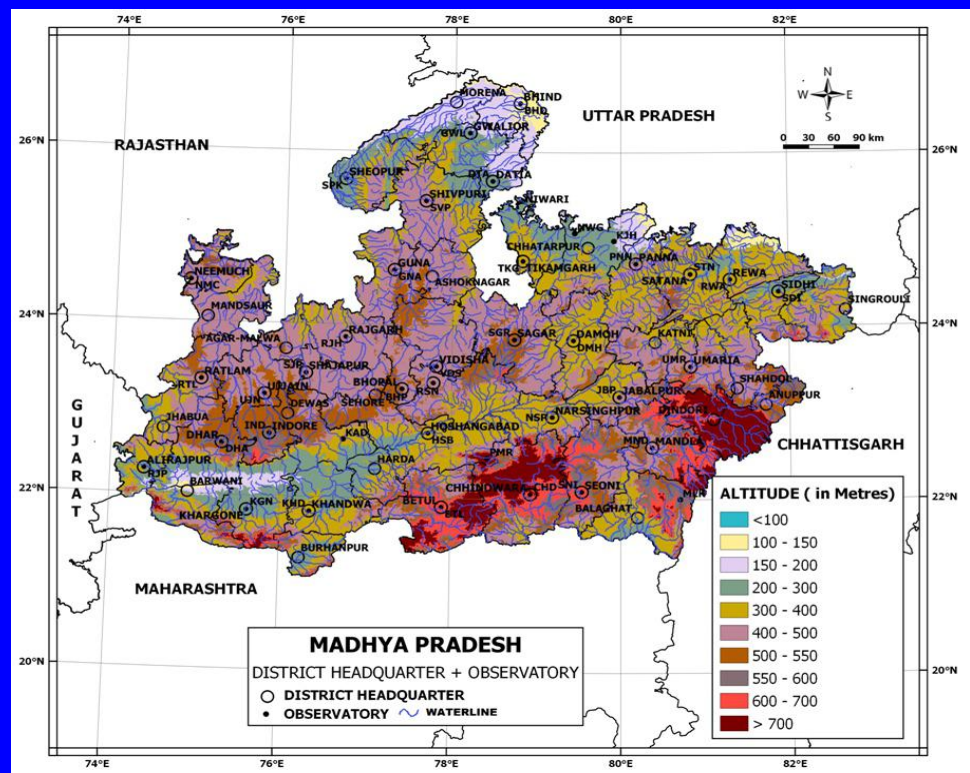




भारत सरकार
GOVERNMENT OF INDIA
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MINISTRY OF EARTH SCIENCES
भारत मौसम विज्ञान विभाग
INDIA METEOROLOGICAL DEPARTMENT

मध्य प्रदेश की जलवायु CLIMATE OF MADHYA PRADESH



CLIMATOLOGICAL SUMMARIES OF STATES SERIES - No. 27
IMD Report No. "MoES/IMD/CLI-REP(M.P.)/01(2024)/19"

ISSUED BY

OFFICE OF THE HEAD, CLIMATE RESEARCH & SERVICES
INDIA METEOROLOGICAL DEPARTMENT
PUNE - 411 005



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The Head, Climate Research & Services
India Meteorological Department
Shivajinagar, Pune-411005
India
Tel : 020-25572265
email : cauipune@gmail.com

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P R E F A C E

The importance of meteorology and its economic and social benefits are being increasingly realized all over the world. In our country also, various sectors like agriculture, aviation, power and energy, tourism, shipping, transport industry etc. require climatological information pertaining to different regions of the country for planning and execution of different projects. Keeping these requirements in view, it was decided by India Meteorological Department to publish a series of “Climatological Summaries” for each state in the country, incorporating the district climatological summaries. “Climate of Madhya Pradesh” is the twenty-seventh issue in the series of ‘State Climatological Summaries’.

The present publication contains district wise climate information on rainfall, temperatures, wind, humidity, clouds and other meteorological parameters for “Madhya Pradesh” state. Information on climatic classification, coefficient of rainfall variation, heavy rainfall, thunderstorm, cyclone and depressions, are also included in the publication. Climatic classification over the state is determined by Koppen’s technique.

The contributions for preparation of climatological summary and related maps have been made by Shri S. M. Deshpande, Smt. U. S. Satpute, Shri. R. A. Pednekar, Smt. P. P. Bhagwat, Smt. S. M. Shaikh, Shri P. V. Kamble, Smt. D. A. Kulkarni, Shri. L. S. Bile and Shri Ashwini Kumar Prasad from “Climatological Publication Section” of the Climate Application and User Interface Group of the office of Climate Research and Services, India Meteorological Department, Pune.

The publication has been prepared at Climate Application and User Interface group under supervision of Dr. Ananya Karmakar, Scientist ‘C’, Dr. Divya Surendran, Scientist ‘D’ and by Dr. Rajib Chattopadhyay, Scientist ‘E’ and reviewed by Dr. Pulak Guhathakurta, Scientist ‘G’ (Retired). Shri. K.S. Hosalikar, Head, CRS, India Meteorological Department, Pune provided the overall guidance for this publication. I appreciate their sincere efforts.

I am hopeful that this publication will be a useful source of climatic information for societal development.

NEW DELHI,

October, 2023

DR. M. MOHAPATRA

DIRECTOR GENERAL OF METEOROLOGY

I N T R O D U C T I O N

The climatology of Madhya Pradesh state of India in terms of various meteorological parameters such as temperature, rainfall, rainfall variability, pressure and winds, relative humidity, clouds, weather hazards, etc. is described in state summary, followed by a detailed description of the climate of each district in the succeeding chapters. In this publication, the districts of Madhya Pradesh state which were in existence as on 1st January 2022 have been considered and the climatology of these districts, arranged in alphabetical order is presented.

The normal for each month and annual rainfall are generally based on the data for the period 1971 to 2020. The monthly and annual normal of other meteorological parameters used for describing the climate are generally based on data for the period 1991 to 2020. The extreme values of temperature and rainfall presented in the publication are based on the updated data up to the year 2020. These data have been obtained from National Data Centre, Pune.

The information on cyclones and depressions affected the state during the period 1891-2021 are included in the state summary.

**INDIA METEOROLOGICAL DEPARTMENT
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16.	End Users	State Gazetteers Units, Central & State Ministries of Agriculture, Science & Technology, Education, Irrigation and Power, Disaster Management Agencies, Research Institutes & Agricultural Universities.
17.	Abstract	The publication contains extensive information on the climate of Madhya Pradesh state and its districts based on rainfall, temperature, winds, clouds and other weather parameters. The information on Heavy rainfall and excessive rainfall, cyclones and depressions, thunderstorms and earthquakes are also included in the publication.
18.	Key Words	State Summary, District Summary, Physical Features, Climatic Classification, Heaviest Rainfall, Mean Maximum Temperature, Mean Minimum Temperature, Highest Maximum Temperature, Lowest Minimum Temperature, Rainfall Variability, Seasonal Rainfall, Annual Rainfall.

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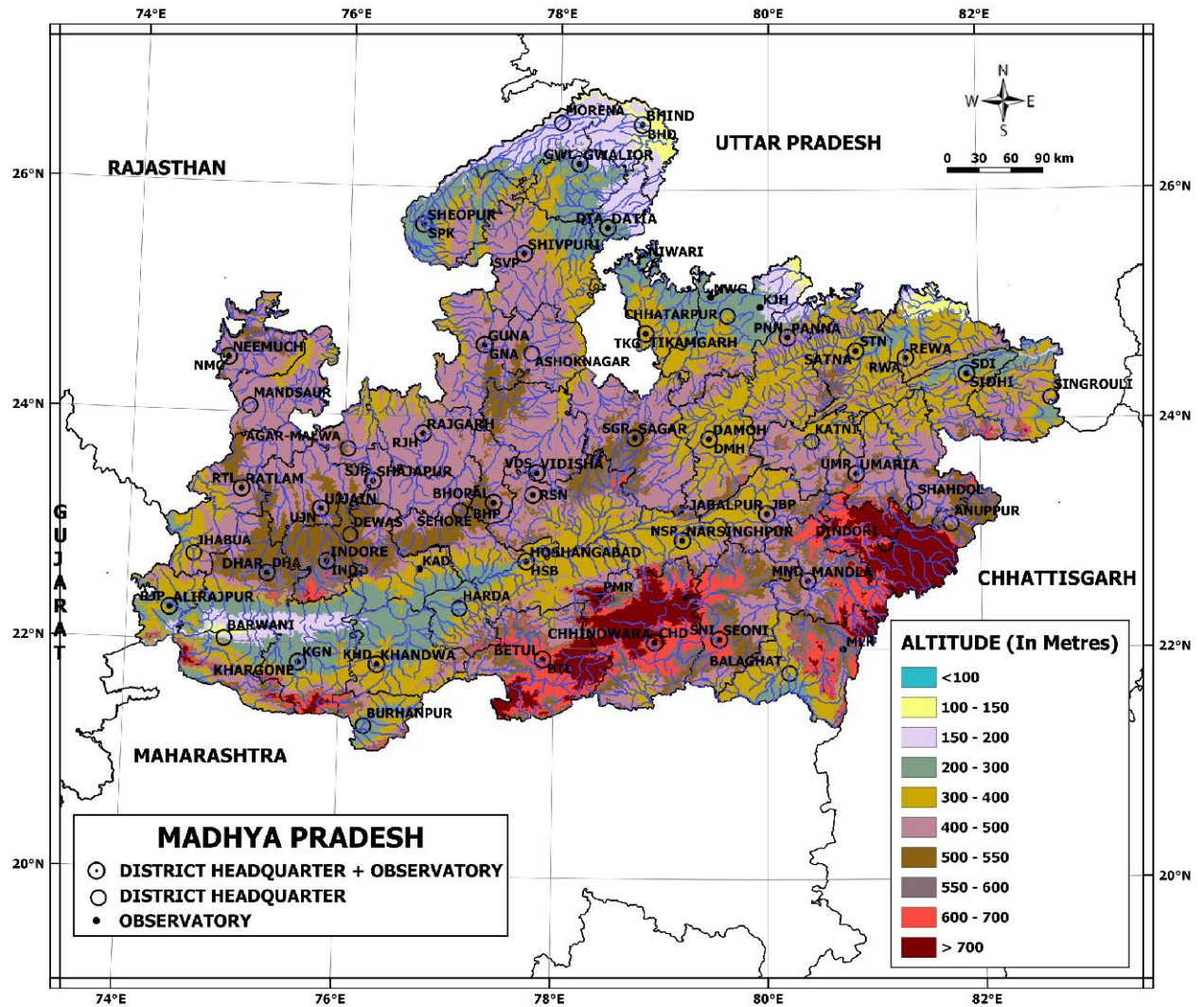


FIG.1(a) : INSET

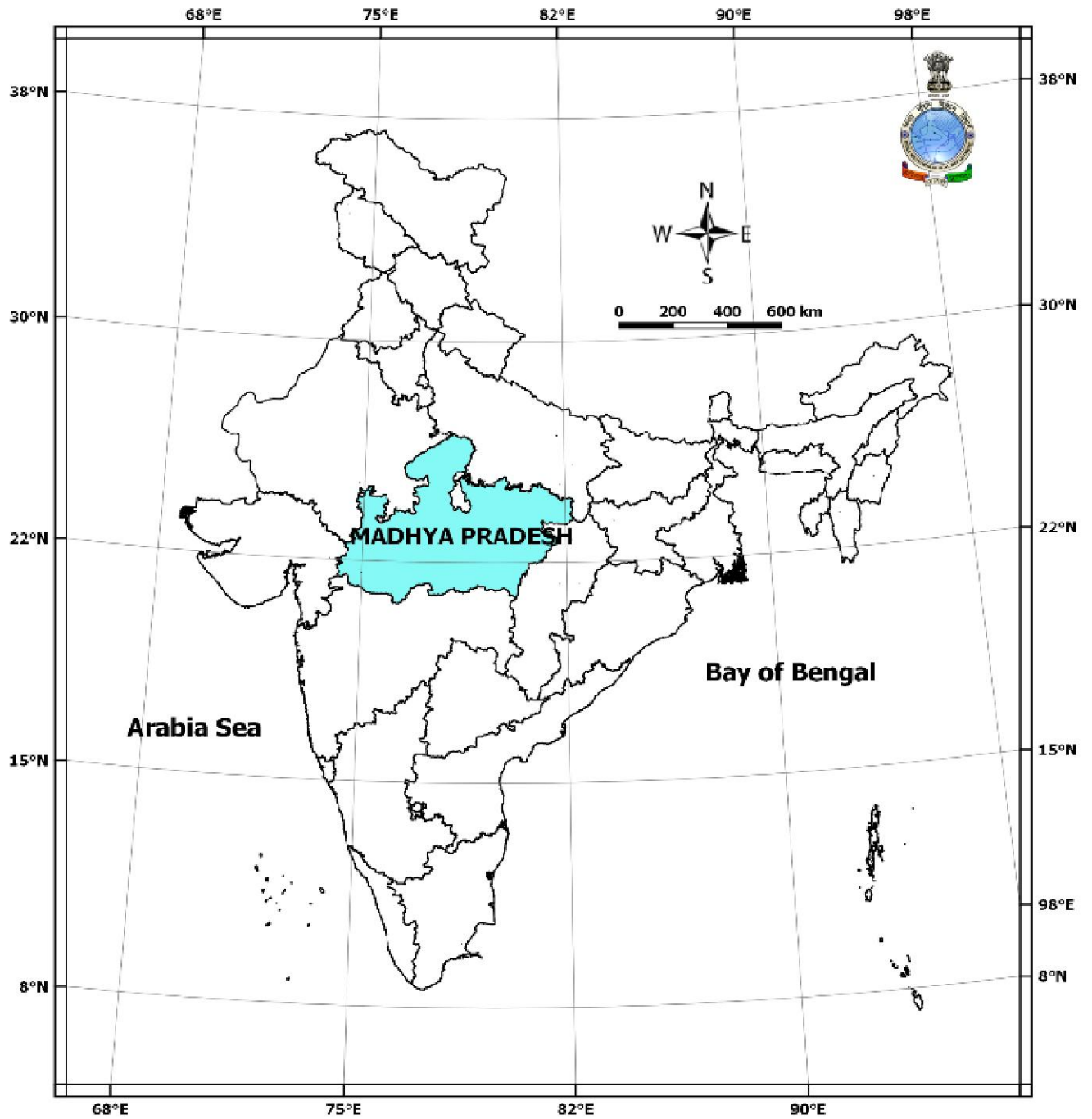


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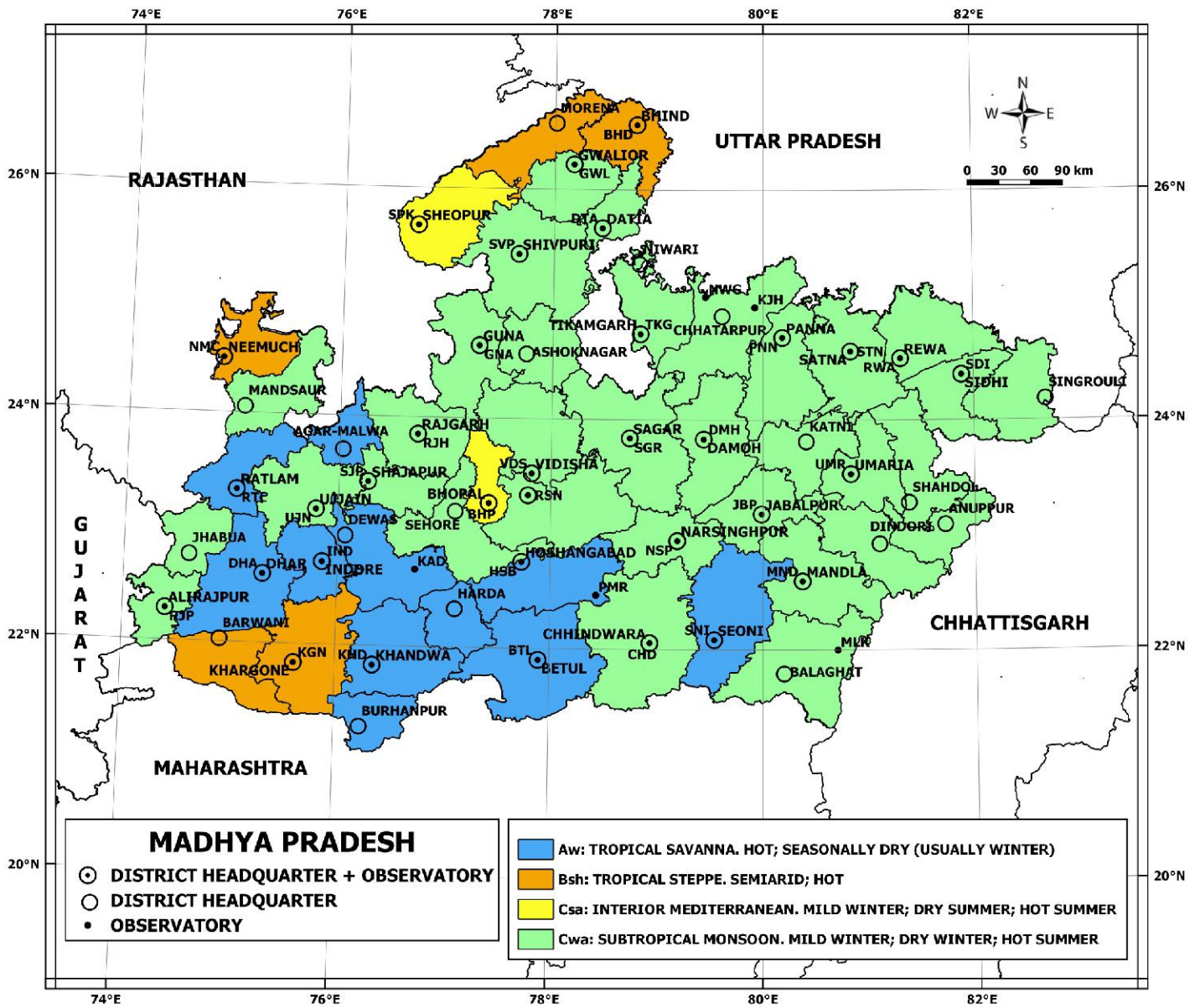


FIG.2(a): MEAN MAXIMUM TEMPERATURE (°C) - MAY

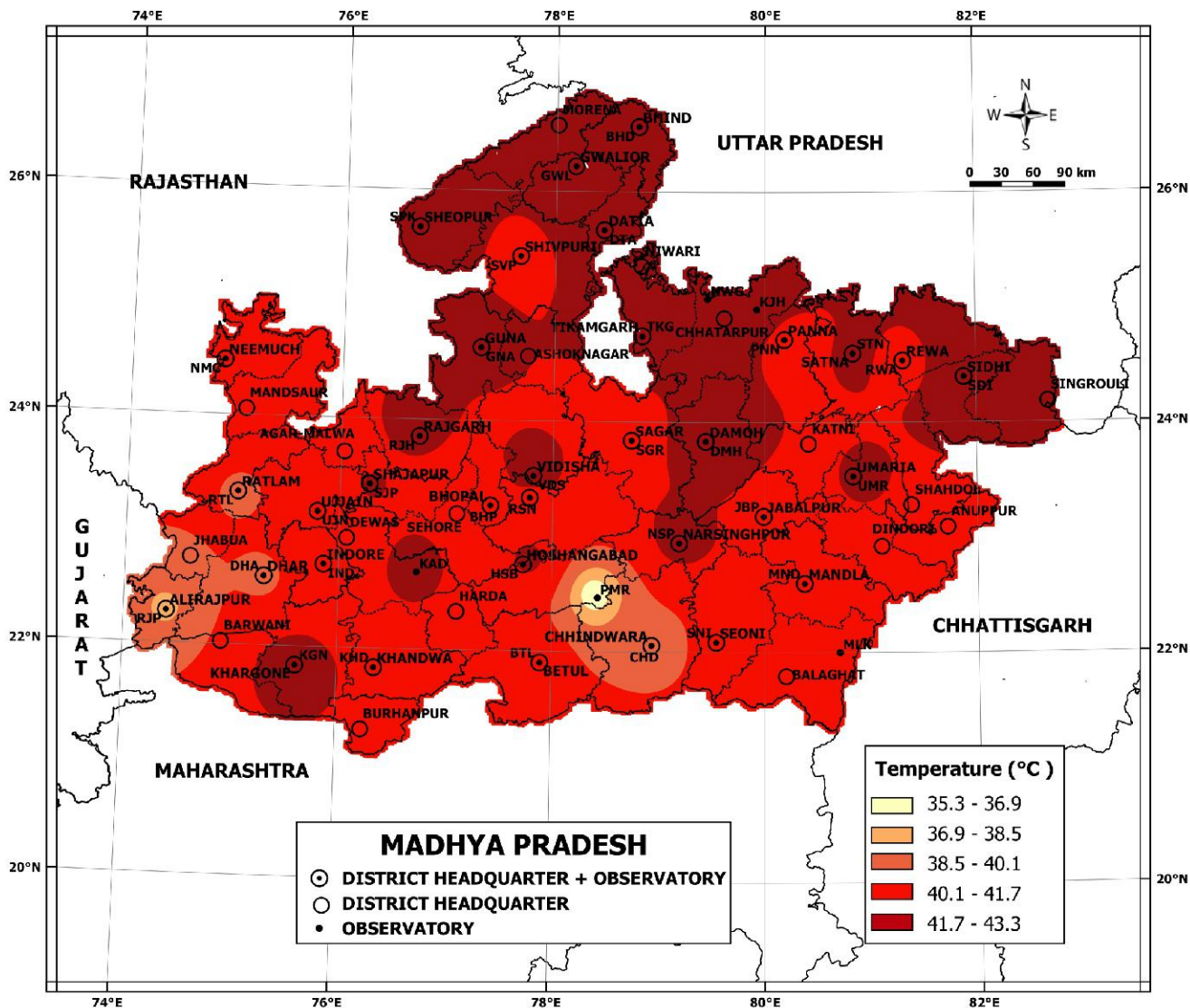


FIG.2(b): MEAN MAXIMUM TEMPERATURE (°C) - JULY

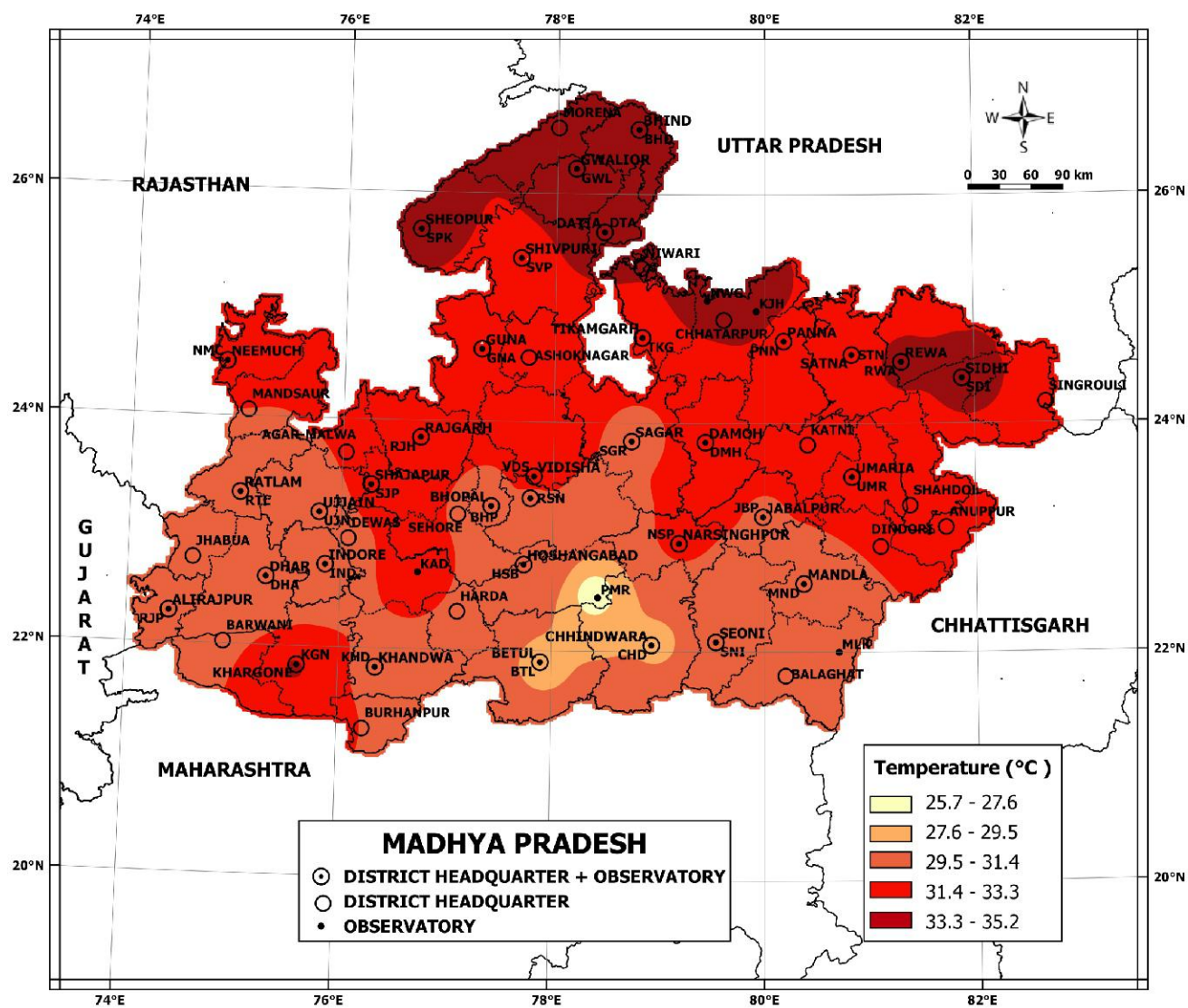


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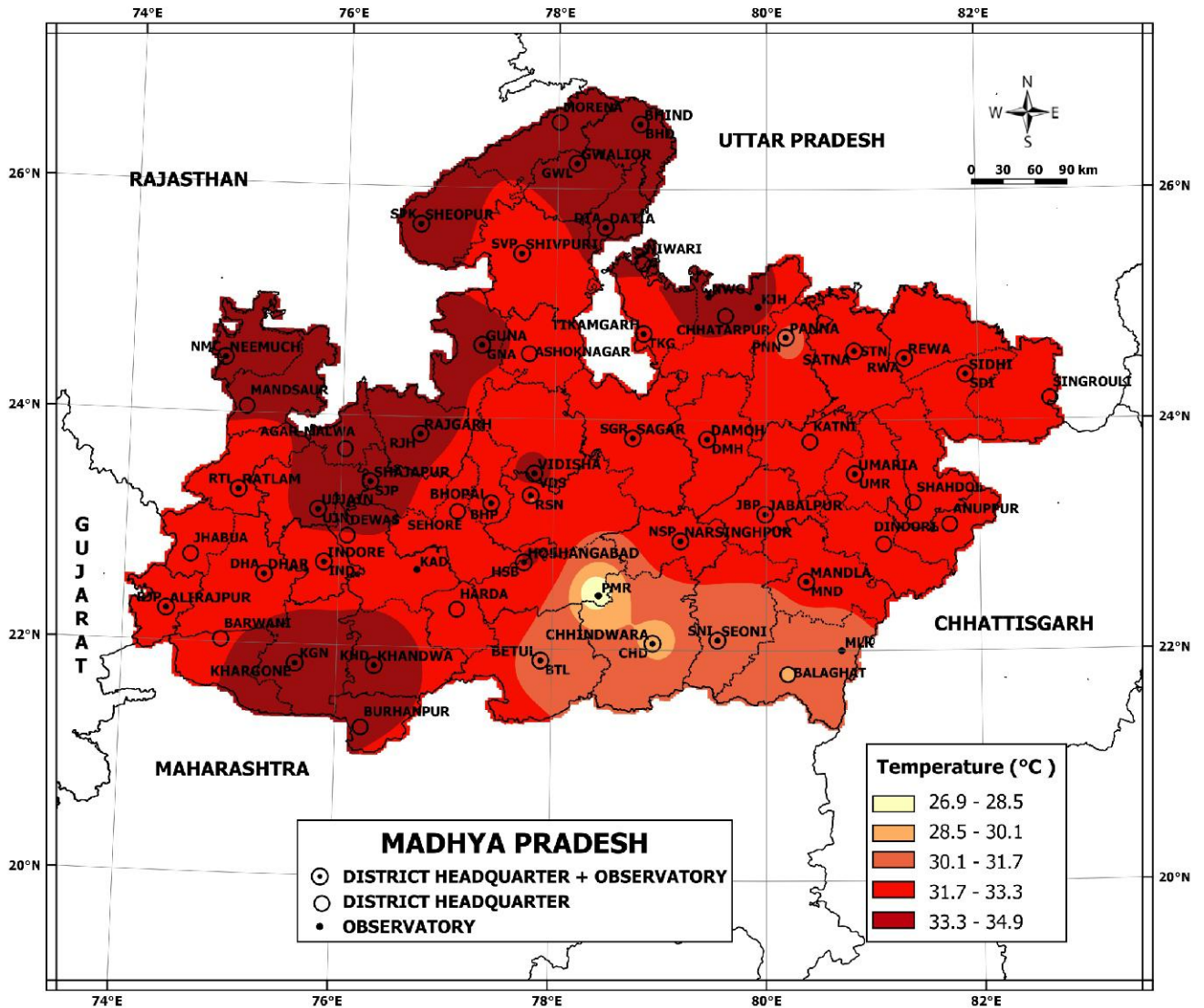


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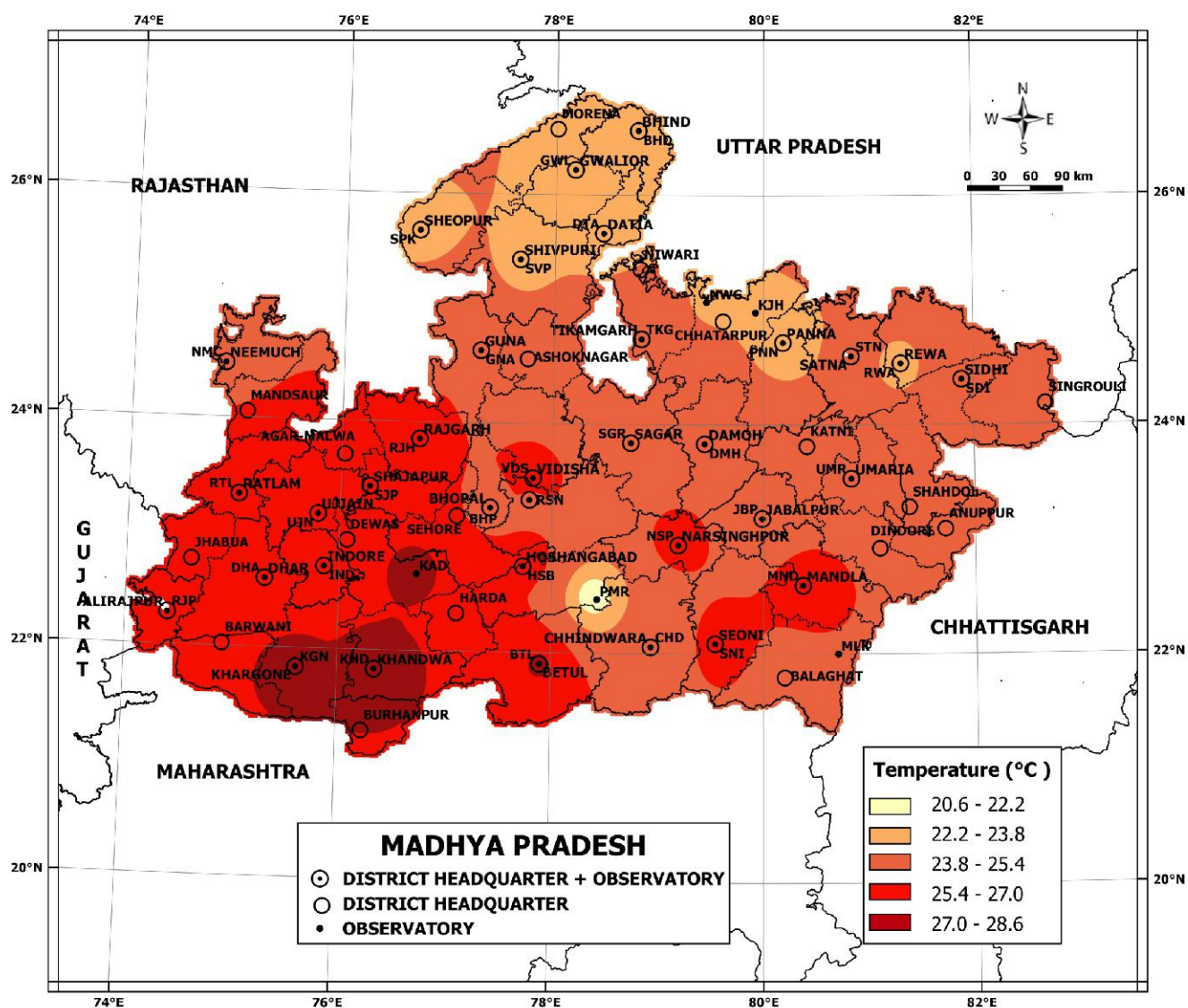


FIG.3(a): MEAN MINIMUM TEMPERATURE (°C) - JANUARY

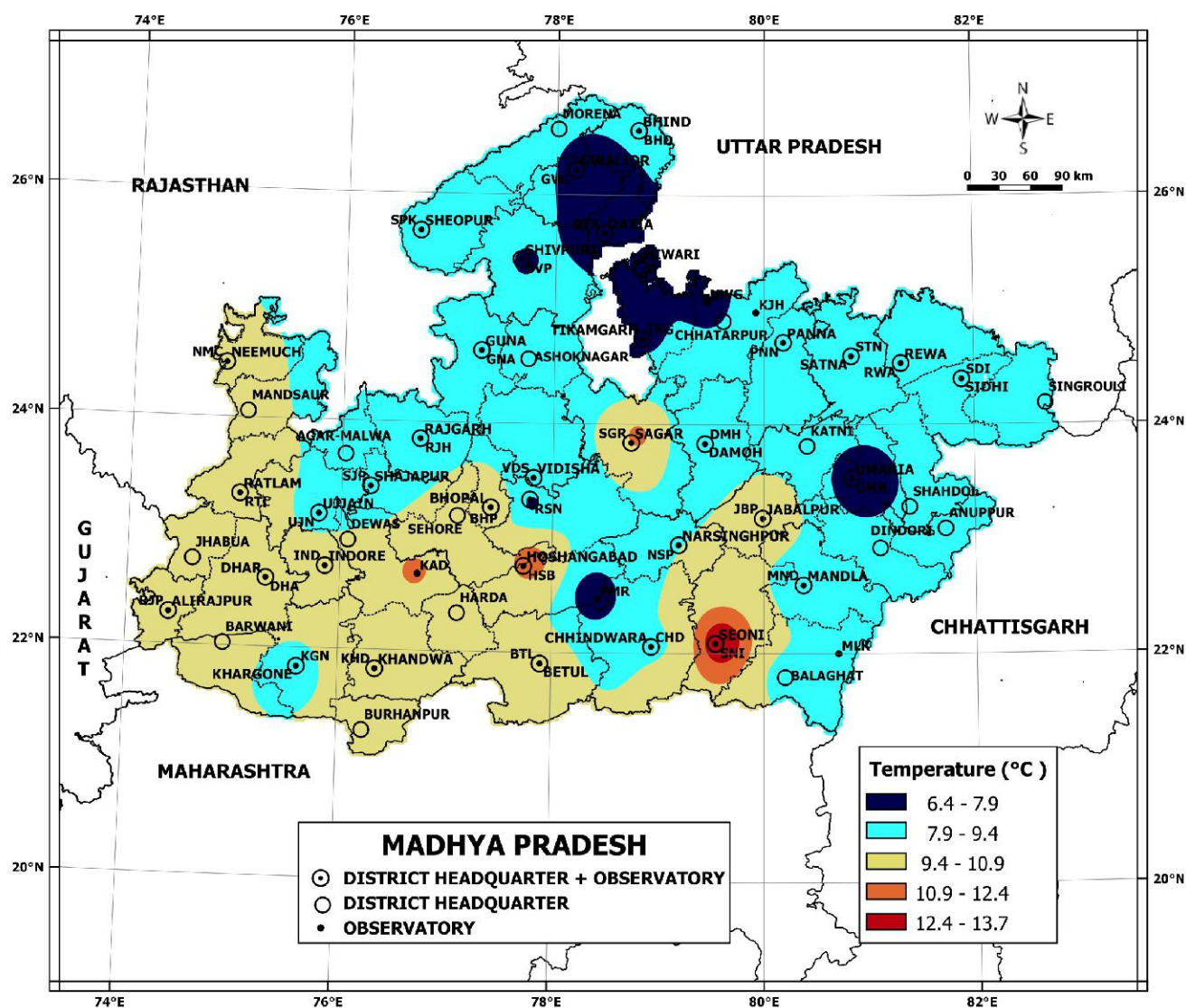


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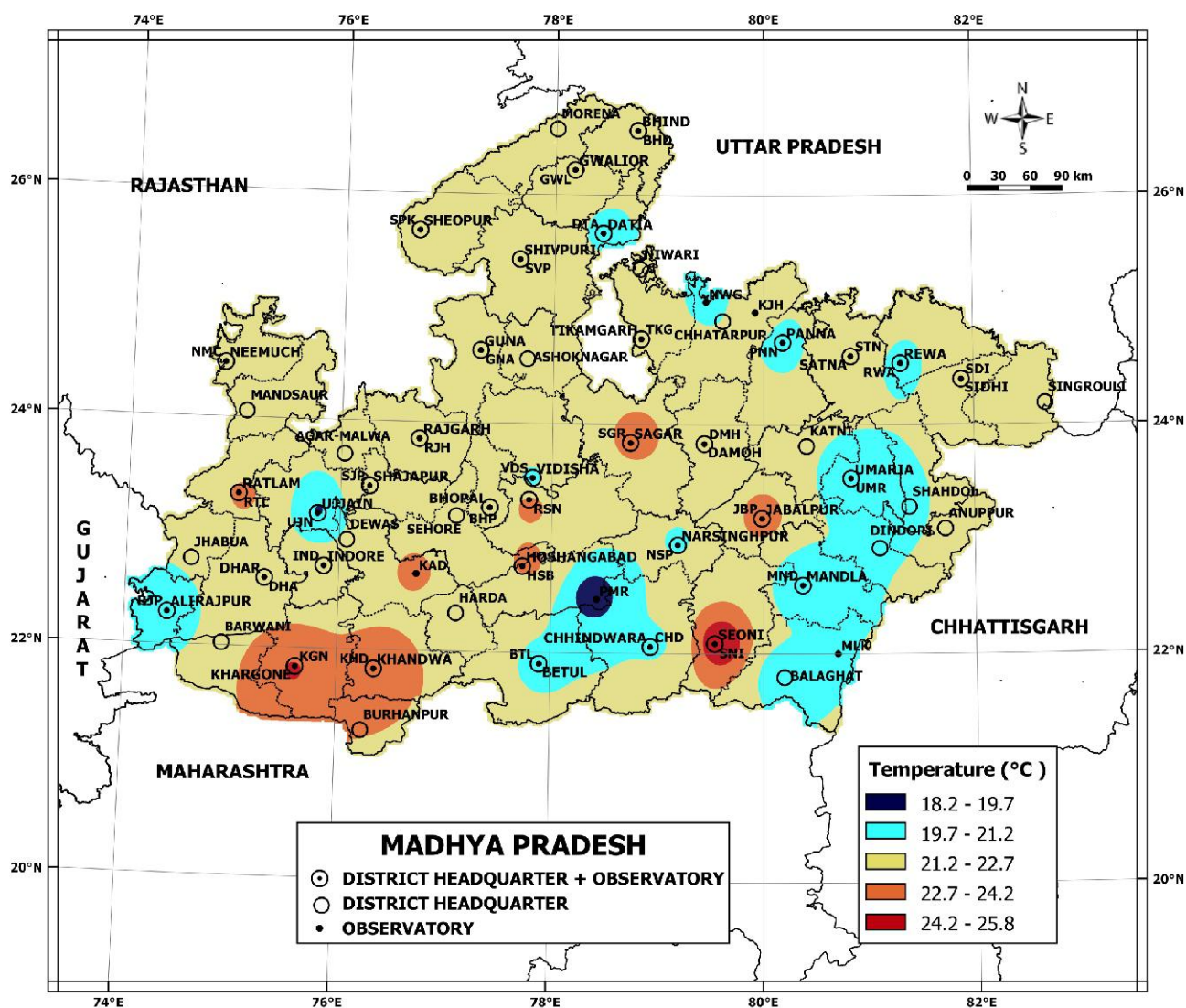


FIG.3(c): MEAN MINIMUM TEMPERATURE (°C) - JULY

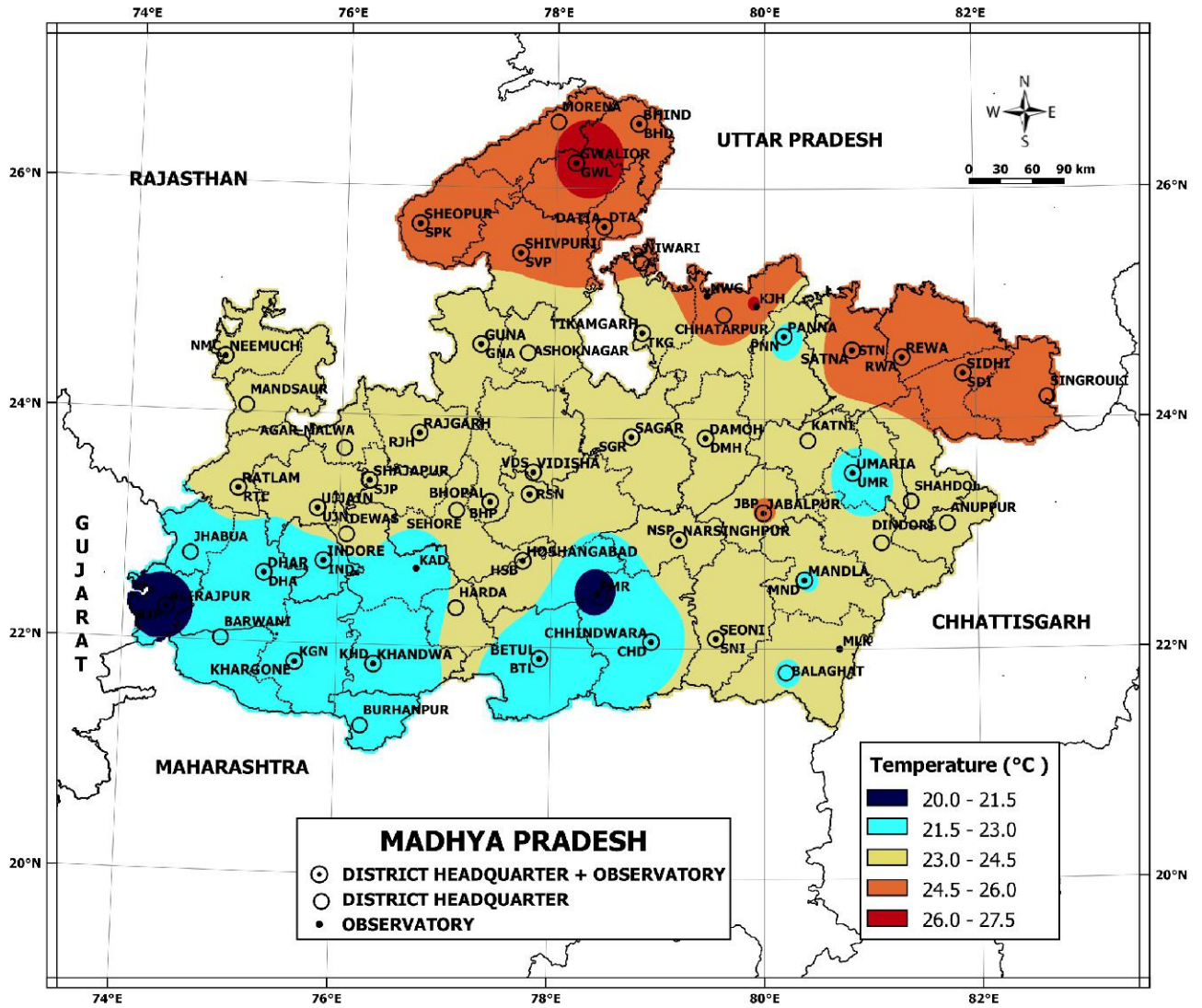


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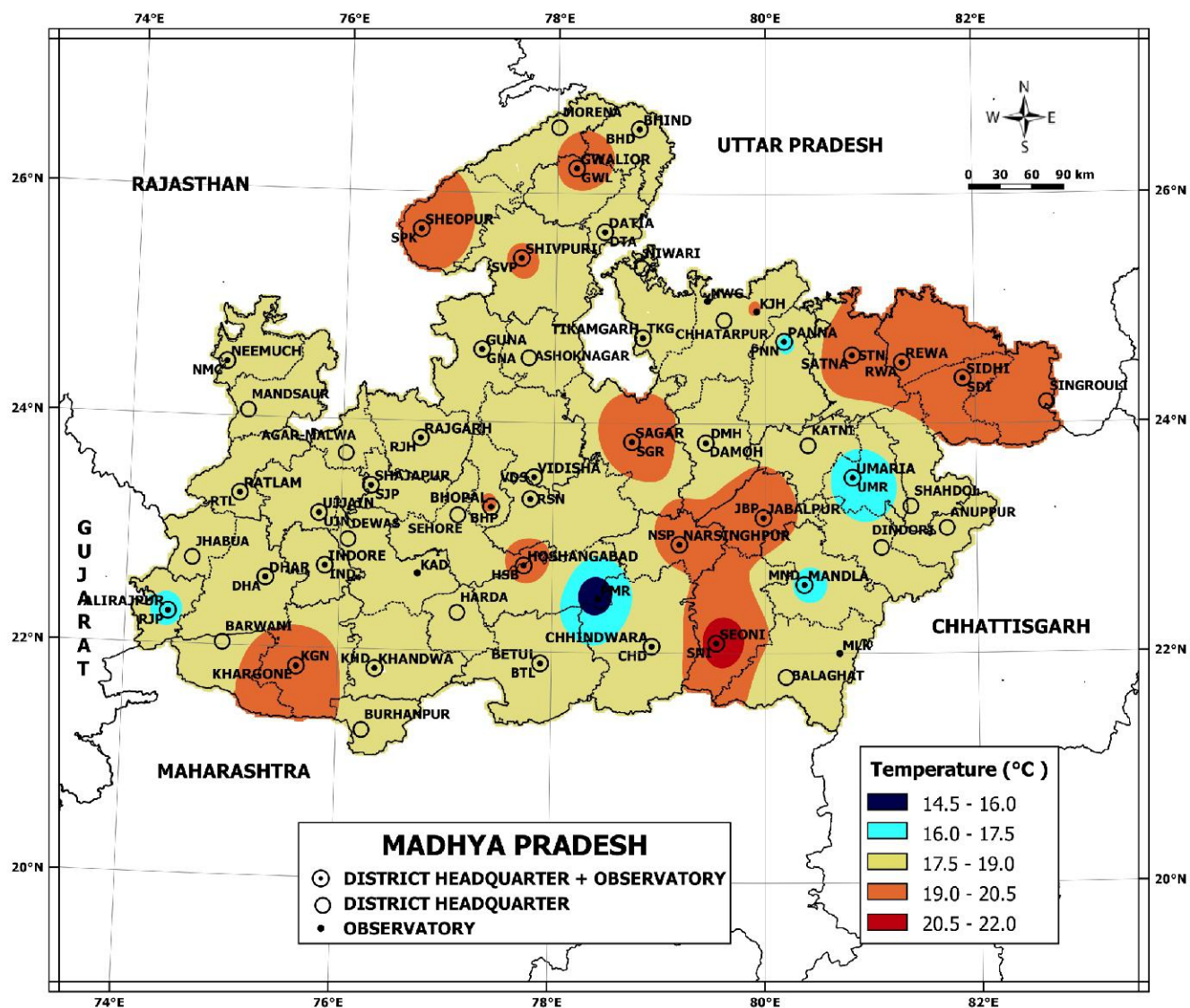


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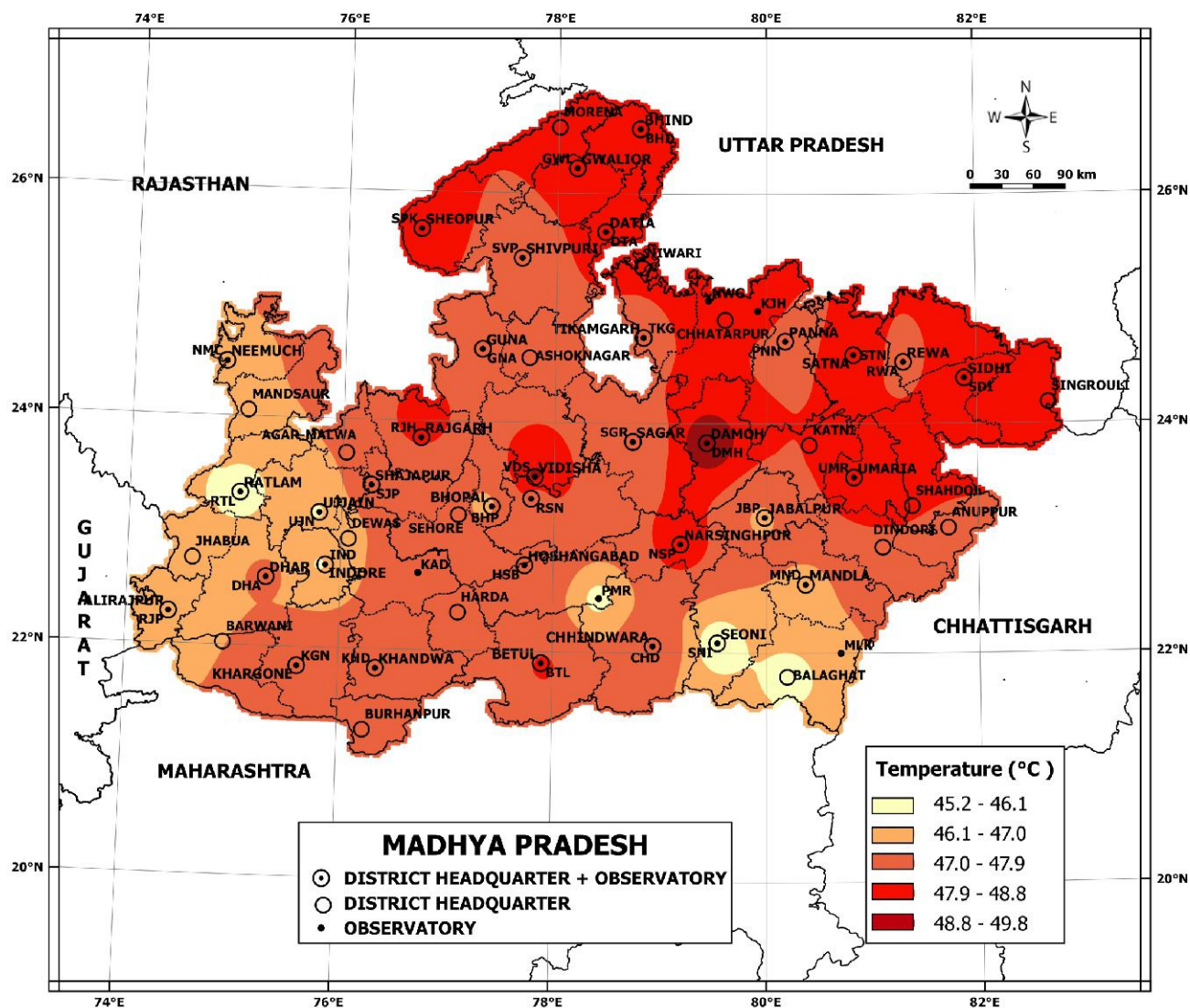


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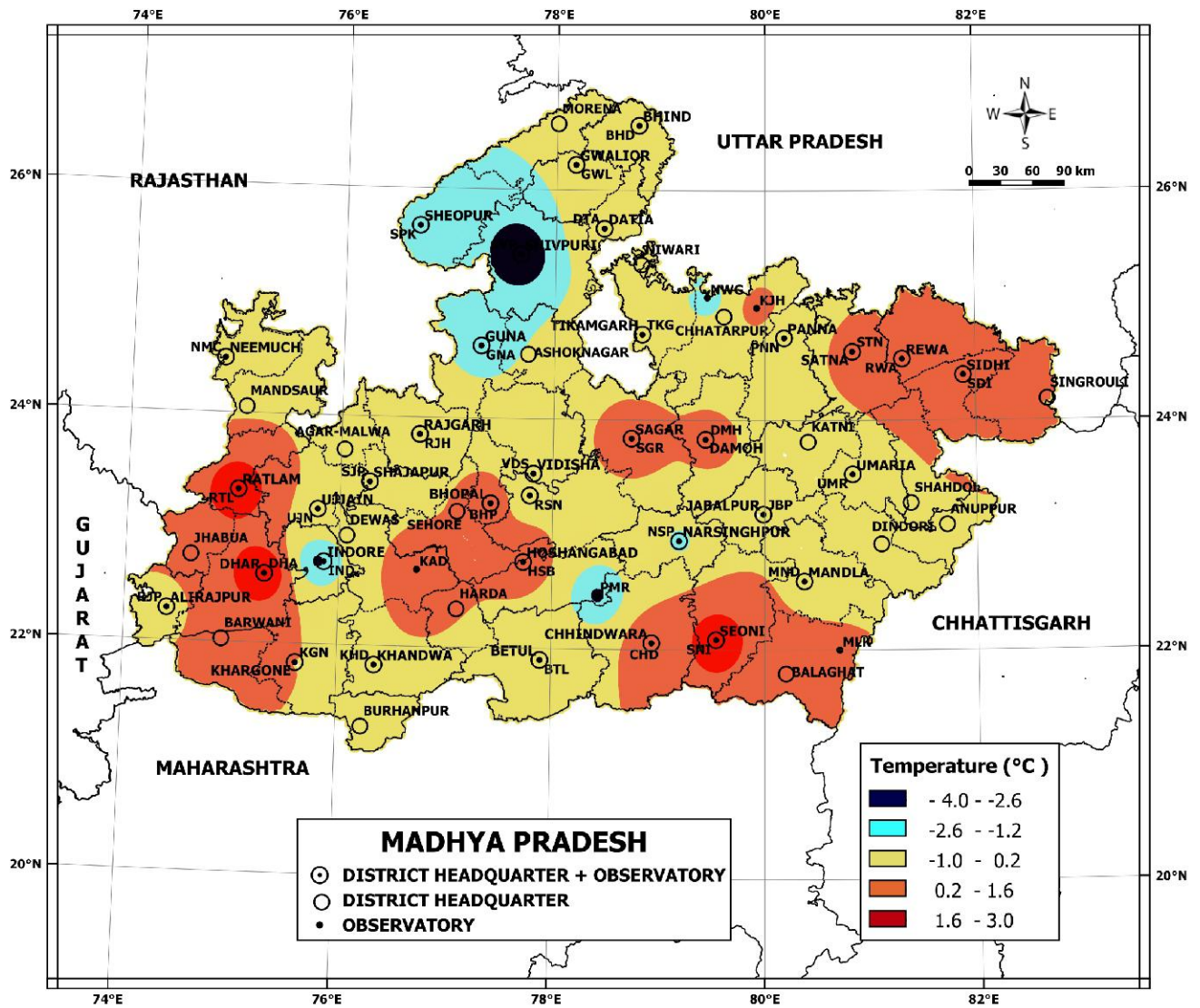
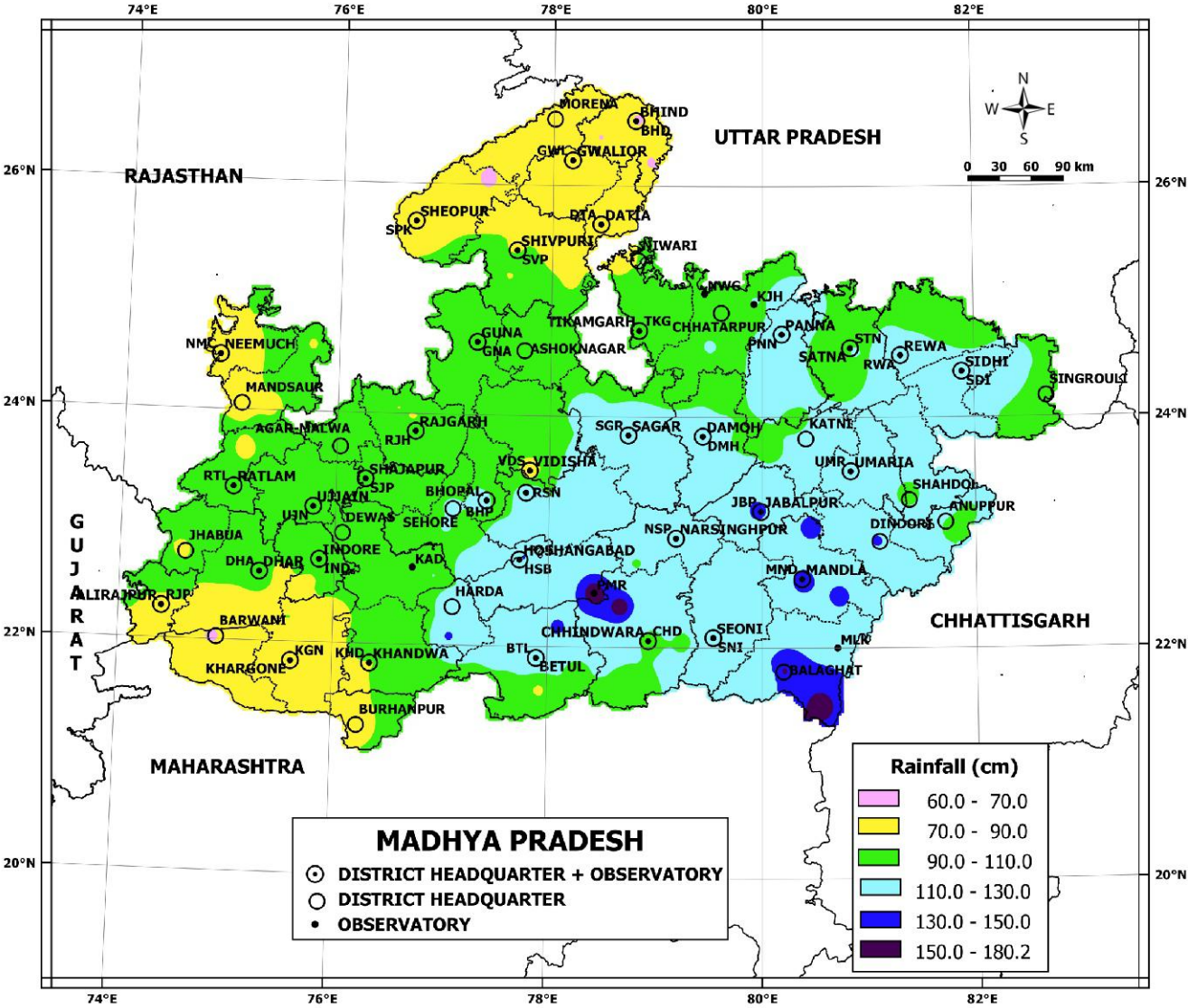
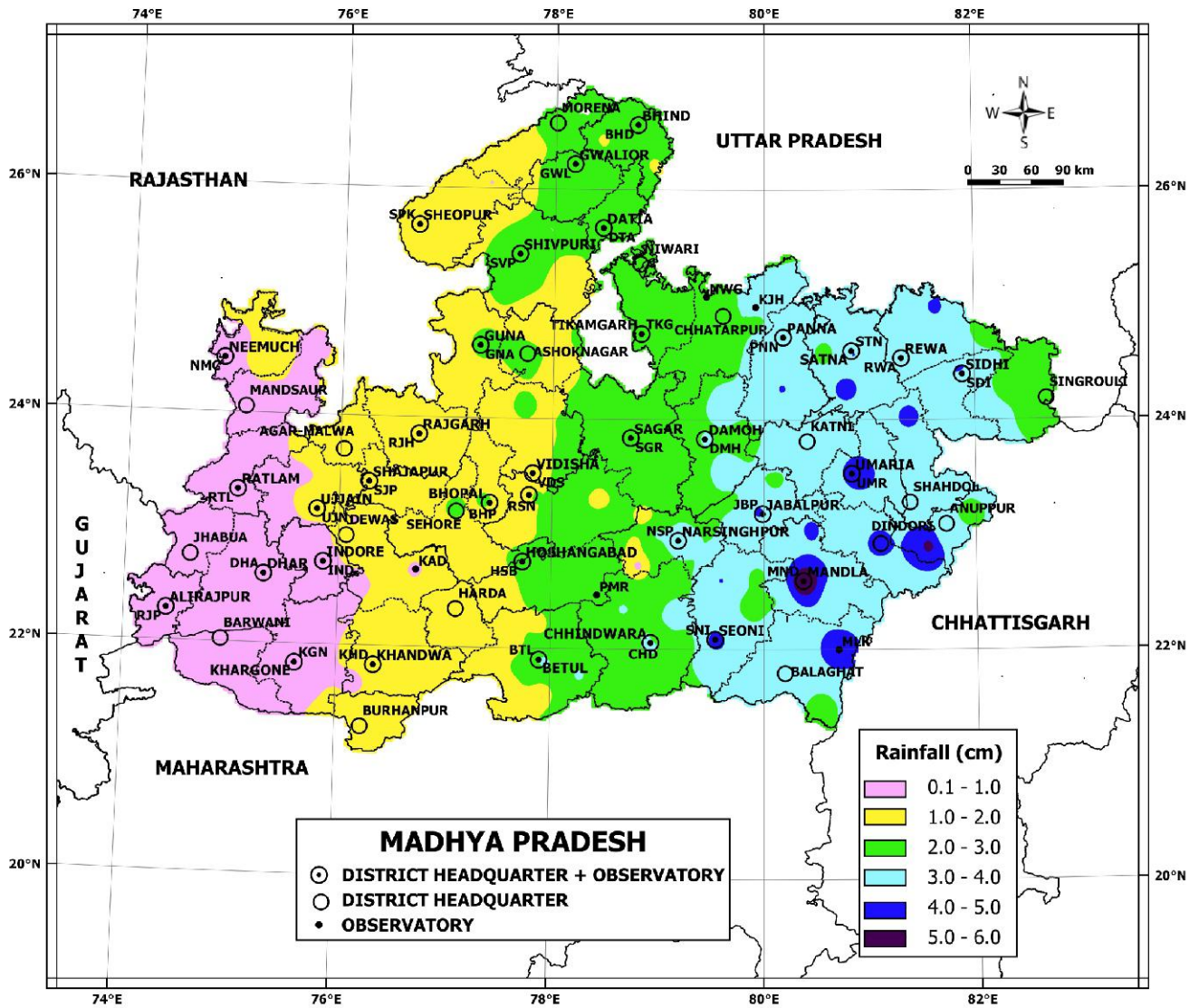


FIG.6: ANNUAL NORMAL RAINFALL (cm)



**FIG.6(a): SEASONAL RAINFALL (cm) - WINTER (COLD WEATHER) SEASON
(JANUARY - FEBRUARY)**



**FIG.6(b): SEASONAL RAINFALL (cm)- PRE-MONSOON (HOT WEATHER) SEASON
(MARCH - MAY)**

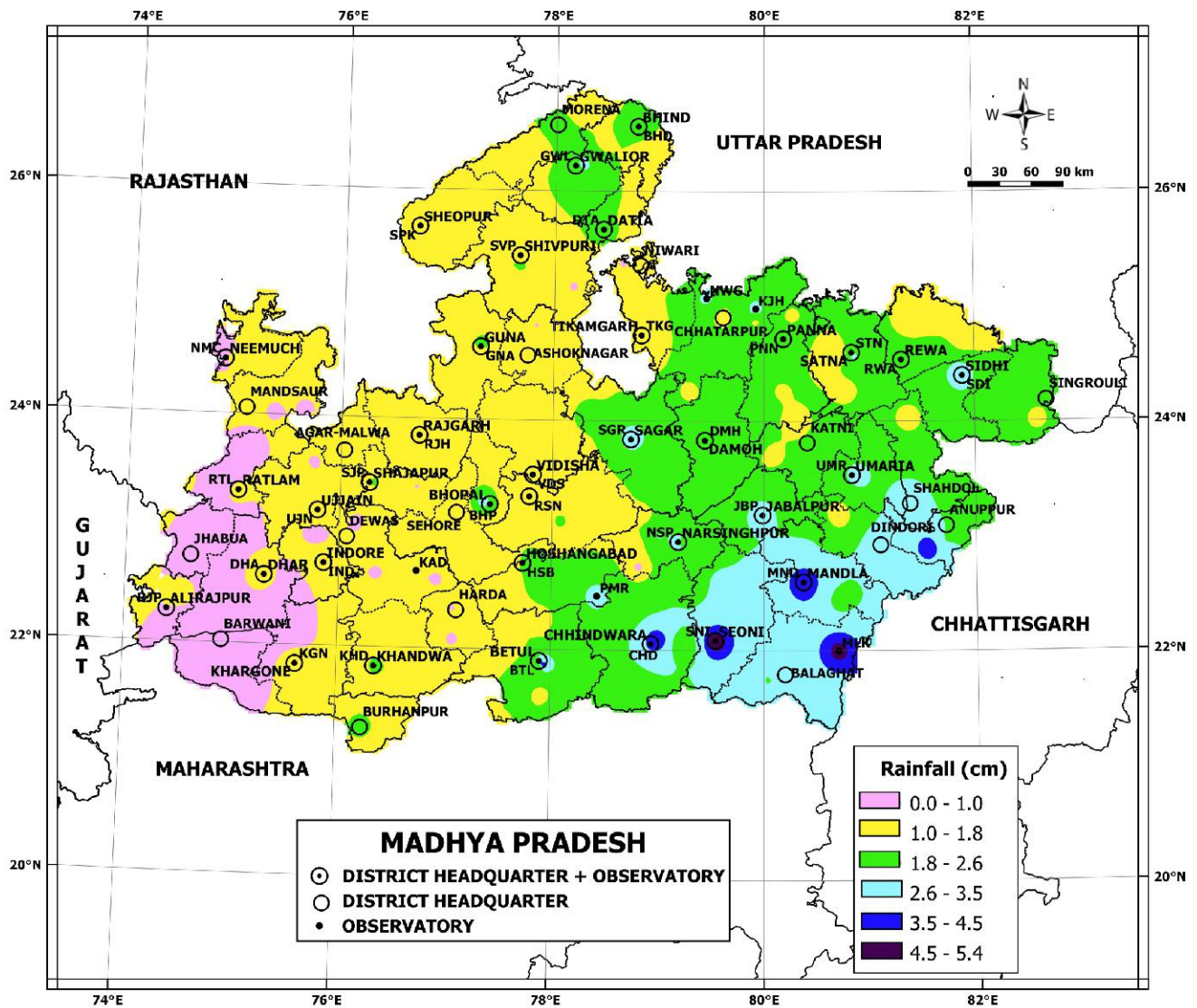


FIG.6(c): SEASONAL RAINFALL (cm) - SOUTHWEST MONSOON SEASON
(JUNE - SEPTEMBER)

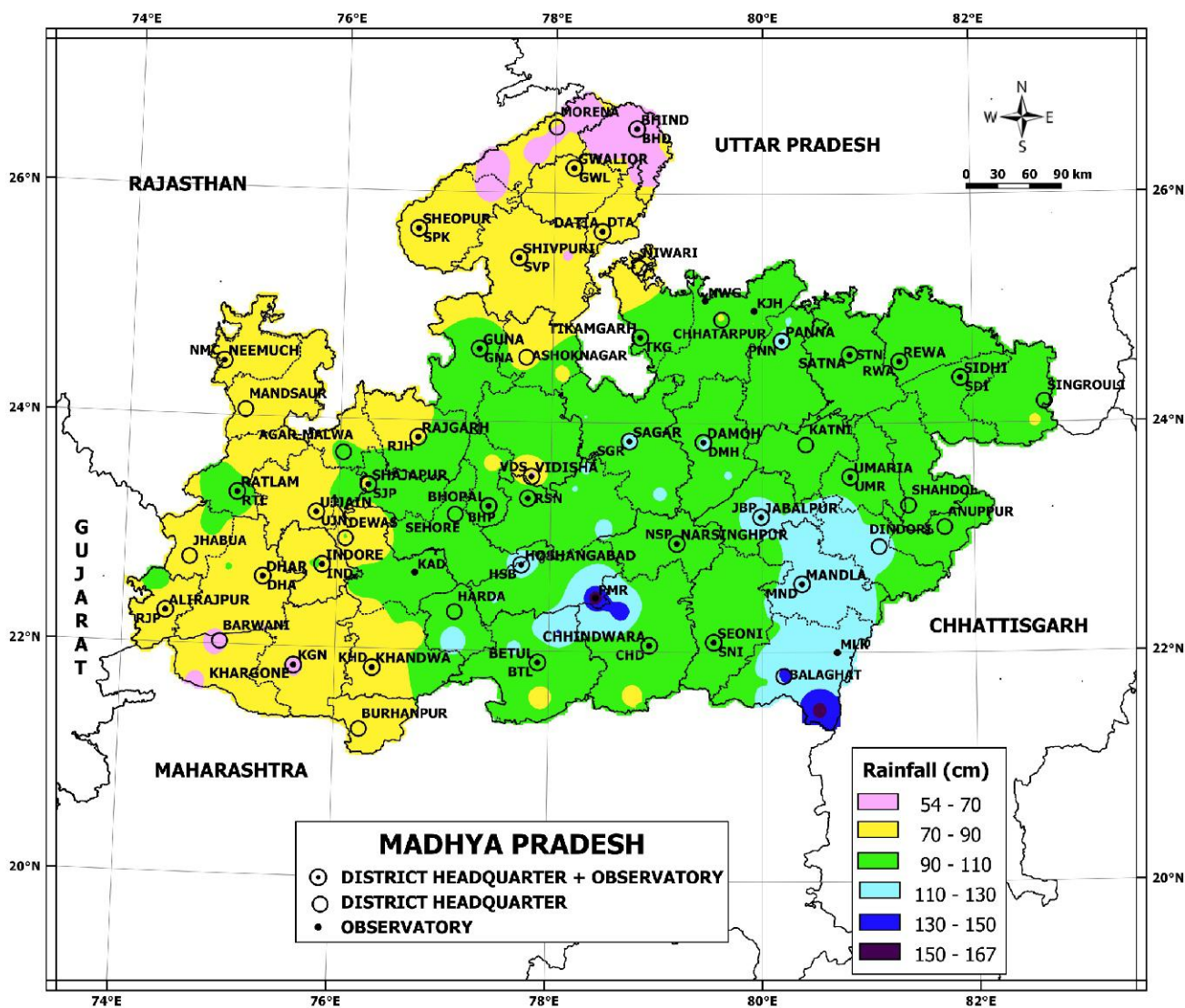


FIG.6(d): SEASONAL RAINFALL (cm) - POST MONSOON SEASON
(OCTOBER-NOVEMBER-DECEMBER)

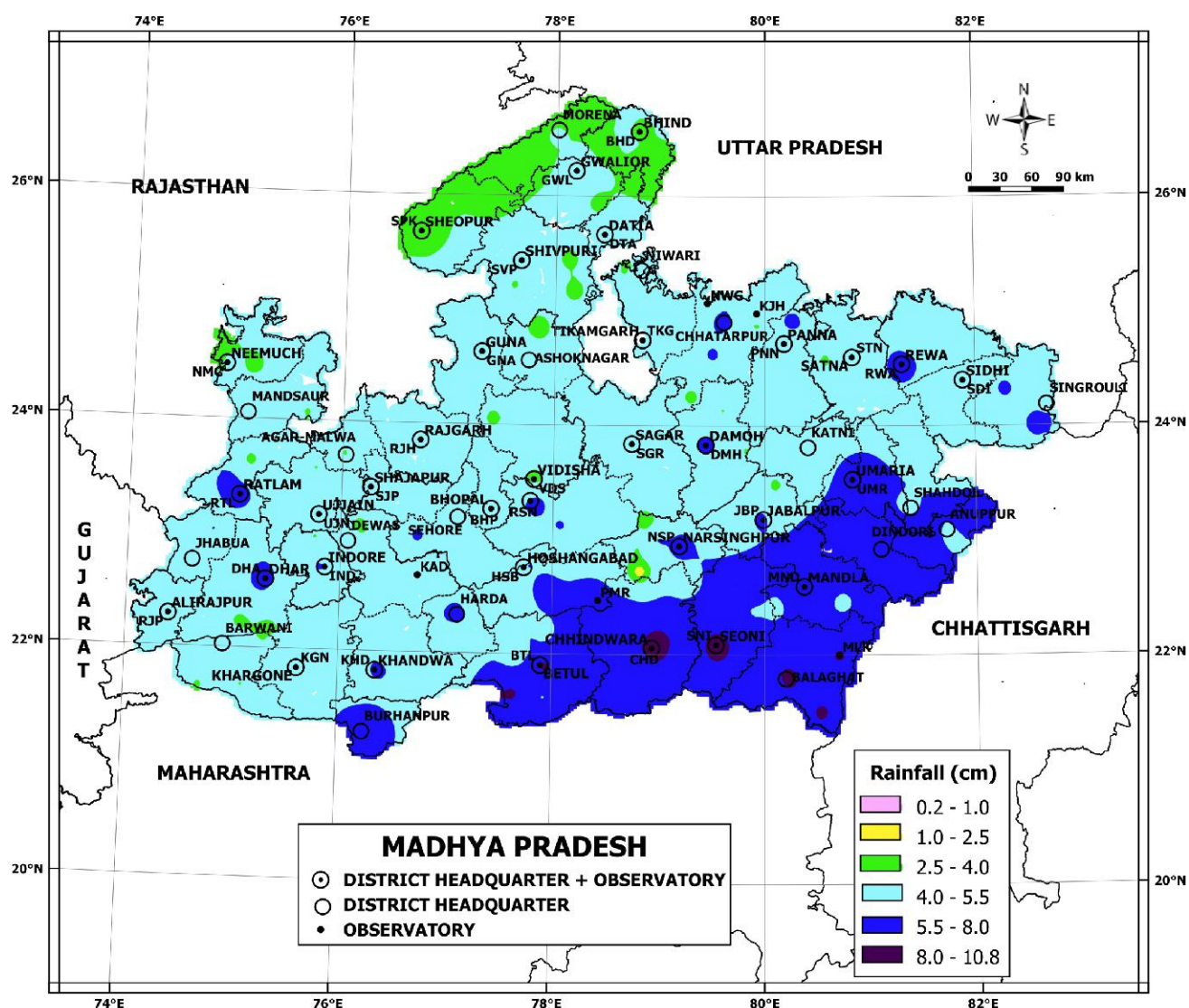


FIG.7: DISTRICT NORMALS OF SEASONAL AND ANNUAL RAINFALL (mm)
SUBDIVISION EAST MADHYA PRADESH

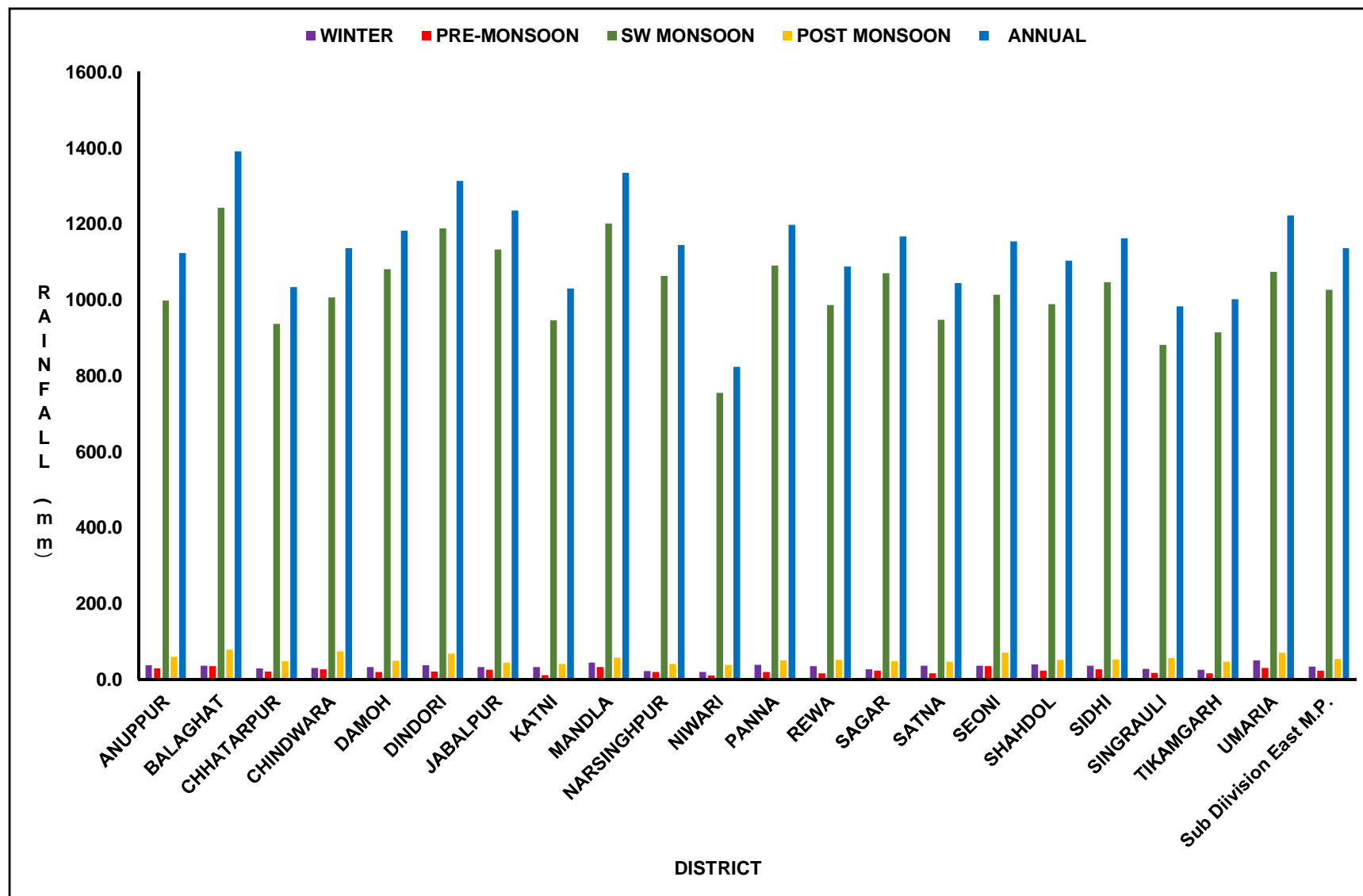


FIG.7(A) : DISTRICT NORMALS OF SEASONAL AND ANNUAL RAINFALL (mm)
SUBDIVISION WEST MADHYA PRADESH

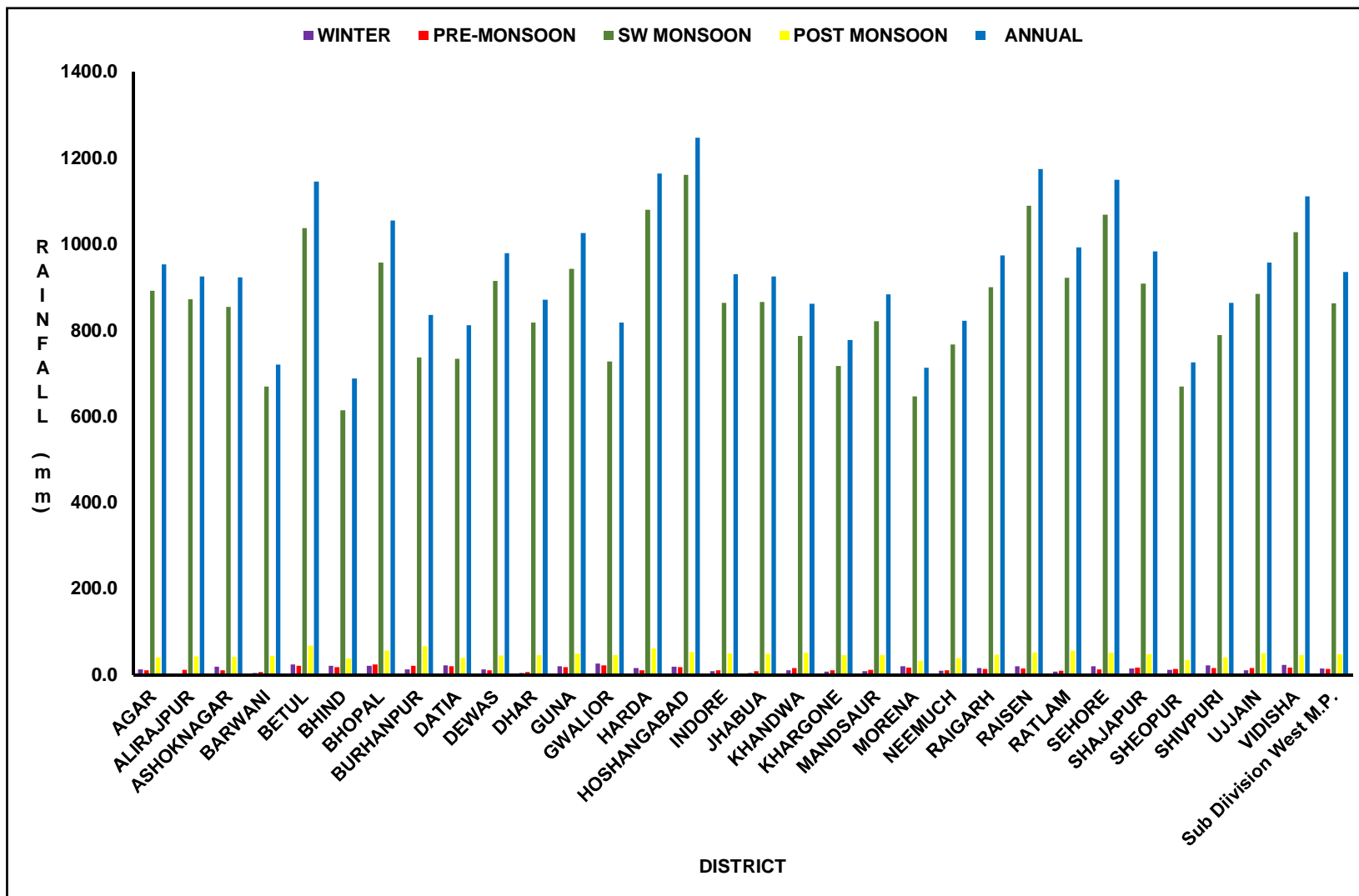


FIG.8: ANNUAL RAINFALL (mm) OVER PART OF CATCHMENT AREA
(103, 104, 105, 315, 404,405,406,407, 408,409 and 414)
MADHYA PRADESH

