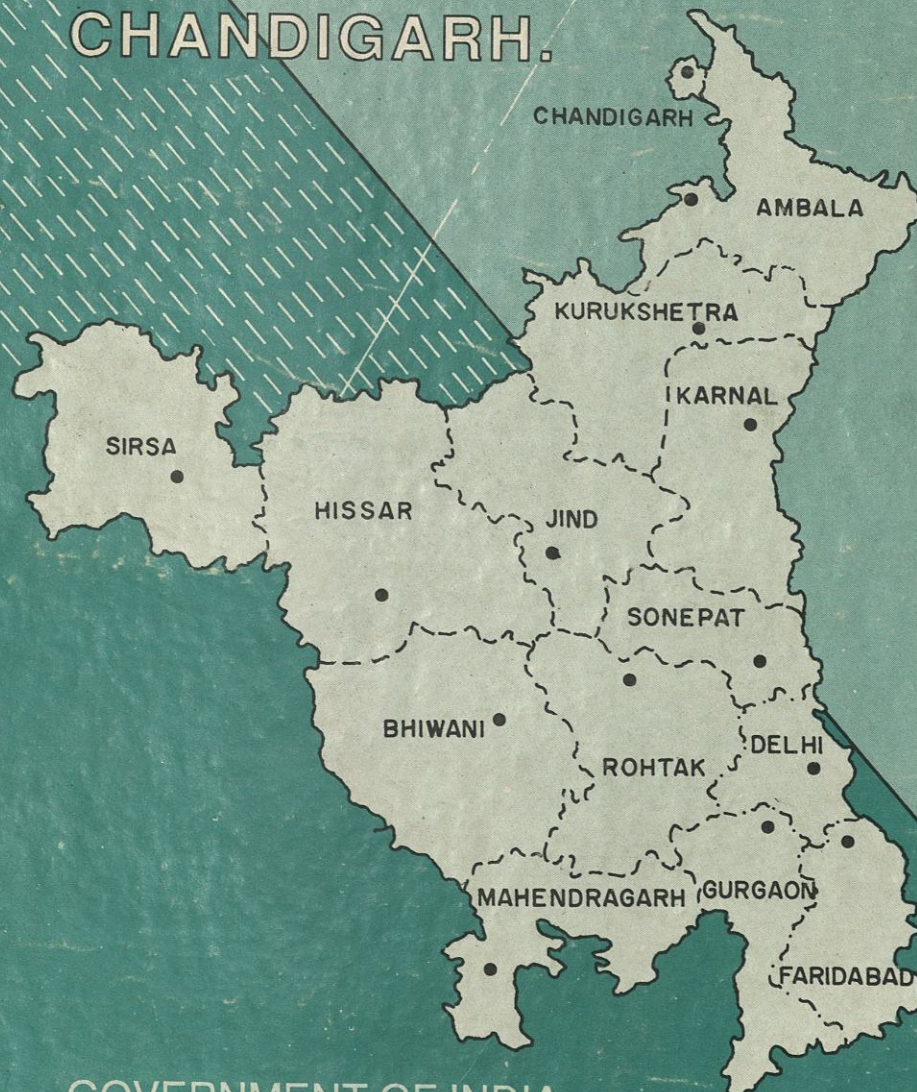




CLIMATE OF HARYANA AND UNION TERRITORIES OF DELHI AND CHANDIGARH.



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1991

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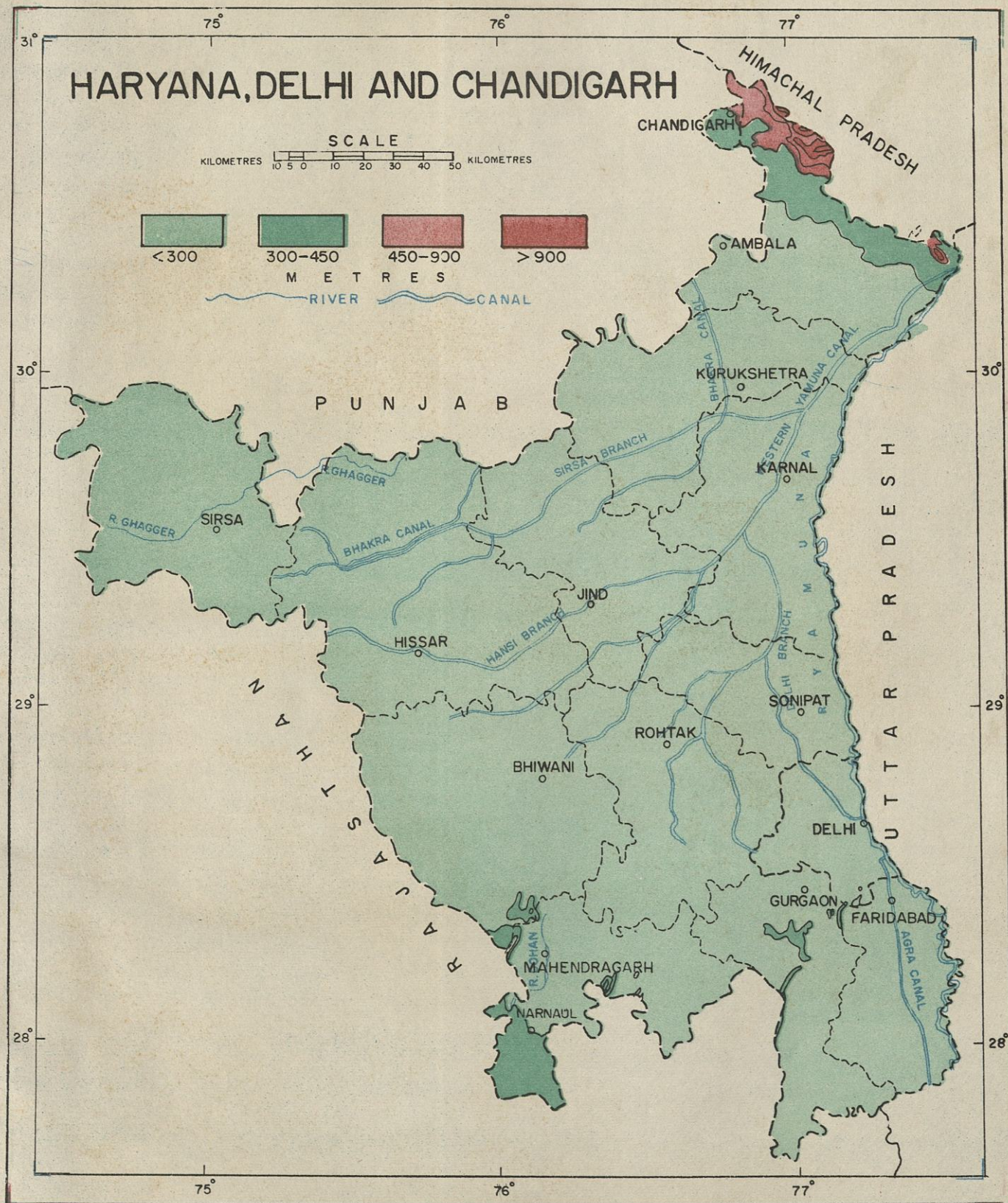
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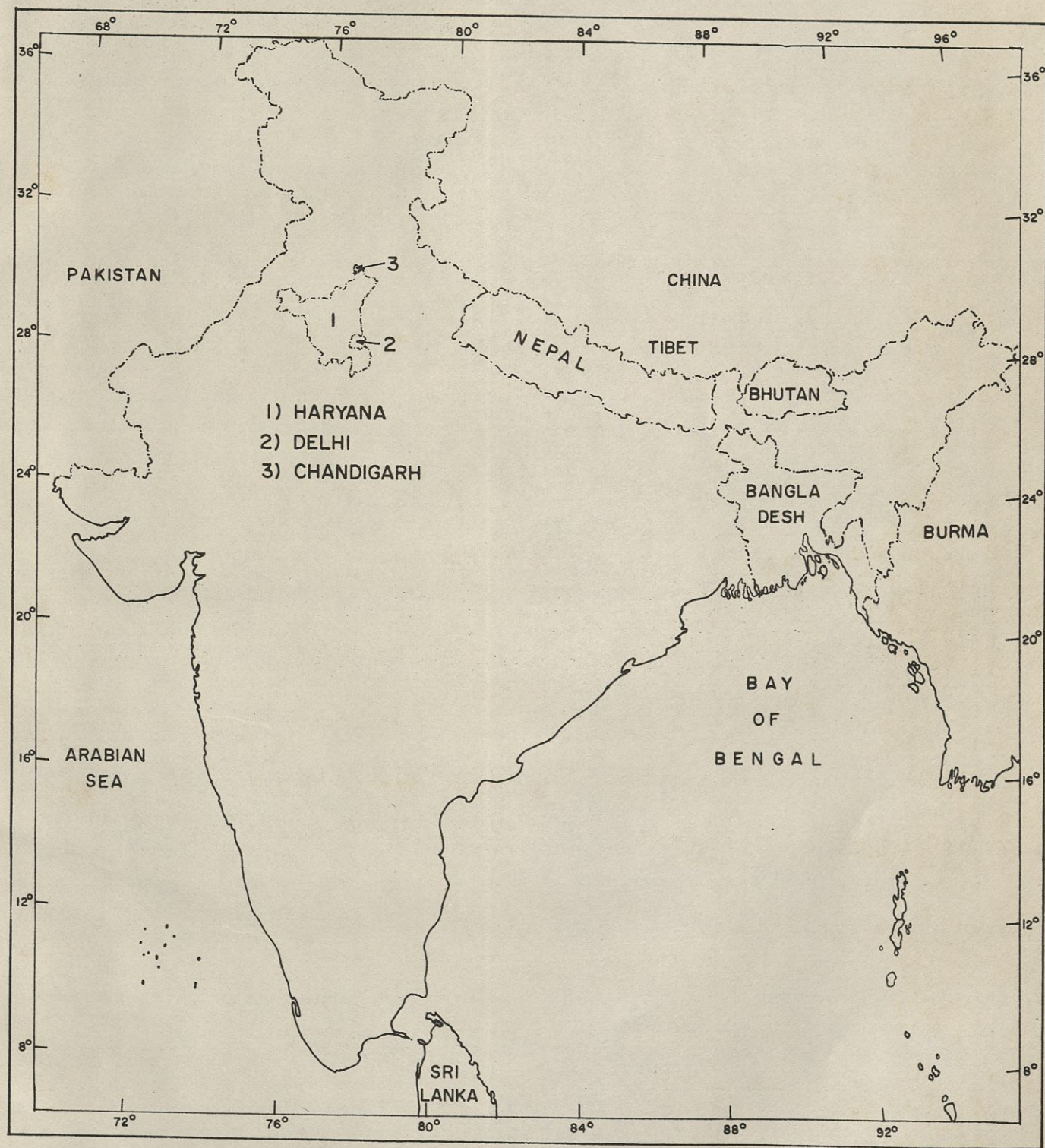
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1991

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PHYSICAL FEATURES



F O R E W O R D

The importance of Meteorology for economic and social benefits of the society is being realised increasingly all over the world. In our country also, various projects undertaken by agriculture, aviation, energy, industrial, ecological and other interests very often require climatological information from this department pertaining to different regions of the country for planning and executing the projects with a view to derive maximum advantage out of meteorological and/or climatological conditions. Keeping these requirements in view, it was decided to publish Climatological Summaries for each State. The eighth issue in the series 'State Climatological Summaries' is the **"CLIMATE OF HARYANA AND UNION TERRITORIES OF DELHI AND CHANDIGARH"**.

The preparation of the summary and maps included in this volume was done in the Section dealing with Revision of Climatological Publications of this Department at Pune under the charge of Shri M.R. Das, Director and under the overall supervision of Dr. H.N. Srivastava, Additional Director General of Meteorology (Research).

NEW DELHI

S.M. KULSHRESTHA

9th August, 1991. DIRECTOR GENERAL OF METEOROLOGY

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

The meteorological conditions of the Haryana State as a whole are described in the first chapter followed by detailed description of the climate of each district in the succeeding chapters. The district summaries which were in existence as on 1st January, 1980 are arranged alphabetically.

The normals of meteorological elements used for describing the climate are generally based on data for the period 1931-60 except in the case of rainfall and for all the elements in cases of some stations where data of recent years were only available. For rainfall, normals using data from 1901 to 1980 as available from National Data Centre, Pune, have been used. The extreme values of temperature and rainfall presented in the summary are based on data updated upto 1981 and 1980 respectively.

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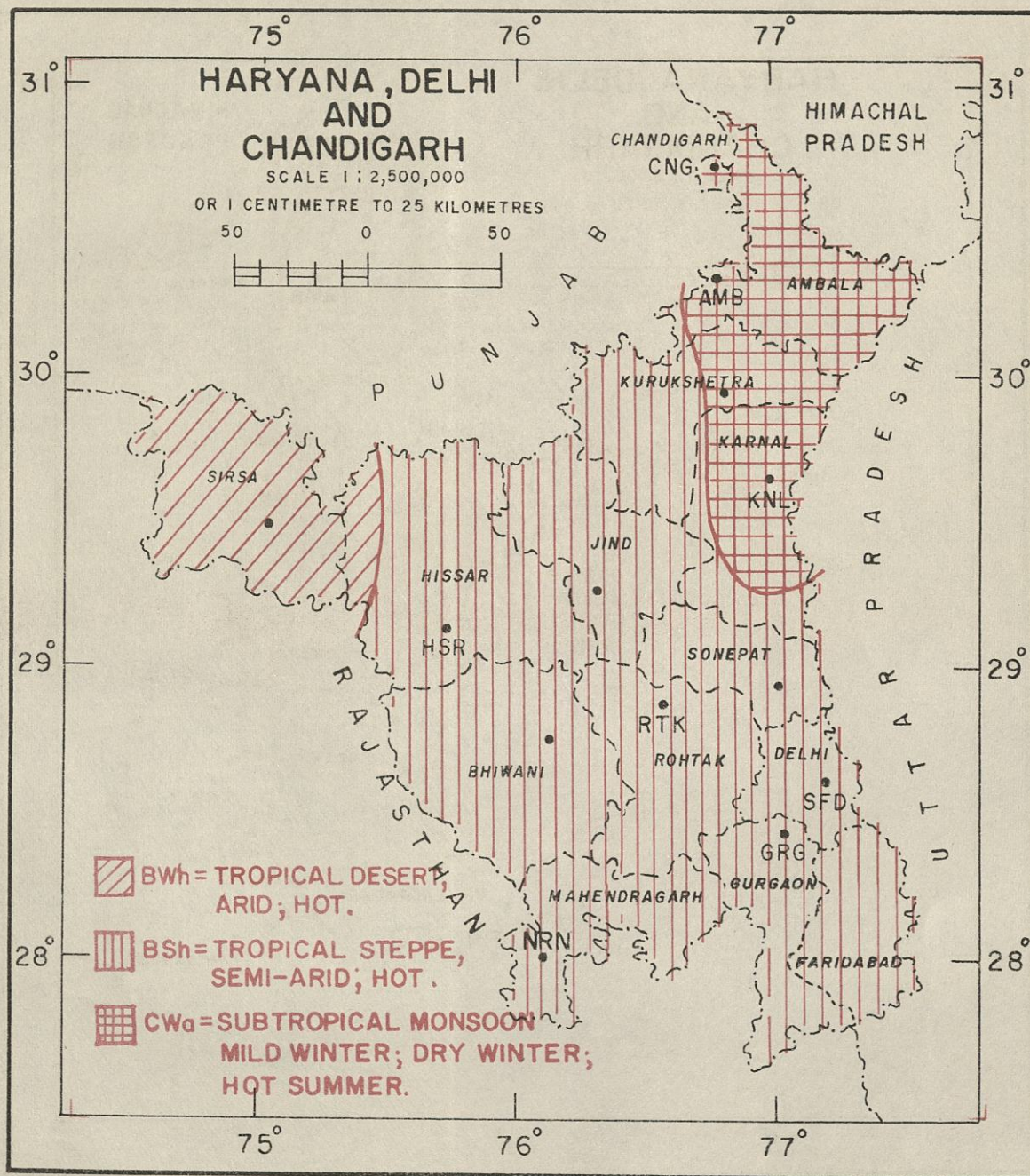


FIG.-1: CLIMATIC CLASSIFICATION.

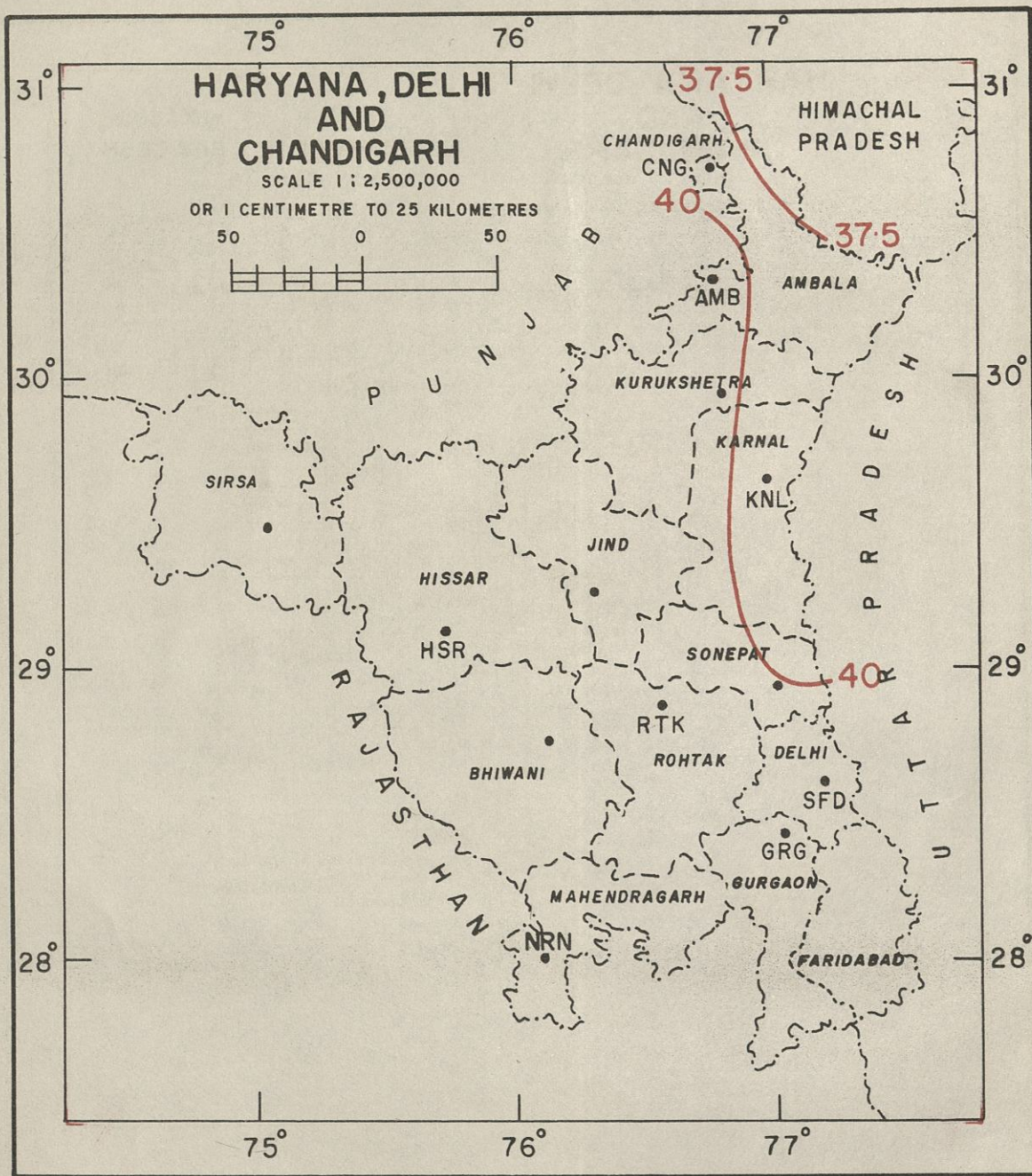
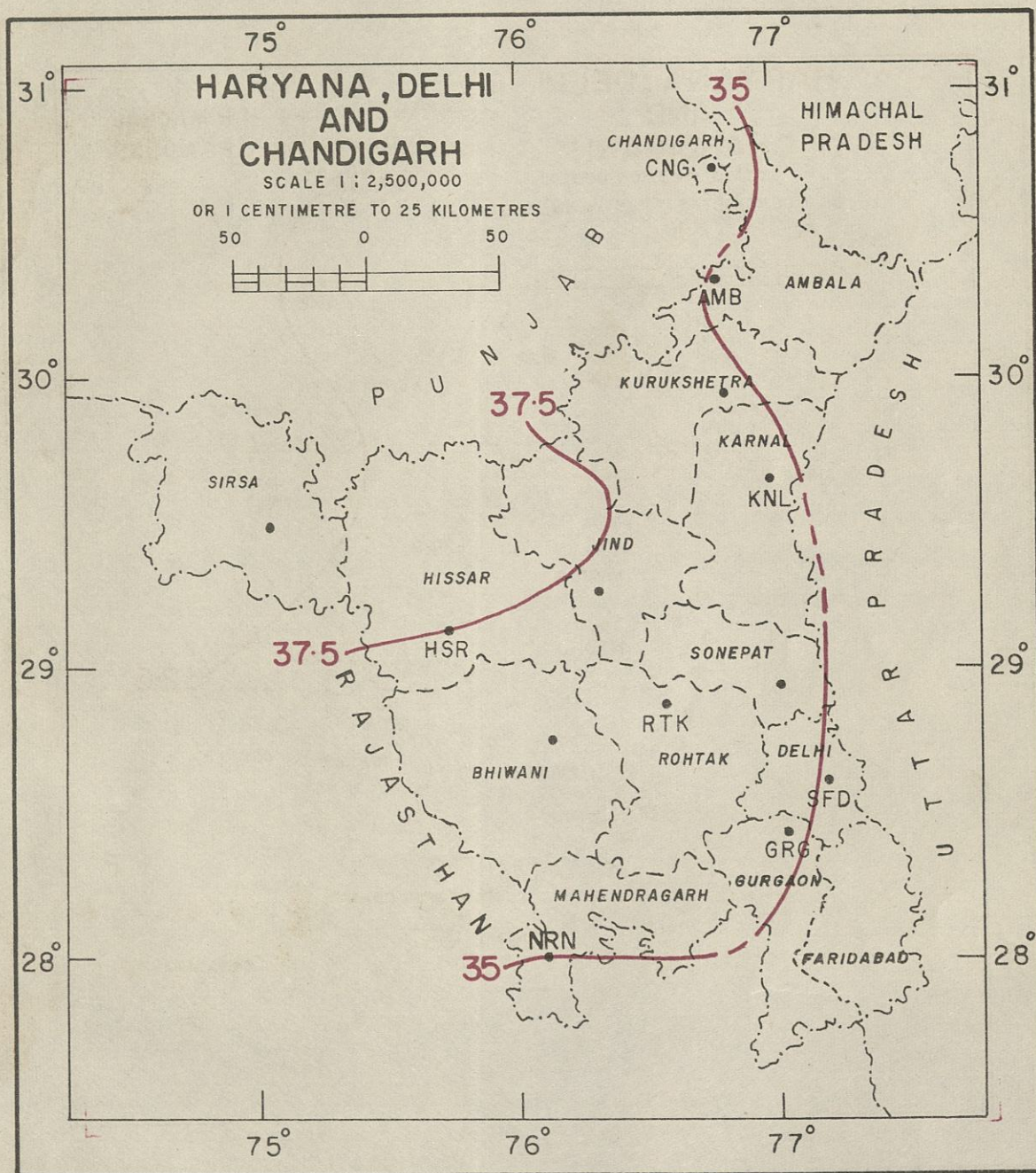


FIG. 2(a) : MEAN MAXIMUM TEMPERATURE (°C)
 MAY.



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

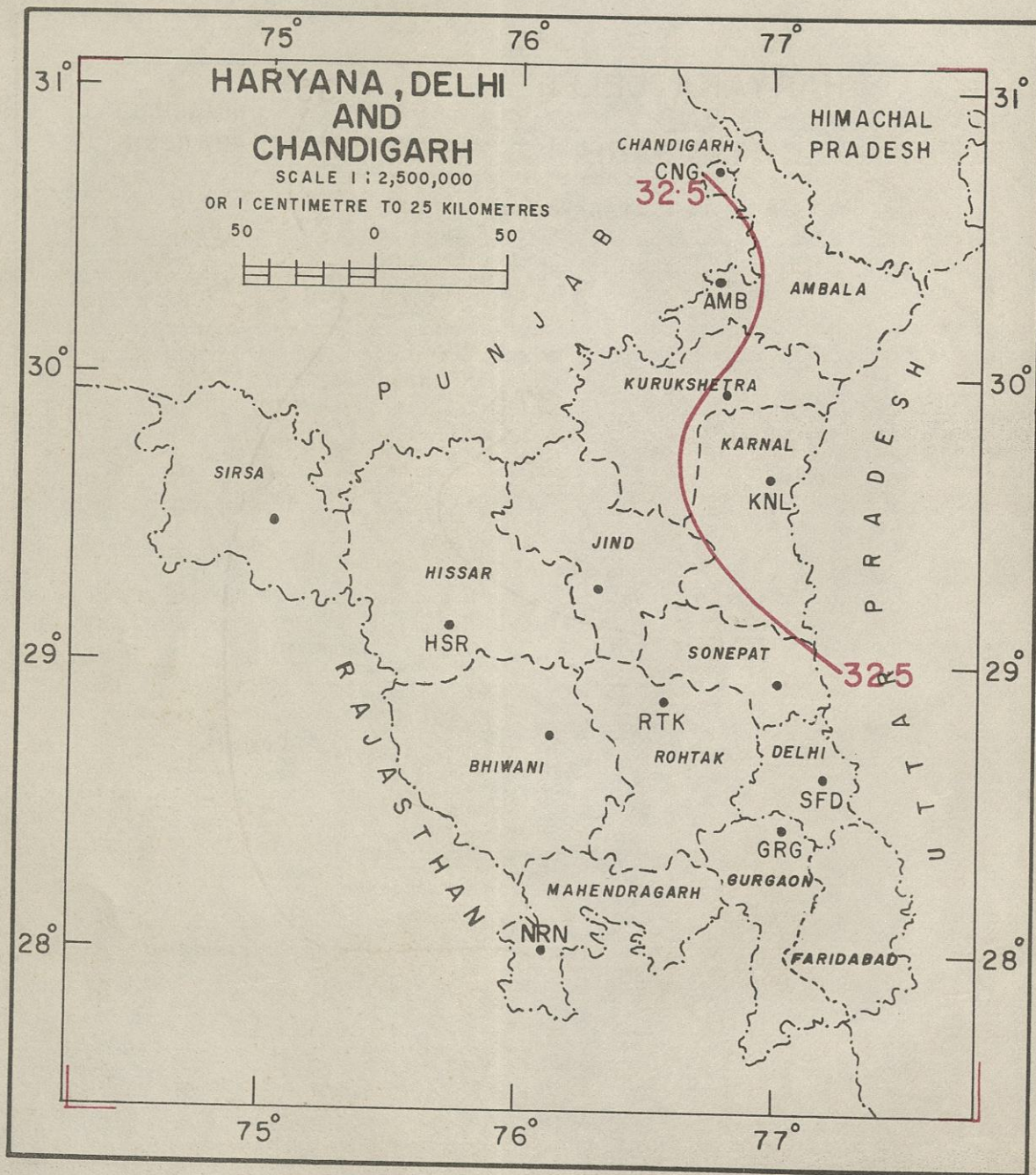
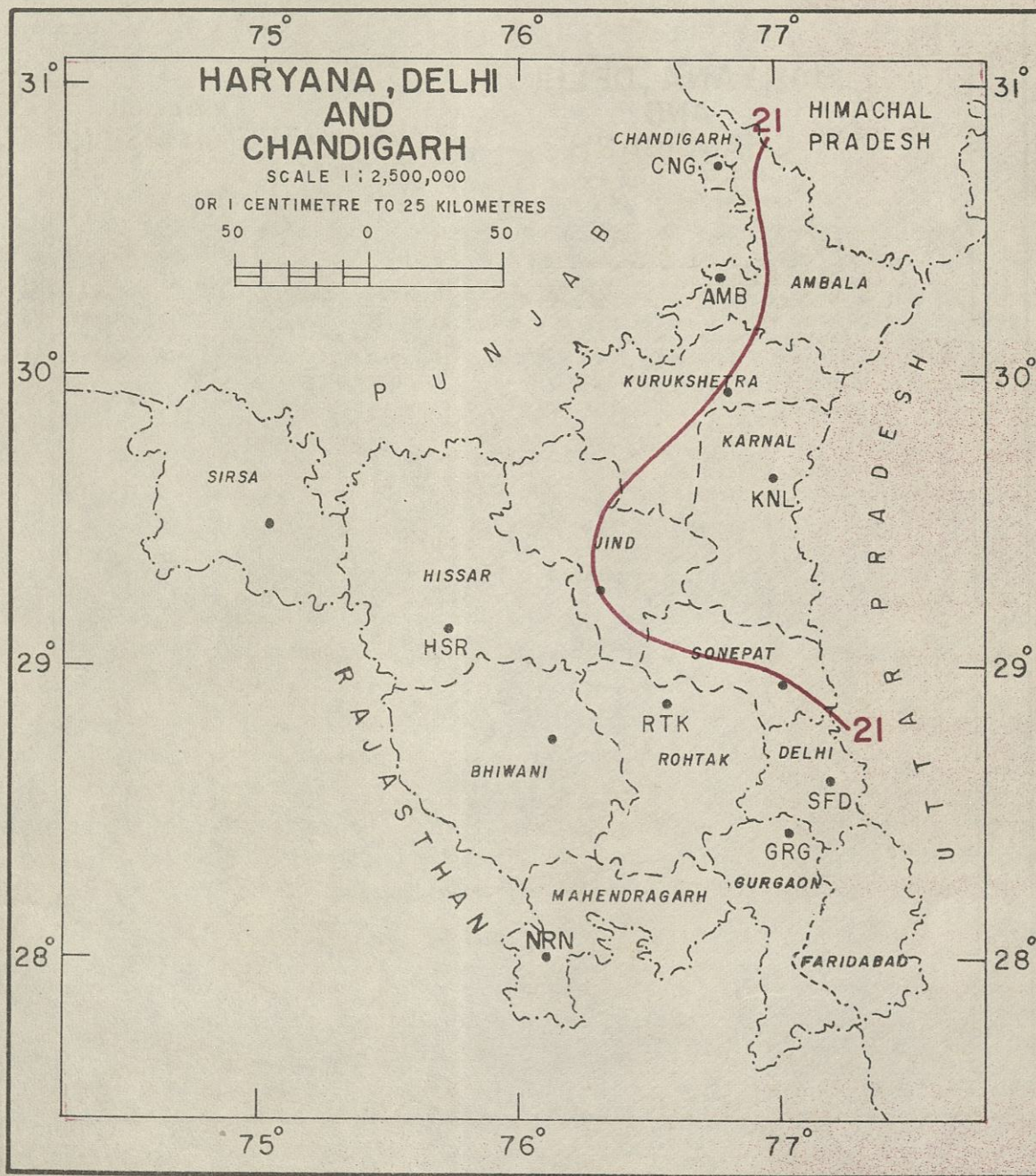
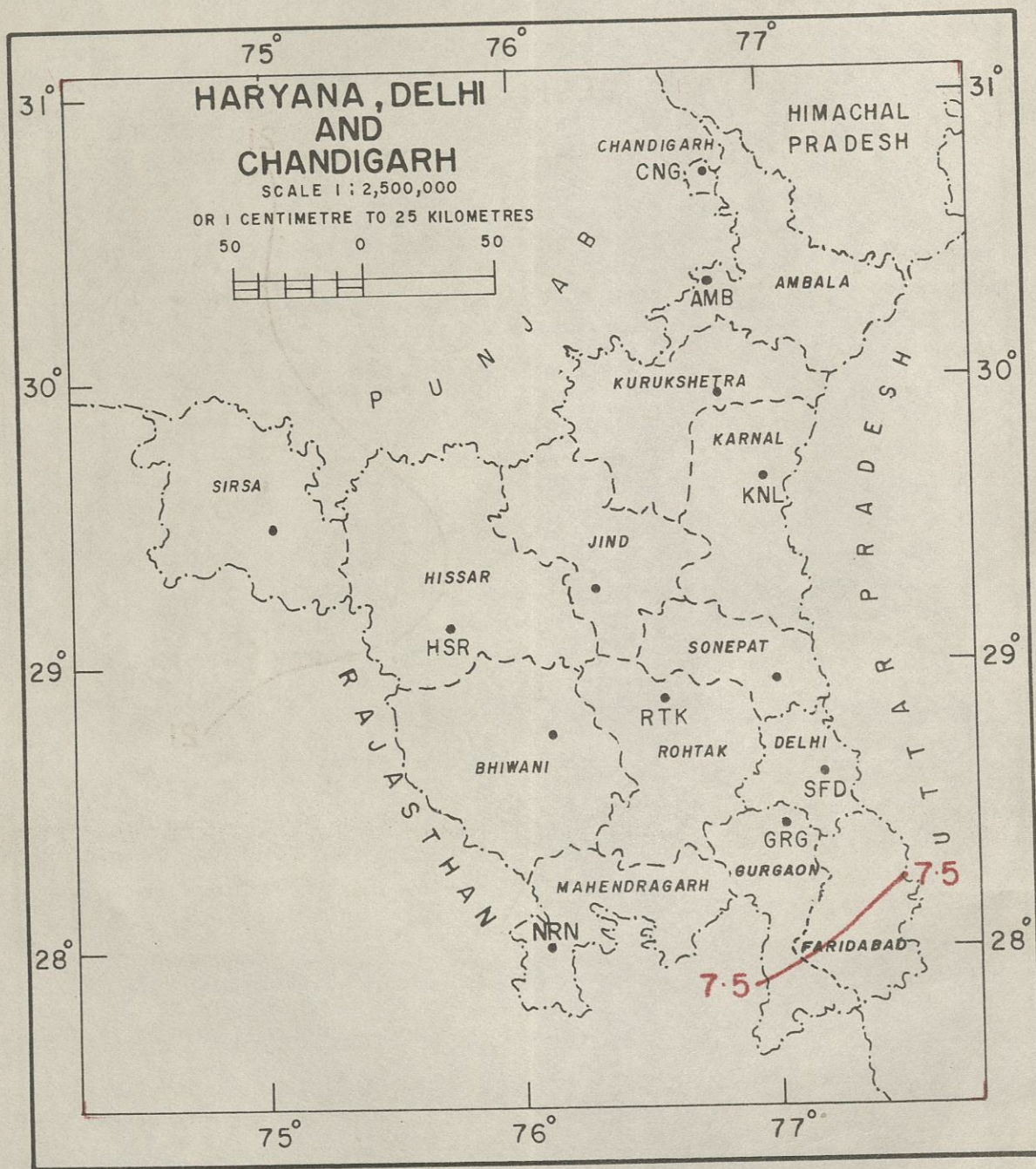


FIG.2 (c): MEAN MAXIMUM TEMPERATURE (°C) OCTOBER.



**FIG.2(d): MEAN MAXIMUM TEMPERATURE (°C)
 JANUARY.**



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

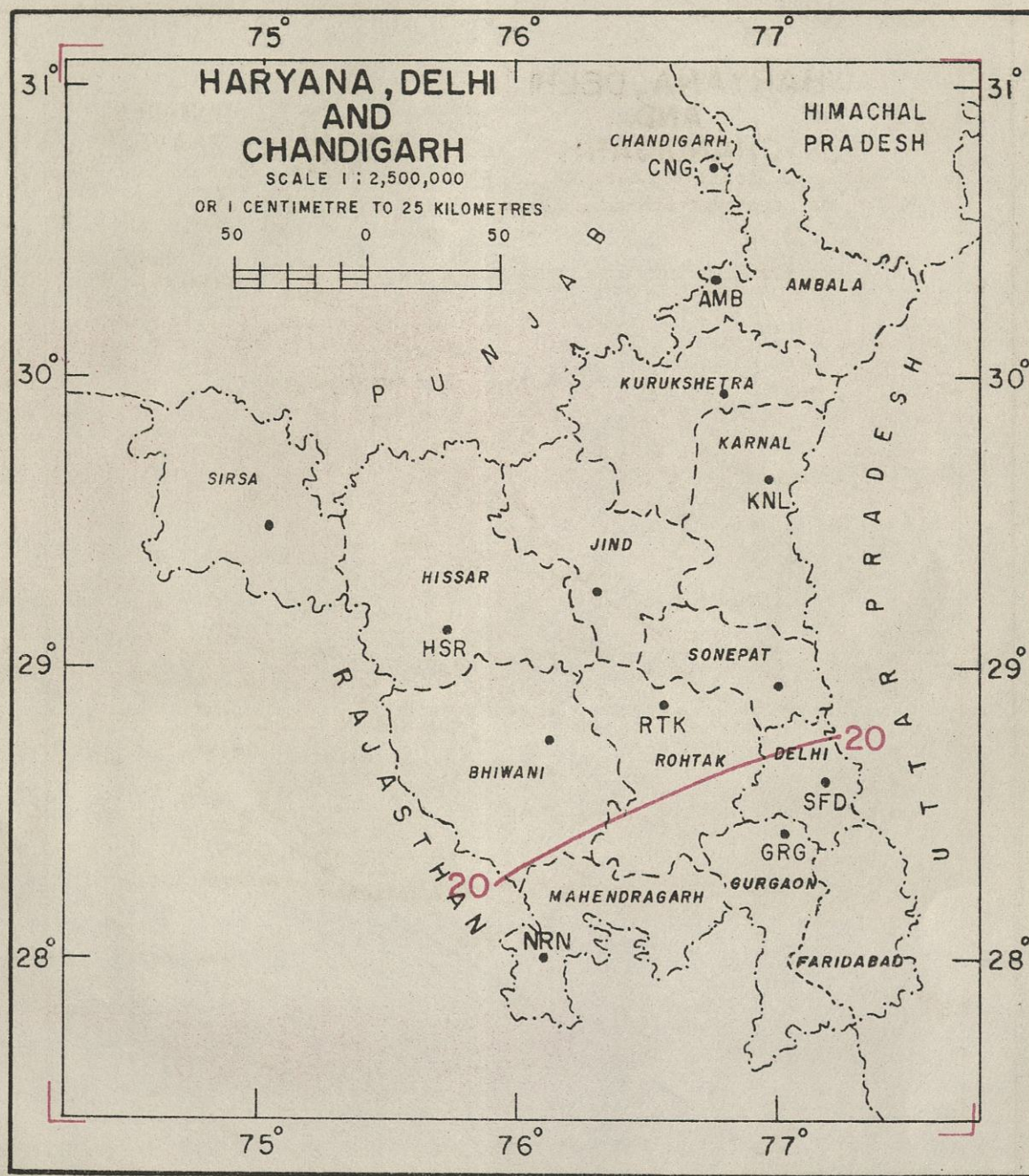


FIG. 3(b) : MEAN MINIMUM TEMPERATURE (°C)
 APRIL.

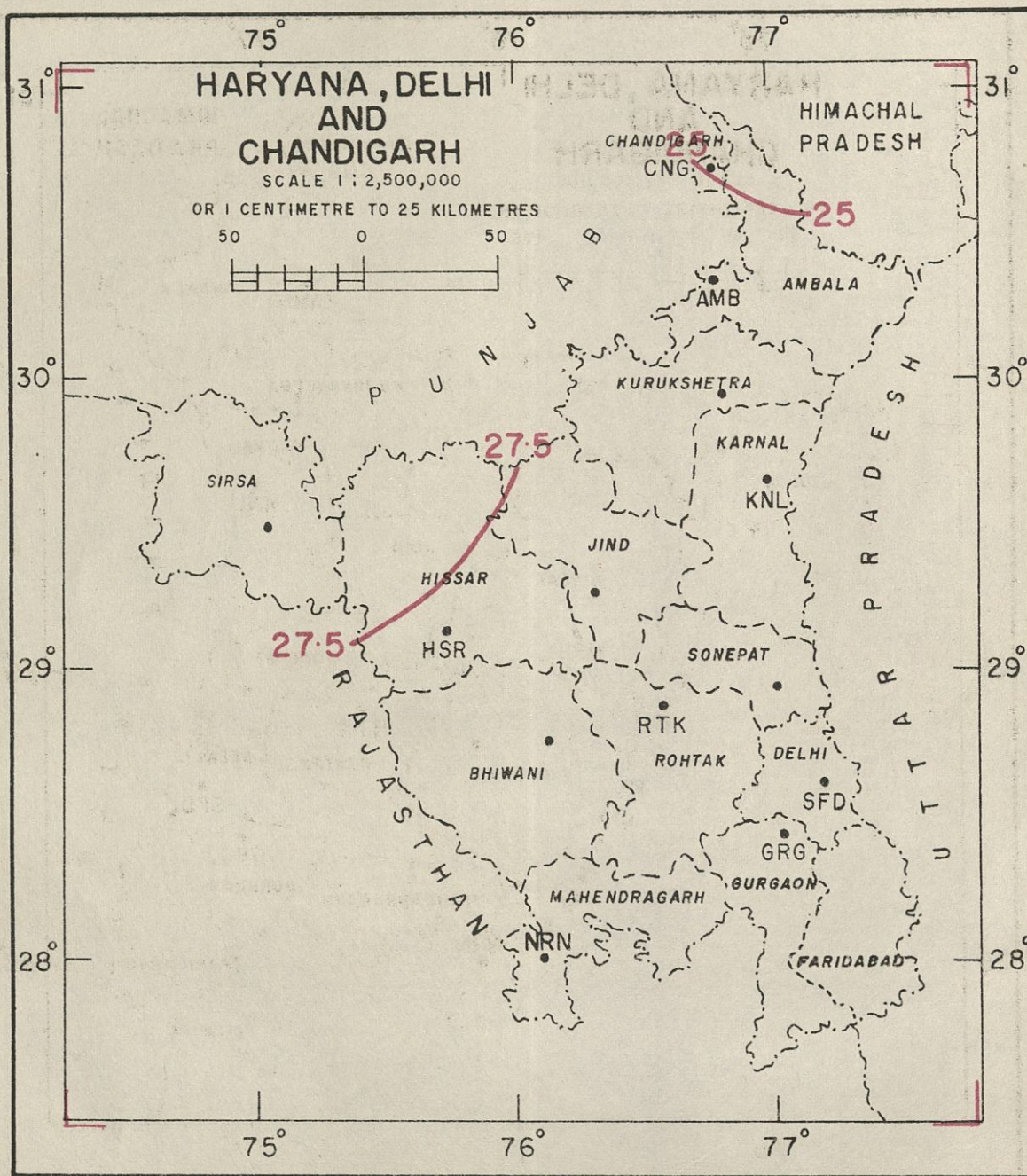
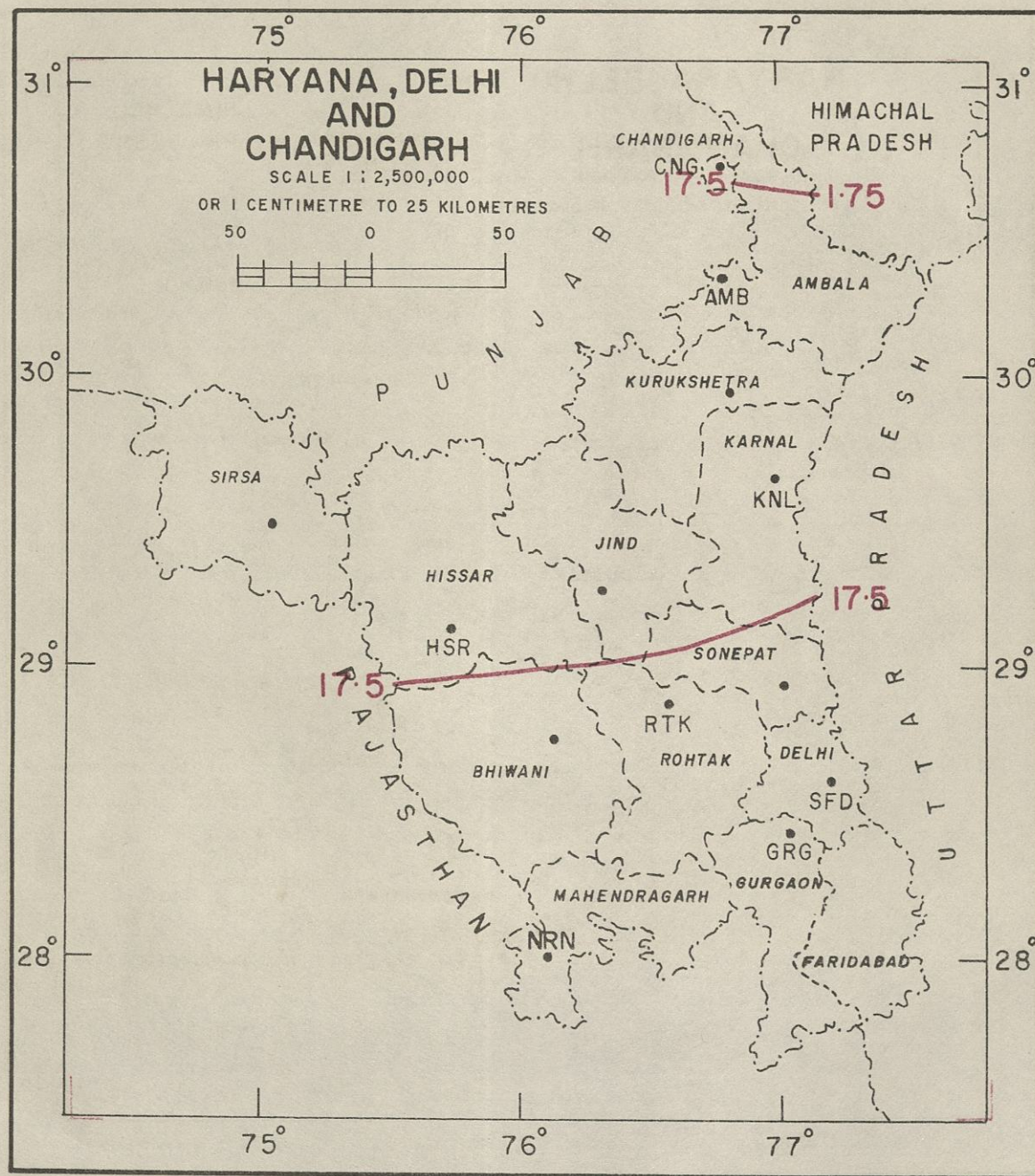


FIG. 3(c) : MEAN MINIMUM TEMPERATURE (°C)
JULY.



**FIG. 3 (d) : MEAN MINIMUM TEMPERATURE (°C)
 OCTOBER.**

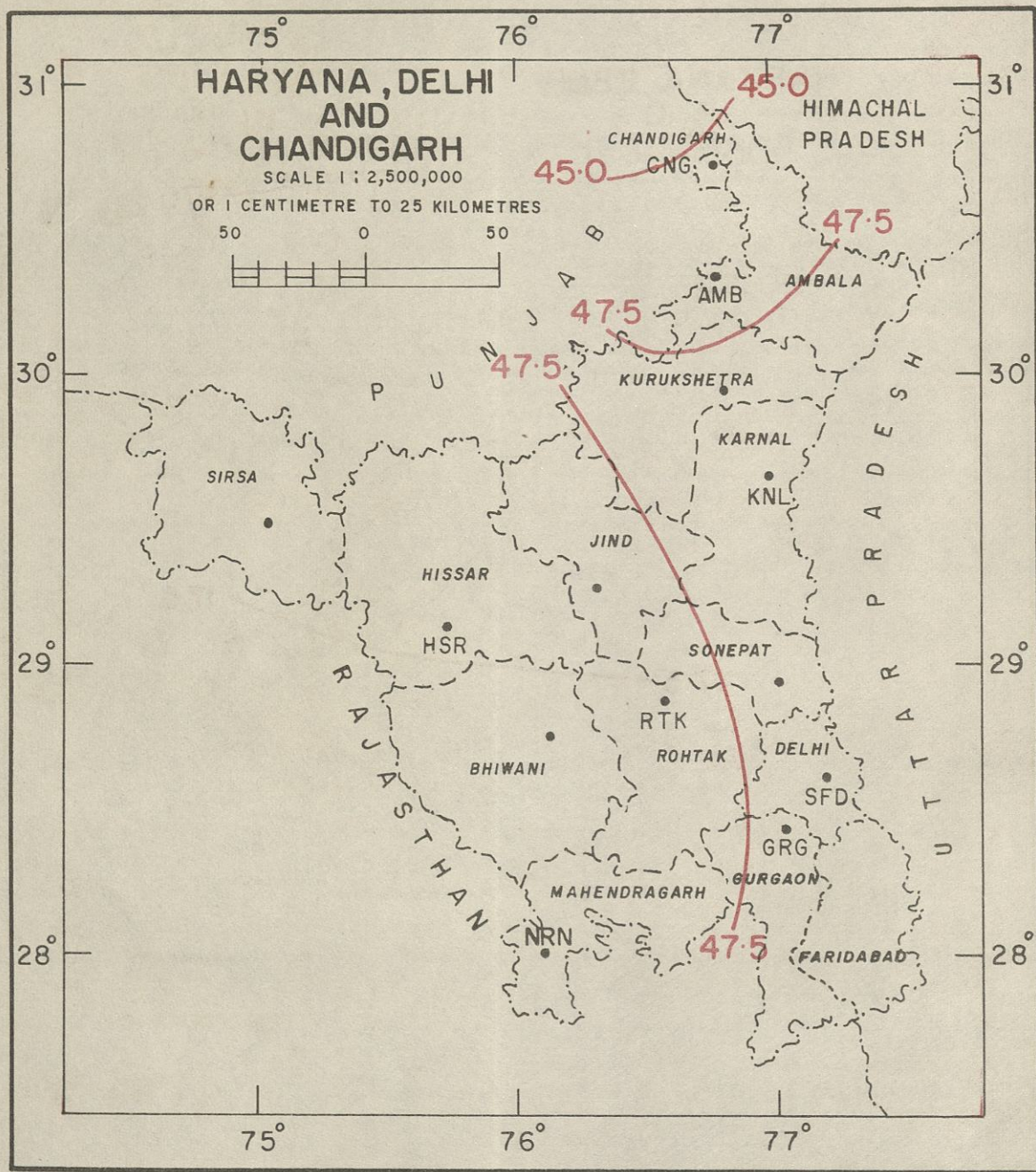


FIG. 4: HIGHEST MAXIMUM TEMPERATURE ($^{\circ}\text{C}$)
 EVER RECORDED.

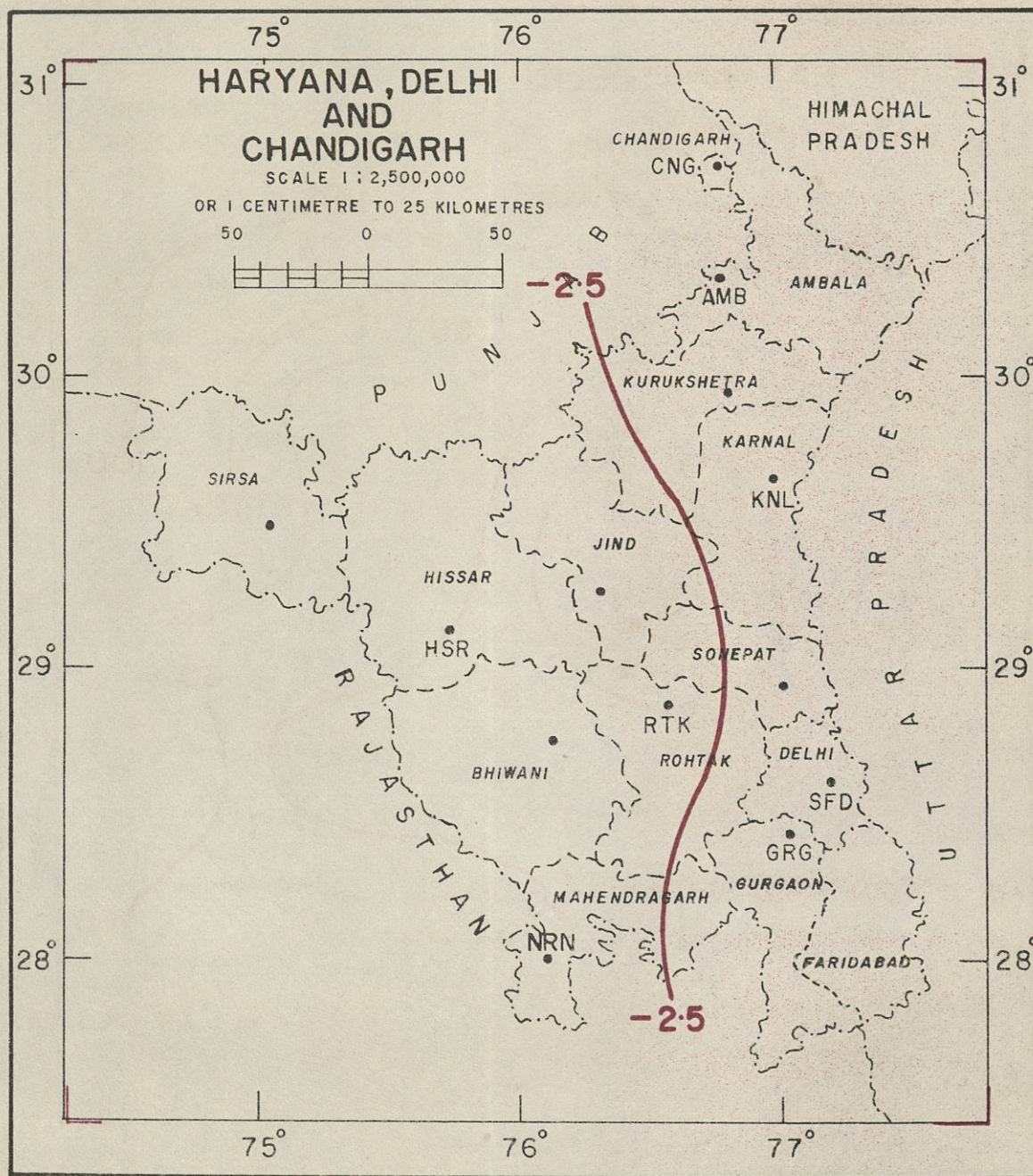


FIG. 5 : LOWEST MINIMUM TEMPERATURE (°C) EVER RECORDED.

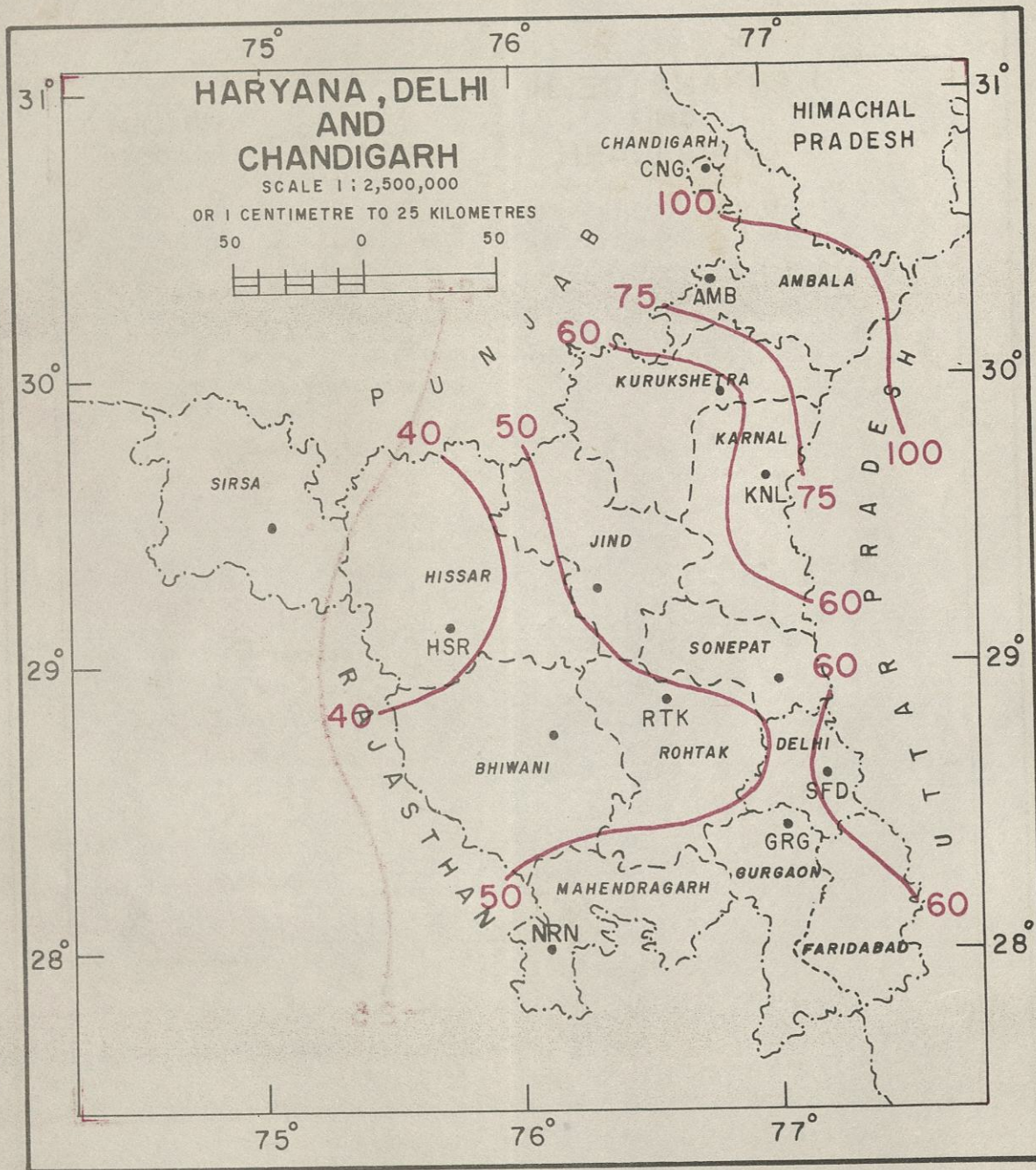


FIG. 6. RAINFALL (cm) ANNUAL.