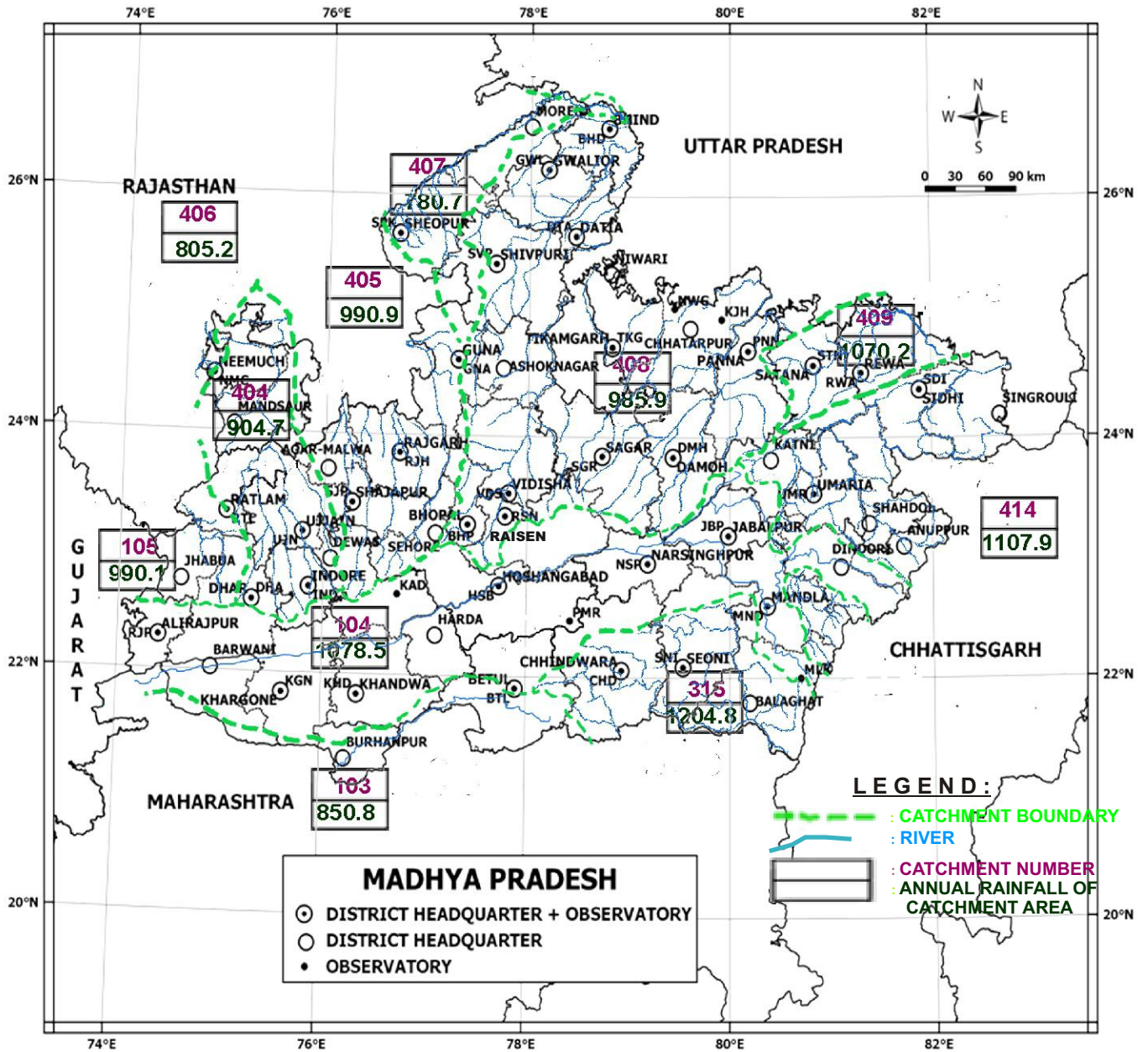


FIG.9: COEFFICIENT OF RAINFALL VARIATION (%) - ANNUAL

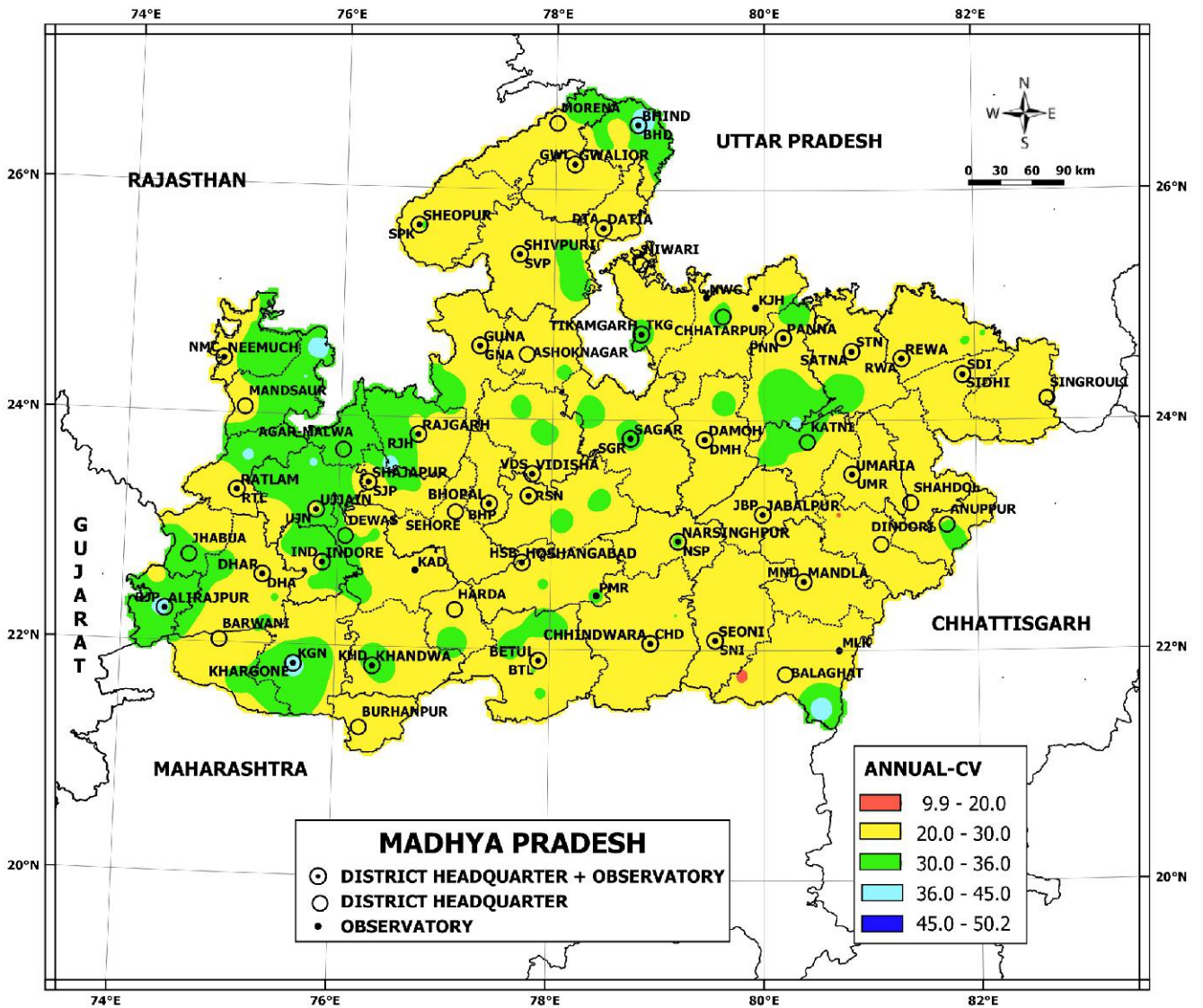


FIG.9(a): COEFFICIENT OF RAINFALL VARIATION (%) - PRE-MONSOON SEASON
(MARCH-APRIL-MAY)

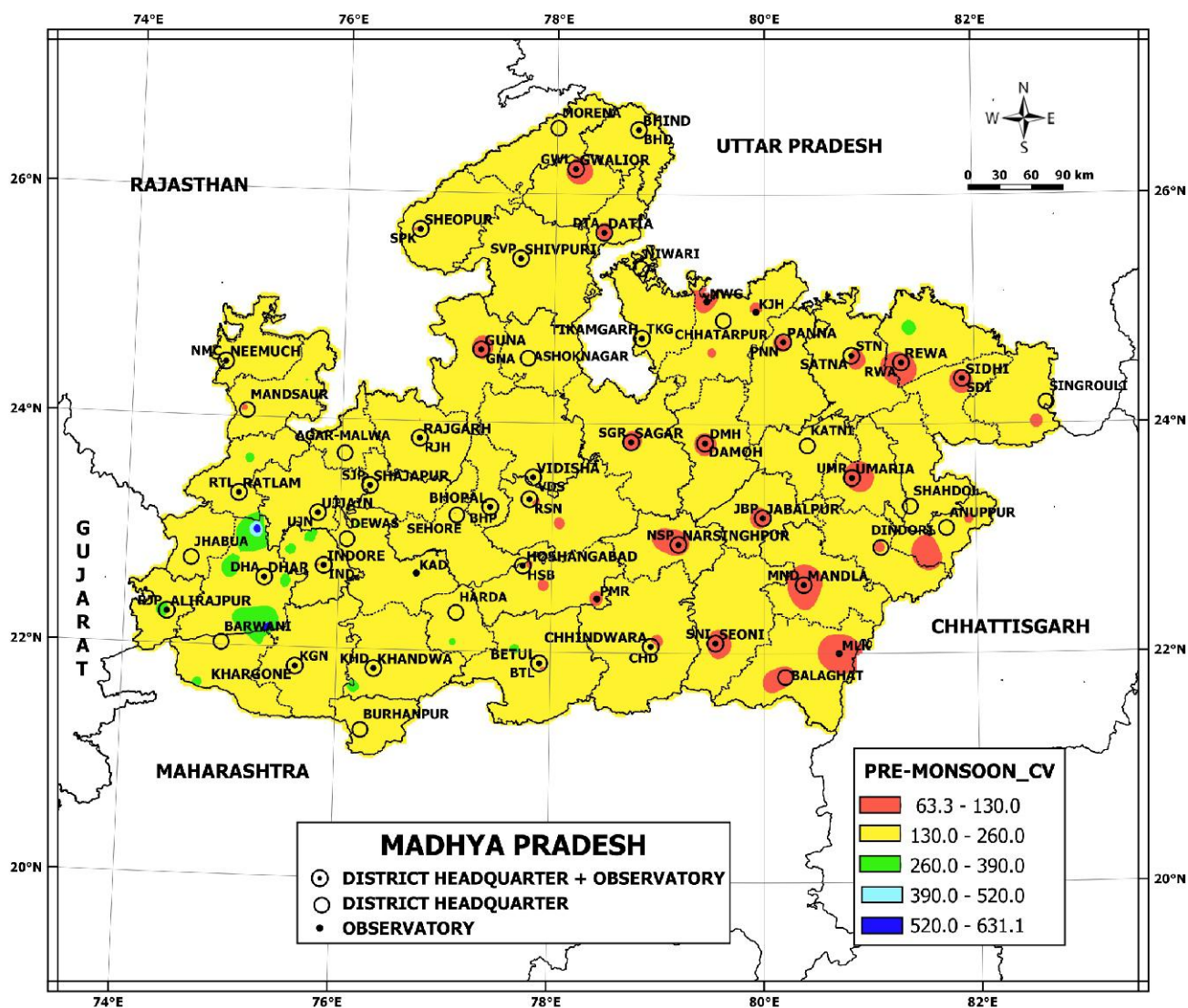
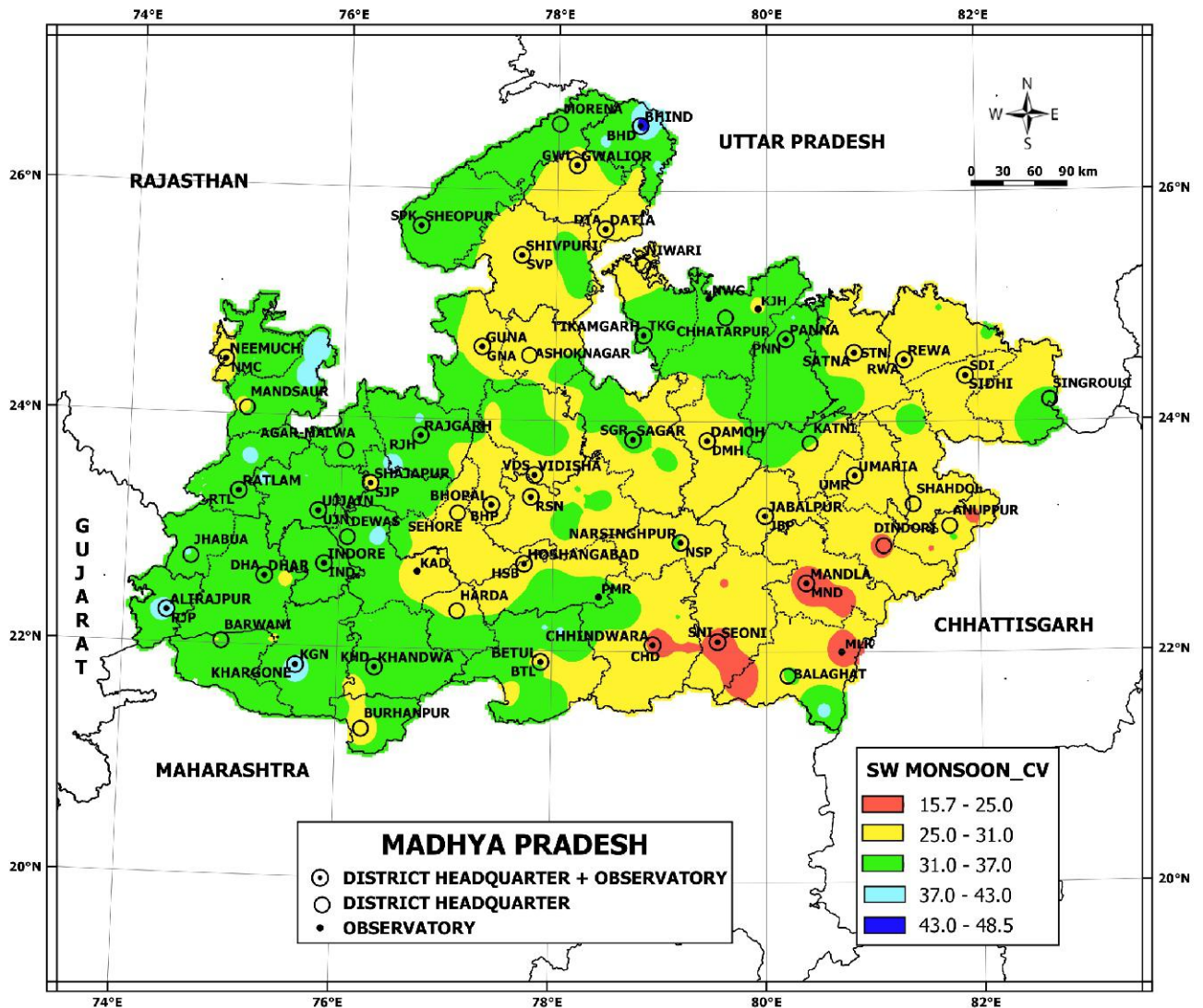


FIG.9(b): COEFFICIENT OF RAINFALL VARIATION (%) - SOUTH WEST MONSOON SEASON (JUNE-SEPTEMBER)



**FIG.9(c): COEFFICIENT OF RAINFALL VARIATION (%) - POST MONSOON SEASON
(OCTOBER-NOVEMBER-DECEMBER)**

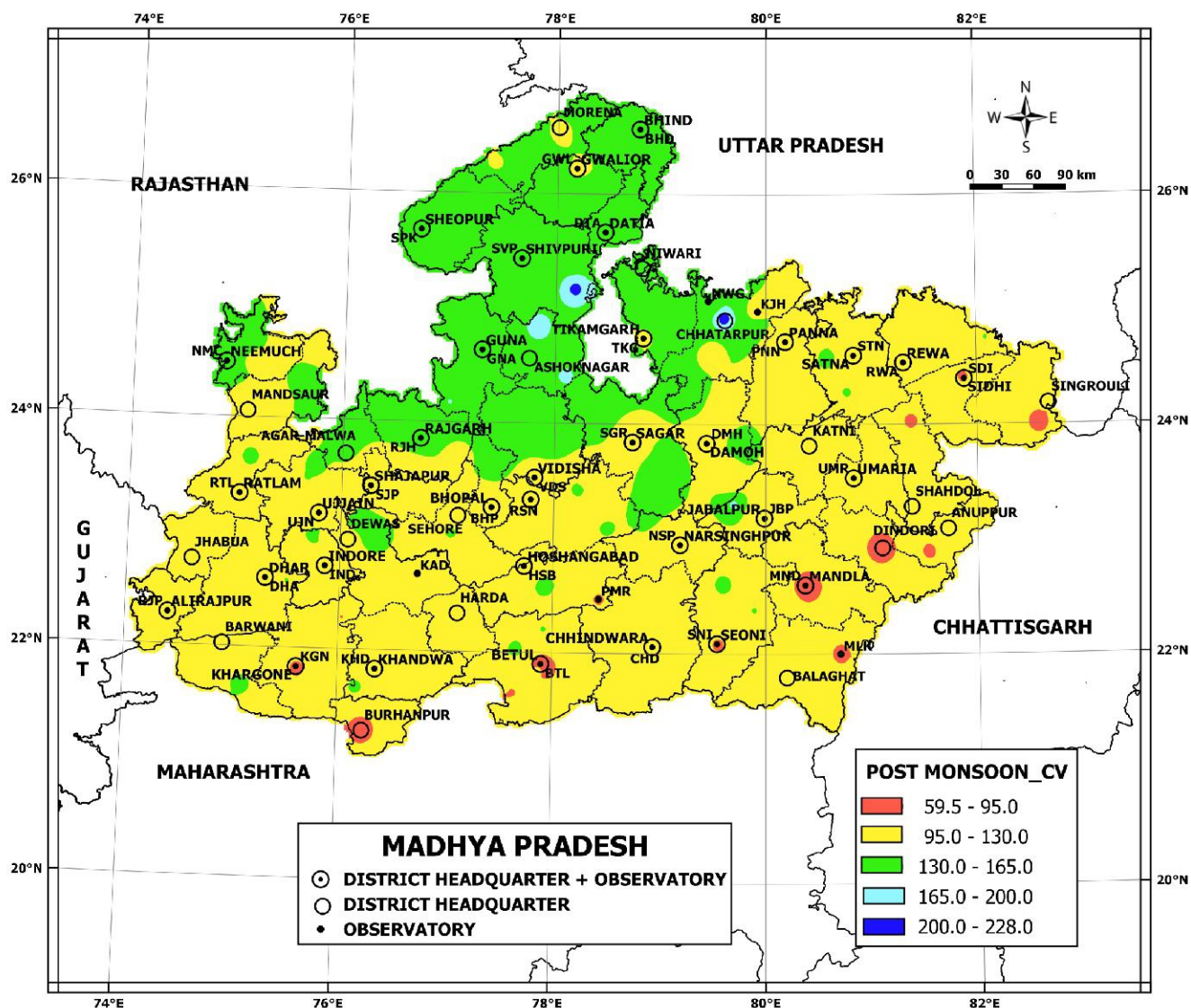


FIG.9(d): COEFFICIENT OF RAINFALL VARIATION (%) - WINTER SEASON
(JANUARY-FEBRUARY)

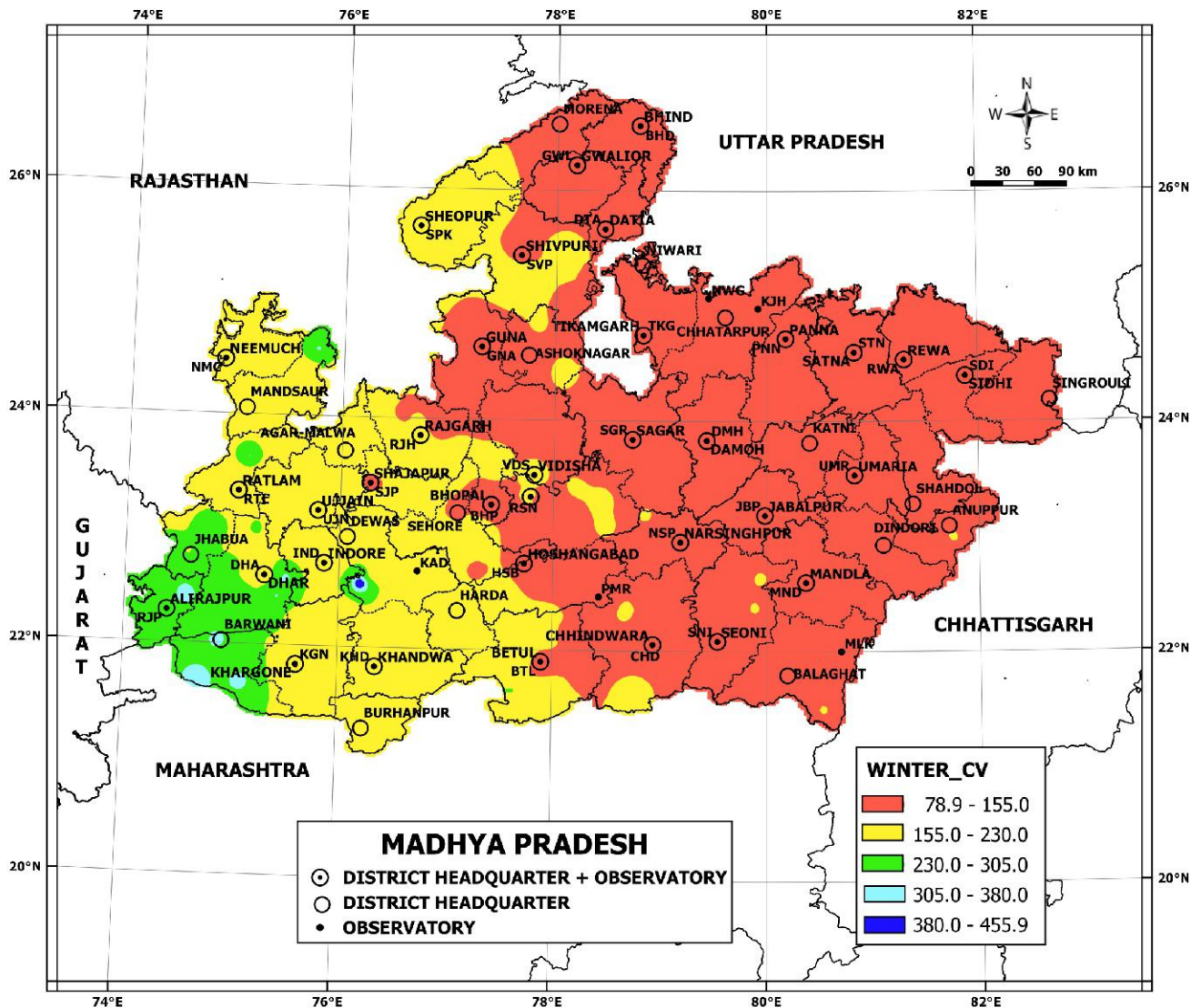
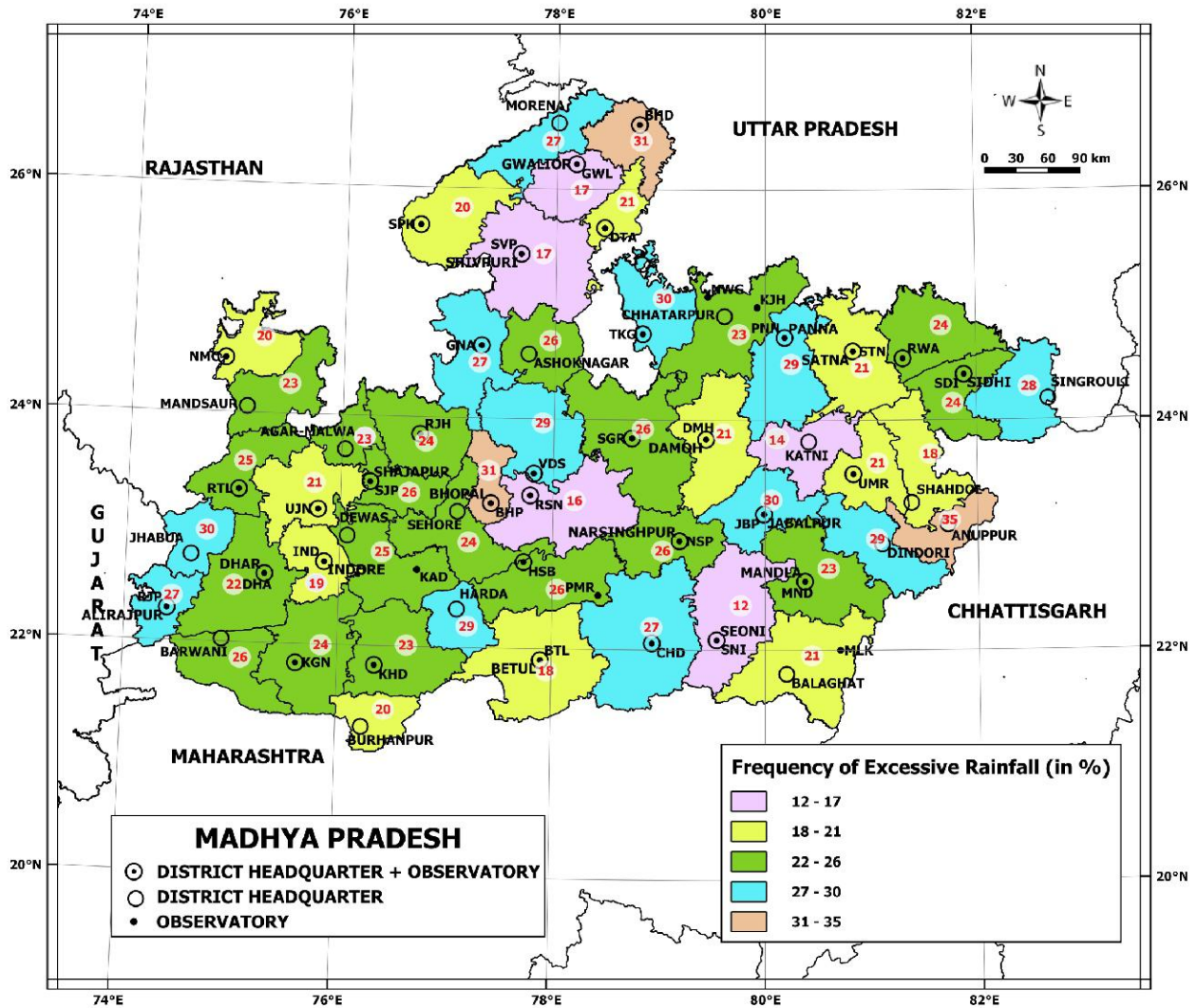
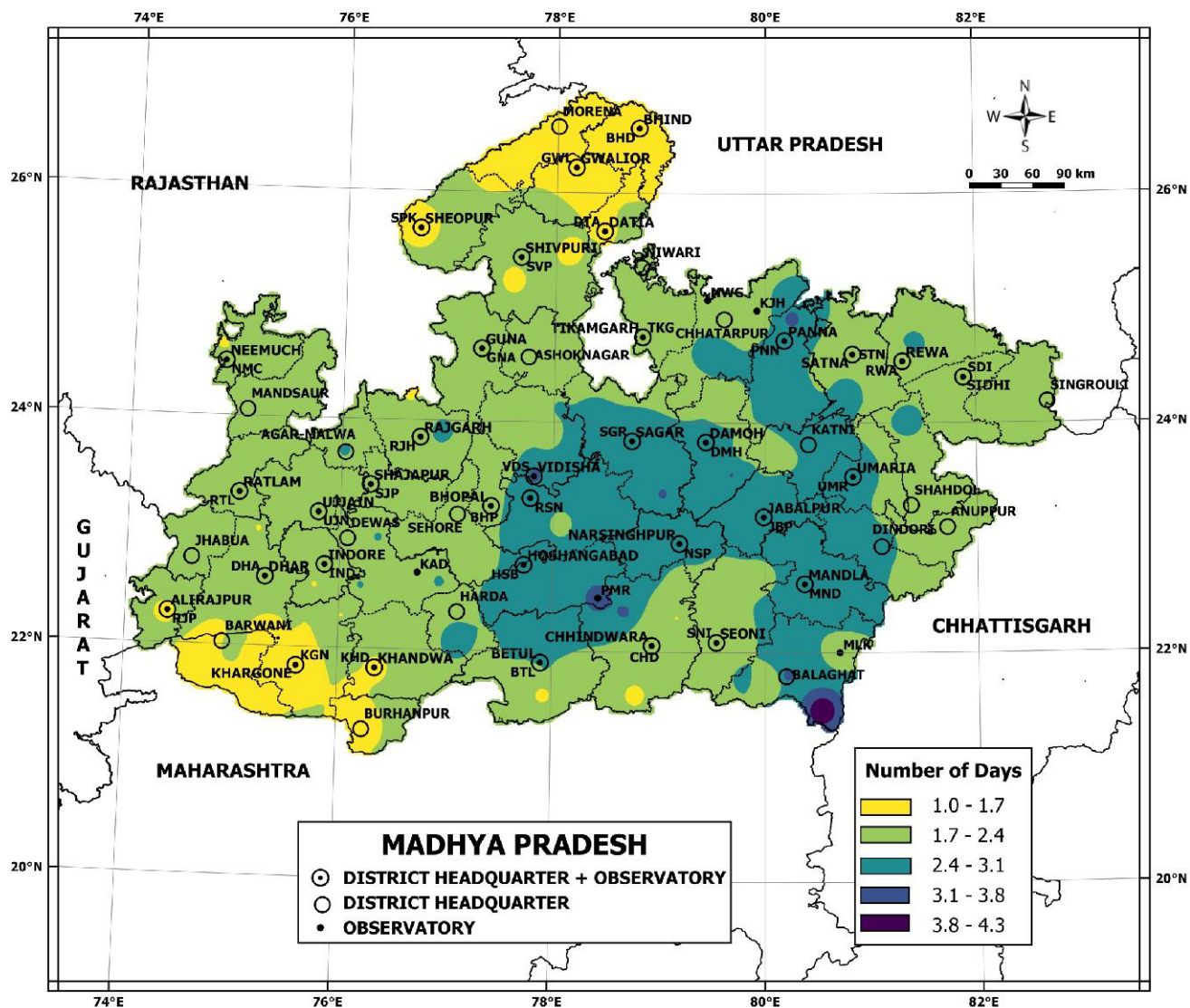


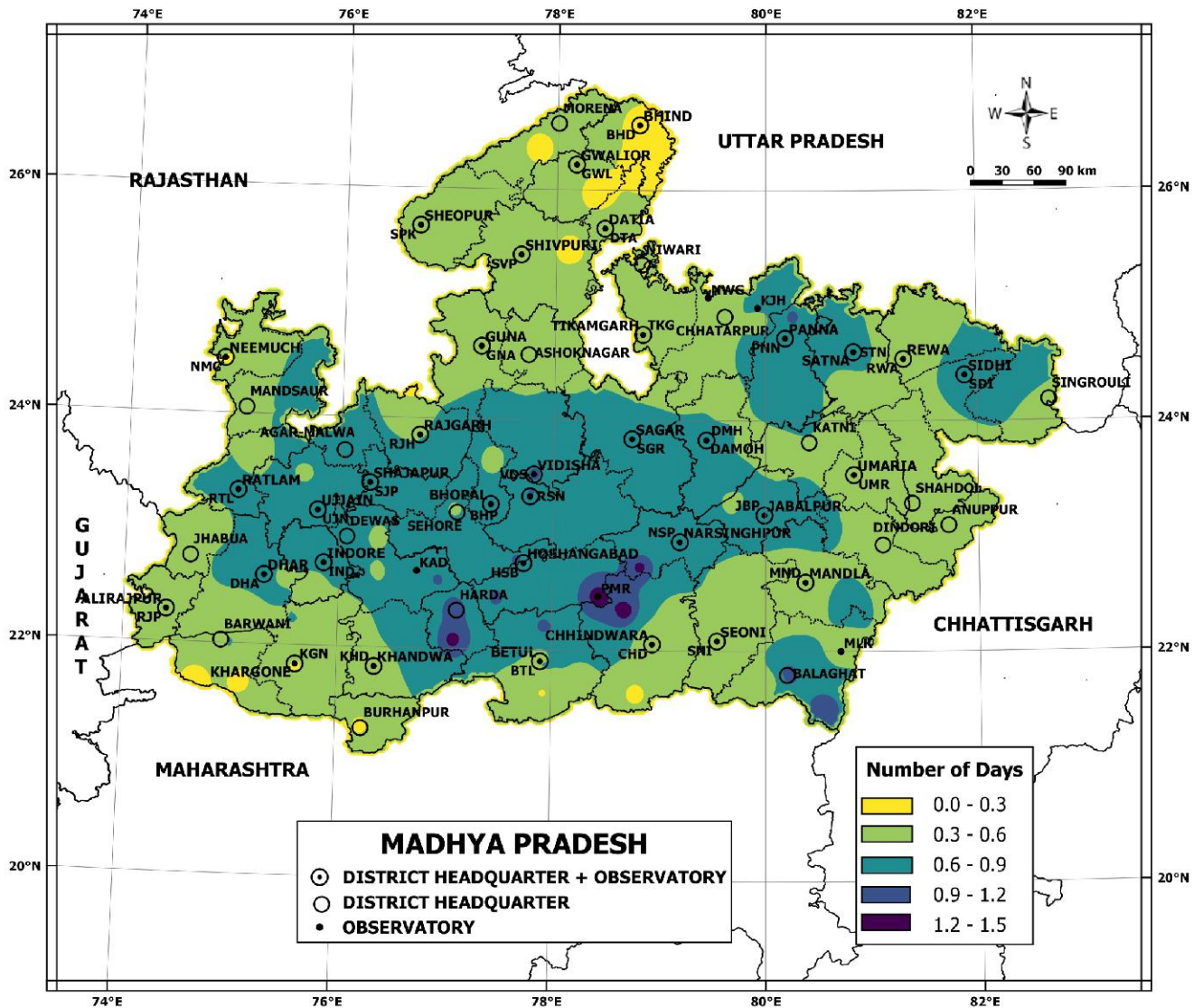
Fig. 10: DISTRICTWISE FREQUENCY OF EXCESSIVE RAINFALL IN PERCENTAGE (1971-2020)



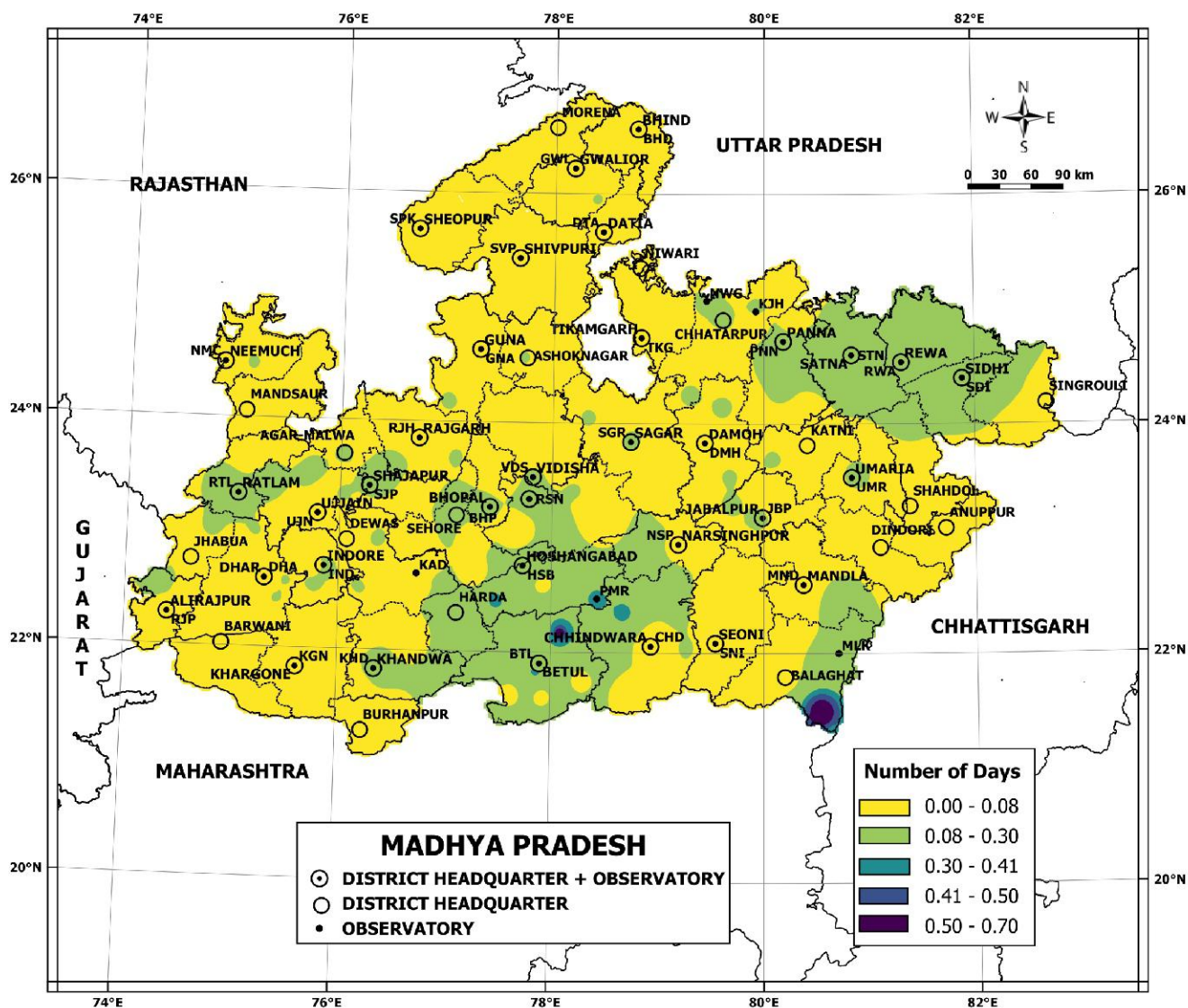
**FIG.11(a): AVERAGE FREQUENCY OF HEAVY RAINFALL EVENTS
SOUTH WEST MONSOON SEASON (1971-2020)
(JUNE-SEPTEMBER)**



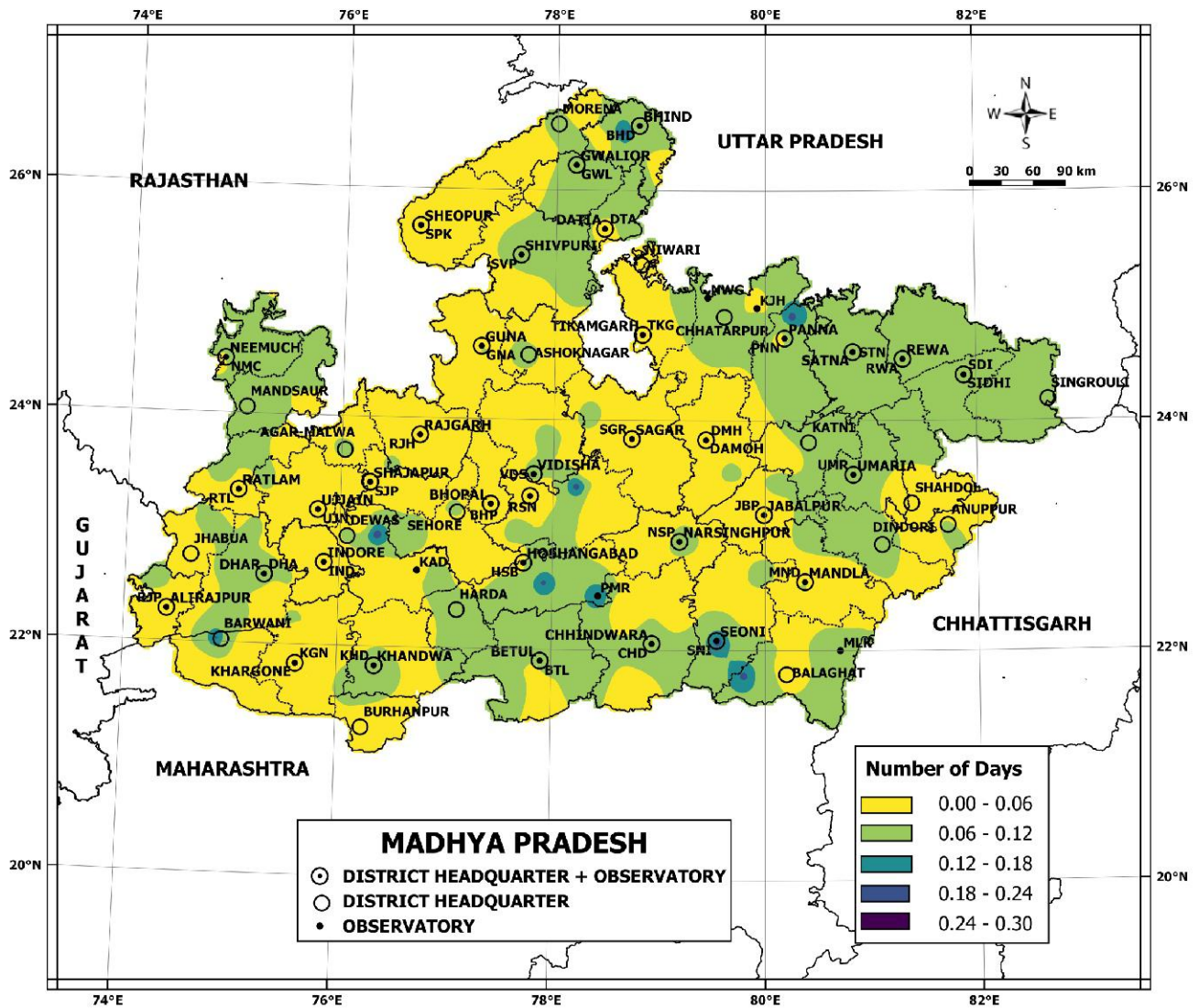
**FIG.11(b): AVERAGE FREQUENCY OF VERY HEAVY RAINFALL EVENTS
SOUTH WEST MONSOON SEASON (1971-2020)
(JUNE-SEPTEMBER)**



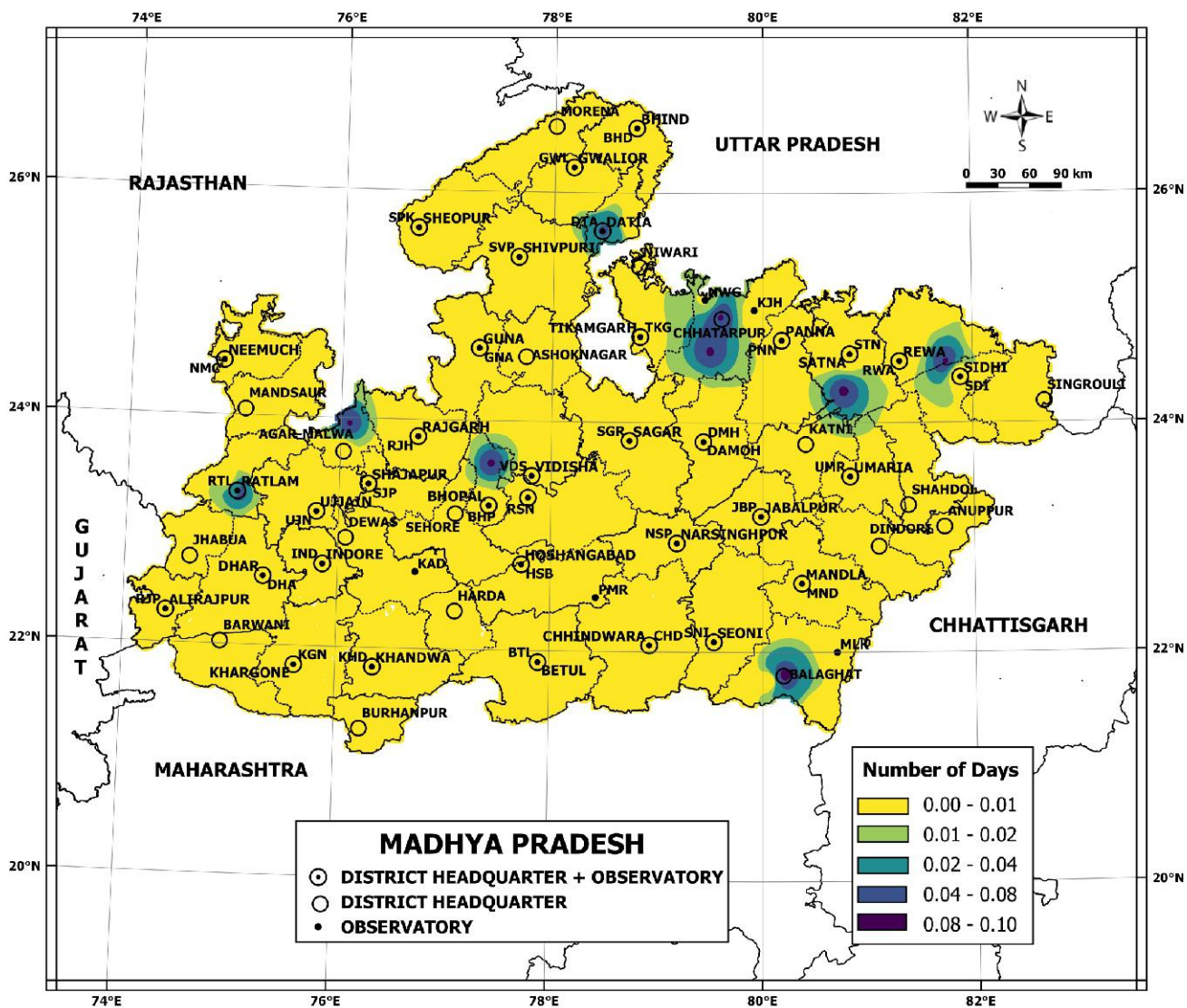
**FIG.11(c): AVERAGE FREQUENCY OF EXTREMELY HEAVY RAINFALL EVENTS
SOUTH WEST MONSOON SEASON (1971-2020)
(JUNE-SEPTEMBER)**



**FIG.11(d): AVERAGE FREQUENCY OF HEAVY RAINFALL EVENTS
POST-MONSOON SEASON (1971-2020)
(OCTOBER-DECEMBER)**



**FIG.11(e): AVERAGE FREQUENCY OF VERY HEAVY RAINFALL EVENTS
POST-MONSOON SEASON (1971-2020)
(OCTOBER-DECEMBER)**



**FIG.11(f): AVERAGE FREQUENCY OF EXTREMELY HEAVY RAINFALL EVENTS
POST-MONSOON SEASON (1971-2020)
(OCTOBER-DECEMBER)**

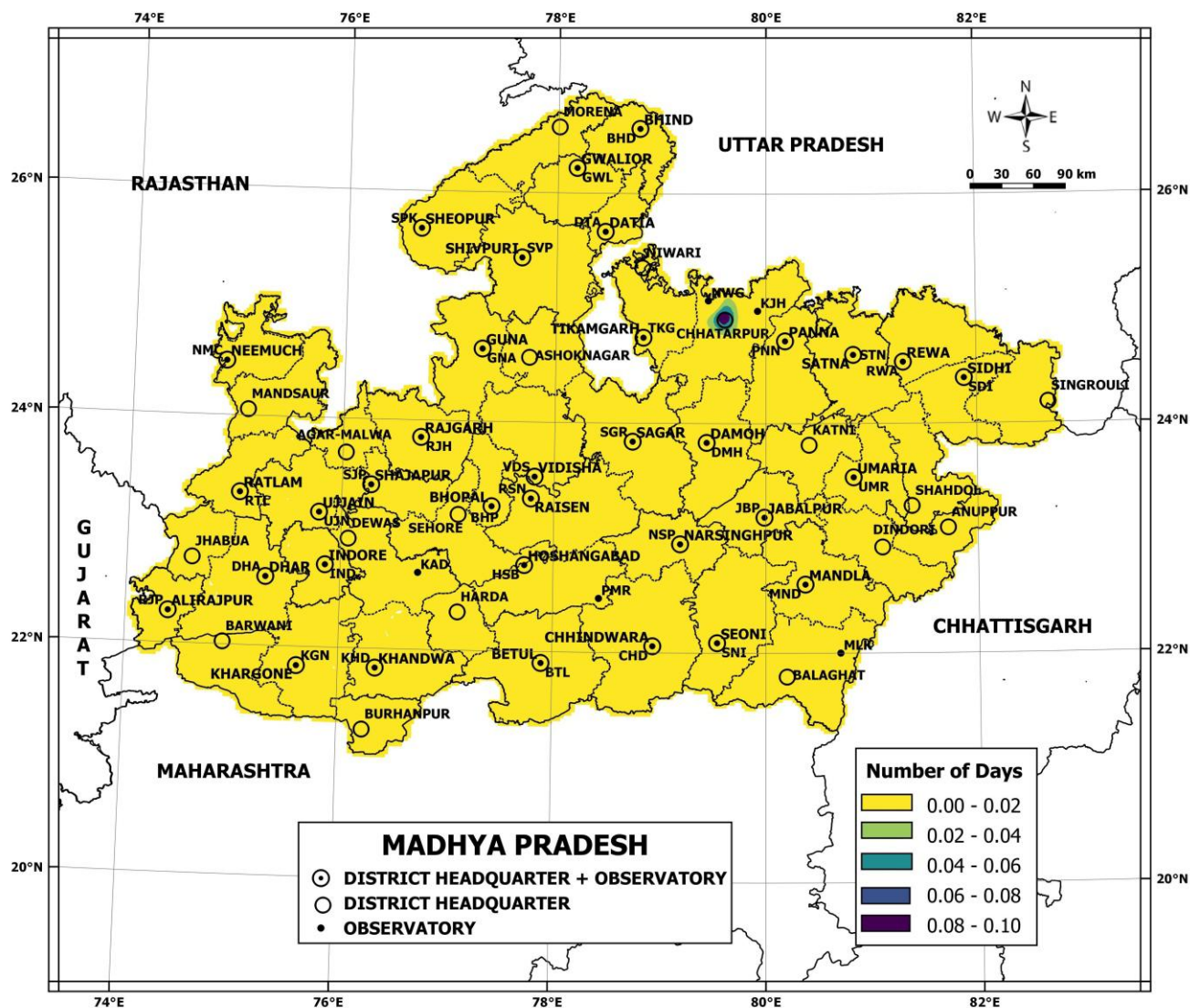


FIG.11(g): AVERAGE FREQUENCY OF HEAVY RAINFALL EVENTS : ANNUAL (1971-2020)

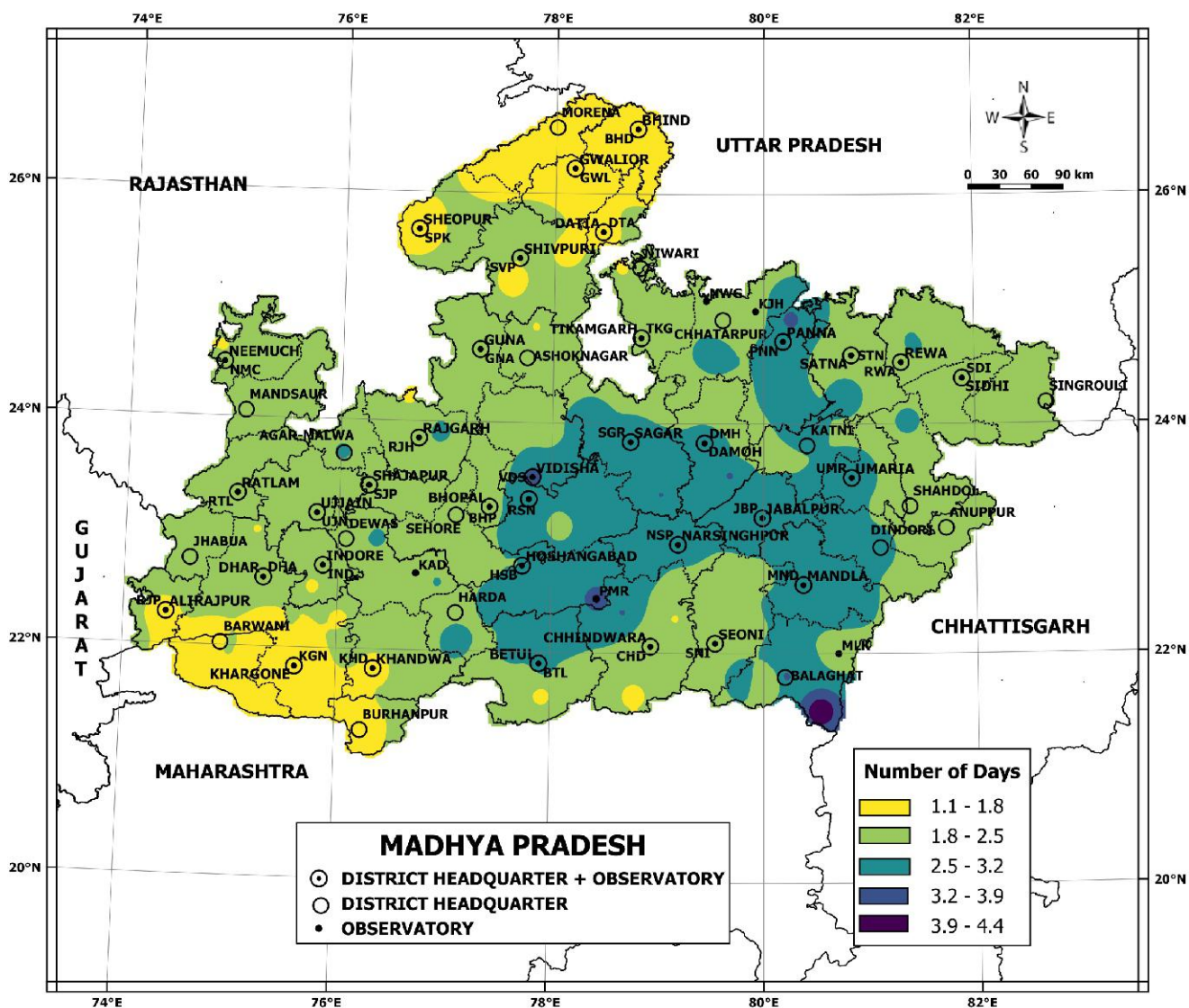


FIG.11(h): AVERAGE FREQUENCY OF VERY HEAVY RAINFALL EVENTS: ANNUAL (1971-2020)

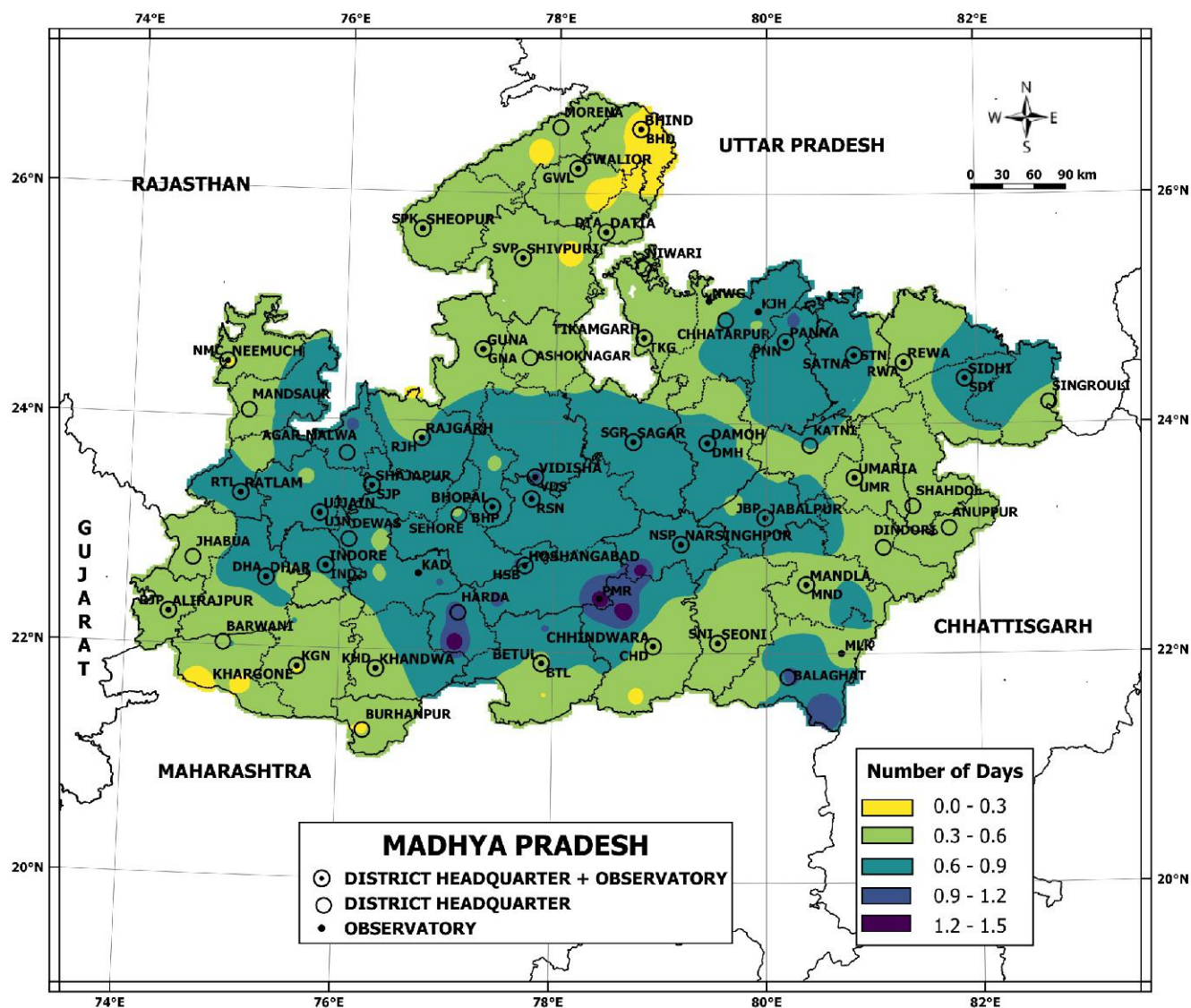
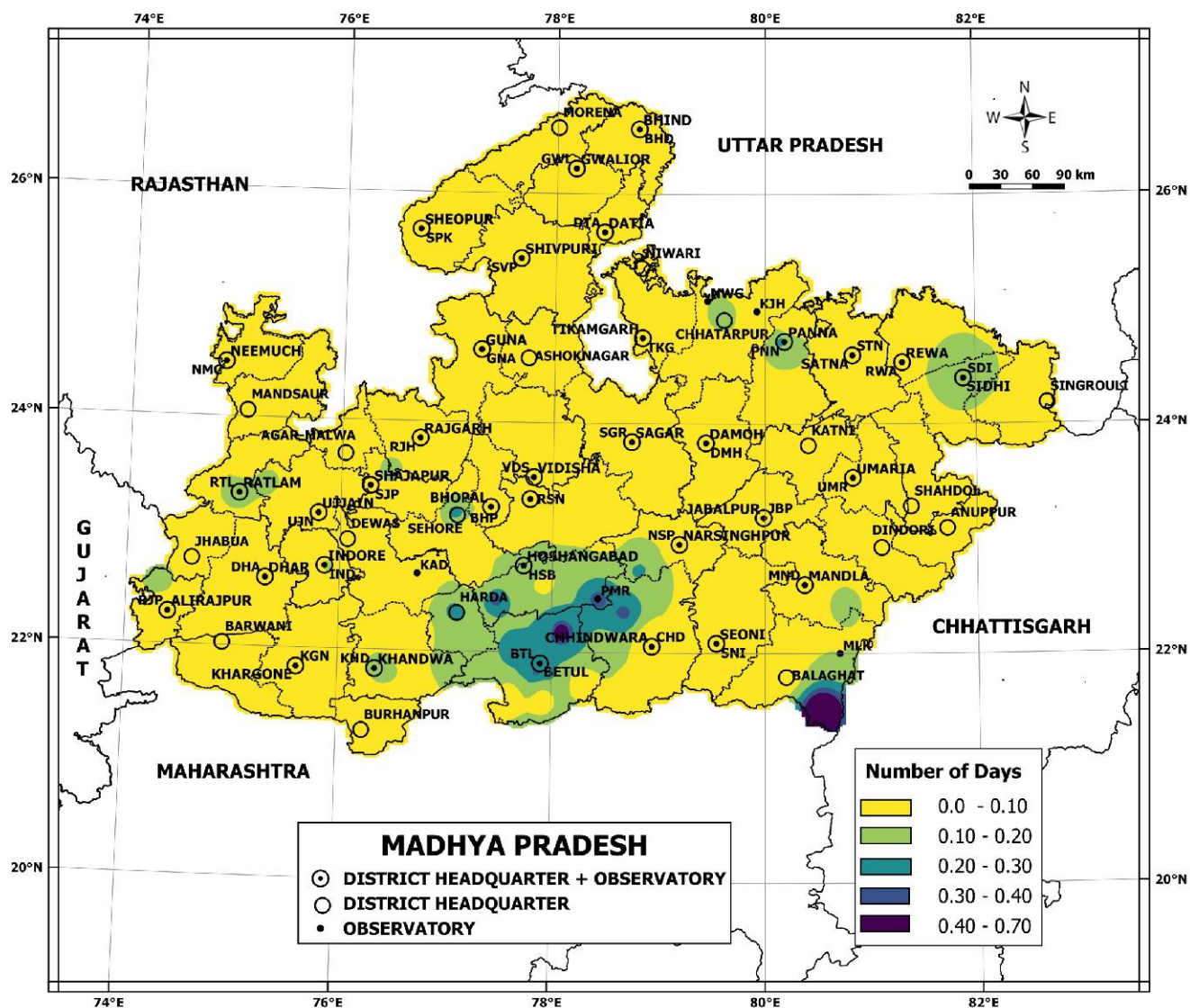


FIG.11(i): AVERAGE FREQUENCY OF EXTREMELY HEAVY RAINFALL EVENTS : ANNUAL (1971-2020)



STATE CLIMATOLOGICAL SUMMARY

CLIMATE OF MADHYA PRADESH

Introduction

Madhya Pradesh is located in the geographic heart of India, between latitude 21.2°N-26.87°N and longitude 74°59'-82°06' E. It is bordered on the west by Gujarat, on the northwest by Rajasthan, on the northeast by Uttar Pradesh, on the east by Chhattisgarh, and on the south by Maharashtra. The State has a subtropical climate. Like most of north India, it has a hot dry summer (April–June), followed by monsoon rains (July–September) and a cool and relatively dry winter. It is the second largest state in India after Rajasthan with an area of 3, 08, 000 sq. km. It is a part of peninsular plateau of India lying in north central part, whose boundary can be classified in the north by the plains of Ganga-Yamuna, in the west by the Aravali, east by the Chhattisgarh plain and in the south by the Tapti valley and the plateau of Maharashtra.

Rivers of Madhya Pradesh

Madhya Pradesh has ten major rivers originating from the State. As Madhya Pradesh is located in the center of India, most of the rivers are interstate rivers. The rivers namely, Chambal, Sindh, Betwa, Ken flow northward and meet with Yamuna whereas the river Sone falls directly into Ganga. Narmada, Tapi and Mahi rivers flow westward and meet Arabian Sea whereas Wainganga and Pench rivers meet Godavari in the south. Annual run off from these rivers within the state is estimated 81719 hm, out of which about 49743 hm can be harnessed for irrigation purpose. The State can be divided into six major river basins, the details of which are as follows. :

GANGA BASIN

River Ganga originates from the hills of Himalayas at Gangotri and meets Bay of Bengal. The basin extends into 11 states viz. Uttranchal, Himachal Pradesh, Uttar Pradesh, Haryana, Delhi, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh and West Bengal. In Madhya Pradesh, the basin extends up to the districts of Mandsaur, Ujjain, Shajapur, Rajgarh, Neemuch, Vidisha, Guna, Shivpuri, Datia, Gwalior, Morena, Sheopur, Bhind, Tikamgarh, Chhattarpur, Panna, Satna, Rewa, Ashoknagar, Shahdol, Sidhi, and Partly in the district of Annuppur, Umaria, Katni, Jabalpur. Mandla, Dindori, Dhar, Ratlam, Indore, Dewas, Sehore,

Raisen, Sagar, Bhopal, and Damoh. The Ganga basin can be further sub-divided into three sub-basins viz. Yamuna, Tons and Sone, details of which are discussed below.

YAMUNA SUB BASIN

Total geographical area of Yamuna sub basin in Madhya Pradesh is 1,42,250 km², out of which the area available for agriculture is estimated as 90,105 km. The major rivers of this sub-basin in Madhya Pradesh are Chambal, Ken, Dhasan, Betwa, Kunwari, Sindh, Paisuni and Jamni details of which are as under:

CHAMBAL SUB-SUB BASIN

River Chambal originates from Indore district and meets river Yamuna near Bhind. Total catchments area of Chambal in Madhya Pradesh is 59940 km². Total length of the river is 938 km, out of which initial length of 320 km lies in Madhya Pradesh, 226 km in Rajasthan, 216 km makes the boundary between Madhya Pradesh and Rajasthan, 112 km makes the boundary between Madhya Pradesh and Uttar Pradesh and 64 km in Uttar Pradesh before confluence with Yamuna river. Kali Sindh, Parvati, Kuno and Sip are the main tributaries of the river Chambal.

KUNWARI SINDH SUB-SUB BASIN

River Sindh originates in Vidisha district. Total catchments area of the river in Madhya Pradesh is 26699 km² and total length is 470 km. A length of 461 km of the river falls in Madhya Pradesh and 9 km in Uttar Pradesh. Major tributaries of Sindh are Mahuar, Parbati, Pahuji, and Kunwari.

JAMNI

River Jamni originates in Sagar district. Total catchment area in Madhya Pradesh is 1235 km² and total length is 201 km. In Madhya Pradesh the river flows for 29 km, for 85 km river makes boundary between Madhya Pradesh and Uttar Pradesh and last 87 km flows in Uttar Pradesh.

DHASAN

This Dhasan river originates in Raisen district of Madhya Pradesh. Total basin area in Madhya Pradesh is 8291 km². Total length of the river is 365 km, out of which 240 km lies in Madhya Pradesh, 54 km common boundary between Madhya Pradesh and Uttar Pradesh and 71 km in Uttar Pradesh.

KEN

River Ken originates in Jabalpur district. Total basin area in Madhya Pradesh is 24785 km². Total length of river is 427 km, out of which 292 in Madhya Pradesh, 84 km in Uttar Pradesh and 51 km makes the common Boundary between the two states.

PAISUNI AND BAIDHAN

Total basin area of river Paisuni in Madhya Pradesh is 416 km² and of Baidhan river is 1504 km² in Madhya Pradesh. These two rivers originate in Satna and Panna District and meet river Yamuna below Banda district.

TONS

Tons originates in Satna district. Total basin area in Madhya Pradesh is 11974 km². The river meets Ganga after flowing 246 km in Madhya Pradesh, 7 km making boundary between Madhya Pradesh and Uttar Pradesh and finally 67 km in Uttar Pradesh.

SONE

Total basin area of this river in Madhya Pradesh is 28880 km². Total length of river is 784 km. In Madhya Pradesh, the river flows for 470 km. The river meets Ganga in Bihar state near Patna. The major tributaries of river Sone are Johila, Mahanadi, Rehar, Knahar and Banas.

NARMADA

River Narmada originates from Amarkantak and flows from east to west and joins Arabian Sea. Total drainage area of the river is 98796 km², out of which 85149 km² lies in Madhya Pradesh after formation of Chhattisgarh, which has 710 km². Total length of river is 1312 km and in Madhya Pradesh the river flows for a length of 1077 km. Major tributaries of the Narmada are Banjar, Heran, Kolar, Sukta, Tawa, Tendon, Beda, Sher, Shalkar, Man, Jobat and Goi rivers.

GODAVARI

In Madhya Pradesh Godavari river basin is mainly comprised by its tributaries river Wainganga, Wardha and Pench which originate in districts Seoni and Chhindwara. Total drainage area of these rivers in Madhya Pradesh is 23388 km².

TAPI

River Tapi originates from Multai in Betul district. This river also flows from east to west. Total basin area of Tapi is 65145 km². Out of which Madhya Pradesh has 9800 km². Total length of the river is 724 km. In Madhya Pradesh the length of river is 332 km.

MAHI

Mahi originates in Dhar district and joins Gulf of Khambat. Total drainage area of this basin is 34842 km² out of which only 6700 km² lies in Madhya Pradesh. Total length of the river is 583 km of which 158 km traverses in Madhya Pradesh. Anas is the major tributary of Mahi in the State.

MAHANADI

After the formation of Chhattisgarh State, the major portion of Mahanadi basin now lies in Chhattisgarh. Presently, only 154 km² basin area of Hasdeo River in district Anuppur lies in Madhya Pradesh.

The state is divided into following two meteorological subdivisions.

- 1) **East Madhya Pradesh** consisting of Anuppur, Balaghat, Chhatarpur, Chhindwara, Damoh, Dindori, Jabalpur, Katni, Mandla, Narsinghpur, Niwari, Panna, Rewa, Sagar, Satna, Seoni, Shahdol, Sidhi, Singrauli, Tikamgarh and Umaria
- 2) **West Madhya Pradesh** consisting of Agar, Alirajpur, Ashoknagar, Barwani, Betul, Bhind, Bhopal, Burhanpur, Datia, Dewas, Dhar, Guna, Gwalior, Harda, Hoshangabad, Indore, Jhabua, Khandwa, Khargon, Mandsaur, Morena, Neemuch, Raisen, Rajgarh, Ratlam, Sehore, Shajapur, Sheopur, Shivpuri, Ujjain and Vidisha

Mountain Peaks of Madhya Pradesh

The top 10 highest mountain peaks of Madhya Pradesh are given below rank wise:

Rank	Mountain	Height (in metre)
1	Dhupgarh	1,351
2	Dhar	828
3	Tinsmal	652
4	Ganaiya Pahar	576
5	Katowa Pahar	576
6	Kariya Pahar	572
7	Maihar Hill	527
8	Ramna Pahar	512
9	BhulaoToria	509
10	Bhonra Pahar	508

Climate

Madhya Pradesh state experiences a tropical type of climate. The state is situated in the central part of India. The geographical factors like distance from the sea and altitude of the state have influenced the Madhya Pradesh climate. The climate of Chhattisgarh is mainly tropical, humid and sub-humid. The climate is hot because of its position on the tropic of cancer. May is the hottest month while December and January are the coldest ones. The state is mostly dependent on the monsoons for rain. The climatic condition during summer is hot and gusts of dry wind blows over the state. During winter the temperature falls to some extent. The period from November to March is generally pleasant over the state except during a few spells when severe cold waves associated with western disturbances affect northern parts of the state in winter months. April and May months are hot, very dry and generally uncomfortable. Weather tends to be oppressive during June due to high order of humidity and temperature. The next three months (July, August and September) are fairly comfortable due to reduced day temperatures, although the humidity continues to be high.

In general, the year may be divided into four seasons. Summer in Madhya Pradesh lasts from the month of March to May. During these months mercury level is quite high. June to September is the southwest monsoon season in Madhya Pradesh. The state receives about 90% of annual rainfall during these months. The period of October, November and December constitutes the post-monsoon season. January and February are the winter months in Madhya Pradesh.

Areas in the state under each climate pattern based on Koppen's classification are shown in Fig.2. This broad classification is based on annual and monthly means of precipitation in cm and temperature in °C.

The climate of state varies from the climate type (Aw) Tropical savanna, Hot; Seasonally dry (usually winter) and (Cwa) Subtropical Monsoon. Mild winter: dry winter: hot summer over most area of the state to (BSh) Tropical steppe. Semi-arid: hot over small area of the state.

Sea Level Pressure and Winds

The seasonal variation of atmospheric pressure over the state takes place in a systematic manner with a maximum in the winter (January) and minimum in the southwest monsoon season (July). The pressure gradient over the state generally remains weak except during late summer and monsoon season.

During winter the atmospheric pressure is high over north India and decreases to the south. Over Madhya Pradesh the pressure gradient is weak. Winds are mostly light and blow from east, north, northeast or southeast. Sometimes winds are calm. Pressure thereafter

decreases and in March it is relatively higher to the east and in April, the pressure decreases from southwest to northeast over the state. Accordingly the winds, which are light and mainly from north to northeast in January, turn gradually anticlockwise and are replaced by light northwesterly to westerly winds by April. With the advance of the summer, the pressure gradient increases and correspondingly the winds are also strengthen reaching their maximum strength in June. In June the pressure decreases from south-southwest to north-northeast over the state and correspondingly the winds are from south or southwest. With the progress of the monsoon, winds become mostly westerly. October is the month of transition, with weakest pressure gradient. From October onwards the changeover of the pressure and wind pattern to the winter pattern commences.

Table I gives the monthly mean wind speed in kilometer per hour and predominant wind direction in the morning and evening for observatory stations in the state.

Temperature

Table II gives the mean maximum and minimum temperatures at the observatory stations of the sub-division. The spatial distribution of mean maximum and mean minimum temperatures for the representative month of four seasons of year is depicted in Fig. 2(a, b,c, d) and 3(a, b, c, d). Fig. 4 and 5 give the extremes of maximum and minimum temperatures ever recorded on data up to 2017.

East Madhya Pradesh

The climate of the region is subtropical monsoon, Mild Winter, Dry winter ; hot summer and Tropical Savanna, Hot, Seasonally dry (usually winter). The chief feature is that the area is warm throughout the year. The annual mean temperature is above 24⁰C. During the hottest part of the year, March to June , the mean temperature ranges between 24.8⁰C to 33.6⁰C, increasing towards the interior and to the south.

Pre-monsoon season is the hottest season. May is the hottest month with mean maximum temperature ranges between 40.2⁰C to 42.6⁰C and mean minimum temperature ranges between 23.8⁰C to 27.4⁰C. Temperatures begin to fall with the onset of the southwest monsoon season in the first week of June. The drop in day temperatures after May till August is 10⁰C to 11⁰C over the subdivision. The fall in night temperature is less rapid. After the withdrawal of the monsoon *i.e.* in the first week of October second maxima in maximum temperature is observed due to insolation and thereafter there is a gradual decrease in both the temperatures till December / January which is coldest part of the year with mean maximum

temperature ranges between 23.5°C to 27.1°C and mean minimum temperature ranges between 6.5°C to 10.8°C. Both day and night temperatures then begin to rise gradually till May.

The mean yearly diurnal range of temperature is about 14°C at East Madhya Pradesh stations. The mean daily diurnal range of temperature for the year as a whole is varies from 7°C to 18°C at East Madhya Pradesh stations. The maximum range is generally reached in December to April and is about 18°C. The minimum range of 7°C to 8°C occur in the monsoon months July and August.

West Madhya Pradesh

Pre-monsoon season is the hottest season. May is the hottest month with mean maximum temperature range between 35 °C to 43 °C and mean minimum temperature ranges between 23 °C to 29 °C. In summer season day temperatures are more or less uniform over the plains. Temperatures begin to fall with the onset of the southwest monsoon season in the second week of June. The drop-in day temperatures after May till August is 10°C to 13°C over the subdivision. The fall in night temperature is less rapid and it is about 2°C to 4°C. After the withdrawal of the monsoon *i.e.* in the first week of October, second maxima in maximum temperature is observed due to insolation and thereafter there is a gradual decrease in both the temperatures till January which is coldest month with mean maximum temperature ranges between 22°C to 30°C and mean minimum temperature ranges between 7.0°C to 13.5°C. In winter temperatures increase southward in plains. Both day and night temperatures then begin to rise gradually till May.

The mean yearly diurnal range of temperature is about 10°C to 15°C at West Madhya Pradesh. July and August have the smallest daily diurnal range of temperature (7°C to 8°C). The mean daily diurnal range of temperature for the period December to May is of the order of 15°C to 17°C at West Madhya Pradesh stations.