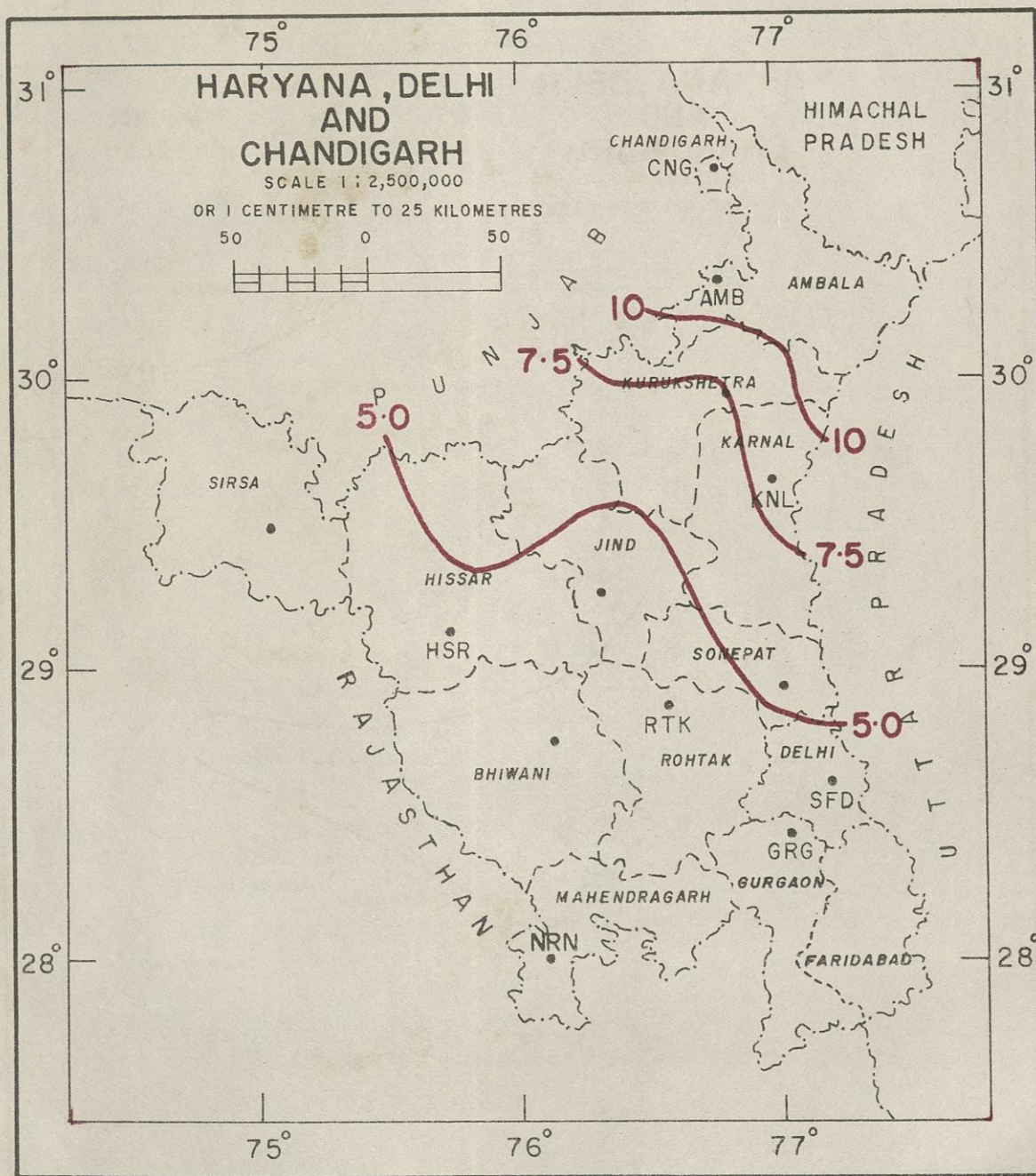


FIG. 6(a) : RAINFALL (cm) NOV—MARCH.

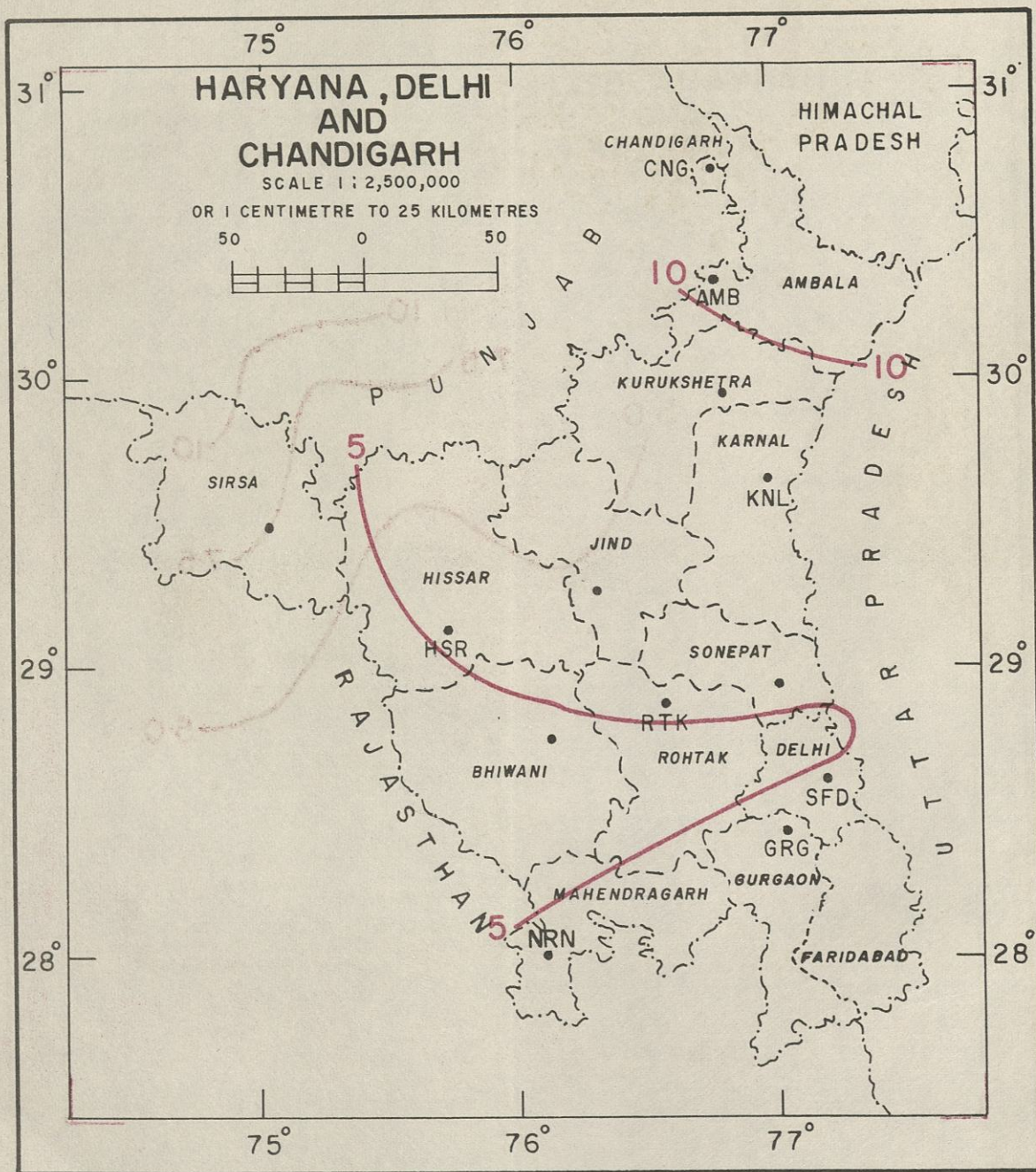


FIG. 6(b) : RAINFALL (cm) APRIL—JUNE.

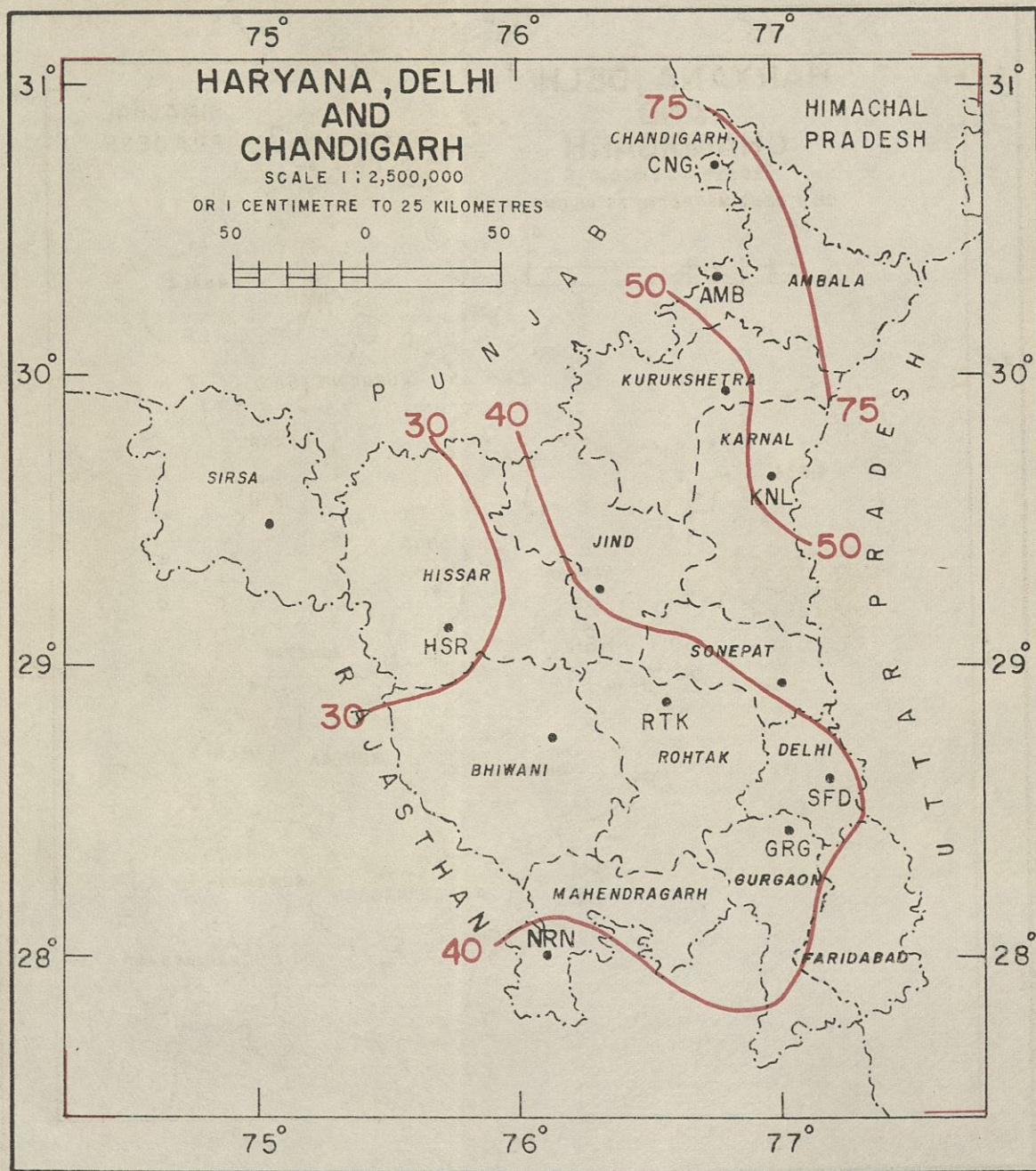


FIG. 6(c): RAINFALL (cm) JULY - SEPTEMBER.

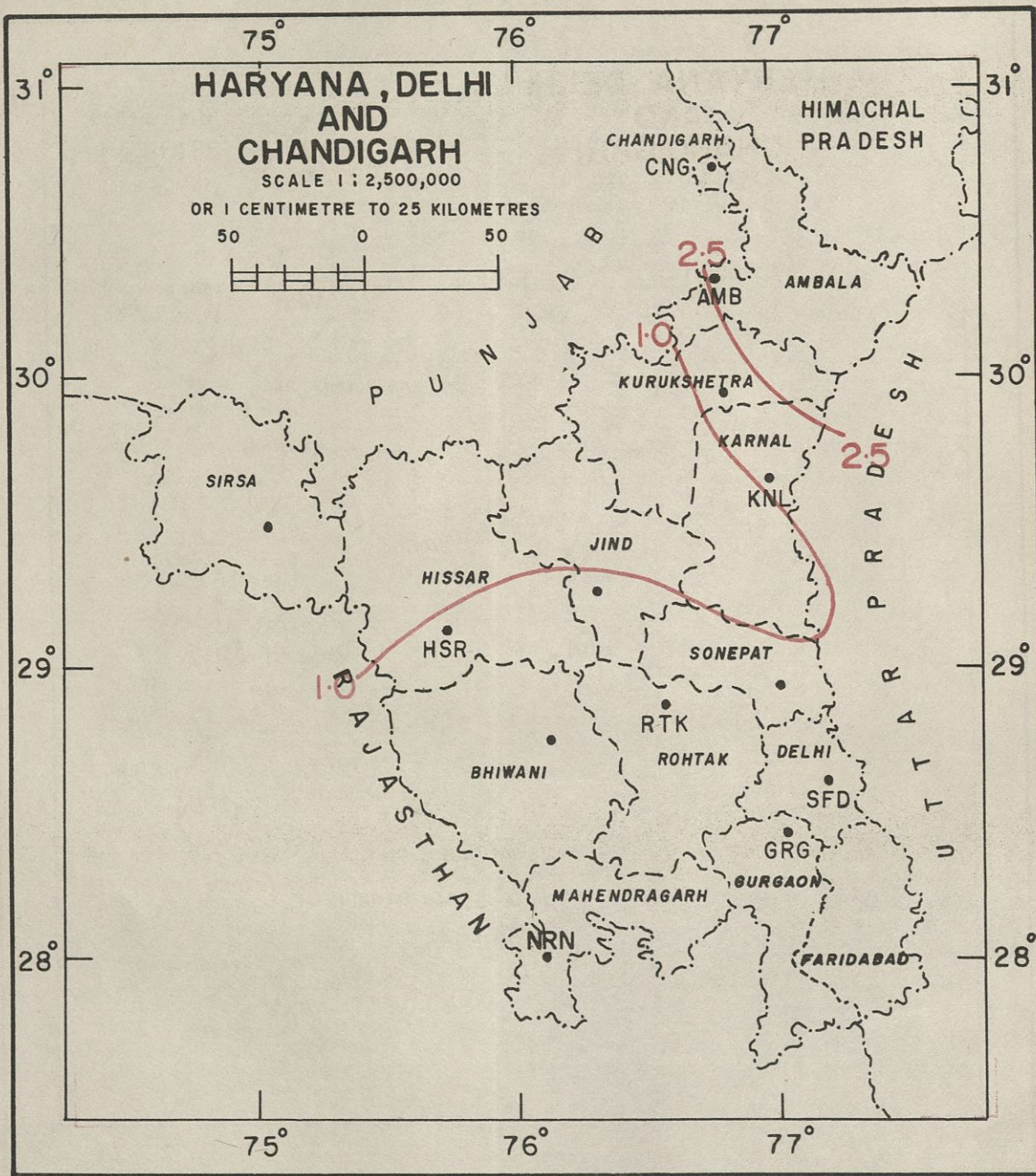


FIG. 6 (d): RAINFALL (cm) OCTOBER.

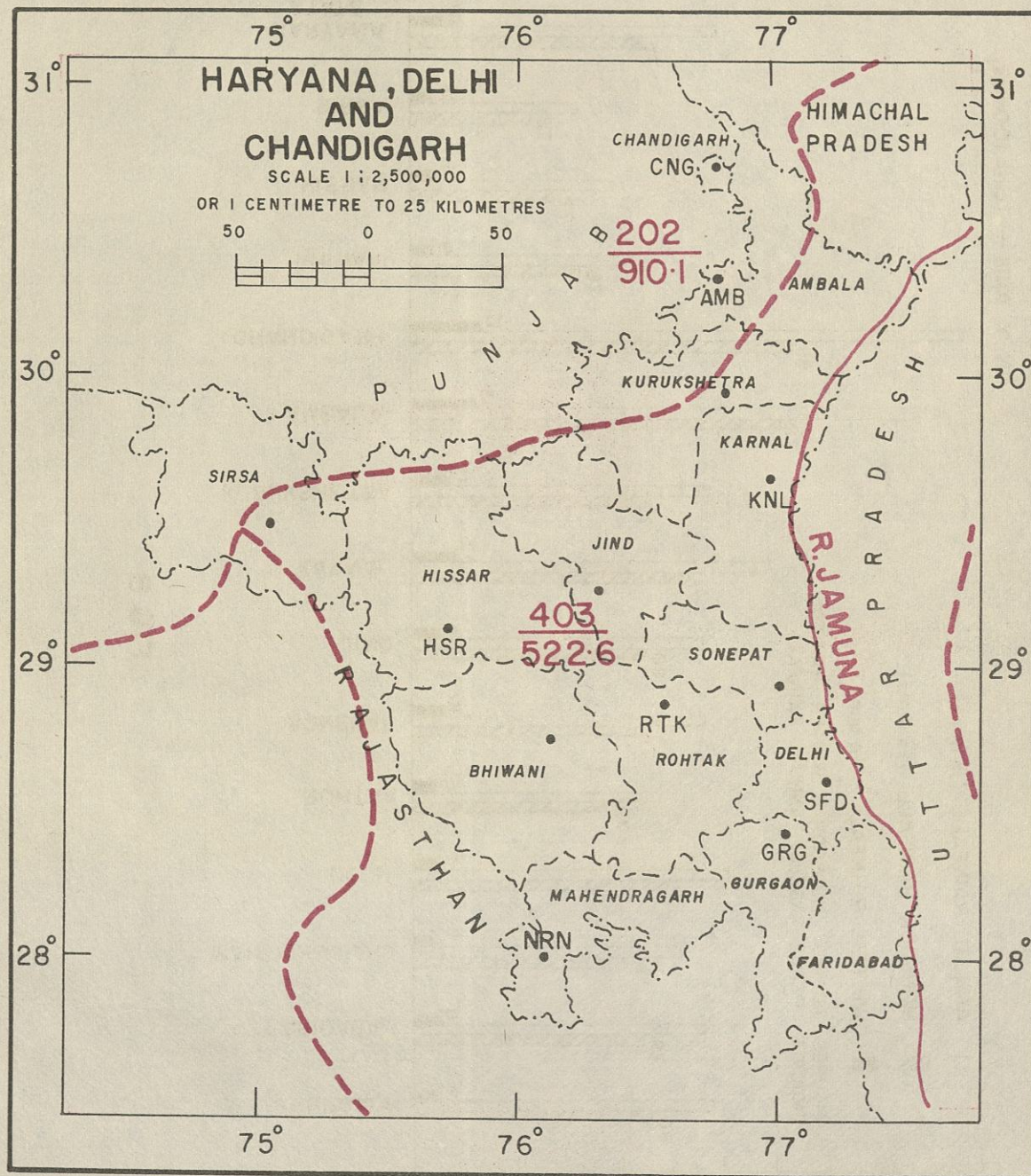


FIG.7: CATCHMENT AREAS(202,403) IN HARYANA WITH ANNUAL RAINFALL IN MMS.

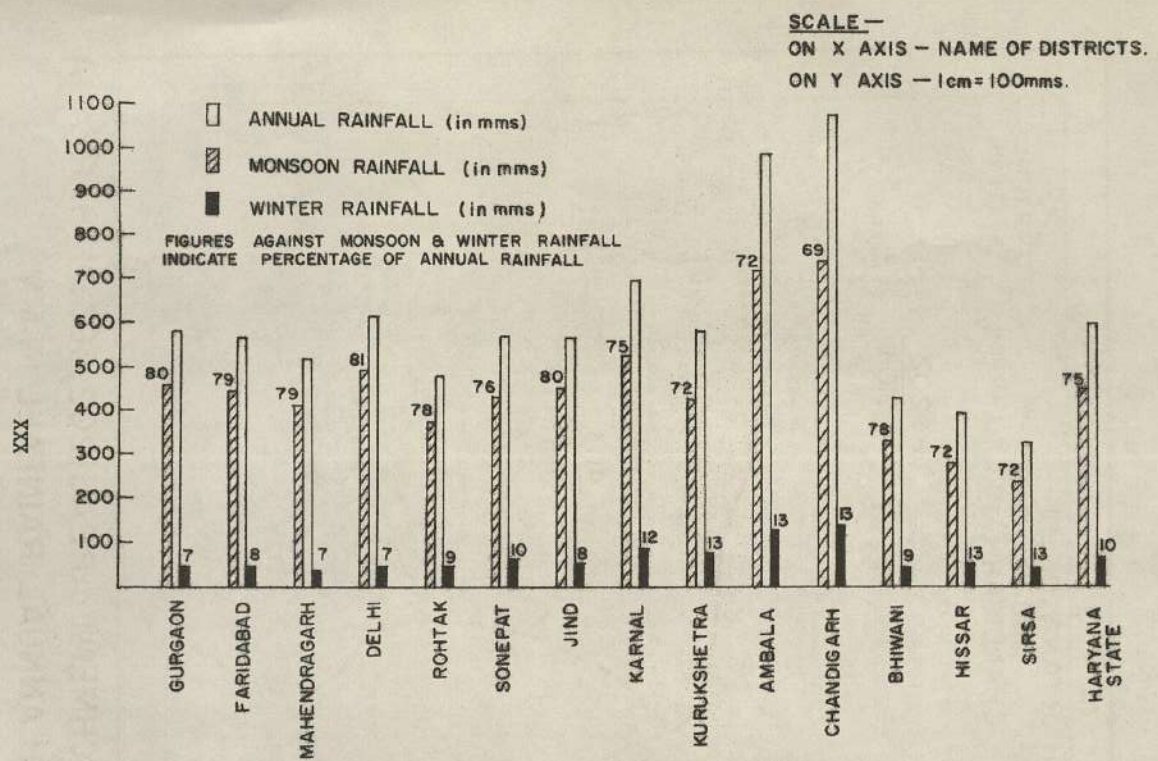


FIG. 8

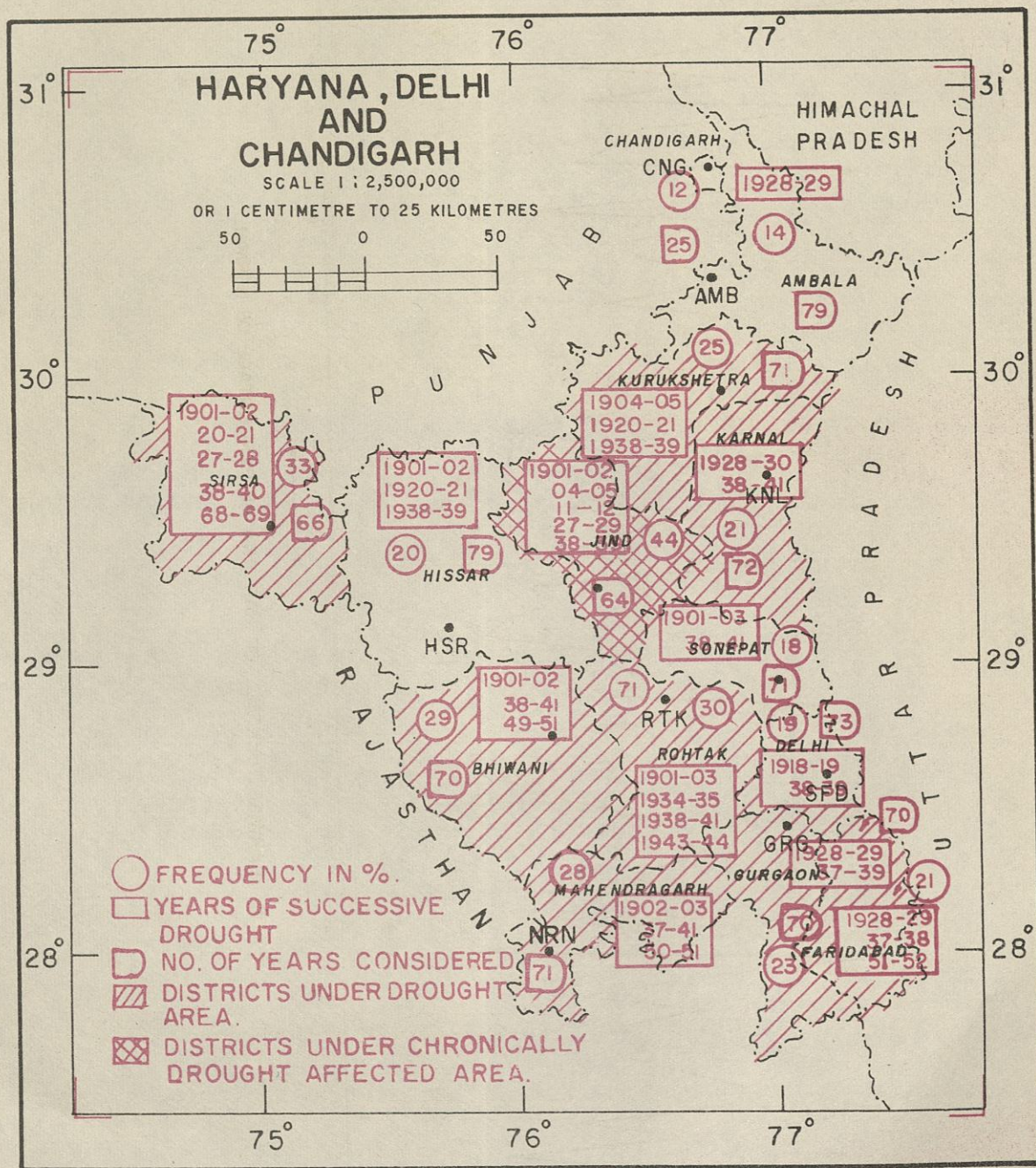


FIG.-9:- DROUGHT AFFECTED AREA.

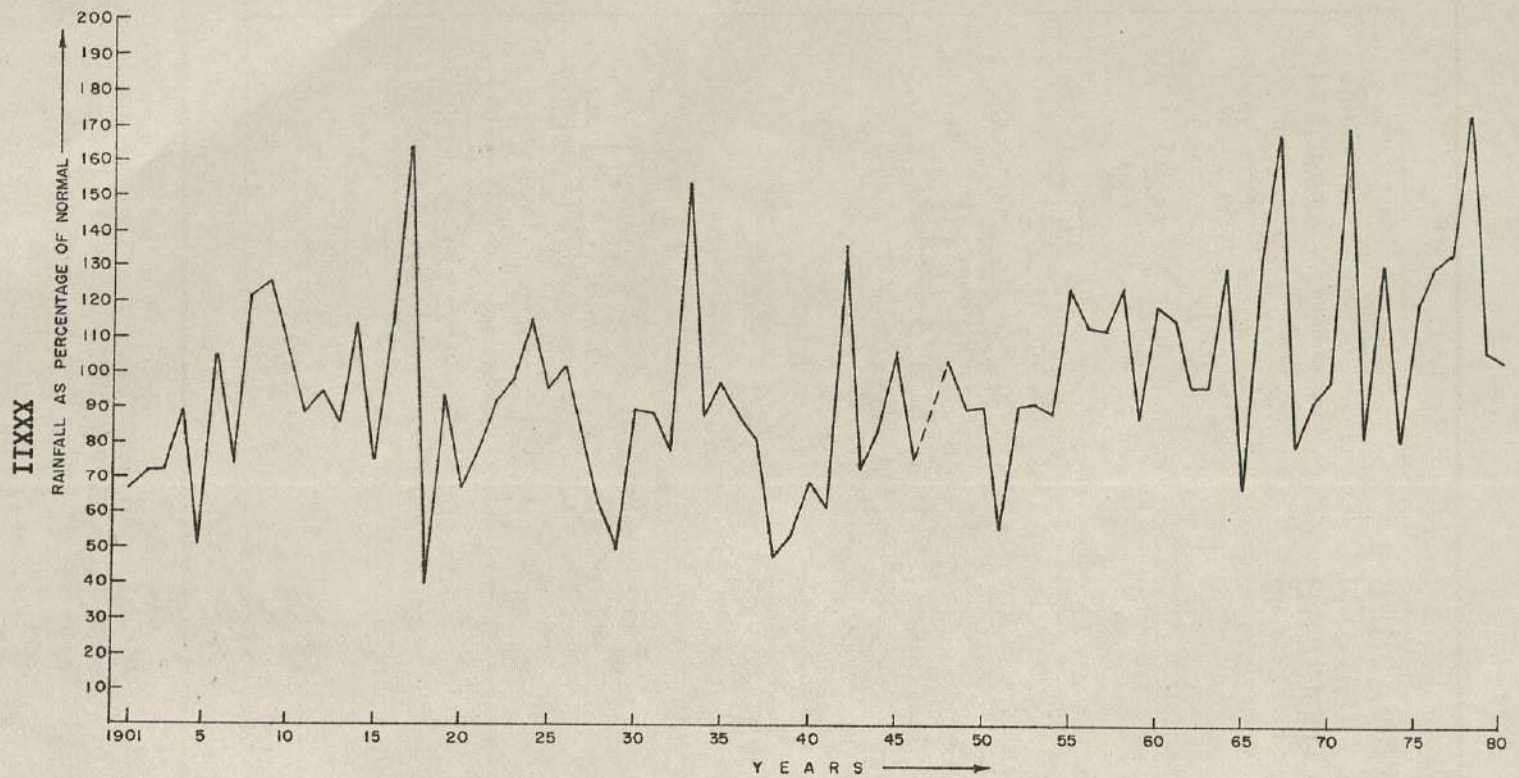


FIG.10: YEARWISE RAINFALL OF HARYANA AS PERCENTAGE OF NORMAL.

HARYANA STATE (Including Delhi & Chandigarh)

Introduction:

The State 'Haryana' which roughly lies in the area bounded by 27°39', 31°N latitudes and 74°31', 77°30'E longitudes forms the eastern part of the table land between the Sutlej and the Jamuna to the south of the former river and to the north of Rajasthan desert. The state has the Jamuna on its eastern border and on the north Himachal Pradesh, while it adjoins Rajasthan desert on the south and southwest and Punjab on the northwest. There are three main physical divisions in the state namely, the Himalayan submontane areas which stretches from the Jamuna to the Salt Range, the arid South-western plains and the western portion of the Indo-Gangetic Plain that constitutes the central portion of the state. The whole of Haryana consists of a vast alluvial plain except in the northeast region which falls under Himalayan submontane region. There is no other mountain system of importance in the state but a few unimportant outliers of the Aravalli system pass across Gurgaon District in the extreme southeast and terminate in the Ridge at Delhi.

The slope of the low country is to the south and southwest, and is very gradual. The Jamuna, the only river of the state, which ultimately drains into the Bay of Bengal, rises in Tehri district of Uttar Pradesh, and forms its junction with the Tons at the eastern extremity of Sirmur district of Himachal Pradesh forms the boundary between Haryana and Uttar Pradesh for a distance of over 320 kilometres.

The most important perennial irrigation canal in Haryana is the Western Jamuna Canal which originates from the west bank of the Jamuna and irrigates almost all the districts of Haryana. The head of the canal is at Rajawala (30°17'N and 77°37'E) in Ambala district.

The state is practically free from maritime influence. orographic features and absence of maritime influence affect to a large extent the climate of the state. Front piece gives the orographic feature of Haryana. The state as a whole experiences an extreme type of climate.

The state consists of the following districts:-

1. Ambala
2. Gurgaon
3. Hissar
4. Karnal
5. Mahendragarh
6. Rohtak
7. Kurukshetra
8. Sonipat
9. Sirsa
10. Bhiwani
11. Jind
12. Faridabad

While describing the climate of the state as a whole, union territories of Delhi and Chandigarh will be taken to be included in the state for the sake of convenience of description of the same.

I. Climate:

Areas in the state under each climatic pattern based on Koeppen's classification are shown in Figure 1. The districts Karnal, Ambala and a portion of Kurukshetra district lying between Karnal and Ambala and Chandigarh fall under the climatic type Cwa: Sub-tropical monsoon, Mild winter, dry winter, hot summer. Only Sirsa district has got climatic type Bwh: Tropical desert, Arid, hot and Hissar district has a climatic type varying between Bwh and Bsh (Tropical Steppe, Semi-arid, hot). The rest of the state belongs to the climatic type Bsh.

The year may be divided into four seasons. The winter season from November to March is followed by summer season from April to June. The period from July to middle of September constitutes the southwest monsoon season and the period from the latter half of September to October forms the post monsoon period.

Winter prevails over the entire state during the period from November to March and is generally very unpleasant due to biting cold. In this season a series of western disturbances affect the climate of the state. In the summer months from April to June weather is very dry and uncomfortable. Due to lower temperature the plateau regions are however,

comparatively less uncomfortable in summer. Weather tends to be humid during July to September due to rise in moisture content of the atmosphere. These monsoon months are fairly comfortable due to reduced day temperature, although humidity continues to be high in comparison with the other months.

II. Atmospheric 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 and a minimum in the southwest monsoon season. The pressure gradient over the state generally remains weak. During the winter season, the higher pressure is to the north or northwest. In April, the pressure is maximum towards west or northwest and it decreases east or southeastwards. Accordingly the winds, which are mainly variable in January become westerly to northwesterly. With the advance of summer, a low pressure area develops over the state and winds over the state become southwesterly to southeasterly. In July, the pressure decreases mainly from south to north over the state and the winds become easterly to southeasterly. October is the month of transition, with the weakest pressure gradient. From October onwards the change over of the pressure and wind pattern to the winter pattern commences.

III. Temperature:

Table 2 gives the mean daily maximum and minimum temperatures. Figure 2 (a,b,c,d) and 3(a,b,c,d) show the distribution of mean maximum and mean minimum temperatures respectively for selected months. Figures 4 and 5 give the extremes of temperatures ever recorded based on data upto 1981 except for few stations.

Day temperatures are more or less uniform over the plains except during winter and monsoon when the temperatures increase southwards and northwestwards respectively. In general, the night minimum temperatures are lower in higher latitude even during the southwest monsoon months, when the influence of monsoon current in the state is practically negligible. Both day and night temperatures are lower over the plateau and at high level stations than over the plains.

May is the hottest month with the mean daily maximum temperature of 41°C in the plains, the plateau regions and elevated places recording 2° to 5°C lower. The period from the second half of June to July is the most favourable one for temperatures to rise 8° or more above normal.

The highest temperature recorded at an individual station in the plains is 48.4°C at Hissar Observatory, on 19th June, 1981 which is about 6.8°C higher than the normal of the warmest month.

January is the coldest month when the mean minimum temperature for the state as a whole is 6.6°C , varying from 5°C in the west to 7°C in east and also from 7.5°C in the south to 6°C in the north. During winter, much lower temperatures may be experienced in the wake of western disturbances. On such occasions minimum temperatures may drop below the freezing point at few stations of western parts of the state. The number of occasions when the temperature over the state fall 8° or more below normal are very few.

The lowest temperature on record at an individual plain station was (minus) -3.9°C at Hissar Observatory on 31st January, 1929 and this is about 9.4°C lower than the normal of the coldest month. Both the maximum and minimum temperatures rise rapidly from February onwards till May. The increase in maximum temperature in the period from January to May ranges from 17°C to 20°C at individual stations as we proceed from south to north of the state. From the beginning of June to the end of July the maximum temperature falls by only 4.0°C to 5.5°C whereas the minimum temperature falls only by about $3-4^{\circ}\text{C}$ from June to September. In September a slight rise in maximum temperature is experienced due to increased insolation. The night temperature starts falling rapidly after September while the day temperature follows this trend after October and both attain lowest values by January. The fall in minimum temperature and maximum temperature is about 19.5°C to 22.0°C and 18.5°C to 20.0°C respectively during these periods. In both cases, the fall has a tendency to increase from eastern parts of the state to the western parts.

IV. Humidity:

Table 3 gives the mean relative humidity at 0830 and 1730 hours Indian Standard Time for the individual stations and the whole of the state. The relative humidity is generally high during the period from July

to September. It is about 42% in June rising to 72% during August, the western parts of the state being less humid than the eastern parts. Among the winter months December to February, the month of January is the most humid (63%). The diurnal variation of relative humidity is least during monsoon season. The relative humidity is lowest during summer afternoons when it becomes about 25 to 33%. The diurnal variation of relative humidity is highest during the winter period.

V. Cloudiness:

The period October to December is cloudless or lightly clouded. During the period January to March, 2 to 3 Oktas of sky remains covered with clouds. In April and May, 1.5 Oktas of sky is covered with clouds. During the monsoon season (July to September) skies are more clouded specially during July and August, when 4.5 Oktas of sky is covered with clouds. On an average in each of these two months, the sky remains overcast for 6 days per month and clear on 4 days per month. During November clouding becomes minimum over the entire state. Clouding generally decreases from south to north and from east to west over the whole of the state and it is more in the afternoon than in the forenoon.

Table 4 and 4(a) give the mean monthly total cloud amount and mean number of days with clear and overcast skies at 0830 and 1730 hours Indian Standard Time respectively.

VI. Rainfall:

Table 5 gives the district-wise and subdivisional mean monthly and annual rainfall and number of rainy days. Figure 6 and 6(a) to 6(d) show the annual and seasonal distribution of rainfall.

The total annual rainfall in the state is 30 cm over the extreme western parts adjacent to Rajasthan and varies from 56 cm on the extreme south to 108 cm over the extreme north along the eastern border of the state.

The northernmost districts of Ambala and Chandigarh constitute the area of maximum rainfall in the state and the western most district Sirsa receives minimum amount of rainfall. In the central portion of the state

annual rainfall varies from 40 cm to 48 cm. The districts adjacent to Rajasthan are much more dry than those adjacent to Uttar Pradesh. The state as a whole receives a total annual rainfall of 59.3 cm. Annual rainfall over Sirsa district and Chandigarh are 32.5 cm to 107.4 cm respectively and these represent lowest and highest district rainfall.

The southwest monsoon extends over the entire state by the last week of June. July and August are the rainiest months, each accounting individually to about 30 percent of annual rainfall. In each of these months there are 5 to 11 rainy days (with daily rainfall of atleast 2.5 mm) for the state.

The withdrawal of the southwest monsoon begins from the state in the middle of September and by the 3rd week of September monsoon withdraws from the entire state.

During winter (November to March) Haryana receives 6.0 cm of rainfall which although small in amount, is of great significance for agriculture. The winter rainfall occurs in association with western disturbances which move from west to east across the state.

Table 6 gives the monthly and annual rainfall for two river catchments in the state and these catchments (Nos 202 & 403) together with their annual rainfall are shown in Fig. 7.

VII. Rainfall Variability:

Co-efficient of variation of annual rainfall is 30 to 40 percent over the entire state, the co-efficient of variation of eastern portion of the state being less than that of the western portion. The coefficient of variation of monsoon rainfall over the state follows more or less the same pattern as that of annual rainfall in the summer, coefficient of variation is less than 80 over the extreme northern parts whereas over the other parts of the state it is between 100 and 80. In winter, coefficient of variation is more than 80 over the districts adjacent to Rajasthan and it is between 60 and 80 elsewhere in the state. In the post monsoon season the coefficient of variation is extremely high.

Fig. 8 shows the annual, southwest monsoon and post-monsoon

rainfall of the districts as well as the state and provides a measure for comparison of southwest monsoon and post monsoon rainfalls with annual rainfall both district and statewise.

VIII. Drought:

Drought:- Meteorologically drought over an area or place may be defined as a situation when annual rainfall over the area or place is less than 75 percent of the normal. It is classified as moderate drought if rainfall deficit is between 25 and 50 percent and 'severe drought' when it is more than 50 percent.

Areas where frequency of drought as defined above is 20 percent of the years examined are classified as 'Drought areas' and areas having drought conditions for more than 40 percent of the years under consideration represent 'Chronically drought affected areas'.

During the 80 year period from 1901 to 1980, drought conditions in Haryana are described below. Probabilities of occurrence of low rainfall, based on co-efficient of variation of rainfall described in the previous section, are also mentioned.

The number of years for which the districts became the victims of drought and also the total number of years whose rainfall data have been considered in this regard are shown below:

<u>Districts/Union Territories</u>		<u>No of years of drought</u>	<u>Total no. of years whose rainfall data are available</u>
1.	Hissar	16	79
2.	Rohtak	21	71
3.	Gurgaon	16	70
4.	Karnal	15	72
5.	Mahendragarh	20	71
6.	Jind	28	64
7.	Ambala	11	79
8.	Kurukshetra	18	71
9.	Sonapat	13	71
10.	Sirsa	22	66

11.	Bhiwani	20	70
12.	Faridabad	15	70
13.	Chandigarh	3	25
14.	Delhi	14	73

The districts Ambala, Sonipat and Chandigarh, Delhi experienced drought condition for less than 20 percent of the years under consideration and therefore, do not come under drought areas; while the districts Hissar, Karnal, Faridabad satisfy marginally the criterion for being classed as 'drought areas' and are marginal between 'drought areas' and 'non-drought areas'. Other districts may be termed drought areas. However, it is noticed that drought condition over eastern part of the state is not as severe as it is over the remaining part.

Occasions of occurrence of drought conditions in successive years, were very frequent in case of this state. Severity of drought not only depends upon the order of rainfall deficiency in a single year, but also upon continued occurrence of deficient rain in successive years, even though the deficiency in each such successive year may not be as high as in single year. The following table gives the years of successive drought as found from the available rainfall data during the 80 year period 1901 to 1980, and the districts in which it occurred.

Table (i)

<u>Year of Successive drought</u>	<u>Affected districts</u>
1901 - 02	Hissar, Jind, Sirsa, Bhiwani
1901 - 03	Rohtak, Sonipat
1901 - 05	Jind
1902 - 03	Mahendragarh, Jind
1904 - 05	Jind, Kurukshetra
1911 - 12	Jind
1918 - 19	Delhi
1920 - 21	Hissar, Kurukshetra, Sirsa
1921 - 22	Jind
1927 - 28	Sirsa, Jind
1927 - 29	Jind

1928 - 29	Gurgaon, Ambala, Faridabad, Jind
1928 - 30	Karnal
1934 - 35	Rohtak
1937 - 38	Faridabad
1937 - 39	Gurgaon
1937 - 41	Mahendragarh
1938 - 39	Hissar, Kurukshetra, Delhi, Jind
1938 - 40	Jind, Sirsa
1938 - 41	Rohtak, Karnal, Sonipat, Bhiwani
1943 - 44	Rohtak, Jind
1949 - 51	Bhiwani
1950 - 51	Mahendragarh
1951 - 52	Faridabad
1968 - 69	Sirsa

Figure 9 shows percentage frequency of drought, years of successive drought, number of years of data considered in districts/union territories and also the districts/union territories under 'drought area' or 'chronically drought affected area'. It also indicates the severity of drought in those districts/union territories. It is seen from Fig. 9 that severity of drought is less in the eastern part of the state. There is no district in the state which comes under 'chronically drought affected area'. Further rainfall of less than 50 percent of the annual normal representating severe drought conditions occurred in various districts as indicated in the following table, where the actual rainfall expressed as percentage of the normal rainfall is given in brackets against each district.

Table (ii) Severe Drought

Year	Districts/Union Territories affected (with percentage)
1901	Bhiwani (49), Sirsa (41), Jind (42)
1902	Jind (40), Sirsa (45)
1904	Jind (45)
1905	Rohtak (30), Mahendragarh (33), Delhi (47), Jind (45)
1907	Delhi (47)
1915	Sirsa (47)
1918	Rohtak (38), Gurgaon (33), Karnal (45), Mahendragarh

	(25), Jind (47), Ambala (44), Sonipat (43), Bhiwani (43), Faridabad (26).
1920	Hissar (45), Sirsa (34)
1921	Mahendragarh (45)
1927	Jind (19)
1928	Gurgaon (47), Jind (22)
1929	Rohtak (49), Jind (28), Sonipat (48), Bhiwani (48), Faridabad (46)
1938	Hissar (28), Rohtak (32), Mahendragarh (38), Jind (39), Kurukshetra (49), Sonipat (42), Faridabad (47)
1939	Rohtak (31), Karnal (42), Mahendragarh (39), Jind (33) Sonipat (43), Sirsa (46)
1941	Mahendragarh (37)
1949	Bhiwani (47)
1951	Mahendragarh (48), Bhiwani (47), Delhi (44)
1959	Delhi (46)
1968	Hissar (37), Sirsa (43)
1972	Kurukshetra (48)

It can be seen that the lowest district rainfall as expressed as percentage of the annual normal was only 19 in Jind district in 1927.

1905, 1929, 1939, 1938, 1918, were the years of widespread drought when the number of districts experiencing rainfall less than 75% of the annual normal was 11 to 13 out of 14 districts of the state. In the year 1918, almost the whole state was affected by drought condition. Chandigarh has never been affected by severe drought so far.

Severe drought conditions occurred in the whole of the state twice during the period 1901 to 1980 and hence the probability of its occurrence is negligible. The same for any kind of drought conditions in the state is about 20 percent.

During the period 1901 to 1980, there was no drought in the state in the 30 years namely, 1906, 1909, 1910, 1914, 1916, 1917, 1923, 1925, 1931, 1933, 1942, 1945, 1947, 1955, 1956, 1957, 1958, 1960, 1961, 1964, 1966, 1967, 1970, 1971, 1973, 1975, 1976, 1977, 1978, 1980.

In the 15 years namely, 1908, 1912, 1913, 1919, 1922, 1924, 1926,

1930, 1934, 1935, 1948, 1949, 1953, 1954, 1979 only one district experienced the drought condition. It is interesting to note that during the above period, Ambala is the only district which has fallen in the grip of drought in two consecutive years only once. From what has been stated, it is seen that the whole state is more or less drought-prone in the meteorological sense.

B. Excessive Rainfall:

It may generally be said that rainfall, sufficiently in excess of the normal, is a predominant factor for occurrence of floods, particularly in high rainfall region. Even with co-efficient of variation of rainfall of 20 percent or less, these regions are prone to frequent floods. For the purpose of the present description, annual rainfall of 125% or more of the normal is considered as excessive rain.

The following table (iii) gives the district wise excessive rainfall years, the highest annual rainfall with the year of occurrence and the same expressed as percentage of normal.

Table (iii)

District/Union Territory	Years of Excessive Rainfall	Highest amount of rainfall (expressed as % of normal) with year.
Hissar	1908, 1909, 1910, 1914, 1917, 1923, 1926, 1933, 1942, 1945, 1955, 1960, 1966, 1967, 1976, 1977, 1978, 1979.	100.0 cm in 1917 (252%)
Rohtak	1906, 1908, 1909, 1914, 1916, 1917, 1933, 1942, 1945, 1948, 1949, 1957, 1958, 1976, 1977.	90.9 cm in 1917 (192%)
Gurgaon	1908, 1910, 1912, 1917, 1924, 1926, 1933, 1942, 1948, 1958, 1964, 1977.	106.7 cm in 1917 (185%)
Karnal	1908, 1914, 1917, 1924, 1925, 1933, 1935, 1942, 1955, 1956, 1958, 1961,	103.0 cm in 1933 (148%)

1964, 1967, 1976.

Mahendragarh	1908, 1917, 1924, 1933, 1957, 1960, 1976.	101.2 cm in 1917 (215%)
Jind	1909, 1917, 1933, 1935, 1942, 1945, 1960, 1964, 1977.	88.9 cm in 1942 (157%)
Ambala	1906, 1917, 1932, 1933, 1942, 1950, 1955, 1959, 1961, 1964, 1973.	164.6 cm in 1942 (167%)
Kurukshetra	1909, 1914, 1917, 1933, 1937, 1942, 1950, 1955, 1956, 1958, 1976.	108.4 cm in 1942 (186%)
Sonipat	1908, 1909, 1914, 1917, 1924, 1933, 1942, 1958, 1960, 1961, 1964, 1976, 1977.	106.0 cm in 1964 (187%)
Sirsa	1908, 1909, 1913, 1914, 1917, 1923, 1926, 1933, 1934, 1935, 1945, 1953, 1955, 1956, 1958, 1962, 1976, 1977.	106.5 cm in 1917 (327%)
Bhiwani	1904, 1908, 1911, 1916, 1917, 1933, 1942, 1957, 1960, 1964, 1976, 1977.	87.3 cm in 1917 (205%)
Faridabad	1904, 1906, 1908, 1910, 1914, 1916, 1917, 1919, 1924, 1933, 1942, 1944, 1948, 1949, 1955, 1958, 1964, 1970, 1977.	104.8 cm in 1917 (186%)
Chandigarh	1955, 1967, 1971, 1973, 1978.	171.8 cm in 1971 (160%)
Delhi	1908, 1909, 1912, 1914, 1917, 1923, 1933, 1934, 1942, 1956, 1957, 1958, 1961, 1964, 1967, 1971, 1972, 1975, 1976, 1977, 1978.	153.4 cm in 1933 (251%)

From the above table it may be seen that during the period

under consideration, the districts of the state recorded excessive rainfall in 46 years, the maximum amount being 327 percent of the normal annual rainfall in the year 1917 for the district Sirsa. Delhi, Faridabad, Sirsa, Hissar, Rohtak had 21, 19, 18, 18, 16 years of such rainfall respectively. Other districts had 7-15 years of such rainfall. If we consider all the districts, each having full years data, then we find that in 1917 the state registered maximum rainfall i.e. 164% of its normal annual rainfall. Successive years of excessive rainfall are shown against each district/Union territory.

**Districts/Union
Territories**

1. Hissar	: 1908, 1909, 1910, 1966, 1967, 1976, 1978, 1979.
2. Rohtak	: 1908, 1909, 1916, 1917, 1948, 1949, 1957, 1958, 1976, 1977.
3. Gurgaon	: Nil
4. Karnal	: 1924, 1925, 1955, 1956
5. Mahendragarh	: Nil
6. Jind	: Nil
7. Ambala	: 1932, 1933
8. Kurukshetra	: Nil
9. Sonipat	: 1908, 1909, 1960, 1961, 1976, 1977
10. Sirsa	: 1908, 1909, 1913, 1914, 1933, 1934, 1935, 1955, 1956, 1976, 1977
11. Bhiwani	: 1916, 1917, 1976, 1977
12. Faridabad	: 1916, 1917, 1948, 1949

13. Chandigarh : Nil
14. Delhi : 1908, 1909, 1933, 1934, 1956, 1957, 1958, 1971, 1972, 1975, 1976, 1977, 1978.

None of the districts Gurgaon, Mahendragarh, Jind, Kurukshetra, Chandigarh experienced two consecutive years of excessive rainfall. Each of the districts Hissar, Sirsa and Delhi experienced excessive rainfall in 3 consecutive years only once and the district Hissar and Delhi experienced the same in 4 consecutive years only once. The heaviest one day rainfall on record at any station in the state was 508.0 mm at Ballabgarh (Faridabad district) on 1st February, 1933.

2. While noting the vagaries of rainfall over the state, it is seen that in the period 1944-80, the state as a whole experienced drought conditions only twice whereas in the period 1901-43 it experienced the same 13 times. It is thus seen that the number of occasions of drought declined considerably during the period 1944-80. The Fig. 10 shows yearwise rainfall of the state as percentage of the normal.

The probability of occurrence of heavy rain of 125% or more of the normal over the state is about 18 percent i.e. 9 times in the 50 years in the long run.

IX. Cyclonic Storms and Depressions:

1. The cyclonic storms and depressions which affect India originate and/or intensify over the Bay of Bengal, mostly during May to November or December. Some of them originating over the Arabian sea also affect Konkan, Gujarat, Saurashtra and Kutch and northwest India during the above period. They usually travel west northwest and cross the coast. In general, storms and depressions weaken on entering land. Hence, the state situated far inland, does not experience the full fury of the severe storms or depressions like the coastal regions. During their course of movement the disturbances sometimes turn or recurve towards north or northeast. This point of turning progressively shifts westwards till September. For example, the disturbances in May recurve while still out in the Bay of Bengal. As such, exceptionally few of them which cross the coast and

travel inland weaken far away from the state and cannot affect it.

During the period 1877 to 1970, only one such storm originating over the Arabian Sea affected Haryana in 1902. The disturbances during the period from June to September form over the head bay of Bengal and travelling westwards move across the state of Madhya Pradesh. During this period sometimes they move west or northwestwards as far as Rajasthan and recurve north northeastwards under the influence of deep westerly system moving slowly across West Pakistan and northwest India. With the further advance of the year, the bay storms and depressions progressively take southerly course.

2. The track of the bay cyclones is still more southerly in October and November and these have no influence on Haryana weather. During the period 1891 to 1970, only two storms, one in 1892 and the other in 1956, originating over Arabian sea affected the weather of Haryana. The Bay cyclonic storm or depression which reach the state generally become weak considerably due to long land travel. Maximum number of storms and depressions affect the state in the months of August/September.

The table 7 gives the total number of depressions or storms which affected the state during 80 years period ending 1970.

Other Weather Phenomena:

Thunderstorms and Dust storms:

Convective activity is essential for the occurrence of thunderstorms and dust-storms. With the advance of summer thunder activity becomes pronounced due to ground-heating. When moisture is insufficient in the atmosphere, dry thunderstorms or dust-storms occur. The maximum number of thunderstorms occur, with the approach of the monsoon current, while dust-storms are mainly confined to the summer month of April to June. Premonsoon and monsoon thunderstorms are sometimes severe and accompanied by hail. Squall is uncommon in the state except in extreme southeastern portion. The average number of days of thunderstorms during monsoon varies from 6.3 in the south to 0.4 in the north, the maximum being in July. The average annual number of thunderstorms varies from 41 in the south to 7 in the north. In the winter months, the state experiences, thunderstorms sometimes accompanied by hail in association with western disturbances. Thunder activity is minimum in the months November and December.

Fog:

Hill fog is not generally observed during the rainy months of July to September. Conditions like light to calm wind, clear skies etc which favour the occurrence of radiation fog, exist after the withdrawal of the monsoon till February. But due to lack of sufficient moisture, fog occurs only occasionally, the frequency of occurrence may vary from 3 in January over southernmost part to 0.3 in January over northern part of the state.

TABLE - 1
Mean Wind Speed (Kmph) and Predominant Wind Direction

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ambala	a	5.5	6.7	7.3	7.2	8.0	8.6	7.1	5.4	4.9	4.4	4.7	4.9	6.2
	M	C/NW	NW	NW	NW	NW/C	SE	SE	SE	C/SE	C/SE	C/NW	C/NW	
	E	NW	NW	NW	NW	NW	NW	SE	SE	NW	NW	NW	NW	
Hissar	a	5.5	6.4	7.3	7.4	8.5	10.1	9.6	7.9	6.9	5.6	4.5	4.9	7.0
	M	SW/W	SW/W	C	Var	Var	SW/W	Var	Var	SW/W	C/SW	SW/W	SW/W	
	E	NW/N	NW/N	NW/N	NW/W	NW/W	W/NW	Var	Var	Var	C/NW	C/NW	C/NW	
New Delhi (Safd)	a	8.4	10.1	10.8	10.9	12.9	14.6	10.3	9.1	8.6	6.3	6.7	7.6	9.8
	M	W	W	W	W	W	W	E/SE	W/NE	W	W	W	W	
	E	C/V	C/V	C/V	C/V	C/V	C/V	SE/S	Var	C/V	C/N	C/R	C/Var	
Karnal	a	- Not available -												
	M	C/W	C/W/NW	C/W/NW	C/NW	C/SE	C/W/NW	C/SE	C/SE/W	C/Var	C/Var	C/NW	C/W	
	E	C/N/NW	C/NW	C/NW	C/NW	C/NW	C/W/NW	C/SE	C/SE	C/NW	C/NW	C/NW	C/W	
Chandigarh		- Not available -												
Sub div. means.	a	6.5	7.7	8.5	8.5	9.8	11.1	9.0	7.5	7.1	5.3	5.3	5.8	7.7

a: Mean wind speed in kms per hour.

M: Predominant Wind direction in the morning.

E: Predominant Wind direction in the evening.