Maximum temperatures of 47°C - 48°C have been recorded at a number of stations in Madhya Pradesh. The highest maximum temperature ever recorded at any individual station was 49.8°C at Damoh Observatory in Damoh district on 29th May 2000 which is about 8.6°C higher than the normal for the warmest month. The lowest minimum temperature ever recorded at any individual plain station was -4.0 °C on 13th January 1981 at Shivpuri observatory in Shivpuri district which is about 13.2 °C lower than the normal for the coldest month.

Humidity

Table III gives the mean relative humidity at 0830-hours and 1730-hours IST for observatory stations in the two subdivisions in the state.

East Madhya Pradesh

Relative humidity is generally high during the period June to February in the morning and on an average, it varies from 60% to 86% and from 43% to 80% in the afternoon. Summer season is the driest part of the year with relative humidity varies from 39% to 52% in the morning and 25% to 32% in the afternoon and making the summer very dry and hot.

Diurnal variation in the relative humidity is the least during the monsoon season and it is the highest in the winter season.

West Madhya Pradesh:

Relative humidity is generally high during the period June to February in the morning and on an average, it varies from 63% to 87% and from 39% to 78% in the afternoon. Summer season is the driest part of the year with relative humidity varies from 40% to 49% in the morning and 25% to 30% in the afternoon and making the summer very dry and hot.

Cloudiness

Table IV and IV(a) give the mean monthly and total cloud amount and mean number of days with clear and overcast skies at 0830 and 1730 hours IST respectively for individual observatory stations in the state and for each subdivision as a whole.

The period, November to March, is cloudless or less clouded. Afternoons are however comparatively more clouded than forenoon in this period. In April and May the sky remain cloudless or lightly clouded over West Madhya Pradesh but clouding over east Madhya Pradesh increases, where about 3-5 oktas of the sky remain covered during evenings.

During the monsoon season (June- September), skies are heavily clouded especially during July and August, when more than 5 oktas of skies are covered with clouds. On an average in each of these two months, the sky remains overcast for more than 10 days per month and clear on hardly a day. During October clouding decreases to a great extent over the entire state, more so in the northwest region.

Rainfall

Table V gives district wise and subdivision wise mean monthly and annual rainfall and number of rainy days (i.e. days with rainfall of 2.5 mm or more). Fig. 6 and 6(a) to 6(d) depict the spatial distribution of the annual and seasonal rainfall over the state.

East Madhya Pradesh:

The total annual precipitation for this subdivision is about 114 cm and total annual rainy days are about 51. The precipitation in the state occurs in the form of rain. The annual rainfall varies from district to district. Southeastern parts of the subdivision receive more rain. Niwari district in the northern part of the subdivision receives the lowest annual rainfall about 82 cm and Balaghat district in the southernmost part together with the adjoining area to the west of the Maikala Hills constitute the area of the maximum rainfall about 139 cm in the subdivision. Southwest monsoon season is the principal rainy season in this subdivision. This subdivision receives maximum amount of rainfall in the southwest monsoon season and varies from 88% at Umari and Seoni districts to 93% at Narsinghpur district. July and August constitute the rainiest part of the year in this subdivision with an average rainfall about 61% of annual rainfall.

West Madhya Pradesh:

The total annual precipitation for this subdivision is about 93 cm and the total annual rainy days are about 41. West Madhya Pradesh subdivision is comparatively drier than the East Madhya Pradesh. August is the rainiest month with an average rainfall about 32 cm. The annual rainfall varies from about 69 cm in Bhind district in the northern parts to 125 cm in Hoshangabad district in the central part. Morena, Bhind and Sheopur districts in the northern part and Barwani, Khargone districts in the southwestern part of this subdivision receive comparatively less rainfall than the districts in the central part of the subdivision viz. Harda, Sehore, Raisen and Hoshangabad etc. Southwest monsoon season is the principal rainy season in this subdivision. This subdivision receives maximum amount of rainfall in the southwest monsoon season and varies from 89% at Burhanpur district to 94% at Alirajpur district. July and August constitute the rainiest part of the year with an average rainfall about 64% of annual rainfall.

Fig. 6 (a) and 6 (b) show rainfall pattern during winter (January and February) and pre-monsoon season (March-May) respectively. During these seasons East Madhya Pradesh receives 2.9% and 2.0% of annual rainfall and West Madhya Pradesh receives 1.5% and 1.4% respectively. Fig. 6(c) shows rainfall during the southwest monsoon season. During this season East Madhya Pradesh and West Madhya Pradesh receive about 90% and 93% respectively of

the annual rainfall. Fig.6(d) shows rainfall during the post monsoon season and receives about 5% of annual rainfall for both subdivisions. The percentage of the seasonal number of rainy days with respect to the annual number of rainy days shows 86% in East Madhya Pradesh and 89% in West Madhya Pradesh during the Southwest monsoon season and about 3% during the pre-monsoon season, 6% during the post monsoon season in both subdivisions. While during the winter season 5% in East Madhya Pradesh and 2% in West Madhya Pradesh .

The precipitation in the state mainly occurs in the form of rain. The state receives rainfall mainly due to low pressure areas and monsoon depressions originating in the Bay of Bengal during the southwest monsoon season. During the monsoon season most of the depressions originating in the Bay of Bengal cross inland and move westwards or west-north-westwards over the state. The rest of the rainfall occurs in winter in association with the passage of western disturbances across north India. The rainfall occurs in pre-monsoon months due to thunderstorms and hailstorms developed with intense convective activity and cyclonic circulations with adequate moisture. After April the rainfall gradually increases till mid-June and there after increases sharply till September. It decreases rapidly after withdrawal of southwest monsoon.

The southwest monsoon sets in over the state by about the second week of June and extends over the entire state by 15th June. The monsoon starts to withdraw from the state by about the last week of September and completely withdraws by about second week of October.

The features of rainfall described above are also evident from Fig. 7 and Fig. 7(A) which show the annual and seasonal rainfall for the individual districts as well as for the subdivision and provides a measure for comparison of seasonal rainfall with the annual for both district wise and subdivision wise rainfall.

During winter (January and February) East Madhya Pradesh and West Madhya Pradesh receive rainfall about 3.3 cm and 1.4 cm respectively, which although small in amount, is of great significance for agriculture. During winter rainfall occurs in association with western disturbances.

Table VI gives the mean monthly and annual rainfall and rainy days for various river catchments (No.103, 104, 105, 315, 404, 405, 406, 407, 408, 409, 414) in the state. The annual rainfall of this river catchments is shown in Fig.8. However, table VI shows the districts/parts of districts of the state covered by these catchments.

Catchment No.103 formed by the river Tapti which covers districts or part of the districts of Barwani, Betul, Burhanpur and Khargone receives an annual rainfall of 850.8 mm with 45 rainy days.

Catchment No.104 formed by river Narmada covers districts or part of the districts viz. Alirajpur, Balaghat, Barwani, Betul, Chhindwara, Dewas, Dhar, Dindori, Harda, Hoshangabad, Jabalpur, Jhabua, Katni, Khandwa, Khargone, Mandla, Narsinghpur, Raisen, Sehore and Seoni receives an annual rainfall of 1078.5 mm with 48 rainy days.

Catchment No.105 formed by river Mahi covers districts or part of the districts Dhar, Jhabua and Ratlam receives an annual rainfall of 990.1 mm with 44 rainy days.

Catchment No.315 formed by river Wainganga (excluding Panganga)which covers districts or part of the districts viz.Balaghat, Chhindwara, Mandla and Seoni receives an annual rainfall of 1204.8 mm with 57 rainy days.

Catchment No. 404 formed by river Chambal up to Kotah dam site which covers the districts or part of the districts viz. Agar, Dewas, Dhar, Indore, Mandsaur, Neemuch, Ratlam and Ujjain receives annual rainfall of 904.7 mm with 39 rainy days.

Catchment No.405 formed by river Chambal from Kotah dam site to its confluence with river Banas (excluding river Banas) which covers the districts or part of the districts viz. Agar, Dewas, Guna, Mandsaur, Rajgarh, Sehore, and Shajapur receives annual rainfall of 990.9 mm with 42 rainy days.

Catchment No. 406 formed by river Banas which covers the district or part of the district viz. Neemuch receives annual rainfall of 805.2 mm with 35 rainy days.

Catchment No. 407 formed by river Chambal from its confluence with river Banas to its confluence with river Yamuna which covers the district or part of the district viz. Sheopur receives annual rainfall of 780.7 mm with 35 rainy days.

Catchment No. 408 formed by river Yamuna between River Chambal and its confluence with River Ganga which covers the districts or part of the districts viz. Ashoknagar, Bhind, Bhopal, Chhatarpur, Damoh, Datia, Gwalior, Morena, Niwari, Panna, Raisen, Sagar, Sheopur, Shivpuri, Tikamgarh and Vidisha receives annual rainfall of 985.9 mm with 43 rainy days.

Catchment No. 409 formed by river Ganga between its confluence with river Yamuna and river Gogra (excluding river Gogra) including Gomti which covers the districts or part of the districts viz. Rewa and Satna receives annual rainfall of 1070.2 mm with 46 rainy days.

Catchment No. 414 formed by river Son which covers the districts or part of the districts viz. Anuppur, Dindori, Shahdol, Sidhi, Singrauli and Umaria receives annual rainfall of 1107.9 mm with 52 rainy days.

Rainfall Variability

The spatial distribution of variation of annual rainfall over Madhya Pradesh is depicted in Fig. 9. Coefficient of Variation (CV) which is expressed as percentage is defined as:

$$\text{C.V.} = \frac{\text{Standard deviation } (\sigma)}{\text{Normal (N)}} \times 100$$

The spatial distribution of CV of seasonal rainfall over Madhya Pradesh is shown in Fig.9, 9(a), 9(b), 9(c) and 9(d) for the annual rainfall and seasons: pre-monsoon season (March to May), southwest monsoon season (June to September), post monsoon season (October, November and December) and winter season (January and February) respectively

It is observed from Fig. 9 that values of CV of annual rainfall range between 9.9 % and 50.2 % over the entire state of Madhya Pradesh. Most part of the state is having CV ranging between 20% and 30%. Most part of the districts viz., Neemuch, Mandsaur, Agar-Malwa, Alirajpur and Bhind of the West MP and small parts of districts viz., Panna, Satna, Anuppur, Balaghat, Katni and Damoh of East MP have CV values ranging between 30% and 36%. Small parts of the districts namely Balaghat, Panna, Bhind, Khargone, Rajgarh, Shajapur, Mandsaur, Agar Malwa, Ujjain and Alirajpur have CV values ranging between 36% and 45%. The smallest range of CV i.e. 9.9% to 20% is observed in Balaghat, Chhindwara and Dindori districts.

It is observed from Fig. 9(a) that values of CV of pre-monsoon season range between 63.3% to 631.7%. Most part of the districts in East and Central Madhya Pradesh is having CV ranging between 63.3% and 175%.

Most part of the districts in West Madhya Pradesh viz. Agar-Malwa, Alirajpur, Jhabua, Rewa, Mandsaur, Shajapur, Ratlam, Ujjain, Dewas, Indore, Dhar, Barwani, Khandwa, Khargone, Betul and Burhanpur and some parts of the districts viz., Morena, Raisen, Ashoknagar, Sheopur, Shivpuri, Bhind, Niwari, Chhatarpur, Damoh, Katni, Panna, Dindori, Chhindwara and Balaghat have CV values ranging between 175% and 300%. The highest range of CV i.e. 500% to 631.7% is observed in the smallest part of the districts Dhar, Khargone, and Barwani. The smallest range of CV i.e. 63.3% to 175% is observed in more than 50% of total of the districts of state.

During the southwest monsoon season, it is observed that values of rainfall variability (CV) ranges between 15.7 % and 48.5% (Fig. 9(b)). Most part of the state is having CV values range between 29% and 36%. Remaining part of the state has CV values range between 22% and 29%. The highest range of CV i.e. 45% to 48.5% is observed in the smallest part of the

Bhind district. The smallest range of CV i.e. 15.7% to 22% is observed in Chhindwara, Seoni, Balaghat and Mandla districts.

During the post monsoon season the values of CV ranges between 59.5% and 228% (Fig. 9(c)). Major part of the state is having CV values ranging between 100% and 135% in the Eastern, Western and Southern districts of the state. The lowest CV values are observed in 40% of the districts (21) i.e. ranging between 59.5% and 100%. The highest value of CV ranging between 200% and 228% is observed in the smallest part of Chhatarpur and Shivpuri districts.

During the winter season the values of CV range between 78.9% and 455.9%(Fig. 9(d)). All districts in East MP and some districts of West MP have the lowest CV values ranging between 78.9% and 150%. Most districts of western Madhya Pradesh are having CV values ranging between 150% and 230%. Major part of the districts Alirajpur, Jhabua, Barwani and Khargone in the western most part of the state are having CV values ranging between 230% and 300%. Some part of these districts are having CV values ranging between 300% and 375%. The highest CV value is observed in the smallest part of Dewas district of West MP which ranges between 375% to 455.9%.

As 91% of annual rainfall occurs during southwest monsoon season, the variability in this season over Madhya Pradesh state is relatively low and similar to that of annual rainfall while as the variability of rainfall during pre-monsoon and winter seasons are very high with CV values exceeding 500% and 375% respectively over the state. In general, the contribution of rainfall during the southwest monsoon season to the annual rainfall is the maximum over the state.

Excessive Rainfall:

Rainfall sufficiently in excess of the normal is a predominant factor for occurrence of floods, particularly in high rainfall regions. An annual rainfall of 120% or more of the normal is considered as excessive rainfall.

Fig. 10 shows the percentage frequency of excessive rainfall years and successive years of excessive rainfall during the period 1971-2020. The following table (ii) gives the district wise excessive rainfall years and the highest annual rainfall (expressed as percentage of normal) with the years of occurrence.

Table (ii)

Subdivision: East Madhya Pradesh

Sr. No.	District	Years of Excessive Rainfall	Highest Amount of Annual Rainfall in cm (expressed as % of normal with year)			Annual Rainfall In cm.
1	ANUPPUR	1971, 1972, 1980, 1983, 1984, 1985, 1986, 1994, 2011, 2014, 2019	179.7	160	1994	112.3
2	BALAGHAT	1975, 1978, 1990, 1994, 1997, 1998, 1999, 2001, 2005	265.7	191	1994	139.1
3	CHHATARPUR	1971, 1978, 1980, 1982, 1983, 1985, 1990, 1999, 2003, 2013, 2016, 2019	167.3	162	1980	103.3
4	CHINDWARA	1973, 1978, 1990, 1993, 1994, 1997, 1999, 2009, 2013, 2019, 2020	176.1	155	2008	113.6
5	DAMOH	1971, 1978, 1987, 1990, 1994, 1999, 2003, 2013, 2019	189.1	160	1994	118.2
6	DINDORI	1973, 1975, 1978, 1980, 1987, 1990, 1994, 2003, 2011	207.5	158	1978	131.3
7	JABALPUR	1971, 1972, 1977, 1978, 1980, 1990, 1993, 1994, 1999, 2003, 2005, 2013, 2016, 2019	191.4	155	2013	123.5
8	KATNI	1971, 1983	154.5	150	1971	103.0
9	MANDLA	1971, 1973, 1975, 1977, 1990, 1994, 1999, 2013, 2019, 2020	202.9	152	1994	133.5
10	NARSINGHPUR	1971, 1973, 1977, 1978, 1980, 1993, 1994, 1997, 1999, 2005, 2013, 2019	191.0	167	1977	114.4
11	PANNA	1971, 1975, 1977, 1978, 1980, 1990, 1992, 1997, 1999, 2003, 2005, 2013	198.9	166	2003	119.8
12	REWA	1971, 1980, 1981, 1982, 1994, 2001, 2003, 2013, 2019	168.5	155	1971	108.7
13	SAGAR	1971, 1973, 1975, 1977, 1982, 1983, 1990, 1994, 1999, 2005, 2013, 2019	193.7	166	2013	116.7
14	SATNA	1971, 1975, 1978, 1980, 1982, 2001, 2003, 2005, 2013, 2016	166.2	159	2016	104.5
15	SEONI	1977, 1990, 2003, 2013, 2019	171.9	149	2013	115.4
16	SHAHDOL	1971, 1980, 1994, 1996, 1997, 2003	162.1	147	1994	110.3
17	SIDHI	1971, 1977, 1978, 1981, 1982, 1994, 1997, 2011, 2012	185.8	160	1971	116.1
18	SINGRAULI	1977, 1994, 1999, 2001, 2003,	146.3	149	2003	98.2
19	TIKAMGARH	1971, 1972, 1975, 1978, 1982, 1983, 1985, 1990, 1999, 2008, 2011, 2013	169.2	169	1982	100.1
20	UMARIA	1971, 1975, 1980, 1987, 2003, 2005	200.4	164	1971	122.2

From the above table, it is seen that during the period under consideration, there were 34 years in which some districts or the other in East Madhya Pradesh sub-division of the state recorded excessive rainfall. In the year 1994, Balaghat district in East Madhya Pradesh received highest excessive rainfall, i.e. 191% of the annual normal rainfall. In the 1971, maximum number of districts (i.e. 15 out of 20) of the state experiences excessive rainfall. Jabalpur (14), Narsingpur, Panna, Sagar & Tikamgarh (12) districts experience maximum number of excessive rainfall years. Niwari (4) and Katni (2) districts of East Madhya Pradesh experienced minimum number of excessive rainfall years.

Sr. No.	Districts	Successive Years of Excessive Rainfall
1.	ANUPPUR	1971 - 1972, 1983-1984-1985-1986
2	BALAGHAT	1997-1998-1999
3	CHAHARTARPUR	1982-1983
4	CHINDWARA	1993-1994, 2019-2020
5	JABALPUR	1971-1972, 1977-1978, 1993-1994
6	MANDLA	2019-2020
7	NARSINGHPUR	1977-1978, 1993-1994.
8	PANNA	1977-1978
9	REWA	1980-1981-1982
10	SAGAR	1982-1983
11	SHAHDOL	1996-1997
12	SIDHI	1977-1978, 1981-1982, 2011-2012
13	TIKAMGARH	1971-1972, 1982-1983

Subdivision: West Madhya Pradesh

Sr. No.	District	Years of Excessive Rainfall	Highest Amount of Annual Rainfall in cm (expressed as % of normal with year)			Annual Rainfall In cm.
1	AGAR	1985, 1986, 1990, 1996, 2007, 2011, 2015, 2019	193.3	203	2019	95.2
2	ALIRAJPUR	1973, 1976, 1977, 1981, 1983, 1990, 1996, 2006, 2007, 2013, 2019	154.3	167	1973	92.4

3	ASHOKNAGAR	1973, 1975, 1985, 1987, 1993, 1994, 2008, 2011, 2013, 2019	142.9	155	2011	92.2
4	BARWANI	1973, 1976, 1981, 1988, 1990, 1994, 2006, 2013, 2014, 2019, 2020	130.9	182	2019	71.9
5	BETUL	1973, 1975, 1984, 1990, 1994, 1998, 2012, 2013, 2019	182.1	159	1984	114.5
6	BHIND	1971, 1976, 1977, 1980, 1983, 1995, 1998, 1999, 2008, 2011, 2013, 2018, 2019	117.5	171	2013	68.7
7	BHOPAL	1973, 1974, 1975, 1978, 1983, 1985, 1986, 1990, 1999, 2006, 2013, 2016, 2020	188.7	179	2006	105.4
8	BURHANPUR	1973, 1979, 1981, 1988, 1990, 1993, 1996, 1998 2019	132.6	159	1993	83.4
9	DATIA	1971, 1980, 1985, 1988, 1990, 1996, 1999, 2012, 2013	131.4	162	1971	81.1
10	DEWAS	1971, 1973, 1990, 1994, 1996, 2011, 2012, 2013, 2015, 2019, 2020	170.2	174	1973	97.8
11	DHAR	1973, 1976, 1981, 1988, 1994, 1996, 2003, 2006, 2007, 2013, 2019	143.6	165	1973	87
12	GUNA	1971, 1973, 1982, 1985, 1990, 1994, 1995, 1996, 1997, 2011, 2013, 2016, 2019	174.3	170	2011	102.5
13	GWALIOR	1971, 1982, 1983, 1985, 1990, 1995, 2006, 2013	115.2	141	1971	81.7
14	HARDA	1973, 1975, 1983, 1988, 1994, 2009, 2012, 2013	191.9	165	2013	116.3
15	HOSHANGABAD	1973, 1975, 1978, 1990, 1993, 1994, 1999, 2003, 2006, 2016, 2019, 2020	260.6	209	1973	124.7
16	INDORE	1973, 1976, 1994, 1997, 2006, 2013, 2015, 2019, 2020	191.4	206	1973	92.9
17	JHABUA	1973, 1976, 1977, 1983, 1990, 1994, 1996 2003, 2006, 2013, 2019, 2020	159.9	173	2019	92.4
18	KHANDWA	1973, 1975, 1978, 1979, 1981, 1990, 1994, 1998, 2012, 2013	145.5	169	2013	86.1
19	KHARGONE	1973, 1976, 1988, 1990, 1993, 1994, 1996, 1997, 1998, 2013, 2019	125.1	161	1973	77.7
20	MANDSAUR	1973, 1976, 1986, 1994, 1996, 2004, 2011, 2013, 2016, 2019	211.0	239	2019	88.3
21	MORENA	1975, 1983, 1990, 1992, 1995, 1996, 1999, 2006, 2008, 2012, 2013	113.9	160	2006	71.2
22	NEEMUCH	1973, 1976, 1978, 1983, 1996, 2011, 2016, 2019	178.2	217	2019	82.1
23	NIWARI	1996, 2003, 2008, 2019	120.2	146	2003	82.3
24	RAISEN	1973, 1977, 1994, 1999, 2013, 2019, 2020	194.7	166	1999	117.3
25	RAJGARH	1971, 1973, 1982, 1985, 1990, 1996, 2006, 2011, 2013, 2015, 2019	173.0	178	1973	97.2
26	RATLAM	1971, 1973, 1976, 1978, 1990, 1994,	175.4	177	2019	99.1

		2006, 2011, 2013, 2019, 2020				
27	SEHORE	1973, 1975, 1978, 1983, 1999, 2006, 2013, 2016, 2019, 2020	181.5	158	1973	114.9
28	SHAJAPUR	1973 1976 1985 1986, 1990 1998 2011 2013 2015 2016 2019	172.8	176	2019	98.2
29	SHEOPUR	1975, 1982, 1990, 1995, 1996, 2011, 2013	120.2	166	2013	72.4
30	SHIVPURI	1971, 1973, 1975, 1982, 1983, 1985, 2013	135.5	157	1971	86.3
31	UJJAIN	1973, 1976, 1994, 1996, 2006, 2013, 2015, 2016, 2019, 2020	174.0	182	1973	95.6
32	VIDISHA	1973, 1975, 1977, 1982, 1983, 1987, 1993, 1994, 1996, 2011, 2013, 2019	167.6	151	1977	111.0

From the above table, it is seen that during the period under consideration, there were 46 years in which some districts or the other in West Madhya Pradesh sub-division of the state recorded excessive rainfall. In the year 2019, Mandsaur district in West Madhya Pradesh received highest excessive rainfall, i.e. 239% of the annual normal rainfall. In the 2013, maximum number of districts (i.e. 25 out of 32) of the state experiences excessive rainfall. Bhind, Bhopal and Guna districts experience maximum number of excessive rainfall (13) years. Raisen, Sheopur and Shivpuri districts of West Madhya Pradesh experienced minimum number of excessive rainfall (7) years.

Sr. No.	Districts	Successive Years of Excessive Rainfall
1.	AGAR	1985 -1986
2	ALIRAJPUR	1976-1977, 2006-2007
3	ASHOKNAGAR	1993 -1994
4	BARWANI	2013-2014, 2019-2020
5	BETUL	2012-2013
6	BHIND	1976 -1977, 1998-1999, 2018-2019
7	BHOPAL	1973-1974-1975, 1985-1986
8	DATIA	2012-2013
9	DEWAS	2011-2012-2013, 2019-2020
10	DHAR	2006-2007
11	GUNA	1994 -1995-1996-1997
12	GWALIOR	1982-1983
13	HARDA	2012-2013
14	HOSHANGABAD	1993-994, 2019-2020
15	INDORE	2019-2020

16	JHABUA	1976-1977
17	KHANDWA	1978-1979 , 2012-2013
18	KHARGONE	1993 -1994, 1996-1997-1998
19	MORENA	1995 -1996
20	RAISEN	2019-2020
21	RATLAM	2019-2020
22	SEHORE	2019-2020
23	SHAJAPUR	1985 -1986, 2015-2016
24	SHEOPUR	1995-1996
25	UJJAIN	2015-2016, 2019-2020
26	VIDISHA	1982-1983, 1993-1994

The heaviest one day rainfall on record at any station in the state was 648.0 mm on 15th September 1998 at Gharadengri in Betul district.

HEAVY RAINFALL EVENTS MP (IN 24 HOURS)

Average frequency of Heavy, Very heavy and Extremely heavy rainfall accumulated in 24 hours during 1971-2020 for the southwest monsoon season, post-monsoon season and Annual have been computed based on following classification of accumulated rainfall in 24 hours and depicted in Fig. 11(a) to Fig.11 (i) for the average frequency of heavy rainfall events, very heavy rainfall events and extremely heavy rainfall events for south west monsoon season, post monsoon season and annual rainfall respectively and discussed below.

Rainfall in 24 hours	Rainfall in range in mm.	Rainfall range in cm.	Percentile
Heavy Rainfall	64.5 - 115.5	07- 11	95 - 99
Very heavy rainfall	115.6 - 204.4	12 - 20	99 - 99.9
Extremely heavy rainfall	Greater or equal to 204.5	21 cm or more	Greater than 99.9

From Fig.11(a) it is seen that minimum frequency (1.0-1.7 days) of heavy rainfall events is seen in smaller part of southwest and northern part of the state, maximum frequency (3.6-4.3) is seen in smaller part of southeastern part of the state and smaller part of Hoshangabad and Balaghat district. Most part of the West Madhya Pradesh and East Madhya Pradesh shows (1.7-2.3) and (2.3-3.0) respectively average number of days of heavy rainfall for the southwest monsoon season.

From fig.11(b) it is seen that small parts of northern, southern and southwestern districts of the state have minimum average number of days of very heavy rainfall (0.00-0.30). Most parts of the state i.e north, east, southeastern, southwestern and western part have average number of days of rainfall (0.30-0.60). Most parts of the central area of the state having the districts Raisen, Hoshangabad, Sagar, Harda and Bhopal, Vidisha, Shajapur, Indore, Narsingpur, Jabalpur, Agar-Malwa, Sehore, Ujjain and Panna, some parts of Balaghat, Sidhi, Singrauli, Damoh, Chhindwara, Betul, Khandwa, Dhar, Ratlam, Mandsaur, Rajgarh and Satna districts and few parts of Mandla, Chhatarpur, Mandsaur show (0.60-0.90) number of days. Small part of Balaghat, Chhindwara, Mandla, Rewa, Khandwa Hoshangabad, Harda, Panna districts have average number of very heavy rainfall days (0.90-1.20). Smaller part of Harda, Hoshangabad districts show maximum number of days (1.2 – 1.5) of very heavy rainfall for southwest monsoon season.

From fig11(c) it is seen that most part of the state shows minimum average number of days of (0.00- 0.08) extremely heavy rainfall. Some parts of the southern districts, small parts of eastern, western and central part of the districts show average frequency of (0.08- 0.30) days of extremely heavy rainfall. Small part of Balaghat district shows average number of days (0.30-0.41), (0.41-0.50) and (0.50-0.70) of extremely heavy rainfall for southwest monsoon season.

From Fig.11 (d) it is seen that most areas over the state shows minimum average number of days of (0.00 – 0.06) heavy rainfall. Some northern, southern, southwestern, northeastern, eastern and western parts show average number of (0.08- 0.12) days of heavy rainfall. Some part of some districts in central, western, southwestern, northeastern shows average number of days (0.12-0.18) of heavy rainfall. Smaller part of Panna and Bhind districts in shows average number of (0.18-0.24) days of heavy rainfall.

From Fig 11 (e) it is seen that entire state except small part of Agar, Ratlam, Bhopal, Datia, Chhatarpur, Satna, Rewa and Balaghat districts show minimum average number of days of very heavy rainfall (0.00-0.02). Smaller parts of Agar, Ratlam, Bhopal, Datia, Chhatarpur, Satna, Rewa and Balaghat districts show average number of days of very heavy rainfall (0.02-0.10) for post-monsoon season.

From Fig 11 (f) it is seen that entire state except small part of Chhatarpur district show minimum average number of days of very heavy rainfall (0.00-0.02). Smaller part of Chhatarpur district show average number of days of extremely heavy rainfall (0.02-0.10) for post-monsoon season.

From Fig.11(g) it is seen that most part of the state shows average number of days of annual heavy rainfall (1.6-3.0). Small parts of the Sheopur, Gwalior, Morena, Bhind, Khargone,

Barwani, Khandwa, Burhanpur. Chhindwara and Betul districts shows minimum average number of days (1.00-1.60). Small part of Harda, Raisen, Panna, Vidisha, Balaghat, Damoh, Hoshangabad, Sagar and Chhindwara districts show average number of days of annual heavy rainfall (3.00-3.60). Small part of Balaghat and Hoshangabad districts show maximum average number of days of annual heavy rainfall (3.60-4.40).

From Fig11 (h) it is seen that most part of the state shows number of days of very heavy rainfall (0.40-0.90). Most part of the extreme northern districts and small part of eastern, western, northern, southern and southwestern districts show minimum average number of days of annual very heavy rainfall (0.00-0.40). Small part of Vidisha, Raisen, Harda, Indore, Khandwa, Chhindwara, Agar-Malwa, Balaghat and Panna shows annual average number of days of very heavy rainfall (0.90-1.25). Small part of Chhindwara, Harda, and Hoshangabad districts show maximum average number of days of annual very heavy rainfall (1.25-1.55).

From Fig.11(i) it is seen that most part of the state shows minimum number of days (0.00-0.10). Districts in eastern, western, northern, southern and extreme southeastern part of the state show annual average number of days of extremely heavy rainfall (0.10-0.20). Small part of the districts viz. Harda, Hoshangabad, Chhindwara, Balaghat, Narsinghpur, Betul and Sehore shows annual average number of days of extremely heavy rainfall (0.20-0.40). Small part of the Balaghat and Chhindwara districts shows maximum annual average number of days of extremely heavy rainfall (0.40-0.70).

Cyclones and depressions

Table VII depicts the number of storms/depressions which affected the state during the period 1891- 2021. The cyclonic storms and depressions which affect India mostly originate and/or intensify over the Bay of Bengal, mainly during the months of May to December. They usually travel northwestwards or westwards and cross the east coast of India. In general, storms and depressions weaken on entering land. However, in association with these systems, heavy to very heavy rainfall occurs over the affected districts. In India most of the storms originate in the Bay of Bengal which affects the east coast of India. As the Madhya Pradesh state is situated far inland, it does not experience the full fury of storms/depressions like the coastal regions. During the course of movement, the disturbances sometimes turn or recover towards north or northeast under the deep influence of deep westerly system moving across Pakistan and Northwest India. The point of recurvature progressively shifts westward till September. The disturbances in May recurve while still out in Bay of Bengal. As exceptionally a few of them

cross the coast and travel inland, weaken far away from the state and therefore cannot affect the state.

During the months from December to March, the state has not been affected by the storms and depression for a single occasion. It occurs during the period from April to November, and its frequency is maximum during the period from June to October. The maximum number of storms and depressions originating in the Bay of Bengal affect the state in August was 118 and in July it was 105.

During the period from 1891- 2021, total 387 storms/depressions affected the state.

Other Weather Phenomena

(a) Thunderstorms, Hail storms and Dust storms

Convective activity is responsible for the occurrence of thunderstorms, hailstorms and dust storms in Madhya Pradesh state. Thunderstorms generally occur throughout the year in the state. With the advance of the summer, thunderstorm activity becomes pronounced due to heating of the land. When the moisture in the atmosphere is insufficient, dry thunderstorms or dust storms occur. The maximum number of thunderstorms occurs with approach of the monsoon current, so its frequency reaches maximum in the monsoon months June to September while duststorms are mainly confined to the summer months March to May. The maximum number of pre-monsoon and monsoon thunderstorms are sometimes accompanied by squalls or hail. Thunderstorm activity is the least in the state during the winter months December to February. Dust storms sometimes occur during the pre-monsoon and monsoon season.

(b) Fog

Favourable conditions for formation of fog such as light to calm wind, sufficient humidity, clear skies, low temperatures etc. do exist after the withdrawal of the monsoon till February. But due to lack of sufficient moisture, fog generally occurs in winter, maximum frequency of fog occurrence being during the months of December, January and February. Hill fog is frequent during the rainy months of June to September, when air is almost saturated and is easily cooled below the dew point while rising over high elevations.

(c) Frost

Frost occurs when the ground temperature reaches 0°C or less, humidity conditions being favourable. Usually, ground temperature is lower by 6°C or so in the mornings than the minimum air temperature recorded. Hence whenever minimum temperature 6°C or less is recorded, ground frost is likely to occur.

Occasionally during severe cold waves minimum temperature in whole Madhya Pradesh, may fall by even 10°C or more below than mean value. These areas have mean minimum temperatures of 15°C or less during December to February and hence are susceptible to frost during this period.

TABLE-I
MEAN WIND SPEED (KMPH) AND PREDOMINANT WIND DIRECTION
MADHYA PRADESH

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Alirajpur	a													
Alirajpur	m	E	E	W	W	W	W	W	W	W	E	E	E	
Alirajpur	e	W/E	W	W	W	W	W	W	W/SW	W	W/E/NW	E	E	
Betul	a	2.1	2.3	2.4	2.5	2.9	3.7	3.4	2.8	2.1	1.7	1.8	1.5	2.4
Betul	m	C/NE	C/NE	C/NE	C/NW	NW/C	NW/W	W/NW	C/NW	C/NW	C/NE	C/NE	C/E	
Betul	e	C/NE	NE/C/NW	NW/NE	NW/C	NW/C	NW	NW/W	NW/W	NW/C	C/NE	C/NE	C/NE	
Bhopal AP	a	4.8	5.5	5.9	7.3	9.0	9.9	8.4	7.2	6.1	4.2	4.3	3.8	6.3
Bhopal AP	m	C/NE/E	C/NE/E	C/NE/SE	NW/W	NW/W	W	W	W	NW/W	C/NW/NE	C/NE/E	C/NE/E	
Bhopal AP	e	NE	NE/NW	NW/W	NW/W	NW/W	W	W	W	NW	C/N/NE	NE/N	NE	
Chhindwara	a													
Chhindwara	m	C/W	C/W/NW	C/W/NW	NW/W	NW	W	W	W/NW	W	C/W/NW	C/W/NW	C/W	
Chhindwara	e	C/W	NW/W	NW/W	NW/W	NW	NW/W	W	W	W/NW	C/NW/W	C/NW/W	C/NW/W	
Damoh	a													
Damoh	m	C/NW/NE	C/NW/N	C/NW/NE	C/NW/W	C/NW	C/NW/SW	C/NW/SW	C/NW	C/NW/W	C/NE/NW	C/NW/NE	C/NW/W	
Damoh	e	C/N/NW	C/NW	C/NW	C/NW	C/NW	C/NW/W	C/SW/W	C/NW/SW	C/NW/W	C/NE/NW	C/N/NW	C/N/NW	
Datia	a	1.6	2.1	3.2	3.1	4.9	5.0	4.2	3.0	2.5	1.7	1.6	1.2	2.9
Datia	m	C/W/NE	C/N/NW	C/NW/N	C/W/NW	C/W/NW	W	C/W/SW	C/W	C/W/NW	C/W/NW	C	C	
Datia	e	C/NE/N	C/N/NW	C/N/NW	C/W/NW	W/NW/C	W	C/W	C/W	C/W/NW	C	C	C	
Dhar	a													
Dhar	m	NE	NE	NE	NW/NE/W	W	SW/W	SW	SW/W	SW/W	NE	NE	NE	
Dhar	e	NE	NE	W/NE/SW	W/NW/SW	W	SW/W	SW	SW/W	W/SW	NE	NE/SW	NE	
Guna	a	2.7	3.2	3.4	3.5	4.5	5.2	4.0	3.2	2.5	2.1	2.0	2.1	3.2
Guna	m	C/NE/SE	C/E/SE	C/SE/NE	C/SW/W	W/SW	SW/W	SW	SW	C/SW/NW	C	C/SE/E	C/SE	
Guna	e	C/NW/ NE	NW/C/W	NW/W	NW/W/SW	W/NW	W/SW	SW	SW	C/NW/W	C/NW/N	C/NW/NE	C/NW	
Gwalior	a	1.9	2.6	3.4	3.8	5.1	5.4	4.7	4.1	3.5	1.7	1.3	1.5	3.7

T ABLE-I
MEAN WIND SPEED (KMPH) AND PREDOMINANT WIND DIRECTION
MADHYA PRADESH

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Gwalior	m	C	C	C/NW	C/NW/W	C/W/NW	C/W/NW	C/W/SW	C/W/SW	C/W/SW	C	C	C	
Gwalior	e	C/NW/N	C/NW	NW/C	NW	NW	NW/C/W	C/W/SW	C/W/SW	C/NW/W	C	C	C	
Hoshangabad	a													
Hoshangabad	m	E	E	E	C/E	W/SW	SW /W	SW	SW /W/C	C\W\SW	C\E	E	E	
Hoshangabad	e	C	C/E	C	SW /C/W	SW /W	SW	SW	SW /C/W	C	C	C	C	
Indore AMS	a	4.5	5.5	6.3	7.9	11.5	12.6	11.9	9.3	6.1	3.9	3.4	3.6	7.2
Indore AMS	m	C/E	C	C/W/E	W/NW	W/NW	W	W	W	W/NW	C	C	C	
Indore AMS	e	NE	NE/NW	NW/W	W/NW	NW/W	W	W	W	W\NW	NE	NE/C	NE/C	
Kannod	a	3.2	3.7	4.3	6.5	7.2	7.3	6.3	6	4.3	3.8	3	3.2	4.9
Kannod	m	C/NE	C/NE	C/NE	C/NW/W	NW/C/W	NW/C/SW	C/NW/W	C/NW/W	C/NW	C/NE	C/NE	C/NE	
Kannod	e	C/NE	C/NE	C/NE/NW	NW/C/W	NW/C/W	NW/C/SW	NW/C/SW	C/NW/W	C/NW	C/NE	C/NE	C/NE	
Khajuraho	a	1.8	2.1	2.5	3.1	3.9	4.7	4.1	2.9	2.5	1.7	1.4	1.3	2.7
Khajuraho	m	C/SW/W	C/SW/W	C/SW/W	SW	SW/W	SW/W	SW	C/SW/W	C/SW/W	C/SW/W	C/SW/W	C/SW/W	
Khajuraho	e	C/NW/NE	NW	NW	NW	NW	NW/W	SW/W	C/SW/W	C/NW/W	C/NE/NW	C/NE/NW	C/NW/NE	
Khandwa	a	2.0	3.0	3.8	5.1	9.3	9.9	9.1	6.7	4.3	1.6	1.3	1.1	4.5
Khandwa	m	C	C	C/W/NW	C/ W/ NW	W/C/NW	W/C/NW	W/C/NW	W/C/NW	C/ W /NW	C	C	C	
Khandwa	e	C	C/NW/W	C/W/NW	C/ W/ NW	W/C/NW	W/CN/W	W/C/SW	W/C/NW	C/W/NW	C	C	C	
Khargone	a													
Khargone	m	S/W	W/S	S/W	W	W	W	W	W	W	S/W	S/W	S/W	
Khargone	e	S	S	S	S	S	S/W	S/W	S	S	S	S	S	
Neemuch	a	4.0	4.1	5.7	7.0	9.0	11.2	9.9	8.1	5.7	4.1	3.2	3.3	6.3
Neemuch	m	NE/C	NE/C	NE/C/W	W/SW/C	W/SW	SW/W	SW/W	SW/W	W/SW	NE/C/W	NE/C/E	C/NE	
Neemuch	e	NE/C/W	W/NE/C	W/SW/NW	W/SW	W/SW	SW/W	SW/W	SW/W	W/SW	NE/W/N	NE/C/E	NE/C/E	
Nowgong	a													
Nowgong	m	C	C	C	C/NW	C/SW/NW	C/SW/NW	C/SW	C/SW	C/SW	C	C	C	
Nowgong	e	C/NW	C/NW	C/NW	C/NW	NW/SW	C/NW/SW	C/SW	C/SW/NW	C/NW/SW	C/NW/NE	C/NW/NE	C/NW/NE	

TABLE-I
MEAN WIND SPEED (KMPH) AND PREDOMINANT WIND DIRECTION
MADHYA PRADESH

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Rajgarh	a													
Rajgarh	m	W	W	W/C/S	W	W	W	W	W	W	W	W	W/C/S	
Rajgarh	e	N/W	W	W	W	W	W	W	W	W	W	W	W/N/C	
Ratlam	a	3.1	3.2	3.5	4.0	6.6	6.9	6.3	5.1	3.5	2.1	2.2	2.3	4.1
Ratlam	m	NE	NE/C/E	C/NE/E	W	W	W	W	W	W	C/NE/E	C/NE/E	NE/C	
Ratlam	e	NE/C	NE/W/E	W	W	W	W	W	W	W	C/NE	C/NE	C/NE	
Sagar	a	3.0	3.6	3.9	3.9	4.6	5.9	5.9	4.7	3.2	2.0	2.1	2.4	3.8
Sagar	m	C/NE	C/ NE	C/NE	W/C /SW	W	W	W/SW	W/C	C/W	C	C/NE	C/NE	
Sagar	e	C/NE	C/ NE/W	W/NW/C	W/NW	SW/W/NW	W/SW/C	W/SW/C	W/C	C	C	C/NE	C	
Seoni	a	2.1	2	2.5	2	2	2	2	2.1	2.6	2.4	2.3	2	2.2
Seoni	m	N	N/NE/S	N	N/S/SW	N/NW	W	W/SW	W	NW/N	N/NE	N/NE	N/NE	
Seoni	e	N/NE/E	N/NE/S	N/NW	N/W	NW/N	W/SW/S	W/SW	W/SW	NW/N	NE/N/E	N/NE/E	NE/N/E	
Shajapur	a													
Shajapur	m	C/NE/SE	C/NE	C/W/SW	NW/W	W	W	W	W	W/C/NW	C	C	C	
Shajapur	e	C/NE	C/NE/W	NW/W	NW/W	W	W/NW	W	W	C/W/NW	C	C	C	
Sheopur	a	3.5	4.0	4.1	4.2	7.3	6.9	5.5	4.9	4.2	3.3	2.5	3.1	4.4
Sheopur	m	C/NE	C/NE/SW	C/NE/NW	C/SW/NE	C/NW/W	C/NW/W	C/SW/W	C/NW/W	C/SW/NE	C/SW/S	S/NE/SW	C/NE	
Sheopur	e	C/NE/NW	C/N/NW	C/N/NW	NW/W	C/NW/W	C/NW/W	C/SW/W	C/NW/W	C/NE/NW	C/NE	C/NE/N	C/NE	
Shivpuri	a													
Shivpuri	m	SW/SE	SW	SW/SE	SW/SE	SW	SW	SW	SW	SW	SE/SW	SW/SE	SW/SE	
Shivpuri	e	NW/SW	SW/NW	NW/SE	SW/NW	NW/SW	NW/SW	SW/NW	SW/NW	NW/SW	NW	NW	NW	
Tikamgarh	a													
Tikamgarh	m	S/SW	W/E	E/S	E/S	E/SE/S	E	E	E	E	E/SE	E/NE	S/E	
Tikamgarh	e	S/W	S/W	S	S/W	S/SE	E/S	E	E/W	E/SE/S	S/SE	S	S	
Ujjain	a	3.9	4.1	4.7	5.1	9.0	10.1	9.7	7.1	5.6	4.1	3.2	3.2	5.9
Ujjain	m	C/E/NE	C/E/SE	C/W/E	C/NW/W	NW/W	W	W	W/NW	W	C/E/NW	C/E/SE	C/E/W	
Ujjain	e	C/E/NE	C/NW/W	NW/W	NW	NW/W	W/NW	NW/W	NW/W	NW	C/NE/NW	C/NE/E	C/NE/E	

TABLE-I
MEAN WIND SPEED (KMPH) AND PREDOMINANT WIND DIRECTION
MADHYA PRADESH

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Vidisha	a													
Vidisha	m	C	C	C	C	C	C	C	C	C	C	C	C	
Vidisha	e	C	C	C	C	C	C	C	C	C	C	C	C	
Sub Division West Madhya Pradesh	a	2.9	3.4	4.0	4.6	6.5	7.1	6.4	5.1	3.9	2.7	2.4	2.4	4.3

a: Mean Wind Speed in Km. per hour.

m: Predominant Wind Direction in the Morning.

e: Predominant Wind Direction in the Evening.

C: Calm.

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Jabalpur	a	2.5	3.1	3.5	4.0	5.0	5.7	5.0	4.5	3.8	2.9	2.2	1.9	3.7
Jabalpur	m	C	C	C	C	C	W	W/C/SW	C/W	C	C	C	C	
Jabalpur	e	C	C	C	NW/W/C	W/NW	W/C/NW	W/C	W	C	C	C	C	
Malanjkhand	a	2.6	3.1	3.5	3.9	4.4	4.1	3.4	3.8	3.3	2.4	2.0	2.0	3.0
Malanjkhand	m	C/SE	C/NW	C/SE	C/SE	NW	NW	NW/C	NW	NW	C	C	C	
Malanjkhand	e	NW/C	NW	NW	NW	NW	NW/SW	C/NW	NW/C	NW/C	C	C	C	
Mandla	a	2.4	3.1	5.1	6.8	8.3	7.9	4.3	4.1	3.6	2.9	2.4	3.2	4.5
Mandla	m	C/NW/N	C/NW/N	C/N/NW	C/S/SE	C/NW/N	S/C/NW	C/NW/S	NW/C/N	NW/C/N	C/N/NW	C/NW/N	C/NW/N	
Mandla	e	C/NW/N	C/NW/N	C/N/NW	NW/C/N	NW/N/C	C/N/S	C/NW/S	NW/C/N	C/NW/N	C/N/NW	C/N/NW	C/NW/N	
Narsinghpur	a													
Narsinghpur	m	C/W/SE	C/W/NE	C/W	C/W/E	W/C	W	W	W	C/W	C/W	C/W	C/W	
Narsinghpur	e	C/W	C/W	C/W	W/C	W	W	W	W	W	C/W	C/W/S	C/W/S	
Panna	a													

TABLE-I
MEAN WIND SPEED (KMPH) AND PREDOMINANT WIND DIRECTION
MADHYA PRADESH

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Panna	m	C/E/N	C/E/N	C/NW	C/NW	C/W/S	W/C/N	W/C	C/W/N	C/W/N	C/SW	C/N/S	C/N/E	
Panna	e	N/C	N/C	C/N	N/C/W	N/C	N/W/C	C/W/N	C/W/N	C/W/N	C/N	N/C	N/C	
Rewa	a													
Rewa	m	C	C	C	C	C	C/NW/SW	C	C	C	C	C	C	
Rewa	e	C	C	C/NW	NW	NW	NW/C	C/NW/SW	C/NW	C	C	C	C	
Satna	a	2.0	3.4	3.1	3.5	4.6	5.5	4.7	4.0	3.3	2.1	1.8	1.7	3.3
Satna	m	C	C	C	C	C/W/ SW	SW/ W	SW/C/W	C/SW/ W	C	C	C	C	
Satna	e	C/NW	NW/C	NW	NW	NW	NW	SW/C	C/SW/ W	C/NW	C	C	C	
Sidhi	a	0.6	0.7	0.8	0.5	0.3	1.1	1.9	1.2	1.1	0.6	0.3	0.3	0.8
Sidhi	m	C	C	C	C/W	C/W	C/W	C/W	C/W	C/W	C	C	C	
Sidhi	e	C	C/W	C/W	W/C	W/C	C/W	C/W	C/W	C/W	C	C	C	
Umaria	a													
Umaria	m	C	C	C	C/NW	C/W/NW	C/SW/NW	C/SW/W	C/SW/NW	C/NW	C	C	C	
Umaria	e	C/NW	C/NW	NW/C	NW	NW	NW/C/SW	C	C	C	C	C	C	
Sub Division East Madhya Pradesh	a	2.0	2.7	3.2	3.7	4.5	4.9	3.9	3.5	3.0	2.2	1.7	1.8	3.1

a: Mean Wind Speed in Km. per hour.
m: Predominant Wind Direction in the Morning.
e: Predominant Wind Direction in the Evening.
C: Calm.

TABLE-II
MEAN MAXIMUM AND MINIMUM TEMPERATURE (°C)
MADHYA PRADESH

OBSERVATORY	TEMP	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Alirajpur	MAX	26	29.3	34.5	37.5	38.2	35.1	29.9	28.5	29.9	32.1	29.4	26.9	31.4
Alirajpur	MIN	9.5	11.5	15	20.1	23.3	21.9	20.7	20.1	20	17.3	13.8	9.7	17.0
Betul	MAX	27.3	30.5	35.2	38.9	40.7	35.5	28.9	27.4	29.8	31.4	29.3	28.1	31.9
Betul	MIN	10	12	16.2	20.9	25.1	24.5	22.6	21.9	21.2	17.7	13.8	10.1	17.9
Bhopal AP	MAX	24.9	28.4	33.9	38.7	41.1	37.4	30.9	28.9	31.3	32.7	29.9	26.7	32.0
Bhopal AP	MIN	10.6	13.1	17.6	22.4	26.6	26	23.8	23	22.2	19.1	15	11.2	19.2
Chhindwara	MAX	24.4	26.9	31.8	36.7	39.2	34.7	29.1	27.6	28.8	29.5	27	25.5	30.0
Chhindwara	MIN	9.2	12.1	16	20.9	24.4	23.3	22.4	22	21.5	17.8	12.9	9.2	17.5
Damoh	MAX	25	28.9	34	39.1	42.7	38.7	32.6	30.6	31.7	33.1	30	26.6	32.7
Damoh	MIN	8.1	11.9	17.2	22.2	26.8	26.3	24.2	23.2	22.4	18.6	13.4	8.5	18.4
Datia	MAX	22.8	26.7	33.5	39.5	43	40.8	34.9	33.1	33.5	34	30	25.4	33.0
Datia	MIN	6.9	10.5	15.3	20.9	26.9	28	25.9	24.8	23.3	17.7	12	8.1	18.5
Dhar	MAX	26	29.3	34.3	38.4	39.7	35.5	29.6	28.6	30.2	32.5	30.2	28.1	31.8
Dhar	MIN	10.3	12.8	18.2	22.2	24.6	23.7	21.9	21.2	20.8	18.6	14.8	11.7	18.3
Guna	MAX	24.4	27.9	33.7	39	42	39	32.3	30.2	32.3	33.6	30.3	26.9	32.6
Guna	MIN	9	11.9	16.8	22	26.3	26.5	24.3	23.3	22.5	18.8	14.2	10	18.6
Gwalior	MAX	22.3	26.6	32.9	38.9	42.1	40.4	35.2	33.3	34	34.2	30.1	25.2	32.8
Gwalior	MIN	7.7	10.9	16.2	21.7	27	28.8	27.1	26.2	24.8	19.3	13.1	8.5	19.2
Hoshangabad	MAX	25.8	28.9	34.8	40	42	37.8	31.1	29.5	31.9	33.5	31	27.9	32.8
Hoshangabad	MIN	12	14.1	18.3	23.1	27	26.5	24.3	23.6	23	19.9	16.2	12.4	20.0
Indore	MAX	26.2	29.4	34.5	38.7	40.4	36.4	30.2	28.6	30.6	32.8	30.4	27.6	32.1
Indore	MIN	10.3	12.6	16.9	21.3	24.6	24.4	22.8	22	21.1	18.2	14.7	11.4	18.4
Kannod	MAX	28.1	30.1	35.3	39.8	42.3	38.8	32.3	30.1	32	33.3	30.4	28.1	33.4
Kannod	MIN	11.2	12.7	17.7	23	25.7	24.2	22.2	21.6	21	17.8	12.9	10.1	18.3
Khajuraho	MAX	23.6	28.1	34.4	40.2	43.2	40.8	34.6	32.8	33.6	34.1	30.5	26.3	33.4
Khajuraho	MIN	8.4	10.7	15.7	21.7	26.8	28.3	26.3	25.3	24.1	19.1	13.6	8.9	18.9
khandwa	MAX	28.6	31.5	36.7	40.3	41.7	37.2	31.1	29.6	31.6	34	32.1	29.8	33.7
khandwa	MIN	10.9	13.5	18.6	23.6	26.7	25.1	22.8	22.1	21.7	18.6	15.1	11.4	19.1
Khargone	MAX	27.9	31.5	36.6	41.3	42.7	38.6	33.5	31.2	33.2	34.9	31.6	30.4	34.6
Khargone	MIN	8.9	12.1	18	24.4	26.7	25	22.8	22.4	22.6	20.5	16.3	10.8	19.7
Neemuch	MAX	25	27.8	33.1	38	40.1	37.3	31.8	29.9	32	33.9	30.3	26.7	32.2
Neemuch	MIN	9.7	12.1	17.1	22	25	24.9	23	22.4	21.6	19	14.6	10.7	18.5
Nowgong	MAX	23.5	27.4	34.1	39.5	43	40.4	34.2	32.3	33.1	34.3	30.4	26	33.1

TABLE-II
MEAN MAXIMUM AND MINIMUM TEMPERATURE (°C)
MADHYA PRADESH

OBSERVATORY	TEMP	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Nowgong	MIN	7.2	10	15.2	20.7	26	27.2	25.2	24.1	23	18.1	12.2	8.2	17.9
Pachmarhi	MAX	20.6	24	29.1	32.8	35.3	30.7	25.7	24.1	26.1	26.9	24.4	23	27.0
Pachmarhi	MIN	6.4	9	13.4	18.2	23	21.9	20	19.5	18.8	14.5	10.4	6.9	15.5
Raisen	MAX	25.1	29.6	34.1	37.5	40.7	36.6	30.9	29.4	30.6	31.5	27.8	25	31.5
Raisen	MIN	7.5	11.2	16.7	23.6	28.6	25.5	23.6	23.5	22.9	18.3	15.4	10.2	18.8
Rajgarh	MAX	25.9	29	35	39.5	42.2	39.2	32.8	30.4	32.4	34.2	31.1	28.2	33.3
Rajgarh	MIN	8.5	11.4	17	22.5	27.4	26.8	24.4	23.3	22.2	17.9	13.2	9.1	18.6
Ratlam	MAX	25.8	28.5	34.1	38.4	39.8	36.3	30.1	28.2	30.3	33	30.6	27.6	31.9
Ratlam	MIN	10.4	12.7	17.6	22.9	25.8	25.1	23.3	22.8	21.9	19	15.5	11.8	19.1
Sagar	MAX	24.7	28.2	33.5	38.4	41.3	37.5	30.8	29	31	32.5	29.8	26.8	32.0
Sagar	MIN	11.2	14.1	18.8	23.4	26.3	25.5	23.8	22.9	22.3	20.1	16.4	12.7	19.8
Seoni	MAX	26.3	29.7	34.2	38.1	40.4	35.3	29.6	28.5	30.1	31.1	28.8	27.1	31.5
Seoni	MIN	13.7	16.4	21.2	25.8	28.1	26.7	24.2	24	23.9	22	18.6	15.1	21.3
Shajapur	MAX	25.8	29.3	35.1	39.7	41.8	38.2	31.9	29.8	32.1	33.9	30.5	27.3	32.9
Shajapur	MIN	8.6	11	16	21.9	26.6	26	24.1	23.2	22.3	18.2	13.2	9.6	18.3
Sheopur	MAX	23.1	27.8	33.8	38.8	42.7	41	34.8	32.6	34	34.4	29.8	25.2	33.2
Sheopur	MIN	8.4	10.9	16.5	22	26.8	27.7	26	24.7	24.6	19.5	14.2	9.6	19.1
Shivpuri	MAX	23.3	27	32.8	37.5	41.2	39.1	33.1	31	32	32.3	28.7	25.7	31.9
Shivpuri	MIN	7.8	11.2	16.3	21.5	26	26.4	24.5	23.5	23	19.1	13.3	8.8	18.4
Tikamgarh	MAX	24.6	27.9	33.9	38.3	41.9	39.1	33.2	31.8	32.6	33.1	30.1	26.4	32.9
Tikamgarh	MIN	7.3	11.3	16.9	21.6	25.3	25.6	23.5	23.2	22.7	18.5	13.2	9.2	18.2
Ujjain	MAX	26.4	29.4	34.9	38.9	40.9	37.3	31	29.1	31.5	33.8	30.9	28.2	32.5
Ujjain	MIN	8.7	10.6	14.8	19.5	24.8	25	23.2	22.2	21.4	18	13.7	9.4	17.4
Vidisha	MAX	26.2	29.5	34.7	40.2	42.8	38.9	32.3	30.3	32.2	34.0	31.4	27.9	33.4
Vidisha	MIN	8.3	10.8	15.3	20.5	26.1	25.5	23.4	22.8	21.5	18.3	13.0	9.1	17.9
Sub Division West Madhya Pradesh	MAX	25.2	28.6	34.1	38.7	41.2	37.7	31.7	29.9	31.5	32.9	29.9	26.9	32.3
	MIN	9.2	11.9	16.8	21.9	26.0	25.6	23.7	22.9	22.2	18.6	14.1	10.1	18.5

TABLE-II
MEAN MAXIMUM AND MINIMUM TEMPERATURE (°C)
MADHYA PRADESH

OBSERVATORY	TEMP	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Jabalpur	MAX	24.3	27.9	33.3	38.5	41.3	37.6	31.3	29.9	31.3	31.8	29.1	25.8	31.8
Jabalpur	MIN	10.7	13.6	18.2	23.3	27.4	27	24.7	24.1	23.7	20.3	15	11	19.9
Malanjkhanda	MAX	24.8	28	33.4	37.6	40.2	35.2	29.8	28.5	29.8	30	27.6	25.3	30.8
Malanjkhanda	MIN	8.9	11.7	15.9	20.2	24.2	24.3	22.9	22.6	21.7	18.1	12.8	8.4	17.6
Mandla	MAX	26.4	29.9	34.2	38.4	41.4	37.1	30.7	29.4	30.9	31.8	29.3	27.2	32.0
Mandla	MIN	8.3	11.1	15.1	19.9	23.8	24.8	22.9	22.4	21.3	17	12.1	7.8	17.2
Narsinghpur	MAX	26.3	29.8	35.2	39.7	42.6	38.4	32.1	29.7	31.6	33.1	30.3	27.8	32.8
Narsinghpur	MIN	9.4	11.8	16.1	21	26	25.6	23.8	22.9	22.6	19.4	14.1	9	18.2
Panna	MAX	23	25.8	31.5	37.3	40.8	38.5	32.3	30.4	30.6	31	27.8	24.1	31.1
Panna	MIN	8.2	9.9	15	20.6	25	24.6	21.8	20.9	20.4	17.2	12.5	9.4	17.1
Rewa	MAX	23.5	27.1	33.4	38.8	41.6	38.9	33.6	31.9	32.2	32.4	29.1	25.4	32.3
Rewa	MIN	7.9	10.8	15.4	20.7	25.5	26.8	25.4	24.7	23.7	19.5	13.6	8.4	18.4
Satna	MAX	23.9	27.6	33.3	38.9	41.8	39.1	33.1	31.6	32.2	32.7	29.7	26	32.4
Satna	MIN	9.1	12.3	17.2	22.7	27.4	28	25.8	25.2	24.3	20.2	14.4	9.8	19.6
Sidhi	MAX	24.4	28	33.5	39.7	42.2	38.8	33.8	32.4	32.6	32.9	29.8	26.2	32.7
Sidhi	MIN	8.5	11.7	16.3	22	26.8	27.6	26	25.3	24.3	20.3	14.4	9	19.2
Umaria	MAX	25.1	28.6	34.1	39	41.8	38.1	32	30.7	31.6	31.8	29.2	26.6	32.3
Umaria	MIN	6.8	10	14.8	19.9	24.1	24	21.9	21	20.4	16	10.7	6.2	16.2
Sub Division East Madhya Pradesh	MAX	24.6	28.1	33.5	38.7	41.5	38.0	32.1	30.5	31.4	31.9	29.1	26.0	32.0
	MIN	8.6	11.4	16.0	21.1	25.6	25.9	23.9	23.2	22.5	18.7	13.3	8.8	18.2

TABLE-III
MEAN RELATIVE HUMIDITY (%)
MADHYA PRADESH

OBSERVATORY	HRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Alirajpur	M	52	45	39	42	50	63	78	82	77	52	49	51	56
Alirajpur	E	46	33	28	30	35	52	75	78	72	52	50	51	49
Betul	M	75	64	55	43	43	71	89	93	90	80	72	72	71
Betul	E	45	35	27	23	25	56	80	85	75	62	56	47	52
Bhopal AP	M	67	57	42	32	39	64	85	89	82	63	59	65	62
Bhopal AP	E	42	33	24	19	22	46	74	79	66	45	43	43	45
Chhindwara	M	69	66	57	52	47	68	84	88	86	79	72	69	70
Chhindwara	E	44	43	38	31	32	52	69	75	71	60	50	43	51
Damoh	M	68	60	46	36	37	57	79	85	81	67	63	64	62
Damoh	E													
Datia	M	82	73	56	40	41	56	78	83	79	69	70	78	67
Datia	E	58	51	39	32	30	45	71	76	69	53	50	56	53
Dhar	M	65	58	47	50	57	74	89	91	87	66	61	63	67
Dhar	E	50	41	35	40	38	57	79	82	76	52	53	54	55
Guna	M	73	62	44	32	37	59	84	89	81	63	60	67	63
Guna	E	42	34	25	19	21	43	72	79	65	42	42	44	44
Gwalior	M	84	72	54	39	39	53	76	82	76	69	74	83	67
Gwalior	E	56	42	30	23	24	40	66	74	64	54	57	60	49
Hoshangabad	M	70	63	50	35	39	65	87	92	86	73	67	68	66
Hoshangabad	E	50	40	27	19	23	48	75	83	72	53	50	47	49
Indore AMS	M	62	51	36	31	46	69	86	90	85	61	54	60	61
Indore AMS	E	37	27	18	15	20	46	72	78	66	40	36	38	41
Kannod	M	69	60	49	45	48	68	86	91	84	72	63	67	67
Kannod	E	45	40	31	31	30	50	72	80	71	54	43	45	50
Khajuraho	M	83	73	54	34	34	53	78	85	81	73	73	81	67
Khajuraho	E	50	38	24	18	34	41	69	78	68	50	47	49	46
khandwa	M	64	52	37	31	44	64	80	84	80	66	61	61	60
khandwa	E	33	23	17	14	20	42	66	72	62	42	36	33	38
Khargone	M	74	66	53	51	57	69	80	86	82	71	72	75	69
Khargone	E													
Neemuch	M	61	52	41	37	47	65	84	88	81	57	52	57	60
Neemuch	E	40	32	25	22	26	43	68	76	65	40	38	38	43
Nowgong	M	82	72	56	40	38	56	81	86	82	67	66	75	67
Nowgong	E	55	48	35	27	24	43	70	77	69	48	49	55	50
Pachmarhi	M	79	70	53	47	44	68	91	96	89	83	86	85	74
Pachmarhi	E	53	45	27	31	28	55	85	90	81	69	69	64	59

TABLE-III
MEAN RELATIVE HUMIDITY (%)
MADHYA PRADESH

OBSERVATORY	HRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Rajgarh	M	73	62	46	41	45	66	82	88	82	68	66	71	66
Rajgarh	E	41	35	28	27	28	47	70	77	66	46	42	43	46
Ratlam	M	58	52	39	38	55	69	85	89	81	59	54	56	61
Ratlam	E	35	29	20	19	24	46	71	77	63	37	35	35	41
Sagar	M	61	53	41	31	37	62	87	92	84	62	53	56	60
Sagar	E	43	34	25	19	23	48	77	83	71	48	44	44	47
Seoni	M	63	59	49	43	40	65	86	87	80	68	62	59	64
Seoni	E	56	50	44	37	33	61	82	84	76	66	59	53	59
Shajapur	M	69	60	44	33	42	63	82	87	80	64	62	68	63
Shajapur	E	43	33	24	19	21	44	69	76	66	43	44	47	44
Sheopur	M	81	74	57	43	40	59	82	86	79	68	72	80	69
Sheopur	E	53	43	34	26	22	41	69	75	62	46	46	56	48
Shivpuri	M	76	66	55	44	38	46	63	71	70	63	64	72	61
Shivpuri	E	58	51	42	36	30	38	58	69	64	52	52	53	50
Tikamgarh	M	65	63	55	40	40	56	79	81	79	68	66	65	63
Tikamgarh	E	58	54	46	35	30	48	71	74	70	62	60	57	55
Ujjain	M	77	70	57	46	51	70	85	89	84	70	70	78	71
Ujjain	E	42	35	27	21	22	44	69	77	65	41	42	42	44
Vidisha	M	79	73	60	51	51	67	89	94	89	76	74	77	73
Vidisha	E	51	42	32	27	26	49	73	81	71	50	46	47	50
Sub Division West Madhya Pradesh	M	71	63	49	40	44	63	83	87	82	68	65	69	65
	E	47	39	30	25	26	47	72	78	69	50	48	48	48

M-MORNING

E-EVENING

TABLE-III
MEAN RELATIVE HUMIDITY (%)
MADHYA PRADESH

OBSERVATORY	HRS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Jabalpur	M	75	67	50	36	38	62	83	88	82	72	69	72	66
Jabalpur	E	47	38	27	21	21	49	73	79	69	52	51	49	48
Malanjkhanda	M	79	66	48	39	39	67	87	90	85	77	77	83	70
Malanjkhanda	E	52	42	31	25	28	58	82	85	79	68	61	53	56
Mandla	M	79	72	58	46	41	66	85	88	85	78	78	82	72
Mandla	E	51	44	37	33	29	54	78	82	76	61	58	55	56
Narsinghpur	M	75	68	53	41	44	60	79	84	82	74	72	71	67
Narsinghpur	E	47	39	32	25	27	47	71	79	71	54	49	46	49
Panna	M	69	60	46	33	37	55	79	85	80	65	60	66	61
Panna	E	55	45	36	25	27	46	73	81	76	59	53	55	52
Rewa	M	71	68	52	36	33	49	75	83	79	71	67	70	62
Rewa	E	57	51	35	26	26	45	69	77	72	60	58	57	52
Satna	M	77	68	52	36	37	57	81	86	82	71	68	74	66
Satna	E	48	39	27	20	23	45	72	77	70	49	45	47	47
Sidhi	M	75	68	53	40	43	61	79	85	82	75	73	75	67
Sidhi	E	45	39	27	21	27	49	70	76	71	54	50	51	48
Umaria	M	78	70	57	44	41	61	83	87	82	76	75	77	69
Umaria	E	52	46	34	30	27	51	75	80	75	61	56	51	53
Sub Division East Madhya Pradesh	M	75	67	52	39	39	60	81	86	82	73	71	74	67
	E	50	43	32	25	26	49	74	80	73	58	53	52	51

M-MORNING

E-EVENING

TABLE IV
MEAN CLOUD AMOUNT ** (OCTA OF THE SKY) AND MEAN NUMBER OF DAYS OF
CLEAR AND OVERCAST SKIES AT 0830 HRS IST

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Betul	a	22	20	23	21	21	4	0	0	5	17	20	22	175
Betul	b	1	1	1	1	1	12	22	24	9	3	2	1	78
Betul	c	1.3	1.3	1.3	1.2	1.3	5.3	7.2	7.3	4.9	2.3	1.5	1.1	3.0
Bhopal AP	a	16	18	18	18	18	4	0	0	4	16	19	19	150
Bhopal AP	b	1	0	0	0	0	4	15	17	6	1	0	0	44
Bhopal AP	c	1.8	1.4	1.4	1.3	1.4	4.4	6.7	7.0	4.6	1.9	1.4	1.4	2.9
Chhindwara	a	23	20	13	20	18	4	1	0	3	17	21	23	185
Chhindwara	b	2	1	0	0	1	7	17	17	10	2	1	1	51
Chhindwara	c	1.4	1.5	1.2	1.6	2.1	5.0	6.8	6.7	4.9	2.4	1.5	1.1	3.0
Damoh	a	5	3	5	6	5	3	3	2	4	7	8	9	60
Damoh	b	1	1	1	1	1	3	12	13	3	1	1	1	39
Damoh	c	2.9	2.9	2.5	2.5	2.7	4.3	5.5	5.5	3.9	2.6	2.3	1.9	3.3
Datia	a	25	20	25	25	27	16	5	3	13	26	26	17	228
Datia	b	1	1	0	0	0	1	6	8	4	1	0	1	23
Datia	c	0.9	1.2	0.7	0.6	0.5	2.2	4.8	5.1	2.8	0.8	0.6	0.5	1.7
Dhar	a	22	22	24	24	20	4	0	0	4	20	21	23	184
Dhar	b	1	0	0	0	0	7	18	19	11	1	1	0	58
Dhar	c	1.3	0.9	0.8	0.9	1.5	4.9	6.9	7.0	4.9	1.4	1.3	1.0	2.7
Guna	a	19	18	19	17	18	7	1	1	8	19	20	19	166
Guna	b	1	0	0	0	0	4	13	15	6	1	1	1	42
Guna	c	1.9	1.7	1.5	1.6	1.6	3.8	6.2	6.5	3.8	1.6	1.5	1.5	2.7
Gwalior	a	21	17	19	18	21	11	2	2	10	24	24	23	192
Gwalior	b	1	1	1	0	0	2	6	7	3	1	0	0	22
Gwalior	c	1.7	1.6	1.5	1.4	1.1	2.7	5.3	5.4	3.1	0.9	0.9	1.0	2.2
Hoshangabad	a	18	19	22	20	20	5	0	0	4	16	19	22	165
Hoshangabad	b	2	0	0	0	0	4	15	18	6	1	1	1	48
Hoshangabad	c	1.5	1.0	1.1	1.0	1.0	4.0	6.5	7.0	4.2	1.7	1.2	1.0	2.6
Indore AMS	a	17	18	20	19	18	3	0	0	3	14	17	16	145
Indore AMS	b	0	0	0	0	0	1	5	5	2	0	0	0	13
Indore AMS	c	1.4	1.1	1.1	1.1	1.2	4.3	6.1	6.4	4.3	1.7	1.3	1.4	2.6
Kannod	a	25	26	30	29	28	20	8	13	17	27	28	26	277
Kannod	b	1	0	0	0	0	1	3	2	1	1	0	1	10
Kannod	c	0.9	0.5	0.2	0.4	0.4	1.8	3.7	3.2	1.8	0.9	0.4	0.6	1.2
Khajuraho	a	20	18	19	20	20	8	1	1	8	21	21	22	179
Khajuraho	b	1	1	1	0	0	2	6	7	4	1	1	1	25
Khajuraho	c	1.8	1.3	1.4	1.2	1.3	3.5	5.5	5.7	3.7	1.3	1.1	1.0	2.4
khandwa	a	25	24	27	26	26	11	2	1	12	23	25	28	230
khandwa	b	1	1	1	0	0	7	15	16	7	2	1	1	52
khandwa	c	1.0	0.7	0.6	0.6	0.6	3.8	6.2	6.3	3.8	1.4	0.8	0.5	2.1
Khargone	a	6	7	9	9	8	7	5	1	1	8	9	7	77
Khargone	b	0	0	0	0	0	0	2	2	1	0	0	0	5
Khargone	c	2.1	2.0	2.0	2.0	1.9	1.9	2.4	2.4	2.7	1.8	1.8	2.1	2.1
Neemuch	a	23	20	21	24	25	14	2	1	6	23	23	22	204

TABLE IV
MEAN CLOUD AMOUNT ** (OCTA OF THE SKY) AND MEAN NUMBER OF DAYS OF
CLEAR AND OVERCAST SKIES AT 0830 HRS IST

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Neemuch	b	1	1	1	1	1	2	11	15	4	1	1	1	40
Neemuch	c	1.2	1.2	1.2	0.8	0.7	2.9	5.4	6	3.7	1	0.8	1.1	2.2
Nowgong	a	24	19	22	20	22	10	4	3	11	25	25	26	211
Nowgong	b	1	1	0	0	0	2	5	6	4	1	0	1	21
Nowgong	c	1.3	1.4	1.3	1.5	1.4	3.5	5.1	5.5	3.6	1.0	0.9	0.8	2.3
Rajgarh	a	25	23	25	26	26	11	1	1	13	25	24	26	226
Rajgarh	b	1	0	1	0	0	3	17	14	5	1	1	1	44
Rajgarh	c	1.0	1.0	0.9	0.8	0.9	3.3	5.9	6.3	3.5	0.7	1.0	0.7	2.2
Ratlam	a	23	22	24	24	21	19	23	25	18	24	23	24	270
Ratlam	b	0	0	0	0	0	0	2	2	0	0	0	0	4
Ratlam	c	0.8	0.7	0.8	0.7	1.1	2.0	2.0	1.5	1.7	0.8	0.7	0.8	1.1
Sagar	a	22	20	21	19	20	6	1	1	6	18	21	21	176
Sagar	b	1	0	0	0	0	2	11	12	5	1	0	1	33
Sagar	c	1.4	1.1	1.3	1.2	1.2	3.8	6.1	6.5	4.0	1.6	1.1	1.2	2.5
Seoni	a	16	15	15	9	9	2	1	0	3	8	14	16	108
Seoni	b	2	1	1	1	1	12	18	16	6	1	1	1	61
Seoni	c	1.9	1.5	1.6	1.8	2.1	4.8	6.5	6.1	3.9	2.3	1.6	1.3	2.9
Shajapur	a	20	19	20	22	22	7	1	0	6	21	21	22	181
Shajapur	b	1	0	1	0	0	4	16	19	5	1	1	0	48
Shajapur	c	1.5	1.1	1.3	0.9	0.9	3.8	6.4	6.8	3.9	1.3	1.2	1.2	2.5
Sheopur	a													
Sheopur	b													
Sheopur	c	1.5	1.9	1.7	1.6	1.2	2.8	4.7	5.4	2.5	0.9	1.0	1.2	2.2
Shivpuri	a	27	25	28	28	28	16	4	2	18	17	26	29	271
Shivpuri	b	2	1	1	0	0	4	15	23	5	2	2	1	45
Shivpuri	c	0.8	0.6	0.5	0.5	0.6	2.9	5.8	6.4	2.9	0.8	0.7	0.4	1.8
Tikamgarh	a													
Tikamgarh	b													
Tikamgarh	c	0.5	0.4	0.1	0.1	0.0	0.9	3.0	2.3	1.3	0.1	0.3	0.3	0.8
Ujjain	a	20	18	20	18	21	4	0	0	3	18	17	21	164
Ujjain	b	1	1	1	0	1	7	19	21	12	1	1	1	64
Ujjain	c	1.6	1.5	1.4	1.3	1.3	4.7	6.9	7.2	5.3	1.6	1.9	1.4	3.0
Vidisha	a	23	23	24	23	21	6	1	1	8	21	23	27	201
Vidisha	b	2	1	2	2	2	14	25	24	13	3	2	1	91
Vidisha	c	1.4	1	1.4	1.2	1.8	5	7	7.1	4.6	1.7	1.2	0.6	2.8
Sub Division West Madhya Pradesh	a	20	19	21	20	20	8	3	2	8	19	21	21	184
	b	1	1	1	0	0	4	12	13	6	1	1	1	40
	c	1.4	1.3	1.2	1.1	1.2	3.6	5.6	5.7	3.6	1.4	1.2	1.0	2.3

TABLE IV
MEAN CLOUD AMOUNT ** (OCTA OF THE SKY) AND MEAN NUMBER OF DAYS OF
CLEAR AND OVERCAST SKIES AT 0830 HRS IST

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Jabalpur	a	20	18	19	19	17	5	1	0	5	18	21	23	166
Jabalpur	b	2	1	1	0	0	4	14	15	5	1	1	1	45
Jabalpur	c	1.6	1.4	1.4	1.2	1.4	4.2	6.3	6.5	4.4	1.9	1.2	1.0	2.7
Malanjkhanda	a	20	19	21	19	18	3	0	0	4	15	19	21	159
Malanjkhanda	b	3	1	2	1	1	10	19	19	8	4	2	1	71
Malanjkhanda	c	1.7	1.5	1.3	1.5	1.7	5.2	6.9	7.1	4.8	2.5	1.4	1.2	3.1
Mandla	a	23	24	25	19	23	4	1	1	12	19	22	26	218
Mandla	b	1	0	0	1	1	14	19	22	5	1	0	1	46
Mandla	c	1.7	1.3	1.2	1.2	1.2	4.5	6.7	6.7	4.4	2.0	1.1	1.2	2.8
Narsinghpur	a	22	21	25	23	24	10	2	1	7	21	23	25	204
Narsinghpur	b	2	1	0	0	0	3	8	13	4	1	1	0	33
Narsinghpur	c	1.3	1	0.9	0.8	0.8	3.3	5.2	6	3.9	1.3	0.9	0.7	2.2
Panna	a	10	9	10	9	11	5	0	0	1	6	9	10	80
Panna	b	0	0	0	0	0	0	1	1	0	0	0	0	2
Panna	c	1.9	1.9	1.7	1.9	1.8	3.1	4.8	4.9	3.9	2.4	1.9	1.7	2.7
Rewa	a	24	22	24	24	25	7	1	1	6	22	25	27	208
Rewa	b	3	1	0	0	0	4	15	15	10	2	1	1	52
Rewa	c	1.5	1.1	1.0	1.1	0.8	3.7	5.9	5.9	4.3	1.7	0.8	0.7	2.4
Satna	a	20	19	18	18	18	7	1	1	6	21	23	23	175
Satna	b	3	1	1	0	0	3	8	10	5	1	1	1	34
Satna	c	2.1	1.6	1.5	1.4	1.5	3.9	5.9	6.0	4.1	1.6	1.1	1.2	2.7
Sidhi	a	25	22	27	26	26	14	5	4	12	23	26	28	236
Sidhi	b	1	1	0	0	0	2	4	7	4	2	1	0	23
Sidhi	c	1.3	1.1	0.7	0.9	0.8	2.8	4.7	5.1	3.5	1.4	0.8	0.6	1.9
Umaria	a	17	16	18	15	15	4	1	0	4	13	16	18	137
Umaria	b	1	0	0	0	0	2	6	8	4	0	1	0	22
Umaria	c	1.8	1.6	1.6	1.7	1.8	4.2	5.7	6.0	4.4	2.4	2.0	1.4	2.9
Sub Division East Madhya Pradesh	a	20	19	21	19	20	7	1	1	6	18	20	22	176
	b	2	1	0	0	0	5	10	12	5	1	1	1	36
	c	1.7	1.4	1.3	1.3	1.3	3.9	5.8	6.0	4.2	1.9	1.2	1.1	2.6

a : Days with clear sky.

b : Days with sky overcast.

c : Mean Cloud amount.

** = Unit, equal to one eighth of the sky used in specifying cloud amount
For example : 1 Okta means $\frac{1}{8}^{\text{th}}$ of the sky covered.