Var: Variable.

C: Calm. The next predominant direction is also indicated when calm is mentioned.

TABLE - 2

MEAN MAXIMUM AND MEAN MINIMUM TEMPERATURE (°C)

STATION		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Ambala	Max.	20.8	23.8	29.6	36.2	40.8	40.5	35.3	33.8	35.4	33.2	28.6	23.2	31.8
	Min.	6.8	8.5	14.1	19.7	24.9	27.3	26.0	25.4	23.9	16.4	10.2	7.1	17.5
Hissar	Max.	21.7	25.0	30.7	37.0	41.6	41.3	37.3	35.5	35.7	34.6	29.6	24.1	32.8
	Min.	5.5	8.1	13.3	19.0	24.6	27.7	27.3	26.1	23.9	17.4	9.8	6.0	17.4
N. Delhi (Safed)	Max.	21.3	23.6	30.2	36.2	40.5	39.9	35.3	33.7	34.1	33.1	28.7	23.4	31.7
	Min.	7.3	10.1	15.1	21.0	26.6	28.7	27.2	26.1	24.6	18.7	11.8	8.0	18.8
Karnal	Max.	20.2	24.0	29.4	35.7	39.7	39.6	34.9	32.9	33.3	31.5	27.2	22.8	30.9
	Min.	7.0	9.2	14.1	19.3	24.2	26.6	25.7	25.0	23.6	17.3	11.9	8.4	17.7
Chandi- garh	Max.	20.6	23.2	28.5	34.1	37.8	39.1	34.2	32.9	33.1	32.1	27.1	21.8	30.4
	Min.	6.1	9.3	14.3	19.6	23.5	26.5	25.0	24.2	22.4	17.6	11.2	7.3	17.3
Sub-Div. Means.	Max.	20.9	23.9	29.7	35.8	40.1	40.1	35.4	33.8	34.3	32.9	28.2	23.1	31.5
	Min.	6.5	9.0	14.2	19.7	24.8	27.4	26.2	25.4	23.7	17.5	11.0	7.4	17.7

TABLE - 3

Mean Relative Humidity (%)

Station		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ambala	M	79	73	61	41	36	49	78	82	80	68	68	78	66
	E	52	44	33	22	21	32	63	68	58	41	39	48	43
Hissar	M	75	70	59	46	41	52	71	76	72	61	61	72	63
	E	44	37	32	27	24	33	56	63	53	39	37	43	41
N. Delhi (Safed)	M	72	59	47	32	31	48	73	77	70	54	48	63	56
	E	41	28	21	16	18	32	60	65	54	35	31	38	37
Karnal	M	85	73	64	45	41	55	79	85	79	73	64	79	69
	E	51	38	33	21	19	34	62	71	61	46	41	47	44
Chandi- garh	M	70	63	50	38	35	50	75	81	76	57	58	67	60
	E	44	41	33	25	23	35	64	69	58	40	40	45	40
Sub-Div. Means.	M	76	68	56	40	37	51	75	80	75	63	60	72	63
	E	46	38	30	22	21	33	61	67	57	40	38	44	41

M : Morning.

E : Evening.

TABLE - 4
Mean Cloud Amount *(Okta of the Sky) and Mean Number of Days of Clear and Overcast Skies
at 0830 Hours IST
HARYANA (INCLUDING UNION TERRITORIES OF DELHI & CHANDIGARH)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ambala	a 15	15	17	19	22	17	5	4	14	26	24	18	16.3
	b 4	2	2	1	1	2	6	6	2	1	0	1	2.3
	c 2.6	2.4	2.1	1.6	1.4	2.1	4.5	4.5	2.6	0.7	0.7	1.5	2.2
Hissar	a 13	13	15	18	23	17	8	5	15	26	24	16	16.1
	b 2	1	1	0	0	1	2	2	1	0	0	1	0.9
	c 2.3	1.9	1.6	1.1	0.7	1.5	2.9	3.3	1.8	0.5	0.5	1.6	1.6
New Delhi (Safd)	a 11	11	13	16	20	12	3	2	9	22	22	13	12.8
	b 4	2	2	1	1	4	8	9	4	1	0	1	3.1
	c 3.0	2.5	2.2	1.5	1.2	2.6	5.2	5.4	3.1	0.9	0.8	2.1	2.5
Karnal	a 15	17	17	21	22	19	6	5	13	25	25	18	16.9
	b 6	3	4	1	1	4	11	12	5	2	0	3	4.3
	c 2.8	2.2	2.3	1.3	1.4	2.2	4.9	5.2	3.0	1.1	0.7	1.9	2.4
Chandigarh	a						NA						
	b						-NA						
	c 1.8	2.3	1.9	1.7	1.2	2.3	3.8	4.3	2.3	0.6	0.9	1.7	2.1
Sub Div.	a 14	14	16	19	22	16	5	4	13	25	24	16	16
Means.	b 4	2	2	1	1	3	7	7	3	1	0	1	3
	c 2.5	2.3	2.0	1.4	1.2	2.1	4.3	4.5	2.6	0.8	0.7	1.8	2.2

** 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.

- a Days with clear sky.
- b Days with sky overcast.
- c Mean cloud amount.

TABLE - 4(a)
Mean Cloud Amount ** (Okta of Sky) and Mean Number of Days of Clear and Overcast
Skies at 1730 Hous IST.
HARYANA (INCLUDING UNION TERRITORIES OF DELHI AND CHANDIGARH)

Stations		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ambala	a	14	14	17	17	21	17	7	3	14	26	24	17	15.9
	b	3	2	1	1	1	1	3	3	2	0	0	1	1.5
	c	2.6	2.4	2.1	1.8	1.6	2.1	3.8	3.9	2.4	0.7	0.7	2.0	2.2
Hissar	a	13	11	13	14	18	13	4	2	10	22	21	14	12.9
	b	1	1	1	1	1	1	1	2	1	0	0	0	0.8
	c	2.2	1.9	1.9	1.7	1.0	1.6	3.3	4.1	2.2	0.6	0.7	1.8	1.9
New Delhi (Safd)	a	10	10	11	11	13	7	1	1	5	18	19	12	9.8
	b	3	2	2	2	1	3	6	6	3	1	0	1	2.5
	c	2.7	2.6	2.7	2.3	1.8	2.8	5.3	5.5	3.1	1.0	1.0	2.3	2.8
Karnal	a	13	15	15	16	21	18	5	5	12	25	24	17	15.5
	b	7	2	4	1	1	2	9	10	6	2	1	3	4.0
	c	3.2	2.2	2.7	2.0	1.7	2.0	4.8	5.2	3.1	1.1	0.9	2.1	2.6
Chandi- garh	a	- Not available -												
	b	- Not available -												
	c	2.1	2.8	2.5	2.8	2.0	2.6	4.0	4.2	2.5	0.9	1.2	1.7	2.4
Sub-Div. Means.	a	13	13	14	15	18	14	4	3	10	23	22	15	14
	b	3	2	2	1	1	2	5	5	3	1	0	1	2
	c	2.6	2.4	2.4	2.1	1.6	2.2	4.2	4.6	2.7	0.9	0.9	2.0	2.4

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

a - Days with clear sky. b - Days with sky over cast. c - Mean cloud amount.

TABLE - 4(b)
Mean Number of Hours of Bright Sunshine per day.
HARYANA (INCLUDING UNION TERRITORIES OF DELHI AND CHANDIGARH)

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Hansi	7.6	8.6	8.1	9.2	8.3	6.1	6.6	7.3	7.2	9.1	9.2	7.9	7.6
New Delhi	7.7	8.9	8.3	9.4	9.7	7.5	6.5	6.4	7.6	9.1	9.3	8.3	8.2

TABLE - 5
Mean Rainfall (in mm) and Number of Rainy Days.
HARYANA (INCLUDING UNION TERRITORIES OF DELHI & CHANDIGARH).

DISTRICTS		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Hissar	a	15.9	13.2	11.3	6.8	11.0	34.1	110.1	109.7	64.1	11.1	2.9	6.3	396.5
	b	1.4	1.1	1.1	0.7	1.0	2.4	5.6	5.5	2.9	0.6	0.2	0.6	23.1
Rohtak	a	12.9	12.6	8.7	5.6	10.0	34.9	150.5	140.9	78.8	11.0	3.1	5.5	474.4
	b	1.1	1.0	0.8	0.6	0.8	2.1	6.6	6.4	3.3	0.6	0.2	0.4	23.9
Gurgaon	a	13.6	13.1	8.6	5.5	10.7	41.7	175.1	179.6	105.0	17.0	3.3	4.6	577.8
	b	1.2	1.2	0.8	0.5	0.9	2.5	7.8	8.0	4.1	0.7	0.2	0.4	28.3
Karnal	a	29.2	22.2	16.2	8.5	11.0	52.2	191.8	213.9	115.4	22.8	4.0	8.6	695.8
	b	2.2	1.8	1.4	0.7	1.1	2.9	8.3	8.4	4.3	1.0	0.3	0.8	33.2
Mohindergarh	a	11.4	9.6	6.3	4.3	12.1	38.9	149.9	178.0	82.9	17.2	2.9	4.8	518.3
	b	0.9	0.9	0.6	0.4	0.9	2.3	6.9	7.4	3.8	1.0	0.2	0.4	25.7
Jind	a	18.4	11.5	10.4	5.9	13.3	34.3	187.3	165.3	97.5	16.0	2.0	3.4	565.3
	b	1.7	0.9	1.0	0.7	1.2	1.9	6.8	6.6	3.8	0.9	0.1	0.3	25.9
Ambala	a	41.2	38.1	23.6	9.6	19.5	93.6	285.3	274.3	156.4	25.6	6.5	14.3	988.0
	b	2.8	2.6	1.9	1.0	1.6	4.3	11.0	10.9	5.4	1.1	0.4	1.1	44.1
Kurukshetra	a	25.4	22.1	15.9	9.6	10.0	52.5	158.7	157.7	103.3	15.3	2.8	8.5	581.8
	b	2.0	1.8	1.4	0.8	0.9	2.8	7.6	7.3	4.1	0.7	0.3	0.8	30.5
Sonapat	a	21.3	15.7	12.0	7.2	11.8	42.7	168.7	161.9	99.1	16.4	3.1	7.1	567.0
	b	1.8	1.4	1.1	0.7	1.1	2.7	7.5	7.5	4.1	0.9	0.2	0.7	29.7
Sirsa	a	12.9	10.9	9.1	4.7	8.7	28.8	90.8	85.8	56.7	8.8	2.3	5.8	325.3
	b	1.3	0.9	0.9	0.5	0.8	2.0	4.8	4.6	2.5	0.5	0.2	0.6	19.6
Bhiwani	a	17.3	9.7	6.5	3.1	8.5	30.7	128.5	133.8	68.1	12.1	4.0	2.8	425.1
	b	1.1	0.9	0.7	0.4	0.8	2.0	5.7	5.9	3.0	0.6	0.3	0.3	21.7
Faridabad	a	14.5	12.1	9.4	6.0	8.3	41.9	174.8	160.3	110.4	19.3	2.2	5.1	564.3
	b	1.1	1.1	0.7	0.5	0.8	2.4	7.5	7.7	4.2	0.7	0.2	0.4	27.3
Chandigarh	a	38.6	40.1	30.3	10.2	26.3	127.9	283.4	296.3	158.6	32.6	8.2	21.2	1073.6
	b	2.9	2.6	2.5	0.9	1.9	5.5	11.8	11.3	5.3	1.7	0.8	1.5	48.7
Delhi	a	14.5	13.2	9.9	5.5	9.2	38.8	191.6	197.4	105.3	19.3	2.8	4.3	611.8
	b	1.2	1.0	0.8	0.5	0.8	2.1	7.4	7.9	4.0	0.8	0.1	0.4	27.0
Sub-Div.	a	20.5	17.4	12.7	6.6	12.2	49.5	174.7	175.3	100.1	17.5	3.6	7.3	597.4
Means.	b	1.6	1.4	1.1	0.6	1.0	2.7	7.5	7.5	3.9	0.8	0.3	0.6	29.0

(a) Normal rainfall in mm. (b) Average number of rainy days (i.e. days with rain of 2.5 mm or more).

TABLE - 6
RAINFALL (IN MM) OVER PARTS OF DIFFERENT RIVER BASINS FALLING WITHIN HARYANA
STATE INCLUDING CHANDIGARH AND DELHI.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
(1) River Sutlej between Bharka Dam Site and the Beas excluding the Beas: Districts/Parts of districts within this catchment:- Haryana (including Chandigarh & Delhi) Kurukshetra, Ambala, Chandigarh.												
36.5	35.3	24.1	9.6	19.0	90.4	255.2	250.9	144.1	24.0	6.2	14.8	910.1
(2) River Yamuna upto its confluence with River Chambal (excluding Chambal): Districts/Parts of districts within this cathcment:- Haryana (including Chandigarh & Delhi) Hissar, Rohtak, Gurgaon, Karnal, Ambala, Jind, Delhi, Sirsa, Bhiwani, Sonipat, Faridabad, Mohindergarh.												
16.6	13.5	9.9	5.8	10.9	40.2	135.4	170.3	95.3	16.6	3.0	5.1	522.6

TABLE - 7
CYCLONIC STORMS/DEPRESSIONS AFFECTING HARYANA
(During 1891-1970)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
-	-	-	-	1	1	3	6	22	2	-	-	35

DISTRICTS

AMBALA DISTRICT

The climate of the district is characterised by a very hot and dry summer, southwest monsoon season and a bracing cold season. The year may be divided into four seasons. The period from about the middle of November to February is the cold season. This is followed by the summer season from March to about the end of June. The southwest monsoon season commences late in June and continues upto about the middle of September. The period from mid-September to the middle of November, constitutes the post monsoon or transition season.

RAINFALL

Records of rainfall in the district are available for seven stations for sufficiently long periods. The details of the 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 988.0 mm. About 82% of the annual normal rainfall in the district is received during the period June to September. About 10% of the normal rainfall is received in the cold season. The rainfall in the district generally increases from southwest to northeast and varies from 772.5 mm at Ambala to 1155.1 mm at Dadupur. The variation in the annual rainfall from year to year is appreciable. In the 80 year period, 1901-1980, the highest annual rainfall amounting to 167% of the normal occurred in 1942. The lowest annual rainfall which was 44% of the normal was received in 1918. In the same period the annual rainfall in the district was less than 80% of the normal in 18 years. Two consecutive years of such low rainfall occurred two times in this period and three consecutive years of such low rainfall occurred once in this period. It will be seen from table 2 that the annual rainfall in the district was between 701 and 1200 mm in 56 years out of 79.

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 number varies from 48 at Ambala to 49 at Dadupur.

The heaviest rainfall in 24 hours recorded at any station in the district was 444.5 mm at Dadupur on 1956 July 02.

TEMPERATURE

There is a meteorological observatory in the district at Ambala. The records of this observatory may be taken as representative of the climatic conditions in the district in general. From March, temperatures increase rapidly. May and June are the hottest months in the year with the mean daily maximum temperature at about 41°C and the mean daily minimum at about 25 to 27°C . The heat in the summer season is intense. Scorching dust-laden winds which are a fairly common feature in latter part of the summer season contribute much to the discomfort. An occasional dust or thunderstorm brings some relief. With the advance of the monsoon into the district by about the end of June, there is some drop in the day temperature but the nights still continue to be quite warm. The weather remains oppressive in between the rains due to the moisture in the air during the monsoon season. After the withdrawal of the monsoon by about mid-September there is a slight increase in the day temperature. However, the nights become progressively cooler. The decrease in the temperature is rapid from November. January is generally the coldest month with the mean daily maximum temperature at about 21°C and the mean daily minimum at about 7°C . During the winter season cold waves affect the district in the wake of passing western disturbance and the minimum temperature drops down occasionally to about a degree below the freezing of water. On such occasions frosts are likely in the district. The highest maximum temperature recorded at Ambala was 47.8°C on 1944 May 29 and 1923 June 17. The lowest minimum temperature at Ambala was -1.1°C on 1947 January 19.

HUMIDITY

Relative humidity is high, about 70% during the monsoon season. During the rest of the year the atmosphere is generally dry. The driest part of the year is the summer season when during afternoons relative humidity is lowest about 25%.

CLOUDINESS

The skies are generally moderately to heavily clouded and occasionally overcast during the monsoon season and for brief spells of a

day or two in association with the passing western disturbances during the cold season. The skies are mainly clear or lightly clouded during the rest of the year.

WINDS

Winds are generally light in the district. In the post monsoon and cold seasons winds are predominantly from the northwest. In March and April easterly to southeasterly winds also blow on some days. In the period May to September, easterlies and southeasterlies are predominant but on many days northwesterly winds blow in the afternoons.

SPECIAL WEATHER PHENOMENA

The district is scarcely affected by monsoon depressions. During the period January to March, western disturbances affect the district causing rain, often associated with thunder and gusty winds. Rain during the monsoon season is more often associated with thunder. Dust-storms occur occasionally in the hot season. Occasional fog occurs in the cold season.

Tables 3, 4 and 5 give the temperature and relative humidity, mean wind speed and special weather phenomena respectively for Ambala.

T A B L E - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL AS % OF NORMAL	RAINFALL &	in 24 HOURS *	
															YEARS **		Amount (mm)	Date
Ambala (obsy)	76 a b	37.8 2.7	41.4 2.7	27.1 2.0	12.2 1.2	19.2 1.6	72.1 4.0	250.7 10.3	228.4 9.7	151.2 5.1	25.8 1.1	6.2 0.4	15.3 1.3	887.4 42.1	231 (1933)	39 (1918)	228.9	1896 Aug 10
Jagadhari	65 a b	40.0 2.9	36.6 2.8	19.3 1.6	9.2 1.0	14.1 1.5	88.4 4.3	258.9 10.9	249.4 9.9	146.9 5.4	26.8 1.0	5.6 0.4	12.6 1.2	907.8 42.9	149 (1914)	34 (1918)	287.0	1908 Aug 02
Naraingarh	71 a b	45.6 3.1	41.5 2.7	21.7 2.0	10.4 1.0	20.5 1.8	108.0 4.9	310.7 12.0	312.5 12.2	172.8 5.9	28.4 1.1	5.6 0.4	18.2 1.2	1095.9 48.3	162 (1942)	52 (1965)	243.8	1886 Jul 13
Dadupur	69 a b	49.2 3.3	40.1 2.8	21.6 1.9	11.8 1.1	22.3 1.7	115.7 4.9	339.2 12.2	327.8 11.8	177.5 5.8	34.2 1.3	6.3 0.5	13.4 1.2	1155.1 48.5	174 (1946)	44 (1929)	444.5	1966 Jul 02
Kalka	22 a b	49.1 2.7	39.8 1.8	26.6 1.8	6.3 0.6	25.6 1.7	100.5 4.0	302.6 10.4	339.2 12.3	168.2 5.6	23.1 0.9	10.2 0.3	9.3 0.4	1100.5 42.5	142 (1961)	45 (1968)	211.0	1976 Jul 26
Ambala (Aero Obsy)	22 a b	31.5 2.2	28.2 2.4	27.0 2.0	6.6 0.9	18.3 1.2	99.5 4.4	319.8 11.4	279.8 11.0	145.0 5.1	18.1 1.1	6.1 0.5	17.1 1.2	997.0 43.4	147 (1964)	56 (1979)	233.8	1962 Sep 21
Ambala	70 a b	35.5 2.8	39.1 2.7	22.0 1.7	11.0 1.1	16.2 1.4	70.9 3.8	214.9 10.1	187.0 9.1	133.0 4.8	22.9 1.0	5.8 0.5	14.2 1.3	772.5 40.3	229 (1942)	38 (1918)	224.0	1924 Sep 30
Ambala (District)	a b	41.2 2.8	38.1 2.6	23.6 1.9	9.6 1.0	19.5 1.6	93.6 4.3	285.3 11.0	274.3 10.9	156.4 5.4	25.6 1.1	6.5 0.4	14.3 1.1	988.0 44.1	167 (1942)	44 (1918)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(A M B A L A)

Range in mm	No. of years	Range in mm	No. of years
401 - 500	1	1101 - 1200	10
501 - 600	2	1201 - 1300	7
601 - 700	6	1301 - 1400	5
701 - 800	12	1401 - 1500	1
801 - 900	15	1501 - 1600	-
901 - 1000	12	1601 - 1700	1
1001 - 1100	7		

(Data available only for 79 years)

TABLE - 3
Normals of Temperature and Relative Humidity
(A M B A L A)

MONTH	Mean Daily	Mean Daily	Highest Maximum		Lowest Minimum		Relative	
	Maximum	Minimum					Humidity	
	Temperature	Temperature	ever	recorded	ever	recorded	0830	1730*
	°C	°C	°C	Date	°C	Date	%	%
January	20.8	6.8	28.9	1946 Jan 31	-1.1	1947 Jan 19	79	52
February	23.8	8.5	33.9	1956 Feb 28	-0.6	1905 Feb 01	73	44
March	29.6	14.1	41.7	1945 Mar 31	3.7	1979 Mar 09	61	33
April	36.2	19.7	45.0	1941 Apr 28	10.0	1944 Apr 04	41	22
May	40.8	24.9	47.8	1944 May 29	14.4	1920 May 26	36	21
June	40.5	27.3	47.8	1923 Jun 17	18.6	1974 Jun 07	49	32
July	35.2	26.0	46.7	1903 Jul 10	19.4	1956 Jul 05	78	63
August	33.8	25.4	43.9	1918 Aug 07	20.0	1939 Aug 07	82	68
September	35.4	23.9	40.6	1951 Sep 06	15.6	1912 Sep 22	80	58
October	33.2	16.4	39.4	1941 Oct 06	8.3	1898 Oct 30	68	41
November	28.6	10.2	35.6	1947 Nov 14	2.8	1926 Nov 30	68	39
December	23.2	7.1	29.4	1944 Dec 05	-0.6	1913 Dec 27	78	48
Annual	31.8	17.5					66	43

* Hours IST

TABLE - 4
Mean Wind Speed in Km/hr.
(A M B A L A)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5.5	6.7	7.3	7.2	8.0	8.6	7.1	5.4	4.9	4.4	4.7	4.9	6.2

TABLE - 5
Special Weather Phenomena
(A M B A L A)

Mean No. of Days with *	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.4	0.4	0.5	0.6	1.6	1.2	0.2	0.4	0.6	0.2	0.2	0.4	7
Hail	0.0	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.6
Dust-storm	0.0	0.1	0.1	0.5	1.5	0.6	0.1	0.0	0.1	0.0	0.0	0.0	3
Squall	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1
Fog	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3

* No. of days two and above are given in whole numbers

GURGAON DISTRICT

The climate of this district is characterised by the dryness of the air except in the monsoon season, a hot summer and a cold winter. The year may be divided broadly into four seasons. The cold season starts late in November and continues upto the beginning of March. The summer season is from March to the end of June. The period from July to mid-September is the southwest monsoon season. Mid-September to the end of November constitutes the post monsoon or transition period.

RAINFALL

Records of rainfall in the district are available for 9 stations for sufficiently longer periods. The details of the rainfall at these stations and for the district as a whole are given in table 1 and 2. The normal annual rainfall in the district is 577.8 mm. The rainfall in the district increases from the west towards the east. The rainfall varies from 445.9 mm at Farukhnagar to 771.8 mm at Gurgaon (obsy). About 80% of the annual rainfall in the district is received during the southwest monsoon months July to September, July and August being the rainiest months. There is some rainfall in the premonsoon months June, mostly in the form of thundershowers. The variation in the annual rainfall from year to year is appreciable. In the 80 year period, 1901-1980, the highest annual rainfall which was 185% of the normal occurred in 1917, while the very next year the annual rainfall was the lowest in the 80 years, amounting to only 33% of the normal. In this eighty year period the annual rainfall in the district was less than 80% of the normal in 23 years. Two consecutive years of such low rainfall occurred three times in this period, five consecutive years of such low rainfall occurred once in this period. It will be seen from table 2 that the annual rainfall in the district was between 301 and 800 mm in 62 years out of 70.

On an average there are 28 rainy days, (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 22 at Pataudi to 35 at Farukhnagar and Gurgaon.

The heaviest rainfall in 24 hours recorded at any station in the district was 315.0 mm at Ferozepur on 1884 September 01.

TEMPERATURE

There is only one meteorological observatory in the district situated at Gurgaon. The records of the observatory at Gurgaon may be taken as representative of the conditions in the district. From about the beginning of March, temperatures begin to increase rapidly. May and June are the hottest months. The mean daily maximum temperature is about 40°C in May. While days are a little hotter in May than in June nights are warmer in June than in May. From April onwards hot dust-laden winds locally known as 'Luh' blow and the weather is unpleasant. Maximum temperatures may often go above 49°C. With the onset of the monsoon by about the end of June there is appreciable drop in the day temperature and the weather becomes cooler. But the nights are nearly as warm as during the latter part of the summer. After the withdrawal of the monsoon by about the mid-September the day temperatures are as in the monsoon months but the nights become progressively cooler. After October, there is a decrease in both the day and night temperatures, the decrease being more rapid after the middle of November. January is usually the coldest month. The mean daily maximum temperature in January is about 21°C and the mean daily minimum about 5°C. During the cold season the district is affected by cold waves in association with passing western disturbances and on such occasions the minimum temperature occasionally drops down to about the freezing point of water.

The highest maximum temperature recorded at Gurgaon was 49.0°C on 1966 May10. The lowest minimum was -4.7°C on 1972 December 30.

HUMIDITY

The air is generally dry during the greater part of the year. Humidity is high in the southwest monsoon season. April and May are the driest months when the relative humidities in the mornings are about 45% and in the afternoons less than 30%.

CLOUDINESS

In the southwest monsoon season and for brief spells of a day or

two in the cold season in association with passing western disturbances, heavily clouded and overcast skies generally prevail. During the rest of the year the skies are mostly clear or lightly clouded.

WINDS

Winds are generally very light in the district with some strengthening in force during the summer and monsoon seasons. During the monsoon season winds are mostly from the east or southeast. During the rest of the year the winds are predominantly from the west or northwest tending to be more northerly in the afternoons.

SPECIAL WEATHER PHENOMENA

July is the month with the highest incidences of dust-storms and thunderstorms, some of these being very violent while some of the thunderstorms are dry, others are accompanied by heavy showers and occasionally with hail. Thunderstorms also occur in the winter months in association with passing western disturbances.

Table 3, 4 and 5 give the temperature and humidity, mean wind speed and special weather phenomena respectively for Gurgaon.

TABLE - I
Normals and Extremes of Rainfall

Normals and Extremes of Rainfall															HIGHEST ANNUAL AS % OF NORMAL & YEARS **	LOWEST RAINFALL	HEAVIEST RAINFALL in 24 HOURS *	
STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	AS % OF NORMAL & YEARS **	Amount (mm)	Date	
Gurgaon (obsy)	15 a b	14.6 1.5	18.7 1.8	11.5 1.3	8.5 0.9	21.2 1.1	63.5 3.6	261.5 10.2	218.2 8.5	132.7 4.6	11.8 0.8	6.7 0.3	2.9 0.5	771.8 35.1	220 (1978)	82 (1972)	282.2 1968 Jul 14	
Farukhnagar	72 a b	11.0 1.0	9.2 0.9	8.2 0.7	2.9 0.3	8.6 0.7	35.2 2.2	137.3 6.6	137.3 6.4	82.4 3.4	7.4 0.5	2.5 0.2	3.9 0.3	445.9 23.2	228 (1917)	75 (1972)	242.6 1911 Sep 28	
Tauru	73 a b	12.4 1.0	13.2 1.0	9.4 0.9	4.2 0.4	9.8 0.7	40.1 2.3	158.8 6.9	172.5 7.6	86.8 3.8	12.1 0.6	2.3 0.2	4.4 0.4	526.0 25.8	207 (1917)	17 (1968)	215.9 1933 Sep 18	
Nuh	74 a b	15.0 1.3	13.1 1.4	10.8 0.9	6.0 0.6	13.7 1.2	48.6 2.9	190.9 8.9	177.5 8.6	104.7 4.3	20.5 0.7	2.7 0.3	6.0 0.6	609.5 31.7	183 (1917)	42 (1928)	223.5 1875 Sep 08	
Ferozepur	74 a b	14.4 1.3	11.8 1.2	9.4 0.8	7.0 0.7	12.1 1.2	48.2 3.1	179.5 9.2	211.1 10.0	120.7 5.2	22.7 1.0	3.4 0.2	5.4 0.5	647.5 34.4	236 (1917)	49 (1959)	315.0 1884 Sep 01	
Sohana	74 a b	13.8 1.0	13.2 0.9	8.9 0.7	4.7 0.4	6.6 0.7	42.7 2.1	167.4 7.0	167.1 7.5	97.1 3.6	17.4 0.7	2.4 0.1	4.1 0.4	545.0 25.1	196 (1933)	26 (1920)	246.4 1885 Aug 12	
Gurgaon	74 a b	20.8 1.9	16.4 1.5	12.0 1.1	9.7 1.0	15.0 1.4	49.5 3.3	201.0 9.3	186.1 9.0	123.8 5.1	19.1 0.9	3.3 0.3	6.0 0.7	662.7 35.5	187 (1977)	35 (1918)	269.2 1875 Sep 09	
Punahana	74 a b	9.4 0.8	10.5 0.9	5.5 0.5	3.3 0.3	7.0 0.5	30.2 1.8	135.4 6.2	172.9 7.7	107.3 3.7	17.6 0.4	3.0 0.1	4.6 0.4	506.7 23.3	226 (1933)	27 (1918)	241.3 1910 Oct 02	
Pataudi	24 a b	11.0 0.7	11.5 0.9	1.5 0.2	2.8 0.2	2.4 0.3	17.2 1.6	144.4 6.3	173.7 7.0	89.9 3.6	24.6 1.1	3.4 0.3	4.0 0.2	486.4 22.4	188 (1964)	52 (1951)	180.9 1958 Sep 28	
Gurgaon (District)	a b	13.6 1.2	13.1 1.2	8.6 0.8	5.5 0.5	10.7 0.9	41.7 2.5	175.1 7.8	179.6 8.0	105.0 4.1	17.0 0.7	3.3 0.2	4.6 0.4	577.8 28.3	185 (1917)	33 (1918)		

(a) Normal rainfall in mm.