TABLE IV-A
MEAN CLOUD AMOUNT ** (OCTA OF THE SKY) AND MEAN NUMBER OF DAYS OF
CLEAR AND OVERCAST SKIES AT 1730 HRS IST

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Betul	a	19	16	16	14	11	2	0	0	4	15	16	21	134
Betul	b	1	0	1	1	1	10	20	18	9	3	2	1	51
Betul	c	1.4	1.6	1.8	2.0	2.2	5.3	6.8	6.8	4.7	2.5	1.8	1.3	3.2
Bhopal AP	a	15	14	14	8	4	1	0	0	1	8	14	16	95
Bhopal AP	b	1	0	0	0	0	3	10	11	4	0	0	0	29
Bhopal AP	c	1.9	1.8	2.1	2.8	3.3	5.3	6.8	6.8	5.1	2.9	2.1	1.7	3.6
Chhindwara	a	25	18	11	15	6	2	0	0	1	8	18	23	155
Chhindwara	b	1	1	0	1	2	9	18	16	9	3	1	1	58
Chhindwara	c	1.4	2.3	1.9	3.1	4.3	6.2	6.9	6.9	6.0	3.9	2.4	1.5	3.9
Damoh	a	22	3	25	22	21	2	3	3	4	20	22	22	169
Damoh	b	1	0	0	1	1	3	20	20	2	1	1	1	55
Damoh	c													
Datia	a	25	22	24	25	25	15	5	4	13	27	25	28	238
Datia	b	0	0	0	0	0	1	5	6	3	0	0	0	15
Datia	c	0.7	1.0	0.8	0.8	0.9	2.5	4.4	4.6	2.7	0.7	0.6	0.3	1.7
Dhar	a	22	19	22	20	19	3	0	0	2	8	18	21	154
Dhar	b	0	0	0	0	0	5	16	16	5	1	1	0	44
Dhar	c	1.3	1.1	1.4	1.8	2.1	4.8	6.5	6.3	4.9	2.6	1.8	1.2	3.0
Guna	a	16	16	14	10	7	2	0	0	4	13	16	18	116
Guna	b	1	0	1	1	1	4	13	12	4	1	1	1	40
Guna	c	1.9	1.7	2.2	2.7	2.9	4.8	6.5	6.4	4.4	2.1	1.8	1.6	3.3
Gwalior	a	18	16	15	12	12	3	0	0	6	19	19	21	141
Gwalior	b	1	0	1	0	0	2	6	5	2	1	0	0	18
Gwalior	c	1.8	1.7	1.9	2.1	2.0	3.9	5.8	5.7	3.6	1.3	1.2	1.2	2.7
Hoshangabad	a	17	16	17	10	6	1	0	0	2	11	15	20	115
Hoshangabad	b	1	0	0	0	1	4	12	12	5	1	0	0	36
Hoshangabad	c	1.5	1.2	1.5	2.3	2.9	4.9	6.4	6.6	4.6	2.3	1.6	1.1	3.1
Indore AMS	a	17	15	15	10	8	1	0	0	0	7	13	16	102
Indore AMS	b	0	0	0	0	0	1	3	3	1	0	0	0	8
Indore AMS	c	1.4	1.3	1.7	2.1	2.3	4.5	5.9	5.8	4.6	2.7	1.7	1.5	3.0
Kannod	a	27	26	29	29	26	19	13	17	20	28	27	28	289
Kannod	b	1	0	0	0	1	1	3	1	0	0	0	0	7
Kannod	c	0.7	0.4	0.2	0.3	0.7	1.7	3.3	2.6	1.4	0.7	0.2	0.5	1.1
Khajuraho	a	18	16	16	13	11	2	0	0	3	15	20	21	135
Khajuraho	b	1	0	0	0	0	2	4	5	3	0	1	0	16
Khajuraho	c	1.8	1.5	1.9	2.0	2.3	4.6	5.9	6.0	4.4	1.8	1.2	1.2	2.9
khandwa	a	24	22	22	20	19	6	1	2	7	18	22	27	190
khandwa	b	1	1	1	0	0	9	11	13	6	2	1	1	46
khandwa	c	1.0	0.7	0.1	1.4	1.7	4.5	6.2	6.2	4.1	1.9	1.1	1.6	2.5
Khargone	a	6	6	9	8	8	7	4	1	1	7	6	7	70
Khargone	b	0	0	0	0	0	0	2	2	1	0	0	0	0
Khargone	c													
Neemuch	a	22	19	18	18	17	8	1	1	4	18	23	23	172

TABLE IV-A
MEAN CLOUD AMOUNT ** (OCTA OF THE SKY) AND MEAN NUMBER OF DAYS
OF CLEAR AND OVERCAST SKIES AT 1730 HRS IST

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Neemuch	b	1	0	1	1	1	3	7	12	2	1	0	0	29
Neemuch	c	1.2	1.3	1.6	1.7	1.8	3.5	5.1	5.7	3.9	1.6	0.9	1.1	2.4
Nowgong	a	19	15	16	14	10	4	2	2	5	17	20	22	146
Nowgong	b	1	0	0	0	1	2	3	4	3	1	0	0	15
Nowgong	c	1.7	1.9	2.1	2.4	3.0	4.6	5.4	5.6	4.5	1.9	1.4	1.3	3.0
Rajgarh	a	24	21	23	20	15	5	0	0	6	22	23	26	185
Rajgarh	b	0	0	0	0	0	2	16	13	5	1	0	0	37
Rajgarh	c	1.0	0.9	1.1	1.4	2	3.8	6.1	6.1	4	1.1	1	0.7	2.4
Ratlam	a	22	20	23	20	21	17	19	21	9	20	19	23	234
Ratlam	b	0	0	0	0	0	0	1	1	0	0	0	0	2
Ratlam	c	0.9	1.0	1.1	1.2	1.2	1.9	2.4	2.2	2.2	1.6	1.2	1.0	1.5
Sagar	a	17	16	15	10	4	1	0	0	3	12	16	19	113
Sagar	b	1	0	0	0	0	3	8	8	3	1	0	0	24
Sagar	c	1.7	1.5	1.9	2.5	3.2	5.2	6.4	6.2	4.5	2.3	1.6	1.5	3.2
Seoni	a	8	8	16	3	4	1	0	0	2	5	7	7	61
Seoni	b	1	1	2	2	2	16	20	19	6	2	1	1	73
Seoni	c	2.2	1.9	2.3	2.9	3.4	5.5	6.6	6.2	4.5	2.7	2.1	1.9	3.5
Shajapur	a	20	18	18	15	13	2	0	0	3	16	19	21	145
Shajapur	b	1	0	1	1	1	4	15	16	4	1	1	1	46
Shajapur	c	1.6	1.4	1.7	2.1	2.1	4.5	6.3	6.4	4.4	2.1	1.5	1.3	2.9
Sheopur	a													
Sheopur	b													
Sheopur	c	1.6	1.6	1.7	2.3	2.5	3.5	4.9	5.0	2.9	0.9	1.0	1.3	2.5
Shivpuri	a	28	26	28	28	27	17	5	3	20	28	28	29	286
Shivpuri	b	1	1	1	0	1	4	17	23	4	1	1	1	34
Shivpuri	c	0.4	0.5	0.7	0.5	0.9	2.8	5.2	6.1	3.0	0.8	0.6	0.4	1.8
Tikamgarh	a													
Tikamgarh	b													
Tikamgarh	c	0.1	0.1	0.0	0.0	0.0	1.1	2.8	2.1	1.0	0.0	0.2	0.1	0.6
Ujjain	a	20	18	19	13	14	2	0	0	1	9	16	20	142
Ujjain	b	1	0	0	1	1	4	11	10	6	1	0	1	35
Ujjain	c	1.6	1.4	1.8	2.5	2.5	4.7	6.9	7.2	5.3	1.6	1.9	1.4	3.2
Vidisha	a	24	23	22	22	15	5	3	2	6	20	23	27	192
Vidisha	b	1	1	3	2	5	16	23	23	15	3	2	1	95
Vidisha	c	1.2	1.1	1.7	1.5	3.3	5.6	6.7	6.8	5.3	2	1.3	0.7	3.1
Sub Division West Madhya Pradesh	a	20	17	19	16	13	5	2	2	5	15	19	21	157
	b	1	0	1	0	1	5	11	11	4	1	1	0	34
	c	1.3	1.3	1.4	1.8	2.2	4.1	5.6	5.6	3.9	1.8	1.3	1.1	2.6

TABLE IV-A
MEAN CLOUD AMOUNT ** (OCTA OF THE SKY) AND MEAN NUMBER OF DAYS OF
CLEAR AND OVERCAST SKIES AT 1730 HRS IST

OBSERVATORY		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Jabalpur	a	18	16	13	10	4	1	0	0	2	12	18	21	115
Jabalpur	b	1	0	1	0	0	4	8	9	4	1	1	0	29
Jabalpur	c	1.7	1.6	1.9	2.4	3.2	5.3	6.5	6.6	5.1	2.4	1.5	1.2	3.3
Malanjkhanda	a	15	13	13	8	4	0	0	0	0	7	12	17	89
Malanjkhanda	b	2	1	2	1	2	8	17	17	8	3	2	1	64
Malanjkhanda	c	2.1	2.2	2.4	2.9	3.9	6.0	6.8	6.9	5.5	3.6	2.4	1.6	3.9
Mandla	a	22	20	19	15	13	2	0	1	4	16	19	24	183
Mandla	b	1	1	1	1	2	6	18	19	5	2	1	0	46
Mandla	c	1.4	1.4	1.9	2.6	2.7	5.5	6.4	6.5	4.4	2.2	1.6	0.9	3.1
Narsinghpur	a	22	21	23	18	17	4	1	0	5	18	23	24	176
Narsinghpur	b	1	1	0	0	0	3	7	10	3	1	1	0	27
Narsinghpur	c	1.3	1	1.1	1.5	2.1	4.2	5.4	5.9	3.9	1.6	0.9	0.7	2.5
Panna	a	10	9	11	10	12	6	1	0	1	7	9	10	86
Panna	b	0	0	0	0	0	0	0	1	0	0	0	0	1
Panna	c	1.9	1.9	1.7	1.8	1.8	3.3	4.9	5	4.1	2.4	1.9	1.6	2.7
Rewa	a	21	18	20	17	17	3	0	0	4	17	22	23	162
Rewa	b	1	1	0	0	1	6	9	9	4	2	1	1	35
Rewa	c	1.2	1.3	1.3	1.7	2.1	4.5	5.8	5.8	3.9	1.8	1.0	0.7	2.6
Satna	a	18	15	15	12	7	1	0	0	3	13	18	20	122
Satna	b	1	1	1	0	0	4	6	7	4	1	0	0	25
Satna	c	1.9	1.7	2.0	2.4	2.6	4.9	6.1	6.1	4.7	2.1	1.5	1.3	3.1
Sidhi	a	25	22	25	20	21	8	2	4	9	20	24	28	211
Sidhi	b	1	1	1	1	1	3	5	9	5	2	1	0	28
Sidhi	c	1.1	1.1	1.0	1.5	1.6	4.0	5.2	5.2	4.0	1.8	1.0	0.6	2.3
Umaria	a	15	14	14	8	7	1	0	0	3	9	14	17	102
Umaria	b	1	0	1	1	0	3	7	7	4	1	1	0	26
Umaria	c	2.3	2.0	2.2	3.0	3.0	5.1	5.9	6.0	4.9	2.9	2.4	1.9	3.5
Sub Division East Madhya Pradesh	a	18	16	17	13	11	3	0	1	3	13	18	20	138
	b	1	1	1	0	1	4	9	10	4	1	1	0	31
	c	1.7	1.6	1.7	2.2	2.5	4.8	5.9	6.0	4.5	2.3	1.6	1.2	3.0

a : Days with clear sky.

b : Days with sky overcast.

c : Mean Cloud amount.

** = Unit, equal to one eighth of the sky used in specifying cloud amount
For example : 1 Okta means 1/8th of the sky covered.

TABLE- V
MEAN RAINFALL (in mm) AND NUMBER OF RAINY DAYS
MADHYA PRADESH

District		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
AGAR	a	6.3	5.5	3.8	1.8	4.2	110.8	316.8	314.6	148.3	24.0	5.9	9.7	951.7
AGAR	b	0.5	0.4	0.3	0.2	0.3	5.4	11.3	11.4	6.3	1.0	0.3	0.4	37.8
ALIRAJPUR	a	1.5	0.3	2.0	2.1	6.2	124.0	281.3	301.4	164.2	28.4	9.9	3.1	924.4
ALIRAJPUR	b	0.1	0.1	0.1	0.1	0.3	5.5	14.0	13.9	7.4	1.7	0.5	0.2	43.9
ASHOKNAGAR	a	7.2	10.8	3.9	2.2	3.1	106.3	307.8	287.7	151.4	26.2	4.4	10.5	921.5
ASHOKNAGAR	b	0.6	0.7	0.3	0.2	0.2	4.9	12.3	12.4	6.2	1.2	0.3	0.5	39.8
BARWANI	a	2.1	0.8	1.3	1.0	3.6	107.2	208.0	216.5	136.2	28.3	8.7	5.4	719.1
BARWANI	b	0.2	0.1	0.1	0.1	0.3	5.6	11.2	11.0	6.5	1.6	0.6	0.3	37.6
BETUL	a	9.9	12.9	10.8	3.9	5.1	153.9	347.2	348.6	186.1	44.5	14.9	7.0	1144.8
BETUL	b	0.7	1.0	0.7	0.4	0.4	7.6	14.2	14.3	8.0	2.4	0.9	0.5	51.1
BHIND	a	8.9	11.4	5.8	2.0	9.0	67.9	216.6	206.5	122.1	27.3	3.4	5.8	686.7
BHIND	b	0.8	1.0	0.5	0.2	0.7	3.5	10.0	10.3	5.5	1.2	0.2	0.5	34.4
BHOPAL	a	10.6	9.4	6.5	3.5	12.6	134.9	332.0	336.0	152.9	37.1	10.9	7.4	1053.8
BHOPAL	b	0.8	0.9	0.6	0.3	1.0	6.9	13.6	13.5	7.3	1.9	0.6	0.5	47.9
BURHANPUR	a	5.0	6.7	6.5	2.0	11.7	141.5	214.4	237.8	142.6	41.7	15.5	8.8	834.2
BURHANPUR	b	0.4	0.5	0.6	0.2	0.9	6.9	10.9	11.5	7.7	2.5	0.9	0.6	43.6
DATIA	a	8.9	12.2	6.4	3.8	8.4	78.6	254.8	265.1	134.6	26.0	5.2	7.0	811.0
DATIA	b	0.8	0.8	0.5	0.5	0.8	4.3	12.0	12.0	6.0	1.3	0.4	0.4	39.8
DEWAS	a	6.9	4.3	2.6	1.5	5.9	132.7	298.0	328.3	154.3	25.6	13.1	4.8	978.0
DEWAS	b	0.4	0.3	0.2	0.1	0.4	6.1	11.7	12.2	6.8	1.2	0.6	0.3	40.3
DHAR	a	1.9	1.3	1.1	0.8	3.2	123.1	267.2	264.8	161.4	32.7	9.7	2.3	869.5
DHAR	b	0.2	0.1	0.1	0.1	0.2	5.7	12.5	11.9	7.0	1.7	0.6	0.2	40.3
GUNA	a	7.9	11.2	6.6	3.7	6.5	115.7	332.7	345.6	147.3	29.0	9.8	8.8	1024.8
GUNA	b	0.7	0.8	0.5	0.4	0.7	5.4	13.5	13.9	6.6	1.4	0.7	0.6	45.2
GWALIOR	a	11.0	13.7	6.0	5.2	10.0	73.1	237.6	270.9	144.8	30.5	5.6	8.5	816.9
GWALIOR	b	0.9	1.0	0.6	0.5	0.9	4.1	11.0	11.8	6.0	1.2	0.4	0.6	39.0
HARDA	a	5.7	9.4	3.5	0.6	5.0	126.0	388.5	395.7	168.7	34.9	16.2	9.2	1163.4

TABLE- V
MEAN RAINFALL (in mm) AND NUMBER OF RAINY DAYS
MADHYA PRADESH

District		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
HARDA	b	0.5	0.8	0.3	0.1	0.4	6.8	13.3	14.8	7.6	1.7	0.8	0.7	47.8
HOSHANGABAD	a	8.4	9.5	6.8	2.7	7.6	144.4	382.2	437.1	195.7	25.1	19.2	7.9	1246.6
HOSHANGABAD	b	0.7	0.8	0.5	0.2	0.7	6.6	13.8	15.1	8.0	1.5	0.8	0.5	49.2
INDORE	a	3.8	3.8	2.4	1.5	5.8	121.0	287.4	296.7	158.0	32.7	12.0	4.2	929.3
INDORE	b	0.3	0.3	0.2	0.1	0.5	5.8	12.0	12.4	6.8	1.8	0.7	0.3	41.2
JHABUA	a	2.6	1.2	0.8	1.7	5.1	117.8	284.3	309.7	152.6	33.2	11.0	4.1	924.1
JHABUA	b	0.2	0.1	0.1	0.1	0.3	5.7	12.4	12.8	7.6	1.6	0.7	0.2	41.8
KHANDWA	a	6.0	4.0	4.7	2.0	7.6	122.6	265.9	243.9	153.8	35.1	11.0	4.5	861.1
KHANDWA	b	0.4	0.4	0.4	0.2	0.5	6.1	11.8	11.1	6.8	1.9	0.6	0.3	40.5
KHARGONE	a	3.3	3.0	2.6	1.5	5.1	123.7	224.1	231.6	136.9	30.8	9.9	4.2	776.7
KHARGONE	b	0.3	0.3	0.3	0.1	0.4	6.0	11.4	11.2	6.7	1.8	0.6	0.3	39.4
MANDSAUR	a	4.0	3.4	2.5	3.6	4.8	95.9	283.4	309.8	130.7	28.3	13.0	3.4	882.8
MANDSAUR	b	0.2	0.3	0.3	0.2	0.4	4.8	11.0	11.4	5.6	1.3	0.7	0.3	36.5
MORENA	a	8.4	10.1	5.3	4.0	7.0	60.5	235.9	241.4	108.0	22.8	2.6	5.8	711.8
MORENA	b	0.7	0.8	0.5	0.4	0.6	3.5	10.1	10.3	4.8	1.0	0.2	0.4	33.3
NEEMUCH	a	4.4	3.9	1.6	2.5	5.3	94.5	251.8	306.2	113.8	20.9	14.0	2.4	821.3
NEEMUCH	b	0.3	0.3	0.2	0.2	0.5	4.5	10.1	11.9	5.5	1.0	0.6	0.2	35.3
RAISEN	a	8.3	10.9	6.5	1.5	5.9	151.7	357.1	399.7	180	30.6	13.2	7.6	1173.0
RAISEN	b	0.7	0.7	0.5	0.2	0.5	6.9	13.8	14.6	7.8	1.6	0.6	0.4	48.3
RAJGARH	a	7.8	6.8	4.6	2.1	6.2	109.9	312.7	346.2	130.0	27.3	11.5	7.3	972.4
RAJGARH	b	0.6	0.6	0.4	0.2	0.6	5.7	12.1	12.9	6.3	1.3	0.7	0.4	41.8
RATLAM	a	4.1	2.7	1.5	2.3	4.3	109.2	302.2	366.1	143.6	38.3	12.4	4.7	991.4
RATLAM	b	0.4	0.3	0.2	0.2	0.4	5.8	13.0	14.0	6.6	1.6	0.8	0.2	43.5
SEHORE	a	9.2	10.1	5.5	1.0	5.2	139.0	357.0	398.1	173.6	28.3	14.3	7.4	1148.7
SEHORE	b	0.6	0.7	0.4	0.1	0.4	6.5	13.7	14.3	7.8	1.6	0.7	0.4	47.2
SHAJAPUR	a	8.4	5.1	4.8	2.0	8.6	116.1	308.1	334.0	148.7	25.3	11.5	9.7	982.3
SHAJAPUR	b	0.7	0.3	0.3	0.3	0.9	5.9	11.8	12.1	6.8	1.5	0.7	0.6	41.9
SHEOPUR	a	6.6	4.2	2.2	3.3	6.7	78.3	248.3	249.8	91.5	22.3	6.6	4.2	724.0

TABLE- V
MEAN RAINFALL (in mm) AND NUMBER OF RAINY DAYS
MADHYA PRADESH

District		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
SHEOPUR	b	0.4	0.4	0.2	0.3	0.6	3.8	10.5	10.5	4.8	1.0	0.4	0.3	33.2
SHIVPURI	a	8.3	12.3	3.4	3.6	8.1	95.9	292.2	271.1	128.3	27.2	6.6	5.6	862.6
SHIVPURI	b	0.6	0.9	0.3	0.3	0.7	5.0	11.6	12.2	5.9	1.1	0.5	0.2	39.3
UJJAIN	a	5.4	4.3	4.8	2.5	7.3	119.5	299.8	322.8	141.0	27.9	12.6	8.2	956.1
UJJAIN	b	0.4	0.4	0.4	0.2	0.6	5.9	11.7	11.9	6.4	1.5	0.8	0.5	40.7
VIDISHA	a	11.9	10.5	7.7	2.4	5.7	144.7	349.2	378.3	154.7	24.2	10.8	9.9	1110.0
VIDISHA	b	0.8	0.8	0.5	0.2	0.4	6.6	13.4	13.9	7.3	1.3	0.6	0.5	46.3
Sub Division West Madhya Pradesh	a	6.6	7.0	4.3	2.4	6.5	114.2	291.8	308.5	147.0	29.6	10.5	6.4	934.6
	b	0.5	0.5	0.4	0.2	0.5	5.6	12.1	12.5	6.7	1.5	0.6	0.4	41.5

a :- Normal Rainfall (mm)

b:- Average number of rainy days (i.e. days with rainfall of 2.5 mm or more).

TABLE- V
MEAN RAINFALL (in mm) AND NUMBER OF RAINY DAYS

MADHYA PRADESH

District		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
ANUPPUR	a	19.6	18.0	14.0	8.6	6.4	156.8	328.7	320.8	191.2	43.8	7.7	7.7	1123.3
ANUPPUR	b	1.2	1.1	1.1	0.6	0.6	7.0	14.3	14.1	8.7	2.3	0.3	0.5	51.8
BALAGHAT	a	20.3	16.1	16.2	7.5	10.6	190.0	432.3	415.8	203.8	53.5	13.8	112	1391.1
BALAGHAT	b	1.2	1.2	1.2	0.7	0.9	8.5	17.0	17.3	9.9	2.9	0.6	0.6	62.0
CHAHTARPUR	a	12.7	15.8	7.2	5.2	8.3	116.5	290.1	351.2	178.2	34.7	6.7	6.5	1033.1
CHAHTARPUR	b	1.0	1.1	0.6	0.5	0.6	5.2	12.7	13.4	7.2	1.3	0.4	0.4	44.4
CHHINDWARA	a	14.1	15.8	14.7	4.5	7.6	160.7	326.2	332.7	186.7	43.9	18.3	11.0	1136.2
CHHINDWARA	b	1.1	1.1	1.1	0.4	0.7	8.4	14.8	14.4	8.8	2.6	1.0	0.6	55.0
DAMOH	a	15.8	16.6	8.4	5.8	5.3	152.2	348.0	405.2	174.8	29.6	12.0	7.8	1181.5
DAMOH	b	1.2	1.3	0.7	0.4	0.6	6.9	13.9	15.4	8.1	1.7	0.6	0.6	51.4
DINDORI	a	17.5	19.9	8.0	5.4	7.1	194.7	380.0	413.5	199.9	38.1	14.7	14.5	1313.3
DINDORI	b	1.3	1.4	0.6	0.4	0.8	8.4	16.5	17.3	9.5	2.2	0.8	0.9	60.1
JABALPUR	a	16.2	16.6	11.2	4.5	9.8	157.3	350.0	426.7	198.2	29.1	7.7	7.9	1235.2
JABALPUR	b	1.3	1.3	1.0	0.4	0.7	7.3	14.7	15.8	9.0	1.8	0.5	0.6	54.4
KATNI	a	14.8	18.1	7.9	2.7	0.6	119.5	326.9	336.7	163.0	29.6	7.5	3.0	1030.3
KATNI	b	1.0	1.5	0.6	0.4	0.1	5.9	13.9	14.4	7.4	2.0	0.2	0.3	47.7
MANDLA	a	20.4	23.4	17.1	8.5	7.3	174.8	405.4	420.3	200.0	36.6	11.0	9.9	1334.7
MANDLA	b	1.5	1.6	1.3	0.8	0.7	8.4	17.3	17.3	10.3	2.4	0.6	0.7	62.9
NARSINGHPUR	a	9.8	12.3	7.7	3.4	8.0	139.4	340.7	391.8	190.5	23.2	10.9	6.2	1143.9
NARSINGHPUR	b	0.8	0.9	0.6	0.3	0.8	6.2	12.8	13.6	7.8	1.4	0.6	0.5	46.3
NIWARI	a	11.5	8.3	3.8	1.5	4.1	98.0	237.6	275.3	144.2	25.0	4.9	8.8	823.0
NIWARI	b	0.5	0.5	0.4	0.2	0.4	4.0	10.9	11.5	6.1	0.9	0.3	0.1	35.8
PANNA	a	17.9	20.1	9.1	4.4	6.2	133.0	356.2	389.1	211.9	35.6	7.7	6.5	1197.7
PANNA	b	1.2	1.4	0.9	0.5	0.5	5.8	14.1	14.3	8.2	1.7	0.4	0.5	49.5
REWA	a	15.2	19.7	7.1	2.7	5.9	129.2	318.0	318.6	220.3	37.4	7.5	5.8	1087.4
REWA	b	1.0	1.2	0.6	0.3	0.5	5.6	12.9	12.9	8.4	1.6	0.4	0.3	45.7

TABLE- V
MEAN RAINFALL (in mm) AND NUMBER OF RAINY DAYS
MADHYA PRADESH

District		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
SAGAR	a	12.5	14.0	8.7	3.9	10.1	157.1	354.4	384.3	174.6	26.1	12.4	8.6	1166.7
SAGAR	b	1.0	0.9	0.6	0.4	0.8	6.6	13.8	14.4	8.0	1.4	0.7	0.6	49.2
SATNA	a	15.5	20.0	7.5	3.3	5.5	130.0	310.6	319.2	186.8	34.5	6.9	4.7	1044.5
SATNA	b	1.2	1.2	0.7	0.4	0.5	5.8	12.9	13.1	7.7	1.5	0.4	0.4	45.8
SEONI	a	16.7	18.6	18.9	7.6	8.7	169.5	355.7	313.3	174.8	44.4	16.1	9.7	1154.0
SEONI	b	1.1	1.3	1.3	0.6	0.7	8.0	15.5	14.4	8.7	2.4	0.7	0.6	55.3
SHAHDOL	a	18.3	21.7	10.4	5.6	7.2	129.8	309.1	360.2	189.8	34.8	7.3	8.8	1103.0
SHAHDOL	b	1.3	1.3	0.7	0.5	0.6	6.3	13.4	14.3	8.3	2.0	0.5	0.7	49.9
SIDHI	a	16.5	19.2	8.4	5.1	13.5	142.3	347.6	324.0	232.8	38.8	7.5	5.7	1161.4
SIDHI	b	1.3	1.4	0.7	0.6	1.0	6.6	14.1	13.8	9.3	2.0	0.5	0.5	52.3
SINGRAULI	a	9.9	18.0	7.0	4.6	5.4	124.8	270.8	287.5	197.9	43.6	7.3	5.3	982.1
SINGRAULI	b	0.8	1.5	0.5	0.5	0.8	6.1	12.9	13.0	8.6	2.3	0.5	0.4	47.9
TIKAMGARH	a	11.3	13.6	5.2	2.5	8.2	115.8	326.3	326.0	145.9	29.7	10.5	6.1	1001.1
TIKAMGARH	b	0.9	1.1	0.6	0.4	0.8	5.3	13.2	13.5	6.9	1.2	0.5	0.5	44.9
UMARIA	a	25.0	24.8	12.9	8.4	8.1	151.7	305.2	396.9	219.1	42.9	13.6	13.4	1222.0
UMARIA	b	1.8	2.0	1.0	1.0	1.0	7.2	15.3	16.4	9.6	2.2	0.8	1.0	59.3
Sub Division East Madhya Pradesh	a	15.8	17.6	10.1	5.0	7.4	144.9	334.3	357.6	189.7	35.9	10.1	12.9	1141.5
	b	1.1	1.3	0.8	0.5	0.7	6.6	14.2	14.5	8.4	1.9	0.5	0.5	50.9

a :- Normal Rainfall (mm)

b:- Average number of rainy days (i.e. days with rainfall of 2.5 mm or more).

TABLE-VI
MEAN RAINFALL (mm) OVER PART OF DIFFERENT RIVER CATCHMENTS WITHIN MADHYA PRADESH STATE

Sr. No	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1)	River Tapti. (PART OF Catchment No. 103 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 103 :-</u> BARWANI, BETUL, BURHANPUR, KHARGONE												
a	5.8	6.8	6.5	2.7	6.3	132.3	238.6	248.7	142.0	42.1	13.5	5.6	850.8
b	0.4	0.5	0.5	0.2	0.5	6.8	12.4	12.4	7.4	2.4	0.8	0.4	44.6
2)	River Narbada. (Part of Catchment No.104 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 104 :-</u> ALIRAJPUR, BALAGHAT, BARWANI, BETUL, CHHINDWARA, DEWAS, DHAR, DINDORI, HARDA, HOSHANGABAD, JABALPUR, JHABUA, KATNI, KHANDWA, KHARGONE, MANDLA, NARSINGHPUR, RAISEN, SEHORE, SEONI												
a	8.6	9.9	7.2	3.0	6.4	142.9	326.1	348.0	175.7	31.7	12.4	6.6	1078.5
b	0.7	0.7	0.6	0.3	0.5	6.7	13.6	13.9	7.8	1.8	0.7	0.4	47.7
3)	River Mahi. (PART OF Catchment No. 105 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 105 :-</u> DHAR, JHABUA, RATLAM												
a	3.6	2.1	0.9	1.9	4.4	120.0	308.5	341.5	151.9	39.1	12.4	3.9	990.1
b	0.3	0.2	0.1	0.2	0.3	6.0	13.2	13.7	7.0	1.7	0.8	0.2	43.7
4)	River Wainganga (excluding Panganga) (PART OF Catchment No. 315 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 315 :-</u> BALAGHAT, CHHINDWARA, MANDLA, SEONI												
a	16.3	15.3	15.9	6.4	9.0	172.6	364.2	341.7	188.2	48.0	16.1	11.1	1204.8
b	1.1	1.1	1.2	0.6	0.8	8.4	15.6	15.2	9.3	2.8	0.8	0.6	57.4

TABLE-VI

MEAN RAINFALL (mm) OVER PART OF DIFFERENT RIVER CATCHMENTS WITHIN MADHYA PRADESH STATE

5)	River Chambal upto Kotah dam site. (PART OF Catchment No. 404 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 404 :-</u> AGAR, DEWAS, DHAR, INDORE, MANDSAUR, NEEMUCH, RATLAM, UJJAIN												
a	4.4	3.7	2.8	2.1	5.3	112.5	282.4	303.6	143.3	28.4	11.1	4.9	904.7
b	0.3	0.3	0.2	0.1	0.4	5.5	11.4	11.7	6.3	1.4	0.6	0.3	38.8
6)	River Chambal from Kotah dam site to its confluence with river Banas (excluding River Banas) (PART OF Catchment No. 405 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 405 :-</u> AGAR, DEWAS, GUNA, MANDSAUR, RAJGARH, SEHORE, SHAJAPUR												
a	8.4	7.0	4.7	2.3	6.4	117.6	312.5	342.2	144.2	26.5	11.8	7.5	990.9
b	0.6	0.5	0.4	0.2	0.6	5.8	12.2	12.6	6.5	1.3	0.7	0.4	41.9
7)	River Banas. (PART OF Catchment No. 406 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 406 :-</u> NEEMUCH												
a	4.0	4.4	2.0	3.0	3.9	82.6	260.1	302.1	107.3	17.2	16.3	2.3	805.2
b	0.3	0.3	0.2	0.2	0.3	4.2	10.5	12.1	5.4	1.0	0.7	0.1	35.3
8)	River Chambal from its confluence with River Banas to its confluence with River Yamuna. (PART OF Catchment No. 407 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 407 :-</u> SHEOPUR												
a	7.3	4.7	1.3	3.7	7.5	87.0	269.2	270.4	96.0	22.2	7.6	4.1	780.7
b	0.4	0.5	0.1	0.4	0.7	4.1	11.1	10.8	5.0	1.0	0.5	0.3	34.8

TABLE-VI

MEAN RAINFALL (mm) OVER PART OF DIFFERENT RIVER CATCHMENTS WITHIN MADHYA PRADESH STATE

9)	River Yamuna between River Chambal and its confluence with River Ganga (PART OF Catchment No. 408 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 408 :-</u> ASHOKNAGAR, BHIND, BHOPAL, CHHATARPUR, DAMOH, DATIA, GWALIOR, MORENA, NIWARI, PANNA, RAISEN, SAGAR, SHEOPUR, SHIVPURI, TIKAMGARH, VIDISHA												
a	11.2	13.0	6.5	3.6	7.4	114.0	302.8	326.5	156.4	29.1	8.0	7.4	985.9
b	0.9	1.0	0.6	0.3	0.6	5.4	12.5	13.0	6.8	1.4	0.5	0.5	43.2
10)	Ganga between its confluence with River Yamuna and River Gogra (excluding river Gogra) including Gomti. (PART OF Catchment No. 409 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 409 :-</u> REWA, SATNA												
a	15.3	19.8	7.3	3.0	5.7	129.5	315.0	318.8	206.9	36.2	7.2	5.4	1070.2
b	1.1	1.2	0.6	0.3	0.5	5.7	12.9	13.0	8.1	1.6	0.4	0.4	45.7
11)	River Son (PART OF Catchment No. 414 within Madhya Pradesh)												
	<u>Districts / Part of the districts within the catchment 414 :-</u> ANUPPUR, DINDORI, SHAHDOL, SIDHI, SINGRAULI, UMARIA												
a	16.5	19.7	8.7	4.6	7.1	138.8	320.8	331.6	207.2	38.2	7.9	6.8	1107.9
b	1.2	1.3	0.8	0.6	0.8	6.8	14.1	14.4	8.9	2.1	0.5	0.6	52.0

a :- Normal Rainfall in mm

b:- Average number of rainy days

TABLE – VII
STORMS AND DEPRESSIONS AFFECTING MADHYA PRADESH STATE
DURING 1891 – 2021

MONTHS	NO.OF STORMS/DEPRESSIONS
JANUARY	0
FEBRUARY	0
MARCH	0
APRIL	1
MAY	3
JUNE	48
JULY	105
AUGUST	118
SEPTEMBER	79
OCTOBER	24
NOVEMBER	9
DECEMBER	0
TOTAL	387

**DISTRICT
CLIMATOLOGICAL
SUMMARY OF
EAST
MADHYA PRADESH**

ANUPPUR DISTRICT

The climate of this district is characterized by a hot summer and general dryness except during the southwest monsoon season. The year may be divided into four seasons. The period from March to May which is the hot season is followed by the southwest monsoon season from June to September. The period of October and November may be termed as the post monsoon season while the period of December, January and February is of cold season.

RAINFALL

Records of rainfall in the district are available for 3 raingauge stations for the period ranging from 32 to 45 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. Average annual rainfall in the district as a whole is 1123.3 mm. During the southwest monsoon season (June to September) the district receives 89% of the annual rainfall. July and August are the rainiest months with an average rainfall of about 324.7 mm. The variation in the rainfall from year to year is not very large. In the fifty year period 1971-2020, the highest annual rainfall amounting to 160% of the normal occurred in year 1994, while the lowest annual rainfall which was only 64% of the normal occurred in 2002. In this fifty year period there were 3 years in which the rainfall in the district was less than 80% of the normal, none of them being consecutive. It is seen from Table 2 that the rainfall was between 701 mm and 1200mm in 13 years out of 31.

On an average there are 52 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district

The heaviest rainfall in 24 hours recorded at any station in the district was 283.6 mm at Jaithari on 19th July 1971.

TEMPERATURE

There is no meteorological observatory in the district so the description that follows is based on the records of the meteorological data of the observatory in the neighbouring Umaria district, where similar meteorological conditions prevail. After February temperature increase steadily. May is generally the hottest month with the mean daily maximum temperature at about 41 °C and the mean daily minimum temperature at about 24 °C. The heat in summer is intense and the hot dust laden winds which blow on many days make the weather very uncomfortable. On individual days the maximum temperature may go above 45 °C. With the onset of the monsoon in the district by about the middle of June there is appreciable drop in temperature. By about the end of September when the monsoon withdraws there is a slight increase in the day temperature but the nights become progressively cooler. After November there is rapid drop in both the day and night temperatures. January is the coldest month with the mean daily maximum temperature at about 25 °C and the mean daily minimum at about 7 °C. In the cold season, in association with western disturbances passing across north India cold waves affect the district and the minimum temperature occasionally drops down to about couple of degrees above the freezing point of water.

HUMIDITY

Morning humidity is generally high during the period from June to September when it ranges between 61% and 87% while afternoon humidity ranges between 50% and 81%. The summer season is the driest part of the year when the values of relative humidity in the afternoons are about 30%.

CLOUDINESS

During the southwest monsoon season skies are mostly moderate to heavily clouded. The skies are generally clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light over the district. Winds blow mostly from west and southwest direction from the month of May till the end of southwest monsoon season. In the post monsoon and winter season, winds are mostly light.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season move in some westerly direction and reach the district or its neighbourhood causing widespread heavy rain and gusty winds. Storms and depressions from the Bay of Bengal during October occasionally also affect the weather over the district. Thunderstorms occur almost throughout the year. Fog is experienced on few occasions during winter months.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
ANUPPUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
JAITHARI	34	a b	21.6 1.1	11.3 0.9	12.0 1.1	9.8 0.8	2.7 0.4	148.8 6.7	309.4 13.6	301.4 13.6	188.9 9.1	37.4 2.2	7.1 0.3	2.8 0.2	1053.2 50.0	190 (1971)	55 (2009)	283.6	19 JUL 1971
KOTMA	32	a b	11.0 0.8	14.7 1.0	13.6 1.0	3.4 0.3	3.9 0.3	141.9 5.9	334.9 13.4	320.2 13.7	189.0 8.7	45.7 2.3	5.2 0.2	8.3 0.6	1091.8 48.2	153 (1994)	62 (2015)	229.0	21 JUN 1996
PUSHPARAJGARH	45	a b	26.1 1.8	28.1 1.3	16.5 1.1	12.7 0.8	12.7 1.1	179.7 8.4	341.7 15.9	340.7 14.9	195.7 8.4	48.4 2.4	10.7 0.5	11.9 0.6	1224.9 57.2	153 (1994)	65 (2002)	214.0	18 SEP 1980
DISTRICT MEAN	3	a b	19.6 1.2	18.0 1.1	14.0 1.1	8.6 0.6	6.4 0.6	156.8 7.0	328.7 14.3	320.8 14.1	191.2 8.7	43.8 2.3	7.7 0.3	7.7 0.5	1123.3 51.8	160 (1994)	64 (2002)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
ANUPPUR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
701 - 800	3	1301 - 1400	6
801 - 900	1	1401 - 1500	1
901 - 1000	4	1501 - 1600	2
1001 - 1100	2	1601 - 1700	2
1101 - 1200	3	1701 - 1800	3
1201 - 1300	4		

DATA AVAILABLE FOR 31 YEARS

BALAGHAT DISTRICT

The climate of this district is characterized by general dryness except during the monsoon months. The cold season from December to February is followed by the hot season which continues up to the beginning of June. The southwest monsoon season is from June to September. The period of October and November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 5 raingauge stations for the period ranging from 40 to 48 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. Average annual rainfall in the district as a whole is 1391.1 mm. During the southwest monsoon season (June to September) the district receives 89% of the annual rainfall. July and August are the rainiest months with an average rainfall of about 424.1 mm. The variation in the rainfall from year to year is moderately large. In the fifty year period 1971-2020, the highest annual rainfall amounting to 191% of the normal occurred in year 1994, while the lowest annual rainfall which was only 66% of the normal occurred in 2015. In this fifty year period there were 4 years in which the rainfall in the district was less than 80% of the normal and there was a single occasion of two consecutive years. It is seen from Table 2 that the rainfall was between 1001 mm and 1700 mm in 33 years out of 42.

On an average there are 62 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 57 at Katangi to 69 at Malanjkhanda observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 485.2 mm at Lanji on 14th September 2005.

TEMPERATURE

There is only one meteorological observatory at Malanjkhanda. The records of this observatory may be taken as representative of the meteorological conditions prevailing in the district in general. After February temperature increases steadily. May

is generally the hottest month with the mean daily maximum temperature at 40.2 °C and the mean daily minimum temperature at about 24.2°C. The heat in summer is intense and the day temperatures may sometimes rise up to about 43°C . The afternoon thundershowers which occur on some days bring welcome relief though only temporarily. With the onset of the monsoon in the district by about the middle of June there is appreciable drop in temperature and the weather becomes pleasant. By about the end of September when the monsoon withdraws there is a slight increase in the day temperature but the nights become progressively cooler. After October day temperatures also decrease. December and January are generally the coldest months with the mean daily maximum temperature at about 25°C and the mean daily minimum at about 8.6 °C.

The district is sometimes affected by cold waves in the rear of western disturbances and the minimum temperature occasionally drops down to about a degree or so above the freezing point of water.

The highest maximum temperature ever recorded in the district was 45.6°C on 6th June 2019 and the lowest minimum temperature was 0.4 °C on 5th January 2011 at Malanjkhanda observatory.

HUMIDITY

During the southwest monsoon season the relative humidity is high being generally over 75%. The air gradually becomes drier after the withdrawal of the southwest monsoon season. The summer season is the driest part of the year when the values of relative humidity in the afternoons are about 35%.

CLOUDINESS

During the southwest monsoon season skies are mostly moderate to heavily clouded. The skies are generally clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light with some strengthening in force during the late summer and monsoon seasons. Winds blow mostly from northwest direction during the period of southwest monsoon season. In the post monsoon and winter season, winds blow mostly from southeast and northwest directions. In the summer season, the winds are light and are from northwest or southeast directions in the mornings, while these are stronger in the afternoons being mostly from northwest direction.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season move in some westerly direction and reach the district or its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms occur throughout the year and the highest incidence is during the southwest monsoon season. Occasional dust storms occur during the summer and southwest monsoon season. Fog occurs occasionally during the post monsoon and winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Malanjkhanda observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
BALAGHAT

STATION	No. of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BALAGHAT	43	a b	22.6 1.3	17.4 1.4	20.7 1.3	5.2 0.7	8.5 0.9	210.9 8.8	481.7 18.0	458.1 18.6	205.7 9.9	60.7 3.2	17.3 0.8	12.9 0.7	1521.7 65.6	209 (1994)	60 (2006)	280.7	12 JUL 1914
KATANGI	44	a b	20.6 1.1	12.2 0.7	11.3 0.7	9.2 0.7	8.6 0.9	175.6 8.7	359.3 15.1	354.9 16.1	188.0 9.4	50.2 2.6	12.1 0.3	13.6 0.5	1215.6 56.8	143# (2013)	74 (1971)	317.5	17 JUN 1918
LANJI	47	a b	17.2 0.9	10.6 0.6	11.4 0.8	5.3 0.3	12.9 0.4	216.3 7.8	565.4 17.1	531.1 17.2	265.7 9.9	61.3 3.2	10.6 0.3	9.8 0.4	1717.6 58.9	206 (1994)	34 (2015)	485.2	14 SEP 2005
MALANJKHAND OBSY	40	a b	25.4 1.7	25.2 2.0	24.6 2.1	13.9 1.3	15.3 1.7	182.6 9.3	392.1 18.2	357.5 17.3	181.8 10.4	55.4 3.2	17.0 0.9	11.1 0.8	1301.9 68.9	151# (1994)	71 (2008)	235.6	30 JUN 2005
WARASEONI	48	a b	15.5 1.1	15.1 1.2	12.8 1.0	4.0 0.5	7.7 0.7	164.7 7.7	363.1 16.7	377.6 17.4	177.7 9.9	40.0 2.4	11.8 0.5	8.4 0.6	1198.4 59.7	186 (1994)	61 (2015)	289.6	03 AUG 1921
DISTRICT MEAN	5	a b	20.3 1.2	16.1 1.3	16.2 1.2	7.5 0.7	10.6 0.9	190.0 8.5	432.3 17.0	402.4 16.7	203.8 9.9	53.5 2.9	13.8 0.6	112 0.6	1391.1 62.0	191 1994	66 2015		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
BALAGHAT
Data (1971-2020)

Range in mm	No. of years	Range in mm	No. of years
901- 1000	3	1801 - 1900	2
1001- 1100	1	1901 - 2000	0
1101 - 1200	5	2001 - 2100	0
1201 - 1300	6	2101 - 2200	0
1301 - 1400	9	2201 - 2300	0
1401- 1500	3	2301 - 2400	1
1501 - 1600	4	2401 - 2500	0
1601- 1700	5	2501 - 2600	0
1701 - 1800	2	2601 - 2700	1

(Data available for 42 years)

TABLE – 3
Normals of Temperature and Relative Humidity
MALANJKHAND

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	24.8	8.9	33.5	05-01-2010	0.4	05-01-2011	79	52
February	28.0	11.7	35.2	26-02-2006	0.6	03-02-2008	66	42
March	33.4	15.9	40.0	31-03-2017	7.2	06-03-2003	48	31
April	37.6	20.2	43.1	30-04-2009	10.4	02-04-1996	39	25
May	40.2	24.2	44.5	25-05-2010	15.9	04-05-1987	39	28
June	35.2	24.3	45.6	06-06-2019	15.5	19-06-1996	67	58
July	29.8	22.9	39.5	03-07-2002	19.1	01-07-2013	87	82
August	28.5	22.6	34.2	23-08-1998	18.9	31-08-2006	90	85
September	29.8	21.7	35.0	27-09-1978	16.4	29-09-1994	85	79
October	30.0	18.1	34.8	03-10-1987	9.9	26-10-2009	77	68
November	27.6	12.8	32.2	16-11-1989	5.6	23-11-1981	77	61
December	25.3	8.4	31.3	04-12-1985	2.3	10-12-1996	83	53
Annual	30.8	17.6	45.6	06-06-2019	0.4	05-01-2011	70	56

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
MALANJKHAND

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	20	19	21	19	18	3	0	0	4	15	19	21	159
b	3	1	2	1	1	10	19	19	8	4	2	1	71
c	1.5	1.6	1.3	1.5	1.7	5.2	6.9	7.1	4.8	2.5	1.4	1.2	3.1
1730 HOURS IST													
a	15	13	13	8	4	0	0	0	0	7	12	17	89
b	2	1	2	1	2	8	17	17	8	3	2	1	64
c	2.1	2.2	2.4	2.9	3.9	6.0	6.8	6.9	5.5	3.6	2.4	1.6	3.9

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
MALANJKHAND

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.6	3.1	3.5	3.9	4.4	4.1	3.4	3.8	3.3	2.4	2.0	2.0	3
Direction in morning	C/SE	C/NW	C/SE	C/SE	NW	NW	NW/C	NW	NW	C	C	C	
Direction in evening	NW/C	NW	NW	NW	NW	NW/SW	C/NW	NW/C	NW/C	C	C	C	

TABLE - 6
Special Weather Phenomena
MALANJKHAND

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.2	0.1	0.9	0.6	1.4	1.8	2.7	1.1	2.2	0.9	0.0	0.0	11.9
Hailstorm	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.3
Dust storm	0.0	0.0	0.1	0.4	0.5	0.1	0.1	0.0	0.0	0.0	0.1	0.0	1.3
Fog	0.4	0.0	0.1	0.0	0.0	0.0	0.2	0.1	0.6	0.5	0.2	0.1	2.2

CHHATARPUR DISTRICT

The climate of the district is characterised by general dryness except during the southwest monsoon season, and a very hot summer. The year may be divided into four seasons. The cold season from about the middle of November to February is followed by the summer season from March to about the middle of June. The period from about the middle of June to about the end of September is the southwest monsoon season. The succeeding period lasting till the middle of November constitutes the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 6 rain gauge stations for period ranging from 36 to 49 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 1033.1 mm. About 91% of the annual rainfall in the district is received in the southwest monsoon season (June to September), August being the rainiest month with an average value of rainfall of 351.2 mm. During the fifty year period 1971-2020, the highest annual rainfall amounting to 162% of the normal occurred in year 1980, while the lowest annual rainfall which was only 50% of the normal occurred in 2007. In this fifty year period, the annual rainfall in the district was less than 80% of the normal in 7 years. Two consecutive years of low rainfall occurred on two occasions. It is seen from Table 2 that the rainfall was between 801 mm and 1300 mm in 30 years out of 49.

On an average there are 44 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 38 at Rajnagar to 51 at Khajuraho Aero Observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 393.0 mm at Buxwaha on 21 June 2008.

TEMPERATURE

There are two meteorological observatories in the district at Khajuraho and Nowgong so the description that follows is based on the records of the meteorological data of these observatories. From about the end of February, there is rapid increase in both day and night temperatures. May is the hottest month with the average mean daily maximum temperature at about 43.0°C and the mean daily minimum temperature at 26.4°C. Nights in June are however warmer than May. On some days in the summer season, the maximum temperature may go above 48°C. The heat in summer is intense and the scorching dust laden winds which blow on many days add much to the discomfort. Afternoon thundershowers which occur on some days bring welcome relief from the heat though only temporarily. With the onset of the southwest monsoon over the district after about second week of June, there is appreciable drop in temperatures. By about the end of September or October when the southwest monsoon withdraws from the district, there is a slight increase in day temperatures but the night becomes progressively cooler. After October, both the day and night temperatures decrease rapidly. January is generally the coldest month with the average mean daily maximum temperature at 23.50°C and mean daily minimum temperatures at 7.8°C. Nights in January are generally colder than December. During the winter season, the district is affected by cold waves in the wake of moving western disturbances and the minimum temperature may drop down to about a degree or two below the freezing point of water and frosts occur.

The highest maximum temperature ever recorded in the district was 48.8°C on 27 May 1998 and the lowest minimum temperature was -1.7°C on 19 January 1935 and 27 December 1961 at Nowgong Observatory.

HUMIDITY

In the south west monsoon season, the relative humidity generally exceeds 70%. In the rest of the year, the air is dry. The driest part of the year is the summer season with values of relative humidity in the afternoon being about 30%.

CLOUDINESS

During the southwest monsoon season skies are mostly heavily clouded or overcast. In the rest of the year, the skies are generally clear or lightly clouded.

WINDS

Winds are generally light. They blow mostly from directions between southwest and northwest in the summer and southwest monsoon season. Winds are generally light in the post monsoon and early part of the cold season and continue to blow in the same directions.

SPECIAL WEATHER PHENOMENA

Depressions from the Bay of Bengal during the southwest monsoon season which move in a westerly to northwesterly direction, reach the district or its neighbourhood and cause heavy rains and gusty winds. An occasional storm or depression from the Bay of Bengal during October also affects the weather over the district. Dust storms occur occasionally in the summer season. Thunderstorms generally occur throughout the year, the highest incidence being in the period May to September. Dust-storms occur rarely in the month of May. Fog occasionally occurs in the morning of post monsoon and winter seasons.

Tables 3, 4, 5 and 6 and Tables 3(A), 4(A), 5(A) and 6(A) give the normals of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Nowgong and Khajuraho observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
CHHATARPUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BIJAWAR	43	a b	14.4 0.9	14.2 1.0	4.7 0.4	5.7 0.4	9.3 0.6	128.4 5.2	290.2 13.2	394.2 13.9	196.1 6.4	43.3 1.6	9.6 0.5	6.5 0.4	1116.6 44.5	184 (1982)	60 (1991)	257.8	09 SEP 1906
BUXWAHA	45	a b	12.1 0.8	13.1 0.9	8.3 0.4	2.9 0.3	5.4 0.3	142.6 5.3	279.6 12.0	344.1 14.1	154.0 6.9	22.3 1.0	7.2 0.4	4.2 0.3	995.8 42.7	176 (2016)	57 (1979)	393.0	21 JUN 2008
CHAHTARPUR	39	a b	9.0 0.7	14.6 1.3	4.4 0.4	3.1 0.3	6.9 0.5	108.4 5.2	254.0 12.1	327.9 13.0	189.1 7.3	51.4 1.4	5.0 0.4	6.8 0.4	980.6 43.0	184 (1985)	53 (2007)	330.0	09 OCT 1985
KHAJURAHO AERO OBSY	49	a b	18.2 1.5	21.9 1.7	10.1 1.0	7.7 0.7	11.3 1.1	108.4 5.9	318.3 14.0	387.7 13.8	187.2 8.2	34.8 1.7	6.1 0.4	7.3 0.6	1119.0 50.6	159 (1980)	53 (2006)	324.6	28 AUG 1980
NOWGONG OBSY	49	a b	14.0 1.3	16.3 1.2	10.1 1.0	7.3 0.8	11.2 1.0	99.7 5.2	333.1 13.9	333.2 13.3	168.3 7.7	29.7 1.5	9.7 0.6	8.4 0.5	1041.0 48.0	176# (1999)	49 (2010)	266.7	12 AUG 1954
RAJNAGAR	36	a b	8.6 0.7	14.9 0.8	5.5 0.5	4.4 0.3	5.5 0.4	111.3 4.5	265.1 11.1	320.2 12.1	174.5 6.5	26.5 0.9	2.6 0.2	6.1 0.3	945.2 38.3	171 (2013)	50 (2006)	251.4	18 AUG 1993
DISTRICT MEAN	6	a b	12.7 1.0	15.8 1.1	7.2 0.6	5.2 0.5	8.3 0.6	116.5 5.2	290.1 12.7	351.2 13.4	178.2 7.2	34.7 1.3	6.7 0.4	6.5 0.4	1033.1 44.4	162 1980	50 2007		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
CHHATARPUR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	1	1101 - 1200	4
601 - 700	1	1201 - 1300	2
701 - 800	5	1301 - 1400	4
801 - 900	10	1401 - 1500	2
901 - 1000	7	1501 - 1600	4
1001 - 1100	7	1601 - 1700	1

DATA AVAILABLE FOR 48 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
NOWGONG

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	23.5	7.2	33.0	28-01-1990	-1.7	19-01-1935	82	55
February	27.4	10.0	37.7	13-02-1988	-0.6	02-02-1905	72	48
March	34.1	15.2	42.2	28-03-1977	4.9	01-03-1972	56	35
April	39.5	20.7	46.4	20-04-1996	10.0	11-04-2005	40	27
May	43.0	26.0	48.8	27-05-1998	13.9	06-05-1932	38	24
June	40.4	27.2	48.3	05-06-1995	18.4	09-06-1957	56	43
July	34.2	25.2	45.6	01-07-1931	17.4	07-07-1993	81	70
August	32.3	24.1	40.7	03-08-1972	16.3	11-08-1995	86	77
September	33.1	23.0	39.8	13-09-1990	14.9	23-09-1972	82	69
October	34.3	18.1	40.3	05-10-2015	8.4	27-10-1957	67	48
November	30.4	12.2	37.4	04-11-2001	1.9	23-11-1993	66	49
December	26.0	8.2	33.5	02-12-2015	-1.7	27-12-1961	75	55
Annual	33.1	17.9	48.8	27-05-1998	-1.7	19-01-1935 27-12-1961	67	50

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
NOWGONG

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	24	19	22	20	22	10	4	3	11	25	25	26	211
b	1	1	0	0	0	2	5	6	4	1	0	1	21
c	1.3	1.4	1.3	1.5	1.4	3.5	5.1	5.5	3.6	1.0	0.9	0.8	2.3
1730 HOURS IST													
a	19	15	16	14	10	4	2	2	5	17	20	22	146
b	1	0	0	0	1	2	3	4	3	1	0	0	15
c	1.7	1.9	2.1	2.4	3.0	4.6	5.4	5.6	4.5	1.9	1.4	1.3	3.0

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount. For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed (kmph) and Predominant Wind Direction
NOWGONG

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Annual
Wind speed in km/ hr.													
Direction in the morning	C	C	C	C/NW	C/SW/NW	C/SW/NW	C/SW	C/SW	C/SW	C	C	C	
Direction in the evening	C/NW	C/NW	C/NW	C/NW	NW/SW	C/NW/SW	C/SW	C/SW/NW	C/NW/SW	C/NW/NE	C/NW/NE	C/NW/NE	

TABLE - 6
Special Weather Phenomena
NOWGONG

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	No v	Dec	Annual
Thunderstorm	0.1	0	0.1	0	0	0	0	0	0	0	0	0	0.2
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Dust storm	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0.5	0.1	0.1	0	0	0	0	0	0	0	0	0.1	0.8

TABLE – 3 (A)
Normals of Temperature and Relative Humidity
KHAJURAHO

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	23.6	8.4	34.3	29-01-2007	0.8	05-01-1990	83	50
February	28.1	10.7	38.6	28-02-1989	0.6	10-02-1974	73	38
March	34.4	15.7	43.1	30-03-1996	6.0	01-03-2019	54	24
April	40.2	21.7	46.9	29-04-1993	12.6	05-04-2011	34	18
May	43.2	26.8	48.4	31-05-1994	13.2	23-05-2011	34	34
June	40.8	28.3	48.0	04-06-1995	20.4	14-06-2015	53	41
July	34.6	26.3	45.0	02-07-2012	22.4	02-07-1989	78	69
August	32.8	25.3	41.0	03-08-1972	21.8	21-08-1973	85	78
September	33.6	24.1	39.3	25-09-1996	17.3	27-09-1972	81	68
October	34.1	19.1	42.8	01-10-1987	11.7	31-10-1991	73	50
November	30.5	13.6	38.5	06-11-2008	4.8	29-11-1970	73	47
December	26.3	8.9	33.2	02-12-2015	1.9	20-12-2011	81	49
Annual	33.4	18.9	48.4	31-05-1994	0.6	10-02-1974	67	46

TABLE – 4(A)
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
KHAJURAHO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	20	18	19	20	20	8	1	1	8	21	21	22	179
b	1	1	1	0	0	2	6	7	4	1	1	1	25
c	1.8	1.3	1.4	1.2	1.3	3.5	5.5	5.7	3.7	1.3	1.1	1.0	2.4
1730 HOURS IST													
a	18	16	16	13	11	2	0	0	3	15	20	21	135
b	1	0	0	0	0	2	4	5	3	0	1	0	16
c	1.8	1.5	1.9	2.0	2.3	4.6	5.9	6.0	4.4	1.8	1.2	1.2	2.9

a : Days with clear sky.
b : Days with sky overcast.
c : Mean Cloud amount.
** = Unit, equal to one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.
For example: 1 Okta means 1/8th of the sky covered.

TABLE – 5(A)
Mean Wind Speed (kmph) and Predominant Wind Direction
KHAJURAHO

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.	1.8	2.1	2.5	3.1	3.9	4.7	4.1	2.9	2.5	1.7	1.4	1.3	2.7
Direction in the morning	C/SW/ W	C/SW/ W	C/SW/ W	SW	SW/ W	SW/ W	SW	C/SW/ W	C/SW/ W	C/SW/ W	C/SW/ W	C/SW/ W	
Direction in the evening.	C/NW/ NE	NW	NW	NW	NW	NW/ W	SW/ W	C/SW/ W	C/NW/ W	C/NE/ NW	C/NE/ NW	C/NW/ NE	

TABLE – 6(A)
Special Weather Phenomena
KHAJURAHO

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.1	0.4	0.1	0.4	1.0	1.8	1.8	4.6	1.8	0.2	0.0	0.1	12.3
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust storm	0	0	0	0	1.1	0	0	0	0	0	0	0	1.1
Fog	2	0.8	0	0	0	0	0	0	0	0.1	0.2	0.9	4.0

CHHINDWARA DISTRICT

The district has a climate which is comparatively milder than that in the neighbouring districts in the south or east. The year may be divided into four seasons. The cold season from December to February is followed by the summer season from March to about middle of the June. The period from mid-June to September is the southwest monsoon season. October and November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 7 raingauge stations for period ranging from 38 to 49 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 1136.2 mm. Except for the comparatively higher rainfall in the neighbourhood of Tamia, the rainfall in the district generally increases from the west towards the east. The rainfall in the district varies from 913.9 mm at Sausar to 1631.9 mm at Tamia. About 89% of the annual rainfall in the district is received during the southwest monsoon season (June to September). July and August being the rainiest months with an average value of rainfall of 329.5 mm. The variation in the rainfall from year to year is not large. During the fifty year period 1971-2020, the highest annual rainfall amounting to 155% of the normal occurred in year 1999, while the lowest annual rainfall which was 51% of the normal occurred in 2008. During this fifty year period, the annual rainfall in the district was less than 80% of the normal in 10 years, two consecutive years of such low rainfall occurring thrice. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 24 years out of 47.

On an average there are 55 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 49 at Harrai to 61 at Tamia.

The heaviest rainfall in 24 hours recorded at any station in the district was 394.5 mm at Tamia on 12 July 1942.

TEMPERATURE

There is meteorological observatory in the district at Chhindwara. The records of the temperatures and other meteorological elements of this observatory may be taken as fairly representative of the conditions prevailing in the district in general. The summer season starts early in March when temperatures begin to increase rapidly. May is the hottest month with the mean daily maximum temperature at 39.2°C and the mean daily minimum temperature at 24.4°C. During May and early June, the day temperatures on individual days may go up to about 46.0°C. With the onset of the monsoon in the district by about the middle of June, there is an appreciable drop in temperatures and the weather becomes pleasant. After the withdrawal of monsoon by about the end of September or start of October month, there is a slight increase in day temperatures but night becomes progressively cooler. After October, there is a rapid decrease in both the day and night temperatures. January is generally the coldest month with the mean daily maximum temperature at 24.4°C and the mean daily minimum temperature at 9.2°C. Nights are comparatively colder in December and January. During the cold season, the district is sometimes affected by cold waves in the wake of western disturbances passing across North India. On such occasions, the minimum temperature may drop down to about 1.0°C.

The highest maximum temperature ever recorded in the district was 47.6°C on 23 May 2005 and the lowest minimum temperature was 1.1 °C on 29 December 1983.

HUMIDITY

The relative humidity during the south west monsoon season is high, generally between 80 to 90%. Humidity decreases in post monsoon season. Summer season is the driest part of the year with the value of relative humidity ranging between 30- 40% in the afternoon.

CLOUDINESS

During the southwest monsoon season, skies are heavily clouded or overcast. Skies are mostly clear or lightly clouded during the winter, summer and post-monsoon season.

WINDS

Winds are generally light with some increase in force during the latter part of summer and monsoon season. During the southwest monsoon, post monsoon and winter season, winds blow mainly from directions between west and northwest.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal in the monsoon season move in some westerly direction and pass through or in the neighbourhood of the district causing widespread heavy rain and gusty winds. Some of the storms and depressions of the post monsoon season from the Bay of Bengal also affect the district. Thunderstorms generally occur in premonsoon season.

Tables 3, 4, 5 and 6 give the normals of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Chhindwara.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
CHHINDWARA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
AMARWARA	48	a b	18.7 1.2	15.0 1.1	14.6 0.9	4.6 0.4	7.3 0.7	155.7 8.7	332.9 14.5	291.9 14.1	182.7 8.9	39.7 2.5	20.2 1.0	15.6 0.7	1098.9 54.7	202# (2009)	60 (1980)	340.6	14 AUG 2006
CHAURAI	38	a b	10.7 0.9	15.6 1.1	9.4 0.8	0.7 0.1	6.3 0.5	173.9 8.1	330.9 15.1	274.7 13.0	169.1 8.4	37.7 2.4	15.8 1.1	10.3 0.6	1055.1 52.1	148 (1983)	58 (1991)	229.6	12 JUL 1942
CHINDWARA	40	a b	18.1 1.5	17.0 1.6	18.5 1.4	6.7 0.7	10.5 0.9	144.7 8.1	285.1 14.2	273.8 13.9	159.0 8.2	51.5 3.1	24.9 1.4	12.1 0.8	1021.9 55.8	148 (1973)	70 (1991)	248.9	02 AUG 1913
CHHINDWARA OBSY	39	a b	14.0 1.2	10.8 1.2	25.1 2.0	11.3 1.2	8.7 1.0	162.6 9.1	261.1 14.3	296.3 14.0	202.0 10.0	64.0 3.5	32.4 1.6	12.0 0.9	1100.3 60.0	138 (2020)	63 (1980)	242.4	29 AUG 2020
HARRAI	43	a b	14.0 0.9	16.3 0.9	11.3 0.8	2.6 0.1	8.7 0.5	158.2 7.3	336.0 13.4	357.6 14.8	179.3 7.8	34.6 1.9	7.4 0.5	5.4 0.4	1131.4 49.3	169 (1999)	56 (1995)	318.7	21 JUL 2009
SAUSAR	49	a b	10.1 0.8	16.7 1.0	10.9 0.9	3.9 0.3	5.9 0.5	138.9 8.4	259.9 14.4	254.0 13.1	154.1 8.4	40.7 2.5	11.3 0.8	7.5 0.5	913.9 51.6	173 (2013)	55 (1996)	297.6	14 AUG 1975
TAMIA	38	a b	12.9 0.9	19.1 1.0	13.1 0.9	1.7 0.1	5.8 0.6	191.1 9.0	477.6 17.4	580.6 17.7	260.9 9.8	38.9 2.4	16.3 0.8	13.9 0.5	1631.9 61.1	181 (2013)	49 (2015)	394.5	12 JUL 1942
DISTRICT MEAN	7	a b	14.1 1.1	15.8 1.1	14.7 1.1	4.5 0.4	7.6 0.7	160.7 8.4	326.2 14.8	332.7 14.4	186.7 8.8	43.9 2.6	18.3 1.0	11.0 0.6	1136.2 55.0	155 (1999)	51 2008		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE – 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
CHHINDWARA
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	1	1201 - 1300	3
601 - 700	0	1301 - 1400	5
701 - 800	1	1401 - 1500	6
801 - 900	7	1501 - 1600	1
901 - 1000	6	1601 - 1700	0
1001 - 1100	7	1701 - 1800	1
1101 - 1200	3		

DATA AVAILABLE FOR 41 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
CHHINDWARA

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	24.4	9.2	36.0	28-01-1990	1.6	04-01-1983	69	44
February	26.9	12.1	37.0	28-02-1989	2.8	12-02-1950	66	43
March	31.8	16.0	41.0	31-03-2017	7.0	01-03-1971	57	38
April	36.7	20.9	43.0	22-04-2016	9.6	01-04-1989	52	31
May	39.2	24.4	47.6	23-05-2005	14.6	03-05-1995	47	32
June	34.7	23.3	45.5	07-06-2019	10.0	27-06-1995	68	52
July	29.1	22.4	40.3	06-07-1992	2.4	07-07-2006	84	69
August	27.6	22.0	34.0	14-08-1990	2.8	03-08-2006	88	75
September	28.8	21.5	38.6	06-09-2006	6.5	29-09-1994	86	71
October	29.5	17.8	38.0	30-10-1989	2.8	25-10-1994	79	60
November	27.0	12.9	35.5	24-11-1989	2.1	30-11-1994	72	50
December	25.5	9.2	33.4	03-12-1990	1.1	29-12-1983	69	43
Annual	30.0	17.5	47.6	23-05-2005	1.1	29-12-1983	70	51

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
CHHINDWARA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	23	20	13	20	18	4	1	0	3	17	21	23	185
b	2	1	0	0	1	7	17	17	10	2	1	1	51
c	1.4	1.5	1.2	1.6	2.1	5.0	6.8	6.7	4.9	2.4	1.5	1.1	3.0
1730 HOURS IST													
a	25	18	11	15	6	2	0	0	1	8	18	23	155
b	1	1	0	1	2	9	18	16	9	3	1	1	58
c	1.4	2.3	1.9	3.1	4.3	6.2	6.9	6.9	6.0	3.9	2.4	1.5	3.9

a : Days with clear sky.

b : Days with sky overcast.

c : Mean Cloud amount.

** = Unit, equal to one eighth of the sky used in specifying cloud amount
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
CHHINDWARA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.													
Direction in the morning.	C/W	C/W/NW	C/W/NW	NW/W	NW	W	W	WNW	W	C/W/NW	C/W/NW	C/W	
Direction in the evening.	C/W	NW/W	NW/W	NW/W	NW	NW/W	W	W	W/NW	C/NW/W	C/NW/W	C/NW/W	

TABLE - 6
Special Weather Phenomena
CHHINDWARA

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Hailstorm	0	0	0	0.1	0	0	0	0	0	0	0	0	0.1
Dust storm	0	0	0	0	0.1	0	0	0	0	0	0	0	0.1
Fog	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1

DAMOH DISTRICT

The climate of the district is generally pleasant, the air being generally dry except in the southwest monsoon season. The year may be divided into four seasons. The cold season from November to February is followed by the summer season from March to about the middle of June. The period from about the middle of June to about the end of September is the southwest monsoon season. October is the period of transition from the monsoon to the winter season.

RAINFALL

Records of rainfall in the district are available for 4 raingauge stations for period ranging from 11 to 49 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 1181.5 mm. The rainfall generally increases from the northwest towards the southeast in the district. About 91% of the annual rainfall in the district is received in the southwest monsoon season (June to September), August being the rainiest month with an average value of rainfall of 405.2 mm. During the fifty year period 1971-2020, the highest annual rainfall amounting to 160% of the normal occurred in year 1994, while the lowest annual rainfall which was only 47% of the normal occurred in 1979.

In this fifty year period, the annual rainfall in the district was less than 80% of the normal in 9 years, consecutive years of such low rainfall occurred once in this period. It is seen from Table 2 that the rainfall was between 901 mm and 1500 mm in 27 years out of 43.

On an average there are 51 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 323.0 mm at Hatta on 21 June 2008.

TEMPERATURE

There is one meteorological observatory in the district at Damoh so the description that follows is based on the records of the meteorological data of this observatory. From March both day and night temperatures steadily increase till May which is the hottest month with the mean daily maximum temperature at 42.7°C and the mean daily minimum temperature at 26.8°C. On some days in the summer season, the day temperature may go above 48°C. Afternoon thundershowers which occur on some days bring welcome relief from the heat. With the onset of the southwest monsoon in the district by about mid-June, there is appreciable drop in temperatures. In October, there is a slight increase in day temperatures but the night becomes progressively cooler. After October, both the day and night temperatures decrease rapidly. January is generally the coldest month with the mean daily maximum temperature at 25.0°C and mean daily minimum temperatures at 8.1°C. During the winter season, the district is affected by cold waves in the wake of western disturbances which pass eastwards across north India. On such occasions, the minimum temperature may drop down to about a degree or two above the freezing point of water and frosts may occur.

The highest maximum temperature ever recorded in the district was 49.8°C on 29 May 2000 and the lowest minimum temperature was 0.5°C on 21 January 2012 at Damoh observatory.

HUMIDITY

In the south west monsoon season, the moisture in the air is high with value of relative humidity being over 80%. With the withdrawal of the southwest monsoon after September, the relative humidity decreases well below 60-65%.

CLOUDINESS

During the southwest monsoon season skies are moderately to heavily clouded. In the rest of the year the skies are generally clear or lightly clouded.

WINDS

During summer winds blow mostly in northwest direction. During southwest monsoon season, winds blow from direction between southwest and northwest. In October winds blow from northeast direction. From the month of November till winter season, winds blow from direction between north and northwest. These winds continue in early summer .

SPECIAL WEATHER PHENOMENA

The district experiences heavy rains and strong winds, when Storms and depressions from the Bay of Bengal during southwest monsoon season pass through the district and its neighbourhood. Occasionally post monsoon storms or depressions also affect the district. Thunderstorms sometimes occur in latter part of summer and in southwest monsoon season. Thunderstorms accompanies with Hail in winter season. Fog occasionally occurs in the morning of winter season.

Tables 3, 4, 5 and 6 give the normals of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively Damoh observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
DAMOH

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
DAMOH	43	a b	14.0 1.2	20.7 1.4	8.2 0.7	5.6 0.5	5.1 0.6	158.2 7.0	343.4 14.3	433.3 16.1	183.8 8.7	33.0 1.9	12.2 0.6	7.1 0.6	1224.1 53.6	165 (2013)	44 (1979)	275.8	22 JUN 2011
DAMOH OBSY	31	a b	16.9 1.5	8.9 1.2	9.0 0.8	6.9 0.7	3.7 0.5	166.0 7.3	361.8 14.3	419.1 16.3	177.2 8.3	37.0 2.3	18.1 0.9	9.7 0.9	1234.3 55.0	154 (1994)	78 (1972)	275.8	22 JUN 2011
HATTA	45	a b	16.6 1.0	18.0 1.3	7.2 0.6	5.7 0.2	5.5 0.6	134.1 6.6	323.4 13.0	344.4 14.1	152.4 7.5	24.9 1.3	7.9 0.4	5.5 0.4	1045.6 47.0	174# (2013)	53 (1995)	323.0	21 JUN 2008
JABERA	38	a b	15.8 1.2	19.0 1.3	9.3 0.7	5.0 0.3	6.8 0.5	150.6 6.7	363.2 13.9	423.9 14.9	186.3 8.1	23.6 1.3	9.9 0.4	8.9 0.5	1222.3 49.8	159 (1990)	47 (1979)	300.0	26 JUL 2010
DISTRICT MEAN	4	a b	15.8 1.2	16.6 1.3	8.4 0.7	5.8 0.4	5.3 0.6	152.2 6.9	348.0 13.9	405.2 15.4	174.8 8.1	29.6 1.7	12.0 0.6	7.8 0.6	1181.5 51.4	160 1994	47 1979		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
DAMOH
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	2	1201 - 1300	4
601 - 700	0	1301 - 1400	4
701 - 800	3	1401 - 1500	1
801 - 900	7	1501 - 1600	4
901 - 1000	5	1601 - 1700	1
1001 - 1100	8	1701 - 1800	2
1101 - 1200	4	1801 - 1900	1

DATA AVAILABLE FOR 46 YEARS

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
DAMOH

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	⁰ C	⁰ C	⁰ C	DATE	⁰ C	DATE	0830 IST	1730 IST
January	25.0	8.1	33.3	28-01-1990	0.5	21-01-2012	68	
February	28.9	11.9	37.2	27-02-1997	1.8	7-2-1974	60	
March	34.0	17.2	42.6	31-07-2017	7.0	01-03-1971	46	
April	39.1	22.2	45.2	18-04-2010	14.6	04-04-1996	36	
May	42.7	26.8	49.8	29-05-2000	18.6	15-05-2014	37	
June	38.7	26.3	47.7	07-06-2014	16.6	19-06-2014	57	
July	32.6	24.2	42.6	02-07-2012	17.8	05-07-2014	79	
August	30.6	23.2	38.4	01-08-2002	18.2	28-08-2015	85	
September	31.7	22.4	38.2	27-09-1987	15.0	29-09-2010	81	
October	33.1	18.6	39.5	13-10-2015	10.5	30-10-2012	67	
November	30.0	13.4	37.0	03-11-1999	5.0	30-11-1970	63	
December	26.6	8.5	35.0	02-12-2015	2.5	28-12-2019	64	
Annual	32.7	18.4	49.8	29-05-2000	0.5	21-01-2012	62	

TABLE – 4
MEAN CLOUD AMOUNT ** (OKTA OF THE SKY) AND MEAN NUMBER OF DAYS
OF CLEAR AND OVERCAST SKIES.
DAMOH

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	5	3	5	6	5	3	3	2	4	7	8	9	60
b	1	1	1	1	1	3	12	13	3	1	1	1	39
c	2.9	2.9	2.5	2.5	2.7	4.3	5.5	5.5	3.9	2.6	2.3	1.9	3.3
1730 HOURS IST													
a	22	3	25	22	21	2	3	3	4	20	22	22	169
b	1	0	0	1	1	3	20	20	2	1	1	1	51
c													

a : Days with clear sky.
b : Days with sky overcast.
c : Mean Cloud amount.
** = Unit, equal to one eighth of the sky used in specifying cloud amount
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
DAMOH

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.													
Direction in the morning.	C/NW/NE	C/NW/N	C/NW/NE	C/NW/W	C/NW	C/NW/SW	C/NW/SW	C/NW	C/NW/W	C/NE/NW	C/NW/NE	C/NW/W	
Direction in the evening.	C/N/NW	C/NW	C/NW	C/NW	C/NW	C/NW/W	C/SW/W	C/NW/SW	C/NW/W	C/NE/NW	C/N/NW	C/N/NW	

TABLE - 6
Special Weather Phenomena
DAMOH

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0	0	0	0	0.1	0	0.1	0	0	0	0	0	0.2
Hailstorm	0	0.1	0	0	0	0	0	0	0	0	0	0	0.1
Dust storm	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1

DINDORI DISTRICT

The climate of this district is characterized by a hot summer and generally dry climate except in the southwest monsoon season. The year may be divided into four seasons. The hot season is from March to about the second week of June. The southwest monsoon season lasts till 1st week of October. October and November constitute the post monsoon or retreating monsoon season. The period from December to February is the cold season.

RAINFALL

Records of rainfall in the district are available for 2 raingauge stations . The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1313.3 mm. During the monsoon season (June to September) the district receives rain about 90% of the annual rainfall. July and August are the rainiest months with average rainfall of 398.3 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 158% of the annual normal occurred in year 1978, while the lowest annual rainfall which was 70% of the normal occurred in year 2009. In the fifty year period there were 2 years in which the annual rainfall in the district was less than 80% of the normal and during this period there is not a single occasion of occurrence of consecutive years. It is seen from Table 2 that the rainfall was between 1001 mm and 1700 mm in 26 years out of 31.

On an average there are 60 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 55 at Shahpura to 65 at Dindori.

The heaviest rainfall in 24 hours recorded at any station in the district was 272.2 mm at Shahapura on 22nd July 1995.

TEMPERATURE

There is no meteorological observatory in the district, therefore, the records of observatory at Mandla situated in neighboring district may be taken as representative of the conditions in the district. There is a steady increase of temperature after February. May is generally the hottest month with the mean maximum temperature at about 41 °C and mean minimum temperature at about 23.5 °C. The heat in the summer is intense, on some days the maximum temperature may reach about 43°C. Thundershowers sometimes occur during afternoons bring some relief from the heat. With the onset of the southwest monsoon season over the district by about the second week of June there is considerable drop in both the temperatures. After the withdrawal of monsoon early in October, the day temperature increases slightly in October but nights becomes progressively cooler. After October both day and night temperatures decrease rapidly. December and January are the coldest months of the year with the mean maximum temperature at about 26.8 °C and mean minimum temperature at about 8.1 °C. Nights during December are comparatively colder than in January. During winter season, cold waves sometimes affect the district in the wake of western disturbances which move across north India, on such occasions the minimum temperature may go down to about a one or two degree above the freezing point of water.

HUMIDITY

In the southwest monsoon season the air is generally humid with high values of relative humidity. The values of humidity decrease in post monsoon and winter seasons and air is generally mild humid. Summer season is the driest part of the year with values of relative humidity in the morning being about 48% and afternoon humidity is about 33%.

CLOUDINESS

During the southwest monsoon season, skies are heavily clouded to overcast. In rest of the year skies are generally clear to lightly clouded.

WINDS

Winds are generally light to calm over the district except during southwest monsoon. The winds blow mainly from directions between south and northwest during the months of April, May and southwest monsoon season. Winds are generally light and blow between northwest and north direction in the post monsoon and in the latter part of the cold season. During summer season winds blow from northwest direction.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season and early post-monsoon season cross the east coast of India and move in some westerly direction and affect the weather of the district and its neighbourhood and cause gusty winds and widespread heavy rain. Thunderstorms occur mostly in latter part of summer and southwest monsoon season and occasionally in cold season. Dust storms are generally observed during summer season. Rain during southwest monsoon season is also often associated with thunder. Fog occurs occasionally during winter months.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
DINDORI

STATION	No. of Years of Data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL RAINFALL AS % OF NORMAL & YEARS**		HEAVIEST RAINFALL IN 24 HOURS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
DINDORI	44	a b	21.9 1.8	23.3 1.8	12.8 0.9	10.0 0.8	9.9 1.0	202.2 9.1	396.3 17.7	390.0 17.6	187.3 9.9	40.7 2.8	15.9 0.9	16.1 0.9	1326.4 65.2	156 (1978)	65 (2009)	237.0	8 JUL 1986
SHAHPURA	31	a b	13.0 0.8	16.5 1.0	3.2 0.4	0.8 0.0	4.4 0.5	187.2 7.7	363.8 15.3	437.1 17.0	212.5 9.0	35.4 1.7	13.5 0.6	12.8 0.8	1300.2 54.8	151# (1994)	75 (2009)	272.2	22 JUL 1995
DISTRICT MEAN	2	a b	17.5 1.3	19.9 1.4	8.0 0.6	5.4 0.4	7.1 0.8	194.7 8.4	380.0 16.5	413.5 17.3	199.9 9.5	38.1 2.2	14.7 0.8	14.5 0.9	1313.3 60.1	158 1978	70 2009		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
DINDORI
(Data 1972-2015)

Range in mm	No. of years	Range in mm	No. of years
901 - 1000	1	1501 - 1600	2
1001 - 1100	3	1601 - 1700	4
1101 - 1200	6	1701 - 1800	1
1201 - 1300	5	1801 - 1900	1
1301 - 1400	4	1901 - 2000	1
1401 - 1500	2	2001 - 2100	1

(Data available for 31 years)

JABALPUR DISTRICT

The climate of district is characterized by cold and mild winters, hot summers and general dryness except in the southwest monsoon season. The year may be divided into four seasons. Winter season commences from December and lasts till the end of February. Summer season follows thereafter and continues till about the second week of June. Southwest monsoon season is from the middle of June to September. October and November months constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for three rain gauge stations for the period ranging from 34 to 46 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1235.2mm. The rainfall in the southwest monsoon season (June to September) constitutes about 92% of annual rainfall. August is the rainiest month with average rainfall of about 426.7 mm. The variation in the rainfall from year to year is large. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 155% of the annual normal occurred in year 2013, while the lowest annual rainfall which was 53% of the normal occurred in 1979. In the fifty year period there were seven years in which the annual rainfall in the district was less than 80% of the normal and none of them being consecutive years. It is seen from Table 2 that the annual rainfall was between 1001 mm and 1500 mm in 26 years out of 46.

On an average there are 54 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 50 at Patan to 60 at Jabalpur observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 342.9 mm at Jabalpur observatory on 30th July 1915.

TEMPERATURE

There is one meteorological observatory in the district located at Jabalpur at an elevation of 397 meter above mean sea level. The description that follows is based on the records of this observatory. Temperatures begin to rise rapidly from March till May. May is generally the hottest month with the mean maximum temperature of about 41.3°C and mean minimum temperature of about 27.4°C. The heat in the summer is intense, on some days the maximum temperature may reach about 46.8°C. Thundershowers sometimes occur during afternoons bring some relief from the heat. With the onset of the southwest monsoon season over the district by about the second week of June there is considerable drop in the temperatures, the day temperatures go down appreciably but the drop in the night temperatures is slight. After the withdrawal of monsoon by about September, the day temperature increases slightly in October but nights becomes progressively cooler. After mid November day and night temperatures decrease rapidly. January is the coldest months of the year with the mean maximum temperature about 24.3°C and mean minimum temperature about 10.7°C. During winter season, cold waves sometimes affect the district in the wake of western disturbances which move across north India, on such occasions the minimum temperature may drop to 1 or 2°C above freezing point of water.

The highest maximum temperature ever recorded at Jabalpur was 46.8°C on 1st June 2019 and the lowest minimum temperature ever recorded was 0°C on 2nd February 1905.

HUMIDITY

The value of relative humidity is generally lower in the afternoon than in the morning, except in the southwest monsoon months when there is little difference. In the southwest monsoon months the air is generally humid with value of relative humidity about 85% in the morning. Humidity decreases in post monsoon and winter seasons and air is generally mild humid. Summer season is the driest part of the year with value of relative humidity in the afternoon is sometimes around 20%.

CLOUDINESS

During the southwest monsoon season, skies are heavily clouded to overcast. In rest of the year skies are generally clear to lightly clouded.

WINDS

Winds are generally light to calm except during the late summer and southwest monsoon season. In summer winds blow from direction west and northwest. During southwest monsoon season winds are westerly and southwesterly. In post monsoon and winter season, winds are mostly calm.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season and early post-monsoon season cross the east coast of India and move in some westerly direction and affect the weather of the district and its neighborhood and cause gusty winds and widespread heavy rain. Thunderstorms occur throughout the year; its frequency is more in latter part of summer and southwest monsoon season and to lesser extent in cold season. Rain during southwest monsoon season is also often associated with thunder. Fog occurs occasionally during post monsoon and cold season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Jabalpur observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
JABALPUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
JABALPUR OBSY	46	a	21.0	22.5	16.3	5.5	13.1	189.4	385.3	471.9	200.7	36.1	11.4	11.2	1384.4	155	47	342.9	30 JUL 1915
		b	1.8	1.8	1.3	0.6	1.2	8.1	15.4	16.6	9.4	2.2	0.8	0.8	60.0	(2013)	(1979)		
PATAN	39	a	13.6	14.2	9.0	4.5	3.7	136.4	336.7	412.5	185.3	24.5	8.8	7.9	1157.1	181	60	276.1	20 AUG 1923
		b	1.0	1.1	0.8	0.4	0.4	7.0	13.9	15.3	8.4	1.6	0.4	0.6	50.9	(2013)	(1996)		
SEHORA	34	a	13.9	13.2	8.3	3.5	12.6	146.1	328.0	395.6	208.7	26.8	2.9	4.7	1164.3	151	62	337.1	6 AUG 1961
		b	1.0	1.0	0.8	0.3	0.5	6.7	14.8	15.5	9.1	1.6	0.2	0.4	51.9	(1994)	(1996)		
DISTRICT MEAN	3	a	16.2	16.6	11.2	4.5	9.8	157.3	350.0	426.7	198.2	29.1	7.7	7.9	1235.2	155	53		
		b	1.3	1.3	1.0	0.4	0.7	7.3	14.7	15.8	9.0	1.8	0.5	0.6	54.4	2013	1979		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
JABALPUR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
601 - 700	2	1301 - 1400	5
701 - 800	1	1401 - 1500	5
801 - 900	4	1501 - 1600	3
901 - 1000	2	1601 - 1700	2
1001 - 1100	5	1701 - 1800	3
1101 - 1200	6	1801 - 1900	2
1201 - 1300	5	1901 - 2000	1

DATA AVAILABLE FOR 46 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
JABALPUR

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
JANUARY	24.3	10.7	33.4	07-01-1973	1.1	07-01-1946	75	47
FEBRUARY	27.9	13.6	37.6	27-02-1966	0.0	02-02-1905	67	38
MARCH	33.3	18.2	41.2	31-03-2017	3.3	04-03-1898	50	27
APRIL	38.5	23.3	45.4	28-04-1970	10.6	01-04-1905	36	21
MAY	41.3	27.4	46.7	25-05-1954	17.2	05-05-1937	38	21
JUNE	37.6	27.0	46.8	01-06-2019	19.0	09-06-1971	62	49
JULY	31.3	24.7	41.7	01-07-1902	20.6	17-07-1930	83	73
AUGUST	29.9	24.1	37.8	03-08-1972	18.3	27-08-1929	88	79
SEPTEMBER	31.3	23.7	37.4	18-09-1974	16.7	30-09-1899	82	69
OCTOBER	31.8	20.3	37.9	05-10-1966	10.5	30-10-1952	72	52
NOVEMBER	29.1	15.0	35.8	07-11-1976	3.9	12-11-1889	69	51
DECEMBER	25.8	11.0	33.2	28-12-1960	0.6	28-12-1902	72	49
ANNUAL	31.8	19.9	46.8	01-06-2019	0.0	02-02-1905	66	48

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
JABALPUR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	20	18	19	19	17	5	1	0	5	18	21	23	166
b	2	1	1	0	0	4	14	15	5	1	1	1	45
c	1.6	1.4	1.4	1.2	1.4	4.2	6.3	6.5	4.4	1.9	1.2	1.0	2.7
1730 HOURS IST													
a	18	16	13	10	4	1	0	0	2	12	18	21	115
b	1	0	1	0	0	4	8	9	4	1	1	0	29
c	1.7	1.6	1.9	2.4	3.2	5.3	6.5	6.6	5.1	2.4	1.5	1.2	3.3

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.

For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
JABALPUR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.5	3.1	3.5	4.0	5.0	5.7	5.0	4.5	3.8	2.9	2.2	1.9	3.7
Direction in morning	C	C	C	C	C	W	W/C/SW	C/W	C	C	C	C	
Direction in evening	C	C	C	NW/W/C	W/NW	W/C/NW	W/C	W	C	C	C	C	

TABLE - 6
Special Weather Phenomena
JABALPUR

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.3	0.7	1.2	1.0	1.8	3.3	4.1	3.3	2.7	0.9	0.2	0.1	19.6
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	0.8	3.3

KATNI DISTRICT

The district has dry climate except during the southwest monsoon season. The year may be divided into four seasons. Winter season commences from December and lasts till the end of February. Summer season follows thereafter and continues till about the middle of June. Southwest monsoon season is from the middle of June to September. October and November months constitute the post monsoon season.

RAINFALL

Record of rainfall in the district is available for single rain gauge stations for the period 30 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1030.3 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 92% of annual rainfall. August is the rainiest month with average rainfall of about 336.7 mm. The variation in the rainfall from year to year is large. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 150% of the annual normal occurred in year 1971, while the lowest annual rainfall which was 39% of the normal occurred in 2002. In the fifty-year period there were 4 years in which the annual rainfall in the district was less than 80% of the normal and there is no occasion of such low rainfall occurs in two consecutive years. It is seen from Table 2 that the annual rainfall was between 801 mm and 1200 mm in 8 years out of 14.

On an average there are 48 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 280.0 mm at Bohoribund on 5th July 2005.

TEMPERATURE

There is no meteorological observatory in the district. Therefore the description that follows is based on the records of Umaria observatory which is in the neighbouring

district. This observatory is located at an elevation of 459 meters above mean sea level. The records of this observatory may be taken as representative of meteorological conditions prevailing in the district in general. From the beginning of March, temperatures begin to rise rapidly till first week of June. May is the hottest month with the mean maximum temperature at about 41.8 °C and mean minimum temperature at about 24.1 °C. In the latter part of the summer season i.e. April, May and early part of June, the maximum temperature sometimes reaches about 44 °C to 46 °C on individual days. During the latter part of summer until the onset of the monsoon by second week of June, days are uncomfortable with hot dusty winds. However, the afternoon thundershowers which occur on some days bring welcome relief though only temporarily. With the advance of the southwest monsoon into the district towards the middle of June, the day temperatures fall rapidly while drop in night temperature is comparatively small. With the withdrawal of the monsoon by about end of September, day temperatures remain same level in October but there is rapid drop in the night temperatures. Both the temperatures begin to decrease rapidly after October. December and January are the coldest months of the year when mean maximum temperature is at about 25.9 °C and mean minimum temperature at about 6.5 °C. In winter months, cold waves sometimes affect the district in the wake of western disturbances passing across north India, the minimum temperatures may sometimes drop down to about the freezing point of water.

HUMIDITY

In the south west monsoon months, air is generally humid, and relative humidity exceeds 80% in the mornings and it exceeds 75% in the afternoon. Air is generally mildly humid in post monsoon and winter seasons. The humidity is generally less in the afternoons than in the mornings. Summer is the driest part of the year when the value of relative humidity is about 30% in the afternoon.

CLOUDINESS

In the southwest monsoon season skies are heavily clouded to overcast. In the rest of the year, skies are generally clear or lightly clouded.

WINDS

Winds are generally light with a little strengthening in the latter part of summer and early part of monsoon season. In the southwest monsoon season winds are mostly southwesterly to northwesterly. In the rest of the year winds are generally in northwesterly direction and calm winds are also sometimes observed. During the monsoon season, when depressions affect the weather of the district, the district may experience occasionally gusty winds.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season cross the east coast and moving in some west direction pass through or in the neighbourhood of the district causing widespread and locally heavy rain and gusty winds. Occasionally post monsoon storms from the Bay of Bengal affect the weather of the district. Thunderstorm occurs in the district throughout the year. Fog occurs occasionally in the mornings of winter season and latter part of post monsoon season.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
KATNI

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL*		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BOHORIBUND	30	a	14.8	18.1	7.9	2.7	0.6	119.5	326.9	336.7	163.0	29.6	7.5	3.0	1030.3	173#	39	280.0	5 JUL 2005
		b	1.0	1.5	0.6	0.4	0.1	5.9	13.9	14.4	7.4	2.0	0.2	0.3	47.7	(2005)	(2002)		
DISTRICT MEAN	1	a	14.8	18.1	7.9	2.7	0.6	119.5	326.9	336.7	163.0	29.6	7.5	3.0	1030.3	150	39		
		b	1.0	1.5	0.6	0.4	0.1	5.9	13.9	14.4	7.4	2.0	0.2	0.3	47.7	1971	2002		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
KATNI
(DATA 1971 - 2015)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	1	1001 - 1100	2
501 - 600	2	1101 - 1200	3
601 - 700	1	1201 - 1300	0
701 - 800	0	1301 - 1400	0
801 - 900	2	1401 - 1500	0
901 - 1000	1	1501 - 1600	2

DATA AVAILABLE FOR 14 YEARS

MANDLA DISTRICT

The district has dry climate except during the southwest monsoon season. The year may be divided into four seasons. Winter season commences from December and lasts till the end of February. Summer season follows thereafter and continues till about the middle of June. Southwest monsoon season is from the middle of June to September. October and November months constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for five rain gauge stations for the period ranging from 32 to 43 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1334.7 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 90% of annual rainfall. August is the rainiest month with average rainfall of about 420.3 mm. The variation in the rainfall from year to year is large. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 152% of the annual normal occurred in year 1994, while the lowest annual rainfall which was 56% of the normal occurred in 2006. In the fifty-year period there were 6 years in which the annual rainfall in the district was less than 80% of the normal and there is one occasions of such low rainfall occurs in two consecutive years. It is seen from Table 2 that the annual rainfall was between 1101 mm and 1600 mm in 25 years out of 43.

On an average there are 63 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district and this number varies from 58 at Nainpur to 66 at Mandla Obsy.

The heaviest rainfall in 24 hours recorded at any station in the district was 358.6 mm at Bichhia on 21 September 1926.

TEMPERATURE

There is one meteorological observatory in the district, so the description which follows is based on the meteorological data and climatological conditions prevailing at

the observatory Mandla at an elevation of 443 meter above mean sea level. Temperatures begin to rise rapidly from March till May. May is generally the hottest month with the mean maximum temperature of about 41.4°C and mean minimum temperature of about 23.8°C. The heat in the summer is intense, on some days the maximum temperature may reach about 46°C. Thundershowers sometimes occur during afternoons bring some relief from the heat. With the onset of the southwest monsoon season over the district by about the second week of June there is considerable drop in the temperatures, the day temperatures go down appreciably whereas night temperatures drop down very slowly. After the withdrawal of monsoon by about September, the day temperature increases slightly in October but nights become progressively cooler. After October day and night temperatures decrease rapidly. December and January are the coldest months of the year with the mean maximum temperature about 26.8°C and mean minimum temperature about 8.0°C. During winter season, cold waves sometimes affect the district in the wake of western disturbances which move across north India, on such occasions the minimum temperature may go down to about 0°C.

The highest maximum temperature recorded at Mandla was 46.8°C on 28th May 1973 and the lowest minimum temperature recorded was 0°C on 6th January 1987 and on 29th December 1987.

HUMIDITY

In the southwest monsoon months the air is generally humid with high value of relative humidity. Humidity decreases in post monsoon and winter seasons and air is generally mild humid. Summer season is the driest part of the year with value of relative humidity in the afternoon being about 40% and morning humidity is about 30%.

CLOUDINESS

During the southwest monsoon season, skies are heavily clouded to overcast. In the rest of the year skies are generally clear to lightly clouded.

WINDS

The winds blow mainly from directions between north and northwest during pre and post monsoon except during southwest monsoon. The winds blow mainly from directions between north and northwest during the month of May and southwest monsoon season and also some southerly winds observed.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season and early post-monsoon season cross the east coast of India and move in some westerly direction and affect the weather of the district and its neighbourhood and cause gusty winds and widespread heavy rain. Thunderstorms occur mostly in latter part of summer and southwest monsoon season and occasionally in cold season. Dust storms generally observed during summer season. Rain during southwest monsoon season is also often associated with thunder. Fog occurs occasionally during winter months.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Mandla observatory.

TABLE - I
NORMALS AND EXTREMES OF RAINFALL
MANDLA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BICHHIA	35	a b	13.2 0.9	17.9 1.4	12.7 0.9	5.0 0.5	2.1 0.2	172.9 8.5	412.4 17.9	440.5 17.8	216.6 11.2	35.4 2.5	10.9 0.4	3.3 0.2	1342.9 62.4	135 (2019)	52 (1972)	358.6	21 SEP 1926
MANDLA	38	a b	29.1 2.1	30.6 2.3	17.7 1.4	15.5 1.3	7.8 0.8	172.8 8.9	409.6 17.6	377.3 16.9	180.6 10	29.7 2.1	16.1 1.1	12.3 0.9	1299.1 65.4	148 (1990)	69 (2002)	212.0	13 AUG 1968
MANDLA OBSY	37	a b	24.5 1.8	32.9 1.9	24.7 2.0	9.9 1.1	11.8 1.1	217.9 9.1	397.6 17.7	416.6 16.5	178.2 9.9	53.4 3.2	9.4 0.7	13.3 1.0	1390.2 66.0	133 (1990)	67 (2002)	261.0	17 AUG 2001
NAINPUR	32	a b	12.9 1.1	15.1 0.9	15.6 1.2	8.7 0.7	7.6 0.7	156.8 8.3	403.6 16.1	377.4 16.5	210.1 10.1	27.1 1.9	5.9 0.3	10.4 0.7	1251.2 58.5	153 (2019)	60 (2006)	240.0	10 JUL 1994
NIWAS	43	a b	22.1 1.6	20.7 1.5	14.9 1.0	3.5 0.4	7.1 0.7	153.4 7.1	403.7 17.4	489.7 18.7	214.5 10.3	37.2 2.4	12.7 0.6	10.2 0.7	1389.7 62.4	175 (1994)	50 (1979)	260.0	01 SEP 1970
DISTRICT MEAN	5	a b	20.4 1.5	23.4 1.6	17.1 1.3	8.5 0.8	7.3 0.7	174.8 8.4	405.4 17.3	420.3 17.3	200 10.3	36.6 2.4	11 0.6	9.9 0.7	1334.7 62.9	152 1994	56 2006		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - II
FREQUENCY OF ANNUAL R/F IN THE DISTRICT
(DATA 1971 - 2020)
MANDLA

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
701 - 800	1	1401 - 1500	2
801 - 900	1	1501 - 1600	3
901 - 1000	2	1601 - 1700	4
1001 - 1100	4	1701 - 1800	1
1101 - 1200	6	1801 - 1900	4
1201 - 1300	4	1901 - 2000	0
1301 - 1400	10	2001 - 2100	1

DATA AVAILABLE FOR 43 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
MANDLA

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	830	1730
JANUARY	26.4	8.3	33.4	27-01-2009	0.0	06-01-1987	79	51
FEBRUARY	29.9	11.1	36.7	23-02-2006	1.9	11-02-2012	72	44
MARCH	34.2	15.1	40.0	31-03-1972	3.6	14-03-1982	58	37
APRIL	38.4	19.9	44.2	30-04-2009	8.6	03-04-1968	46	33
MAY	41.4	23.8	46.8	28-05-1973	12.5	24-05-1986	41	29
JUNE	37.1	24.8	46.4	08-06-1973	14.0	02-06-1986	66	54
JULY	30.7	22.9	40.0	01-07-2012	14.0	27-07-1987	85	78
AUGUST	29.4	22.4	36.0	03-08-1972	13.0	28-08-1986	88	82
SEPTEMBER	30.9	21.3	36.0	24-09-2009	12.0	30-09-1986	85	76
OCTOBER	31.8	17.0	39.0	01-10-1987	3.1	31-10-1986	78	61
NOVEMBER	29.3	12.1	34.0	02-11-1966	1.5	24-11-1987	78	58
DECEMBER	27.2	7.8	33.2	01-12-1979	0.0	29-12-1987	82	55
ANNUAL	32.0	17.2	46.8	28-05-1973	0.0	06-01-1987 29-12-1987	72	56

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies

MANDLA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	23	24	25	19	23	4	1	1	12	19	22	26	199
b	1	0	0	1	1	14	19	22	5	1	0	1	65
c	1.7	1.3	1.2	1.2	1.2	4.5	6.7	6.7	4.4	2.0	1.1	1.2	2.8
1730 HOURS IST													
a	22	20	19	15	13	2	0	1	4	16	19	24	155
b	1	1	1	1	2	6	18	19	5	2	1	0	57
c	1.4	1.4	1.9	2.6	2.7	5.5	6.4	6.5	4.4	2.2	1.6	0.9	3.1

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
 For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
(MANDLA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.4	3.1	5.1	6.8	8.3	7.9	4.3	4.1	3.6	2.9	2.4	3.2	4.5
Direction in morning	C/NW/N	C/NW/N	C/N/NW	C/S/SE	C/NW/N	S/C/NW	C/NW/S	NW/C/N	NW/C/N	C/N/NW	C/NW/N	C/NW/N	
Direction in evening	C/NW/N	C/NW/N	C/N/NW	NW/C/N	NW/N/C	C/N/S	C/NW/S	NW/C/N	C/NW/N	C/N/NW	C/N/NW	C/NW/N	

TABLE - 6
Special Weather Phenomena
(MANDLA)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.1	0.2	0.3	0.6	0.1	1.6	0.9	0.8	0.0	0.0	0.0	0.0	4.6
Hailstorm	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Dust storm	0.0	0.1	0.1	0.5	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Fog	1.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	2.1

NARSINGHPUR DISTRICT

The climate of this district is characterized by generally pleasant weather except in the hot season. The year may be divided into four seasons. The cold season from about the middle of November to February, is followed by hot season which continues up to the middle of June. The period from mid June to the end of September is the southwest monsoon season. October and the first half of November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 6 rain gauge stations for period ranging from 32 to 46 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1143.9 mm. During the monsoon season (June to September) the district receives rain about 93% of the annual rainfall. August is the rainiest month with average rainfall of 391.8 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 167% of the annual normal occurred in year 1977, while the lowest annual rainfall which was 61% of the normal occurred in year 2003. In the fifty year period there were 6 years in which the annual rainfall in the district was less than 80% of the normal and none of them were consecutive years. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 31 years out of 47.

On an average there are 46 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 29 at Mohpani to 54 at Narsinghpur Observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 460.0 mm at Mohpani on 31st August 1976.

TEMPERATURE

There is one meteorological observatory in the district located at Narsinghpur at an elevation of 356 metre above mean sea level. The description that follows is based on the records of this observatory. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 42.6°C and mean minimum of 26.0°C . The heat in summer is quite intense and the hot dust raising winds in the latter part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. Towards the end of the monsoon season day temperatures increase slightly and reach a secondary maximum in October, but the nights become progressively cooler. The day temperatures start decreasing from the month of November and the nights also become progressively cooler. January is the coldest month with mean maximum temperature at 26.3°C and mean minimum temperature at 9.4°C . During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may fall to near about the freezing point of water.

The highest maximum temperature ever recorded at Narsinghpur was 48.6°C on 10th April 1980 and the lowest minimum temperature ever recorded was -1.4°C on 28th December 1968.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 60% to 84% in the morning and 47% to 79% in the afternoon. The values of relative humidity start to decrease from October. The driest part of the year is the summer season, when the average humidity is about 27% in the afternoons and 46% in the mornings.

CLOUDINESS

During the southwest monsoon season the sky is heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds generally blow from west direction. During post monsoon and winter season westerly or south-easterly winds prevail in the morning while in the afternoon winds generally blow from west direction. In the summer season also winds generally blow from west direction.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms occur frequently during the period January to September.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Narsinghpur observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
NARSINGHPUR

STATION	No. of Years of Data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL RAINFALL AS % OF NORMAL **		HEAVIEST RAINFALL IN 24 HOURS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BARMANGHAT HYDRO	38	a b	15.0 1.2	17.1 1.4	8.7 0.8	4.0 0.5	14.5 1.2	146.7 7.1	341.8 13.8	396.2 15.2	183.1 8.2	31.5 2.0	17.1 0.9	10.7 0.7	1186.4 53.0	172 (1994)	7 (2015)	283.2	9 SEP 2009
GADARWARA	46	a b	5.2 0.5	11.8 0.8	7.0 0.5	0.5 0.1	5.1 0.4	133.3 6.2	350.1 13.8	405.0 13.7	206.6 8.5	23.8 1.5	9.0 0.4	4.9 0.3	1162.3 46.7	182# (1999)	49 (1996)	326.0	9 SEP 2009
MOHPANI	32	a b	3.2 0.2	0.2 0.0	4.3 0.2	0.0 0.0	0.5 0.0	81.2 3.4	266.7 8.2	476.9 10.4	221.4 6.5	2.2 0.2	0.0 0.0	0.7 0.1	1057.3 29.2	209# (1973)	80 (1991)	460.0	31 AUG 1976
NARSINGHPUR	41	a b	11.5 0.9	18.2 1.3	8.3 0.7	2.9 0.3	10.7 1.1	157.1 7.5	358.6 13.9	386.3 14.8	173.3 7.8	34.2 1.8	17.6 1.1	8.4 0.6	1187.1 51.8	177 (1994)	55 (1996)	286.0	9 SEP 2009
NARSINGHPUR OBSY	38	a b	19.6 1.6	20.3 1.5	14.3 1.3	6.3 0.6	12.8 1.5	165.7 7.7	322.3 13.5	373.5 14.6	157.6 7.7	33.7 2.1	16.4 1.0	10.8 0.8	1153.3 53.9	169# (1999)	26 (2003)	271.3	15 SEP 1999
TENDUKHERA	32	a b	4.5 0.4	6.1 0.3	3.4 0.3	6.6 0.3	4.5 0.4	152.1 5.2	404.4 13.5	312.7 13.0	201.1 8.2	13.9 0.9	5.3 0.3	1.4 0.2	1116.0 43.0	165 (2013)	72 (1996)	372.0	9 SEP 2009
DISTRICT MEAN		a b	9.8 0.8	12.3 0.9	7.7 0.6	3.4 0.3	8.0 0.8	139.4 6.2	340.7 12.8	391.8 13.6	190.5 7.8	23.2 1.4	10.9 0.6	6.2 0.5	1143.9 46.3	167 1977	61 2003		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
Frequency of Annual Rainfall in the District
NARSINGHPUR
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
601 - 700	1	1301 - 1400	6
701 - 800	3	1401 - 1500	3
801 - 900	2	1501 - 1600	2
901 - 1000	10	1601 - 1700	1
1001 - 1100	7	1701 - 1800	1
1101 - 1200	5	1801 - 1900	1
1201 - 1300	3	1901 - 2000	2

(Data available for 47 years)

TABLE – 3
Normals of Temperature and Relative Humidity
NARSINGHPUR

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	26.3	9.4	34.6	28-01-1992	1.2	23-01-1963	75	47
February	29.8	11.8	37.8	28-02-1980	1.4	07-02-1974	68	39
March	35.2	16.1	42.8	31-03-1977	6.0	02-03-1971	53	32
April	39.7	21.0	48.6	10-04-1980	10.0	03-04-1968	41	25
May	42.6	26.0	48.0	17-05-1992	17.0	12-05-1968	44	27
June	38.4	25.6	47.4	06-06-1995	16.0	20-06-2008	60	47
July	32.1	23.8	42.4	01-07-1969	14.0	14-07-2007	79	71
August	29.7	22.9	38.2	01-08-2002	16.0	25-08-2007	84	79
September	31.6	22.6	38.8	18-09-1974	15.0	21-09-2007	82	71
October	33.1	19.4	41.2	17-10-1977	9.6	31-10-1968	74	54
November	30.3	14.1	37.6	25-11-1979	2.2	30-11-1970	72	49
December	27.8	9.0	33.2	07-12-1998	-1.4	28-12-1968	71	46
Annual	32.8	18.2	48.6	10-04-1980	-1.4	28-12-1968	67	49

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
NARSINGHPUR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	22	21	25	23	24	10	2	1	7	21	23	25	204
b	2	1	0	0	0	3	8	13	4	1	1	0	33
c	1.3	1.0	0.9	0.8	0.8	3.3	5.2	6.0	3.9	1.3	0.9	0.7	2.2
1730 HOURS IST													
a	22	21	23	18	17	4	1	0	5	18	23	24	176
b	1	1	0	0	0	3	7	10	3	1	1	0	27
c	1.3	1.0	1.1	1.5	2.1	4.2	5.4	5.9	3.9	1.6	0.9	0.7	2.5

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
NARSINGHPUR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	C/W/SE	C/W/NE	C/W	C/W	W/C	W	W	W	C/W	C/W	C/W	C/W	
Direction in evening	C/W	C/W	C/W	W/C	W	W	W	W	W	C/W	C/W/S	C/W/S	

TABLE - 6
Special Weather Phenomena
NARSINGHPUR

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.1	0.0	0.0	0.7	0.7	1.9	0.0	0.0	0.0	0.0	3.4
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust storm	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0	0	0	0	0	0	0	0	0	0	0	0	0

NIWARI DISTRICT

The climate of Niwari district is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the hot season commences from March to about the middle of June. The period from mid-June to about the end of September is the southwest monsoon season. The period of October and November constitutes post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 1 rain gauge stations for the period of 30 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 823.0 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 92% of the annual normal rainfall. August is the rainiest months with the highest rainfall with an average value of about 275.3 mm. The variation in annual rainfall in the district from year to year is large. In the fifty years period 1971 to 2020, the highest annual rainfall was in year 2018 when it amounted to 184% of the normal. In the year 2006, the annual rainfall in the district was the lowest in this period and amounted to only 47% of the normal. In this period the rainfall was less than 80% of the normal in 3 years and during the same period there is not a single occasion of two consecutive years. It is seen from Table 2 that the annual rainfall was between 601 mm and 1000 mm in 10 years out of 21.

On an average there are 36 rainy days (i.e. Days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 299.0 mm at Orchha on 24 August 2018.

TEMPERATURE

There is no meteorological observatory in the district. Hence, the climatologically description of the district which follows is based on the meteorological data of the observatory in the neighbouring district Tikamgarh. By end of February temperatures begin to rise rapidly till May which is usually the hottest month of the year with the mean maximum temperature is at about 41.9°C and mean minimum temperature is at about 25.3°C. The intense heat in May and June with hot dust laden winds which may blow on many days make the weather very uncomfortable. On individual days the maximum temperature may reach about 46°C. Thundershowers occasionally occur in afternoon and bring relief from the heat. With the onset of the southwest monsoon into the district after about the second week of June there is appreciable drop in temperatures and the weather becomes pleasant. After withdrawal of southwest monsoon by about the end of September day temperatures slightly change but the night temperatures continue to decrease. From November both the temperatures begin to drop rapidly. January is usually the coldest month with the mean maximum temperature at 24.6°C and mean minimum at 7.3°C. During winter season the district is affected by cold waves in the rear of the passing western disturbances and the minimum temperatures may go down to about the couple degree below the freezing point of water.

HUMIDITY

During the southwest monsoon season the air is generally humid with values of relative humidity generally about 56% to 81% in the morning and about 48% to 74% in the afternoon. The driest part of the year is summer season when the value of relative humidity in the afternoon is about 37% whereas it is about 45% in the morning. Except during the southwest monsoon season, the air is generally dry, afternoons being drier than in the mornings. In the post monsoon and winter season values of relative humidity in the afternoons are between 50% and 60%.

CLOUDINESS

During the southwest monsoon season skies are generally heavily clouded to overcast. In the rest of the year skies are generally clear or lightly clouded.

WINDS

Winds are generally light to moderate with some increase in force in the latter part of summer and southwest monsoon season. During the southwest monsoon season winds mostly blow from east direction. In the post monsoon and winter seasons winds are easterly or southerly in the mornings, they blow from directions between south and west in the afternoons. In the summer easterlies and southerlies blow in the mornings whereas southerly wind blows in the evenings.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season and post monsoon season cross the east coast of India and move in a westerly or north-westerly direction across the peninsula. Some of these depressions affect the weather over the district and its neighbourhood causing widespread heavy rain and gusty winds. In the cold season western disturbances passing across north India affect the weather of the district. Thunderstorms occasionally occur during the south west monsoon months. Rain during the southwest monsoon season is often accompanied with thunder. Fog sometimes occur during the winter season.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
NIWARI

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
ORCHHA	30	a b	11.5 0.5	8.3 0.5	3.8 0.4	1.5 0.2	4.1 0.4	98.0 4.0	237.6 10.9	275.3 11.5	144.2 6.1	25.0 0.9	4.9 0.3	8.8 0.1	823.0 35.8	184# (2018)	47 (2006)	299.0	24 AUG 2018
DISTRICT MEAN	1	a b	11.5 0.5	8.3 0.5	3.8 0.4	1.5 0.2	4.1 0.4	98.0 4.0	237.6 10.9	275.3 11.5	144.2 6.1	25.0 0.9	4.9 0.3	8.8 0.1	823.0 35.8	184# (2018)	47 2006		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS OF OCCURRENCE GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
NIWARI
(DATA 1991 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
301 - 400	2	801 - 900	3
401 - 500	0	901 - 1000	0
501 - 600	0	1001 - 1100	2
601 - 700	4	1101 - 1200	2
701 - 800	3		

(DATA AVAILABLE FOR 16 YEARS)

PANNA DISTRICT

The climate of this district is characterized by a general dryness except during South-west monsoon season. The year may be divided into four seasons. The cold season from about the middle of November to February, is followed by hot season which continues up to the middle of June. The period from mid June to the end of September is the southwest monsoon season. October and the first half of November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 5 rain gauge stations for period ranging from 35 to 47 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1197.7 mm. During the monsoon season (June to September) the district receives rain about 91 % of the annual rainfall. August is the rainiest month with average rainfall of 389.1 mm. The annual rainfall variation from year to year in the district is appreciable. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 166% of the annual normal occurred in year 2003, while the lowest annual rainfall which was 43% of the normal occurred in year 2006. In the fifty year period there were 12 years in which the annual rainfall in the district was less than 80% of the normal. During this period there were two occasions of 2 consecutive years and one occasion of 5 consecutive years when such a low rainfall occurred. It is seen from Table 2 that the rainfall was between 801 mm and 1500 mm in 32 years out of 42.

On an average there are 49 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 45 at Ajaigarh to 55 at Panna observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 378.3 mm at Panna Observatory on 4th September 1978.

TEMPERATURE

There is one meteorological observatory in the district located at Panna at an elevation of 354 metre above mean sea level. The description that follows is based on the records of this observatory. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 40.8 °C and mean minimum of 25.0 °C. The heat in summer is quite intense and on individual days during May and early parts of June the day temperatures go up to about 46°C or over. Afternoon thunder showers which occur on some days bring welcome relief though only temporarily. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. Due to the increase in the moisture of the monsoon air the weather is often uncomfortable in between the rains. After the withdrawal of the monsoon, early in October, the day temperatures increase a little but the nights become progressively cooler. Day temperatures also decrease after October. January is the coldest month with mean maximum temperature at 23.0 °C and mean minimum temperature at 8.2 °C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about the freezing point of water.

The highest maximum temperature ever recorded at Panna was 47.0 °C on 05th June 1995 and the lowest minimum temperature ever recorded was -0.4 °C on 02nd January 1992.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges in between 55% to 85% during morning and 46% to 81% during afternoon. The values of relative humidity during post monsoon and winter season are comparatively less than those during the southwest monsoon season. The driest part of the year is the summer season, when the average humidity is less than 36% in the afternoons and about 39% in the mornings.

CLOUDINESS

During the southwest monsoon season the skies are mostly heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds generally blow from west direction. During post monsoon and winter season winds generally blow from north and east direction. Westerly and northerly winds predominate in the summer season .

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly to North-westerly direction passing through the district or its neighborhood causing widespread heavy rain and gusty winds. Thunderstorms occur occasionally during the summer season. Fog occurs very occasionally during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Panna observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
PANNA

STATION	No. of Years of Data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL RAINFALL AS % OF NORMAL		HEAVIEST RAINFALL IN 24 HOURS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
AJAIGARH	47	a	14.7	21.5	5.8	4.1	5.3	123.9	368.5	413.1	215.1	43.3	6.9	7.7	1229.9	179	40	290.1	10 SEPT 1906
		b	1.0	1.2	0.6	0.3	0.4	4.5	13.3	13.7	7.7	1.5	0.4	0.3	44.9	(1971)	(2008)		
PANNA	42	a	15.7	23.1	10.4	6.4	7.5	135.6	341.4	385.8	222.8	30.7	7.6	6.3	1193.3	192	45	365.3	08 AUG 1919
		b	1.4	1.6	1.1	0.7	0.6	6.2	14.9	14.4	8.2	1.8	0.5	0.6	52.0	(1980)	(2007)		
PANNA OBSY	35	a	18.7	18.5	14.0	6.5	7.5	140.3	384.5	438.3	246.1	34.3	8.5	8.4	1325.6	175	65	378.3	04 SEP 1978
		b	1.4	1.5	1.4	0.8	0.7	6.8	14.6	15.5	9.4	2.0	0.6	0.8	55.5	(1980)	(1974)		
PAWAI	42	a	23.9	17.3	7.7	2.8	6.0	132.3	353.6	374.0	197.8	40.3	9.4	6.7	1171.8	198	45	274.9	13 SEP 1992
		b	1.3	1.3	0.5	0.3	0.5	6.1	14.0	14.3	7.7	1.8	0.4	0.6	48.8	(1971)	(1979)		
SAHANAGAR	37	a	16.5	20.0	7.6	2.1	4.7	133.1	333.2	334.2	177.7	29.5	6.1	3.5	1068.2	177	28	200.0	05 JUL 2005
		b	1.1	1.2	0.7	0.2	0.5	5.5	13.6	13.8	7.8	1.3	0.3	0.4	46.4	(1990)	(1979)		
DISTRICT MEAN		B	17.9	20.1	9.1	4.4	6.2	133.0	356.2	389.1	211.9	35.6	7.7	6.5	1197.7	166	43		
			1.2	1.4	0.9	0.5	0.5	5.8	14.1	14.3	8.2	1.7	0.4	0.5	49.5	2003	2006		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
Frequency of Annual Rainfall in the District
PANNA
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
501 - 600	2	1301 - 1400	1
601 - 700	1	1401 - 1500	7
701 - 800	2	1501 - 1600	0
801 - 900	6	1601 - 1700	2
901 - 1000	1	1701 - 1800	0
1001 - 1100	6	1801 - 1900	2
1101 - 1200	3	1901 - 2000	1
1201 - 1300	8		

(Data available for 42 years)

TABLE – 3
Normals of Temperature and Relative Humidity
(PANNA)

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	23.0	8.2	35.0	09.01.2008	-0.4	02.01.1992	69	55
February	25.8	9.9	37.1	28.02.2006	2.2	11.02.1992	60	46
March	31.5	15.0	40.2	28.03.1972	2.2	05.03.2003	46	36
April	37.3	20.6	46.8	18.04.2006	4.6	12.04.2005	33	25
May	40.8	25.0	46.2	31.05.1988	5.2	07.05.2005	37	27
June	38.5	24.6	47.0	05.06.1995	4.5	25.06.2005	55	46
July	32.3	21.8	43.4	06.07.2002	3.5	05.07.2005	79	73
August	30.4	20.9	38.8	03.08.1972	4.8	18.08.2004	85	81
September	30.6	20.4	37.6	21.09.1997	6.4	18.09.2005	80	76
October	31.0	17.2	36.9	08.10.2006	4.3	30.10.2004	65	59
November	27.8	12.5	34.5	06.11.1977	3.3	29.11.2004	60	53
December	24.1	9.4	32.0	07.12.2006	2.6	28.12.1991	66	55
Annual	31.1	17.1	47.0	05.06.1995	-0.4	02.01.1992	61	52

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
(PANNA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	10	9	10	9	11	5	0	0	1	6	9	10	80
b	0	0	0	0	0	0	1	1	0	0	0	0	2
c	1.9	1.9	1.7	1.9	1.8	3.1	4.8	4.9	3.9	2.4	1.9	1.7	2.7
1730 HOURS IST													
a	10	9	11	10	12	6	1	0	1	7	9	10	86
b	0	0	0	0	0	0	0	1	0	0	0	0	1
c	1.9	1.9	1.7	1.8	1.8	3.3	4.9	5.0	4.1	2.4	1.9	1.6	2.7

a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
(PANNA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	C/E/N	C/E/N	C/NW	C/NW	C/W/S	W/C/N	W/C	C/W/N	C/W/N	C/S/W	C/N/S	C/N/E	
Direction in evening	N/C	N/C	C/N	N/C/W	N/C	N/W/C	C/W/N	C/W/N	C/W/N	C/N	N/C	N/C	

TABLE - 6
Special Weather Phenomena
(PANNA)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Hailstorm	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7

REWA DISTRICT

The climate of this district is characterized by extremes of temperature and dryness in non monsoon months. The cold weather season is from December to February and is followed by the hot season from March to about the middle of June. The southwest monsoon season commences after mid-June and lasts till the end of September. October and November may be termed as the post monsoon season.

RAINFALL

Records of rainfall in the district are available for 6 rain gauge stations for period ranging from 33 to 43 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall during the period in the district is 1087.4 mm. During the South West monsoon season (June to September) the district receives rainfall about 91% of the annual rainfall. July and August are rainiest months with average rainfall of 318.0 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 155% of the annual normal occurred in year 1971, while the lowest annual rainfall which was 64% of the normal occurred in year 2010. During the period there were 8 years in which the annual rainfall in the district was less than 80% of the normal and there was one occasion when such a low rainfall occurred in three consecutive years. It is seen from Table 2 that the rainfall was between 901 mm and 1300 mm in 20 years out of 37.

On an average there are 46 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 41 at Teonthar to 52 at Rewa observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 396.0 mm at Hanumana Rev on 1st September 1997.

TEMPERATURE

There is one meteorological observatory in the district located at Rewa at an elevation of 299 metre above mean sea level. The description that follows is based on the records of this observatory. The cold season starts from about the latter half of November when both day and night temperatures begin to drop fairly rapidly. December and January are the coldest months with mean maximum temperature at 24.5°C and mean minimum temperature at 8.1°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to within a degree or two of the freezing point of water. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 41.6°C and mean minimum of 25.5°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 47°C on individual days. With the onset of the monsoon by about middle of June provides a welcome relief to intense heat. In September and October there is a slight increase in the day temperatures, but thereafter temperatures gradually decrease.

The highest maximum temperature ever recorded at Rewa was 47.5°C on 12th June 2019 and the lowest minimum temperature ever recorded was 0.6°C on 14th January 1967.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges between 49% to 83% in the mornings and 45% to 77% in the evenings. The values of relative humidity are comparatively less during rest of the year. The driest part of the year is the summer season, when the average humidity is about 40 % in the mornings and 29% in the afternoons.

CLOUDINESS

During the southwest monsoon season the skies are heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon season, winds generally blow from southwest and northwest direction. In the summer season winds generally blow from northwest direction.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain. Thunderstorm generally occurs throughout the year and its frequency is high during south west monsoon season. In association with passing western disturbances thunderstorms may occur from December to February. The rainfall in the monsoon period is often associated with thunder. Fog occurs occasionally during winter months.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Rewa observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
REWA

STATION	No. of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
HANUMANA REV	33	a b	7.4 0.6	15.1 0.9	5.5 0.5	0.9 0.1	3.6 0.3	125.6 5.6	324.9 13.6	318.4 12.8	242.7 8.9	34.9 1.3	3.6 0.3	7.5 0.2	1090.1 45.1	173 (1994)	54 (2004)	396.0	1 SEP 1997
MAUGANJ	42	a b	15.5 0.9	15.7 0.9	6.1 0.5	1.2 0.2	5.8 0.4	131.7 5.6	288.4 12.7	298.0 12.7	224.8 8.1	36.3 1.6	7.9 0.4	2.2 0.2	1033.6 44.2	177 (2003)	53 (1979)	322.0	1 SEP 1997
REWA	38	a b	19.9 1.6	23.9 1.6	8.1 0.8	5.5 0.5	6.0 0.6	137.4 6.4	341.3 13.5	319.9 12.8	211.6 8.6	45.7 1.9	9.4 0.5	7.1 0.5	1135.8 49.3	148 (1971)	59 (2009)	278.5	4 SEP 1990
REWA OBSY	39	a b	16.9 1.4	17.5 1.4	9.3 1.0	6.8 0.5	11.2 1.1	148.9 6.9	339.0 13.8	332.8 13.6	196.9 8.8	38.9 2.1	9.2 0.5	7.5 0.6	1134.9 51.7	151 (1971)	64 (2010)	278.5	4 SEP 1990
SIRMAUR	40	a b	13.3 0.8	22.3 1.0	6.0 0.3	1.1 0.1	5.8 0.3	120.6 4.6	311.7 12.2	330.7 13.0	229.9 8.1	35.2 1.5	7.9 0.4	6.9 0.4	1091.4 42.7	155 (1982)	55 (2009)	315.0	1 SEP 1925
TEONTHAR	43	a b	18.4 0.8	24.0 1.1	7.5 0.4	0.9 0.1	3.0 0.2	111.3 4.3	302.6 11.9	311.8 12.6	216.0 7.9	33.2 1.3	6.9 0.3	3.5 0.2	1039.1 41.1	191 (1981)	57 (2009)	317.5	27 JUL 1982
DISTRICT MEAN	6	a b	15.2 1.0	19.7 1.2	7.1 0.6	2.7 0.3	5.9 0.5	129.2 5.6	318.0 12.9	318.6 12.9	220.3 8.4	37.4 1.6	7.5 0.4	5.8 0.3	1087.4 45.7	155 1971	64 2010		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE – 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
REWA
(DATA 1971 – 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
601 - 700	1	1201 - 1300	6
701 - 800	4	1301 - 1400	5
801 - 900	3	1401 - 1500	1
901 - 1000	6	1501 - 1600	2
1001 - 1100	5	1601 - 1700	1
1101 - 1200	3		

DATA AVAILABLE FOR 37 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
REWA

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
JANUARY	23.5	7.9	32.0	23-01-2019	0.6	14-01-1967	71	57
FEBRUARY	27.1	10.8	36.5	27-02-1966	1.6	14-02-2008	68	51
MARCH	33.4	15.4	41.2	31-03-2017	5.0	01-03-2019	52	35
APRIL	38.8	20.7	45.0	28-04-1970	11.0	06-04-2013	36	26
MAY	41.6	25.5	46.8	09-05-1973	17.4	04-05-2013	33	26
JUNE	38.9	26.8	47.5	12-06-2019	17.5	30-06-2017	49	45
JULY	33.6	25.4	43.2	02-07-2012	15.2	09-07-2003	75	69
AUGUST	31.9	24.7	39.4	04-08-1987	20.3	05-08-1966	83	77
SEPTEMBER	32.2	23.7	37.6	27-09-1968	10.2	28-09-1966	79	72
OCTOBER	32.4	19.5	38.6	05-10-1966	9.0	26-10-2009	71	60
NOVEMBER	29.1	13.6	36.2	04-11-2001	4.4	30-11-1970	67	58
DECEMBER	25.4	8.4	32.4	09-12-1989	1.3	31-12-2007	70	57
ANNUAL	32.3	18.4	47.5	12-06-2019	0.6	14-01-1967	62	52

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
REWA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	24	22	24	24	25	7	1	1	6	22	25	27	208
b	3	1	0	0	0	4	15	15	10	2	1	1	52
c	1.5	1.1	1.0	1.1	0.8	3.7	5.9	5.9	4.3	1.7	0.8	0.7	2.4
1730 HOURS IST													
a	21	18	20	17	17	3	0	0	4	17	22	23	162
b	1	1	0	0	1	6	9	9	4	2	1	1	35
c	1.2	1.3	1.3	1.7	2.1	4.5	5.8	5.8	3.9	1.8	1.0	0.7	2.6

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.

For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
REWA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	C	C	C	C	C	C/NW/SW	C	C	C	C	C	C	
Direction in evening	C	C	C/NW	NW	NW	NW/C	C/NW/SW	C/NW	C	C	C	C	

TABLE - 6
Special Weather Phenomena
REWA

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0	0.2	0	0.1	0.4	0.1	1.2	0.7	0.5	0.1	0	0.1	3.4
Hailstorm	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1
Dust storm	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0.1	0.2	0	0	0	0	0	0	0	0	0	0	0.3

SAGAR DISTRICT

The climate of this district is generally pleasant and salubrious. The year may be divided into four seasons. The cold season from November to February is followed by the hot season from the middle of June. The monsoon season is from mid-June to the end of September. The transition from monsoon to winter conditions occurs in October.

RAINFALL

Records of rainfall in the district are available for 5 rain gauge stations for period ranging from 34 to 49 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1166.7 mm. The monsoon reaches the district by the middle of June and withdraws by the beginning of October. August is the rainiest month with average rainfall of 384.3 mm. During the monsoon season (June to September) the district receives rain about 92% of the annual rainfall. The variation of rainfall from year to year is large. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 166% of the annual normal occurred in year 2013, while the lowest annual rainfall which was 51% of the normal occurred in year 2007. In the fifty year period there were 12 years in which the annual rainfall in the district was less than 80% of the normal and during this period there was one occasion when such a low rainfall occurred in consecutive years. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 24 years out of 46.

On an average there are 49 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 44 at Garhakota to 55 at Sagar observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 475.6 mm at Sagar observatory on 4th July 2005.

TEMPERATURE

There is one meteorological observatory in the district located at Sagar and the records of this observatory may be taken as representative of the conditions in the district as a whole. January is the coldest month of the year with mean daily maximum temperature of 24.7 °C and mean daily minimum temperature of 11.2 °C. During the winter season when the district is affected by cold waves in the wake of the western disturbances moving eastwards across north India, the minimum temperature may go down to one or two degree Celsius above freezing point of water. Both day and night temperatures begin to rise progressively from March reaching maximum values in May. The mean daily maximum temperature in May is about 41.3 °C and mean daily minimum of 26.3°C. The onset of the monsoon by mid June brings down the temperature considerably. After September day temperatures begin to rise and reach a secondary maximum in October.

The highest maximum temperature ever recorded at Sagar was 47.0°C on 04th June 2019 and the lowest minimum temperature ever recorded was 1.1°C on 1st February 1929.

HUMIDITY

The summer is extremely dry when relative humidity ranges between 30 to 40% in the morning and 19 to 25% in the afternoon. During the southwest monsoon season the moisture content of the air is high and it ranges between at about 62% to 92% in the morning and 48% to 83% in the evening. The values of relative humidity start to decrease in October. It is comparatively less during rest of the year.

CLOUDINESS

Heavily clouded or overcast skies are a regular feature during the monsoon season. In the rest of the year skies are generally clear or lightly clouded.

WINDS

Fairly wide spread winds are common throughout the year. In the post monsoon and early winter months the wind speed is slightly less than in other months. During monsoon, winds blow mainly from west and southwest direction. During post monsoon and winter season winds from northeast direction are predominant. In the summer season, westerlies are also common.

SPECIAL WEATHER PHENOMENA

Heavy rain and strong winds are caused in the district by depressions which come from the Bay of Bengal during the monsoon season and occasionally in association with post monsoon storms and depressions of October. Thunderstorms occur generally throughout the year but are more common during the summer and monsoon seasons. The thunderstorms during the winter and pre-monsoon months are at times accompanied with hail. Fog may occur occasionally during whole year except summer season. Thunderstorm sometimes accompanied with dust storm during pre monsoon season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Sagar observatory

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
SAGAR

STATION	No. of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
DEORI	46	a b	12.9 1.0	16.5 1.0	7.4 0.5	2.1 0.3	8.1 0.7	160.0 7.4	367.8 13.6	413.2 14.5	189.8 8.6	24.1 1.3	12.8 0.7	10.4 0.5	1225.1 50.1	168 (1999)	68 (2008)	270.0	8 SEP 2000
GARHAKOTA	34	a b	9.1 0.8	14.6 0.7	8.1 0.4	5.4 0.4	11.4 0.7	146.9 5.7	300.0 13.3	292.2 12.3	158.7 7.3	25.0 1.3	6.7 0.4	5.5 0.4	983.6 43.7	167 (1994)	61 (2015)	183.6	13 AUG 1942
KHURAI	49	a b	11.7 1.0	12.7 1.1	9.8 0.8	2.3 0.3	8.4 0.5	151.4 6.4	384.6 14.1	413.3 14.8	165.6 7.8	25.8 1.3	13.8 0.7	6.1 0.6	1205.5 49.4	195 (2013)	43 (1979)	317.0	27 JUN 2013
REHLI	49	a b	14.6 1.1	13.8 0.9	8.2 0.6	4.0 0.3	5.7 0.6	156.9 6.2	346.3 13.3	391.8 14.4	179.0 7.7	27.9 1.4	12.7 0.7	8.8 0.6	1169.7 47.8	198# (1999)	51 (2007)	264.0	4 JUL 2005
SAGAR OBSY	47	a b	14.2 1.1	12.5 1.0	9.9 0.8	5.9 0.5	17.0 1.4	170.1 7.5	373.2 14.8	410.8 16.1	180.0 8.5	27.8 1.7	16.0 0.9	12.0 1.0	1249.4 55.3	173 (1990)	39 (1981)	475.6	4 JUL 2005
DISTRICT MEAN	5	a b	12.5 1.0	14.0 0.9	8.7 0.6	3.9 0.4	10.1 0.8	157.1 6.6	354.4 13.8	384.3 14.4	174.6 8.0	26.1 1.4	12.4 0.7	8.6 0.6	1166.7 49.2	166 2013	51 2007		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
SAGAR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	1	1301 - 1400	2
601 - 700	1	1401 - 1500	2
701 - 800	4	1501 - 1600	4
801 - 900	5	1601 - 1700	3
901 - 1000	3	1701 - 1800	1
1001 - 1100	6	1801 - 1900	0
1101 - 1200	7	1901 - 2000	1
1201 - 1300	6		

DATA AVAILABLE FOR 46 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
(SAGAR)

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	24.7	11.2	33.3	26.01.2009	1.7	13.01.1934	61	43
February	28.2	14.1	37.3	23.02.2006	1.1	01.02.1929	53	34
March	33.5	18.8	42.5	23.03.2010	7.2	03.03.1898	41	25
April	38.4	23.4	44.4	18.04.2010	10.6	08.04.1926	31	19
May	41.3	26.3	46.4	31.05.1994	16.3	05.05.1969	37	23
June	37.5	25.5	47.0	04.06.2019	13.1	20.06.1966	62	48
July	30.8	23.8	41.4	03.07.2012	14.5	02.07.1969	87	77
August	29.0	22.9	37.6	01.08.2002	14.8	03.08.1969	92	83
September	31.0	22.3	39.7	30.09.1966	16.7	30.09.1926	84	71
October	32.5	20.1	39.9	15.10.1969	11.3	30.10.1966	62	48
November	29.8	16.4	37.7	02.11.1966	6.1	20.11.1926	53	44
December	26.8	12.7	33.6	01.12.1963	2.1	22.12.1961	56	44
Annual	32.0	19.8	47.0	04.06.2019	1.1	01.02.1929	60	47

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
(SAGAR)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	22	20	21	19	20	6	1	1	6	18	21	21	176
b	1	0	0	0	0	2	11	12	5	1	0	1	33
c	1.4	1.1	1.3	1.2	1.2	3.8	6.1	6.5	4.0	1.6	1.1	1.2	2.5
1730 HOURS IST													
a	17	16	15	10	4	1	0	0	3	12	16	19	113
b	1	0	0	0	0	3	8	8	3	1	0	0	24
c	1.7	1.5	1.9	2.5	3.2	5.2	6.4	6.2	4.5	2.3	1.6	1.5	3.2

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
(SAGAR)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	3.0	3.6	3.9	3.9	4.6	5.9	5.9	4.7	3.2	2.0	2.1	2.4	3.8
Direction in morning	C/NE	C/ NE	C/NE	W/C /SW	W	W	W/SW	W/C	C/W	C	C/NE	C/NE	
Direction in evening	C/NE	C/ NE/W	W/NW/C	W/NW	SW/W/ NW	W/SW/ C	W/SW/ C	W/C	C	C	C/NE	C	

TABLE - 6
Special Weather Phenomena
(SAGAR)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.9	1.8	1.4	1.8	3.7	7.2	8.3	5.8	3.9	0.9	0.4	0.5	36.6
Hailstorm	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Dust storm	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Fog	2.3	0.4	0.2	0.0	0.0	0.0	0.1	0.1	0.4	0.3	0.5	1.0	5.3

SATNA DISTRICT

The climate of this district is characterized by extremes of temperature and dryness except during the monsoon months. The cold season is from December to February. That is followed by hot season from March to about the middle of June. The period from mid-June to September constitutes southwest monsoon season. October and November forms the post monsoon season.

RAINFALL

Records of rainfall in the district are available for 4 rain gauge stations for period ranging from 38 to 48 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1044.5 mm. The period from June to September is the main rainy season. July and August is the rainiest months with average rainfall of 315.0 mm. During the monsoon season (June to September) the district receives rain about 91% of the annual rainfall. In January and February, some rainfall occurs in association with passing western disturbances. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 159% of the annual normal occurred in year 2016, while the lowest annual rainfall which was 50% of the normal occurred in year 1979. In the fifty year period there were 9 years in which the annual rainfall in the district was less than 80% of the normal and during this period there was not a single occasion when such a low rainfall occurred in consecutive years. It is seen from Table 2 that the rainfall was between 801 mm and 1300 mm in 30 years out of 47.

On an average there are 46 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 41 at Sohawal to 54 at Satna Obsy.

The heaviest rainfall in 24 hours recorded at any station in the district was 340.0 mm at Maihar on 7th July 2016.

TEMPERATURE

There is one meteorological observatory in the district located at Satna at an elevation of 316 metre above mean sea level. The description that follows is based on the records of this observatory. Temperatures begin to drop from about the latter half of November. December and January are the coldest months with average maximum temperature at about 25.0 °C and mean minimum temperature at about 9.5 °C. During cold waves which sometimes affect the district in association with the passage of western disturbances across North India, the minimum temperature may drop to within a degree or two of the freezing point of water. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month with mean maximum temperature of 41.8 °C and mean minimum of 27.4 °C. Nights are slightly hotter in June than in May. Temperatures in May and June sometimes go up to about 47 °C to 48 °C and weather is oppressive hot. With the commencement of the South West Monsoon by about mid-June, the day temperatures drop appreciably and the weather becomes more bearable. With the withdrawal of monsoon day temperatures slightly increase, but immediately thereafter starts decreasing gradually.

The highest maximum temperature ever recorded at Satna was 48.4 °C on 12th June 2014 and the lowest minimum temperature ever recorded was 0.4 °C on 27th December 1961 and 7th January 2013.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges between 57% to 86% in the morning and 45% to 77% in the evening. The values of relative humidity start to decrease in October. It is comparatively less during rest of the year. The driest part of the year is the summer season, when the values of relative humidity are around 42% in the mornings and around 23 % in the afternoons.

CLOUDINESS

Skies are generally clear or lightly clouded, except during the monsoon season, when heavily clouded to overcast conditions prevail. During the month of January, skies are moderately clouded for short spells of a day or two, in association with western disturbances.

WINDS

Winds are generally light, except during the summer and monsoon seasons when the wind force strengthens. During the monsoon season, winds predominantly blow from the west or southwest. In winter and summer season winds are generally light and blow from northwest direction in the evening.

SPECIAL WEATHER PHENOMENA

During the monsoon season depressions originating in the Bay of Bengal move in a westerly to north westerly direction and pass through the district or its neighborhood causing widespread heavy rain and gusty winds. During October storms and depressions also affect the district occasionally. In the cold season western disturbances passing across north India affect the weather over the district. Thunderstorms occur throughout the year and its frequency is high during summer and southwest monsoon season. Thunderstorm sometimes accompanied with dust storms during the summer months. Rain during the southwest monsoon season is often accompanied with thunder. Fog may occur occasionally during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Satna observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
SATNA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
MAIHAR	48	a	21.8	23.8	8.4	2.9	4.1	119.1	332.7	325.2	191.7	40.6	8.0	4.4	1082.7	194	52	340.0	7 JUL 2016
		b	1.2	1.2	0.6	0.3	0.3	5.2	13.4	13.5	8.4	1.4	0.3	0.3	46.1	(1980)	(1979)		
NAGODE	38	a	9.7	14.7	6.8	1.3	1.4	144.6	293.2	292.0	183.8	28.7	3.0	2.5	981.7	174	48	280.0	7 SEP 1987
		b	0.8	0.9	0.6	0.1	0.3	5.9	11.9	12.3	7.1	1.2	0.3	0.3	41.7	(2003)	(2010)		
SATNA OBSY	47	a	18.4	23.6	11.4	7.5	14.9	137.5	347.0	345.2	197.8	36.1	8.3	7.0	1154.7	151	55	299.7	9 AUG 1919
		b	1.5	1.7	1.1	0.9	1.2	6.9	14.3	14.4	8.6	2.0	0.5	0.6	53.7	(1971)	(1979)		
SOHAWAL	41	a	12.0	17.7	3.4	1.7	1.5	118.6	269.6	314.2	173.9	32.4	8.1	5.0	958.1	147	40	260.6	09 SEP 2003
		b	1.2	1.1	0.4	0.2	0.2	5.1	12.1	12.2	6.8	1.3	0.5	0.3	41.4	(1971)	(1979)		
DISTRICT MEAN	4	a	15.5	20.0	7.5	3.3	5.5	130.0	310.6	319.2	186.8	34.5	6.9	4.7	1044.5	159	50		
		b	1.2	1.2	0.7	0.4	0.5	5.8	12.9	13.1	7.7	1.5	0.4	0.4	45.8	2016	1979		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
SATNA
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	1	1101 - 1200	6
601 - 700	1	1201 - 1300	1
701 - 800	5	1301 - 1400	4
801 - 900	6	1401 - 1500	0
901 - 1000	7	1501 - 1600	4
1001 - 1100	10	1601 - 1700	2

-
DATA AVAILABLE FOR 47 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
(SATNA)

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	⁰ C	⁰ C	⁰ C	Date	⁰ C	Date	0830 IST	1730 IST
January	23.9	9.1	32.9	29.01.2007	0.4	07.01.2013	77	48
February	27.6	12.3	36.8	27.02.2006	1.1	02.02.1905	68	39
March	33.3	17.2	41.1	23.03.2004	4.4	02.03.1949	52	27
April	38.9	22.7	45.0	19.04.2010	12.2	08.04.1918	36	20
May	41.8	27.4	47.6	31.05.1994	18.3	02.05.1933	37	23
June	39.1	28.0	48.4	12.06.2014	19.4	29.06.1929	57	45
July	33.1	25.8	45.0	01.07.1931	17.8	25.07.1929	81	72
August	31.6	25.2	39.5	04.08.1987	20.5	23.08.2003	86	77
September	32.2	24.3	38.3	02.09.1979	16.7	22.09.1912	82	70
October	32.7	20.2	38.9	04.10.1966	10.0	31.10.1890	71	49
November	29.7	14.4	36.1	04.11.2001	4.8	30.11.1970	68	45
December	26.0	9.8	32.9	04.12.1963	0.4	27.12.1961	74	47
Annual	32.4	19.6	48.4	12.06.2014	0.4	07.01.2013, 27.12.1961	66	47

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
(SATNA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	20	19	18	18	18	7	1	1	6	21	23	23	175
b	3	1	1	0	0	3	8	10	5	1	1	1	34
c	2.1	1.6	1.5	1.4	1.5	3.9	5.9	6.0	4.1	1.6	1.1	1.2	2.7
1730 HOURS IST													
a	18	15	15	12	7	1	0	0	3	13	18	20	122
b	1	1	1	0	0	4	6	7	4	1	0	0	25
c	1.9	1.7	2.0	2.4	2.6	4.9	6.1	6.1	4.7	2.1	1.5	1.3	3.1

a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
(SATNA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.0	3.4	3.1	3.5	4.6	5.5	4.7	4.0	3.3	2.1	1.8	1.7	3.3
Direction in morning	C	C	C	C	C/W/ SW	SW/ W	SW/C/ W	C/SW/ W	C	C	C	C	
Direction in evening	C/NW	NW/C	NW	NW	NW	NW	SW/C	C/SW/ W	C/NW	C	C	C	

TABLE - 6
Special Weather Phenomena
(SATNA)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.3	1.0	1.2	1.7	2.3	3.6	5.9	4.9	3.5	0.9	0.1	0.2	25.6
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Dust storm	0	0	0	0	0	0.1	0	0	0	0	0	0	0.1
Fog	1.7	0.4	0	0	0	0	0	0	0	0	0	1.0	3.1

SEONI DISTRICT

The climate of this district is characterized by general dryness except during the south west monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the hot season which lasts up to the middle of June. The period from mid-June to the end of September is the southwest monsoon season. October and November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 4 raingauge stations for period ranging from 32 to 48 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1154.0 mm. During the monsoon season (June to September) the district receives rain about 88% of the annual rainfall. July is the rainiest month with average rainfall of 355.7 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 149% of the annual normal occurred in year 2013, while the lowest annual rainfall which was 64% of the normal occurred in year 2017. In the fifty year period there were 10 years in which the annual rainfall in the district was less than 80% of the normal and during this period there are two occasions when such a low rainfall occurred for 2 consecutive years. It is seen from Table 2 that the rainfall was between 801 mm and 1400 mm in 36 years out of 42.

On an average there are 55 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 51 at Keolari to 65 at Seoni .

The heaviest rainfall in 24 hours recorded at any station in the district was 304.0 mm at Ghansore on 18th August 2002.

TEMPERATURE

There is one meteorological observatory in the district located at Seoni at an elevation of 619 metre above mean sea level. The description that follows is based on the records of this observatory. Temperatures begin to rise steadily from about end of February. May is generally the hottest month with mean maximum temperature of 40.4°C and mean minimum of 28.1°C. The weather in the period April to mid-June is oppressively hot with maximum temperature on individual days sometimes goes up to about 45°C.

Hot dust raising winds blow on many of the days. Afternoon thunder showers which occur on certain days bring welcome relief from the heat. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes pleasant. Towards the end of the monsoon season day temperatures increase slightly and reach a secondary maximum in October, but the nights become progressively cooler. The day temperatures start decreasing from the month of November and the nights also become progressively cooler. January is the coldest month with mean maximum temperature at 26.3 °C and mean minimum temperature at 13.7 °C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may fall to near about the freezing point of water.

The highest maximum temperature ever recorded at Seoni was 45.2°C on 29th May 1988 and the lowest minimum temperature ever recorded was 2.8°C on 7th January 1937.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 65% to 87% in the morning and 61% to 84% in the

afternoon. The values of relative humidity start to decrease from October. The driest part of the year is the summer season, when the average humidity is about 38% in the afternoons and 44% in the mornings.

CLOUDINESS

During the southwest monsoon season the skies are generally heavily clouded or overcast. Skies are mostly clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light with an increase in force during the summer and monsoon seasons. Winds generally blow from West and southwest directions during southwest monsoon season. In the post monsoon season and winter seasons winds generally blow from northerly and north-easterly direction. In the summer season winds are mostly from North and North-west direction.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the monsoon season move in some westerly direction, reach the district or its neighborhood causing widespread heavy rain and gusty winds. Some of the storms and depressions from the Bay of Bengal during the post monsoon season also affect the district similarly. Thunderstorms occur during the summer and south west monsoon seasons. Fog occurs on a few occasions during winter.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed & wind direction and special weather phenomena respectively for Seoni observatory.

TABLE - I
NORMALS AND EXTREMES OF RAINFALL
SEONI

STATION	No. of yrs of data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
GHANSORE	39	a b	13.3 0.8	13.4 1.1	17.9 1.1	6.9 0.4	5.6 0.5	156.5 7.5	360.7 15.0	326.3 14.4	168.3 8.1	40.9 1.8	17.3 0.7	9.3 0.6	1136.4 52.0	188 (2013)	64 (2001)	304.0	18 AUG 2002
KEOLARI	32	a b	14.0 0.8	9.6 0.8	20.9 1.2	2.4 0.3	4.7 0.2	169.2 7.3	373.7 15.2	309.5 13.8	157.9 8.3	37.6 1.9	7.2 0.4	8.2 0.4	1114.9 50.6	145 (2003)	37 (2014)	266.0	19 AUG 2002
LAKHNADON	48	a b	18.6 1.4	22.4 1.5	16.8 1.1	6.1 0.4	5.5 0.5	150.4 7.5	335.1 15.5	316.0 14.3	186.8 8.8	33.5 2.1	16.1 0.6	9.4 0.6	1116.7 54.3	149 (1977)	60 (1991)	256.0	21 JUN 1990
SEONI	40	a b	20.9 1.6	29.0 2.0	20.0 1.8	15.0 1.2	18.9 1.7	201.8 9.7	353.5 16.1	301.5 15.2	186.3 9.7	65.7 3.9	23.9 1.1	12.0 0.9	1248.5 64.9	131 (1981)	65 (2008)	260.5	9 AUG 1979
DISTRICT MEAN	4	a b	16.7 1.1	18.6 1.3	18.9 1.3	7.6 0.6	8.7 0.7	169.5 8.0	355.7 15.5	313.3 14.4	174.8 8.7	44.4 2.4	16.1 0.7	9.7 0.6	1154.0 55.3	149 (2013)	64 (2017)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE – 2
FREQUENCY OF ANNUAL R/F IN THE DISTRICT
SEONI
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
701 - 800	1	1301 - 1400	7
801 - 900	9	1401 - 1500	1
901 - 1000	3	1501 - 1600	3
1001 - 1100	3	1601 - 1700	0
1101 - 1200	10	1701 - 1800	1
1201 - 1300	4		

(DATA AVAILABLE FOR 42 YEARS)

TABLE – 3
Normals of Temperature and Relative Humidity
(SEONI)

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	26.3	13.7	35.2	21/01/2000	2.8	07/01/1937	63	56
February	29.7	16.4	37.2	29-02-1896	3.3	02/02/1911	59	50
March	34.2	21.2	43.2	19/03/1999	6.1	06/03/1910	49	44
April	38.1	25.8	45.0	21/04/1974	11.7	01/04/1905	43	37
May	40.4	28.1	45.2	29/05/1988	15.0	04/05/1917	40	33
June	35.3	26.7	45.0	09/06/1942	15.0	23/06/1994	65	61
July	29.6	24.2	39.8	08/07/1995	14.0	22/07/1994	86	82
August	28.5	24.0	36.6	23/08/1998	14.0	27/08/1994	87	84
September	30.1	23.9	37.4	27/09/1987	16.0	17/09/1993	80	76
October	31.1	22.0	36.4	14/10/2015	10.6	31/10/1910	68	66
November	28.8	18.6	35.4	11/11/1984	5.0	29/11/1912	62	59
December	27.1	15.1	34.2	09/12/2012	3.3	30/12/1936	59	53
Annual	31.5	21.3	45.2	29/05/1988	2.8	07/01/1937	64	59

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and
Mean Number of days of Clear and Overcast Skies
(SEONI)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	16	15	15	9	9	2	1	0	3	8	14	16	108
b	2	1	1	1	1	12	18	16	6	1	1	1	61
C	1.9	1.5	1.6	1.8	2.1	4.8	6.5	6.1	3.9	2.3	1.6	1.3	2.9
1730 HOURS IST													
a	8	8	16	3	4	1	0	0	2	5	7	7	61
b	1	1	2	2	2	16	20	19	6	2	1	1	73
c	2.2	1.9	2.3	2.9	3.4	5.5	6.6	6.2	4.5	2.7	2.1	1.9	3.5

- a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
(SEONI)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.1	2	2.5	2	2	2	2	2.1	2.6	2.4	2.3	2	2.2
Direction in morning	N	N/NE/S	N	N/S/SW	N/NW	W	W/SW	W	NW/N	N/NE	N/NE	N/NE	
Direction in evening	N/NE/E	N/NE/S	N/NW	N/W	NW/N	W/SW/S	W/SW	W/SW	NW/N	NE/N/E	N/NE/E	NE/N/E	

TABLE - 6
Special Weather Phenomena
(SEONI)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust storm	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1

SHAHDOL DISTRICT

The climate of this district is characterized by a hot summer and general dryness except during the southwest monsoon season. The year may be divided into four seasons. The cold season, December to February is followed by the hot season from March to about the middle of June. The period from the middle of June to September is the southwest monsoon season. October and November form the post monsoon or transition period.

RAINFALL

Records of rainfall in the district are available for two stations for long period. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average rainfall in the district is 1103.0 mm. About 90% of the annual rainfall in the district is received during the southwest monsoon months June to September. August is the rainiest month in the district with rainfall 360.2 mm. The rainfall in district in general increases from the north towards south. The variation in rainfall from year to year is small. In the fifty year period 1971 to 2020, the highest annual rainfall in the district amounting 147% in the year 1994 and the lowest annual rainfall was 61% in the year 1979. In the fifty year period there were 5 years in which the annual rainfall in the district was less than 80% of the normal and during this period there are two occasions when such a low rainfall occurred for 2 consecutive years. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 21 years out of 34.

On an average there are 50 rainy days (i.e days with rainfall of 2.5mm or more) in a year in the district. This number varies from 47 at Beohari to 52 at Sohagpur.

The heaviest rainfall in 24 hours recorded at any station in the district was 295.0 mm at Sohagpur on 21st July 1994..

TEMPERATURE

As there is no meteorological observatory in the Shahdol district, hence the description that follows is based on the records of Umaria observatory situated in the neighboring district. From the beginning of March temperatures begin to rise rapidly till first week of June. May is the hottest month with the mean maximum temperature at about 41.8°C and mean minimum temperature at about 24.1°C. In the latter part of the summer season i.e. April, May and early part of June, the maximum temperature sometimes reaches 44°C to 46°C on individual days. Until the onset of the monsoon by second week of June, days are discomfortable with hot dusty winds. However, the afternoon thundershowers which occur on some days bring welcome relief though only temporarily. With the advance of the southwest monsoon into the district towards the middle of June, the day temperatures fall rapidly while drop in night temperature is comparatively small. With the withdrawal of the monsoon by about end of September, day temperatures remain almost same as those in October but there is rapid drop in the night temperatures. Both the temperatures begin to decrease rapidly after October. January is the coldest month of the year when mean maximum temperature is at about 25.1°C and mean minimum temperature at about 6.8°C. In winter months, cold waves sometimes affect the district in the wake of western disturbances passing across north India when the minimum temperatures may sometimes drop down to about the freezing point of water.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges from 61% to 87% in the morning and from 51% to 80% in the afternoon. The values of humidity are comparatively less in the rest of the year. The driest part of the year is the summer season, when the average humidity is about 30% in the afternoons and about 47% in the mornings.

CLOUDINESS

In the southwest monsoon season skies are heavily clouded to overcast. In the rest of the year, skies are generally clear or lightly clouded.

WINDS

Winds are generally light with a little strengthening in the latter part of summer and early part of monsoon season. In the southwest monsoon season winds are mostly South-westerly, Westerly to North-westerly. In the rest of the year winds are generally calm. During the monsoon season, when depressions affect the weather of the district, the district may experience occasionally gusty winds.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season cross the east coast and moving in some west direction pass through or in the neighbourhood of the district causing widespread and locally heavy rain and gusty winds. Occasionally post monsoon storms from the Bay of Bengal affect the weather of the district. Thunderstorm occurs in the district throughout the year. Its frequency is more in the latter part of summer season and in the southwest monsoon season. Fog occurs occasionally in the mornings of winter seasons and latter part of post monsoon season.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
SHAHDOL

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BEOHARI	47	a	20.3	22.2	7.8	4.7	1.7	132.5	346.9	382.0	189.5	34.8	6.0	6.5	1154.9	243#	50	288.0	16 AUG 2008
		b	1.2	1.1	0.5	0.4	0.2	5.6	13.3	14.0	8.0	1.9	0.3	0.6	47.1	(1975)	(2010)		
SOHAGPUR	44	a	16.4	21.3	13.0	6.5	12.7	127.0	271.4	338.4	190.1	34.8	8.6	11.0	1051.2	174	53	295.0	21 JUL 1994
		b	1.4	1.5	0.9	0.6	0.9	6.9	13.5	14.6	8.6	2.1	0.6	0.8	52.4	(1994)	(1974)		
DISTRICT MEAN	2	a	18.3	21.7	10.4	5.6	7.2	129.8	309.1	360.2	189.8	34.8	7.3	8.8	1103.0	147	61		
		b	1.3	1.3	0.7	0.5	0.6	6.3	13.4	14.3	8.3	2.0	0.5	0.7	49.9	(1994)	(1979)		

- (a) NORMAL RAINFALL IN MM
(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)
(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR
(*) BASED ON ALL AVAILABLE DATA UPTO 2020
(**) YEARS GIVEN IN BRACKETS
(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE – 2
FREQUENCY OF ANNUAL R/F IN THE DISTRICT
SHAHDOL
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
601 - 700	2	1201 - 1300	3
701 - 800	2	1301 - 1400	0
801 - 900	3	1401 - 1500	3
901 - 1000	7	1501 - 1600	1
1001 - 1100	5	1601 - 1700	2
1101 - 1200	6		

(DATA AVAILABLE FOR 34 YEARS)

SIDHI DISTRICT

The climate of Sidhi district is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February followed by the hot season commences from March till about the middle of June. The period from mid-June to about the end of September is the southwest monsoon season. The period of October and November constitutes post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for three raingauge stations for the period ranging from 32 to 40 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1161.4 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 90% of the annual normal rainfall, July and August are the rainiest months with the highest rainfall with an average value of about 335.8 mm. The annual rainfall in the district varies over a large range. In the fifty years period 1971 to 2020, the highest annual rainfall was in year 1971 when it amounted to 160% of the normal. In the year 1974, the annual rainfall in the district was the lowest in this period and amounted to only 52% of the normal. In this period the rainfall was less than 80% of the normal in 11 years and during the same period there were two occasions of two consecutive years and one occasion of three consecutive years when such a low rainfall occurred . It is seen from Table 2 that the annual rainfall was between 901 mm and 1400 mm in 19 years out of 37.

On an average there are 52 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 39 at Sihawan to 55 at Sidhi observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 307.9 mm at Sidhi & Sidhi obsy on 1st September 1997.

TEMPERATURE

There is one meteorological observatory in the district at Sidhi. Hence, the climatological description of the district which follows is based on the meteorological data of this observatory. From the middle of February temperatures begin to rise rapidly till May which is usually the hottest month of the year with the mean maximum temperature at about 42.2 °C and mean minimum temperature at about 26.8°C. The intense heat in May and June with hot dust laden winds which may blow on many days make the weather very uncomfortable. On individual days the maximum temperature may reach 46 °C. Thundershowers occasionally occur in afternoon and bring relief from the heat. With the onset of the southwest monsoon into the district after about the second week of June there is appreciable drop in temperatures and the weather becomes pleasant. After withdrawal of southwest monsoon by about the end of September or early in October day temperatures slightly change but the night temperatures continue to decrease. From November both the temperatures begin to drop rapidly. January is usually the coldest month with the mean maximum temperature at 24.4 °C and mean minimum at 8.5 °C. During winter season the district is affected by cold waves in the rear of the passing western disturbances and the minimum temperatures may go down to about the freezing point of water.

The highest maximum temperature ever recorded in the district was 48.8 °C on 10 April 1959 and the lowest minimum temperature was 0.8 °C on 9 January 2011 at Sidhi observatory.

HUMIDITY

During the southwest monsoon season the air is generally humid with values of relative humidity generally exceeding above 70%. During the rest of the year it is comparatively less. The driest part of the year is summer season when the value of relative humidity in the afternoon is at about 25% whereas it is about 45% in the morning.