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

* Based on data available upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(G U R G A O N)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	1	601 - 700	9
201 - 300	1	701 - 800	8
301 - 400	11	801 - 900	4
401 - 500	12	901 - 1000	1
501 - 600	22	1001-1100	1

(Data available only for 70 years)

TABLE - 3
Normals of Temperature and Relative Humidity
(G U R G A O N)

MONTH	Mean Daily Maximum Temperature °C	Mean Daily Minimum Temperature °C	Highest Maximum ever recorded °C	Lowest Minimum ever recorded °C	Relative Humidity 0830 1730* % %
			Date	Date	
January	21.4	5.1	27.4 1980 Jan 27	0.0 1971 Jan 11	75 48
February	23.5	7.5	33.0 1980 Feb 28	0.7 1974 Feb 21	69 42
March	29.8	12.4	38.3 1985 Mar 28	3.8 1979 Mar 09	60 35
April	37.1	19.1	44.6 1979 Apr 28	9.4 1976 Apr 02	45 25
May	40.0	23.7	49.0 1966 May 10	17.0 1977 May 01	43 28
June	39.5	26.7	46.3 1969 Jun 21	19.1 1982 Jun 04	56 39
July	35.0	26.1	44.0 1974 Jul 02	21.0 1985 Jul 10	77 66
August	33.3	25.1	38.6 1974 Aug 30	15.5 1978 Aug 11	82 71
September	34.3	22.8	41.0 1974 Sep 16	15.8 1984 Sep 30	72 58
October	33.8	17.6	38.0 1974 Oct 1,3	9.8 1974 Oct 31	59 40
November	28.9	10.7	38.4 1974 Nov 06	3.2 1978 Nov 28	64 43
December	23.4	6.1	29.6 1982 Dec 02	-4.7 1972 Dec 30	71 46
Annual	31.7	16.9			64 45

*Hours IST

TABLE - 4
Mean Wind Speed in Km/hr.
(G U R G A O N)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
3.7	4.5	5.5	5.8	6.7	7.6	6.3	3.9	4.3	3.6	3.2	3.2	4.3

TABLE - 5
Special Weather Phenomena
(G U R G A O N)

Mean No. of Days with *	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0	0.1	0	0	0	0	0.9	0	0.5	0	0	0	1.5
Hail	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	0.1
Squall	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0	0.3	0	0	0	0	0	0	0	0	0	0	0.3

*No. of days two and above are given in whole numbers.

HISSAR DISTRICT

The climate of this district is characterised by its dryness and extremes of temperature and scanty rainfall. The year may be divided into four seasons. The cold season from November to March is followed by the summer season which lasts upto the end of June. The period from July to about the middle of September is the southwest monsoon season. The latter half of September and October constitute the post monsoon or transitional period.

RAINFALL

Records of the rainfall in the district are available for six stations for sufficiently long periods. 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 396.5 mm. The rainfall in the district increases generally from the west towards the east and varies from 358.1 mm at Fatehabad to 459.4 mm at Hissar (obsy). About 72 percent of the annual normal rainfall in the district is received during the short southwest monsoon period, July to September, July and August being the rainiest months. There is significant amount of rainfall in the months of June, mostly in the form of thundershowers. In the rest of the year there is very little rainfall. The variation in the annual rainfall from year to year in the district is very large. In the eighty year period, 1901 to 1980, the highest annual rainfall which was 252% of the normal was recorded in 1917. The lowest annual rainfall amounting to only 28% of the normal was recorded in 1938. In the same eighty year period the annual rainfall in the district was less than 80% of the normal in 20 years and two consecutive years of such low rainfall occurred twice and four consecutive years occurred once.

It can be seen from table 2 that the annual rainfall in the district was between 201 to 500 mm in 58 years out of 79.

On an average there are 23 rainy days (i.e. days with rainfall of

2.5 mm or more in a year in a district). This number varies from 19 at Budhala to 27 at Hissar (obsy).

The heaviest rainfall in 24 hours recorded at any station in the district was 346.7 mm at Hissar (obsy) on 1926 August 16.

TEMPERATURE

There is a meteorological observatory in the district at Hissar and the records of this observatory may be taken as representative of the meteorological conditions prevailing in the district in general. There is rapid increase of temperature after February. The mean daily maximum temperature in May, which is the hottest month is 41.6°C . On individual days the maximum temperature during the summer season may rise upto about 47 or 48°C . The hot scorching winds, which blow in summer add to the discomfort. Afternoon thundershowers which occur on some days bring welcome relief, though only temporarily. With the advance of the monsoon into the district by about the end of June there is appreciable drop in the day temperature and the weather becomes cooler during the day time, but the nights are even warmer than those during the summer season. With the added moisture in the monsoon air, the nights are often uncomfortable. After the withdrawal of the monsoon from the district in the latter half of September the temperature begin to decrease. The decrease in temperature is rapid after October and the drop in temperature after nightfall is particularly trying. January is generally the coldest month with the mean daily maximum at 21.7°C and the mean daily minimum at 5.5°C . In the cold season the district is affected by cold waves in the wake of passing western disturbances and the minimum temperature drops down to about -3.0°C occasionally.

The highest maximum temperature recorded at Hissar was 48.4°C on 1981 June 19. The lowest minimum temperature was -3.9°C on 1929 January 31.

HUMIDITY

Relative humidity in the mornings is generally high during the monsoon season and during the period December to February, usually being

about 70 percent or more. Humidity is comparatively less during the rest of the year, the driest part of the year being the summer season with the relative humidity being about 30% in the afternoons.

CLOUDINESS

During the monsoon season the skies are mostly moderately to heavily clouded. In the rest of the year the skies are generally clear or lightly clouded. Cloudy skies prevail for brief spells of a day or two in association with passing western disturbances in the cold season.

WINDS

Winds are generally light in the district with some strengthening in force during the late summer and monsoon seasons. During the southwest monsoon season while the winds from the southwest or west are more common, easterlies and southeasterlies also blow on some days. In the post monsoon and winter season while southwesterly or westerly winds are more common in the mornings northerlies and northwesterlies are predominant in the afternoons. In the summer winds are more common from the west or southwest in the mornings. In the afternoons they are mostly from directions between west and northwest.

SPECIAL WEATHER PHENOMENA

Some of the depressions which originate in the Bay of Bengal in the southwest monsoon season and which move across the central parts of the country reach the district during the last stages of activity and cause widespread rain before dissipating. An occasional post monsoon storm or depression also affects the district. Thunderstorms occur throughout the year but the highest incidence is during the monsoon season. Dust storms occur often during the hot season. Occasional fogs affect the district in the cold season.

Tables 3, 4 and 5 give the temperature and humidity, mean wind speed and special weather phenomena respectively for Hissar.

TABLE - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL			
															ANNUAL	RAINFALL	in 24 HOURS *			
															AS % OF NORMAL & YEARS **	&	Amount	Date		
																		(mm)		
Hissar (obsy)	67 a	15.9	14.9	14.3	6.6	16.9	36.7	124.5	134.5	70.5	13.9	3.6	7.1	459.4	228	36	346.7	1926 Aug 16		
	b	1.4	1.3	1.4	0.8	1.3	3.0	6.5	6.4	3.4	0.8	0.3	0.7	27.3	(1917)	(1920)				
Fatehabad	74 a	17.2	11.9	10.3	5.4	11.4	29.7	100.8	90.9	60.5	11.4	2.3	6.3	358.1	212	20	157.5	1947 Sep 26		
	b	1.5	1.0	0.9	0.7	1.1	2.3	5.5	5.1	2.9	0.6	0.2	0.5	22.3	(1917)	(1938)				
Hissar	74 a	16.3	13.3	11.5	10.6	13.9	33.0	110.1	115.5	65.3	10.7	3.2	5.2	408.6	233	30	301.5	1926 Aug 16		
	b	1.5	1.2	1.2	0.7	1.2	2.6	5.8	6.0	3.1	0.6	0.2	0.6	24.7	(1917)	(1968)				
Hansi	74 a	13.7	11.7	8.0	7.3	8.7	39.7	113.9	108.5	66.9	13.3	3.7	5.7	401.1	278	27	228.6	1960 Aug 21		
	b	1.2	1.1	0.9	0.7	1.0	2.5	6.1	5.9	3.2	0.7	0.3	0.5	24.1	(1917)	(1938)				
Tohana	70 a	15.7	10.9	10.9	6.0	9.3	31.9	106.8	104.3	59.8	9.4	2.3	5.7	373.0	238	23	158.7	1953 Jul 11		
	b	1.3	0.8	1.0	0.6	0.8	2.0	4.9	5.0	2.4	0.4	0.2	0.4	19.8	(1977)	(1965)				
Budhala	49 a	16.3	16.3	12.6	5.1	5.7	33.9	104.7	104.7	61.9	7.8	2.2	7.6	378.8	297	30	203.2	1946 Aug 12		
	b	1.5	1.1	1.0	0.5	0.6	1.8	5.0	4.4	2.3	0.3	0.1	0.7	19.3	(1917)	(1938)				
Hissar (District)	a	15.9	13.2	11.3	6.8	11.0	34.1	110.1	109.7	64.1	11.1	2.9	6.3	396.5	252	28				
	b	1.4	1.1	1.1	0.7	1.0	2.4	5.6	5.5	2.9	0.6	0.2	0.6	23.1	(1917)	(1938)				

(a) Normal rainfall in mm.

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

** Years given in brackets.

* Based on all available data upto 1980.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(H I S S A R)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	3	601 - 700	7
201 - 300	14	701 - 800	2
301 - 400	25	801 - 900	-
401 - 500	19	901 - 1000	1
501 - 600	8		

(Data available for 79 Years)

TABLE - 3
Normals of Temperature and Relative Humidity
(H I S S A R)

MONTH	Mean Daily	Mean Daily	Highest Maximum		Lowest Minimum		Relative	
	Maximum	Minimum					Humidity	
	Temperature	Temperature	ever	recorded	ever	recorded	0830	1730*
	°C	°C	°C	Date	°C	Date	%	%
January	21.7	5.5	30.6	1952 Jan 24	-3.9	1929 Jan 31	75	44
February	25.0	8.1	34.9	1980 Feb 28	-2.2	1929 Feb 01	70	37
March	30.7	13.3	45.6	1945 Mar 31	2.8	1945 Mar 05	59	32
April	37.0	19.0	47.9	1958 Apr 27	8.3	1918 Apr 07	46	27
May	41.6	24.6	48.3	1944 May 30	14.4	1977 May 04	41	24
June	41.3	27.7	48.4	1981 Jun 19	17.8	1922 Jun 03	52	33
July	37.3	27.3	47.2	1947 Jul 13	20.4	1974 Jul 26	71	56
August	35.5	26.1	43.3	1918 Aug 02	21.0	1962 Aug 19	76	63
September	35.7	23.9	42.2	1938 Sep 16	15.6	1923 Sep 28	72	53
October	34.6	17.4	41.7	1951 Oct 02	8.3	1949 Oct 31	61	39
November	29.6	9.8	36.7	1943 Nov 04	2.5	1962 Nov 29	61	37
December	24.1	6.0	33.6	1960 Dec 17	-1.5	1973 Dec 29	72	43
Annual	32.8	17.4					63	41

*Hours I.S.T.

TABLE - 4
Mean Wind Speed in Km/hr.
(H I S S A R)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5.5	6.4	7.3	7.4	8.5	10.1	9.6	7.9	6.9	5.3	4.5	4.9	7.0

TABLE - 5
Special Weather Phenomena
(H I S S A R)

Mean No. of Days with *	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.9	1.3	2	1.8	4	5	5	4	3	0.4	0.3	0.8	28
Hail	0.3	0	0.1	0.2	0.1	0.1	0.2	0	0	0.1	0	0	1.0
Dust-storm	0.2	0	0.3	0.3	1.9	1.8	0.3	0.2	0.2	0	0	0	5
Squall	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0.6	0.4	0	0.3	0.2	0.3	0	0	0.1	0.1	0.1	0.7	3

*No. of days two and above are given in whole numbers.

KARNAL DISTRICT

The climate of this district is characterised by the extreme dryness of the air, with an intensely hot summer and a cold winter. It is only during the three monsoon months, July, August and September does moist air of oceanic origin penetrate into the district. The year may be divided into four seasons. The cold season from mid-November to about mid-March is followed by the hot season which continues to about the end of June. July to about mid-September is the southwest monsoon season. Mid-September to mid-November constitutes the transition period from the monsoon to winter conditions.

RAINFALL

Records of rainfall in the district are available for three stations for sufficiently long periods. The details of the 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 695.8 mm. The rainfall in the district generally increases from the southwest towards the northeast. About 82% of the normal annual rainfall in the district is received during the months June to September, August being the rainiest month. Some rain is also received during the cold season in association with passing western disturbances. The variation in the annual rainfall from year to year is large. In the 80 years period from 1901-1980, the highest annual rainfall amounting to 148% of the normal occurred in 1933 while the lowest rainfall which was only 42% of the normal occurred in 1939. In the same 80 years period, the annual rainfall in the district was less than 80 percent of the normal in 18 years, consecutive two, three and four years of such low rainfall occurring once each. It will be seen from table 2 that the annual rainfall in the district was between 401 and 800 mm in 50 years out of 72.

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 31 at Panipat to 35 at Karnal.

The heaviest rainfall in 24 hours recorded at any station in the district was 269.7 mm at Karnal on 1952 August 21.

TEMPERATURE

There is a meteorological observatory in the district at Karnal. The records of this observatory may be taken as representative of the meteorological conditions in the district in general. The cold season generally starts by about mid-November when temperatures begin to decrease rapidly. January is generally the coldest month with the mean daily maximum temperature at 20.2°C and the mean daily minimum at 7.0°C. In association with the passage eastwards of western disturbances in the cold season, cold waves affect the district and the minimum temperature sometimes goes down to about a degree or so below the freezing point of water. From about the middle of March temperatures begin to rise rapidly. May and June are the hottest months with the mean daily maximum temperature at about 40°C. From about April hot westerly winds, locally known as 'Luh' begin to blow and the weather progressively becomes intensely hot and trying. In May and June the maximum temperature may sometimes go above 45°C. With the advance of the southwest monsoon into the district towards the end of June there is appreciable drop in the day temperatures while night temperatures continue to be nearly as high as in summer. Even during the brief southwest monsoon season the weather is sultry and unpleasant due to the increased moisture in the monsoon air. After the withdrawal of the monsoon by about mid-September there is an increase in the day temperatures but night temperature drops down rapidly with the progress of the season.

The highest maximum temperature recorded at Karnal was 46.0°C on 1962 May 29. The lowest minimum was 0.0°C on 1964 January 31.

HUMIDITY

The air is generally dry over the district during the greater part of the year. During the monsoon season the humidity is high, generally

being between 60 and 85 percent. Humidity decreases in the post-monsoon season. April and May are usually the driest months, with relative humidities being about 20 percent or less in the afternoons.

CLOUDINESS

During the southwest monsoon season and particularly during July and August skies are heavily clouded or overcast. In the rest of the year skies are clear or lightly clouded generally. During the period January to early March skies become cloudy and often overcast in association with the passage of western disturbances-

WINDS

Winds are in general light over the district with some strengthening in force during the summer season. During the monsoon season, winds are mostly easterly or southeasterly. During the rest of the year winds are predominantly westerly or northwesterly.

SPECIAL WEATHER PHENOMENA

April to June is the period with the highest incidence of thunderstorms and dust-storms. Violent squalls (Andhis) often accompany such storms. Some of the thunderstorms do not give any appreciable rain, but others are often accompanied with heavy rain and occasional hail. Thunderstorms also occur in the winter months in association with passing western disturbances. Fogs sometimes dense occur in the cold season.

Tables 3, 4 and 5 give the temperature and relative humidity, mean wind speed and special weather phenomena respectively for Karnal.

T A B L E - I
Normals and Extremes of Rainfall

STATION	No of Years or DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL	RAINFALL	in 24 HOURS *	
															AS % OF NORMAL	&	Amount	Date
															YEARS **		(mm)	
Karnal (obsy)	32 a	29.0	19.9	20.5	7.3	9.6	45.4	186.3	244.5	116.2	30.4	3.5	8.5	721.1	160	53	250.0	1962 Sep 21
	b	2.1	1.5	1.6	0.5	1.1	2.8	8.0	9.0	4.1	1.3	0.3	0.7	33.3	(1956)	(1960)		
Panipat	74 a	23.4	19.2	12.1	8.0	11.0	51.5	177.9	185.5	108.7	70.6	3.7	7.9	626.5	190	32	254.0	1933 Sep 19
	b	1.9	1.7	1.2	0.7	1.0	2.8	8.0	7.7	4.3	0.8	0.2	0.8	31.1	(1958)	(1939)		
Karnal	74 a	35.1	27.6	16.1	10.3	12.4	59.6	211.2	211.8	121.2	20.3	4.8	9.5	739.9	163	47	269.7	1952 Aug 21
	b	2.4	2.2	1.5	1.0	1.2	3.2	8.9	8.4	4.4	1.0	0.4	0.9	35.5	(1935)	(1918)		
Karnal (District)	a	29.2	22.2	16.2	8.5	11.0	52.2	191.8	213.9	115.4	22.8	4.0	8.6	695.8	148	42		
	b	2.2	1.8	1.4	0.7	1.1	2.9	8.3	8.4	4.3	1.0	0.3	0.8	33.2	(1933)	(1939)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(K A R N A L)

Range in mm	No. of years	Range in mm	No. of years
201 - 300	1	701 - 800	20
301 - 400	3	801 - 900	5
401 - 500	8	901 - 1000	10
501 - 600	11	1001- 1100	3
601 - 700	11		

(Data available only for 72 years).

TABLE - 3
Normals of Temperature and Relative Humidity
(K A R N A L)

MONTH	Mean Daily Maximum Temperature °C	Mean Daily Minimum Temperature °C	Highest Maximum ever recorded °C Date	Lowest Minimum ever recorded °C Date	Relative Humidity	
					0830 %	1730* %
January	20.2	7.0	27.2 1952 Jan 24	0.0 1964 Jan 31	85	51
February	24.0	9.2	31.7 1960 Feb 16	1.0 1950 Feb 12	73	38
March	29.4	14.1	37.5 1977 Mar 26	7.0 1974 Mar 06	64	33
April	35.7	19.3	42.8 1952 Apr 25	11.2 1957 Apr 01	45	21
May	39.7	24.2	46.0 1962 May 29	16.8 1960 May 08	41	19
June	39.6	26.6	45.6 1958 Jun 17	18.0 1962 Jun 18	55	34
July	34.9	25.7	43.9 1959 Jul 05	19.0 1960 Jul 12	79	62
August	32.9	25.0	42.0 1962 Aug 05	18.4 1960 Aug 26	85	71
September	33.3	23.6	38.3 1951 Sep 06	6.7 1949 Sep 30	79	61
October	31.5	17.3	39.3 1957 Oct 02	11.1 1957 Oct 30	73	46
November	27.2	11.9	34.4 1953 Nov 04	4.5 1962 Nov 30	64	41
December	22.8	8.4	27.8 1959 Dec 15	0.1 1964 Dec 12	79	47
Annual	30.9	17.7			69	44

* HOURS IST

TABLE - 4
Mean Wind Speed in Km/hr.
(K A R N A L)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
3.4	4.3	4.2	3.7	4.8	4.0	2.6	2.1	2.7	2.3	2.7	2.0	3.2

TABLE - 5
Special Weather Phenomena
(K A R N A L)

Mean No. of Days with *	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	1.1	1.0	0.2	1.3	1.7	3.0	2.0	3.0	3.0	0.7	0.3	0.0	17.0
Hail	0.0	0.1	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.6
Dust-storm	0.0	0.5	0.5	0.6	3.0	1.8	0.2	0.1	0.0	0.0	0.0	0.0	7.0
Squall	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	0.2	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	1.6

* No. of days two and above are given in whole numbers.

MAHENDRAGARH DISTRICT

The climate, except during the monsoon, is characterised by the dryness of air, a hot summer and a cold winter. The year may be divided into four seasons viz. winter, summer, monsoon and post-monsoon or the transition period. The winter starts in November and continues upto March. The summer season is from April to June. The period from July to mid-September is the southwest monsoon season. Mid-September to the end of October constitutes the post monsoon or the transition period.

RAINFALL

Records of rainfall in the district are available for 7 stations for sufficiently long periods. The details of the rainfall at these stations and for the district as a whole are given in tables 1 and 2. The normal annual rainfall in the district is 518.3 mm. The rainfall in the district increases from west to east. About 79% of the annual rainfall in the district is received during the southwest monsoon months, July to September. July and August are the rainiest months. There is some rainfall in the premonsoon month June mostly in the form of thundershowers. The variation in the annual rainfall from year to year is appreciable. In the 80 year period 1901-1980, the highest annual rainfall which was 215% of the normal occurred in 1917 while in the next year 1918 the annual rainfall was the lowest in the 80 year period amounting to only 25% of the normal. The annual rainfall was less than 80% of the normal in 25 years. Two consecutive years of such low rainfall occurred three times in this 80 year period and five and three consecutive years of such low rainfall occurred once in this period. The annual rainfall in the district was between 301 and 700 mm in 56 years out of 71.

On an average there are 26 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 Rewari to 19 at Jatusana & Khol.

The heaviest rainfall in 24 hours recorded at any station in the district was 370.8 mm at Jatusana on 1885 August 12.

TEMPERATURE

There is one meteorological observatory in the district situated at Narnaul. Normals of meteorological elements have not been compiled for this station as records are not available for sufficient period. The account which follows is therefore based on the records of the observatories in the neighbouring districts where climatic conditions are similar to those in this district. From March temperatures begin to increase. May and June are the hottest months, when the mean daily maximum temperature is about 41°C and the mean daily minimum temperature is about 27°C . While days are a little hotter in May than in June, nights are warmer in June than in May. From April onwards hot scorching and dust laden winds blow and these add to discomfort. Maximum temperatures may often go above 46°C . With the onset of the monsoon by the end of June there is appreciable drop in day temperature but due to increased humidity and nights remaining as warm as during the latter part of the summer the weather remains uncomfortable. After the withdrawal of the monsoon by about mid-September till October end the days are as warm as in the monsoon months but the nights become progressively cooler. After October there is decrease in both the day and night temperatures, the decrease being more rapid after the middle of November. January is the coldest month. The mean daily minimum temperature is about $5-6^{\circ}\text{C}$ and the mean daily maximum temperature is about 22°C in January. During the cold season the district is affected by the cold waves in association with passing western disturbances and on such occasions the minimum temperature occasionally drops down to about the freezing point of water and frosts may occur.

HUMIDITY

The air is generally dry during the summer season when the humidity is of the order of 40% in the morning and 20% in the afternoon. Humidity is high during the monsoon season, about 75% in the morning and 60% in the afternoon. During winter humidity is about 60% in the morning and 40% in the afternoon.

WINDS

Winds are generally light in the district strengthening in force during the summer and monsoon seasons. Winds blow generally from the sector southwest-west-northwest, during mornings and from the north western quadrant during afternoons throughout the year and during July and August they also blow from east to southeast.

CLOUDINESS

In the southwest monsoon season and for brief spells of a day or two in the cold season in association with passing western disturbances heavily clouded or overcast skies generally prevail. During the rest of the year the skies are mostly clear or lightly clouded.

SPECIAL WEATHER PHENOMENA

The period from April to June is one with the highest incidence of dust-storms. Thunderstorms occur throughout the year and its incidence is maximum in August and minimum in November. Thunderstorms are sometimes accompanied by heavy showers, squall and occasionally with hail. Fog occurs during winter season. Dust-storms occur occasionally during summer.

TABLE - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL	RAINFALL	in 24 HOURS *	
															AS % OF NORMAL	&	Amount	Date
															YEARS **		(mm)	
Narnaul	21 a	9.9	6.6	3.2	6.5	17.8	47.1	155.7	222.2	89.3	24.9	2.7	5.4	591.3	156	56	253.6	1972 Aug 12
	b	1.0	0.7	0.4	0.7	1.3	2.5	6.8	8.5	4.8	1.3	0.2	0.5	28.7	(1976)	(1958)		
Mahendragarh	21 a	10.9	10.9	8.2	5.4	15.1	45.3	139.5	181.2	80.7	21.3	2.9	4.1	525.5	172	54	212.0	1960 Aug 20
	b	1.2	1.0	0.9	0.7	1.3	2.9	7.1	8.0	4.6	1.5	0.2	0.4	29.8	(1960)	(1959)		
Narnaul (obs'y)	13 a	17.0	11.3	7.1	6.3	15.5	48.7	222.1	194.1	68.4	21.0	2.6	10.9	625.0	141	71	237.4	1972 Aug 12
	b	1.0	1.0	0.6	0.6	1.1	3.2	10.2	7.5	2.7	1.2	0.3	0.9	30.3	(1967)	(1974)		
Jatusana	74 a	12.1	10.5	7.2	2.6	8.4	36.7	128.7	125.3	72.8	9.0	1.6	3.1	418.0	245	21	370.8	1885 Aug 12
	b	0.9	0.9	0.6	0.2	0.6	1.8	5.3	5.3	2.6	0.5	0.1	0.3	19.1	(1917)	(1941)		
Rewari	74 a	15.5	10.7	9.6	4.5	13.2	44.4	160.5	171.5	102.2	17.8	3.0	5.9	558.8	244	29	233.7	1885 Aug 13
	b	1.5	1.2	0.9	0.5	1.3	3.0	7.9	9.0	4.7	0.9	0.3	0.6	31.8	(1917)	(1918)		
Khol	71 a	9.8	9.0	6.4	3.3	5.1	28.4	121.0	131.5	79.2	10.6	2.6	2.6	409.6	287	28	283.2	1917 Sep 21
	b	0.8	0.7	0.6	0.2	0.4	1.4	5.0	5.5	3.1	0.6	0.2	0.2	18.7	(1908)	(1937)		
Bawal	23 a	4.7	8.1	2.6	1.7	9.7	21.8	121.8	220.2	87.7	15.6	4.8	1.4	500.1	170	28	143.0	1972 Aug 11
	b	0.5	0.5	0.3	0.1	0.9	1.4	6.2	8.3	4.0	0.7	0.3	0.1	23.3	(1976)	(1954)		
Mahendragarh (District)	a	11.4	9.6	6.3	4.3	12.1	38.9	149.9	178.0	82.9	17.2	2.9	4.8	518.3	215	25		
	b	0.9	0.9	0.6	0.4	0.9	2.3	6.9	7.4	3.8	1.0	0.2	0.4	25.7	(1917)	(1918)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(MAHENDRAGARH)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	4	601 - 700	8
201 - 300	6	701 - 800	2
301 - 400	13	801 - 900	2
401 - 500	20	901 - 1000	-
501 - 600	15	1001- 1100	-
		1101- 1200	1

(Data available for 71 years only)

ROHTAK DISTRICT

The climate of this district is characterised by the dryness of the air with an intensely hot summer and a cold winter. Only during the three monsoon months July, August and September does moist air of oceanic region penetrate into this district and weather is comparatively milder. The year may be divided into four seasons. The cold season starts by late November and extends to about the middle of March. This is followed by the hot season which continues to about the end of June when the southwest monsoon arrives over the district. July to September is the southwest monsoon season. The postmonsoon months October and November constitute a transition period from the monsoon to the winter conditions.