CLOUDINESS

During the southwest monsoon season skies are generally heavily clouded to overcast. The cloudiness decreases in the post monsoon season. In the latter part of summer and post monsoon seasons, the clouding is moderate and cloudiness is more in the afternoon than the morning. In the rest of the year skies are generally clear or lightly clouded.

WINDS

Winds are generally light to moderate with some increase in force in the latter part of summer and southwest monsoon season. Winds are generally calm throughout the year except during the southwest monsoon and summer seasons when westerlies are predominant. In the post monsoon and winter seasons, winds are mostly calm.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during latter part of monsoon season and post monsoon season cross the east coast of India and move in a westerly or northwesterly direction across the peninsula. Some of these depressions affect the weather over the district and its neighbourhood causing widespread heavy rain and gusty winds. In the cold season western disturbances passing across north India affect the weather of the district. Thunderstorms and occasional dust storms occur during the summer months.

Tables 3, 4, 5 and 6 give the normals of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Sidhi observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
SIDHI

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
JAIWAN	32	a b	13.3 0.9	13.0 0.8	6.0 0.5	2.7 0.3	11.9 0.7	139.0 6.1	345.5 13.7	341.6 13.2	234.0 8.8	44.3 2.1	7.9 0.5	3.9 0.3	1163.1 47.9	167# (1985)	63 (1992)	238.8	24 SEP 1962
SIDHI	38	a b	14.0 1.3	20.3 1.4	7.6 0.6	5.3 0.7	12.5 1.1	139.9 6.7	345.8 14.1	303.6 13.6	230.8 9.4	35.4 2.0	7.4 0.5	6.4 0.6	1129.0 51.9	178 (1971)	53 (1974)	307.9	01 SEP 1997
SIDHI OBSY	40	a b	22.3 1.8	24.4 1.9	11.6 1.1	7.3 0.8	16.1 1.3	148.0 7.1	351.5 14.4	326.9 14.5	233.7 9.7	36.6 2.0	7.1 0.5	6.7 0.7	1192.2 55.8	175 (1971)	51 (1974)	307.9	01 SEP 1997
DISTRICT MEAN	3	a b	16.5 0.8	19.2 1.4	8.4 0.7	5.1 0.6	13.5 1.0	142.3 6.6	347.6 14.1	324.0 13.8	232.8 9.3	38.8 2.0	7.5 0.5	5.7 0.5	1161.4 51.8	160 1971	52 1974		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

TABLE – 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
SIDHI
(DATA 1971 - 2013)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
601 - 700	1	1301 - 1400	1
701 - 800	3	1401 - 1500	5
801 - 900	5	1501 - 1600	1
901 - 1000	3	1601 - 1700	2
1001 - 1100	5	1701 - 1800	0
1101 - 1200	4	1801- 1900	1
1201 - 1300	6		

(DATA AVAILABLE FOR 37 YEARS)

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
SIDHI

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	24.4	8.5	32.8	21-01-1959	0.8	09-01-2011	75	45
February	28.0	11.7	37.4	28-02-1989	2.0	10-02-1974	68	39
March	33.5	16.3	42.2	23-03-2004	7.8	10-03-1979	53	27
April	39.7	22.0	48.8	10-04-1959	11.8	01-04-1968	40	21
May	42.2	26.8	46.6	30-05-1988 19-05-2010	17.0	09-05-1960	43	27
June	38.8	27.6	47.4	09-06-1966	20.0	27-06-1968	61	49
July	33.8	26.0	43.2	01-07-1987	17.0	22-07-1968	79	70
August	32.4	25.3	39.4	03-08-1987	17.4	04-08-1968	85	76
September	32.6	24.3	39.0	11-09-1969	18.2	27-09-1972	82	71
October	32.9	20.3	39.6	06-10-2006	12.0	26-10-2009	75	54
November	29.8	14.4	36.4	05-11-2001	4.0	30-11-1970	73	50
December	26.2	9.0	34.6	08-12-2001	1.0	27-12-1961	75	51
Annual	32.7	19.2	48.8	10-04-1959	0.8	09-01-2011	67	48

TABLE – 4
Mean Cloud Amount *(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
SIDHI

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	25	22	27	26	26	14	5	4	12	23	26	28	236
b	1	1	0	0	0	2	4	7	4	2	1	0	23
c	1.3	1.1	0.7	0.9	0.8	2.8	4.7	5.1	3.5	1.4	0.8	0.6	1.9
1730 HOURS IST													
a	25	22	25	20	21	8	2	4	9	20	24	28	211
b	1	1	1	1	1	3	5	9	5	2	1	0	28
c	1.1	1.1	1.0	1.5	1.6	4.0	5.2	5.2	4.0	1.8	1.0	0.6	2.3

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
SIDHI

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.	0.6	0.7	0.8	0.5	0.3	1.1	1.9	1.2	1.1	0.6	0.3	0.3	0.8
Direction in the morning.	C	C	C	C/W	C/W	C/W	C/W	C/W	C/W	C	C	C	
Direction in the evening.	C	C/W	C/W	W/C	W/C	C/W	C/W	C/W	C/W	C	C	C	

TABLE - 6
Special Weather Phenomena
SIDHI

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust storm	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1

SINGRAULI DISTRICT

The climate of this district is characterized by hot dry summer season and general dryness except during southwest monsoon season. The year may be divided into four seasons. Winter season is from December to February, the summer (pre-monsoon) season from March to middle of June and southwest monsoon season is from the middle of June to September. The period of October and November constitutes post monsoon season.

RAINFALL

Records of rainfall in the district are available for Singrauli raingauge station for 34 years only. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 982.1 mm. The variation in rainfall from year to year is large. The rainfall in the southwest monsoon season constitutes about 90% of the annual normal rainfall, August being the month with the highest rainfall with an average value of 287.5 mm. In the fifty year period 1971 to 2020, the highest annual rainfall was in year 2003 when it amounted to 149% of the normal. In the year 1992, the annual rainfall in the district was the lowest during this period and amounted to only 50% of the normal. In this fifty year period the rainfall was less than 80% of the normal in 2 years and these years were not consecutive. It is seen from Table 2 that the annual rainfall was between 701 mm and 1200 mm in 12 years out of 18.

On an average there are 48 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours at any station in the district was 255.0 mm at Singrauli on 22nd July 2011.

TEMPERATURE

There is no meteorological observatory in the district so the description which follows is based on the neighbouring observatories viz. Sidhi and Churk observatories which are situated in the neighbouring districts where similar climatic conditions prevail. After February, temperature begins to rise steadily till May which is the hottest month with the mean maximum temperature at about 41°C and mean minimum temperature at about 26°C. The days in summer season are intensely hot and on some days, maximum temperature exceeds 48°C. With the advance of southwest monsoon into the district by middle of June there is drop in the day temperature. However, Nights in June are slightly warmer than May. After the withdrawal of monsoon by late September or the first week of October the day temperatures remain more or less same as in September, while drop in night temperature is appreciable. After November both day and night temperatures decrease rapidly. January is generally the coldest month with the mean maximum temperature at about 23.0°C and mean minimum temperature at about 9°C. In the winter season cold waves affect the district in the wake of passing western disturbances and minimum temperature drops down to about degree above freezing point of water.

HUMIDITY

In the south west monsoon months, air is generally humid, and relative humidity exceeds 75% in the mornings and 70% in the afternoon. Summer is the driest part of the year when the value of relative humidity is about 25% in the afternoon.

CLOUDINESS

In the southwest monsoon season skies are heavily clouded to overcast. In the rest of the year, skies are generally clear or lightly clouded. However, for brief spell of a day or two in the winter season, the skies are cloudy in association with passing western disturbances.

WINDS

Winds are generally light with a little strengthening in the latter part of summer and early part of monsoon season. In the winter and summer months winds are generally in southwesterly direction during mornings and northerly or northwesterly during evenings. In the southwest monsoon season winds are mostly southwesterly during mornings and northerly to northeasterly on some days along with southwesterly in the evenings. In the post-monsoon season, winds are predominantly southwesterly in the mornings and northerly to northeasterly in the evenings.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season cross the east coast and moving in westerly to northwesterly direction and pass through or in the neighbourhood of the district causing widespread and heavy rain and gusty winds. Occasionally post monsoon storms from the Bay of Bengal affect the weather of the district. In the winter season western disturbances passing across north India affect weather over district. Thunderstorm occurs in the district in summer and winter months and occasional dust-storms occur during summer months. Rain during the southwest monsoon season is often accompanied with thunder. Fog occurs occasionally in the mornings of winter season and part of post monsoon season.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
SINGRAULI

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
SINGRAULI	34	a	9.9	18.0	7.0	4.6	5.4	124.8	270.8	287.5	197.9	43.6	7.3	5.3	982.1	184#	50	255.0	22 JUL 2011
		b	0.9	1.3	0.6	0.5	0.7	5.9	13.2	13.0	8.4	2.0	0.5	0.5	47.5	(2011)	(1992)		
DISTRICT MEAN	1	a	9.9	18.0	7.0	4.6	5.4	124.8	270.8	287.5	197.9	43.6	7.3	5.3	982.1	149	50		
		b	0.6	1.5	0.5	0.5	0.4	5.9	13.2	13.0	8.4	2.0	0.5	0.5	47.5	2003	1992		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
SINGRAULI
(DATA 1971 – 2013)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 700	1	1001 - 1100	3
501 - 800	0	1101 - 1200	2
601 - 900	1	1201 - 1300	1
701 - 1000	1	1301 - 1400	1
801 - 1100	5	1401 - 1500	2
901 - 1200	1		

DATA AVAILABLE FOR 18 YEARS

TIKAMGARH DISTRICT

The climate of Tikamgarh district is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the hot season commences from March to about the middle of June. The period from mid-June to about the end of September is the southwest monsoon season. The period of October and November constitutes post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for two rain gauge stations . The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1001.1 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 91% of the annual normal rainfall. July and August are the rainiest months with the average rainfall with an average value of 326.1 mm. The annual rainfall in the district varies over a large range. In the fifty years period 1971 to 2010, the highest annual rainfall was in year 1982 when it amounted to 169% of the normal. In the year 2007, the annual rainfall in the district was the lowest in this period and amounted to only 32% of the normal. In this period the rainfall was less than 80% of the normal in 12 years and during the same period there was not a single occasion of occurrence of consecutive years. It is seen from Table 2 that the annual rainfall was between 701 mm and 1300 mm in 29 years out of 40.

On an average there are 45 rainy days (i.e.days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 319.2 mm at Tikamgarh on 27 August 1972 and at Tikamgarh observatory on 28 August 1972.

TEMPERATURE

There is one meteorological observatory in the district at Tikamgarh. Hence, the climatological description of the district which follows is based on the meteorological data of this observatory. From the middle of February temperatures begin to rise rapidly till May which is usually the hottest month of the year with the mean maximum temperature is at 41.9°C and mean minimum temperature is at 25.3°C. The intense heat in May and June with hot dust laden winds which may blow on many days make the weather very uncomfortable. On individual days the maximum temperature may reach 46°C. Thundershowers occasionally occur in afternoon and bring relief from the heat. With the onset of the southwest monsoon into the district after about the second week of June there is appreciable drop in temperatures and the weather becomes pleasant. After withdrawal of southwest monsoon by about the end of September day temperatures slightly change but the night temperatures continue to decrease. From November both the temperatures begin to drop rapidly. January is usually the coldest month with the mean maximum temperature at 24.6°C and mean minimum at 7.3°C. During winter season the district is affected by cold waves in the rear of the passing western disturbances and the minimum temperatures may go down to about the freezing point of water.

The highest maximum temperature ever recorded in the district was 47.5°C on 25 May 1989 and the lowest minimum temperature was -0.6°C on 07 February 1974 at Tikamgarh observatory.

HUMIDITY

During the southwest monsoon season the air is generally humid with values of relative humidity generally about 55% to 82% in the morning and about 47% to 75% in the afternoon. The driest part of the year is summer season when the value of relative humidity in the afternoon is about 37% whereas it is about 45% in the morning. Except during the southwest monsoon season, the air is generally dry, afternoons being drier than in the mornings. In the post monsoon and winter season relative humidities in the afternoons are about 58%.

CLOUDINESS

During the southwest monsoon season skies are generally heavily clouded to overcast. In the rest of the year skies are generally clear or lightly clouded.

WINDS

Winds are generally light to moderate with some increase in force in the latter part of summer and southwest monsoon season. During the southwest monsoon season winds mostly blow from east directions. In the post monsoon and winter seasons winds are easterly or southerly in the mornings, they blow from directions between south and west in the afternoons. In the summer winds are predominantly from the east and south directions in the mornings whereas southerlies are predominant in the afternoons.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season and post monsoon season cross the east coast of India and move in a westerly or north-westerly direction across the peninsula. Some of these depressions affect the weather over the district and its neighbourhood causing widespread heavy rain and gusty winds. In the cold season western disturbances passing across north India affect the weather of the district. Thunderstorms and occasional dust storms occur during the summer months. Rain during the southwest monsoon season is often accompanied with thunder.

Tables 3, 4, 5 and 6 give the normal of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Tikamgarh observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
TIKAMGARH

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
TIKAMGARH	42	a b	11.2 0.9	12.5 1.0	3.3 0.4	2.0 0.3	5.9 0.6	116.1 5.0	311.9 12.8	344.6 14.0	161.2 7.1	34.9 1.4	9.8 0.5	6.6 0.5	1020.0 44.5	167 (1982)	32 (2007)	319.2	27 AUG 1972
TIKAMGARH OBSY	32	a b	11.4 0.8	14.7 1.3	7.0 0.9	2.9 0.4	10.5 0.9	115.4 4.8	340.8 13.6	307.5 12.9	130.5 6.7	24.4 1.0	11.1 0.5	5.6 0.5	981.8 45.0	172 (1982)	55 (2012)	319.2	28 AUG 1972
DISTRICT MEAN	2	a b	11.3 0.9	13.6 1.1	5.2 0.6	2.5 0.4	8.2 0.8	115.8 5.3	326.3 13.2	326.0 13.5	145.9 6.9	29.7 1.2	10.5 0.5	6.1 0.5	1001.1 44.9	169 1982	32 2007		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS OF OCCURRENCE GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
TIKAMGARH
(DATA 1971 - 2013)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
301 - 400	1	1001 - 1100	3
401 - 500	0	1101 - 1200	2
501 - 600	0	1201 - 1300	5
601 - 700	3	1301 - 1400	1
701 - 800	8	1401 - 1500	4
801 - 900	7	1501 - 1600	1
901 - 1000	4	1601 - 1700	1

(DATA AVAILABLE FOR 40 YEARS)

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
TIKAMGARH

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	24.6	7.3	36.2	01-01-1994	-0.2	08-01-1972	65	58
February	27.9	11.3	37.5	27-02-2006	-0.6	07-02-1974	63	54
March	33.9	16.9	41.6	23-03-2010	5.0	05-03-1984	55	46
April	38.3	21.6	47.1	10-04-1985	7.6	03-04-1990	40	35
May	41.9	25.3	47.5	25-05-1989	9.5	10-05-2011	40	30
June	39.1	25.6	46.6	10-06-1993	16.0	23-06-1989 27-06-2003	56	48
July	33.2	23.5	45.0	01-07-1991	16.0	27-07-1991	79	71
August	31.8	23.2	41.0	23-08-2002	16.0	01-08-1991	81	74
September	32.6	22.7	38.4	15-09-1988	8.0	10-09-2002	79	70
October	33.1	18.5	38.3	14-10-1979	10.0	28-10-1991	68	62
November	30.1	13.2	36.1	05-11-1977	3.2	29-11-1970	66	60
December	26.4	9.2	33.3	17-12-1985	0.0	29-12-1971	65	57
Annual	32.9	18.2	47.5	25-05-1989	-0.6	07-02-1974	63	55

TABLE – 4
Mean Cloud Amount ^{}(Okta of the Sky) and Mean Number**
of days of Clear and Overcast Skies
TIKAMGARH

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a													
b													
c	0.5	0.4	0.1	0.1	0.0	0.9	3.0	2.3	1.3	0.1	0.3	0.3	0.8
1730 HOURS IST													
a													
b													
c	0.1	0.1	0.0	0.0	0.0	1.1	2.8	2.1	1.0	0.0	0.2	0.1	0.6

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

^{**} Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.

For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
TIKAMGARH

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.													
Direction in the morning.	S/SW	W/E	E/S	E/S	E/SE/S	E	E	E	E	E/SE	E/NE	S/E	
Direction in the evening.	S/W	S/W	S	S/W	S/SE	E/S	E	E/W	E/SE/S	S/SE	S	S	

TABLE - 6
Special Weather Phenomena
TIKAMGARH

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.5
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2

UMARIA DISTRICT

The climate of this district is characterized by hot dry summer season and general dryness except during southwest monsoon season.

The year may be divided into four seasons. Winter season is from December to February, the summer (pre-monsoon) season from March to middle of June and southwest monsoon season is from the middle of June to September. The period of October and November constitutes post monsoon season.

RAINFALL

Records of rainfall in the district are available for only one raingauge station for the period of 42 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 1222.0 mm. The variation in rainfall from year to year is large. The rainfall in the southwest monsoon season constitutes about 88% of the annual normal rainfall, August being the month with the highest rainfall with an average value of 396.9 mm. In the fifty-year period 1971 to 2020, the highest annual rainfall was in year 1971 when it amounted to 164% of the normal. In the year 1979, the annual rainfall in the district was the lowest during this period and amounted to only 50% of the normal. In this fifty-year period the rainfall was less than 80% of the normal in 7 years and there was not a single occasion for occurrence of consecutive years. It is seen from Table 2 that the annual rainfall was between 901 mm and 1500 mm in 19 years out of 28.

On an average there are 59 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours at any station in the district was 305.0 mm on 9th September 1983 at Umaria observatory.

TEMPERATURE

There is a meteorological observatory in the district at Umaria situated at the elevation of 459 metres above mean sea level. The records of this observatory may be taken as representative of meteorological conditions prevailing in the district in general.

From the beginning of March, temperatures begin to rise rapidly till first week of June. May is the hottest month with the mean maximum temperature at 41.8 °C and mean minimum temperature at 24.1 °C. In the latter part of the summer season i.e. April, May and early part of June, the maximum temperature sometimes reaches about 44 °C to 46 °C on individual days. During the latter part of summer until the onset of the monsoon by second week of June, days are uncomfortable with hot dusty winds. However, the afternoon thundershowers which occur on some days bring welcome relief though only temporarily. With the advance of the southwest monsoon into the district towards the middle of June, the day temperatures fall rapidly while drop in night temperature is comparatively small. With the withdrawal of the monsoon by about end of September, day temperatures remain same level in October but there is rapid drop in the night temperatures. Both the temperatures begin to decrease rapidly after October. December and January are the coldest months of the year when mean maximum temperature is at about 25.9 °C and mean minimum temperature at about 6.5 °C. In winter months, cold waves sometimes affect the district in the wake of western disturbances passing across north India, the minimum temperatures may sometimes drop down to about the freezing point of water.

The highest maximum temperature ever recorded at Umaria was 48.7 °C on 17th April 2000 and 11th June 2009. The lowest minimum was 0.0 °C on 13th January 1992, 05th January 2011 and 3rd December 2000.

HUMIDITY

In the south west monsoon months, air is generally humid, and relative humidity exceeds 80% in the mornings and it exceeds 75% in the afternoon. Air is generally mildly humid in post monsoon and winter seasons. The humidity is generally less in the afternoons than in the mornings. Summer is the driest part of the year when the value of relative humidity is about 30% in the afternoon.

CLOUDINESS

In the southwest monsoon season skies are heavily clouded to overcast. In the rest of the year, skies are generally clear or lightly clouded.

WINDS

Winds are generally light with a little strengthening in the latter part of summer and early part of monsoon season. In the southwest monsoon season winds are mostly southwesterly to northwesterly. In the rest of the year winds are generally in northwesterly direction and calm winds are also sometimes observed. During the monsoon season, when depressions affect the weather of the district, the district may experience occasionally gusty winds.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season cross the east coast and moving in some west direction pass through or in the neighbourhood of the district causing widespread and locally heavy rain and gusty winds. Occasionally post monsoon storms from the Bay of Bengal affect the weather of the district. Thunderstorm occurs in the district throughout the year. Its frequency is more in the latter part of summer season and in the southwest monsoon season. Fog occurs occasionally in the mornings of winter season and latter part of post monsoon season.

Table 3, 4, 5 and 6 give the normals of temperature and humidity, cloudiness, wind speed and direction, and special weather phenomena respectively for Umaria observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
UMARIA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT (mm)	DT MON YEAR
UMARIA OBSY	42	a b	25.0 1.8	24.8 2.0	12.9 1.0	8.4 1.0	8.1 1.0	151.7 7.2	305.2 15.3	396.9 16.4	219.1 9.6	42.9 2.2	13.6 0.8	13.4 1.0	1222.0 59.3	164 (1971)	50 (1979)	305.0	09 SEP 1983
DISTRICT MEAN	1	a b	25.0 1.8	24.8 2.0	12.9 1.0	8.4 1.0	8.1 1.0	151.7 7.2	305.2 15.3	396.9 16.4	219.1 9.6	42.9 2.2	13.6 0.8	13.4 1.0	1222.0 59.3	164 (1971)	50 (1979)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
UMARIA
(DATA 1971 – 2013)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
601 - 700	1	1301 - 1400	0
701 - 800	0	1401 - 1500	4
801 - 900	3	1501 - 1600	1
901 - 1000	4	1601 - 1700	0
1001 - 1100	7	1701 - 1800	3
1101 - 1200	4	1801 - 1900	0
1201 - 1300	0	1901 - 2000	1

DATA AVAILABLE FOR 28 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
UMARIA

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	25.1	6.8	34.4	24-01-1943	0.0	13-01-1992 05-01-2011	81	55
February	28.6	10.0	37.6	27-02-2006	0.4	03-02-2002	71	47
March	34.1	14.8	41.0	31-03-1994	4.4	05-03-2002	56	34
April	39.0	19.9	48.7	17-04-2000	10.6	01-04-1968	43	29
May	41.8	24.1	46.9	28-05-1998	14.0	30-05-2002	42	29
June	38.1	24.0	48.7	11-06-2009	14.2	12-06-1988	61	50
July	32.0	21.9	41.5	06-07-1982	13.2	10-07-1980	83	76
August	30.7	21.0	37.8	03-08-1972	11.0	30-08-1991	87	81
September	31.6	20.4	36.2	12-09-1968	11.0	30-09-2002	83	76
October	31.8	16.0	38.0	24-10-2000	6.1	18-10-2004 28-10-2002	76	61
November	29.2	10.7	35.0	04-11-1963	1.0	29-11-2002 30-11-2013	75	56
December	26.6	6.2	32.5	11-12-1993	0.0	03-12-2000	78	54
Annual	32.3	16.2	48.7	17-04-2000 11-06-2009	0.0	13-01-1992 05-01-2011 03-12-2000	70	54

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
UMARIA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	17	16	18	15	15	4	1	0	4	13	16	18	137
b	1	0	0	0	0	2	6	8	4	0	1	0	22
c	1.8	1.6	1.6	1.7	1.8	4.2	5.7	6.0	4.4	2.4	2.0	1.4	2.9
1730 HOURS IST													
a	15	14	14	8	7	1	0	0	3	9	14	17	102
b	1	0	1	1	0	3	7	7	4	1	1	0	26
c	2.3	2.0	2.2	3.0	3.0	5.1	5.9	6.0	4.9	2.9	2.4	1.9	3.5

a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
UMARIA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	C	C	C	C/NW	C/W/NW	C/SW/NW	C/SW/W	C/SW/N W	C/NW	C	C	C	
Direction in evening	C/NW	C/NW	NW/C	NW	NW	NW/C/SW	C	C	C	C	C	C	

TABLE - 6
Special Weather Phenomena
UMARIA

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.1	0.1	0.1	0.1	0.1	0.2	0.6	0.3	0.2	0.2	0.0	0.1	2.1
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5

**DISTRICT
CLIMATOLOGICAL
SUMMARY OF
WEST
MADHYA PRADESH**

AGAR DISTRICT

The district has a dry climate except in the southwest monsoon season. The year may be divided into four seasons. The period from March to May which is the hot season is followed by the monsoon season from June to September. The period of October and November may be termed as the post monsoon period while the cold season is from December to February.

RAINFALL

Records of rainfall in the district are available for 3 raingauge stations for the period ranging from 32 to 44 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. Average annual rainfall in the district as a whole is 951.7 mm. During the southwest monsoon season (June to September) the district receives 94% of the annual rainfall. July and August are the rainiest months with an average rainfall of about 315.7 mm. The variation in the rainfall from year to year is not very large. In the fifty year period 1971-2020, the highest annual rainfall amounting to 203% of the normal occurred in year 2019, while the lowest annual rainfall which was only 49% of the normal occurred in 1972. In this fifty year period there were 9 years in which the rainfall in the district was less than 80% of the normal. There was one occasion when such a low rainfall occurred in three consecutive years and two occasions of two consecutive years in this fifty year period. It is seen from Table 2 that the rainfall was between 701 mm and 1100mm in 20 years out of 35.

On an average there are 38 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 321.3 mm at Agar on 6th September 1932.

TEMPERATURE

There is no meteorological observatory in the district so the description that follows is based on the records of the meteorological data of the Shajapur observatory in the neighbouring district, where similar meteorological conditions prevail. After February temperature increases steadily. May is generally the hottest month with the mean daily

maximum temperature at about 41 °C and the mean daily minimum temperature at about 26 °C. The heat in summer is intense and the hot dust laden winds which blow on many days make the weather very comfortable. On individual days the maximum temperature may go above 45°C. With the onset of the monsoon in the district by about the middle of June there is appreciable drop in temperature. By about the end of September when the monsoon withdraws there is a slight increase in the day temperature but the nights become progressively cooler. After November there is rapid drop in both the day and night temperatures. January is the coldest month with the mean daily maximum temperature at about 26 °C and the mean daily minimum at about 9 °C. In the cold season, in association with western disturbances passing across north India cold waves affect the district and the minimum temperature occasionally drops down to about a couple of degree or so above the freezing point of water.

HUMIDITY

Morning humidity is generally high during the period from June to September when it ranges between 63% and 80% while afternoon humidity ranges between 44% and 76%. During the period of post monsoon and winter season, values of relative humidity in the morning ranges between 60% and 69% whereas afternoon humidities ranges between 33% and 47%.The summer season is the driest part of the year when the relative humidities in the afternoons are about 21%.

CLOUDINESS

During the southwest monsoon season skies are mostly moderate to heavily clouded. The skies are generally clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light with some strengthening in force during the late summer and monsoon season. Winds blow mostly from west direction from the month of May till the end of southwest monsoon season. In the post monsoon and winter season, winds mostly blow from northeast direction. Westerlies or north-westerlies appear in the month of March in the afternoons and continue till the end of April.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season move in some westerly direction and reach the district or its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms occur during the pre-monsoon and southwest monsoon season.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
AGAR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
AGAR	44	a	8.2	5.2	3.9	1.9	5.1	114.2	324.4	344.8	150.1	22.8	5.7	9.7	996.0	215	41	321.3	06 SEP 1932
		b	0.5	0.4	0.4	0.2	0.3	5.3	11.5	11.6	6.2	0.8	0.3	0.4	37.9	(2015)	(1972)		
NALKHEDA	32	a	2.9	8.0	4.1	1.5	2.0	112.1	323.1	297.0	145.6	22.1	4.3	11.4	934.1	211	40	210.1	10 JUL 2016
		b	0.3	0.5	0.3	0.1	0.2	5.5	11.2	11.3	6.5	1.1	0.3	0.4	37.7	(2019)	(2002)		
SUSNER	42	a	7.7	3.2	3.3	2.0	5.6	106.0	302.9	301.9	149.3	27.2	7.8	7.9	924.8	196	55	289.6	06 JUL 1952
		b	0.6	0.4	0.3	0.3	0.5	5.5	11.1	11.2	6.1	1.0	0.4	0.3	37.7	(2019)	(2002)		
DISTRICT MEAN	3	a	6.3	5.5	3.8	1.8	4.2	110.8	316.8	314.6	148.3	24.0	5.9	9.7	951.7	203	49		
		b	0.5	0.4	0.3	0.2	0.3	5.4	11.3	11.4	6.3	1.0	0.3	0.4	37.8	2019	1972		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
AGAR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	1	1201 - 1300	6
501 - 600	1	1301 - 1400	0
601 - 700	4	1401 - 1500	0
701 - 800	4	1501 - 1600	0
801- 900	10	1601- 1700	0
901- 1000	4	1701- 1800	1
1001- 1100	2	1801- 1900	0
1101- 1200	1	1901- 2000	1

DATA AVAILABLE FOR 35 YEARS

ALIRAJPUR DISTRICT

The climate of this district is generally dry except in the monsoon months. The period from March to May which is the hot season is followed by the monsoon season from June to September. October and November may be termed as the post monsoon period while January and February is the period of winter season.

RAINFALL

Records of rainfall in the district are available for 3 rain gauge stations for the period ranging from 32 to 44 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. Average annual rainfall in the district as a whole is 924.4 mm. During the southwest monsoon season (June to September) the district receives 94% of the annual rainfall. August is the rainiest month with an average rainfall of about 301.4 mm. The variation in the rainfall from year to year is very large. In the fifty year period 1971-2020, the highest annual rainfall amounting to 167% of the normal occurred in year 1973, while the lowest annual rainfall which was only 43% of the normal occurred in 1985. In this fifty year period there were 16 years in which the rainfall in the district was less than 80% of the normal. There were two occasions when such a low rainfall occurred in 2 consecutive years, one occasion each for four and three consecutive years respectively in this fifty year period. It is seen from Table 2 that the rainfall was between 701 mm and 1200 mm in 16 years out of 41.

On an average there are 44 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 345.0 mm at Bhabra on 28th July 1996.

TEMPERATURE

There is only one meteorological observatory in the district at Alirajpur so the description that follows is based on the records of the meteorological data of this observatory. The hot season commences by March and temperatures rise gradually with the advance of the season. May is the hottest month with the mean

daily maximum temperature at 39.2 °C and the mean daily minimum temperature at 25.1 °C. The maximum temperature may sometimes reach to about 44 °C. With the onset of the monsoon by about the middle of June, the weather becomes cool. After the withdrawal of the monsoon by the end of September, day temperatures increase slightly. From November both day and night temperatures decrease continuously till January, which is the coldest month. The mean daily minimum temperature in January is 10.3 °C. In the wake of some western disturbances passing across north India, cold waves affect the district and temperatures may go down on some occasions to about couple degree above the freezing point of water.

The highest maximum temperature ever recorded in the district was 46.2°C on 20th April 1999 and the lowest minimum temperature was 0.0 °C on 22nd January 1962 at Alirajpur observatory.

HUMIDITY

Morning humidity is generally high during the period from June to September when it ranges between 70% and 86% while afternoon humidity ranges between 49% and 77%. In the summer and winter season, values of humidities are low both in the morning and afternoon. During the period of post monsoon season, values of morning and evening relative humidity start to decrease than that of southwest monsoon season.

CLOUDINESS

During the southwest monsoon season skies are mostly heavily clouded and often overcast. The skies are generally clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light in the post monsoon and winter months. Wind speed increases during the summer months. They are moderate to strong during the period May to about the middle of September. During the period of pre

monsoon and southwest monsoon season winds mainly blow from west direction . Easterly winds begin to blow from November during the morning. These winds become predominant during the period of post monsoon and winter months. Westerlies blow in the evening in the winter season.

SPECIAL WEATHER PHENOMENA

In October and to a lesser extent in the monsoon months, the district is affected by depressions which move across the country, causing widespread rain. Occasional thunderstorms occur in the months of pre monsoon and southwest monsoon season. During the monsoon, rainfall is sometimes associated with thunder. Fog also generally occurs during the post monsoon and winter season.

Table 3 and 4 give the normals of temperature, windspeed and wind direction respectively for Alirajpur observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
ALIRAJPUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
ALIRAJPUR	44	a b	0.7 0.1	0.5 0.0	0.6 0.1	1.2 0.1	8.3 0.3	114.4 5.5	271.4 13.0	259.0 12.9	139.4 6.6	26.2 1.7	10.6 0.6	3.1 0.2	835.4 41.0	180 (1973)	48 (1985)	331.2	21 JUL 1971
BHABRA	32	a b	2.2 0.1	0.0 0.0	1.9 0.1	2.2 0.2	6.3 0.3	137.1 5.8	322.4 15.6	340.0 15.0	175.7 7.8	30.4 1.6	6.7 0.2	3.4 0.1	1028.3 46.8	157 (1996)	58 (1999)	345.0	28 JUL 1996
JOBAT	40	a b	1.7 0.1	0.5 0.0	3.6 0.2	2.8 0.2	4.1 0.2	120.4 5.3	250.1 13.4	305.3 13.9	177.4 7.8	28.5 1.8	12.5 0.7	2.9 0.3	909.8 43.9	178 (2013)	55 (1974)	234.9	09 JUL 1958
DISTRICT MEAN	3	a b	1.5 0.1	0.3 0.1	2.0 0.1	2.1 0.1	6.2 0.3	124.0 5.5	281.3 14.0	301.4 13.9	164.2 7.4	28.4 1.7	9.9 0.5	3.1 0.2	924.4 43.9	167 1973	43 1985		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
ALIRAJPUR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
301 - 400	1	1001 - 1100	4
401 - 500	4	1101 - 1200	2
501 - 600	3	1201 - 1300	3
601 - 700	8	1301 - 1400	3
701 - 800	2	1401 - 1500	2
801 - 900	2	1501 - 1600	1
901 - 1000	6		

DATA AVAILABLE FOR 41 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
ALIRAJPUR

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	26.0	9.5	35.0	30-01-2005	0.0	22-01-1962	52	46
February	29.3	11.5	38.0	05-02-1996	0.1	12-02-1996	45	33
March	34.5	15.0	42.4	30-03-1994	0.5	04-03-2004	39	28
April	37.5	20.1	46.2	20-04-1999	13.0	05-04-2008	42	30
May	38.2	23.3	46.0	29-05-1995	16.0	22-05-1995	50	35
June	35.1	21.9	43.6	05-06-1979	10.0	21-06-1996	63	52
July	29.9	20.7	39.8	02-07-1976	13.0	26-07-1995	78	75
August	28.5	20.1	37.4	15-08-2007	13.0	22-08-1995	82	78
September	29.9	20.0	38.0	18-09-1974	12.0	12-09-1995	77	72
October	32.1	17.3	44.5	18-10-1980	10.0	09-10-1995	52	52
November	29.4	13.8	39.5	01-11-1980	5.0	25-11-1994 30-11-2002	49	50
December	26.9	9.7	38.0	02-12-1980	0.5	28-12-1998	51	51
Annual	31.4	17.0	46.2	20-04-1999	0.0	22-01-1962	56	49

TABLE - 4
Mean Wind Speed and Predominant Wind Direction
ALIRAJPUR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	E	E	W	W	W	W	W	W	W	E	E	E	
Direction in evening	W/E	W	W	W	W	W	W	W/SW	W	W/E/N W	E	E	

ASHOKNAGAR DISTRICT

The climate of this district is characterized by a hot summer and general dryness except during the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the summer season from March to mid-June. The period from mid-June to about the end of September is the southwest monsoon season. The period from October to November constitute the post-monsoon season.

RAINFALL

Records of rainfall in the district are available for 3 raingauge stations for the period ranging from 30 to 45 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. Average annual rainfall in the district as a whole is 921.5 mm. During the southwest monsoon season (June to September) the district receives 93% of the annual rainfall. July is the rainiest month with an average rainfall of about 307.8 mm. The variation in the annual rainfall from year to year in the district is large. In the fifty year period 1971-2020, the highest annual rainfall amounting to 155% of the normal occurred in year 2011, while the lowest annual rainfall which was only 39% of the normal occurred in 1979. In this fifty year period there were 10 years in which the rainfall in the district was less than 80% of the normal. There were two occasions when such a low rainfall occurred in two consecutive years. It is seen from Table 2 that the rainfall was between 601 mm and 1100mm in 27 years out of 39.

On an average there are 40 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 305.6 mm at Issagarh on 25th June 1899.

TEMPERATURE

There is no meteorological observatory in the district so the description that follows is based on the records of the meteorological data of the Guna observatory in the neighbouring district, where similar meteorological conditions prevail. From

March temperatures increase steadily. May is generally the hottest month with the mean daily maximum temperature at about 42.0 °C and the mean daily minimum temperature at about 26.3 °C. With the arrival of the monsoon over the district by about the middle of June there is appreciable drop in temperatures. After the withdrawal of the monsoon by about the last week of September, there is a slight increase in day temperatures and continues till October but the nights become progressively cooler. After the month of October, both the day and night temperatures decrease rapidly. January is generally the coldest month with the mean daily maximum temperature at about 24.4 °C and the mean daily minimum at about 9.0 °C. In the cold season, the district is sometimes affected by cold waves in the rear of passing western disturbances and the minimum temperature occasionally drops down to about the freezing point of water and frosts occur.

HUMIDITY

Relative humidity during the monsoon season is high, generally about 70% on the average. Value of humidity is comparatively less during the rest of the year, the driest part of the year being the summer season with values of humidity about 25% in the afternoons.

CLOUDINESS

During the southwest monsoon season skies are mostly moderate to heavily clouded. The skies are generally clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light over the district with some strengthening in force during the southwest monsoon season. Southwesterly wind is predominant during latter part of summer and southwest monsoon season. In the post monsoon season, winds are mostly either calm or blow from southeast / Northeast . Winds mainly blow from northeast or east directions in the morning during the cold season.

SPECIAL WEATHER PHENOMENA

Heavy rain and strong winds are caused in the district by the depressions which come from the Bay of Bengal during the monsoon season. Thunderstorms occur almost throughout the year. Fog is experienced on a few occasions during winter season.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
ASHOKNAGAR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
ASHOKNAGAR	41	a b	10.2 0.7	14.0 0.9	5.8 0.4	2.3 0.2	2.2 0.2	107.8 5.0	308.5 12.6	279.3 13.0	146.7 6.6	36.9 1.6	3.7 0.3	11.4 0.6	928.8 42.1	160 (1985)	34 (1979)	286.0	23 JUN 2011
ISSAGARH	30	a b	5.6 0.5	8.3 0.7	2.7 0.3	0.0 0.0	2.8 0.2	113.8 5.2	311.4 12.1	281.9 11.8	149.5 5.7	18.7 1.0	3.0 0.2	10.6 0.3	911.5 38.2	133 (2019)	66 (2010)	305.6	25 JUN 1899
MUNGAOLI	45	a b	5.8 0.5	10.1 0.6	3.2 0.3	1.2 0.1	4.4 0.2	97.4 4.6	303.6 12.3	301.9 12.4	158.1 6.4	22.9 0.9	6.4 0.4	9.5 0.5	924.5 39.2	175 (2011)	43 (1979)	294.6	30 JUL 1923
DISTRICT MEAN	3	a b	7.2 0.6	10.8 0.7	3.9 0.3	2.2 0.2	3.1 0.2	106.3 4.9	307.8 12.3	287.7 12.4	151.4 6.2	26.2 1.2	4.4 0.3	10.5 0.5	921.5 39.8	155 2011	39 1979		

- (a) NORMAL RAINFALL IN MM
(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)
(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR
(*) BASED ON ALL AVAILABLE DATA UPTO 2020
(**) YEARS GIVEN IN BRACKETS
(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
ASHOKNAGAR
(DATA 1973 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
301 - 400	1	901 - 1000	6
401 - 500	0	1001 - 1100	4
501 - 600	1	1101 - 1200	4
601 - 700	5	1201 - 1300	3
701 - 800	8	1301 - 1400	2
801 - 900	4		

DATA AVAILABLE FOR 39 YEARS

BARWANI DISTRICT

The climate of this district is generally dry except in the monsoon months. The year may be divided into four seasons. The cold season from December to February is followed by the hot season from March to May. The southwest monsoon season follows thereafter and lasts till September. The period of October and November constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for 5 raingauge stations for the period ranging from 41 to 50 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. Average annual rainfall in the district as a whole is 719.1 mm. During the southwest monsoon season (June to September) the district receives 93% of the annual rainfall. July and August are the rainiest months with an average rainfall of about 212.3 mm. The variation in the rainfall from year to year is not very large. In the fifty year period 1971-2020, the highest annual rainfall amounting to 182% of the normal occurred in year 2019, while the lowest annual rainfall which was only 64% of the normal occurred in 1985. In this fifty year period there were 10 years in which the rainfall in the district was less than 80% of the normal and there was one occasion of such a low rainfall occurred for 2 consecutive years. It is seen from Table 2 that the rainfall was between 501 mm and 900 mm in 341 years out of 43.

On an average there are 38 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 35 at Barwani to 42 at Pansemal (Toppa).

The heaviest rainfall in 24 hours recorded at any station in the district was 320.0 mm at Pansemal (Toppa) on 29th September 1954.

TEMPERATURE

There is no meteorological observatory in the district so the description that follows is based on the records of the meteorological data of the observatory in the neighbouring West Nimar (Khargone) district where similar climatic conditions prevail. The hot season commences by March and temperatures begin to rise rapidly from March. May is the hottest month of the year with the mean daily maximum temperature at about 42°C and the mean daily minimum temperature at about 26 °C. During May and in June before the onset of the southwest monsoon season, the day temperatures sometimes rise up to about 47 °C. Thunder showers that occur on some summer afternoons bring welcome relief. With the onset of the monsoon by about the middle of June, there is an appreciable drop in the day temperature. After the withdrawal of the monsoon by the end of September, day temperatures increase slightly and a secondary maximum in day temperature is recorded in October. After October both day and night temperatures steadily decrease. December and January constitute the coldest part of the year with the mean daily maximum temperature at about 30°C and mean daily minimum temperature at about 11°C. During the cold season, in association with the eastward passage of western disturbances across North India, the district experiences spells of cold weather when the minimum temperatures sometimes drop down to about couple of degree above the freezing point of water.

HUMIDITY

Morning humidity is generally high above 70% during the period from June to January when it ranges between 69% and 86% while afternoon humidity ranges between 55% and 80%. The summer is the driest part of the year when the values of relative humidity especially in the afternoons are about 50%.

CLOUDINESS

During the southwest monsoon season skies are mostly lightly to moderately clouded. The skies are generally clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light except during the latter half of summer and the southwest monsoon season when they are moderate. During the period of summer season winds mainly blow from the west direction, whereas southerlies also appear in the evening. During the southwest monsoon season winds are mostly westerly or southwesterly. In the rest of the year winds are light and blows mainly from south direction both in the morning and in the afternoon. Sometimes westerly winds also blow in this period.

SPECIAL WEATHER PHENOMENA

In association with depressions which form in the Bay of Bengal during the southwest monsoon season and move in a westnorthwesterly direction across the central parts of the country and less frequently with storms and depressions of post monsoon months from the Bay of Bengal, the district experiences widespread heavy rain and strong winds. Thunderstorms occur occasionally during the summer and southwest monsoon months. Dust storms occur occasionally in the summer afternoons.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
BARWANI

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BARWANI	41	a b	0.4 0.1	0.9 0.1	1.4 0.1	2.0 0.1	4.3 0.4	94.4 5.5	164.7 10.0	167.5 9.4	119.5 6.1	30.1 1.7	10.7 0.6	6.0 0.4	601.9 34.5	172# (2006)	42 (2012)	254.1	06 SEP 1970
PANSEMAL (TOPPA)	41	a b	0.7 0.1	0.4 0.0	0.9 0.0	1.0 0.1	2.0 0.2	118.1 5.8	211.9 12.9	224.7 13.2	126.3 7.0	31.2 1.7	6.5 0.5	3.1 0.1	726.8 41.6	178 (2013)	61 (1985)	320.0	29 SEP 1954
RAJPUR	43	a b	3.7 0.1	1.2 0.1	1.1 0.1	0.4 0.1	2.3 0.2	106.8 5.3	229.8 10.5	219.5 10.2	138.0 6.1	28.1 1.4	8.2 0.6	5.5 0.4	744.6 35.1	176 (1973)	57 (1987)	253.0	22 SEP 2013
SENDHWA(MED)	50	a b	3.5 0.2	0.0 0.0	1.2 0.1	0.5 0.1	3.1 0.3	111.0 5.8	212.2 10.9	211.5 10.6	155.9 6.9	22.9 1.5	9.2 0.6	7.2 0.3	738.2 37.3	183 (2019)	41 (1995)	293.6	25 JUL 1990
THIKRI HYDRO	43	a b	2.2 0.3	1.4 0.2	1.9 0.3	0.9 0.1	6.2 0.5	105.6 5.5	221.5 11.8	259.4 11.5	141.4 6.6	29.0 1.5	8.8 0.6	5.2 0.4	783.5 39.3	160 (2019)	58 (1972)	253.7	29 JUL 1967
DISTRICT MEAN	5	a b	2.1 0.2	0.8 0.1	1.3 0.1	1.0 0.1	3.6 0.3	107.2 5.6	208.0 11.2	216.5 11.0	136.2 6.5	28.3 1.6	8.7 0.6	5.4 0.3	719.1 37.6	182 2019	64 1985		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
BARWANI
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	3	901 - 1000	5
501 - 600	9	1001 - 1100	2
601 - 700	9	1101 - 1200	0
701 - 800	7	1201 - 1300	1
801 - 900	6	1301 - 1400	1

DATA AVAILABLE FOR 43 YEARS

BETUL DISTRICT

The climate of this district is pleasant though marked by dryness during the greater part of the year, the summer being generally milder than in the surrounding districts. The year may be divided into four seasons. The cold season from December to February is followed by the summer season from March to May. The southwest monsoon season follows thereafter lasts till September. The period of October and November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 9 raingauge stations for the period ranging from 31 to 49 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. Average annual rainfall in the district as a whole is 1134.8 mm. The southwest monsoon reaches the district by about the second week of June and withdraws by about the beginning of October. During the southwest monsoon season (June to September) the district receives 90% of the annual rainfall. July and August are the rainiest months with an average rainfall of about 347.9 mm. The variation in the rainfall from year to year is considerably large. In the fifty year period 1971-2020, the highest annual rainfall amounting to 159% of the normal occurred in year 1984, while the lowest annual rainfall which was only 63% of the normal occurred in 1987. In this fifty year period there were 12 years in which the rainfall in the district was less than 80% of the normal and there was one occasion when such a low rainfall occurred in 2 consecutive years in this fifty year period. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 30 years out of 49.

On an average there are 51 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 42 at Atner to 61 at Betul observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 466.2 mm at Sarani Dam Hydro on 3rd August 1984.

TEMPERATURE

The only meteorological observatory in the district is at Betul. The records of temperature and other meteorological parameters at this station can be taken as representing the climatic conditions in the district as a whole. The summer season starts early in March when temperatures begin to rise steadily. May is the hottest month of the year with the mean daily maximum temperature at 40.7 °C and the mean daily minimum temperature at 25.1 °C. During May the day temperatures sometimes rise up to about 45 °C. With the onset of the monsoon by about the middle of June, the weather cools down appreciably. In the southwest monsoon season the day temperatures are not very different from those in the winter season, but the night temperatures are higher. The day temperature shows a slight increase in October and thereafter begins to fall, while the night temperatures decrease continuously after the end of the southwest monsoon season. December and January months constitute the coldest part of the year with the mean daily minimum temperature at about 10.0 °C and mean daily maximum at about 27.7 °C. Day temperatures are slightly lower in January than December. In the winter season, the district is sometimes affected by cold waves in the wake of western disturbances which pass eastwards across north India. On such occasions the minimum temperatures may go down two to three degree above the freezing point of water.

The highest maximum temperature ever recorded in the district was 48.0°C on 6th May 1993 and the lowest minimum temperature was -0.2 °C on 29th January 1977 at Betul observatory.

HUMIDITY

Morning humidity is generally high above 70% during the period of southwest monsoon season when it ranges between 70% and 95% while afternoon humidity ranges between 56% and 85%. In the post monsoon and winter season, value of relative humidity is generally above 70% in the morning. The summer is the driest part of the year when the values of relative humidity, especially in the afternoons are about 25%.

CLOUDINESS

During the southwest monsoon season skies are mostly moderate to heavily clouded. The skies are generally clear or lightly clouded in the rest of the year.

WINDS

Winds are generally light to moderate throughout the year. Westerly and Northwesterly winds are predominant during the southwest monsoon season. In the post monsoon and winter season winds mostly blow from northeast and east directions. Northwesterly winds are predominant in the evening in the summer season.

SPECIAL WEATHER PHENOMENA

The depressions during the monsoon season which originate in the Bay of Bengal and move westwards affect the district and its neighbourhood causing strong winds and widespread heavy rain. Some of the storms and depressions of the post monsoon season also affect the district. Thunderstorms occur sometimes in the summer and southwest monsoon seasons and much of the rainfall in the monsoon season is associated with thunder. Fog occurs occasionally during the winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Betul observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
BETUL

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
ATNER	48	a b	5.7 0.4	7.3 0.6	8.3 0.5	3.7 0.3	2.5 0.2	118.3 6.6	235.0 11.7	209.0 10.8	124.5 7.0	35.0 2.5	10.6 0.6	5.9 0.4	765.8 41.6	192 (2013)	59 (1999)	200.1	18 JUN 2012
BETUL	44	a b	11.4 0.8	17.1 1.4	14.2 1.0	5.7 0.5	5.2 0.5	156.8 8.4	342.1 14.3	403.4 16.3	188.1 8.6	50.2 2.8	17.2 1.1	8.7 0.6	1220.1 56.3	154 (2013)	60 (1987)	360.6	30 JUL 1991
BETUL OBSY	40	a b	16.5 1.2	17.8 1.2	20.1 1.6	8.1 0.7	10.6 1.0	160.4 8.8	355.2 15.9	386.6 16.2	197.1 8.9	51.1 3.1	25.1 1.6	11.8 0.8	1260.4 60.6	153# (1999)	64 (1987)	360.6	30 JUL 1991
BHAINSDEHI	48	a b	9.0 0.4	6.7 0.6	11.5 0.7	2.4 0.2	4.7 0.3	156.2 7.9	283.6 13.4	310.2 14.1	178.2 8.2	65.8 3.1	16.2 0.8	6.1 0.4	1050.6 50.1	188 (2019)	63 (1987)	240.0	15 AUG 2001
CHICHOLI	41	a b	5.8 0.6	8.8 0.6	7.7 0.4	1.7 0.1	1.3 0.2	185.6 8.0	382.9 15.0	361.5 14.7	192.7 7.6	31.8 1.7	7.3 0.4	2.2 0.2	1189.3 49.5	193 (1990)	45 (1985)	342.3	07 AUG 2012
KHEDI HYDRO	31	a b	10.0 0.7	13.0 0.8	9.0 0.7	2.5 0.4	5.6 0.4	155.9 7.2	359.0 13.7	308.9 13.4	206.4 7.9	44.4 2.4	16.1 1.1	5.4 0.4	1136.2 49.1	175 (2013)	11 (2015)	326.0	08 JUL 2007
MULTAI	49	a b	12.6 0.9	19.7 1.4	11.0 0.8	5.5 0.4	6.1 0.5	138.0 8.1	302.4 14.5	295.6 13.3	167.7 8.1	49.7 2.8	22.6 1.0	5.8 0.6	1036.7 52.4	153 (2020)	46 (1992)	405.2	30 JUL 1991
SARANI DAM HYDRO	37	a b	15.5 1.1	14.1 1.1	9.3 0.8	3.5 0.3	7.3 0.6	149.7 6.6	462.0 16.2	490.7 16.5	217.1 8.9	34.9 1.9	12.8 0.8	9.9 0.6	1426.8 55.4	184# (2013)	10 (2015)	466.2	03 AUG 1984
SHAHPUR	33	a b	2.7 0.2	11.5 0.7	6.4 0.2	1.9 0.2	2.4 0.3	164.6 6.4	402.9 13.6	371.1 13.6	203.2 7.0	37.2 1.5	6.2 0.4	6.8 0.4	1216.9 44.5	181 (1994)	40 (1991)	360.0	01 AUG 2013
DISTRICT MEAN	9	a b	9.9 0.7	12.9 1.0	10.8 0.7	3.9 0.4	5.1 0.4	153.9 7.6	347.2 14.2	338.6 14.3	186.1 8.0	44.5 2.4	14.9 0.9	7.0 0.5	1134.8 51.1	159 1984	63 1987		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
BETUL
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
701 - 800	3	1301 - 1400	6
801 - 900	8	1401 - 1500	4
901 - 1000	8	1501 - 1600	1
1001 - 1100	9	1601 - 1700	1
1101 - 1200	5	1701 - 1800	1
1201 - 1300	2	1801 - 1900	1

DATA AVAILABLE FOR 49 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
BETUL

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	27.3	10.0	34.9	31-01-2009	-0.2	29-01-1977	75	45
February	30.5	12.0	37.8	27-02-1953 25-02-2006	1.1	12-02-1950	64	35
March	35.2	16.2	42.3	14-03-2004	5.4	02-03-1971	55	27
April	38.9	20.9	44.4	30-04-2019	10.6	01-04-1968	43	23
May	40.7	25.1	48.0	06-05-1993	16.6	24-05-1986	43	25
June	35.5	24.5	44.7	08-06-2019	14.9	25-06-1986	71	56
July	28.9	22.6	38.6	10-07-1966	14.5	28-07-1986	89	80
August	27.4	21.9	35.4	04-08-2005	13.1	27-08-1986	93	85
September	29.8	21.2	35.5	27-09-1987	10.5	03-09-1968	90	75
October	31.4	17.7	36.8	22-10-2000	5.0	25-10-2004	80	62
November	29.3	13.8	35.0	05-11-2002	2.6	30-11-1970	72	56
December	28.1	10.1	32.7	15-12-2006	1.3	28-12-1968	72	47
Annual	31.9	17.9	48.0	06-05-1993	-0.2	29-01-1977	71	52

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
BETUL

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	22	20	23	21	21	4	0	0	5	17	20	22	175
b	1	1	1	1	1	12	22	24	9	3	2	1	78
c	1.3	1.3	1.3	1.2	1.3	5.3	7.2	7.3	4.9	2.3	1.5	1.1	3.0
1730 HOURS IST													
a	19	16	16	14	11	2	0	0	4	15	16	21	134
b	1	0	1	1	1	10	20	18	9	3	2	1	51
c	1.4	1.6	1.8	2.0	2.2	5.3	6.8	6.8	4.7	2.5	1.8	1.3	3.2

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
BETUL

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.1	2.3	2.4	2.5	2.9	3.7	3.4	2.8	2.1	1.7	1.8	1.5	2.4
Direction in morning	C/NE	C/NE	C/NE	C/NW	NW/C	NW/W	W/NW	C/NW	C/NW	C/NE	C/NE	C/E	
Direction in evening	C/NE	NE/C/NW	NW/NE	NW/C	NW/C	NW	NW/W	NW/W	NW/C	C/NE	C/NE	C/NE	

TABLE - 6
Special Weather Phenomena
(BETUL)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Fog	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	1.3

BHIND DISTRICT

The climate of this district is characterized by general dryness except during the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the hot season from March to about the middle of June. The period from about the middle of June to about the end of September is the southwest monsoon season. October and November constitutes post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 4 raingauge stations for period ranging from 44 to 49 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 686.7 mm. The spatial variation of rainfall in the district is not much. About 89% of the annual rainfall in the district is received in the southwest monsoon season (June to September), July being the rainiest month with an average value of rainfall of 216.6 mm. The variation in the rainfall from year to year is appreciable. In the fifty year period 1971-2020, the highest annual rainfall amounting to 171% of the normal occurred in year 2013, while the lowest annual rainfall which was only 52% of the normal occurred in 1987. The variation in the annual rainfall from year to year in the district is large. In this fifty year period, the annual rainfall in the district was less than 80% of the normal in 11 years and there is one occasion when such a low rainfall occurred in two consecutive years. It is seen from Table 2 that the rainfall was between 501 mm and 900 mm in 24 years out of 42.

On an average there are 34 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 33 at Gohad to 36 at Bhind.

The heaviest rainfall in 24 hours recorded at any station in the district was 295.9 mm at Bhind on 6th September 1910.

TEMPERATURE

There is no meteorological observatory in the district so the description which follows is based on the records of the Gwalior observatory in the neighbouring

district where similar meteorological conditions prevail. After February, temperature increases steadily till May when the mean daily maximum temperature is about 42.1°C and the mean daily minimum temperature about 27.0°C. In June, the mean daily minimum temperature is higher than in May by a couple of degrees. The heat in summer is intense and the dust laden scorching winds which blow often add much to the discomfort. Afternoon thunder-showers which occur on a few days bring welcome relief though only temporarily. With the onset of the southwest monsoon by about the middle of June, there is appreciable drop in the temperatures. After the end of the September month, when the southwest monsoon withdraws from the district, there is a slight increase in the day temperature but the nights become progressively cooler. After October both the day and night temperatures decrease rapidly. January is generally the coldest month with the mean daily maximum temperature at about 22.3°C and the mean daily minimum temperature at about 7.7°C. In the cold season, in the rear of the passing western disturbances, cold wave affects the district and the minimum temperature may drop down at times to about a degree above the freezing point of water

HUMIDITY

Except during the south west monsoon season when the humidity is high, the air is comparatively dry throughout the year. Summer is the driest part of the year with the value of relative humidity about 25% in the afternoon.

CLOUDINESS

During the monsoon season skies are moderately to heavily clouded. During the rest of the year the skies are mostly clear or lightly clouded.

WINDS

During the post monsoon and winter season winds are comparatively weak and calm both during the morning and evening. During the summer and monsoon season winds are moderate with some strengthening during the latter season and

blow mostly from directions between north and northwest during the summer season whereas westerlies and southwesterlies blow predominantly during the southwest monsoon season.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season move in some westerly direction and occasionally reach the district or its neighbourhood causing widespread heavy rain and gusty winds. Dust-storm generally occur during the summer season. Thunderstorms occur throughout the year and its frequency is high during southwest monsoon season. Thunderstorms also occur in the cold season in association with western disturbances. Rainfall during the monsoon season is often associated with thunder. Fog occasionally occurs in the morning of post monsoon and winter seasons.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
BHIND

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BHIND	44	a b	9.9 0.9	13.4 1.1	6.6 0.6	2.2 0.3	10.8 0.8	61.1 3.9	205.8 10.3	196.1 10.4	115.1 5.8	29.4 1.5	2.3 0.2	7.1 0.5	659.8 36.3	212 (2008)	28 (2007)	295.9	06 SEP 1910
GOHAD	49	a b	9.2 0.7	9.9 0.9	5.6 0.4	2.1 0.2	8.0 0.7	74.9 3.5	216.4 10.2	198.1 9.7	119.4 5.2	20.3 1.0	4.7 0.1	5.1 0.4	673.7 33.0	196 (1976)	49 (1984)	288.0	17 SEP 1990
LAHAR	47	a b	7.3 0.7	11.1 1.0	3.3 0.4	1.0 0.1	8.7 0.7	68.9 3.5	194.8 9.6	209.2 10.7	113.3 5.3	23.7 1.2	2.6 0.2	5.4 0.4	649.3 33.8	205 (1980)	39 (1987)	188.0	08 AUG 1980
MEHGAON	45	a b	9.1 0.7	11.1 0.8	7.7 0.5	2.5 0.2	8.5 0.7	66.8 3.3	249.2 10.0	222.4 10.5	140.6 5.7	35.9 1.3	4.1 0.2	5.7 0.5	763.6 34.4	169 (2013)	60 (2009)	218.0	07 AUG 1961
DISTRICT MEAN	4	a b	8.9 0.8	11.4 1.0	5.8 0.5	2.0 0.2	9.0 0.7	67.9 3.5	216.6 10.0	206.5 10.3	122.1 5.5	27.3 1.2	3.4 0.2	5.8 0.5	686.7 34.4	171 2013	52 1987		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
BHIND
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
301 - 400	3	801 - 900	4
401 - 500	5	901 - 1000	8
501 - 600	8	1001 - 1100	1
601 - 700	5	1101 - 1200	1
701 - 800	7		

DATA AVAILABLE FOR 42 YEARS

BHOPAL DISTRICT

The district has a dry climate except in the southwest monsoon season. The year may be divided into four seasons. The period from March to about the second week of the June is the summer season. The southwest monsoon season which follows thereafter continues up to the end of September. October and November constitutes post monsoon or retreating monsoon season. The cold season is from December to the end of February

RAINFALL

Records of rainfall in the district are available for 2 raingauge stations for period ranging from 38 to 47 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 1053.8 mm. While generally it is seen that the rainfall in the district increases from west to the east, the southernmost parts of the districts get less rainfall in the district. About 91% of the annual rainfall in the district is received during the southwest monsoon season (June to September), July and August being the rainiest months with an average value of rainfall about 334.0 mm. During the fifty year period 1971-2020, the highest annual rainfall amounting to 179% of the normal occurred in year 2006, while the lowest annual rainfall which was only 54% of the normal occurred in 2010. In this fifty year period, the annual rainfall in the district was less than 80% of the normal in 8 years, two consecutive years of such low rainfall occurred once. It is seen from Table 2 that the rainfall was between 800 mm and 1300 mm in 22 years out of 46.

On an average there are 48 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 420.0 mm at Berasia on 23 July 1977.

TEMPERATURE

There is one meteorological observatory in the district at Bhopal and the records of this observatory may be taken as representative of the conditions in the district as a whole.

After February, temperatures increase steadily till May which is generally the hottest month with the mean daily maximum temperatures at 41.1°C and the mean minimum temperature at 26.6°C. In the hot season, the day temperatures may sometimes go above 45.0°C. With the onset of the southwest monsoon by about mid-June day temperatures decrease appreciably. After the withdrawal of the monsoon by about the end of September, there is a slight increase in the temperatures but night becomes progressively colder. After October there is rapid drop in the temperatures, especially night temperatures. January is generally the coldest month with the mean daily maximum temperature at about 24.9°C and mean daily minimum at 10.6°C.

In the cold season, in association with western disturbances which move eastwards across north India, cold waves affect the district and the minimum temperature occasionally drops down to about a degree or so above the freezing point of water and frosts occur.

The highest maximum temperature ever recorded in the district was 46.7°C on 21st May 2016 and the lowest minimum temperature was 0.6 °C on 18th January 1935.

HUMIDITY

Except during the south west monsoon season when the humidity is generally above 70%, the air is generally dry over the district. Summer season is the driest part of the year with the value of relative humidity about 20% in the afternoon.

CLOUDINESS

During the monsoon season heavily clouded or overcast skies prevail generally. In the rest of the year the skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year with some strengthening in force during the latter part of summer and early part of the southwest monsoon season. During the southwest monsoon season winds mostly blow from west along with some northwesterlies. During post monsoon & winter season winds are mostly northeasterly or easterly in the mornings. Westerly or northwesterly winds appear from March in the evening and continue till southwest monsoon both in the mornings and evening.

SPECIAL WEATHER PHENOMENA

Depressions which originate in the head of the Bay of Bengal during the southwest monsoon season often moving in a westerly to north-westerly direction reach the district and its neighbourhood causing widespread heavy rain and gusty winds. Occasionally post monsoon storms or depressions also affect the district similarly. Thunderstorms generally occur throughout the year, the highest incidence being during the southwest monsoon months June to September. Occasionally dust storms and dust raising winds occurs during the summer season. Fog occurs in winter season and sometimes on a few days in southwest monsoon season and post monsoon season.

Tables 3, 4, 5 and 6 give the normals of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Bhopal.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
BHOPAL

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BERASIA	38	a b	8.6 0.6	7.5 0.6	2.7 0.3	1.0 0.1	13.1 1.0	120.0 6.0	293.2 12.9	290.5 12.6	131.5 6.3	42.4 1.9	9.6 0.5	3.0 0.2	925.2 43.0	164 (2006)	41 (2010)	420.0	23 JUL 1977
BHOPAL OBSY	47	a b	11.5 1.0	10.2 1.1	10.4 0.8	6.0 0.5	12.2 1.1	149.8 7.7	370.9 14.3	381.4 14.4	174.3 8.2	31.7 1.9	12.1 0.8	11.8 0.8	1182.3 52.6	159 (2006)	57 (1979)	291.6	14 AUG 2006
DISTRICT MEAN	2	a b	10.6 0.8	9.4 0.9	6.5 0.6	3.5 0.3	12.6 1.0	134.9 6.9	332.0 13.6	336.0 13.5	152.9 7.3	37.1 1.9	10.9 0.6	7.4 0.5	1053.8 47.9	179 2006	54 2010		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
BHOPAL
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	1	1201 - 1300	4
601 - 700	3	1301 - 1400	6
701 - 800	4	1401 - 1500	2
801 - 900	2	1501 - 1600	1
901 - 1000	5	1601 - 1700	0
1001 - 1100	5	1701 - 1800	0
1101 - 1200	6	1801 - 1900	3

DATA AVAILABLE FOR 42 YEARS

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
BHOPAL

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	⁰ C	⁰ C	⁰ C	DATE	⁰ C	DATE	0830 IST	1730 IST
January	24.9	10.6	33.0	26-01-2009	0.6	18-01-1935	67	42
February	28.4	13.1	37.6	22-02-2006	1.7	11-02-1950	57	33
March	33.9	17.6	40.7	29-03-1996	6.1	09-03-1979	42	24
April	38.7	22.4	44.4	29-04-1996	12.2	02-04-1935	32	19
May	41.1	26.6	46.7	21-05-2016	16.7	04-05-1975	39	22
June	37.4	26.0	45.6	05-06-1995	19.5	06-06-1957	64	46
July	30.9	23.8	41.2	12-07-1966	19.0	30-07-2012	85	74
August	28.9	23.0	35.6	05-08-1987	16.8	08-08-1977	89	79
September	31.3	22.2	37.4	25-09-2001	13.8	24-09-1972	82	66
October	32.7	19.1	39.6	22-10-2005	11.7	27-10-1971	63	45
November	29.9	15.0	35.3	04-11-1977	6.1	30-11-1941	59	43
December	26.7	11.2	32.8	11-12-1941	1.0	20-12-2005	65	43
Annual	32.0	19.2	46.7	21-05-2016	0.6	18-01-1935	62	45

TABLE - 4
MEAN CLOUD AMOUNT ** (OKTA OF THE SKY) AND MEAN NUMBER OF DAYS
OF CLEAR AND OVERCAST SKIES.
BHOPAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	16	18	18	18	18	4	0	0	4	16	19	19	150
b	1	0	0	0	0	4	15	17	6	1	0	0	44
c	1.8	1.4	1.4	1.3	1.4	4.4	6.7	7.0	4.6	1.9	1.4	1.4	2.9
1730 HOURS IST													
a	15	14	14	8	4	1	0	0	1	8	14	16	95
b	1	0	0	0	0	3	10	11	4	0	0	0	29
c	1.9	1.8	2.1	2.8	3.3	5.3	6.8	6.8	5.1	2.9	2.1	1.7	3.6

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed (kmph) and Predominant Wind Direction
BHOPAL

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.	4.8	5.5	5.9	7.3	9.0	9.9	8.4	7.2	6.1	4.2	4.3	3.8	6.3
Direction in the morning.	C/NE/E	C/NE/E	C/NE/SE	NW/W	NW/W	W	W	W	NW/W	C/NW/NE	C/NE/E	C/NE/E	
Direction in the evening.	NE	NE/NW	NW/W	NW/W	NW/W	W	W	W	NW	C/N/NE	NE/N	NE	

TABLE - 6
Special Weather Phenomena
BHOPAL

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.2	0.2	0.5	0.9	2.0	3.5	1.6	1.8	0.2	0.4	0.0	11.3
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust storm	0	0	0	0	0.2	0	0	0	0	0	0	0	0.2
Fog	1.3	0.5	0	0.1	0	0.4	0.3	0.3	0.5	0.2	0.3	0.4	4.3

BURHANPUR DISTRICT

The climate of the district is on the whole dry. The year may be divided into four seasons, the cold season from December to February, the hot season from March to May, southwest monsoon season which follows thereafter continues up to the end of September and the post monsoon or retreating monsoon season from October to November.

RAINFALL

Records of rainfall in the district are available for 2 rain gauge stations for period ranging from 39 to 50 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 834.3 mm. About 88% of the annual rainfall in the district is received during the southwest monsoon season (June to September). August being the rainiest month with an average value of rainfall of 237.8 mm. During the fifty year period 1971-2020, the highest annual rainfall amounting to 159% of the normal occurred in year 1993, while the lowest annual rainfall which was only 51% of the normal occurred in 2011. In this fifty year period, the annual rainfall in the district was less than 80% of the normal in 8 years and there is one occasion when such a low rainfall occurred in four consecutive years. It is seen from Table 2 that the rainfall was between 601 mm and 1100 mm in 32 years out of 44.

On an average there are 44 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 222.8 mm at Burhanpur Hydro on 23 July 2014.

TEMPERATURE

There is no meteorological observatory in the district so the description which follows is based on the records of the Khandwa observatory in the neighbouring

district where similar meteorological conditions prevail. Temperatures begin to rise rapidly from March. May is the hottest month with mean maximum temperature at about 41.0°C and mean minimum temperature at about 26.0°C. With the onset of the monsoon, weather cools down and the day temperatures during the monsoon months are not far different from those in winter. A slight rise in day temperatures occurs in October after the withdrawal of monsoon. The night temperatures continue to fall from May reaching the lowest value in January.

HUMIDITY

Except during the south west monsoon season, the relative humidity is generally low especially in the afternoons. Summer season is the driest part of the year with the values of relative humidity about 15-20% in the afternoon.

CLOUDINESS

During the monsoon months, skies are heavily clouded or overcast. Skies are mostly clear or lightly clouded in the winter, summer and post-monsoon months.

WINDS

Hot winds which strengthen with the advance of the season, blow steadily between west and northwest during the summer months. During the southwest monsoon season, the winds are mainly from west direction. In the post monsoon season winds are weak and calm and in winter season winds are weak and variable in the forenoons and blow predominantly from northeast and northwest direction.

SPECIAL WEATHER PHENOMENA

In association with monsoon depressions which originates in the Bay of Bengal and move westwards, the district experiences strong winds and widespread heavy rain. Occasionally post monsoon storms or depressions also affect the weather over the district. Thunderstorms generally occur during pre monsoon and the southwest monsoon season. Occasionally dust storms and dust raising winds occurs during the summer season. Fog is experienced during winter season on a few occasions.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
BURHANPUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BURHANPUR	50	a	4.6	5.8	6.8	1.1	12.4	133.9	214.6	242.6	139.8	42.0	13.0	8.0	824.6	182	37	193.3	14 SEP 1930
		b	0.3	0.5	0.6	0.1	0.8	6.5	10.7	11.4	7.3	2.4	0.8	0.5	41.9	(1993)	(2009)		
BURHANPUR HYDRO	39	a	5.4	7.6	6.1	2.8	11.0	149.0	214.2	233.0	145.3	41.3	18.0	9.5	843.2	142	12	222.8	23 JUL 2014
		b	0.4	0.4	0.5	0.3	0.9	7.2	11.1	11.6	8.0	2.6	0.9	0.6	44.5	(1979)	(2015)		
DISTRICT MEAN	2	a	5.0	6.7	6.5	2.0	11.7	141.5	214.4	237.8	142.6	41.7	15.5	8.8	834.2	159	51		
		b	0.4	0.5	0.6	0.2	0.9	6.9	10.9	11.5	7.7	2.5	0.9	0.6	43.6	1993	2011		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
BURHANPUR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	3	901 - 1000	5
501 - 600	3	1001 - 1100	3
601 - 700	4	1101 - 1200	2
701 - 800	14	1201 - 1300	3
801 - 900	6	1301 - 1400	1

DATA AVAILABLE FOR 44 YEARS

DATIA DISTRICT

Except during the southwest monsoon season, the district has a dry climate. The year may be divided into four seasons. The cold season is from December to February. March to May is the summer season. The period from the middle of June to about the end of September is the southwest monsoon season. October and November constitutes post monsoon season.

RAINFALL

Records of rainfall in the district are available for 3 raingauge stations for long period. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 811.0 mm. The rainfall in the district decreases from the south towards the north. About 90% of the annual rainfall in the district is received in the southwest monsoon season (June to September), August being the rainiest month with an average value of rainfall of 265.1 mm. In the fifty year period 1971-2020, the highest annual rainfall amounting to 162% of the normal occurred in year 1971, while the lowest annual rainfall which was only 52% of the normal occurred in 1981. In this fifty year period, the annual rainfall in the district was less than 80% of the normal in 11 years out of 42 years, consecutive years of such low rainfall occurred twice in this period. It is seen from Table 2 that the rainfall was between 601 mm and 1000 mm in 28 years out of 42.

On an average there are 40 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 330.0 mm at Datia on 21st September 1988.

TEMPERATURE

There is one meteorological observatory in the district at Datia so the description that follows is based on the records of the meteorological data of this observatory. From about the end of February, there is rapid increase in temperature. May is the hottest month with the mean maximum temperature at 43.0°C and the mean minimum temperature at 26.9°C. On some days, the maximum temperature may go above 48.0°C. The heat is intense and the hot dust-laden winds which blow on some days add to the discomfort. Afternoon thundershowers which occasionally occur on some days and bring welcome relief though only temporarily. With the onset of southwest monsoon by about the third week of June, there is an appreciable drop in temperature. After the withdrawal of monsoon by about the end of September, the day temperatures increase a little but the nights become progressively cooler. After October both the day and night temperatures decrease rapidly. January is the coldest month with the mean maximum temperature at 22.8°C and mean minimum at 6.9°C. Cold waves affect the district in association with passing western disturbances and the minimum temperature may sometimes drop down to about freezing point of water and a slight frosts may occur.

The highest maximum temperature ever recorded in the district was 48.5°C on 5th June 2003 and the lowest minimum temperature was 0.0 °C on 9th February 1974 at Datia observatory.

HUMIDITY

Humidity is generally high during the southwest monsoon season, and decreases after the withdrawal of the monsoon. The summer is the driest part of the year with the value of relative humidity in the afternoon below 40%. During the southwest monsoon season, value of relative humidity ranges between 55 and 85% in the morning whereas, it ranges from 45 to 75% in the afternoon approximately.

CLOUDINESS

During the southwest monsoon season skies are moderately to heavily clouded. During the rest of the year the skies are generally clear or lightly clouded.

WINDS

Winds are generally light with some strengthening in force during the summer and monsoon season. During the southwest monsoon season, winds generally blow from the west or southwest. In the post monsoon and cold season, winds are generally light and variable in direction and mostly calm in the afternoons. In the summer season, winds blow mainly from the west or northwest directions.

SPECIAL WEATHER PHENOMEN

Storms and depressions which originate in the Bay of Bengal during the southwest monsoon which move across the central part of the country reach the neighbourhood of the district and cause widespread heavy rain and gusty winds. Dust storm and dust raising winds occur during summer season. Occasional thunderstorms occur in the cold season in association with the western disturbances. Fog occurs on a few occasions during post monsoon and winter season.

Tables 3, 4 and 5 give the normals of temperature and relative humidity, cloudiness, wind speed and direction respectively for Datia observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
DATIA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
DATIA	43	a b	8.4 0.7	12.7 0.8	7.3 0.5	3.7 0.4	8.8 0.9	75.8 4.3	257.1 12.1	275.1 12.1	146.5 5.8	26.8 1.3	4.4 0.4	7.3 0.5	833.9 39.8	179 (1988)	53 (1979)	330.0	21 SEP 1988
DATIA OBSY	40	a b	8.9 0.8	9.9 0.8	7.2 0.6	4.5 0.7	8.1 0.9	99.5 5.0	264.3 12.8	296.4 12.6	117.9 5.6	27.2 1.4	7.6 0.4	7.9 0.5	859.4 42.1	153 (1971)	58 (2005)	177.2	09 AUG 1972
SEODHA (SEONDHA)	48	a b	9.5 0.8	14.0 0.9	4.6 0.5	3.2 0.3	8.3 0.5	60.6 3.7	243.1 11.0	223.9 11.4	139.4 6.5	24.1 1.1	3.4 0.3	5.8 0.3	740.0 37.3	167 (1985)	45 (1981)	309.9	16 SEP 1990
DISTRICT MEAN	3	a b	8.9 0.8	12.2 0.8	6.4 0.5	3.8 0.5	8.4 0.8	78.6 4.3	254.8 12.0	265.1 12.0	134.6 6.0	26.0 1.3	5.2 0.4	7.0 0.4	811.0 39.8	162 1971	52 1981		

(a)

- (a) NORMAL RAINFALL IN MM
(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)
(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR
(*) BASED ON ALL AVAILABLE DATA UPTO 2020.
(**) YEARS GIVEN IN BRACKETS
(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
DATIA
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	2	901 - 1000	5
501 - 600	5	1001 - 1100	3
601 - 700	8	1101 - 1200	2
701 - 800	10	1201 - 1300	1
801 - 900	5	1301 - 1400	1

DATA AVAILABLE FOR 42 YEARS

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
DATIA

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	22.8	6.9	33.6	18-01-2006	0.3	08-01-2013	82	58
February	26.7	10.5	38.2	24-02-2006	0	09-02-1974	73	51
March	33.5	15.3	42.6	23-03-2004	5.5	01-03-1972	56	39
April	39.5	20.9	45.9	18-04-2010	10.8	01-04-1996	40	32
May	43.0	26.9	47.8	28-05-1998	18.5	03-05-2013	41	30
June	40.8	28.0	48.5	05-06-2003	19.0	06-06-1996	56	45
July	34.9	25.9	44.2	10-07-1995	19.4	08-07-1981	78	71
August	33.1	24.8	40.5	01-08-2002	20.5	24-08-1996	83	76
September	33.5	23.3	40.2	01-09-1979	15.0	30-09-1997	79	69
October	34.0	17.7	41.4	06-10-2006	8.8	25-10-1997	69	53
November	30.0	12.0	37.2	07-11-2006	5.4	19-11-1990	70	50
December	25.4	8.1	34	05-12-2003	0.4	09-12-1996	78	56
Annual	33.0	18.5	48.5	05-06-2003	0.0	09-02-1974	67	53

TABLE – 4
Mean Cloud Amount *(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
DATIA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	25	20	25	25	27	16	5	3	13	26	26	17	228
b	1	1	0	0	0	1	6	8	4	1	0	1	23
c	0.9	1.2	0.7	0.6	0.5	2.2	4.8	5.1	2.8	0.8	0.6	0.5	1.7
1730 HOURS IST													
a	25	22	24	25	25	15	5	4	13	27	25	28	238
b	0	0	0	0	0	1	5	6	3	0	0	0	15
c	0.7	1.0	0.8	0.8	0.9	2.5	4.4	4.6	2.7	0.7	0.6	0.3	1.7

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
DATIA

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.	1.6	2.1	3.2	3.1	4.9	5.0	4.2	3.0	2.5	1.7	1.6	1.2	2.9
Direction in the morning.	C/W/NE	C/N/NW	C/NW/N	C/W/NW	C/W/NW	W	C/W/SW	C/W	C/W/NW	C/W/NW	C	C	
Direction in the evening.	C/NE/N	C/N/NW	C/N/NW	C/W/NW	W/NW/C	W	C/W	C/W	C/W/NW	C	C	C	

DEWAS DISTRICT

The climate of this district is characterized by a hot summer and generally dry climate except in the southwest monsoon season. The year may be divided into four seasons. The hot season is from March to about the second week of June. The southwest monsoon season lasts till about the end of September. October and November constitute the post monsoon or retreating monsoon season. The period from December to February is the cold season.

RAINFALL

Records of rainfall in the district are available for 9 raingauge stations for period ranging from 30 to 50 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 978.0 mm. During the monsoon season (June to September) the district receives rain about 93% of the annual rainfall. August is the rainiest month with average rainfall of 328.3 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 174% of the annual normal occurred in year 1973, while the lowest annual rainfall which was 67% of the normal occurred in year 1992. In the fifty year period there were 8 years in which the annual rainfall in the district was less than 80% of the normal and during this period there were two occasions when such a low rainfall occurred in consecutive years. It is seen from Table 2 that the rainfall was between 701 mm and 1200 mm in 33 years out of 48.

On an average there are 40 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 31 at Sonkatch Med. to 45 at Bagli.

The heaviest rainfall in 24 hours recorded at any station in the district was 412.0 mm at Sonkatch on 29th July 2012.

TEMPERATURE

There is only one meteorological observatory in the district located at Kannod. Therefore, the records of the observatory at Kannod may be taken as representative of the conditions in the district. The period from March to May is one of continuous increase in temperature, May is the hottest month with mean maximum temperature in May is of 42.3°C and mean minimum of 25.7°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon, by end of September, the day temperatures increase slightly but the nights become progressively cooler. After October there is a rapid decrease in both the day and night temperatures. December and January are the coldest months with mean maximum temperature at about 28.1°C and mean minimum temperature at about 10.7°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about 3 to 4 °C above freezing point of water.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 68% to 91% in the morning and 50% to 80% in the afternoon. The values of relative humidity start to decrease after the end of the monsoon season. It is comparatively less during rest of the year. The driest part of the year is the summer season, when the average humidity is about 30% in the afternoons and about 49% in the mornings.

CLOUDINESS

During the southwest monsoon season the sky is heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon season, winds generally blow from west or northwest direction. During post monsoon and winter season winds predominantly blow from northeast direction. In the summer season winds are mostly westerly to northwesterly.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Dust storms occur rarely during the summer season. Thunderstorms occur occasionally during the summer and southwest monsoon season. Fog occurs very occasionally during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Kannod observatory. As surface data for Kannod observatory is available upto the year 2010, data for this district is taken from 1981-2010 climatological Normals.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
DEWAS

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
Bagli	35	a b	4.1 0.3	6.6 0.4	4.8 0.2	1.8 0.1	1.1 0.2	140.8 7.0	279.2 13.5	311.5 12.7	170.9 8.0	21.8 1.1	16.4 0.6	7.4 0.5	966.4 44.6	174 (1973)	67 (2008)	225.0	23 AUG 2004
Dewas	44	a b	7.6 0.5	3.1 0.3	2.2 0.2	1.2 0.1	6.6 0.5	129.6 6.4	301.5 12.4	315.4 12.6	158.4 6.8	35.8 1.6	13.0 0.9	5.7 0.3	980.1 42.6	218 (1973)	30 (2007)	231.0	6 SEP 2012
Kannod	45	a b	6.4 0.5	4.4 0.4	2.3 0.2	1.4 0.1	1.0 0.1	131.6 6.4	323.2 12.8	347.6 14.0	149.5 7.1	33.5 1.6	13.0 0.7	8.3 0.4	1022.2 44.3	172 (1973)	58 (1992)	218.6	18 AUG 1974
Kannod (Obsy)	30	a b	3.2 0.3	0.3 0.0	1.3 0.1	1.3 0.2	11.7 1.1	134.7 6.4	235.9 10.6	368.5 13.7	125.8 5.9	22.0 1.4	16.3 0.8	8.5 0.5	929.5 41.0	188 (1973)	101 (1974)	277.0	12 SEP 1975
Khatagaon	48	a b	6.1 0.4	8.1 0.5	2.3 0.2	0.5 0.0	5.3 0.2	143.7 6.4	343.8 12.3	368.2 13.3	179.8 7.3	29.0 1.3	11.8 0.5	5.3 0.2	1103.9 42.6	173 (2020)	46 (1991)	312.0	12 SEP 1975
Sonkatch Med.	31	a b	17.0 0.7	6.2 0.5	2.5 0.2	5.7 0.3	16.3 0.7	117.2 4.5	250.1 8.1	312.7 9.7	115.1 4.8	19.1 0.4	18.4 0.6	0.3 0.1	880.6 30.6	180# (2015)	62 (1982)	412.0	29 JUL 2012
Sonkatch	50	a b	9.5 0.5	4.8 0.4	2.9 0.2	0.8 0.1	2.4 0.2	133.1 6.4	321.1 12.0	309.4 11.0	143.0 6.3	23.9 1.3	11.6 0.6	5.1 0.4	967.6 39.4	192 (2022)	9 (1974)	412.0	29 JUL 2012
Tonkhurd	32	a b	6.0 0.3	2.4 0.1	1.7 0.2	0.1 0.0	2.0 0.0	128.6 5.5	287.8 11.3	283.1 10.5	161.3 7.1	17.3 1.1	5.7 0.3	2.2 0.1	898.2 36.5	170 (2019)	51 (2010)	195.0	27 JUL 1996
Udainagar (Med)	40	a b	2.4 0.2	2.9 0.1	3.4 0.1	0.3 0.1	6.5 0.2	134.8 5.6	339.5 12.5	338.0 12.3	184.6 7.5	27.9 1.3	12.1 0.6	0.6 0.1	1053.0 40.6	199 (1973)	52 (1965)	224.4	29 JUL 2012
DEWAS (District)	9	a b	6.9 0.4	4.3 0.3	2.6 0.2	1.5 0.1	5.9 0.4	132.7 6.1	298.0 11.7	328.3 12.2	154.3 6.8	25.6 1.2	13.1 0.6	4.8 0.3	978.0 40.3	174 1973	67 1992		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
DEWAS
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
601 – 700	3	1201 -1300	4
701 – 800	8	1301 - 1400	1
801 – 900	5	1401 - 1500	0
901 – 1000	5	1501 - 1600	2
1001 – 1100	6	1601 - 1700	0
1101 – 1200	9	1701 - 1800	1

(Data available for 44 years)

TABLE – 3
Normals of Temperature and Relative Humidity
KANNOD

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	28.1	11.2	41.1	03-01-1995	1.1	03-01-1986	69	45
February	30.1	12.7	39.8	21-02-1974	3.1	18-02-1985	60	40
March	35.3	17.7	43.1	22-03-1995	6.1	04-03-1986	49	31
April	39.8	23.0	46.1	02-04-1995	10.6	28-04-1986	45	31
May	42.3	25.7	47.1	23-05-1991	11.6	31-05-1985	48	30
June	38.8	24.2	47.6	07-06-1995	8.1	12-06-1991	68	50
July	32.3	22.2	42.1	11-07-1994	10.0	21-07-1991	86	72
August	30.1	21.6	39.2	02-08-1974	7.1	09-08-1985	91	80
September	32.0	21.0	38.0	19-09-1974	9.1	17-09-1996	84	71
October	33.3	17.8	39.6	24-10-1991	5.1	08-10-1991	72	54
November	30.4	12.9	40.2	17-11-1979	4.1	02-11-1984	63	43
December	28.1	10.1	34.1	24-12-1980	1.6	27-12-1984	67	45
Annual	33.4	18.3	47.6	07-06-1995	1.1	03-01-1986	67	50

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
KANNOD

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	25	26	30	29	28	20	8	13	17	27	28	26	277
b	1	0	0	0	0	1	3	2	1	1	0	1	10
C	0.9	0.5	0.2	0.4	0.4	1.8	3.7	3.2	1.8	0.9	0.4	0.6	1.2
a	27	26	29	29	26	19	13	17	20	28	27	28	289
b	1	0	0	0	1	1	3	1	0	0	0	0	7
c	0.7	0.4	0.2	0.3	0.7	1.7	3.3	2.6	1.4	0.7	0.2	0.5	1.1

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
KANNOD

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	3.2	3.7	4.3	6.5	7.2	7.3	6.3	6	4.3	3.8	3	3.2	4.9
Direction in morning	C/NE	C/NE	C/NE	C/NW/W	NW/C/W	NW/C/SW	C/NW/W	C/NW/W	C/NW	C/NE	C/NE	C/NE	
Direction in evening	C/NE	C/NE	C/NE/NW	NW/C/W	NW/C/W	NW/C/SW	NW/C/SW	C/NW/W	C/NW	C/NE	C/NE	C/NE	

TABLE - 6
Special Weather Phenomena
KANNOD

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

DHAR DISTRICT

The district enjoys a pleasant climate and except during the southwest monsoon season the climate is dry. The year may be divided into four seasons. The hot season is from March to about the middle of June is followed by the monsoon season lasting up to end of September. October and November may be termed the post monsoon season. The period from December to February is the cold season.

RAINFALL

Records of rainfall in the district are available for eight rain gauge stations for period ranging from 33 to 50 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 869.5 mm. During the monsoon season (June to September) the district receives rain about 93% of the annual rainfall. July and August are the rainiest months with average rainfall of 266.0 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 165% of the annual normal occurred in year 1973, while the lowest annual rainfall which was 60% of the normal occurred in year 1985. In the fifty years period there were 10 years in which the annual rainfall in the district was less than 80% of the normal and during this period there were three occasions when such a low rainfall occurred in consecutive years. It is seen from Table 2 that the rainfall was between 601 mm and 1100 mm in 33 years out of 46.

On an average there are 40 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 33 at Dharampuri to 49 at Dhar observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 400.0 mm at Gandhwani on 05th August 2014.

TEMPERATURE

There is only one meteorological observatory in the district located at Dhar, it started functioning on 18th February, 1973. Therefore, the records of this observatory may be taken as representative of the meteorological conditions in the district in general. The period from March to May is one of continuous increase in temperature, May is the hottest month with mean maximum temperature in May is of 39.7°C and mean minimum of 24.6°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 44°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon, by end of September, there is slight rise in the day temperatures and reach a secondary maximum in October but the nights become progressively cooler. But the nights become progressively cooler. January is the coldest month with mean maximum temperature at 26.0°C and mean minimum temperature at 10.3°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about 3 °C.

The highest maximum temperature ever recorded at Dhar was 47.1°C on 6th May 1975 and the lowest minimum temperature ever recorded was 3.0°C on 20th February 1993.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 74% to 91% in the morning and 57% to 82% in the afternoon. The values of relative humidity are comparatively less during the rest of the year. The driest part of the year is the summer season, when the average humidity is about 38% in the afternoons and 51% in the mornings.

CLOUDINESS

Skies are generally clear or lightly clouded except in the monsoon season when heavily clouded or overcast skies prevail.

WINDS

Winds are generally light in the post monsoon and winter season and strengthen in the summer and monsoon season. During the southwest monsoon months, winds generally blow from southwest or west direction. During post monsoon and winter season winds mainly blow from northeast direction. Westerlies or Northeasterlies blow in the summer season.

SPECIAL WEATHER PHENOMENA

In association with depressions during the monsoon season and to a lesser extent in the post monsoon season originating in the Bay of Bengal move in a westerly direction passing through district or its neighborhood causing widespread heavy rain and gusty winds. Dust storm occurs occasionally during the summer season. Thunderstorms occur frequently during pre-monsoon and monsoon season. Fog occurs very occasionally during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Dhar observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
DHAR

	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BADNAWAR	49	a	3.2	1.3	0.9	0.4	0.1	121.7	302.2	320.0	146.8	35.4	9.9	1.8	943.7	180	52	377.4	28 JUL 1996
		b	0.2	0.2	0.1	0.0	0.0	6.3	12.6	12.5	6.9	1.7	0.7	0.2	41.4	(2019)	(1985)		
DHAR	45	a	2.4	2.3	0.8	0.3	4.7	127.6	286.6	291.0	165.8	39.9	11.1	3.7	936.2	180	65	287.2	26 JUL 1987
		b	0.2	0.2	0.1	0.1	0.3	6.3	13.6	13.7	8.1	1.9	0.6	0.2	45.3	(1973)	(1991)		
DHAR OBSY	36	a	4.2	1.5	3.8	4.3	14.6	141.0	293.9	330.4	146.9	44.5	28.0	6.1	1019.2	146#	68	287.2	26 JUL 1997
		b	0.4	0.2	0.4	0.5	0.9	7.4	14.6	14.2	6.5	2.5	1.5	0.4	49.5	(1973)	(1975)		
DHARAMPURI	45	a	1.0	0.5	0.0	0.0	0.0	100.3	207.4	199.3	139.5	16.4	4.9	0.0	669.3	181	45	210.0	31 JUL 1991
		b	0.1	0.1	0.0	0.0	0.0	4.7	10.4	9.8	6.1	1.2	0.4	0.0	32.8	(1981)	(2001)		
GANDHWANI	33	a	0.5	0.9	1.1	0.1	0.3	113.8	226.1	226.5	179.4	32.8	2.8	0.8	785.1	147	57	400.0	5 AUG 2014
		b	0.1	0.0	0.1	0.0	0.1	4.8	12.1	10.9	7.5	1.4	0.1	0.1	37.2	(2006)	(1992)		
MANAWAR	49	a	1.6	0.7	0.8	0.2	1.2	115.9	221.3	223.8	154.2	24.5	6.9	2.1	753.2	169	55	200.0	31 JUL 1991
		b	0.1	0.1	0.1	0.0	0.1	5.0	10.8	10.5	6.4	1.3	0.3	0.1	34.8	(1973)	(1974)		
NALCHHA	33	a	0.6	1.9	1.3	0.6	2.2	125.2	301.3	223.7	194.4	37.2	3.9	1.9	894.2	157	29	300.0	29 JUL 1988
		b	0.1	0.2	0.2	0.1	0.1	5.4	12.4	11.1	7.6	1.7	0.2	0.2	39.3	(2019)	(1991)		
SARDARPUR	50	a	2.0	1.4	0.3	0.8	2.7	139.1	298.6	303.4	163.9	31.3	10.0	1.9	955.4	210	57	253.0	26 JUL 2015
		b	0.2	0.1	0.0	0.1	0.1	6.0	13.1	12.7	7.0	1.7	0.6	0.2	41.8	(1973)	(1985)		
DISTRICT MEAN	8	a	1.9	1.3	1.1	0.8	3.2	123.1	267.2	264.8	161.4	32.7	9.7	2.3	869.5	165	60		
		b	0.2	0.1	0.1	0.1	0.2	5.7	12.5	11.9	7.0	1.7	0.6	0.2	40.3	1973	1985		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
DHAR
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
501 - 600	5	1001 - 1100	6
601 - 700	6	1101 - 1200	2
701 - 800	8	1201 - 1300	3
801 - 900	8	1301 - 1400	1
901 - 1000	5	1401 - 1500	2

(Data available for 46 years)

TABLE – 3
Normals of Temperature and Relative Humidity
DHAR

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	26.0	10.3	33.8	01-01-2016	3.3	29-01-1977	65	50
February	29.3	12.8	37.7	26-02-2006	3.0	22-02-1993	58	41
March	34.3	18.2	43.1	22-03-1974	6.1	11-03-1979	47	35
April	38.4	22.2	44.4	17-04-2010	12.1	18-04-1983	50	40
May	39.7	24.6	47.1	06-05-1975	18.1	07-05-1982	57	38
June	35.5	23.7	44.6	08-06-1993	16.6	17-06-1987	74	57
July	29.6	21.9	39.6	08-07-1982	16.0	24-07-1984	89	79
August	28.6	21.2	46.4	23-08-2014	15.0	06-08-1985	91	82
September	30.2	20.8	38.3	30-09-1979	15.6	21-09-1985	87	76
October	32.5	18.6	38.7	23-10-1990	9.6	30-10-1983	66	52
November	30.2	14.8	35.7	06-11-1990	6.1	24-11-1981	61	53
December	28.1	11.7	35.7	05-12-1990	4.1	13-12-1981	63	54
Annual	31.8	18.3	47.1	06-05-1975	3.0	22-02-1993	67	55

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
DHAR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	22	22	24	24	20	4	0	0	4	20	21	23	184
b	1	0	0	0	0	7	18	19	11	1	1	0	58
C	1.3	0.9	0.8	0.9	1.5	4.9	6.9	7.0	4.9	1.4	1.3	1.0	2.7
1730 HOURS IST													
a	22	19	22	20	19	3	0	0	2	8	18	21	154
b	0	0	0	0	0	5	16	16	5	1	1	0	44
c	1.3	1.1	1.4	1.8	2.1	4.8	6.5	6.3	4.9	2.6	1.8	1.2	3.0

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
DHAR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	NE	NE	NE	NW/NE/W	W	SW/W	SW	SW/W	SW/W	NE	NE	NE	
Direction in evening	NE	NE	W/NE/SW	W/NW/SW	W	SW/W	SW	SW/W	W/SW	NE	NE/SW	NE	

TABLE - 6
Special Weather Phenomena
DHAR

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.5
Hailstorm	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Dust storm	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

GUNA DISTRICT

The climate of this district is characterized by a hot summer and generally dry climate except during southwest monsoon season. The year may be divided into four seasons. The cold season from December to February is followed by the summer from March to the middle of June. The period from mid-June to about the end of September is the southwest monsoon season. October and November constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for 3 raingauge stations for period ranging from 42 to 48 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1024.8 mm. During the monsoon season (June to September) the district receives rain about 92% of the annual rainfall. August is the rainiest month with average rainfall of 345.6 mm. The variation in the annual rainfall in the district, from year to year is large. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 170% of the annual normal occurred in year 2011, while the lowest annual rainfall which was 44% of the normal occurred in year 1979. In the fifty year period there were 16 years in which the annual rainfall in the district was less than 80% of the normal and during this period there were two occasions when such a low rainfall occurred in two consecutive years. It is seen from Table 2 that the rainfall was between 701 mm and 1300 mm in 35 years out of 48.

On an average there are 45 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 42 at Chachora to 48 at Guna Obsy.

The heaviest rainfall in 24 hours recorded at any station in the district was 337.2 mm at Guna obsy on 23rd June 2011.

TEMPERATURE

There is one meteorological observatory in the district located at Guna. The description of climate that follows is based on the records of this observatory. The period from March to May is one of continuous increase in temperature, May is the hottest month with mean maximum temperature in May is of 42.0°C and mean minimum of 26.3°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon by about the last week of September, there is a slight increase in the day temperatures in October but the nights become progressively cooler. It is only after October that both the day and night temperatures decrease rapidly. January is generally the coldest month with mean maximum temperature at 24.4°C and mean minimum temperature at 9.0°C. During the winter season, the district is sometimes affected by cold waves in the rear of passing western disturbances and the minimum temperature occasionally drops down to about the freezing point of water and frosts occur.

The highest maximum temperature ever recorded at Guna was 47.8°C on 14th May 1991 and the lowest minimum temperature ever recorded was -2.2°C on 22nd January 1934.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 59% to 89% in the morning and 43% to 79% in the afternoon. The values of relative humidity are comparatively less during rest of the year. The driest part of the year is the summer season, when the average humidity is about 38% in the mornings and 22% in the afternoons .

CLOUDINESS

During the southwest monsoon season the sky is heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light in the district with some strengthening in force during the late summer and monsoon season. During the southwest monsoon season, winds generally blow from southwest direction. During post monsoon and winter season winds generally blow from southeast and northeast direction. In the summer season southeasterly winds blow in the morning whereas westerly winds blow in the afternoon.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms occur throughout the year, the highest incidence being during the monsoon season. Fog occurs occasionally during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Guna observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
GUNA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
CHACHORA	47	a	7.1	8.9	6.3	2.8	2.7	100.9	355.7	349.0	143.8	23.3	8.6	7.8	1016.9	185	39	261.6	21 JUL 2000
		b	0.5	0.7	0.3	0.2	0.3	4.8	12.9	13.4	6.4	1.1	0.6	0.5	41.7	(1996)	(1979)		
GUNA	42	a	8.9	12.6	5.4	3.1	7.9	123.0	310.0	348.1	145.5	32.7	8.5	10.2	1015.9	162	44	337.2	23 JUN 2011
		b	0.8	0.9	0.5	0.5	0.8	5.5	13.6	14.2	6.5	1.5	0.7	0.7	46.2	(2013)	(1979)		
GUNA OBSY	48	a	7.8	12.2	8.2	5.1	9.0	123.1	332.4	339.7	152.6	31.1	12.2	8.4	1041.8	176	49	337.2	23 JUN 2011
		b	0.9	0.8	0.7	0.6	1.0	6.0	14.0	14.0	6.8	1.5	0.8	0.6	47.7	(2011)	(1979)		
DISTRICT MEAN	3	a	7.9	11.2	6.6	3.7	6.5	115.7	332.7	345.6	147.3	29.0	9.8	8.8	1024.8	170	44		
		b	0.7	0.8	0.5	0.4	0.7	5.4	13.5	13.9	6.6	1.4	0.7	0.6	45.2	2011	1979		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
GUNA
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
401 - 500	1	1101 - 1200	4
501 - 600	1	1201 - 1300	4
601 - 700	1	1301 - 1400	3
701 - 800	13	1401 - 1500	3
801 - 900	6	1501 - 1600	2
901 - 1000	7	1601 - 1700	1
1001 - 1100	1	1701 - 1800	1

(Data available for 48 years)

TABLE – 3
Normals of Temperature and Relative Humidity
GUNA

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	24.4	9.0	33.5	26-01-2009	-2.2	22-01-1934	73	42
February	27.9	11.9	37.8	23-02-2006	-1.1	07-02-1974	62	34
March	33.7	16.8	42.0	31-03-2017	4.7	01-03-1971	44	25
April	39.0	22.0	45.8	18-04-2010	10.5	05-04-2008	32	19
May	42.0	26.3	47.8	14-05-1991	16.7	08-05-1960	37	21
June	39.0	26.5	46.8	11-06-2019	18.2	17-06-2017	59	43
July	32.3	24.3	43.0	12-07-1966	19.1	01-07-1960	84	72
August	30.2	23.3	39.2	14-08-1965	19.4	29-08-1952	89	79
September	32.3	22.5	39.5	25-09-2001	13.1	24-09-1972	81	65
October	33.6	18.8	39.3	04-10-2002	8.3	27-10-1957	63	42
November	30.3	14.2	37.0	03-11-2001	2.8	17-11-1940	60	42
December	26.9	10.0	32.9	02-12-2015	-1.7	10-12-1966	67	44
Annual	32.6	18.6	47.8	14-05-1991	-2.2	22-01-1934	63	44

TABLE – 4
Mean Cloud Amount ^{}(Okta of the Sky) and Mean Number**
of days of Clear and Overcast Skies
GUNA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	19	18	19	17	18	7	1	1	8	19	20	19	166
b	1	0	0	0	0	4	13	15	6	1	1	1	42
C	1.9	1.7	1.5	1.6	1.6	3.8	6.2	6.5	3.8	1.6	1.5	1.5	2.8
1730 HOURS IST													
a	16	16	14	10	7	2	0	0	4	13	16	18	116
b	1	0	1	1	1	4	13	12	4	1	1	1	40
c	1.9	1.7	2.2	2.7	2.9	4.8	6.5	6.4	4.4	2.1	1.8	1.6	3.3

- a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
^{**} Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
GUNA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.7	3.2	3.4	3.5	4.5	5.2	4.0	3.2	2.5	2.1	2.0	2.1	3.2
Direction in morning	C/NE/ SE	C/E/ SE	C/SE/ NE	C/SW/ W	W/SW	SW/W	SW	SW	C/SW/ NW	C	C/SE/ E	C/SE	
Direction in evening	C/NW/ NE	NW/C/ W	NW/W	NW/W/ SW	W/NW	W/SW	SW	SW	C/NW/ W	C/NW/ N	C/NW/ NE	C/NW	

TABLE - 6
Special Weather Phenomena
GUNA

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.4	0.9	0.9	1.9	2.3	4.7	5.3	5.4	3.7	1.0	0.2	0.0	26.9
Hailstorm	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Dust storm	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Fog	1.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.3	2.8

GWALIOR DISTRICT

The climate of this district is on the whole dry except in the southwest monsoon season. As compared to Malwa region of Madhya Pradesh the climate of this district in the hot season is more oppressive and in the cold season more severe. The year may be divided into four seasons. The hot season is from March to May. The southwest monsoon season is from June to September. October and November constitute the post monsoon or retreating monsoon season. The period from December to February is the cold season.

RAINFALL

Records of rainfall in the district are available for 4 raingauge stations for period ranging from 33 to 49 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 816.9 mm. During the monsoon season (June to September) the district receives rain about 89% of the annual rainfall. August is the rainiest month with average rainfall of 270.9 mm. The annual rainfall in the district varies considerably from year to year. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 141% of the annual normal occurred in year 1971, while the lowest annual rainfall which was 59% of the normal occurred in year 1979. In the fifty year period there were 9 years in which the annual rainfall in the district was less than 80% of the normal and during this period there was not a single occasion when such a low rainfall occurred in two consecutive years. It is seen from Table 2 that the rainfall was between 601 mm and 1000 mm in 34 years out of 48.

On an average there are 39 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 36 at Pichhore(Dabra) to 43 at Gwalior observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 290.0 mm at Bhandar on 15th September 1963.

TEMPERATURE

There is one meteorological observatory in the district located at Gwalior. The description that follows is based on the records of this observatory. The period from March to May is one of continuous increase in temperature. May is the hottest month with mean maximum temperature of 42.1°C and mean minimum of 27.0°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon, by end of September, the day temperatures in October remain somewhat same as in September but the nights become progressively cooler. Night temperatures are highest in June and lowest in January. January is the coldest month with mean maximum temperature at 22.3°C and mean minimum temperature at 7.7°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about the couple of degree below freezing point of water.

The highest maximum temperature ever recorded at Gwalior was 48.3°C on 30th May 1947 and the lowest minimum temperature ever recorded was -1.1°C on 24th January 1954.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 53% to 82% in the morning and 40% to 74% in the afternoon. The values of relative humidity are comparatively less during rest of the year.

The driest part of the year is the summer season, when the average humidity is about 25% in the afternoons and about 44% in the mornings.

CLOUDINESS

During the southwest monsoon season the skies are heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds blow from southwest or west direction. During post monsoon and winter season winds generally blow from Northwest direction. In the summer season winds blow mostly from west and Northwest direction.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Dust storms occur occasionally during the summer season. Thunderstorms occur throughout the year with more frequency during the southwest monsoon season and latter part of summer season. Fog occurs very occasionally during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Gwalior observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
GWALIOR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BHANDAR	37	a	12.9	15.9	5.8	3.7	4.2	78.1	239.4	299.3	164.4	32.0	4.9	7.8	868.4	160	47	290.0	15 SEP1963
		b	0.8	1.3	0.4	0.4	0.4	3.7	10.5	11.8	6.2	1.2	0.3	0.5	37.5	(1985)	(1979)		
GIRD(GWALIOR)	33	a	9.7	12.4	3.6	4.3	10.4	61.6	231.2	253.9	156.6	33.4	5.7	10.2	793.0	141	66	223.0	21 SEP 1988
		b	1.0	0.8	0.6	0.4	0.8	3.7	11.2	12.1	6.2	1.4	0.3	0.7	39.2	(1982)	(2002)		
GWALIOR OBSY	49	a	12.1	15.3	8.4	7.3	15.9	80.7	235.0	250.9	142.8	29.6	8.2	9.1	815.3	142#	66	223.0	22 SEP 1988
		b	1.1	1.1	0.9	0.8	1.6	4.8	11.7	12.1	6.1	1.4	0.5	0.7	42.8	(1996)	(2002)		
PICHHORE(DABRA)	47	a	9.2	11.1	6.4	5.3	9.4	72.2	245.0	279.6	115.2	26.9	3.5	7.0	790.8	223	46	274.3	29 JUN 1952
		b	0.6	0.9	0.5	0.5	0.8	4.0	10.6	11.2	5.3	0.9	0.3	0.4	36.0	(2006)	(1979)		
DISTRICT MEAN	4	a	11.0	13.7	6.0	5.2	10.0	73.1	237.6	270.9	144.8	30.5	5.6	8.5	816.9	141	59		
		b	0.9	1.0	0.6	0.5	0.9	4.1	11.0	11.8	6.0	1.2	0.4	0.6	39.0	1971	1979		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
GWALIOR
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
401 - 500	1	801 - 900	15
501 - 600	6	901 - 1000	3
601 - 700	5	1001 -1100	4
701 - 800	11	1101 -1200	3

(Data available for 48 years)

TABLE – 3
Normals of Temperature and Relative Humidity
GWALIOR

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	22.3	7.7	32.4	28-01-2007	-1.1	24-01-1954	84	56
February	26.6	10.9	37.2	27-02-1966	-0.3	07-02-1974	72	42
March	32.9	16.2	41.7	31-03-1945	5.4	01-03-1972	54	30
April	38.9	21.7	46.2	28-04-1958	11.8	02-04-1996	39	23
May	42.1	27.0	48.3	30-05-1947	17.2	03-05-1987	39	24
June	40.4	28.8	47.8	11-06-2019	18.2	05-06-1986	53	40
July	35.2	27.1	44.6	02-07-2012	20.1	07-07-1987	76	66
August	33.3	26.2	41.7	03-08-1972	19.6	07-08-1995	82	74
September	34.0	24.8	40.0	14-09-1988	15.1	23-09-1972	76	64
October	34.2	19.3	40.1	27-10-1994	8.9	31-10-1952	69	54
November	30.1	13.1	37.3	02-11-2001	3.0	29-11-1970	74	57
December	25.2	8.5	32.1	06-12-2006	-0.4	26-12-1961	83	60
Annual	32.8	19.2	48.3	30-05-1947	-1.1	24-01-1954	67	49

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
GWALIOR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	21	17	19	18	21	11	2	2	10	24	24	23	192
b	1	1	1	0	0	2	6	7	3	1	0	0	22
C	1.7	1.6	1.5	1.4	1.1	2.7	5.3	5.4	3.1	0.9	0.9	1.0	2.2
1730 HOURS IST													
a	18	16	15	12	12	3	0	0	6	19	19	21	141
b	1	0	1	0	0	2	6	5	2	1	0	0	18
c	1.8	1.7	1.9	2.1	2.0	3.9	5.8	5.7	3.6	1.3	1.2	1.2	2.7

a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
GWALIOR

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	1.9	2.6	3.4	3.8	5.1	5.4	4.7	4.1	3.5	1.7	1.3	1.5	3.2
Direction in morning	C	C	C/NW	C/NW/W	C/W/NW	C/W/NW	C/W/SW	C/W/SW	C/W/SW	C	C	C	
Direction in evening	C/NW/N	C/NW	NW/C	NW	NW	NW/C/W	C/W/SW	C/W/SW	C/NW/W	C	C	C	

TABLE - 6
Special Weather Phenomena
GWALIOR

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.7	0.9	0.8	1.3	3.0	4.1	5.4	6.1	3.5	0.9	0.1	0.4	27.2
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.1	1.5	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.0
Fog	4.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	6.1

HARDA DISTRICT

The district has a dry climate except during the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February, is followed by the hot season which continues up to the middle of June. The period from mid June to the end of September is the southwest monsoon season. October and November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 1 raingauge station for period of 40 years. The details of the rainfall at this station and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1163.4 mm. During the monsoon season (June to September) the district receives rain about 93% of the annual rainfall. August is the rainiest month with average rainfall of 395.7mm. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 165% of the annual normal occurred in year 2013, while the lowest annual rainfall which was 49% of the normal occurred in year 1991. In the fifty year period there were 6 years in which the annual rainfall in the district was less than 80% of the normal and during this period there was a single occasion when such a low rainfall occurred in two consecutive years. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 15 years out of 28.

On an average there are 48 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 396.2 mm at Harda on 08 July 2007.

TEMPERATURE

There is no meteorological observatory in the district, therefore, the records of the nearby district observatory at Hoshangabad may be taken as representative of the conditions in the Harda district. The period from about the end of February to May is one of continuous increase in temperature. May is the hottest month with mean maximum temperature at about 42°C and mean minimum about 27°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. With the withdrawal of the monsoon after about the end of September there is a slight increase in day temperature in October but the nights become progressively cooler. From about mid-November both day and night temperatures decrease rapidly. January is the coldest month with maximum temperature at about 25°C and mean minimum temperature at about 12°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about couple of degree above the freezing point of water.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 65% to 90% in the morning and 50% to 80% in the afternoon. The values of relative humidity decrease comparatively in the post monsoon season, and in the rest of the year the atmosphere is generally very dry. The driest part of the year is the summer season, when the average humidity is about 40% in the morning and 23% in the afternoon.

CLOUDINESS

During the southwest monsoon season the skies are heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds generally blow from west or southwest direction. During post monsoon and winter season winds generally blow from east direction. In the latter part of summer season winds generally blow from west or southwest direction.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the monsoon season cross the east coast of India and move in some westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms occur almost throughout the year. Fog occurs occasionally during the winter season.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
HARDA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
HARDA	40	a b	5.7 0.5	9.4 0.8	3.5 0.3	0.6 0.1	5.0 0.4	126.0 6.8	388.5 13.3	395.7 14.8	168.7 7.6	34.9 1.7	16.2 0.8	9.2 0.7	1163.4 47.8	165 (2013)	49 (1991)	396.2	08 JUL 2007
DISTRICT MEAN	1	a b	5.7 0.5	9.4 0.8	3.5 0.3	0.6 0.1	5.0 0.4	126.0 6.8	388.5 13.3	395.7 14.8	168.7 7.6	34.9 1.7	16.2 0.8	9.2 0.7	1163.4 47.8	165 (2013)	49 (1991)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
HARDA
(Data 1972-2013)

Range in mm	No. of years	Range in mm	No. of years
501 - 600	1	1301 - 1400	1
601 - 700	1	1401 - 1500	3
701 - 800	2	1501 - 1600	1
801 - 900	2	1601 - 1700	1
901 - 1000	1	1701 - 1800	0
1001 - 1100	6	1801 - 1900	1
1101 - 1200	3	1901 - 2000	1
1201 - 1300	4		

(Data available for 28 years)

HOSHANGABAD DISTRICT

The district has dry climate except during the southwest monsoon season. The year may be divided into four seasons. Winter season commences from December and lasts till the end of February. Summer season follows thereafter and continues till about the second week of June. Southwest monsoon season is from the middle of June to September. October and November months constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for 5 rain gauge stations for the period ranging from 33 to 49 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1246.6 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 93% of annual rainfall. August is the rainiest month with average rainfall of about 437.1 mm. The variation in the rainfall from year to year is large. The annual rainfall in the district varies spatially over a small range except for regions around Pachmarhi which gets comparatively more rainfall. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 209% of the annual normal occurred in year 1973, while the lowest annual rainfall which was 46% of the normal occurred in 2018. In the fifty-year period there were 11 years in which the annual rainfall in the district was less than 80% of the normal and during this same period there were two occasions of two consecutive years. It is seen from Table 2 that the annual rainfall was between 1001 mm and 1500 mm in 23 years out of 47.

On an average there are 49 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 45 at Seoni to 71 at Pachmarhi observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 458.7 mm at Pachmarhi observatory on 2nd August 1913.

TEMPERATURE

There is a meteorological observatory in the district located at Hoshangabad at an elevation of 302 meter above mean sea level respectively. The description that follows is based on the records of this observatory. Temperatures begin to rise rapidly from March till May. May is generally the hottest month with the mean maximum temperature of about 42°C and mean minimum temperature of about 27°C. The heat in the summer is intense, on some days the maximum temperature may reach about 47°C. Thundershowers sometimes occur during afternoons bring some relief from the heat. With the onset of the southwest monsoon season over the district by about the second week of June there is considerable drop in the temperatures, the day temperatures go down appreciably but the drop in the night temperatures is slight. After the withdrawal of monsoon by about September, the day temperature increases slightly in October but nights become progressively cooler. After mid November day and night temperatures decrease rapidly. January is the coldest month of the year with the mean maximum temperature about 25.8°C and mean minimum temperature about 12.0°C. During winter season, cold waves sometimes affect the district in the wake of western disturbances which move across north India, on such occasions the minimum temperature may go down to about 2°C or 3°C in the plains and degree or so below the freezing point of water at Panchmarhi where frost may occur.

The highest maximum temperature recorded at Hoshangabad observatory was 47.7°C on 7th June 2019 and the lowest minimum temperature recorded was 1.0°C on 12th January 1989.

HUMIDITY

The value of relative humidity is generally lower in the afternoon than in the morning, except in the southwest monsoon months when there is little difference. In the southwest monsoon months, the air is generally humid with high value of relative humidity. Humidity decreases in post monsoon and winter seasons and air is generally mild humid. Summer season is the driest part of the year with value of relative humidity in the afternoon is sometimes less than 20%.

CLOUDINESS

During the southwest monsoon season, skies are heavily clouded to overcast. In rest of the year skies are generally clear to lightly clouded.

WINDS

Winds are generally light to calm with some strengthening in force during the late summer and southwest monsoon season. During southwest monsoon season winds are southwesterly and westerly. Winds are predominantly easterly in post monsoon and cold season.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season and early post-monsoon season cross the east coast of India and move in some westerly direction and affect the weather of the district and its neighbourhood and cause gusty winds and widespread heavy rain. Thunderstorms occur throughout the year; its frequency is more in latter part of summer and southwest monsoon season and to lesser extent in cold season. Rain during southwest monsoon season is also often associated with thunder. Fog occurs occasionally during winter months.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Hoshangabad observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
HOSHANGABAD

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
HOSHANGABAD OBSY	49	a	9.0	13.4	7.6	3.5	13.6	154.9	415.7	437.9	205.1	30.2	18.5	8.7	1318.1	155	60	380.0	14 AUG 2006
		b	0.9	1.0	0.8	0.3	1.3	7.8	15.1	16.5	9.0	1.9	0.9	0.7	56.2	(1994)	(2008)		
MAKRAI	33	a	2.2	8.0	5.0	0.0	2.8	120.1	399.6	502.9	242.7	12.4	31.6	3.0	1330.3	196	53	367	03 JUL 1930
		b	0.3	0.7	0.1	0.0	0.3	5.5	12.8	15.0	8.8	1.1	1.0	0.2	45.8	(1973)	(1998)		
@PACHMARHI OBSY	40	a	11.1	19.4	18.5	5.2	13.0	215.0	526.2	652.0	268.2	43.7	19.3	10.2	1801.8	176	56	458.7	02 AUG 1913
		b	1.2	1.6	1.3	0.6	1.2	9.5	19.2	20.3	11.8	2.2	1.2	0.7	70.8	(1973)	(2008)		
SEONI	44	a	8.2	6.9	5.9	3.9	4.4	167.7	361.1	408.0	183.3	26.2	8.3	8.5	1192.4	164	54	380.0	27 JUN 2003
		b	0.6	0.5	0.5	0.3	0.3	6.0	13.0	14.4	7.2	1.6	0.4	0.4	45.2	(2003)	(1979)		
T.DAM(HOSH.BAD) HYDRO	38	a	14.1	9.5	8.8	3.4	9.6	135.0	352.2	399.6	151.8	31.4	18.6	11.4	1145.4	157	8	217.2	1 AUG 2013
		b	1.1	0.9	0.7	0.3	0.9	7.1	14.2	14.5	7.1	1.6	0.8	0.8	50.0	(1994)	(2015)		
DISTRICT MEAN	5	a	8.4	9.5	6.8	2.7	7.6	144.4	382.2	437.1	195.7	25.1	19.2	7.9	1246.6	209	46		
		b	0.7	0.8	0.5	0.2	0.7	6.6	13.8	15.1	8.0	1.5	0.8	0.5	49.2	1973	2018		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
HOSHANGABAD
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	1	1601 - 1700	3
601 - 700	1	1701 - 1800	2
701 - 800	3	1801 - 1900	2
801 - 900	2	1901 - 2000	0
901 - 1000	5	2001 - 2100	1
1001 - 1100	7	2101 - 2200	0
1101 - 1200	5	2201 - 2300	0
1201 - 1300	3	2301 - 2400	0
1301 - 1400	3	2401 - 2500	0
1401 - 1500	5	2501 - 2600	0
1501 - 1600	3	2601 - 2700	1

DATA AVAILABLE FOR 47 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
HOSHANGABAD

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	830 IST	1730 IST
JANUARY	25.8	12.0	33.0	07-01-1973	1.0	12-01-1989	70	50
FEBRUARY	28.9	14.1	37.8	28-02-1953	3.8	04-02-1988	63	40
MARCH	34.8	18.3	44.0	27-03-1971	8.2	01-03-1988	50	27
APRIL	40.0	23.1	46.0	25-04-1980	11.7	01-04-1988	35	19
MAY	42.0	27.0	47.1	25-05-2010	13.4	04-05-1988	39	23
JUNE	37.8	26.5	47.7	07-06-2019	15.5	20-06-1988	65	48
JULY	31.1	24.3	43.2	12-07-1966	15.7	27-07-1988	87	75
AUGUST	29.5	23.6	37.5	03-08-1972	15.9	10-08-1979	92	83
SEPTEMBER	31.9	23.0	40.4	25-09-1959	15.7	24-09-1972	86	72
OCTOBER	33.5	19.9	38.5	22-10-2000	9.4	24-10-1988	73	53
NOVEMBER	31.0	16.2	36.1	06-11-2008	2.2	30-11-1988	67	50
DECEMBER	27.9	12.4	33.5	01-12-1996	2.8	05-12-1988	68	47
ANNUAL	32.8	20.0	47.7	07-06-2019	1.0	12-01-1989	66	49

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
HOSHANGABAD

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	18	19	22	20	20	5	0	0	4	16	19	22	165
b	2	0	0	0	0	4	15	18	6	1	1	1	48
c	1.5	1.0	1.1	1.0	1.0	4.0	6.5	7.0	4.2	1.7	1.2	1.0	2.6
1730 HOURS IST													
a	17	16	17	10	6	1	0	0	2	11	15	20	115
b	1	0	0	0	1	4	12	12	5	1	0	0	36
c	1.5	1.2	1.5	2.3	2.9	4.9	6.4	6.6	4.6	2.3	1.6	1.1	3.1

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
HOSHANGABAD

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	E	E	E	C/E	W/SW	SW/W	SW	SW /W/C	C/W/SW	C/E	E	E	
Direction in evening	C	C/E	C	SW /C/W	SW/W	SW	SW	SW /C/W	C	C	C	C	

TABLE - 6
Special Weather Phenomena
HOSHANGABAD

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.1	0.1	0.1	0.2	0.3	0.5	0.4	0.1	0.1	0.0	0.0	1.9
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

INDORE DISTRICT

The district has a pleasant climate and except during the southwest monsoon season the climate is dry. The year may be divided into four seasons. Winter season commences from December and lasts till the end of February. Summer season follows thereafter and continues till about the second week of June. Southwest monsoon season is from the middle of June to September. October and November months constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for 6 rain gauge stations for the period ranging from 32 to 48 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 929.3 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 93% of annual rainfall. August is the rainiest month with average rainfall of about 296.7 mm. The variation in the rainfall from year to year is large. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 206% of the annual normal occurred in year 1973, while the lowest annual rainfall which was 56% of the normal occurred in 1992. In the fifty-year period there were 10 years in which the annual rainfall in the district was less than 80% of the normal and there were two occasions of such a low rainfall occurred in two consecutive years. It is seen from Table 2 that the annual rainfall was between 701 mm and 1100 mm in 30 years out of 47.

On an average there are 41 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 36 at Gautampura to 47 at Indore (obsy).

The heaviest rainfall in 24 hours recorded at any station in the Indore district was 362.0 mm at Gautampura on 30th August 1994.

TEMPERATURE

There is one meteorological observatory in the district located at Indore at an elevation of 567 meter above mean sea level. The description that follows is based on the records of this observatory. Temperatures begin to drop down rapidly from mid-November and extend up to February. January is the coldest month of the year with the mean maximum temperature about 26.2°C and mean minimum temperature about 10.3°C. During winter season, cold waves sometimes affect the district in the wake of western disturbances which move across north India, on such occasions the minimum temperature may go down to about freezing temperature of water. After February temperatures progressively rise and by the month of May which generally the hottest month with the mean maximum temperature of about 40.4°C and mean minimum temperature of about 24.6°C. The heat in the summer is intense, on some days the maximum temperature may reach about 46°C. Thundershowers sometimes occur during afternoons bring some relief from the heat. With the onset of the southwest monsoon season over the district by about the second week of June there is considerable drop in the temperatures, the day temperatures go down appreciably but the drop in the night temperatures is slight. After the withdrawal of monsoon by about September, the day temperature increases slightly in October but nights becomes progressively cooler. Thereafter temperatures decreases and winter conditions set in the latter part of November.

The highest maximum temperature recorded at Indore was 46.0°C on 31st May 1994 and the lowest minimum temperature recorded was -2.8°C on 1st February 1929.

HUMIDITY

In the southwest monsoon months the air is generally humid with high value of relative humidity. Humidity decreases in post monsoon and winter seasons and air is generally mild humid. Summer season is the driest part of the year with value of relative humidity in the afternoon is sometimes less than 20%.

CLOUDINESS

During the southwest monsoon season, skies are heavily clouded to overcast. In rest of the year skies are generally clear to lightly cloudy.

WINDS

Winds are generally light to calm with some strengthening in force during the late summer and southwest monsoon season. In summer season winds are mainly westerly and northwesterly. During southwest monsoon season winds blow mainly from west direction. Winds are predominantly northeasterly in post monsoon and cold season.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season and early post-monsoon season cross the east coast of India and move in some westerly direction and affect the weather of the district and its neighbourhood and cause gusty winds and widespread heavy rain. Thunderstorms occur throughout the year; its frequency is more in latter part of summer and southwest monsoon season and to lesser extent in cold season. Occasionally dust storms with dust raising winds occur during late summer and monsoon period. Rain during southwest monsoon season is also often associated with thunder. Fog occurs at times during monsoon, post monsoon and winter months.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Indore observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
INDORE

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MONYEAR
DEPALPUR	47	a	4.1	2.9	0.9	2.1	7.8	128.4	300.7	309.1	157.2	34.3	9.8	2.7	960.0	185	42	242.1	10 AUG 1979
		b	0.3	0.1	0.1	0.2	0.2	5.6	11.6	12.4	7.1	1.7	0.6	0.3	40.2	(2013)	(1985)		
GAUTAMPURA	32	a	2.3	4.5	2.0	0.6	0.0	110.7	291.5	291.9	178.3	23.1	4.5	1.4	910.8	191	57	362.0	30 AUG 1994
		b	0.2	0.4	0.2	0.0	0.0	4.2	11.8	11.0	6.5	1.0	0.3	0.1	35.7	(2019)	(1986)		
INDORE OBSY	48	a	5.7	3.2	3.5	3.5	11.5	146.1	296.1	302.8	182.4	38.2	16.5	5.4	1014.9	189	55	293.4	27 JUL 1913
		b	0.4	0.4	0.4	0.3	1.3	7.0	12.8	13.0	7.7	2.5	1.0	0.4	47.2	(1973)	(2008)		
INDORE(CORPORAT)	33	a	3.5	2.0	0.3	1.5	5.1	127.8	280.2	320.7	132.7	37.4	13.8	4.6	929.6	226	76	251.9	31 AUG 1973
		b	0.3	0.3	0.1	0.1	0.7	6.3	11.3	13.2	5.6	2.0	0.8	0.3	41.0	(1973)	(1987)		
MHOW	41	a	2.7	5.5	4.4	0.4	5.2	117.9	259.4	258.9	157.5	33.0	10.0	3.5	858.4	191	42	356.0	4 JUL 2013
		b	0.2	0.3	0.2	0.0	0.5	6.6	12.7	12.7	7.4	1.8	0.6	0.3	43.3	(2013)	(1992)		
SANWER	43	a	4.5	4.9	3.1	0.8	5.3	95.3	296.7	296.8	139.9	30.3	17.2	7.4	902.2	212	59	250.0	28 JUL 2005
		b	0.3	0.4	0.2	0.1	0.3	5.2	11.7	11.8	6.6	1.7	1.0	0.2	39.5	(1973)	(1972)		
DISTRICT MEAN	6	a	3.8	3.8	2.4	1.5	5.8	121.0	287.4	296.7	158.0	32.7	12.0	4.2	929.3	206	56		
		b	0.3	0.3	0.2	0.1	0.5	5.8	12.0	12.4	6.8	1.8	0.7	0.3	41.2	1973	1992		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
INDORE
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	1	1301 - 1400	0
601 - 700	7	1401 - 1500	1
701 - 800	6	1501 - 1600	1
801 - 900	6	1601 - 1700	0
901 - 1000	10	1701 - 1800	0
1001 - 1100	8	1801 - 1900	0
1101 - 1200	2	1901 - 2000	1
1201 - 1300	4		

DATA AVAILABLE FOR 47 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
INDORE

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	830	1730
JANUARY	26.2	10.3	33.9	27.01.1990	-1.1	16.01.1935	62	37
FEBRUARY	29.4	12.6	37.9	22.02.2006	-2.8	01.02.1929	51	27
MARCH	34.5	16.9	41.1	28.03.1892	5.0	04.03.1898	36	18
APRIL	38.7	21.3	44.6	25.04.1958	7.8	01.04.1905	31	15
MAY	40.4	24.6	46.0	31.05.1994	16.7	03.05.1881	46	20
JUNE	36.4	24.4	45.8	03.06.1991	18.9	12.06.1958	69	46
JULY	30.2	22.8	39.9	12.07.1966	18.9	11.07.1983	86	72
AUGUST	28.6	22.0	35.8	19.08.1987	18.6	22.08.2008	90	78
SEPTEMBER	30.6	21.1	37.4	27.09.1987	13.6	24.09.1972	85	66
OCTOBER	32.8	18.2	37.8	22.10.2000	6.2	22.10.1999	61	40
NOVEMBER	30.4	14.7	35.0	05.11.1925	5.6	25.11.1938	54	36
DECEMBER	27.6	11.4	33.0	31.12.2015	1.1	27.12.1936	60	38
ANNUAL	32.1	18.4	46.0	31.05.1994	-2.8	01.02.1929	60	41

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
INDORE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	17	18	20	19	18	3	0	0	3	14	17	16	145
b	0	0	0	0	0	1	5	5	2	0	0	0	13
c	1.4	1.1	1.1	1.1	1.2	4.3	6.1	6.4	4.3	1.7	1.3	1.4	2.6
1730 HOURS IST													
a	17	15	15	10	8	1	0	0	0	7	13	16	102
b	0	0	0	0	0	1	3	3	1	0	0	0	8
c	1.4	1.3	1.7	2.1	2.3	4.5	5.9	5.8	4.6	2.7	1.7	1.5	3.0

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
INDORE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	4.5	5.5	6.3	7.9	11.5	12.6	11.9	9.3	6.1	3.9	3.4	3.6	7.2
Direction in morning	C/E	C	C/W/E	W/NW	W/NW	W	W	W	W/NW	C	C	C	
Direction in evening	NE	NE/NW	NW/W	W/NW	NW/W	W	W	W	W/NW	NE	NE/C	NE/C	

TABLE - 6
Special Weather Phenomena
INDORE

Mean No. Of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.4	0.7	1.2	1.4	3.0	6.8	5.0	3.2	5.0	2.3	0.7	0.2	29.9
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.4	0.0	0.7
Fog	1.3	0.4	0.1	0.0	0.0	0.0	0.0	0.5	1.1	0.4	0.8	1.1	5.7
Squall	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3

JHABUA DISTRICT

The district has dry climate except during the southwest monsoon season. The year may be divided into four seasons. Winter season commences from December and lasts till the end of February. Summer season follows thereafter and continues till about the end of May followed by the southwest monsoon season is from June to September. October and November months constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for 3 rain gauge stations for the period ranging from 39 to 40 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 924.1 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 93% of annual rainfall. August is the rainiest month with average rainfall of about 309.7 mm. The variation in the rainfall from year to year is large. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 173% of the annual normal occurred in year 2019, while the lowest annual rainfall which was 33% of the normal occurred in 1985. In the fifty-year period there were 12 years in which the annual rainfall in the district was less than 80% of the normal and during this same period there were three occasions of two consecutive years of such a low rainfall. It is seen from Table 2 that the annual rainfall was between 701 mm and 1200 mm in 23 years out of 40.

On an average there are 42 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 41 at Jhabua to 44 at Petalwad.

The heaviest rainfall in 24 hours recorded at any station in the district was 292.1 mm at Jhabua on 26th July 1913.

TEMPERATURE

There is no meteorological observatory in the district. Therefore the description that follows is based on the records of Alirajpur observatory which is in the neighbouring district. This observatory is located at an elevation of 293 meters above mean sea level. The hot season commences by March and temperatures rise gradually with the advance of the season. May is the hottest month with the mean daily maximum temperature at 38.2 °C and the mean daily minimum temperature at 23.3°C. The maximum temperature may sometimes reach to about 44 °C. With the onset of the monsoon by about the middle of June, the weather becomes cool. After the withdrawal of the monsoon by the end of September, day temperatures increase slightly. From November both day and night temperatures decrease continuously till January, which is the coldest month. The mean daily minimum temperature in January is 9.5 °C. In the wake of some western disturbances passing across north India, cold waves affect the district and temperatures may go down on some occasions to about couple degree above the freezing point of water.

HUMIDITY

In the southwest monsoon months the air is generally humid with high value of relative humidity. Humidity decreases in post monsoon and winter seasons. Summer season is the driest part of the year with afternoon humidity is about 28-35%.

WINDS

Winds are generally light to calm with some strengthening in force during the late summer and southwest monsoon season. During southwest monsoon season winds are westerly and southwesterly. Winds are predominantly easterly in post monsoon season. During cold season the winds blow from east in mornings where as in afternoons wind blow from west. With the beginning of summer season winds are predominantly westerly.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season and early post-monsoon season cross the east coast of India and move in some westerly direction and affect the weather of the district and its neighbourhood and cause gusty winds and widespread heavy rain.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
JHABUA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
JHABUA	45	a	2.7	1.5	1.0	1.1	7.0	107.9	267.8	294.3	133.5	36.8	10.7	3.5	867.8	173	35	292.1	26 JUL 1913
		b	0.2	0.1	0.1	0.1	0.4	5.5	12.4	12.3	6.7	1.9	0.8	0.2	40.7	(2006)	(1985)		
PETALWAD	39	a	3.2	1.3	0.6	2.2	4.7	120.3	312.8	324.6	172.6	41.4	10.6	4.1	998.4	153	50	255.0	26 JUL 2015
		b	0.2	0.1	0.1	0.1	0.3	6.0	13.0	13.5	8.4	1.5	0.7	0.2	44.1	(2019)	(1999)		
THANDLA	40	a	2.0	0.9	0.7	1.9	3.7	125.1	272.4	310.1	151.6	21.5	11.6	4.6	906.1	185	46	252.8	5 AUG 2019
		b	0.2	0.2	0.1	0.2	0.2	5.5	11.8	12.7	7.6	1.3	0.7	0.3	40.8	(2019)	(1999)		
DISTRICT MEAN	3	a	2.6	1.2	0.8	1.7	5.1	117.8	284.3	309.7	152.6	33.2	11	4.1	924.1	173	33		
		b	0.2	0.1	0.1	0.1	0.3	5.7	12.4	12.8	7.6	1.6	0.7	0.2	41.8	2019	1985		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
JHABUA
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
301 - 400	1	1001 - 1100	5
401 - 500	1	1101 - 1200	6
501 - 600	2	1201 - 1300	1
601 - 700	7	1301 - 1400	2
701 - 800	3	1401 - 1500	2
801 - 900	5	1501 - 1600	0
901 - 1000	4	1601 - 1700	1

DATA AVAILABLE FOR 40 YEARS.

KHANDWA DISTRICT

The climate of the district is generally dry. The cold season from December to February, is followed by hot season which continues up to May. The period June to the end of September is the southwest monsoon season. October and November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for three rain gauge stations for period ranging from 30 to 45 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 861.1 mm. During the monsoon season (June to September) the district receives rain about 91% of the annual rainfall. July is the rainiest month with average rainfall of 265.9 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 169% of the annual normal occurred in year 2013, while the lowest annual rainfall which was 51% of the normal occurred in year 1992. In the fifty years period there were 07 years in which the annual rainfall in the district was less than 80% of the normal and during this period there were two occasions when such a low rainfall occurred in consecutive years. It is seen from Table 2 that the rainfall was between 601 mm and 1100 mm in 33 years out of 44.

On an average there are 41 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 37 at Pandhana to 44 at Khandwa observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 372.0 mm at Harsud on 10 August 1981.

TEMPERATURE

There is one meteorological observatory in the district located at Khandwa at an elevation of 318 metre above mean sea level. The description that follows is based on the records of this observatory. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 41.7°C and mean minimum of 26.7°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon, early in October, the day temperatures remain same as in September but the nights become progressively cooler. Towards the end of the monsoon season day temperatures increase slightly and reach a secondary maximum in October. But the night becomes progressively cooler. January is the coldest month with mean maximum temperature at about 28.6°C and mean minimum temperature at 10.9°C.

The highest maximum temperature ever recorded at Khandwa was 47.6°C on 13 May 1970 and the lowest minimum temperature ever recorded was 0.2°C on 2 February 2008.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 64% to 84% in the morning and 42% to 72% in the afternoon. The values of relative humidity start to decrease in October. Relative humidity is comparatively less during rest of the year. The driest part of the year is the summer season, when the average humidity is less than 18% in the afternoons and about 37% in the mornings.

CLOUDINESS

During the southwest monsoon season the skies is heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds generally blow from west direction. During post monsoon and winter season winds blow from west and northwest direction. In the summer season also winds generally blow from west direction.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Dustorms occurs occasionally during the summer season. Thunderstorms occur frequently during the period January to September. Fog occurs very occasionally during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, mean wind speed and wind direction and special weather phenomena respectively for Khandwa observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
KHANDWA

STATION	No. of Years of Data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL RAINFALL AS % OF NORMAL & YEARS**		HEAVIEST RAINFALL IN 24 HOURS*	
																HIGHEST	LOWEST	AMOUNT (mm)	DT MON YR
HARSUD	45	a b	7.0 0.4	4.9 0.5	2.8 0.3	0.8 0.1	6.2 0.5	126.2 6.3	283.5 11.9	288.6 11.7	143.9 6.4	30.7 1.5	13.3 0.7	4.9 0.2	912.8 40.5	157 (1973)	43 (1992)	372.0	10 AUG 1981
KHANDWA OBSY	43	a b	6.5 0.4	4.1 0.5	8.5 0.5	3.3 0.4	10.3 0.7	126.1 6.3	268.4 12.3	249.5 11.8	158.2 7.3	35.7 2.1	15.3 0.9	8.1 0.5	894.0 43.7	220 (2013)	62 (1987)	278.0	22 SEP 1998
PANDHANA	30	a b	4.6 0.3	3.1 0.3	2.9 0.3	1.9 0.1	6.4 0.3	115.5 5.6	245.8 11.2	193.5 9.8	159.4 6.7	38.9 2.0	4.3 0.2	0.4 0.1	776.7 36.9	162 (1998)	63 (1992)	290.2	1 JUL 2007
DISTRICT MEAN	3	a b	6.0 0.4	4.0 0.4	4.7 0.4	2.0 0.2	7.6 0.5	122.6 6.1	265.9 11.8	243.9 11.1	153.8 6.8	35.1 1.9	11.0 0.6	4.5 0.3	861.1 40.5	169 2013	51 1992		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1971-2020)
KHANDWA

Range in mm	No. of years	Range in mm	No. of years
401 - 500	1	1001 - 1100	3
501 - 600	2	1101 - 1200	4
601 - 700	7	1201 - 1300	3
701 - 800	5	1301 - 1400	0
801 - 900	9	1401 - 1500	1
901 - 1000	9		

(Data available for 44 years)

TABLE – 3
Normals of Temperature and Relative Humidity
(KHANDWA)

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	28.6	10.9	35.5	31-01-2009	1.7	07-01-1946	64	33
February	31.5	13.5	39.5	26-02-2006	0.2	02-02-2008	52	23
March	36.7	18.6	43.3	28-03-1892	6.0	03-03-1971	37	17
April	40.3	23.6	46.7	25-04-1958	11.1	02-04-1905	31	14
May	41.7	26.7	47.6	13-05-1970	17.2	03-05-1881	44	20
June	37.2	25.1	46.3	01-06-1995	16.0	28-06-2001	64	42
July	31.1	22.8	42.2	07-07-1969	15.1	26-07-2004	80	66
August	29.6	22.1	39.4	29-08-1951	14.5	23-08-2004	84	72
September	31.6	21.7	40.6	12-09-1899	12.2	22-09-2011	80	62
October	34.0	18.6	40.1	07-10-2000	8.5	27-10-2004	66	42
November	32.1	15.1	40.1	03-11-2002	4.6	30-11-1970	61	36
December	29.8	11.4	34.5	11-12-2008	1.2	28-12-1968	61	33
Annual	33.7	19.1	47.6	13-05-1970	0.2	02-02-2008	60	38

TABLE – 4
Mean Cloud Amount ^{}(Okta of the Sky) and Mean Number**
of days of Clear and Overcast Skies
(KHANDWA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	25	24	27	26	26	11	2	1	12	23	25	28	230
b	1	1	1	0	0	7	15	16	7	2	1	1	52
C	1.0	0.7	0.6	0.6	0.6	3.8	6.2	6.3	3.8	1.4	0.8	0.5	2.2
1730 HOURS IST													
a	24	22	22	20	19	6	1	2	7	18	22	27	190
b	1	1	1	0	0	9	11	13	6	2	1	1	46
c	1.0	0.7	1.1	1.4	1.7	4.5	6.2	6.2	4.1	1.9	1.1	0.6	2.5

- a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
^{**} Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
(KHANDWA)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	2.0	3.0	3.8	5.1	9.3	9.9	9.1	6.7	4.3	1.6	1.3	1.1	4.5
Direction in morning	C	C	C/W/NW	C/ W	W	W	W	W	C/ W	C	C	C	
Direction in evening	C	C/NW/W	C/W/NW	C/ W	W/C	W/C	W	W	C/W	C	C	C	

TABLE - 6
Special Weather Phenomena
(KHANDWA)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MANDSAUR DISTRICT

The district has dry climate except during the southwest monsoon season. The year may be divided into four seasons. Winter season commences from December and lasts till the end of February. Summer season follows thereafter and continues till about the middle of June. Southwest monsoon season is from the middle of June to September. October and November months constitute the post monsoon season.

RAINFALL

Records of rainfall in the district are available for five rain gauge stations for the period ranging from 32 to 48 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 882.8 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 93% of annual rainfall. August is the rainiest month with average rainfall of about 309.8 mm. The variation in the rainfall from year to year is small. In the fifty years period 1971 to 2020, the highest annual rainfall amounting to 239% of the annual normal occurred in year 2019, while the lowest annual rainfall which was 50% of the normal occurred in 1979. In the fifty-year period there were 10 years in which the annual rainfall in the district was less than 80% of the normal and three of them were consecutive years. It is seen from Table 2 that the annual rainfall was between 701 mm and 1100 mm in 26 years out of 43.

On an average there are 37 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 35 at Suvasara to 37 at Bhonpur and Mandsaur.

The heaviest rainfall in 24 hours recorded at any station in the district was 340.2 mm at Garoth on 16 August 2004.

TEMPERATURE

There is no meteorological observatory in the district. Therefore the description that follows is based on the records of Neemuch observatory which is in the neighbouring district. This observatory is located at an elevation of 496 meter above mean sea level. There is rapid increase in temperature after February till May which is the hottest month with mean maximum temperature 40.1°C and mean minimum temperature 25.0°C. The heat in summer is quite intense and the hot dust raising winds in the latter part of the summer add to the discomfort. The

day temperature during the period April to the early part of June goes up to about 44°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. By end of September when the southwest monsoon withdraws from the district there is a slight increase in the day temperatures but the nights become progressively cooler. After about mid-November the drop in the temperatures is more rapid. January is the coldest month with mean maximum temperature at 25.0°C and mean minimum temperature at 9.7°C. During the winter season, the cold waves in the rear of western disturbances passing across north India affect the district and on such occasions the minimum temperature occasionally goes down to about a degree or so below the freezing point of water and frosts occur.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges in between 65% to 88% in morning and 43% to 76% in afternoon. The air is generally dry in the rest of the year, the driest part of the year being the period February to May when the afternoon relative humidity is less than 35%.

CLOUDINESS

During the southwest monsoon season the skies are generally heavily clouded and sometimes overcast. During the rest of the year the skies are mostly clear or lightly clouded. However, in the winter season for brief spells of a day or two, cloudy skies prevail in association with passing western disturbances.

WINDS

Winds are generally light with some strengthening in force during the late summer and southwest monsoon. During the southwest monsoon season, winds generally blow from southwest or west direction. During post monsoon and winter season winds mostly blow from northeast direction. In the summer season winds blow from west or southwest directions both in the mornings and in the afternoons.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighborhood causing widespread heavy rain and gusty winds. Thunderstorms occur during the southwest monsoon period. Fog occurs very rarely during winter season.

TABLE - I
NORMALS AND EXTREMES OF RAINFALL
MANDSAUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YR
BHONPURA	32	A	2.1	3.5	3.8	2.1	4.3	87.2	278.1	339.4	128.2	21.5	14.4	4.9	889.5	217	49	211.8	26 JUL 2015
		B	0.1	0.4	0.4	0.1	0.5	4.6	11.0	12.1	5.7	1.0	0.8	0.4	37.1	(2019)	(1979)		
GAROTH	48	A	4.0	4.8	3.1	8.7	5.1	105.5	281.2	323.0	120.5	28.0	13.2	2.9	900.0	264	50	340.2	16 AUG 2004
		B	0.3	0.3	0.3	0.2	0.5	4.7	11.0	11.5	5.6	1.3	0.8	0.3	36.8	(2019)	(1979)		
MANDSAUR	43	A	5.7	3.7	1.9	2.9	5.0	88.8	278.2	252.0	134.3	31.1	15.9	3.9	823.4	196	55	334.0	08 SEP 2010
		B	0.3	0.4	0.2	0.3	0.5	5.2	11.1	10.9	5.6	1.6	0.7	0.3	37.1	(1973)	(2002)		
SITAMAU	43	A	4.3	3.4	2.1	2.3	4.6	98.2	277.1	306.1	127.2	32.6	13.5	2.7	874.1	202	49	259.1	20 AUG 1974
		B	0.3	0.3	0.3	0.2	0.3	4.8	10.6	11.3	5.5	1.3	0.7	0.2	35.8	(1973)	(1979)		
SUVASARA	45	A	3.9	1.8	1.4	2.1	4.8	99.6	302.6	328.6	143.1	28.2	7.8	2.4	926.3	219	41	256.5	19 AUG 1941
		B	0.2	0.2	0.2	0.1	0.3	4.6	11.1	11.1	5.7	1.1	0.4	0.2	35.2	(2019)	(1979)		
DISTRICT MEAN	5	A	4.0	3.4	2.5	3.6	4.8	95.9	283.4	309.8	130.7	28.3	13.0	3.4	882.8	239	50		
		B	0.2	0.3	0.3	0.2	0.4	4.8	11.0	11.4	5.6	1.3	0.7	0.3	36.5	2019	1979		

(A) NORMAL RAINFALL IN MM

(B) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE – 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
MANDSAUR
(DATA 1971-2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	1	1301 - 1400	1
501 - 600	2	1401 - 1500	0
601 - 700	7	1501 - 1600	1
701 - 800	8	1601 - 1700	0
801 - 900	9	1701 - 1800	0
901 - 1000	4	1801 - 1900	0
1001 - 1100	5	1901 - 2000	0
1101 - 1200	4	2001 - 2100	0
1201 - 1300	0	2101 - 2200	1

DATA AVAILABLE FOR 43 YEARS

MORENA DISTRICT

The climate of this district is characterized by a hot summer and general dryness except during the southwest monsoon season. The year may be divided into four seasons. The cold season is from December to February, is followed by hot season which continues up to the middle of June. The period from mid June to the end of September is the southwest monsoon season. October and the first half of November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 4 rain gauge stations for period ranging from 36 to 48 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 711.8 mm. During the monsoon season (June to September) the district receives rain about 91% of the annual rainfall. August is the rainiest month with average rainfall of 241.4 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 160% of the annual normal occurred in year 2006, while the lowest annual rainfall which was 52% of the normal occurred in year 2007. In the fifty year period there were 7 years in which the annual rainfall in the district was less than 80% of the normal and during this period there was one occasion when such a low rainfall occurred in consecutive years. It is seen from Table 2 that the rainfall was between 501 mm and 900 mm in 32 years out of 41.

On an average there are 33 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 32 at Jaura to 36 at Morena.

The heaviest rainfall in 24 hours recorded at any station in the district was 304.8 mm at Jaura on 28th August 1919.

TEMPERATURE

As there is no meteorological observatory in the district hence the description that follows is based on the records of Gwalior observatory situated in the neighboring district. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is about 42.1°C and mean minimum at about 27.0°C . The heat in summer is quite intense and the hot dust laden scorching winds which blow often make the weather very uncomfortable. Day temperature during the period April to the early part of June goes up to about 44°C to 46°C on individual days. Afternoon thundershowers which occur on a few days bring welcome relief though only temporarily. With the advance of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon, towards the end of September there is a slight increase in the day temperature but the night becomes progressively cooler. After October both day and night temperatures decrease rapidly. January is generally the coldest month with mean maximum temperature at 22.3°C and mean minimum temperature at 7.7°C . During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature occasionally may go down to about the freezing point of water.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges from 53% to 82% in the morning and from 40% to 74% in the afternoon. The values of humidity are less in the rest of the year. The driest part of the year is the summer season, when the average humidity is about 26% in the afternoons and about 44% in the mornings.

CLOUDINESS

During the southwest monsoon season the skies are moderate to heavily clouded. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds generally blow from west direction. During post monsoon winds are calm and in the winter season northerly or northwesterly winds prevail in the morning and also in the afternoon. In the summer season winds generally blow from west and northwest direction.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Dust storms occur occasionally during the summer season. Thunderstorms occur almost throughout the year and the intensity is more in the monsoon. Fog occurs very occasionally during winter season.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
MORENA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
AMBAH	41	a	9.5	11.2	4.8	4.3	4.3	60.1	224.0	221.1	118.9	21.9	1.2	6.2	687.5	179	37	265.0	25 AUG 1983
		b	0.7	0.7	0.5	0.3	0.4	3.2	10.0	9.8	4.8	1.1	0.1	0.4	32.0	(1983)	(1987)		
JAURA	41	a	7.8	11.0	3.2	2.7	6.7	55.9	245.2	240.9	97.3	20.6	0.6	5.0	696.9	162	49	304.8	28 AUG 1919
		b	0.6	0.8	0.3	0.3	0.6	3.1	10.1	10.3	4.4	0.9	0.1	0.3	31.8	(1995)	(2002)		
MORENA	36	a	10.1	11.2	7.1	5.9	10.7	61.9	221.8	280.4	121.0	29.4	5.0	6.3	770.8	163	38	225.0	20 JUL 1986
		b	0.9	1.1	0.6	0.5	0.9	3.9	10.1	10.8	5.4	1.3	0.3	0.4	36.2	(1995)	(1980)		
SABALGARH	48	a	6.2	7.1	6.0	3.3	6.3	64.3	252.6	223.1	94.8	19.5	3.5	5.8	692.5	172	45	247.0	26 JUN 1994
		b	0.6	0.6	0.4	0.3	0.3	3.7	10.3	10.2	4.4	0.8	0.2	0.4	32.2	(2013)	(2002)		
DISTRICT MEAN		a	8.4	10.1	5.3	4.0	7.0	60.5	235.9	241.4	108.0	22.8	2.6	5.8	711.8	160	52		
		b	0.7	0.8	0.5	0.4	0.6	3.5	10.1	10.3	4.8	1.0	0.2	0.4	33.3	2006	2007		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE – 2
Frequency of Annual Rainfall in the District
MORENA
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
301 - 400	1	801 - 900	9
401 - 500	2	901 - 1000	2
501 - 600	8	1001 - 1100	3
601 - 700	7	1101 - 1200	1
701 - 800	8		

(Data available for 41 years)

NEEMUCH DISTRICT

The climate of this district is characterized by generally pleasant weather except in the hot season. The year may be divided into four seasons. The cold season from about the middle of November to February, is followed by hot season which continues up to the middle of June. The period from mid June to the end of September is the southwest monsoon season. October and the first half of November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 4 raingauge stations for period ranging from 35 to 47 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 821.3mm. During the monsoon season (June to September) the district receives rain about 93% of the annual rainfall. August is the rainiest month with average rainfall of 306.2 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 217% of the annual normal occurred in year 2019, while the lowest annual rainfall which was 57% of the normal occurred in year 2002. In the fifty year period there were 7 years in which the annual rainfall in the district was less than 80% of the normal and during this period there was single occasion of 3 consecutive years and of 2 consecutive years respectively for having such a low rainfall. It is seen from Table 2 that the rainfall was between 601 mm and 1000 mm in 29 years out of 41.

On an average there are 35 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 34 at Neemuch to 36 at Manasa.

The heaviest rainfall in 24 hours recorded at any station in the district was 259.6 mm at Neemuch (Obsy) on 23rd June 1980.

TEMPERATURE

There is one meteorological observatory in the district located at Neemuch at an elevation of 496metre above mean sea level. The description that follows is based on the records of this observatory. There is rapid increase in temperature after February till May which is the hottest month with mean maximum temperature 40.1°C and mean minimum temperature 25.0°C . The heat in summer is quite intense and the hot dust raising winds in the latter part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 44°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. By end of September when the southwest monsoon withdraws from the district there is a slight increase in the day temperatures but the nights become progressively cooler. After about mid-November the drop in the temperatures is more rapid. January is the coldest month with mean maximum temperature at 25.0°C and mean minimum temperature at 9.7°C . During the winter season, the cold waves in the rear of western disturbances passing across north India affect the district and on such occasions the minimum temperature occasionally goes down to about a degree or so below the freezing point of water and frosts occur.

The highest maximum temperature ever recorded at Neemuch was 46.7°C on 15th May 1912 and the lowest minimum temperature ever recorded was -1.1°C on 24th January 1905.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges in between 65% to 88% in morning and 43% to 76% in afternoon. The air is generally dry in the rest of the year, the driest part of the year being the period February to May when the afternoon relative humidity is less than 35%.

CLOUDINESS

During the southwest monsoon season the skies are generally heavily clouded and sometimes overcast. During the rest of the year the skies are mostly clear or lightly clouded. However, in the winter season for brief spells of a day or two, cloudy skies prevail in association with passing western disturbances.

WINDS

Winds are generally light with some strengthening in force during the late summer and southwest monsoon. During the southwest monsoon season, winds generally blow from southwest or west direction. During post monsoon and winter season winds mostly blow from northeast direction. In the summer season winds blow from west or southwest directions both in the mornings and in the afternoons.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighborhood causing widespread heavy rain and gusty winds. Thunderstorms occur during the southwest monsoon period. Fog occurs very rarely during winter season.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Neemuch observatory. As surface data for Neemuch observatory is available upto the year 2010, data for this district is taken from 1981-2010 climatological Normals.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
NEEMUCH

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
JAWAD	47	a	4.0	4.4	2.0	3.0	3.9	82.6	260.1	302.1	107.3	17.2	16.3	2.3	805.2	182	50	236.2	29 JUL 1943
		b	0.3	0.3	0.2	0.2	0.3	4.2	10.5	12.1	5.4	1.0	0.7	0.1	35.3	(2019)	(2002)		
MANASA	40	a	5.2	5.6	2.3	3.3	4.3	116.4	271.8	332.2	120.4	25.7	6.4	2.9	896.5	233	51	252.6	16 AUG 2004
		b	0.4	0.3	0.3	0.2	0.4	4.7	10.3	12.5	5.5	1.0	0.3	0.3	36.2	(2019)	(2002)		
NEEMUCH	36	a	5.7	3.1	1.5	2.1	4.0	82.7	244.0	309.9	124.4	21.5	7.2	1.3	807.4	158#	66	258.8	09AUG 2011
		b	0.3	0.3	0.1	0.1	0.4	4.5	9.4	11.3	5.7	1.0	0.4	0.2	33.7	(2013)	(2002)		
NEEMUCH OBSY	35	a	2.8	2.3	0.7	1.5	8.9	96.4	231.1	280.4	103.1	19.3	26.1	3.2	775.8	189	46	259.6	23 JUN 1980
		b	0.2	0.3	0.1	0.1	1.0	4.7	10.2	11.5	5.3	1.1	0.9	0.2	35.6	(1973)	(1988)		
DISTRICT MEAN		a	4.4	3.9	1.6	2.5	5.3	94.5	251.8	306.2	113.8	20.9	14.0	2.4	821.3	217	57		
		b	0.3	0.3	0.2	0.2	0.5	4.5	10.1	11.9	5.5	1.0	0.6	0.2	35.3	(2019)	(2002)		

- (a) NORMAL RAINFALL IN MM
(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)
(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR
(*) BASED ON ALL AVAILABLE DATA UPTO 2020
(**) YEARS GIVEN IN BRACKETS
(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
NEEMUCH
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	1	1101 - 1200	3
501 - 600	4	1201 - 1300	0
601 - 700	7	1301 - 1400	0
701 - 800	9	1401 - 1500	1
801 - 900	9	1501 - 1600	0
901 - 1000	4	1601 - 1700	0
1001 - 1100	2	1701 - 1800	1

(Data available for 41 years)

TABLE – 3
Normals of Temperature and Relative Humidity
NEEMUCH

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	25.0	9.7	32.8	31-01-1988	-1.1	24-01-1905	61	40
February	27.8	12.1	36.8	22-02-2006	-0.6	04-02-1886	52	32
March	33.1	17.1	41.8	31-03-1999	4.4	01-03-1905	41	25
April	38.0	22.0	44.6	27-04-1958	8.9	01-04-1905	37	22
May	40.1	25.0	46.7	15-05-1912	13.8	30-05-2007	47	26
June	37.3	24.9	46.1	09-06-1897	14.4	02-06-2008	65	43
July	31.8	23.0	42.2	04-07-1901	13.3	05-07-2007	84	68
August	29.9	22.4	38.2	18-08-1987	9.2	23-08-2006	88	76
September	32.0	21.6	39.8	18-09-2007	15.2	16-09-2002	81	65
October	33.9	19.0	39.4	05-10-1899	10.6	31-10-1890	57	40
November	30.3	14.6	36.0	02-11-2001	5.0	30-11-1938	52	38
December	26.7	10.7	38.0	18-12-1998	0.6	27-12-1929	57	38
Annual	32.2	18.5	46.7	15-05-1912	-1.1	24-01-1905	60	43

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
NEEMUCH

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	23	20	21	24	25	14	2	1	6	23	23	22	204
b	1	1	1	1	1	2	11	15	4	1	1	1	40
c	1.2	1.2	1.2	0.8	0.7	2.9	5.4	6.0	3.7	1.0	0.8	1.1	2.2
1730 HOURS IST													
a	22	19	18	18	17	8	1	1	4	18	23	23	172
b	1	0	1	1	1	3	7	12	2	1	0	0	29
c	1.2	1.3	1.6	1.7	1.8	3.5	5.1	5.7	3.9	1.6	0.9	1.1	2.4

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
NEEMUCH

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	4.0	4.1	5.7	7.0	9.0	11.2	9.9	8.1	5.7	4.1	3.2	3.3	6.3
Direction in morning	NE/C	NE/C	NE/C/W	W/SW/C	W/SW	SW/W	SW/W	SW/W	W/SW	NE/C/W	NE/C/E	C/NE	
Direction in evening	NE/C/W	W/NE/C	W/SW/NW	W/SW	W/SW	SW/W	SW/W	SW/W	W/SW	NE/W/N	NE/C/E	NE/C/E	

TABLE - 6
Special Weather Phenomena
NEEMUCH

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.5
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

RAISEN DISTRICT

The district has a dry climate except in the Southwest monsoon season. The year may be divided into four seasons. The period from March to about the second week of June is the summer season. The Southwest monsoon season follows thereafter continues up to the end of September. October and November constitute the post monsoon or retreating monsoon season. The cold season is from December to the end of February.

RAINFALL

Records of rainfall in the district are available for 9 rain gauge stations for period ranging from 33 to 49 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1173.0 mm. During the monsoon season (June to September) the district receives rain about 93% of the annual rainfall. August is the rainiest month with average rainfall of 399.7 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 166% of the annual normal occurred in year 1999, while the lowest annual rainfall which was 58% of the normal occurred in year 2008. In the fifty year period there were 7 years in which the annual rainfall in the district was less than 80% of the normal and during this period there is only one occasion when such a low rainfall occurred for 2 consecutive years. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 32 years out of 44.