RAINFALL

Records of rainfall in the district are available for seven stations for long periods. The details of the 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 474.4 mm. The rainfall generally increases from the southwest to the northeast in the district. The rainfall in the southwest monsoon season constitutes about 78 percent of the annual rainfall, July being the month with the highest rainfall. The annual rainfall in the district varies over a wide range. In the eighty year period 1901 to 1980 the highest annual rainfall was in 1917 when it amounted to 192% of the normal. In the year 1905 the annual rainfall in the district was the lowest in the eighty year period and amounting to only 30% of the normal. In the same eighty year period the rainfall was less than 80% of the normal in 23 years. Considering the district as a whole there were three occasions of two, and one occasion of three and one occasion of four consecutive years of such low rainfall.

It will be seen from table 2 that the annual rainfall was between 301 and 600 mm in 42 years out of 71.

On an average there are 24 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 16 at Dujana to 32 at Rohtak (obsy).

The heaviest rainfall recorded in 24 hours at any station in the district was 484.1 mm at Rohtak on 1933 September 19.

TEMPERATURE

There is a meteorological observatory at Rohtak functioning since 1967 in the district. As the data available is not sufficient for preparation of normals, the description that follows is based on the records of observatories in the neighbouring districts. The cold season starts towards the latter half of November when both day and night temperatures decrease rapidly with the advance of the season. January is the coldest month when the mean daily maximum temperature is about 21°C and the mean daily minimum about 7°C. In winter months, during cold waves which affect the district in the wake of western disturbances passing across north India, minimum temperatures may sometimes go down to the freezing point of water and frosts occur. From about the middle of March temperatures begin to rise rapidly. May and June are the hottest months. From April the hot westerly winds locally known as "Luh" blow and the heat is intense. In May and June maximum temperatures may sometimes reach about 47°C. With the advance of the southwest monsoon into the district towards the end of June day temperatures drop appreciably while night temperatures continue to be as high as in summer. Even during the brief southwest monsoon the weather is stuffy and uncomfortable in between the spells of rain on account of increased moisture in the air. In October day temperatures are as high as during the monsoon months but the nights are cooler.

HUMIDITY

The air is dry during the greater part of the year. In the monsoon months the humidities are high about 70%. April and May are usually the driest months, the relative humidities in the afternoons being less than 20%.

CLOUDINESS

During the monsoon season particularly in July and August skies are heavily clouded or overcast. In the rest of the year skies are clear or lightly clouded generally. In January, February and early March skies become cloudy and sometimes overcast in association with the passage of western disturbances.

WINDS

Winds are generally light during the post monsoon and winter months. They strengthen a little during the summer and monsoon months. Winds are predominantly easterly or southeasterly in the monsoon season. In the other seasons winds are mostly westerly or northwesterly, during the mornings and blow from directions between northwesterly and northeasterly during afternoons.

SPECIAL WEATHER PHENOMENA

April to June is the period with the highest incidence of thunderstorms and dust-storms. Violent squalls (Andhis) often accompany such storms. While some of the thunderstorms are dry, others are accompanied with heavy rain and occasionally with hail. Rain during the monsoon months is often accompanied with thunder. Thunderstorms also occur in the winter months in association with western disturbances. Fogs, sometimes dense, occur in the winter months.

TABLE - I
Normals and Extremes of Rainfall

STATION	No.of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL	RAINFALL	in 24 HOURS *	
															AS % OF NORMAL	&	Amount	Date
															YEARS **		(mm)	
Rohtak (obsy)	13 a	13.1	20.0	17.5	4.6	19.6	38.3	263.9	160.2	68.1	5.9	4.9	12.9	629.0	185	67	202.7	1975 Aug 31
	b	1.1	1.1	1.3	0.8	1.5	2.6	10.6	8.0	3.5	0.6	0.3	0.7	32.1	(1975)	(1973)		
Rohtak	74 a	19.8	16.1	12.1	7.0	13.2	44.2	160.1	142.8	104.0	14.7	3.8	6.6	544.4	233	34	484.1	1933 Sep 19
	b	1.7	1.3	1.2	0.8	1.1	3.0	7.6	7.4	4.4	0.9	0.2	0.6	30.2	(1933)	(1905)		
Sampla	69 a	13.8	12.5	10.0	6.5	6.9	32.8	144.4	152.5	90.7	10.0	2.6	5.0	487.7	267	04	259.1	1875 Sep 09
	b	1.1	1.0	0.8	0.5	0.6	2.0	6.4	6.5	3.4	0.5	0.2	0.4	23.4	(1975)	(1934)		
Jhajjar	74 a	16.4	11.9	9.4	5.3	10.3	42.5	156.8	161.5	89.5	13.2	3.3	5.4	525.5	183	27	325.1	1933 Sep 19
	b	1.5	1.2	1.0	0.6	1.1	2.8	7.6	7.7	4.2	0.8	0.3	0.5	29.3	(1917)	(1918)		
Sathawas	67 a	9.5	9.0	5.3	5.7	9.8	33.0	100.4	97.4	72.8	10.5	1.9	3.0	358.3	216	01	256.5	1911 Sep 28
	b	0.8	0.7	0.5	0.4	0.7	1.7	4.5	4.5	2.6	0.5	0.1	0.2	17.2	(1917)	(1905)		
Beri	64 a	11.2	11.0	5.3	4.8	5.8	29.1	113.2	121.9	66.4	10.8	1.3	2.7	383.5	237	13	279.4	1933 Sep 19
	b	0.9	0.8	0.6	0.4	0.5	1.9	5.3	5.7	2.6	0.6	0.1	0.3	19.7	(1977)	(1944)		
Dhiana	19 a	6.5	7.6	1.4	5.2	4.7	24.7	114.8	150.3	60.4	12.1	3.6	2.6	393.9	286	08	160.0	1963 Aug 13
	b	0.5	0.7	0.2	0.4	0.4	0.9	4.0	5.2	2.6	0.5	0.2	0.1	15.7	(1977)	(1972)		
Rohtak (District)	a	12.9	12.6	8.7	5.6	10.0	34.9	150.5	140.9	78.8	11.0	3.1	5.5	474.4	192	30		
	b	1.1	1.0	0.8	0.6	0.8	2.1	6.6	6.4	3.3	0.6	0.2	0.4	23.9	(1917)	(1905)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(R O H T A K)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	4	501 - 600	14
201 - 300	9	601 - 700	9
301 - 400	17	701 - 800	4
401 - 500	11	801 - 900	2
		901 - 1000	1

(Data available only for 71 years)

KURUKSHETRA DISTRICT

The climate of this district is characterised by the extreme dryness of the air, with an intensely hot summer and a cold winter. It is only during the three monsoon months, July, August and September does moist air of oceanic origin penetrate into the district. The year may be divided into 4 seasons. The cold season from mid-November to about mid-March is followed by the hot season which continues to about the end of June. July to about the mid-September is the southwest monsoon season.

RAINFALL

Records of rainfall in the district are available for 3 stations for sufficiently longer periods. The details of the 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 581.8 mm. The rainfall in the district generally increases from the southwest towards the northeast. About 81% of the normal annual rainfall in the district is received during the months June to September, August being the rainiest month. Some rain is also received during cold season in association with passing western disturbances. The variation in the annual rainfall from year to year is large. In the 80 year period 1901-1980 the highest annual rainfall amounting to 186% of the normal occurred in 1942 while the lowest rainfall which was only 48% of the normal occurred in 1972. In the same 80 years period the annual rainfall in the district was less than 80% of the normal in 19 years. Consecutive 2 and 3 years of such low rainfall occurred twice and once respectively. It will be seen from table 2 that the annual rainfall in the district was between 301 and 800 mm in 62 years out of 71. On an average there are 30 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 27 at Gulab to 35 at Thanesar. The heaviest rainfall in 24 hours recorded at any station in the district was 217.0 mm at Thanesar on 1972 July 08.

TEMPERATURE

There is no meteorological observatory in this district. So the description which follows is mainly based on the records of the observatories in the neighbouring district, where climatic conditions are somewhat similar to those in the district. The cold season generally starts by about mid-November when temperature begins to decrease rapidly. January is generally the coldest month with mean daily maximum temperature at about 20.0°C and the mean daily minimum at about 7.0°C. In association with the passage eastwards of western disturbances in the cold season, cold waves affect the district and the minimum temperature sometimes goes down to about a degree or so below the freezing point of water. From about the middle of March temperatures begin to rise rapidly. May and June are the hottest months with the mean daily maximum temperature at about 40°C. From about April hot westerly winds, locally known as 'Luh' begin to blow and the weather progressively becomes intensely hot and trying. In May and June the maximum temperature may sometimes go about 45°C. With the advance of the southwest monsoon into the district towards the end of June there is appreciable drop in the day temperatures, while night temperatures continue to be nearly as high as in summer. Even during the southwest monsoon season the weather is sultry and unpleasant due to the increased moisture in the monsoon air. After the withdrawal of the monsoon by about mid-September there is an increase in the day temperatures but night temperatures drops down rapidly with the progress of the season.

HUMIDITY

The air is generally dry over the district during the greater part of the year. During the monsoon season the humidity is high, generally being between 60 and 85%. Humidity decreases in the post monsoon season, April and May are usually the driest months, with relative humidities being about 20% or less in the afternoons.

CLOUDINESS

During the southwest monsoon season and particularly during July and August skies are heavily clouded or overcast. In the rest of the year the skies are clear or lightly clouded generally. During the period January to early March skies become cloudy and often overcast in association with the passage of western disturbances.

WINDS

Winds are in general light over the district with some strengthening in force during the summer season. During the monsoon season, winds are mostly easterly or south-easterly. During the rest of the year the winds are predominantly westerly or northwesterly.

SPECIAL WEATHER PHENOMENA

April to June is the period with the highest incidence of thunderstorms and dust storms, violent squalls (Andhis) often accompanying such storms. Some of the thunderstorms do not give any appreciable rain, but others are accompanied with heavy rain and occasional hail. Thunderstorms also occur in the winter months in association with passing western disturbances. Fogs sometimes dense occur in the cold season.

TABLE - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL		
															ANNUAL	RAINFALL	in 24 HOURS *		
															AS % OF NORMAL	&	Amount	Date	
															YEARS **			(mm)	
Kaithal	73 a	24.4	19.2	15.4	9.7	11.4	50.6	145.0	154.7	100.1	12.9	2.9	8.5	554.8	198	41	188.2	1949 Jul 15	
	b	2.0	1.6	1.3	0.9	1.0	2.6	7.3	7.1	4.1	0.7	0.3	0.8	29.7	(1958)	(1938)			
Gurah	74 a	21.8	19.4	15.4	9.6	9.2	46.6	137.0	144.7	90.6	15.0	1.8	6.7	517.8	198	31	160.8	1949 Jul 14	
	b	1.7	1.6	1.3	0.7	0.8	2.5	6.6	6.7	3.8	0.6	0.2	0.8	27.3	(1917)	(1951)			
Thanesar	74 a	30.1	27.6	16.8	9.6	9.3	60.2	194.2	173.8	119.2	17.9	3.6	10.4	672.7	186	49	217.0	1972 Jul 08	
	b	2.4	2.1	1.6	0.9	1.0	3.3	8.8	8.1	4.5	0.8	0.3	0.8	34.6	(1942)	(1918)			
Kurukshetra (District)	a	25.4	22.1	15.9	9.6	10.0	52.5	158.7	157.7	103.3	15.3	2.8	8.5	581.8	186	48			
	b	2.0	1.8	1.4	0.8	0.9	2.8	7.6	7.3	4.1	0.7	0.3	0.8	30.5	(1942)	(1972)			

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(KURUKSHETRA)

Range in mm	No. of years	Range in mm	No. of years
201 - 300	2	701 - 800	6
301 - 400	11	801 - 900	3
401 - 500	11	901 - 1000	3
501 - 600	18	1001 - 1100	1
601 - 700	16		

(Data available for 71 years only).

SONIPAT DISTRICT

The climate of this district is characterised by the dryness of the air with an intensely hot summer and a cold winter. Only during the three monsoon months, July, August and September the weather is comparatively milder due to penetration of moist air of oceanic origin into this district. The year may be divided into four seasons. The cold season starts by late November and extends to about the middle of March. This is followed by the hot season which continues to about the end of June when the southwest monsoon arrives over the district. July to September is the southwest monsoon season. The post monsoon months October and November constitute transition period from the monsoon to winter conditions.

RAINFALL

This is a new district formed out of Rohtak district. Records of rainfall in the district are available for two stations for period of about 74 years. The details of the 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 567.0 mm. The rainfall generally increases from the southwest to the northeast in the district. The rainfall in the southwest monsoon season constitutes about 76% of the annual rainfall, July being the month with the highest rainfall. The annual rainfall in the district varies over a wide range. In the eighty year period 1901-1980 the highest annual rainfall was in 1964 when it amounted to 187% of the normal. In the year 1938 the annual rainfall in the district was lowest in the eighty year period and was only 42% of the normal. In the same eighty year period the rainfall was less than or equal to 80% of the normal in 18 years. Considering the district as a whole there was one occasion each of two (1928-29), three (1901-03) and four (1938-41) consecutive years of such low rainfall. It will be seen from table 2 that the annual rainfall was between 401 and 700 mm in 46 years out of 71 years.

On an average there are 30 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall recorded in 24 hours at any station in the district was 257.8 mm at Sonipat on 1933 September 19.

TEMPERATURE

There is no meteorological observatory in the district. Therefore description that follows is based on the records of observatories in the neighbouring district. The cold season starts towards the later half of November when both day and night temperatures decrease rapidly with the advance of the season. January is the coldest month when the mean daily maximum temperature is about 21°C and the mean daily minimum about 7°C in the winter months, during cold waves which affect the district in the wake of western disturbances passing across north India, minimum temperature may sometimes go down to freezing point of water and frosts occur. From about the middle of March temperatures begin to rise rapidly. May and June are the hottest months. After April the hot westerly winds locally known as 'Luh' blow and the heat is intense. In May and June maximum temperatures may sometimes reach about 47°C. With the advance of the southwest monsoon into the district towards the end of June day temperatures drop appreciably while night temperatures continue to be as high as in summer. Even during the brief southwest monsoon the weather is stuffy and uncomfortable in between spells of rain on account of increased moisture in the air. In October the day temperatures are as high as during the monsoon months but the nights are cooler.

HUMIDITY

The air is dry during greater part of the year. In the monsoon months the humidities are high about 70%. April and May are usually the driest months, the relative humidities in the afternoon being less than 20%.

CLOUDINESS

During the monsoon particularly in July and August skies are heavily clouded or overcast. In the rest of the year skies are clear or

lightly clouded generally. In January, February and early March skies become cloudy and sometimes overcast in association with the passage of western disturbances.

WINDS

Winds are generally light during the post monsoon and winter months. They strengthen a little during the summer and monsoon months. Winds are predominantly easterly and southeasterly in the monsoon season. They are mostly westerly or northwesterly during the mornings and blow from directions between northwesterly and northeasterly during afternoons.

SPECIAL WEATHER PHENOMENA

April to June is the period with the highest incidence of thunderstorms. Violent squalls (Andhis) often accompany such storms while some of the thunderstorms are dry, others are accompanied with heavy rain and occasionally with hail. Rain during the monsoon months is often accompanied with thunder. Thunderstorms also occur in the winter months in association with western disturbances. Fogs sometimes dense, occur in the winter months in the rear of the western disturbances.

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TABLE - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL	RAINFALL	in 24 HOURS *	
															AS % OF NORMAL	&	Amount	Date
															YEARS **		(mm)	
Gohana	74 a	21.7	17.8	13.4	8.4	11.9	42.5	156.3	165.5	93.0	15.9	3.6	7.5	557.5	165	45	189.5	1911 Sep 28
	b	1.8	1.5	1.2	0.7	1.1	2.7	7.3	7.3	4.1	0.8	0.2	0.7	29.4	(1909)	(1938)		
Sonipat	74 a	20.8	13.7	10.6	6.0	11.7	42.8	181.2	158.4	105.1	16.9	2.5	6.6	576.3	232	31	257.8	1933 Sep 19
	b	1.8	1.3	0.9	0.6	1.1	2.6	7.6	7.7	4.1	0.9	0.2	0.7	29.5	(1964)	(1939)		
Sonipat (District)	a	21.3	15.7	12.0	7.2	11.8	42.7	168.7	161.9	99.1	16.4	3.1	7.1	567.0	187	42		
	b	1.8	1.4	1.1	0.7	1.1	2.7	7.5	7.5	4.1	0.9	0.2	0.7	29.7	(1964)	(1938)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(S O N I P A T)

Range in mm	No. of years	Range in mm	No. of years
201 - 300	5	601 - 700	13
301 - 400	6	701 - 800	6
401 - 500	15	801 - 900	4
501 - 600	18	901 - 1000	3
		1001-1100	1

(Data available for 71 years only)

SIRSA DISTRICT

The climate of this district is characterised by its dryness and extremes of temperature and scanty rainfall. The year may be divided into four seasons. The cold season from November to March is followed by the summer season which lasts upto the end of June. The period from July to about the middle of September and from the middle of September to October constitute the southwest monsoon and postmonsoon seasons respectively.

RAINFALL

Records of rainfall in the district are available for Sirsa, the only rainfall measuring station in the district, for sufficiently long periods. The details of the rainfall at this station are given in table 1 which will be taken to represent the rainfall pattern for the district as a whole. The average annual rainfall in the district is 325.3 mm. The rainfall in the district increases generally from the west towards the east. About 72% of the normal rainfall in the district is received during the short southwest monsoon period, July to September, July and August being the rainiest months. There is significant amount of rainfall in the month of June, mostly in the form of thundershowers. In the rest of the year, there is very little rainfall. The variation in the annual rainfall from year to year in the district is very large. During the period, 1901 to 1977, the highest annual rainfall as recorded was 327% of the normal in 1917. The lowest annual rainfall amounting to only 34% of the normal was recorded in 1920. In the same period the annual rainfall in the district was less than 80% of the normal in 24 years. The three consecutive years of such low rainfall occurred once, whereas the two consecutive years of such low rainfall occurred five times. Occurrence of such low rainfall in two consecutive years is quite common in the district. It can be seen from table 2 that the annual rainfall in the district was between 101 and 600 mm in 64 years out of 66 years.

On an average there are 20 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 in the district was 165.4 mm on 1917, September 22.

TEMPERATURE

There is no meteorological observatory in the district. However records of Ganganagar (Rajasthan) on the west-northwest of the district and Hissar on the east-southeast are available for a longer period. Hence the mean meteorological conditions prevailing at these stations may be taken as representative of those prevailing in the district in general. There is rapid increase of temperature after February. The mean daily maximum temperature during May and June which is the hottest period varies from 41.5°C to 41.7°C. On individual days the maximum temperature during the summer season may rise upto about 49°C. The hot scorching winds, which blow in summer add to the discomfort. Afternoon thundershowers which occur on some days bring welcome relief, though only temporarily. With the advance of the monsoon into the district, by about the end of June, there is appreciable drop in the day temperatures and the weather becomes cooler during the day time, but the nights are even warmer than those during the summer season. With the added moisture in the monsoon air, the nights are often uncomfortable. After the withdrawal of the monsoon from the district in the later half of September, the temperatures begin to decrease. The decrease in temperature is rapid after October and the drop in temperature after nightfall is particularly trying. January is generally the coldest month with the mean daily maximum at 21.1°C and the mean daily minimum at 5.1°C. In the cold season the district is affected by cold waves in the wake of passing western disturbances and the minimum temperature drops down to about -3.3°C occasionally.

HUMIDITY

Relative humidity in the mornings is generally high during the monsoon season and during the period December to February, usually being about 70% or more. Humidity is comparatively less during the rest of the year the driest part of the year being the summer season with the relative humidity being about 30% in the afternoons.

CLOUDINESS

During the monsoon season the skies are mostly moderately to heavily clouded. In the rest of the year the skies are generally clear or lightly clouded. Cloudy skies prevail for brief spell of a day or two in association with passing western disturbances in the cold season.

WINDS

Winds are generally light in the district with some strengthening in force during the late summer and monsoon seasons. During the southwest monsoon while winds from the southwest or west are more common, easterlies and southeasterlies also blow on some days. In the postmonsoon and winter season while southwesterly or westerly winds are more common in the mornings northerlies and northwesterlies are predominant in the afternoons. In the summer season winds are mostly common from the west and southwest in the mornings. In the afternoons they are mostly from directions between west and northwest.

SPECIAL WEATHER PHENOMENA

Some of the depressions which originate in the Bay of Bengal in the southwest monsoon season and which move across the central parts of the country reach the district during the last stages of activity and cause widespread rain before dissipating. An occasional postmonsoon storm or depression also affects the district. Thunderstorms occur throughout the year but the highest incidence is during the monsoon season. Dust-storms occur often during the hot season. Occasional fogs affect the district in the cold season.

TABLE - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL		
															ANNUAL	RAINFALL	in 24 HOURS *		
															AS % OF NORMAL	&	Amount	Date	
															YEARS **			(mm)	
Sirsa	74 a	12.9	10.9	9.1	4.7	8.7	28.8	90.8	85.8	56.7	8.8	2.3	5.8	325.3	327	34	165.4	1917 Sep 22	
	b	1.3	0.9	0.9	0.5	0.8	2.0	4.8	4.6	2.5	0.5	0.2	0.6	19.6	(1917)	(1920)			

(a) Normal rainfall in mm.

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

* Based on all available data upto 1977.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(SIRSA)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	14	601 - 700	1
201 - 300	18	701 - 800	0
301 - 400	16	801 - 900	0
401 - 500	7	901 - 1000	0
501 - 600	9	1001-1100	1

(Data available only for 66 years).

FARIDABAD DISTRICT

The climate of this district is characterised by the dryness of the air except in the monsoon season, a hot summer and a cold winter. The year may be divided broadly into four seasons. The cold season starts late in November and continues upto the beginning of March. The summer season is from March to the end of June. The period from July to mid-September is the southwest monsoon season. Mid-September to the end of November constitutes the post monsoon or transition period.

RAINFALL

Records of rainfall in the district are available for four stations for sufficiently long periods. The details of the rainfall at these stations and for the district as a whole are given in tables 1 and 2. The normal annual rainfall in the district is 564.3 mm. The rainfall varies from 489.5 mm at Hassanpur to 657.0 mm at Ballabgarh. The rainfall in the district increases from south towards north. About 79% of the annual rainfall in the district is received during the southwest monsoon months July to September, July and August being the rainiest months. There is some rainfall in the premonsoon month June, mostly in the form of thundershowers. The variation in the annual rainfall from year to year is appreciable. In the 80 year period, 1901-1980 the highest annual rainfall which was 186% of the normal occurred in 1917 while the very next year the annual rainfall was the lowest in the 80 years, amounting to only 26% of the normal. In this 80 year period the annual rainfall in the district was less than 80% of the normal in 19 years. Two consecutive years of such low rainfall occurred three times in this period. It will be seen from table 2 that the annual rainfall in the district was between 401 mm and 800 mm in 49 years out of 70.

On an average there are 27 rainy days (i.e days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 20 at Hassanpur to 35 at Palwal.

The heaviest rainfall in 24 hours recorded at any station in the district was 398.8 mm at Palwal on 1875 September 9.

TEMPERATURE

There is no meteorological observatory in the district. Hence, the description which follows is mainly based on records of the observatories in the neighbouring districts where similar conditions exist. From about the beginning of March temperature begin to increase rapidly. May and June are the hottest months with the mean daily maximum temperature at about 41°C and the mean daily minimum at about 27°C . The heat in summer is intense with the maximum temperature on individual days, sometimes reaching 45°C . The hot dry and dust laden winds add to the discomfort of the already intensely hot summer days. With the onset of the monsoon by about the end of June there is appreciable drop in the day temperature and the weather becomes cooler, but nights continue to be as warm as during the latter part of the summer season. After the monsoon withdraws from the district by about the third week of September there is a slight increase in the day temperatures but the nights become rapidly cooler. After the end of October day temperatures also decrease rapidly. January is generally the coldest month with the mean daily maximum temperature at about 21°C and the mean daily minimum at about 8°C . Cold waves affect the district in the wake of passing western disturbances. The minimum temperature on such occasions drops down occasionally to about the freezing point of water and frosts occur.

HUMIDITY

The air is generally dry during the greater part of the year. Humidity is high in the southwest monsoon season. April and May are the driest months when the relative humidities in the afternoons become less than 20 percent.

CLOUDINESS

Skies remain almost overcast during the monsoon season and for brief spells of a day or two in association with passing western disturbances. In the rest of the year skies are mostly clear or lightly clouded.

WINDS

Winds are generally light with some increase in speed during summer and monsoon seasons. During the monsoon season winds are mostly from the east or southeast. During the rest of the year the winds are predominantly from the west or northwest.

SPECIAL WEATHER PHENOMENA

In association with depressions during the monsoon season which move across the central parts of the country, the district gets widespread heavy rain. In the cold season western disturbances affect the district. In association with them, thundershowers, sometimes accompanied with hail occur and this may form in the wake of the passing western disturbances. Dust-storms occur occasionally in the hot season. Fogs occur at times during the cold season.

T A B L E - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL	RAINFALL	in 24 HOURS *	
															AS % OF	NORMAL &	Amount	Date
															YEARS **		(mm)	
Ballabgarh	73 a	21.1	15.7	12.5	10.4	9.4	53.4	202.0	175.5	126.2	21.8	2.5	6.5	657.0	238	40	299.7	1875 Sep 09
	b	1.6	1.3	1.1	0.8	1.0	3.1	9.2	8.8	5.0	0.9	0.3	0.6	33.7	(1933)	(1903)		
Hassanpur	64 a	9.2	7.5	5.2	1.8	4.4	32.9	153.6	155.2	95.4	18.3	1.7	4.3	489.5	224	11	210.0	1969 Sep 10
	b	0.7	0.6	0.4	0.2	0.4	1.5	5.8	6.4	3.3	0.7	0.1	0.3	20.4	(1917)	(1938)		
Hattin	72 a	12.0	11.4	6.5	4.1	8.4	36.6	158.5	147.4	98.6	16.7	2.2	4.3	506.7	220	06	254.0	1939 Sep 16
	b	1.0	0.9	0.5	0.4	0.7	2.0	6.5	6.6	3.5	0.5	0.1	0.3	23.0	(1917)	(1968)		
Palwal	74 a	15.6	14.0	13.5	7.6	10.8	44.7	185.0	163.1	121.4	20.6	2.3	5.1	603.7	195	41	398.8	1875 Sep 09
	b	1.3	1.4	1.0	0.7	1.1	2.9	8.7	8.8	5.0	0.9	0.3	0.5	34.9	(1933)	(1918)		
Faridabad (District)	a	14.5	12.1	9.4	6.0	8.3	41.9	174.8	160.3	110.4	19.3	2.2	5.1	564.3	186	26		
	b	1.1	1.1	0.7	0.5	0.8	2.4	7.5	7.7	4.2	0.7	0.2	0.4	27.3	(1917)	(1918)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(FARIDABAD)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	1	601 - 700	7
201 - 300	5	701 - 800	12
301 - 400	8	801 - 900	3
401 - 500	12	901 - 1000	2
501 - 600	18	1001-1100	2

(Data available only for 70 years)

BHIWANI

The district, bordering on the Rajasthan Desert in the northeast and lying far inland, is a flat country with elevation around 250 metre above mean sea level everywhere. These features have profoundly influenced the climate which is very hot in summer from April to June and cold in a fairly long winter period lasting from November to March. It is also characterised by general dryness except during the monsoon season, which lasts from July to mid-September. The period mid-September to October constitutes the post monsoon or the transition period.

RAINFALL

Records of rainfall are available for 4 stations in the district. Details of the rainfall at these stations and for the district as a whole are given in table 1. The average annual rainfall over the district is 425.1 mm. Rainfall generally increase from the Northwest to Southeast. About 78% of the annual rainfall is received during the monsoon months July to September, and about 7% is accounted in the premonsoon month of June. July and August constitute the rainiest period when about 62% of the annual rainfall is received. Winter rains during January to March occurring in association with passing western disturbances though small in amount hardly 8% are of considerable economic importance. The variation in the rainfall from year to year is considerable. During the period 1901 to 1980 the highest annual rainfall as recorded was 205% of the normal occurred in 1917 and in the next year, the annual rainfall was lowest in this period, amounting to only 43% of the normal. In this 80 year period the annual rainfall in the district was less than 80% of the normal in 24 years. Two consecutive years of such low rainfall occurred four times in this period and four consecutive years of such low rainfall occurred two times.

It will be seen from table 2 that the annual rainfall in the district was between 201 and 600 mm in 62 years out of 70. On an average there are 22 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 15 at Siwani to 27 at Dadri.