On an average there are 48 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 45 at Kaliakheri to 52 at Raisen observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 480.0 mm at Silwani on 09th September 1983.

TEMPERATURE

There is one meteorological observatory in the district located at Raisen at an elevation of 440metre above mean sea level. But due to insufficient data from this observatory, the description of the climate that follows is based on the records of this observatory and Bhopal observatory in the neighbouring district. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 40.7°C and mean minimum of 28.6°C. The heat in summer is quite intense and the hot dust raising winds in the latter part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon by end of September, the day temperatures increase slightly and reach a secondary maximum in October but the nights become progressively cooler. From November both day and night temperatures decrease rapidly. January is the coldest month with mean maximum temperature at 25.1 °C and mean minimum temperature at 7.5 °C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about the freezing point of water.

The highest maximum temperature ever recorded at Raisen was 47.7 °C on 03rd May 1988 and the lowest minimum temperature ever recorded was 0.0 °C on 03rd January 1991.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges from about 64% to 89% in morning and 46% to 79% in the afternoon. The values of relative humidity start to decrease in October. It is comparatively less during rest of the year. The driest part of the year is the summer season, when the average humidity is less than 24% in the afternoons and less than 42% in the mornings.

CLOUDINESS

During the southwest monsoon season the sky is heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during late summer and southwest monsoon season. During the southwest monsoon months, winds generally blow from West direction. During post monsoon and winter season winds blow from northeast direction. Northeasterly winds appear in the month of January and by summer northwesterly to westerly winds become predominant both in the morning and afternoon.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighborhood causing widespread heavy rain and gusty winds. Dust storms occur occasionally during the summer season. Thunderstorms occur frequently during the period April to September. Fog occurs very occasionally during winter season.

Table 3 gives the normals of temperature for Raisen observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
RAISEN

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	DT MON YEAR	DT MON YEAR
BARELI	38	a b	4.6 0.4	9.6 0.6	5.4 0.5	1.8 0.2	8.5 0.7	163.3 7.1	347.6 13.3	346.8 14.1	155.5 6.7	24.5 1.6	12.7 0.4	5.6 0.3	1085.9 45.9	156# (2013)	58 (2008)	256.2	9 SEP 2009
BARNA DAM HYDRO	38	a b	11.4 0.9	11.3 1.0	6.5 0.7	3.4 0.5	9.1 0.9	140.3 7.9	330.3 14.0	397.2 14.0	146.1 7.7	27.7 1.4	18.3 1.0	10.0 0.6	1111.6 50.6	156 (2013)	10 (2015)	270.4	24 AUG 1991
BEGUMGANJ	49	a b	9.8 0.8	11.1 0.8	9.6 0.7	1.8 0.1	5.5 0.5	166 7.1	358.1 14.2	422.4 15.8	210.4 8.5	31.1 1.7	11.6 0.5	9.1 0.5	1246.5 51.2	177 (2019)	53 (2010)	374.8	9 SEP 1983
GHAIRATGANJ	44	a b	9.4 0.6	11.6 0.6	10.8 0.5	0.3 0.0	5.4 0.2	145.3 5.9	382.0 13.9	394.9 14.6	193.8 7.6	38.2 1.7	5.5 0.2	2.9 0.2	1200.1 46.0	187# (1999)	38 (1979)	352.0	9 SEP 1983
KALIAKHERI	38	a b	7.0 0.6	9.2 0.7	3.2 0.3	2.0 0.2	4.0 0.2	145.9 7.1	330.1 12.1	371.4 13.9	172.3 7.8	29.5 1.5	12.1 0.7	10 0.4	1096.7 45.5	170 (1999)	56 (1979)	260.0	23 JUL 1986
RAISEN	42	a b	6.1 0.5	11.4 0.7	4.0 0.4	0.2 0.0	6.7 0.4	143.5 6.7	383.7 14.5	436.9 14.2	176 7.5	30.3 1.6	15.9 0.6	7.6 0.5	1222.3 47.6	169# (1999)	56 (2010)	331.2	20 AUG 1983
RAISEN OBSY	33	a b	12.5 1.0	8.5 0.8	5.8 0.5	1.3 0.2	6 0.5	145.2 7.5	312.6 14.5	452.8 15.0	176.5 8.0	33.4 2.1	23.9 1.0	10.2 0.7	1188.7 51.8	155# (1999)	75 (1988)	331.2	20 AUG 1983
SALWANI(SILVANI)	47	a b	6.1 0.4	9.8 0.6	7.8 0.6	1.9 0.2	2.0 0.2	145.1 5.5	369.8 13.7	372.7 14.6	195.7 8.3	28.7 1.4	6.7 0.2	5.5 0.3	1151.8 46.0	175 (2019)	26 (1978)	480.0	9 SEP 1983
UDAIPURA	49	a b	7.6 0.7	15.5 0.8	5.2 0.5	0.6 0.1	6 0.5	170.5 7.2	399.6 13.9	402 15.3	193.6 8.0	32.3 1.5	12 0.4	7.8 0.4	1252.7 49.3	176 (1999)	55 (1979)	339.8	11 JUL 1998
DISTRICT MEAN	9	a b	8.3 0.7	10.9 0.7	6.5 0.5	1.5 0.2	5.9 0.5	151.7 6.9	357.1 13.8	399.7 14.6	180.0 7.8	30.6 1.6	13.2 0.6	7.6 0.4	1173.0 48.3	166 (1999)	58 (2008)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
RAISEN
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
601 - 700	1	1301 - 1400	6
701 - 800	3	1401 - 1500	0
801 - 900	1	1501 - 1600	4
901 - 1000	7	1601 - 1700	1
1001 - 1100	5	1701 - 1800	0
1101 - 1200	7	1801 - 1900	0
1201 - 1300	7	1901 - 2000	2

(Data available for 44 years)

TABLE – 3
Normals of Temperature and Relative Humidity
RAISEN

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	25.1	7.5	33.0	26/01/2009	0.0	03/01/1991		
February	29.6	11.2	39.5	22/02/1977	0.0	9/02/1972		
March	34.1	16.7	41.0	31/03/1988	2.5	10/03/1979		
April	37.5	23.6	47.5	30/04/1988	10.8	09/04/1982		
May	40.7	28.6	47.7	03/05/1988	16.8	03/05/1979		
June	36.6	25.5	47.0	04/06/2019	19.5	01/06/1979		
July	30.9	23.6	41.5	01/07/2012	19.1	27/07/2015		
August	29.4	23.5	38.7	05/08/1989	19.0	24/08/1990		
September	30.6	22.9	40.0	30/09/1987	12.2	24/09/1972		
October	31.5	18.3	40.4	03/10/1987	9.0	28/10/1986		
November	27.8	15.4	36.4	07/11/1987	2.5	29/11/1974		
December	25.0	10.2	33.1	12/12/2008	0.0	28/12/1983		
Annual	31.5	18.8	47.7	03/05/1988	0.0	03/01/1991		

RAJGARH DISTRICT

The district has a dry climate except in the southwest monsoon season. The year may be divided into four seasons. The period from March to about second week of June is the summer season. The succeeding period up to the end of September is the southwest monsoon season. October and November constitute the post monsoon or retreating monsoon season. The cold season is from December to the end of February.

RAINFALL

Records of rainfall in the district are available for 6 rain gauge stations for period ranging from 37 to 49 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 972.4 mm. During the monsoon season (June to September) the district receives rain about 92% of the annual rainfall. August is the rainiest month with average rainfall of 346.2 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 178% of the annual normal occurred in year 1973, while the lowest annual rainfall which was 56% of the normal occurred in year 2002. In the fifty year period there were 9 years in which the annual rainfall in the district was less than 80% of the normal. During this period there is one occasion of 3 consecutive years and one occasion of 2 consecutive years for having such a low rainfall. It is seen from Table 2 that the rainfall was between 701 mm and 1100 mm in 31 years out of 46.

On an average there are 42 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 37 at Rajgarh Observatory to 46 at Narsingarh.

The heaviest rainfall in 24 hours recorded at any station in the district was 431.8 mm at Biaora on 07 July 1952.

TEMPERATURE

There is one meteorological observatory in the district located at Rajgarh at an elevation of 382 meter above mean sea level. The description that follows is based on the records of this observatory. After February temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 42.2°C and mean minimum of 27.4°C. The heat in summer is quite intense and the hot dust raising winds in the latter part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 45°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After the withdrawal of the monsoon by about the end of September there is a slight increase in the day temperature but the nights become progressively cooler. After October however both day and night temperatures decrease rapidly. January is generally the coldest month with mean daily maximum temperature at 25.9°C and mean minimum temperature at 8.5°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about one or two degree above freezing point of water.

The highest maximum temperature ever recorded at Rajgarh was 48.3°C on 1st June 1994 and the lowest minimum temperature ever recorded was 0.0°C on 25th December 1955.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges between 66% and 88% in the morning and 47% to 77% in the afternoon. The values of humidity are comparatively less during rest of the year. The driest part of the year is the summer season, when the average humidity is about 28% in the afternoons and about 44% in the mornings.

CLOUDINESS

During the southwest monsoon season the skies are heavily clouded or overcast. In the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light with some strengthening in the force during the late summer and early part of monsoon season. During the southwest monsoon and post monsoon season, winds generally blow west direction. During winter season winds mostly blow from west direction or they are either calm. In the summer season also winds generally blow from west direction.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Dust storms occur occasionally during the summer season. Thunderstorms generally occur during the period March to September. Fog occurs very occasionally during winter season.

Tables 3, 4 and 5 give normals of temperature and relative humidity, cloudiness and mean wind speed and wind direction respectively for Rajgarh observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
RAJGARH

STATION	No. of Years of Data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL RAINFALL AS % OF NORMAL**		HEAVIEST RAINFALL IN 24 HOURS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BIAORA	49	a b	7.9 0.7	8.4 0.7	5.0 0.4	2.8 0.2	6.3 0.7	121.7 6.1	355.6 12.5	392.8 13.6	138.8 6.4	25.5 1.3	12.4 0.7	7.5 0.4	1084.7 43.7	177 (2013)	49 (1988)	431.8	07 JULY 1952
KHILCHIPUR	49	a b	6.6 0.6	5.9 0.6	5.6 0.5	2.0 0.2	6.0 0.6	101.2 5.4	274.2 11.6	315.9 13.1	127 6.3	25.2 1.2	12.4 0.7	7.0 0.4	889.0 41.2	172 (1996)	42 (2002)	322.5	21 AUG 1996
NARSINGARH	49	a b	7.7 0.6	5.4 0.5	4.8 0.4	1.8 0.2	3.9 0.3	130.4 6.5	359.4 13.6	381.5 14.1	157.2 7.4	29.1 1.6	10.2 0.6	7.3 0.4	1098.7 46.2	172 (2015)	56 (1981)	387.0	19 JUL 2015
RAJGARH	49	a b	8.8 0.8	9.5 0.7	5.2 0.5	1.9 0.2	9.6 0.9	109.6 5.7	324.1 12.2	346.6 13.3	136.5 6.6	29 1.3	12 0.8	9.1 0.5	1001.9 43.5	237 (1973)	54 (2002)	304.8	23 JUL 1973
RAJGARH OBSY	37	a b	7.9 0.6	8.2 0.6	1.1 0.2	2.5 0.2	7.3 0.8	80.7 4.7	267 11.5	274.9 11.1	86.9 4.8	27.7 1.2	9.8 0.6	5.2 0.4	779.2 36.7	197# (1973)	87 (1980)	300.2	08 AUG 1960
SARANGPUR	49	a b	8.0 0.5	3.5 0.3	5.6 0.4	1.4 0.1	4.0 0.3	116.1 5.7	295.8 11.4	365.3 12.4	133.6 6.2	27.2 1.5	12.0 0.6	7.4 0.4	979.9 39.8	232 (2019)	47 (1972)	305.0	19 JUL 2015
DISTRICT MEAN	6	a b	7.8 0.6	6.8 0.6	4.6 0.4	2.1 0.2	6.2 0.6	109.9 5.7	312.7 12.1	346.2 12.9	130.0 6.3	27.3 1.3	11.5 0.7	7.3 0.4	972.4 41.8	178 (1973)	56 (2002)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
Frequency of Annual Rainfall in the District
RAJGARH
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
501 - 600	1	1201 - 1300	1
601 - 700	2	1301 - 1400	1
701 - 800	6	1401 - 1500	2
801 - 900	10	1501 - 1600	3
901 - 1000	8	1601 - 1700	0
1001 - 1100	7	1701 - 1800	2
1101 - 1200	3		

(Data available for 46 years)

TABLE – 3
Normals of Temperature and Relative Humidity
RAJGARH

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	25.9	8.5	33.8	26/01/2009	1.3	22/01/1962	73	41
February	29.0	11.4	38.2	19/02/2004	1.2	03/02/2004	62	35
March	35.0	17.0	42.1	31/03/1991	5.7	05/03/2003	46	28
April	39.5	22.5	46.3	24/04/1958	12.3	03/04/1965	41	27
May	42.2	27.4	46.8	25/05/2010	16.7	09/05/1960	45	28
June	39.2	26.8	48.3	01/06/1994	16.8	27/06/2004	66	47
July	32.8	24.4	43.6	01/07/1991	16.2	14/07/2005	82	70
August	30.4	23.3	38.9	03/08/1972	18.2	31/08/2004	88	77
September	32.4	22.2	39.0	24/09/2001	13.8	24/09/1972	82	66
October	34.2	17.9	39.3	16/10/2008	9.1	26/10/1964	68	46
November	31.1	13.2	37.2	02/11/2001	4.3	30/11/1970	66	42
December	28.2	9.1	33.6	12/12/2008	0.0	25/12/1955	71	43
Annual	33.3	18.6	48.3	01/06/1994	0.0	25/12/1955	66	46

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
RAJGARH

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	25	23	25	26	26	11	1	1	13	25	24	26	226
b	1	0	1	0	0	3	17	14	5	1	1	1	44
c	1.0	1.0	0.9	0.8	0.9	3.3	5.9	6.3	3.5	0.7	1.0	0.7	2.2
1730 HOURS IST													
a	24	21	23	20	15	5	0	0	6	22	23	26	185
b	0	0	0	0	0	2	16	13	5	1	0	0	37
c	1.0	0.9	1.1	1.4	2	3.8	6.1	6.1	4	1.1	1	0.7	2.4

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
 For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
RAJGARH

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	W	W	W/C/S	W	W	W	W	W	W	W	W	W/C/S	
Direction in evening	N/W	W	W	W	W	W	W	W	W	W	W	W/N/C	

RATLAM DISTRICT

The climate of this district is on the whole dry except in the southwest monsoon season. The year may be divided into four seasons. The period from March to about second week of June is the summer season. The succeeding period upto the end of September is the southwest monsoon season. October and November constitute the post monsoon or retreating monsoon season. The cold season is from December to February.

RAINFALL

Records of rainfall in the district are available for 4 raingauge stations for period ranging from 35 to 49 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 991.4 mm. During the monsoon season (June to September) the district receives rain about 93% of the annual rainfall. August is the rainiest month with average rainfall of 366.1 mm. The variation in the annual rainfall from year to year in the district is appreciable. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 177% of the annual normal occurred in year 1919, while the lowest annual rainfall which was 49% of the normal occurred in year 2015. In the fifty year period there were 12 years in which the annual rainfall in the district was less than 80% of the normal and during this period there were three occasions when such a low rainfall occurred in two consecutive years. It is seen from Table 2 that the rainfall was between 701 mm and 1100 mm in 21 years out of 44.

On an average there are 43 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 35 at Jaora to 47 at Ratlam observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 359.7 mm at Sailana on 11th August 1941.

TEMPERATURE

There is one meteorological observatory in the district located at Ratlam at an elevation of 486metre above mean sea level. The description that follows is based on the records of this observatory. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 39.8°C and mean minimum of 25.8°C. The days are intensely hot during the summer and the hot dust raising winds in the latter part of the summer add to the discomfort. The day temperature during the period April to the early part of June goes up to about 43°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. After mid-September when the monsoon withdraws there is a slight increase in the day temperatures. However, the nights become progressively cooler after the withdrawal of the monsoon. After October both the day and night temperatures decrease rapidly till January which is the coldest month with mean maximum temperature at 25.8°C and mean minimum temperature at 10.4°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature may go down to about 4 to 5°C above the freezing point of water.

The highest maximum temperature ever recorded at Ratlam was 45.5°C on 13th May 1970 and the lowest minimum temperature ever recorded was 2.5°C on 29th January 1973.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months which range from 69% to 89% in the morning and 46% to 77% in the afternoon. The values of relative humidity decrease during the post monsoon season. The driest part of the year is the summer season, when the average humidity is about 21% in the afternoons and about 44% in the mornings.

CLOUDINESS

During the southwest monsoon season the skies are heavily clouded or overcast. In the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds generally blow from west direction. During the post monsoon season winds are generally calm and in the winter season winds generally blow from northeast direction. In the summer season winds blow predominantly from West direction.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighborhood causing widespread heavy rain and gusty winds. Thunderstorms occur occasionally during the summer season and rain during the monsoon months is often associated with thunder.

Tables 3, 4 and 5 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction respectively for Ratlam observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
RATLAM

STATION	No. of Years of Data		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL RAINFALL AS % OF NORMAL**		HEAVIEST RAINFALL IN 24 HOURS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
JAORA	43	a b	2.3 0.2	1.8 0.2	2.3 0.2	0.3 0.1	1.1 0.1	85.6 5.0	230.4 10.7	316.1 11.2	128 6.1	24.4 1.1	4.2 0.3	3.1 0.1	799.6 35.3	214 (2019)	55 (2001)	272.8	26 JUL 1945
RATLAM	44	a b	4.0 0.4	3.1 0.3	2.1 0.3	1.7 0.2	6.3 0.5	108.5 5.6	343.0 13.9	370.0 14.6	148.6 6.8	45.6 1.8	13.2 0.8	6.6 0.3	1052.7 45.5	184 (2006)	52 (2002)	334.5	28 JUL 1950
RATLAM OBSY	35	a b	6.2 0.5	4.3 0.4	0.9 0.1	4.0 0.3	6.5 0.6	128.6 6.9	302.7 13.5	393.1 15.3	145.9 6.6	38.8 1.6	19.7 1.2	2.8 0.2	1053.5 47.2	176 (1973)	70 (1985)	300.5	29 JUL 1950
SAILANA	49	a b	3.7 0.3	1.5 0.2	0.7 0.1	3.3 0.3	3.4 0.4	114 5.8	332.6 13.8	385.1 14.9	151.8 6.9	44.4 1.9	12.6 0.7	6.3 0.2	1059.4 45.5	170 (2019)	50 (2002)	359.7	11 AUG 1941
DISTRICT MEAN	4	a b	4.1 0.4	2.7 0.3	1.5 0.2	2.3 0.2	4.3 0.4	109.2 5.8	302.2 13.0	366.1 14.0	143.6 6.6	38.3 1.6	12.4 0.8	4.7 0.2	991.4 43.5	177 2019	49 2015		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
Frequency of Annual Rainfall in the District
RATLAM
(Data 1971-2020)

Range in mm	No. of years	Range in mm	No. of years
401 - 500	1	1101 - 1200	6
501 - 600	2	1201 - 1300	2
601 - 700	5	1301 - 1400	1
701 - 800	4	1401 - 1500	2
801 - 900	4	1501 - 1600	1
901 - 1000	7	1601 - 1700	2
1001 - 1100	6	1701 - 1800	1

(Data available for 44 years)

TABLE – 3
Normals of Temperature and Relative Humidity
RATLAM

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	25.8	10.4	34.0	06/01/1973	2.5	29/01/1973	58	35
February	28.5	12.7	37.8	28/02/1953	2.6	03/02/2004	52	29
March	34.1	17.6	41.9	31/03/1999	9.0	09/03/1979	39	20
April	38.4	22.9	45.2	27/04/1958	11.6	09/04/1985	38	19
May	39.8	25.8	45.5	13/05/1970	18.4	29/05/1964	55	24
June	36.3	25.1	45.0	02/06/1991	17.3	23/06/1995	69	46
July	30.1	23.3	40.6	01/07/1968	18.1	23/07/1973	85	71
August	28.2	22.8	38.7	20/08/1959	16.9	13/08/1972	89	77
September	30.3	21.9	39.3	29/09/2001	14.0	11/09/1980	81	63
October	33.0	19.0	39.0	22/10/2000	12.5	30/10/1972	59	37
November	30.6	15.5	36.9	02/11/2001	7.9	29/11/1994	54	35
December	27.6	11.8	33.8	09/12/2001	3.9	14/12/1964	56	35
Annual	31.9	19.1	45.5	13/05/1970	2.5	29/01/1973	61	41

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
RATLAM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	23	22	24	24	21	19	23	25	18	24	23	24	270
b	0	0	0	0	0	0	2	2	0	0	0	0	4
c	0.8	0.7	0.8	0.7	1.1	2.0	2.0	1.5	1.7	0.8	0.7	0.8	1.1
1730 HOURS IST													
a	22	20	23	20	21	17	19	21	9	20	19	23	234
b	0	0	0	0	0	0	1	1	0	0	0	0	2
c	0.9	1.0	1.1	1.2	1.2	1.9	2.4	2.2	2.2	1.6	1.2	1.0	1.5

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
RATLAM

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr	3.1	3.2	3.5	4.0	6.6	6.9	6.3	5.1	3.5	2.1	2.2	2.3	4.1
Direction in morning	NE	NE/C/E	C/NE/E	W	W	W	W	W	W	C/NE/E	C/NE/E	NE/C	
Direction in evening	NE/C	NE/W/E	W	W	W	W	W	W	W	C/NE	C/NE	C/NE	

SEHORE DISTRICT

The district has dry climate except in the southwest monsoon seasons. The year may be divide into four seasons. The period from March to about the second week of June is the summer season. The south west monsoon season which follows thereafter continues up to the end of September. October and November constitute the post monsoon season. The cold season is from December to the end of February.

RAINFALL

Records of rainfall in the district are available for five rainguage stations. Tables 1 and 2 gives the details of the rainfall at these stations for the district as a whole. The average annual rainfall in the district is 1148.7 mm. Generally it is seen that the rainfall increases from the west to east, the southernmost part of the district get less rainfall than elsewhere and the area around Sehore gets the maximum rainfall in the district. About 93% of the annual rainfall in the district is received during the monsoon months June to September. From table 1 it will be seen that during the period the highest annual rainfall amounting to 158% of the normal occurred in 1973 while the lowest annual rainfall which was only 60% of the normal occurred in 1992. In the fifty year period there were 4 years in which the annual rainfall in the district was less than 80% of the normal and none of them were consecutive years. It is seen from Table 2 that the rainfall was between 901 mm and 1400 mm in 30 years out of 41.

On an average there are 47 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 45 at Ashta & Ichhawar to 49 at Sehore.

The heaviest rainfall in 24 hours recorded at any station in the district was 355.0 mm at Nasrulgunj on 20th July 2015.

TEMPERATURE

As there is no meteorological observatory in the district hence the description that follows is based on the records of Bhopal observatory situated in the neighbouring district. After February, temperatures increase steadily till May which is generally the hottest month with the mean daily maximum temperatures at about 41.1°C and the mean minimum temperature at about 26.6°C. In the hot season, the day temperatures may sometimes go above 44.0°C. With the onset of the southwest monsoon by about mid-June day temperatures decrease appreciably. After the withdrawal of the monsoon by about the end of September, there is a slight increase in the temperatures but night becomes progressively colder. After October there is rapid drop in the temperatures, especially night temperatures. January is generally the coldest month with the mean daily maximum temperature at about 24.9°C and mean daily minimum at about 10.6°C. In the cold season, in association with western disturbances which move eastwards across north India, cold waves affect the district and the minimum temperature occasionally drops down to about a degree or so above the freezing point of water and frosts occur.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 64% to 89% in the morning and 46% to 79% in the afternoon. The values of relative humidity start to decrease from October. The driest part of the year is the summer season, when the average humidity is about 38% in the mornings and 22% in the afternoons.

CLOUDINESS

During the monsoon season the sky is heavily clouded or overcast. In the rest of the year the skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year with some strengthening in force during the latter part of summer and early part of the southwest monsoon season. During the southwest monsoon season winds mostly blow from westerly with some north-westerly. During post monsoon season northeasterly and easterly winds start to appear in the district along with some southeasterly. During winter winds are light and mostly blow from northeasterly direction. In summer season northwesterly and westerly winds are predominant.

SPECIAL WEATHER PHENOMENA

Depressions which originates in the head of the Bay of Bengal during the monsoon, season often moving in a westerly to north-westerly direction reach the district and its neighbourhood causing widespread heavy rain and gusty winds. Occasionally post monsoon storms or depressions also affect the district similarly. Thunderstorms generally occur throughout the year, the highest incidence being during the southwest monsoon months June to September. Occasionally dust storms and dust raising winds occur during the summer season. Fog occurs on a few days in winter season.

TABLE - I
NORMALS AND EXTREMES OF RAINFALL
SEHORE

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
ASHTA	43	a	8.7	8.3	4.9	1.3	6.2	125.9	312.5	359.7	151.5	33.6	17.1	7.0	1036.7	182	61	342.6	30 AUG 1973
		b	0.5	0.6	0.3	0.1	0.4	6.4	13.4	13.3	7.1	1.9	0.8	0.5	45.3	(1973)	(2010)		
BUDHNI	48	a	7.7	13	6.4	0.3	4.7	134.7	402.3	441.5	198.2	25.9	14.9	6.8	1256.4	161#	62	330.0	14 AUG 2006
		b	0.6	0.8	0.4	0.0	0.4	6.7	14.2	15	8.2	1.3	0.6	0.4	48.6	(1994)	(2008)		
ICHHAWAR	49	a	9.0	8.8	5.2	1.6	2.4	139.1	341.8	397.2	182.1	28.1	12.1	4.0	1131.4	180	49	285.0	14 AUG 2006
		b	0.6	0.6	0.4	0.1	0.2	6.0	13.0	14.1	8.0	1.5	0.5	0.3	45.3	(1973)	(2010)		
NASRULGUNJ	44	a	7.2	10.6	5.3	0.4	4.8	145.0	375.6	398.6	165.5	22.9	15.5	7.5	1158.9	149#	56	355.0	20 JUL 2015
		b	0.6	0.8	0.4	0.1	0.3	6.6	13.8	14.6	7.9	1.3	0.6	0.4	47.4	(1994)	(1992)		
SEHORE	42	a	13.6	9.9	5.8	1.4	8.0	150.5	353	393.5	170.8	30.8	12.1	11.8	1161.2	161	48	301.6	19 AUG 1984
		b	0.9	0.7	0.6	0.3	0.7	6.9	14.0	14.4	7.6	1.9	0.8	0.5	49.3	(1975)	(2010)		
DISTRICT MEAN	5	a	9.2	10.1	5.5	1.0	5.2	139.0	357.0	398.1	173.6	28.3	14.3	7.4	1148.7	158	60		
		b	0.6	0.7	0.4	0.1	0.4	6.5	13.7	14.3	7.8	1.6	0.7	0.4	47.2	(1973)	(1992)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - II
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
SEHORE
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
601 - 700	2	1301 - 1400	5
701 - 800	1	1401 - 1500	2
801 - 900	0	1501 - 1600	3
901 - 1000	8	1601 - 1700	1
1001 - 1100	4	1701 - 1800	1
1101 - 1200	8	1801 - 1900	1
1201 - 1300	5		

(DATA AVAILABLE FOR 41 YEARS)

SHAJAPUR DISTRICT

The climate of this district is on the whole dry except in the southwest monsoon season. The year may be divided into four seasons. The cold season from about the middle of November to February, is followed by hot season which continues up to the middle of June. The period from mid June to the end of September is the southwest monsoon season. October and the first half of November constitute the post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for three raingauge stations for period ranging from 40 to 48 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 982.3 mm. During the monsoon season (June to September) the district receives about 92.3% of the annual rainfall. August is the rainiest months with average rainfall of 334.0 mm. The annual rainfall from year to year in the district has moderate variation. In the fifty year period 1971 to 2020, the highest annual rainfall amounting to 176% of the annual normal occurred in year 2019, while the lowest annual rainfall which was 56% of the normal occurred in year 1992. In the fifty year period there were 9 years in which the annual rainfall in the district was less than 80% of the normal and during this period there was only one occasion when such a low rainfall occurred in consecutive years. It is seen from Table 2 that the rainfall was between 701 mm and 1200 mm in 26 years out of 42.

On an average there are 42 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 41 at Shajapur to 44 at Shajapur observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 400.0 mm at Shajapur on 29th July 1988.

TEMPERATURE

There is one meteorological observatory in the district located at Shajapur at an elevation of 446 metre above mean sea level. The description that follows is based on the records of this observatory. From about the beginning of March, temperatures begin to rise rapidly till May which is the hottest month. The mean maximum temperature in May is of 41.8°C and mean minimum of 26.6°C. The heat in summer is quite intense and the hot dust raising winds in the later part of the summer add to the discomfort. The day temperature during the period from April to the early part of June may goes up to about 46°C on individual days. With the onset of the monsoon by about mid-June, there is appreciable drop in the day temperatures and the weather becomes progressively cooler. Towards the end of the monsoon season day temperatures increase slightly and reach a secondary maximum in October, but the nights becomes progressively cooler. The day temperatures start decreasing from the month of November and the nights also become progressively cooler. January is the coldest month with mean maximum temperature at 25.8°C and mean minimum temperature at 8.6°C. During the winter season, the cold waves affect the district in the wake of the western disturbances passing across North India and the minimum temperature occasionally drops down to about a degree or so above the freezing point of water.

The highest maximum temperature ever recorded at Shajapur was 47.3°C on 21st May 2016 and the lowest minimum temperature ever recorded was -0.5°C on 2nd January 1991.

HUMIDITY

The value of relative humidity is generally high during the southwest monsoon months and it ranges at about 63% to 87% in the morning and 44% to 76% in the evening. The values of relative humidity start to decrease in October. It is comparatively less during rest of the year. The driest part of the year is the summer season, when the average humidity about 40% in the mornings and 21% in the afternoons.

CLOUDINESS

During the southwest monsoon season the skies is heavily clouded or overcast. During the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light to moderate throughout the year except during southwest monsoon season. During the southwest monsoon months, winds generally blow from West direction. During post monsoon winds are light or calm and in winter season winds generally blow from northeast direction. In the summer season winds generally blow from west and northwest direction.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season move in a westerly direction passing through district or its neighbourhood causing widespread heavy rain and gusty winds. Dust storms occur occasionally during the summer season. Thunderstorms occur frequently during the premonsoon and monsoon season.

Tables 3, 4 and 5 give normals of temperature and relative humidity, mean wind speed and wind direction respectively for Shajapur.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
SHAJAPUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
SHAJAPUR	42	a b	9.1 0.8	6.2 0.4	5 0.4	2.2 0.3	8.8 1.0	115.8 5.8	310.6 11.2	328.2 11.5	137.1 6.5	22.6 1.4	11.4 0.8	10.4 0.6	967.4 40.7	145# (2006)	48 (1992)	400.0	29 JUL 1988
SHAJAPUR OBSY	40	a b	8.3 0.7	4.8 0.3	5.8 0.4	2.9 0.5	12.7 1.3	120.5 6.0	290.3 11.6	336.3 12.3	159.2 7.1	29.9 1.9	11.9 0.8	12.0 0.8	994.6 43.7	209# (2006)	77 (1972)	371.9	20AUG 1974
SHUJALPUR	48	a b	7.7 0.5	4.2 0.3	3.5 0.2	1.0 0.1	4.4 0.3	111.9 6.0	323.3 12.6	337.5 12.4	149.8 6.7	23.4 1.3	11.3 0.6	6.8 0.3	984.8 41.3	176 (1986)	52 (1972)	249.0	9 AUG 1985
DISTRICT MEAN	3	a b	8.4 0.7	5.1 0.3	4.8 0.3	2.0 0.3	8.6 0.9	116.1 5.9	308.1 11.8	334.0 12.1	148.7 6.8	25.3 1.5	11.5 0.7	9.7 0.6	982.3 41.9	176 (2019)	56 (1992)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2

**FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
(DATA 1971 - 2020)
SHAJAPUR**

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	3	1201 - 1300	4
601 - 700	3	1301 - 1400	3
701 - 800	3	1401 - 1500	0
801 - 900	6	1501 - 1600	1
901 - 1000	9	1601 - 1700	0
1001 - 1100	5	1701 - 1800	2
1101 - 1200	3		

DATA AVAILABLE FOR 42 YEARS

**TABLE – 3
Normals of Temperature and Relative Humidity
(SHAJAPUR)**

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	25.8	8.6	33.6	30/01/2001	-0.5	02/01/1991	69	43
February	29.3	11.0	38.3	22/02/2006	1.5	22/02/1984	60	33
March	35.1	16.0	42.1	22/03/2010	5.1	01/03/1971	44	24
April	39.7	21.9	45.6	17/04/2010	9.3	01/04/1996	33	19
May	41.8	26.6	47.3	21/05/2016	17.8	09/05/1989	42	21
June	38.2	26.0	46.6	06/06/2016	20.3	20/06/1991	63	44
July	31.9	24.1	40.7	08/07/2009	19.6	30/07/2012	82	69
August	29.8	23.2	39.1	08/08/2004	20.0	09/08/1985	87	76
September	32.1	22.3	39.8	19/09/2007	12.1	25/09/1972	80	66
October	33.9	18.2	39.0	22/10/2000	9.5	29/10/1983	64	43
November	30.5	13.2	36.1	02/11/2001	3.3	29/11/1970	62	44
December	27.3	9.6	32.7	01/12/1993	2.1	28/12/1983	68	47
Annual	32.9	18.3	47.3	21/05/2016	-0.5	02/01/1991	63	44

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
(SHAJAPUR)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	20	19	20	22	22	7	1	0	6	21	21	22	181
b	1	0	1	0	0	4	16	19	5	1	1	0	48
C	1.5	1.1	1.3	0.9	0.9	3.8	6.4	6.8	3.9	1.3	1.2	1.2	2.5
1730 HOURS IST													
a	20	18	18	15	13	2	0	0	3	16	19	21	145
b	1	0	1	1	1	4	15	16	4	1	1	1	46
c	1.6	1.4	1.7	2.1	2.1	4.5	6.3	6.4	4.4	2.1	1.5	1.3	2.9

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
 For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
(SHAJAPUR)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	C/NE/SE	C/NE	C/W/SW	NW/W	W	W	W	W	W/C/NW	C	C	C	
Direction in evening	C/NE	C/NE/W	NW/W	NW/W	W	W/NW	W	W	C/W/NW	C	C	C	

SHEOPUR DISTRICT

The climate of Sheopur district is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February followed by the hot season commences from March till about the middle of June. The period from mid-June to about the end of September is the southwest monsoon season. The period of October and November constitutes post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 3 rain gauge stations for the period ranging from 32 to 46 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 724.0 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 92% of the annual normal rainfall, July and August being the months with the highest rainfall with an average value of about 249.0 mm. The annual rainfall in the district varies over a moderate range. In the fifty years period 1971 to 2020, the highest annual rainfall was in year 2013 when it amounted to 166% of the normal. In the year 2002, the annual rainfall in the district was the lowest in this period and amounted to only 32% of the normal. In this period the rainfall was less than 80% of the normal in 10 years and there was a single occasion of two consecutive years. It is seen from Table 2 that the annual rainfall was between 501 mm and 900 mm in 26 years out of 35.

On an average there are 33 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 388.0 mm at Sheopur observatory on 15th July 1979.

TEMPERATURE

There is one meteorological observatory in the district at Sheopur. Hence the climatological description, which follows is based on the meteorological data of this observatory. After February temperatures begin to rise rapidly till May which is usually the hottest month of the year with the mean maximum temperature is at 42.7°C and mean minimum temperature is at 26.8°C. The intense heat in May and June with hot dust laden winds which may blow on many days make the weather very uncomfortable. On individual days the maximum temperature may reach above 46°C. Thundershowers occasionally occur in afternoon and bring relief from the heat. With the onset of the southwest monsoon into the district after about the second week of June there is appreciable drop in temperatures and the weather becomes pleasant. After withdrawal of southwest monsoon by about the end of September day temperatures slightly increase but the night temperatures continue to decrease. From November both the temperatures begin to drop rapidly. January is usually the coldest month with the mean maximum temperature at 23.1°C and mean minimum at 8.4°C. During winter season the district is affected by cold waves in the rear of the passing western disturbances and the minimum temperatures may go down to about the freezing point of water or below and frost occurs.

The highest maximum temperature ever recorded in the district was 48.8°C on 11th May 1973 and the lowest minimum temperature was -2.2 °C on 06th January 1986 at Sheopur observatory.

HUMIDITY

During the southwest monsoon season the air is generally humid with values of relative humidity about 80% in the morning and about 65% in the afternoon during the period from July to September. During the post monsoon and winter seasons morning relative humidity ranges between 68% and 81% in the mornings and between 43% and 56% in the afternoons. The driest part of the year

is summer season when the value of relative humidity in the afternoon is at about 25% in afternoon whereas it is about 45% in the morning.

CLOUDINESS

During the southwest monsoon season skies are generally heavily clouded to overcast. The cloudiness decreases in the post monsoon season. In the latter part of summer and post monsoon seasons, the clouding is moderate and cloudiness is more in the afternoon than the morning. In the rest of the year skies are generally clear or lightly clouded.

WINDS

Winds are generally light to moderate with some increase in force in the latter part of summer and southwest monsoon season. During the southwest monsoon and latter part of summer season northwesterly winds are mostly predominant in the morning, along with some westerly winds observed on some days whereas northwest wind is predominant along with southwesterly/westerly wind flowing on some days in the evenings. In the winter season, winds are mostly northeasterly in the mornings and northerly along with some northwesterly winds are observed in the evenings. In the post-monsoon season northeasterly winds are predominant in the morning and northerly winds in the latter part of season in the evening.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the monsoon season cross the east coast of India and move in a westerly or northwesterly direction across the peninsula. Some of these depressions occasionally affect the weather over the district and its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms and dust storms occur during the summer and sometimes in the monsoon season. Fog may occasionally occur during the cold season.

Tables 3, 4, 5 and 6 give the normals of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Sheopur observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
SHEOPUR

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BIJAYPUR	46	a b	5.2 0.4	3.3 0.3	4.1 0.4	2.4 0.1	5.2 0.4	61.0 3.3	206.5 9.2	208.7 9.4	82.5 4.4	22.6 0.9	4.6 0.2	4.6 0.3	610.7 29.9	176 (1975)	36 (2002)	184.0	16 JUL 2005
SHEOPUR	34	a b	8.4 0.3	2.8 0.3	1.0 0.1	2.3 0.2	2.1 0.2	84.4 3.9	249.5 10.2	262.8 10.3	91.2 4.7	19.7 0.7	3.9 0.2	5.4 0.3	733.5 31.4	165 (2013)	33 (2002)	186.0	12 AUG 1994
SHEOPUR OBSY	32	a b	6.2 0.6	6.5 0.7	1.5 0.1	5.1 0.6	12.8 1.2	89.6 4.2	288.9 12.0	277.9 11.3	100.7 5.2	24.7 1.3	11.3 0.8	2.7 0.2	827.9 37.5	146 (2011)	74 (2011)	388.0	15 JUL 1979
DISTRICT MEAN	3	a b	6.6 0.4	4.2 0.4	2.2 0.2	3.3 0.3	6.7 0.6	78.3 3.8	248.3 10.5	249.8 10.5	91.5 4.8	22.3 1.0	6.6 0.4	4.2 0.3	724.0 33.2	166 2013	32 2002		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
SHEOPUR
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
201 - 300	1	801 - 900	6
301 - 400	0	901 - 1000	2
401 - 500	4	1001 - 1100	1
501 - 600	7	1101 - 1200	0
601 - 700	10	1201 - 1300	1
701 - 800	3		

(DATA AVAILABLE FOR 35 YEARS)

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
SHEOPUR

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	23.1	8.4	32.0	28-01-2007	-2.2	06-01-1986	81	53
February	27.8	10.9	37.2	28-02-1953	1.1	07-02-1974	74	43
March	33.8	16.5	42.0	30-03-2017	4.6	04-03-1990	57	34
April	38.8	22.0	46.0	30-04-2009	8.8	08-04-1994	43	26
May	42.7	26.8	48.8	11-05-1973	16.0	28-05-1986	40	22
June	41.0	27.7	47.8	09-06-1994 06-06-2007	17.4	16-06-1988	59	41
July	34.8	26.0	46.4	01-07-1995	15.8	20-07-1986	82	69
August	32.6	24.7	41.8	18-08-1987	15.2	21-08-1988	86	75
September	34.0	24.6	41.2	16-09-1988	15.1	24-09-1972	79	62
October	34.4	19.5	40.8	05-10-1987	8.8	22-10-1986	68	46
November	29.8	14.2	39.0	18-11-2012	4.4	13-11-1986	72	46
December	25.2	9.6	32.6	02-12-1994	0.0	26-12-1961	80	56
Annual	33.2	19.1	48.8	11-05-1973	-2.2	06-01-1986	69	48

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
SHEOPUR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a													
b													
c	1.5	1.9	1.7	1.6	1.2	2.8	4.7	5.4	2.5	0.9	1.0	1.2	2.2
1730 HOURS IST													
a													
b													
c	1.6	1.6	1.7	2.3	2.5	3.5	4.9	5.0	2.9	0.9	1.0	1.3	2.5

a : Days with clear sky.
b : Days with sky overcast.
c : Mean Cloud amount.
** = Unit, equal to one eighth of the sky used in specifying cloud amount
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
SHEOPUR

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.	3.5	4.0	4.1	4.2	7.3	6.9	5.5	4.9	4.2	3.3	2.5	3.1	4.4
Direction in the morning.	C/NE	C/NE/SW	C/NE/NW	C/SW/NE	C/NW/W	C/NW/W	C/SW/W	C/NW/W	C/SW/NE	C/SW/S	S/NE/SW	C/NE	
Direction in the evening.	C/NE/NW	C/N/NW	C/N/NW	NW/W	C/NW/W	C/NW/W	C/SW/W	C/NW/W	C/NE/NW	C/NE	C/NE/N	C/NE	

TABLE - 6
Special Weather Phenomena
SHEOPUR

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.1	0.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Fog	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

SHIVPURI DISTRICT

The climate of Shivpuri district is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February followed by the hot season commences from March till about the middle of June. The period from mid-June to about the end of September is the southwest monsoon season. The period of October and November constitutes post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 5 raingauge stations for the period ranging from 42 to 47 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 862.6 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 91% of the annual normal rainfall, July and August being the months with the highest rainfall with an average value of about 281.7 mm. The annual rainfall in the district varies over a small range. In the fifty years period 1971 to 2020, the highest annual rainfall was in year 1971 when it amounted to 157% of the normal. In the year 2002, the annual rainfall in the district was the lowest in this period and amounted to only 50% of the normal. In this period the rainfall was less than 80% of the normal in 7 years and there is no occasion of consecutive years. It is seen from Table 2 that the annual rainfall was between 601 mm and 1100 mm in 32 years out of 42.

On an average there are 39 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 35 at Karera to 45 at Shivpuri observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 320.0 mm at Pichhore on 21 July 1991.

TEMPERATURE

There is one meteorological observatory in the district at Shivpuri. Hence, the climatological description of the district which follows is based on the meteorological data of this observatory. From the middle of February temperatures begin to rise rapidly till May which is usually the hottest month of the year with the mean maximum temperature is at 41.2°C and mean minimum temperature is at 26.0°C. The intense heat in May and June with hot dust laden winds which may blow on many days make the weather very uncomfortable. On individual days the maximum temperature may reach 46°C. Thundershowers occasionally occur in afternoon and bring relief from the heat. With the onset of the southwest monsoon into the district after about the second week of June there is appreciable drop in temperatures and the weather becomes pleasant. After withdrawal of southwest monsoon by about the end of September day temperatures slightly change but the night temperatures continue to decrease. From November both the temperatures begin to drop rapidly. January is usually the coldest month with the mean maximum temperature at 23.3°C and mean minimum at 7.8°C. During winter season the district is affected by cold waves in the rear of the passing western disturbances and the minimum temperatures may go down to about the freezing point of water.

The highest maximum temperature ever recorded in the district was 47.2°C on 30 May 1994 and the lowest minimum temperature was -4.0 °C on 13 January 1967 at Shivpuri observatory.

HUMIDITY

During the southwest monsoon season the air is generally humid with values of relative humidity about 70%. During the post monsoon and winter seasons morning relative humidity ranges between 63% and 76% in the mornings and between 51% and 58% in the afternoons. The driest part of the year is summer season when the value of relative humidity in the afternoon is at about 36% whereas it is about 46% in the morning.

CLOUDINESS

During the southwest monsoon season skies are generally heavily clouded to overcast. The cloudiness decreases in the post monsoon season. In the latter part of summer and post monsoon seasons, the clouding is moderate and cloudiness is more in the afternoon than the morning. In the rest of the year skies are generally clear or lightly clouded.

WINDS

Winds are generally light to moderate with some increase in force in the latter part of summer and southwest monsoon season. During the southwest monsoon season and summer seasons southwest winds are mostly predominant along with some southeasterlies in the morning and some northwesterly in the afternoon. In the post monsoon and winter seasons, southwesterlies are predominant along with southeasterlies in the morning and in the afternoon northwesterlies are predominant along with some southwesterlies .

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during latter part of pre-monsoon season and post monsoon season cross the east coast of India and move in a westerly or northwesterly direction across the peninsula. Some of these depressions affect the weather over the district and its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms rarely occur during southwest monsoon season and also during the cold season in association with the passing of western disturbances. Fog may occasionally occur during the cold season.

Tables 3, 4, 5 and 6 give the normals of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Shivpuri observatory.

TABLE – 1
NORMALS AND EXTREMES OF RAINFALL
SHIVPURI

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
KARERA	47	a b	9.7 0.6	9.8 0.8	2.3 0.3	3.7 0.3	11.7 0.6	77.7 4.4	226.9 10.6	231.5 10.8	106.2 5.3	29.9 1.1	5.1 0.4	3.4 0.2	717.9 35.4	200 (2013)	54 (2002)	216.0	05 AUG 2014
KOLARAS	47	a b	11.4 0.6	11.1 0.6	5.5 0.4	3.4 0.2	3.7 0.4	89.3 4.6	290.4 12.1	307.6 13.1	122.6 5.8	25.2 1.1	6.8 0.4	7.0 0.3	884.0 39.6	174 (1971)	43 (2002)	249.8	23 JUL 1971
PICHHORE	47	a b	4.7 0.4	9.7 0.7	2.1 0.2	1.9 0.3	3.8 0.3	94.7 4.3	293.3 11.5	282.9 11.0	145.8 5.8	29.0 1.0	2.9 0.3	4.8 0.1	875.6 35.5	187 (2013)	27 (1979)	320.0	21 JUL 1991
SHIVPURI	42	a b	7.2 0.7	15.3 1.0	4.0 0.4	3.7 0.4	9.2 0.9	97.7 5.3	302.3 12.0	259.8 12.3	127.4 6.0	24.6 1.2	9.7 0.6	8.9 0.3	869.8 41.6	167 (1971)	50 (2002)	317.5	25 JUN 1933
SHIVPURI OBSY	40	a b	8.4 0.8	15.6 1.2	2.9 0.4	5.1 0.4	12.3 1.1	120.0 6.3	348.0 12.8	273.6 13.1	139.7 6.4	27.2 1.1	8.7 0.8	3.9 0.3	965.4 44.7	151 (1971)	46 (2012)	244.0	09 JUL 1968
DISTRICT MEAN	5	a b	8.3 0.6	12.3 0.9	3.4 0.3	3.6 0.3	8.1 0.7	95.9 5.0	292.2 11.6	271.1 12.2	128.3 5.9	27.2 1.1	6.6 0.5	5.6 0.2	862.6 39.3	157 1971	50 2002		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS OF OCCURRENCE GIVEN IN BRACKETS

TABLE – 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
SHIVPURI
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	4	901 - 1000	8
501 - 600	0	1001 - 1100	1
601 - 700	3	1101 - 1200	4
701 - 800	11	1201 - 1300	1
801 - 900	9	1301 - 1400	1

DATA AVAILABLE FOR 42 YEARS

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
SHIVPURI

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
JANUARY	23.3	7.8	33.0	30-01-2007	-4.0	13-01-1967	76	58
FEBRUARY	27.0	11.2	35.4	27-02-1966	-2.2	01-02-1964	66	51
MARCH	32.8	16.3	42.0	30-03-2017	2.0	09-03-1979	55	42
APRIL	37.5	21.5	45.6	25-04-1970	8.7	07-04-1967	44	36
MAY	41.2	26.0	47.2	30-05-1994	15.5	10-05-1968	38	30
JUNE	39.1	26.4	46.0	21-06-1964	16.5	24-06-1987	46	38
JULY	33.1	24.5	43.0	05-07-2012	12.0	18-07-2009	63	58
AUGUST	31.0	23.5	38.6	03-08-1972	18.0	11-08-2019	71	69
SEPTEMBER	32.0	23.0	38.6	09-09-1972	13.7	23-09-1972	70	64
OCTOBER	32.3	19.1	38.7	29-10-1965	8.9	20-10-1985	63	52
NOVEMBER	28.7	13.3	39.3	01-11-1965	2.1	29-11-1970	64	52
DECEMBER	25.7	8.8	31.5	09-12-2011	-2.1	10-12-1966	72	53
ANNUAL	31.9	18.4	47.2	30-05-1994	-4.0	13-01-1967	61	50

TABLE – 4
Mean Cloud Amount ^{}(Okta of the Sky) and Mean Number**
of days of Clear and Overcast Skies
SHIVPURI

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	27	25	28	28	28	16	4	2	18	17	26	29	271
b	2	1	1	0	0	4	15	23	5	2	2	1	45
c	0.8	0.6	0.5	0.5	0.6	2.9	5.8	6.4	2.9	0.8	0.7	0.4	1.8
1730 HOURS IST													
a	28	26	28	28	27	17	5	3	20	28	28	29	286
b	1	1	1	0	1	4	17	23	4	1	1	1	34
c	0.4	0.5	0.7	0.5	0.9	2.8	5.2	6.1	3.0	0.8	0.6	0.4	1.8

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

^{**} Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.

For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
SHIVPURI

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.													
Direction in the morning.	SW/SE	SW	SW/SE	SW/SE	SW	SW	SW	SW	SW	SE/SW	SW/SE	SW/SE	
Direction in the evening.	NW/SW	SW/NW	NW/SE	SW/NW	NW/SW	NW/SW	SW/NW	SW/NW	NW/SW	NW	NW	NW	

TABLE - 6
Special Weather Phenomena
SHIVPURI

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Hailstorm	0	0	0	0	0	0	0	0	0	0	0	0	0
Dust storm	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0.1	0	0	0	0	0	0	0	0	0	0	0	0.1

UJJAIN DISTRICT

The climate of Ujjain district is characterized by a hot summer and general dryness except in the southwest monsoon season. The year may be divided into four seasons. The cold season from December to February followed by the hot season commences from March till about the middle of June. The period from mid-June to about the end of September is the southwest monsoon season. The period of October and November constitutes post monsoon or retreating monsoon season.

RAINFALL

Records of rainfall in the district are available for 6 rain gauge stations for the period ranging from 39 to 49 years. The details of rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 956.1 mm. The rainfall in the southwest monsoon season (June to September) constitutes about 92% of the annual normal rainfall, August is the rainiest month with the highest rainfall with an average value of about 322.8 mm. The annual rainfall in the district varies over a large range. In the fifty years period 1971 to 2020, the highest annual rainfall was in year 1973 when it amounted to 182% of the normal. In the year 1985, the annual rainfall in the district was the lowest in this period and amounted to only 55% of the normal. In this period the rainfall was less than 80% of the normal in 14 years and during the same period there were three occasions each of such a low rainfall which occurred in two consecutive years. It is seen from Table 2 that the annual rainfall was between 701 mm and 1200 mm in 31 years out of 47.

On an average there are 41 rainy days (*i.e.* days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 38 at Mahidpur to 43 at Ujjain observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 434.9 mm at Mahidpur 29th July 1950.

TEMPERATURE

There is one meteorological observatory in the district at Ujjain. Hence, the climatologically description of the district which follows is based on the meteorological data of this observatory. From the middle of February temperatures begin to rise rapidly till May which is usually the hottest month of the year with the mean maximum temperature is at 40.9°C and mean minimum temperature is at 24.8°C. The intense heat in May and June with hot dust laden winds which may blow on many days make the weather very uncomfortable. On individual days the maximum temperature may reach above 44°C. Thundershowers occasionally occur in afternoon and bring relief from the heat. With the onset of the southwest monsoon into the district after about the second week of June there is appreciable drop in temperatures and the weather becomes pleasant. After withdrawal of southwest monsoon by about the end of September day temperatures slightly change but the night temperatures continue to decrease. From November both the temperatures begin to drop rapidly. January is usually the coldest month with the mean maximum temperature at 26.4°C and mean minimum at 8.7°C. During winter season the district is affected by cold waves in the rear of the passing western disturbances and the minimum temperatures may go down to about the freezing point of water.

The highest maximum temperature ever recorded in the district was 46.0°C on 22 May 2010 and the lowest minimum temperature was 0.0°C on 22 January 1962 at Ujjain observatory.

HUMIDITY

During the southwest monsoon season the air is generally humid with values of relative humidity generally about 70% to 90% in the morning and about 45% to 75% in the afternoon. The driest part of the year is summer season when the value of relative humidity in the afternoon is about 23% whereas it is about 50% in the morning. Except during the southwest monsoon season, the air is generally dry, afternoons being drier than in the mornings. In the post monsoon and winter season values of relative humidity in the afternoons are between 30% and 40%.

CLOUDINESS

During the southwest monsoon season skies are generally heavily clouded to overcast. In the rest of the year skies are generally clear or lightly clouded.

WINDS

Winds are generally light to moderate with some increase in force in the latter part of summer and southwest monsoon season. During the southwest monsoon season winds mostly blow from west direction and northwest on some days. In the post monsoon and winter seasons winds are mainly calm, on some days blow from east or northeast direction. In the summer season winds are predominantly from the west and northwest.

SPECIAL WEATHER PHENOMENA

Storms and depressions originating in the Bay of Bengal during the monsoon season and post monsoon season cross the east coast of India and move in a westerly or northwesterly direction across the peninsula. Some of these depressions affect the weather over the district and its neighbourhood causing widespread heavy rain and gusty winds. In the cold season western disturbances passing across north India affect the weather of the district. Thunderstorms and occasional dust storms occur during the summer months. Rain during the southwest monsoon season is often accompanied with thunder.

Tables 3, 4, 5 and 6 give the normal of temperature and relative humidity, cloudiness, wind speed and direction and special weather phenomena respectively for Ujjain observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
UJJAIN

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL **		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BADNAGAR	48	a	5.1	3.4	3.5	2.7	8.5	114.8	280.7	284.0	144.4	29.1	14.9	7.0	920.8	166	42	251.0	19 JUL 2015
		b	0.3	0.2	0.3	0.2	0.5	5.8	11.7	11.7	7.3	1.7	0.9	0.5	41.1	(2015)	(1985)		
KHACHROD	49	a	4.3	2.3	4.4	2.3	5.1	111.2	298.9	324.5	145.9	31.3	11.5	6.9	948.6	181	42	283.0	26 JUL 2015
		b	0.4	0.2	0.3	0.2	0.4	5.6	12.1	12.0	6.4	1.6	0.6	0.3	40.1	(2006)	(2002)		
MAHIDPUR	49	a	4.3	4.0	3.5	0.9	6.8	110.3	280.8	315.1	129.6	24.1	8.8	8.8	897.0	196	54	434.3	29 JUL 1950
		b	0.4	0.4	0.3	0.1	0.6	5.5	11.0	11.8	5.9	1.3	0.6	0.4	38.3	(1973)	(1982)		
TARANA	49	a	5.7	4.7	6.5	2.6	7.7	136.6	321.7	360.4	143.7	26.9	8.9	7.6	1033.0	199	55	359.7	08 AUG 1977
		b	0.4	0.4	0.4	0.2	0.5	6.0	11.9	11.9	6.3	1.4	0.7	0.4	40.5	(1973)	(2008)		
UJJAIN	42	a	7.7	6.6	6.9	1.9	7.1	121.2	308.3	320.0	136.6	27.4	13.8	9.2	966.7	173	49	339.0	10 AUG 2006
		b	0.6	0.5	0.6	0.2	0.4	5.9	11.6	11.7	6.1	1.7	1.0	0.5	40.8	(2006)	(1965)		
UJJAIN OBSY	39	a	5.6	4.8	4.2	4.7	8.5	123.1	308.6	310.0	145.7	28.6	17.5	9.8	971.1	197	49	301.0	10 AUG 2006
		b	0.5	0.6	0.3	0.4	0.9	6.8	12.1	12.0	6.4	1.5	1.2	0.7	43.4	(1973)	(1972)		
DISTRICT MEAN	6	a	5.4	4.3	4.8	2.5	7.3	119.5	299.8	322.8	141.0	27.9	12.6	8.2	956.1	182	55		
		b	0.4	0.4	0.4	0.2	0.6	5.9	11.7	11.9	6.4	1.5	0.8	0.5	40.7	1973	1985		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
UJJAIN
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
501 - 600	3	1201 - 1300	2
601 - 700	6	1301 - 1400	1
701 - 800	6	1401 - 1500	0
801 - 900	8	1501 - 1600	2
901 - 1000	3	1601 - 1700	1
1001 - 1100	6	1701 - 1800	1
1101 - 1200	8		

DATA AVAILABLE FOR 47 YEARS

TABLE- 3
NORMALS OF TEMPERATURE AND RELATIVE HUMIDITY
UJJAIN

MONTH	MEAN MAXIMUM TEMP	MEAN MINIMUM TEMP	HIGHEST MAXIMUM EVER RECORDED		LOWEST MINIMUM EVER RECORDED		RELATIVE HUMIDITY (%)	
	°C	°C	°C	DATE	°C	DATE	0830 IST	1730 IST
January	26.4	8.7	34.6	24-01-2011	0.0	22-01-1962	77	42
February	29.4	10.6	39.0	22-02-2006	1.0	23-02-1984	70	35
March	34.9	14.8	42.5	22-03-2010	4.6	01-03-1971	57	27
April	38.9	19.5	45.2	18-04-2010	10.1	01-04-1968	46	21
May	40.9	24.8	46.0	22-05-2010	12.0	09-05-2004	501	22
June	37.3	25.0	45.5	07-06-2016	18.7	13-06-1983	70	44
July	31.0	23.2	41.1	12-07-1966	18.0	24-07-2011	85	69
August	29.1	22.2	37.0	19-08-1987	16.5	02-08-2002	89	77
September	31.5	21.4	39.8	24-09-2009	11.8	24-09-1972	84	65
October	33.8	18.0	39.8	17-10-2010	8.1	29-10-1983	70	41
November	30.9	13.7	39.6	16-11-2004	2.8	30-11-1974	70	42
December	28.2	9.4	34.9	18-12-2002	0.5	28-12-1983	78	42
Annual	32.5	17.4	46.0	22-05-2010	0.0	22-01-1962	71	44

TABLE – 4
Mean Cloud Amount ** (Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
UJJAIN

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
0830 HOURS IST													
a	20	18	20	18	21	4	0	0	3	18	17	21	164
b	1	1	1	0	1	7	19	21	12	1	1	1	64
c	1.6	1.5	1.4	1.3	1.3	4.7	6.9	7.2	5.3	1.6	1.9	1.4	3.0
1730 HOURS IST													
a	20	18	19	13	14	2	0	0	1	9	16	20	142
b	1	0	0	1	1	4	11	10	6	1	0	1	35
c	1.6	1.4	1.8	2.5	2.5	4.7	6.9	7.2	5.3	1.6	1.9	1.4	3.2

a : Days with clear sky.
b : Days with sky overcast.
c : Mean Cloud amount.
** = Unit, equal to one eighth of the sky used in specifying cloud amount
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
UJJAIN

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Wind speed in km/ hr.	3.9	4.1	4.7	5.1	9.0	10.1	9.7	7.1	5.6	4.1	3.2	3.2	5.9
Direction in the morning.	C/E/NE	C/E/SE	C/W/E	C/NW/W	NW/W	W	W	W/NW	W	C/E/NW	C/E/SE	C/E/W	
Direction in the evening.	C/E/NE	C/NW/W	NW/W	NW	NW/W	W/NW	NW/W	NW/W	NW	C/NE/NW	C/NE/E	C/NE/E	

TABLE - 6
Special Weather Phenomena
UJJAIN

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Hailstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

VIDISHA DISTRICT

Physio graphically the district is predominantly a part Malwa Plateau off the main Vindhya Range. The climate of this district is generally dry except during southwest monsoon season. The year may be divided into four seasons. Summer (pre-monsoon) season from March to about middle of June is followed by southwest monsoon season which extends up to about the end of September. October and November months constitute the post monsoon season. Winter season which follows thereafter lasts till the end of February.

RAINFALL

Records of rainfall in the district are available for 5 raingauge stations for period ranging from 44 to 50 years. The details of the rainfall at these stations and for the district as a whole are given in Table 1 and 2. The average annual rainfall in the district is 1110.0 mm. During southwest monsoon season (June to September) the district receives rainfall of about 92% of annual rainfall. August is the rainiest month with average rainfall of about 378.3 mm. The variation in the rainfall from year to year is large. In the fifty-year period 1971 to 2020, the highest annual rainfall amounting to 151% of the annual normal occurred in year 1977, while the lowest annual rainfall which was 59% of the normal occurred in 2007. In the fifty-year period there were 11 years in which the annual rainfall in the district was less than 80% of the normal and there is not a single occasion of such a low rainfall occurs in two consecutive years. It is seen from Table 2 that the rainfall was between 801 mm and 1400 mm in 30 years out of 41.

On an average there are 46 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 42 at Sironj and 50 at Vidisha.

The heaviest rainfall in 24 hours recorded at any station in the district was 360.2 mm at Basoda on 31 July 1951.

TEMPERATURE

Vidisha is a meteorological observatory in the district situated at an elevation of 430 meter above mean sea level. The temperature and other meteorological data for this station may be taken as representative of the climatic conditions in the district as a whole. After February, temperature begins to rise rapidly till first week of June. May is the hottest month with the mean maximum temperature at 42.8°C and mean minimum temperature at 26.1°C. On some days in April, May and early part of June, the maximum temperature sometimes goes above 45°C. With the onset of the southwest monsoon season over the district by about the second week of June the weather becomes slightly cool, the day temperatures go down appreciably but the drop in the night temperatures is slight. After withdrawal of monsoon about the end of September, there is a slight increase in the day temperature but night become progressively cooler. After October both day and night temperatures steadily decrease. January is the coldest month of the year with the mean maximum temperature at 26.2°C and the mean minimum temperature at 8.3°C. Cold waves sometimes affect the district in winter months in the wake of western disturbances which move across northern part of India, the minimum temperature may drop down occasionally to degree or so above the freezing point of water and frost may occur.

The highest maximum temperature ever recorded at Vidisha was 49.1°C on 31st May 1994 and the lowest minimum temperature ever recorded was 0.0°C on 03rd January 1991.

HUMIDITY

The air is generally dry over the district except during the southwest monsoon season when the relative humidity is above 70 %. The summer season is the driest part of the year with value of relative humidity especially in the afternoon is less than 30 %.

CLOUDINESS

In the southwest monsoon season skies are heavily clouded to overcast. From October, cloudiness decreases. In the rest of the year skies are generally mostly clear or lightly clouded. On some days in winter, when western disturbances affect the weather of the district skies are heavily clouded. Cloudiness increases in latter part of summer, especially in the afternoon.

WINDS

Winds are generally light to calm with some strengthening in force during the late summer and southwest monsoon season. Winds are mostly calm or blow from directions between northwest and southwest during the southwest monsoon season.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season move in westerly direction and reach the district or its neighbourhood causing widespread heavy rain and gusty winds. Thunderstorms generally occur throughout the year. Its frequency is more in latter part of summer and southwest monsoon season. Fog occurs on few days during winter.

Tables 3, 4, 5 and 6 give normals of temperature and relative humidity, cloudiness, mean wind speed and wind direction and special weather phenomena respectively for Vidisha observatory. As surface data for Vidisha observatory is available upto the year 2010, data for this district is taken from 1981-2010 climatological Normals.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
VIDISHA

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS* R/F	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BASODA	50	a b	9.3 0.8	9.7 0.8	8.6 0.6	2.9 0.3	4.7 0.4	146.9 6.7	349.6 13.7	365.0 14.2	149.4 7.3	29.6 1.3	9.4 0.6	9.0 0.5	1094.1 47.2	189 (2013)	57 (1979)	360.2	31 JUL 1951
KURWAI	49	a b	8.9 0.7	9.6 0.8	8.0 0.6	2.3 0.2	3.7 0.4	152.5 7.	348.0 13.5	382.2 14.6	144.8 7.5	21.8 1.3	9.5 0.6	8.8 0.5	1100.1 47.7	180 (2013)	59 (1972)	306.0	20 JUL 2000
LATERI	49	a b	8.2 0.7	8.5 0.8	5.0 0.4	1.9 0.1	4.7 0.3	120.0 6.1	321.8 13.4	375.8 14.0	145.0 7.2	17.2 1.1	8.2 0.5	8.3 0.4	1024.6 45.0	169 (1987)	45 (2002)	245.0	28 AUG 1987
SIRONJ	47	a b	11.3 0.7	9.8 0.7	6.6 0.4	1.6 0.1	5.7 0.4	128.7 5.9	324.8 12.4	339.0 12.7	147.4 6.7	21.0 1.2	11.5 0.5	8.2 0.4	1015.6 42.1	171 (1975)	57 (1991)	254.0	01 SEP 1947
VIDISHA	44	a b	22.0 1.3	15.1 1.1	10.1 0.7	3.1 0.2	9.5 0.6	175.6 7.3	401.9 14.0	429.3 14.1	186.9 7.6	31.6 1.5	15.3 0.9	15.0 0.7	1315.4 50.0	204# (1999)	50 (2007)	328.9	07 SEP 1939
DISTRICT MEAN	5	a b	11.9 0.8	10.5 0.8	7.7 0.5	2.4 0.2	5.7 0.4	144.7 6.6	349.2 13.4	378.3 13.9	154.7 7.3	24.2 1.3	10.8 0.6	9.9 0.5	1110.0 46.3	151 (1999)	59 (2007)		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020.

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
Frequency of Annual Rainfall in the District
VIDISHA
(Data 1971-2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
601 - 700	1	1201 - 1300	2
701 - 800	3	1301 - 1400	5
801 - 900	7	1401 - 1500	2
901 - 1000	7	1501 - 1600	2
1001 - 1100	8	1601 - 1700	3
1101 - 1200	1		

(Data available for 41 years)

TABLE – 3
Normals of Temperature and Relative Humidity
VIDISHA

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	26.2	8.3	35.0	28-01-2003	0.0	03-01-1991	79	51
February	29.5	10.8	36.2	28-02-2004	2.5	08-02-1974	73	42
March	34.7	15.3	42.1	31-03-1999	5.8	01-03-1971	60	32
April	40.2	20.5	46.9	18-04-2000	2.5	30-04-2001	51	27
May	42.8	26.1	49.1	31-05-1994	18.5	20-05-1993	51	26
June	38.9	25.5	49.0	06-06-1995	16.3	19-06-1993	67	49
July	32.3	23.4	43.3	08-07-1995	13.0	18-07-1996	89	73
August	30.3	22.8	38.6	01-08-2002	10.0	22-08-1996	94	81
September	32.2	21.5	39.0	24-09-2001	10.1	21-09-1996	89	71
October	34.0	18.3	40.8	04-10-2002	11.0	19-10-1994	76	50
November	31.4	13.0	38.0	11-11-2003	4.9	26-11-1992	74	46
December	27.9	9.1	35.0	12-12-2001	3.1	29-12-1996	77	47
Annual	33.4	17.9	49.1	31-05-1994	0.0	03-01-1991	73	50

TABLE – 4
Mean Cloud Amount **(Okta of the Sky) and Mean Number
of days of Clear and Overcast Skies
VIDISHA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0830 HOURS IST													
a	23	23	24	23	21	6	1	1	8	21	23	27	201
b	2	1	2	2	2	14	25	24	13	3	2	1	91
c	1.4	1	1.4	1.2	1.8	5	7	7.1	4.6	1.7	1.2	0.6	2.8
1730 HOURS IST													
a	24	23	22	22	15	5	3	2	6	20	23	27	192
b	1	1	3	2	5	16	23	23	15	3	2	1	95
c	1.2	1.1	1.7	1.5	3.3	5.6	6.7	6.8	5.3	2	1.3	0.7	3.1

- a: Days with clear sky.
b: Days with sky overcast.
c: Mean cloud amount in Okta.
** Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction
VIDISHA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	C	C	C	C	C	C	C	C	C	C	C	C	
Direction in evening	C	C	C	C	C	C	C	C	C	C	C	C	

TABLE - 6
Special Weather Phenomena
VIDISHA

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunderstorm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hailstorm	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1

KHARGONE (WEST NIMAR) DISTRICT

The climate of this district is characterized by hot dry summer season and well distributed rainfall in southwest monsoon season. The year may be divided in to four seasons. Winter season is from December to February, the summer (pre-monsoon) season from March to middle of June and southwest monsoon season is from the middle of June to first week of October. The period of October and November constitutes post monsoon season.

RAINFALL

Records of rainfall in the district are available for 8 raingauge stations for the period ranging from 32 to 50 years. The details of rainfall at these stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 776.7 mm. The variation in rainfall from year to year is large. The rainfall in the southwest monsoon season constitutes about 92% of the annual normal rainfall, July and August being the months with the highest rainfall with an average value of 227.8 mm. In the fifty year period 1971 to 2020, the highest annual rainfall was in year 1973 when it amounted to 161% of the normal. In the year 1972, the annual rainfall in the district was the lowest during this period and amounted to only 63% of the normal. In this fifty year period the annual rainfall was less than 80% of the normal in 6 years, however none of them were consecutive. It is seen from Table 2 that the annual rainfall was between 601 mm and 1000 mm in 32 years out of 46.

On an average there are 39 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 36 at Khargone Obsy to 43 at Maheshwar.

The heaviest rainfall in 24 hours at any station in the district was 400.3 mm at Khargone on 20 June 1938.

TEMPERATURE

There is one meteorological observatory in the district at Khargone situated at the elevation of 251 metre above mean sea level. The description of climate that follows, is based on the records of this observatory. Temperatures begin to rise rapidly from March till May. May is generally the hottest month with the mean maximum temperature of about 42.7°C and mean minimum temperature of about 26.7°C. The heat in the summer is intense, on some days the maximum temperature may reach about 46°C. Thundershowers sometimes occur during afternoons bring some relief from the heat. With the onset of the southwest monsoon season over the district by about the second week of June there is considerable drop in the temperatures, the day temperatures go down appreciably but the drop in the night temperatures is slight. After the withdrawal of monsoon by about end of September, the day temperature increases slightly in October but nights become progressively cooler. After mid-November day and night temperatures decrease rapidly. January is the coldest month of the year with the mean maximum temperature is at about 27.9°C and mean minimum temperature at about 8.9°C. In winter months, cold waves sometimes affect the district in the wake of western disturbances passing across north India, the minimum temperatures may sometimes go down to about 3°C or 4°C on individual days.

The highest maximum temperature ever recorded at Khargone was 47.9°C on 06th May 2002 and the lowest minimum was 0.2°C on 2nd December 1988.

HUMIDITY

In the south west monsoon months, air is generally humid and relative humidity ranges between 70% and 86% in the mornings and it ranges between 58% and 80% in the afternoon. Air is generally mildly humid in post monsoon and winter seasons. The humidity is generally less in the afternoons than in the mornings. Summer is the driest part of the year when the value of relative humidity is about 40% to 50% in the afternoon.

CLOUDINESS

During southwest monsoon season skies are heavily clouded. In the rest of the year, skies are generally clear or lightly clouded.

WINDS

Winds are generally light with a little strengthening in the latter part of summer and early part of monsoon season. In the summer season and southwest monsoon season winds are mostly westerly in the morning and westerly to southerly in the afternoon. In the rest of year winds are light and southerly winds are predominant both in the morning and afternoon. During the monsoon season, when depressions affect the weather of the district, the district may experience occasionally gusty winds.

SPECIAL WEATHER PHENOMENA

Depressions originating in the Bay of Bengal during the southwest monsoon season cross the east coast and moving in some west direction pass through or in the neighbourhood of the district causing widespread and locally heavy rain and gusty winds. Occasionally post monsoon storms from the Bay of Bengal affect the weather of the district. Thunderstorms occur in the district during summer and southwest monsoon season. Fog occurs occasionally in the mornings of post monsoon and winter seasons.

Table 3, 4 and 5 give the normals of temperature and humidity, cloudiness and wind speed and direction respectively for Khargone observatory.

TABLE - 1
NORMALS AND EXTREMES OF RAINFALL
KHARGONE

STATION	No. Of years of DATA		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	ANNUAL R/F AS % OF NORMAL**		HEAVIEST R/F IN 24 HRS*	
																HIGHEST	LOWEST	AMOUNT	DT MON YEAR
BURWAHA	50	a b	3.4 0.2	3.6 0.4	2.5 0.1	0.6 0.1	6.1 0.3	131.2 6.1	256.6 11.4	235.5 11.0	137.7 6.7	27.7 1.8	8.9 0.5	5.4 0.3	819.2 38.9	166 (1994)	51 (1985)	276.4	25 JUL 1937
KASRAWAD	28	a b	2.3 0.2	5.0 0.3	2.1 0.3	0.2 0.0	1.9 0.2	102.4 5.7	228.7 11.9	235.4 11.7	139.1 7.3	28.0 1.8	12.9 0.8	3.0 0.2	761.0 40.4	159 (1973)	49 (1982)	226.0	07 SEP 2014
KHARGONE	50	a b	4.5 0.4	3.8 0.4	3.6 0.4	2.2 0.2	6.3 0.6	131.7 6.2	203.4 10.8	212.3 10.6	138.5 6.5	40.5 2.2	15.8 0.9	5.4 0.4	768.0 39.6	168 (1988)	55 (2007)	400.3	20 JUN 1938
KHARGONE OBSY	33	a b	4.4 0.4	2.2 0.3	3.8 0.4	3.1 0.3	6.5 0.5	104.5 5.8	176.0 9.3	215.8 9.7	109.3 6.2	33.9 2.0	8.1 0.4	4.5 0.3	672.1 35.6	190 (1981)	18 (2002)	291.0	16 AUG 1981
MAHESHWAR	49	a b	1.9 0.2	2.6 0.3	2.0 0.3	1.3 0.1	1.9 0.3	145.6 6.5	264.9 12.5	285.2 12.3	160.6 7.2	35.7 1.9	7.4 0.6	3.7 0.3	912.8 42.5	182 (1997)	49 (1984)	336.4	07 SEP 2014
MORTAKKA HYDRO	32	a b	6.0 0.6	5.2 0.5	3.4 0.3	1.4 0.2	9.4 0.9	138.6 6.9	235.2 11.0	229.8 10.4	141.0 6.4	25.3 1.7	14.9 0.9	7.2 0.4	817.4 40.2	146 (1976)	11 (2015)	220.0	26 JUL 1997
PANSEMAL (MED.)	42	a b	2.4 0.2	0.0 0.0	1.1 0.1	2.5 0.1	5.5 0.4	112.4 5.3	208.7 12.8	225.5 12.3	111.9 6.5	29.7 1.6	7.4 0.7	0.6 0.0	707.7 40.0	194# (2006)	64 (1972)	160.0	07 AUG 2006
SEGAON	22	a b	1.7 0.1	1.8 0.2	2.0 0.2	0.4 0.0	3.4 0.2	123.5 5.3	219.5 11.5	213.5 11.5	157.0 6.9	25.4 1.6	3.4 0.2	3.4 0.3	755.0 38.0	140# (2006)	65 (2012)	255.0	03 SEP 2002
DISTRICT MEAN	8	a b	3.3 0.3	3.0 0.3	2.6 0.3	1.5 0.1	5.1 0.4	123.7 6.0	224.1 11.4	231.6 11.2	136.9 6.7	30.8 1.8	9.9 0.6	4.2 0.3	776.7 39.4	161 1973	63 1972		

(a) NORMAL RAINFALL IN MM

(b) AVERAGE NUMBER OF RAINY DAYS (DAYS WITH RAIN OF 2.5 MM OR MORE)

(#) NUMBER OF OBSERVATIONS LESS IN THE YEAR

(*) BASED ON ALL AVAILABLE DATA UPTO 2020

(**) YEARS GIVEN IN BRACKETS

(@) HILL STATION, NOT CONSIDERED FOR DISTRICT MEAN

TABLE - 2
FREQUENCY OF ANNUAL RAINFALL IN THE DISTRICT
KHARGONE
(DATA 1971 - 2020)

RANGE IN MM	NO. OF YEARS	RANGE IN MM	NO. OF YEARS
401 - 500	3	901 - 1000	5
501 - 600	3	1001 - 1100	5
601 - 700	11	1101 - 1200	2
701 - 800	8	1201 - 1300	1
801 - 900	8		

DATA AVAILABLE FOR 46 YEARS

TABLE – 3
Normals of Temperature and Relative Humidity
KHARGONE

MONTH	Mean Maximum Temperature	Mean Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	°C	°C	°C	Date	°C	Date	0830 IST	1730 IST
January	27.9	8.9	36.2	26-01-1992	4.0	05-01-1989	71	64
February	31.5	12.1	40.0	27-02-2009	3.5	06-02-1980	59	60
March	36.6	18.0	43.6	31-03-1991	7.6	09-03-1980	52	49
April	41.3	24.4	46.2	27-04-2001	12.0	02-04-1989	50	46
May	42.7	26.7	47.9	06-05-2002	20.5	23-05-1979	56	42
June	38.6	25.0	47.6	03-06-1991	15.1	07-06-1980	70	58
July	33.5	22.8	43.0	05-07-1981	18.2	30.07.1996	80	72
August	31.2	22.4	38.6	09-08-2000	18.1	06-08-2004	86	80
September	33.2	22.6	41.8	19-09-1983	12.7	03-09-2000	82	75
October	34.9	20.5	42.4	08-10-2002	10.7	12-10-1979	72	64
November	31.6	16.3	38.7	23-11-1987	5.0	26-11-1987	69	69
December	30.4	10.8	38.4	24-12-1983	0.2	02-12-1988	72	68
Annual	34.6	19.7	47.9	06-05-2002	0.2	02-12-1988	68	62

TABLE – 4
Mean Cloud Amount ^{}(Okta of the Sky) and Mean Number**
of days of Clear and Overcast Skies

KHARGONE

0830 HOURS IST													
a	6	7	9	9	8	7	5	1	1	8	9	7	77
b	0	0	0	0	0	0	2	2	1	0	0	0	5
c	2.1	2.0	2.0	2.0	1.9	1.9	2.4	2.4	2.7	1.8	1.8	2.1	2.1
1730 HOURS IST													
a	6	6	9	8	8	7	4	1	1	7	6	7	70
b	0	0	0	0	0	0	2	2	1	0	0	0	5
c													

a: Days with clear sky.

b: Days with sky overcast.

c: Mean cloud amount in Okta.

^{**} Okta = Unit equal to area of one eighth of the sky used in specifying cloud amount.
For example: 1 Okta means 1/8th of the sky covered.

TABLE - 5
Mean Wind Speed and Predominant Wind Direction

KHARGONE

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind speed in km/hr													
Direction in morning	S/W	W/S	S/W	W	W	W	W	W	W	S/W	S/W	S/W	
Direction in evening	S	S	S	S	S	S/W	S/W	S	S	S	S	S	



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