The heaviest rainfall in 24 hours recorded at any station in the district was 327.7 mm at Siwani on 1964 July 28.

TEMPERATURE

There is no meteorological observatory in the district recording observations for other weather elements. Hence, the description that follows is based on records of observatories in the neighbouring districts experiencing similar climate. Temperatures start rising rapidly from March, when the mean daily maximum temperature is about 30°C, compared with that of about 25°C in February, and the minimum temperature at about 14°C compared to the temperature as low as 8°C in February. By May the mean maximum temperature reaches 41°C, remaining more or less steady till June by which time the minimum also rises to 28°C. May and June constitute the hottest part of the year. The maximum temperature may occasionally exceed 48°C on individual days during the period. Hot, scorching and dust-laden winds which blow from across the Rajasthan desert add to the summer discomfort. With the onset of the monsoon day temperatures fall appreciably in July and range between 36° to 38°C till September. But nights continue to remain oppressively warm, with the mean minimum temperature around 27°C till August. In late September, night temperatures, drop to 24°C due to the clearing of skies with the withdrawal of the monsoon. The temperatures then begin to fall rapidly and the winter conditions set in November. December to January is the coldest part of the year when the mean minimum temperature is 5° to 6°C with the mean maximum temperature around 22°C. In winter, cold waves, in the wake of western disturbances affect the district, causing temperatures to fall appreciably. During severe cold waves, the minimum temperature of 2° to 4°C below the freezing point may occasionally be reached in December and January. Even in February minimum temperature may occasionally drop below 0°C. Frost occurs under these conditions.

HUMIDITY

In the monsoon season the relative humidity is high being about 70 percent in the morning and 50-60 percent in the afternoons in July to September. Humidity is also high in the morning during December-February.

It is dry for the rest of the year. Summer is the driest month when the relative humidity drops to about 25 percent in the afternoon.

CLOUDINESS

Skies are moderately to heavily clouded for 10-15 days in July and August, and for about a week during December to March, in association with the western disturbances. During the rest of the year, skies are mostly clear to lightly clouded.

WINDS

Winds are generally light with some strengthening in late summer and the monsoon season. During the monsoon months of July to September, winds are mostly southwesterly to westerly, with easterlies to southeasterlies on some days. In the post monsoon and winter periods, winds veer to NW or North, particularly in the afternoons. In summer winds are mostly confined between the southwest to northwest.

SPECIAL WEATHER PHENOMENA

A few depressions originating in the Bay of Bengal during the monsoon season and moving across the country, reach the district and cause widespread heavy rain. Dust-storms mostly occur from April to June and thunderstorms in June to September. Thunderstorms in winter during December to February occur in association with the western disturbances, when they are occasionally accompanied by hail. Occasional fog affects the district in the cold season.

T A B L E - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL AS % OF NORMAL	RAINFALL & YEARS **	in 24 HOURS *	Date
Bhiwani	74 a	16.9	11.5	8.3	4.1	9.9	37.6	121.6	119.5	76.4	10.6	4.8	4.6	425.8	205	38	205.7	1872 Aug 09
	b	1.2	1.1	0.9	0.5	1.0	2.6	6.1	6.0	3.3	0.7	0.3	0.5	24.2	(1917)	(1965)		
Siwani	35 a	14.1	10.0	6.3	1.8	5.7	28.8	106.2	84.9	54.3	5.5	3.1	2.6	323.3	220	16	327.7	1964 Jul 28
	b	0.8	0.7	0.6	0.2	0.6	1.7	4.0	3.8	2.1	0.3	0.2	0.3	15.3	(1960)	(1951)		
Loharu	24 a	16.7	8.2	2.8	2.6	7.3	20.5	127.1	120.1	55.8	6.8	2.2	1.3	371.4	262	11	116.3	1957 Jul 23
	b	1.0	0.8	0.5	0.4	0.7	1.3	5.2	5.9	3.0	0.4	0.3	0.2	19.7	(1977)	(1965)		
Dadri	21 a	21.5	9.2	8.6	4.1	11.2	35.9	159.1	210.8	86.1	25.4	5.8	2.8	580.5	172	47	142.0	1970 Aug 12
	b	1.2	0.9	0.7	0.4	0.9	2.4	7.3	8.1	3.6	1.1	0.3	0.3	27.2	(1960)	(1959)		
Bhiwani (District)	a	17.3	9.7	6.5	3.1	8.5	30.7	128.5	133.8	68.1	12.1	4.0	2.8	425.1	205	43		
	b	1.1	0.9	0.7	0.4	0.8	2.0	5.7	5.9	3.0	0.6	0.3	0.3	21.7	(1917)	(1918)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(B H I W A N I)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	2	501 - 600	11
201 - 300	16	601 - 700	3
301 - 400	18	701 - 800	1
401 - 500	17	801 - 900	2

(Data available only for 70 years)

JIND DISTRICT

The climate of this district is on the whole dry and hot in summer and cold in winter. The year may be divided into four seasons. The cold season from November to March is followed by the hot season which lasts till the onset of the southwest monsoon by 1st July. The monsoon withdraws by 15th September and is followed by the post monsoon or the transition period.

RAINFALL

Records of rainfall are available for 9 stations in the district , the details of which are given in table 1 and 2. The average annual over the district as a whole is about 565.3 mm. Rainfall generally increases from south or southwest to east or northeast. Over 80% of the annual rainfall is received during the monsoon months of July to September. July and August are the rainiest months, together accounting for over 62% of the annual rain. Premonsoon rainfall in June constitutes about 6% of the annual normal. Some precipitation constituting about 6% of the annual rainfall, is also received during the winter months of December to February in association with western disturbances which pass across the district or its neighbourhood from west to east, affecting the weather over the district in this season. The variation in annual rainfall from year to year is large. In the 80 year period 1901 to 1980, the highest annual rainfall which was 157% of the normal occurred in 1942 and the lowest annual rainfall was 19% of the normal, which occurred in 1927. The annual rainfall was less than 80% of the normal in 29 years. Two consecutive years of such low rainfall occurred two times in this 80 year period and three consecutive years of such low rainfall occurred three times and five consecutive years of such low rainfall occurred once in this period. It will be seen from table 2 that the rainfall in the district was between 301 to 700 mm in 45 years out of 64.

On an average there are 26 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 17 at

Rajaund to 31 at Narwana (division) & Kurur.

The heaviest rainfall in 24 hours recorded at any station in the district was 209.5 mm at Kharwal on 21st August 1960.

TEMPERATURE

There is no meteorological observatory in the district. The account which follows is, therefore, based on the records of the observatories in the neighbouring district where similar climatic conditions prevail. From about the beginning of March temperatures increase rapidly till June which is generally the hottest month. The mean daily maximum temperature during June is around 41°C and the mean daily minimum around 27°C . The heat in summer is intense. On individual days, the day temperature may occasionally exceed 47° or 48°C . Scorching dust laden winds which blow during the hot season render the weather very tiring. Afternoon thundershowers which occur on some days bring some relief although temporarily. With the onset of the monsoon by about the end of June or beginning of July there is a drop in the day temperatures but the nights are nearly as warm as in June. Due to the increased humidity in the monsoon air, the weather is oppressive in between the rains. After the withdrawal of the monsoon by about the middle of September there is a decrease in temperatures, the drop in night temperatures being more rapid. After October both day and night temperatures decrease rapidly. January is usually the coldest month with the mean daily maximum temperature at about 21°C and the mean daily minimum at about 6°C . In the cold season, particularly in January and February, cold winds in the wake of passing western disturbances affect the district and the minimum temperature occasionally drops down to below the freezing point of water.

HUMIDITY

During the south east monsoon season, July to September, the relative humidity is high, being over 75 - 80 percent in the mornings and 55 - 65 percent in the afternoons. High humidities of more than 70% also prevail during the winter months of December to February. It is

comparatively drier during the rest of the year. April and May constitute the driest part of the year when in the afternoons the relative humidity is 20 percent or less.

CLOUDINESS

Skies are moderately to heavily clouded mainly in July and August. Cloudiness decreases rapidly in October. In the period of November to May the skies are mostly clear or lightly clouded, except during passage of western disturbances in the cold season when the skies become cloudy for a brief spell of a day or two. From June onwards cloudiness increases.

WINDS

Winds are generally light, with some strengthening in force during the late summer and early part of the monsoon season. In the south east monsoon season winds from the south east and west are more common, with the easterlies and southeasterlies blowing on some days. In the post monsoon and winter season, southeasterlies and westerlies are common in the mornings while northerlies and northeasterlies are predominant in the afternoons. In the summer winds are from the west or south east in the mornings. In the afternoons winds blow from directions between west and north.

SPECIAL WEATHER PHENOMENA

Thunderstorms in association with premonsoon and monsoon rains occur mostly during June to September. During the winter also a few thunderstorms occur in association with the western disturbances. A few thunderstorms may be accompanied by hail. Occasional dust-storms occur during the hot season. Fog is rare and occurs only in winter.

TABLE - I
Normals and Extremes of Rainfall

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL	RAINFALL	in 24 HOURS *	
															AS % OF NORMAL	&	Amount	Date
															YEARS **		(mm)	
Jind	67 a	16.3	14.9	8.6	8.0	11.4	46.7	158.4	144.9	99.8	12.6	3.0	6.1	530.7	210	28	193.0	1920 Jul 29
	b	1.5	1.3	1.0	0.8	1.0	2.8	6.9	6.5	3.8	0.5	0.1	0.6	26.8	(1933)	(1939)		
Narwana	17 a	12.0	4.2	5.0	5.0	15.0	18.6	175.4	208.5	68.7	11.6	5.7	3.0	532.7	150	52	196.9	1953 Jul 11
	b	1.2	0.5	0.4	0.6	1.1	1.2	6.3	6.7	2.9	0.3	0.3	0.3	21.8	(1960)	(1965)		
Rajaund	68 a	14.7	14.0	7.3	5.4	6.8	32.6	110.8	99.3	76.2	9.9	1.3	4.1	382.4	218	28	129.5	1903 Aug 03
	b	1.0	0.9	0.6	0.5	0.5	1.5	4.4	4.1	2.3	0.4	0.1	0.4	16.7	(1909)	(1927)		
Narwana (Division)	14 a	16.1	9.6	11.3	5.5	14.5	31.3	222.1	174.9	111.2	25.2	1.1	3.2	626.0	171	51	160.0	1960 Aug 21
	b	2.4	0.9	1.2	0.8	1.6	2.3	8.0	7.4	4.5	1.4	0.1	0.3	30.9	(1977)	(1965)		
Dhaka1	12 a	27.5	14.6	17.1	9.2	18.4	51.9	265.5	225.1	76.2	17.0	0.3	1.9	724.7	164	36	196.8	1956 Jul 21
	b	2.3	1.2	1.0	1.1	1.7	2.2	7.3	7.6	3.2	0.9	0.0	0.1	28.6	(1977)	(1965)		
Tarkha	14 a	13.7	9.8	9.5	1.3	12.0	21.5	182.0	184.1	104.4	14.7	0.2	0.8	554.0	148	50	171.5	1960 Aug 21
	b	1.2	0.7	0.8	0.2	1.2	1.6	6.4	6.9	4.3	1.0	0.0	0.2	24.5	(1964)	(1965)		
Badrikri	15 a	29.0	12.8	9.5	5.5	10.9	23.6	204.5	146.1	125.5	19.1	1.2	4.2	591.9	141	62	145.3	1960 Aug 21
	b	2.0	0.8	1.1	0.7	1.2	1.3	7.8	6.9	4.8	1.6	0.1	0.3	28.6	(1960)	(1959)		
Kurur	15 a	20.4	12.1	16.8	10.9	14.2	40.0	225.1	191.9	127.7	19.2	3.1	3.8	685.2	168	55	175.0	1971 Jul 17
	b	2.2	1.1	1.4	0.8	1.3	2.4	7.9	7.4	4.8	1.5	0.2	0.3	31.3	(1964)	(1959)		
Kharwal	15 a	15.7	11.9	8.9	2.4	16.6	42.3	141.5	112.9	87.7	15.0	2.3	3.9	461.1	170	67	209.5	1960 Aug 21
	b	1.6	0.9	1.1	0.4	1.5	2.2	6.6	5.5	3.9	0.7	0.2	0.3	24.9	(1960)	(1965)		
Jind (District)	a	18.4	11.5	10.4	5.9	13.3	34.3	187.3	165.3	97.5	16.0	2.0	3.4	565.3	157	19		
	b	1.7	0.9	1.0	0.7	1.2	1.9	6.8	6.6	3.8	0.9	0.1	0.3	25.9	(1942)	(1927)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(J I N D)

Range in mm	No. of years	Range in mm	No. of years
101 - 200	4	501 - 600	12
201 - 300	6	601 - 700	6
301 - 400	17	701 - 800	3
401 - 500	10	801 - 900	6

(Date available only for 64 years)

UNION TERRITORY OF CHANDIGARH

The climate of the territory of Chandigarh is characterised by general dryness except in the southwest monsoon season, a hot summer and a bracing cold season. The year may be divided into four seasons. The period from about the middle of November to February is the cold season. This is followed by the summer season from March to about the end of June. The southwest monsoon commences late in June and continues upto about the middle of September. The period from mid-September to the middle of November constitutes the post monsoon or transition season.

RAINFALL

Records of rainfall are available for 2 stations. The details of the rainfall at these stations are given in table 1 and 2, which will be taken to represent the rainfall pattern for the territory as a whole. The average annual rainfall is 1073.6 mm. About 80% of the annual normal rainfall is received during the period June to September, July and August being the rainiest months. About 10% of the normal rainfall is received in the cold season. The variation in the annual rainfall from year to year is very large. The annual rainfall for district as a whole was 160% of the normal in 1971. The lowest annual rainfall amounting to 52% of the normal was received in 1974. In the same period annual rainfall in the district was less than 80% of the normal in 5 years. It can be seen from table 2 that the annual rainfall was between 801 to 1300 mm in 16 years out of 25 years.

On an average there are 49 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year. The heaviest rainfall in 24 hours recorded in territory was 234.9 mm on 1955 September 26.

TEMPERATURE

There is a meteorological observatory in the territory at Chandigarh. The records of this observatory may be taken as representative

of the climatic conditions in the territory in general. From March temperatures increase rapidly. May and June are the hottest months in the year with the mean daily maximum temperature at about 39°C and the mean daily minimum at about 24° to 26°C. The heat in the summer season is intense. Scorching dust laden winds which are a fairly common feature in the latter part of the summer season contribute much to the discomfort. An occasional dust-storm or thunderstorm brings some relief. With the advance of the monsoon into the territory by about the end of June there is some drop in the day temperature but the nights still continue to be quite warm. The weather remains oppressive in between the rains due to the moisture in the air during the monsoon season. After the withdrawal of the monsoon by about mid-September there is a slight increase in the day temperature. The decrease in the temperature is rapid from November. January is generally the coldest month with the mean daily maximum temperature at about 20°C and the mean daily minimum at about 7°C. During the winter season cold waves affect the territory in the wake of passing western disturbances and the minimum temperature drops down occasionally to about the freezing point of water. The highest maximum temperature recorded at Chandigarh was 45.3°C on 1958 June 17. The lowest minimum ever recorded was 0.0°C on 1973 January 1 and 1961 February 8.

HUMIDITY

Relative humidity is high, about 70% during the monsoon season. The driest part of the year is summer season when during afternoons relative humidity is lowest about 25%.

CLOUDINESS

The skies are generally moderately to heavily clouded and occasionally overcast during the monsoon season and for brief spells of a day or two in association with the passing western disturbances during the cold season. The skies are mainly clear or lightly clouded during the rest of the year.

WINDS

Wind data is not available, so the description which follows is based on the records of observatories in the neighbouring district where similar conditions prevail. Winds are generally light in the territory. In the post-monsoon and cold season winds are predominantly from the northwest. In March and April easterly to southeasterly winds also blow on some days. In the period May to September easterlies and southeasterlies are predominant but on many days northwesterly winds blow in the afternoons.

SPECIAL WEATHER PHENOMENA

The territory is scarcely affected by monsoon depressions. During the period January to March, western disturbances affect the territory causing rain, often associated with thunder and gusty winds. Rain during the monsoon season is more often associated with thunder. Dust-storms occur occasionally in the hot season. Occasional fog occurs in the cold season.

Tables 3 and 4 give the temperature, humidity and special weather phenomena respectively for Chandigarh.

T A B L E - I
Normals and Extremes of Rainfall

STATION	No.of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL	RAINFALL	in 24 HOURS *	
															AS % OF NORMAL & YEARS **		Amount (mm)	Date
Chandigarh (obsy)	23 a b	44.1 3.1	41.4 2.5	30.1 2.3	11.9 0.8	24.2 1.6	110.5 4.7	286.4 11.3	285.1 11.2	184.2 5.5	43.3 2.1	7.0 0.8	20.4 1.5	1088.6 47.4	172 (1971)	60 (1965)	234.9	1955 Sep 26
Chandigarh (Aero obsy)	16 a b	33.1 2.6	38.9 2.7	30.4 2.6	8.5 1.1	28.3 2.1	145.2 6.3	280.4 12.3	307.5 11.4	133.0 5.0	21.9 1.4	9.4 0.8	21.9 1.4	1058.5 49.7	148 (1971)	52 (1965)	212.0	1978 Aug 19
Chandigarh (District)	a b	38.6 2.9	40.1 2.6	30.3 2.5	10.2 0.9	26.3 1.9	127.9 5.5	283.4 11.8	296.3 11.3	158.6 5.3	32.6 1.7	8.2 0.8	21.1 1.5	1073.6 48.7	160 (1971)	52 (1974)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1955 - 1980)
(CHANDIGARH)

Range in mm	No. of years	Range in mm	No. of years
501 - 600	1	1101 - 1200	1
601 - 700	1	1201 - 1300	4
701 - 800	1	1301 - 1400	3
801 - 900	5	1401 - 1500	2
901 - 1000	2	1501 - 1600	-
1001 - 1100	4	1601 - 1700	-
		1701 - 1800	1

TABLE - 3
Normals of Temperature and Relative Humidity
(CHANDIGARH)

MONTH	Mean Daily Maximum Temperature °C	Mean Daily Minimum Temperature °C	Highest Maximum ever recorded °C	Lowest Minimum ever recorded °C	Relative Humidity 0830 1730*
			Date	Date	% %
January	20.6	6.1	26.3 1961 Jan 29	0.0 1973 Jan 01	70 44
February	23.2	9.3	32.8 1954 Feb 20	0.0 1961 Feb 08	63 41
March	28.5	14.3	35.6 1958 Mar 28	5.7 1976 Mar 1,2	50 33
April	34.1	19.6	41.2 1958 Apr 27	9.2 1976 Apr 01	38 25
May	37.8	23.5	44.6 1962 May 30	13.4 1976 May 17	35 23
June	39.1	26.5	45.3 1958 Jun 17	15.0 1976 Jun 05	50 35
July	34.2	25.0	42.0 1976 Jul 01	17.7 1976 Jul 11	75 64
August	32.9	24.2	38.4 1962 Aug 07	18.2 1975 Aug 23	81 69
September	33.1	22.4	37.3 1958 Sep 01	16.7 1975 Sep 09	76 58
October	32.1	17.6	37.0 1960 Oct 02	9.4 1955 Oct 29	57 40
November	27.1	11.2	33.5 1976 Nov 07	3.7 1975 Nov 30	58 40
December	21.8	7.3	28.0 1964 Dec 04	0.3 1975 Dec 10	67 45
Annual	30.4	17.3			60 40

*Hours I.S.T.

TABLE - 4
Special Weather Phenomena
(C H A N D I G A R H)

Mean No. of Days with *	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0	0.2	0.3	0.4	0.4	0.6	0	0.2	0.1	0.3	0	0.1	2.6
Hail	0	0	0.1	0	0	0	0	0	0	0	0	0	0.1
Dust-storm	0.1	0	0	0.2	0.2	0.2	0	0	0	0.1	0	0	0.8
Squall	0	0	0	0	0	0	0	0	0	0	0	0	0
Fog	0.2	0.4	0.1	0	0	0	0	0	0	0	0	0	0.7

* No. of days two and above are given in whole numbers.

DELHI DISTRICT

The climate of this district is mainly influenced by its inland position and the prevalence of air of the continental type during the major part of the year. Extreme dryness with an intensely hot summer and cold winter are the characteristics of the climate. Only during the three monsoon months July, August and September does air of oceanic origin penetrate to this district and causes increased humidity, cloudiness and precipitation. The year can broadly be divided into four seasons. The cold season starts in late November and extends to about the beginning of March. This is followed by the hot season which lasts till about the end of June when the monsoon arrives over the district. The monsoon continues to the last week of September. The two post monsoon months October and November constitute a transition period from the monsoon to winter conditions.

RAINFALL

Records of rainfall in the district are available for 13 stations for sufficiently long periods. The details of the rainfall at these stations and for the district as a whole are given in tables 1 and 2. The normal annual rainfall in the district is 611.8 mm. The rainfall in the district increases from the southwest to the northeast. About 81% of the annual rainfall is received during the monsoon months July, August and September. The rest of the annual rainfall is received as winter rains and as thunderstorm rain in the pre and post monsoon months. The variation of rainfall from year to year is large. During the 80 year period 1901-1980, 1933 was the year with the highest annual rainfall which amounted to 251% of the normal. In 1951, the year with the lowest rainfall only 44% of the average annual rainfall was received. During the same 80 year period rainfall was less than 80% of the normal in 21 years. Two consecutive years of such low rainfall occurred four times in this period.

It will be seen from table 2 that in 59 years out of 73, the rainfall was between 401 and 1000 mm.

On an average rain of 2.5 mm or more falls on 27 days in the year. Of these, 19 days are during the monsoon months. Two to three days in June are rainy. In other months, excepting November and the first part of December when it is practically rainless, rain falls on a day or two only in each month.

The heaviest rainfall in 24 hours recorded at any station in the district was 495.3 mm at Delhi (Safd) on 1875 September 9.

TEMPERATURE

There are five meteorological observatory in the district at Chandrawal, New Delhi (Safd), Delhi (University), New Delhi Palam and Okhla. Out of these five observatories normals of temperature, humidity and other meteorological parameters are available only in respect of the meteorological observatory at New Delhi (Safd). These may be taken to be representative for the district (territory). The cold season starts towards the latter half of November when both day and night temperatures drop rapidly with the advance of the season. January is the coldest month with the mean daily maximum temperature at 21.3°C and the mean daily minimum at 7.3°C . In the winter months during cold waves which affect the district in the wake of western disturbances passing across north India, minimum temperatures may sometimes go down to the freezing point of water. From about the middle of March temperatures begin to rise fairly rapidly. May and June are the hottest months. While day temperatures are higher in May the nights are warmer in June. From April the hot wind known locally as luh blows and the weather is unpleasant. In May and June maximum temperatures may sometimes reach 46 or 47°C . With the advance of the monsoon into the area towards the end of June or the beginning of July day temperatures drop appreciably while the night temperatures remain high. In October the day temperatures are as in the monsoon months but the nights are cooler.

The highest maximum temperature recorded at Delhi (Safd) was 47.2°C on 1944 May 29. The lowest minimum temperature at Delhi (Safd) was -0.6°C on 1935 January 16.

HUMIDITY

The air over Delhi is dry during the greater part of the year. Humidity is high in the monsoon months. April and May are the driest months with relative humidities of about 30% in the mornings and less than 20% in the afternoons.

CLOUDINESS

During the monsoon specially in July and August skies are heavily clouded and often overcast. In the rest of the year skies are clear or lightly clouded. But in the months of January, February and early March skies become cloudy and sometimes overcast when the district is affected by western disturbances.

WINDS

Winds are generally light during the post monsoon and winter months. They strengthen during the summer and monsoon months. Except during the monsoon months winds are predominantly from a westerly or northwesterly direction and tend to be more northerly in the afternoon. Easterly and southeasterly winds are more common in the monsoon months.

SPECIAL WEATHER PHENOMENA

April to June is the period with the highest incidence of thunderstorms and dust storms. Some thunderstorms give rise to violent squalls (Andhis). While some of the thunderstorms are dry others are accompanied with heavy rain and less frequently with hail. Thunderstorms also occur in the winter months in association with western disturbances. Fogs sometimes dense occur in the winter months.

Tables 3, 4 and 5 give the data of temperature and humidity, mean wind speed and frequency of weather phenomena respectively for New Delhi.

T A B L E - I
Normals and Extremes of Rainfall

Normals and Extremes of Rainfall															HIGHEST ANNUAL AS % OF NORMAL & YEARS **	LOWEST RAINFALL	HEAVIEST RAINFALL in 24 HOURS *	
STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	AS % OF NORMAL & YEARS **	Amount	Date	
Chandrawal (obsy)	20 a b	8.5 0.6	15.3 1.2	16.7 1.2	5.5 0.5	18.2 1.5	47.6 2.2	329.8 10.5	308.4 10.4	102.3 3.9	14.4 0.9	8.2 0.2	11.6 0.8	886.5 33.9	163 (1977)	64 (1969)	171.0 1976 Aug 08	
New Delhi (Safd)	79 a b	20.5 1.8	20.1 1.5	13.3 1.2	7.8 0.8	12.5 1.4	62.2 3.6	203.2 9.2	202.2 9.5	137.6 5.1	21.7 1.0	3.1 0.2	8.0 0.7	712.2 36.0	215 (1933)	43 (1905)	495.3 1875 Sep 09	
Delhi (University (obsy)	29 a b	20.7 1.6	18.3 1.4	19.1 1.5	5.1 0.7	16.4 1.5	62.2 2.8	281.5 10.3	263.5 10.5	147.4 5.2	41.6 1.6	4.1 0.2	7.6 0.8	887.6 38.1	209 (1957)	52 (1974)	250.0 1963 Sep 16	
New Delhi Palam	22 a b	14.7 1.3	14.1 1.5	9.3 1.0	6.1 0.6	18.9 1.5	54.2 3.5	241.1 10.9	284.3 10.7	119.4 4.9	16.8 1.4	6.4 0.2	8.6 0.8	793.9 38.3	165 (1967)	51 (1965)	265.8 1972 Jul 09	
Okhala (obsy)	21 a b	9.6 0.9	11.9 1.3	14.7 0.9	2.6 0.3	17.1 1.4	66.9 3.4	212.5 9.3	296.3 10.7	124.6 5.1	23.2 0.9	5.7 0.3	7.3 0.6	792.4 35.1	159 (1964)	66 (1974)	190.0 1967 Aug 26	
Mahruali	33 a b	13.9 1.1	10.1 0.7	7.3 0.6	9.4 0.6	3.6 0.3	28.3 1.5	159.9 5.8	152.5 5.9	98.7 3.0	11.5 0.3	1.5 0.2	2.3 0.3	499.0 20.3	197 (1944)	42 (1954)	177.8 1911 Sep 28	
Delhi Sadar	38 a b	22.6 1.9	17.5 1.4	13.0 1.4	8.8 0.6	9.6 0.9	44.8 2.4	184.3 7.6	180.0 8.9	132.3 4.7	26.1 1.0	3.5 0.3	5.1 0.6	647.6 31.7	194 (1964)	42 (1903)	224.8 1942 Sep 05	
Nangloi	25 a b	8.5 0.8	4.6 0.3	1.1 0.2	4.0 0.2	2.4 0.3	19.8 1.1	100.3 4.6	121.6 5.4	69.0 3.1	5.0 0.4	0.4 0.0	0.5 0.0	337.2 16.4	246 (1964)	21 (1950)	120.0 1964 Aug 14	
Sahadra	12 a b	15.5 0.7	17.9 0.8	5.6 0.7	5.3 0.3	2.8 0.5	24.8 1.4	170.7 6.1	125.8 5.0	74.9 2.8	7.9 0.3	0.0 0.0	0.6 0.1	451.9 18.7	206 (1944)	42 (1948)	129.5 1944 Sep 04	

contd....

TABLE - I (contd)

STATION	No. of Years of DATA	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL	HIGHEST	LOWEST	HEAVIEST RAINFALL	
															ANNUAL AS % OF NORMAL YEARS **	RAINFALL & YEARS **	in 24 HOURS * Amount (mm)	Date
Najafgarh	23 a	8.9	8.2	4.7	4.2	3.0	25.1	122.0	122.8	75.9	21.7	0.5	1.8	398.9	171	10	139.7	1954 Oct 01
	b	0.8	0.7	0.2	0.4	0.4	1.3	5.5	5.6	3.2	0.8	0.0	0.2	19.1	(1942)	(1959)		
Badli	23 a	13.7	8.6	9.6	3.6	1.4	21.8	154.2	181.3	88.2	32.9	0.8	0.0	516.1	257	37	205.7	1961 Jul 17
	b	1.0	0.7	0.6	0.4	0.2	1.1	5.8	6.4	3.7	0.8	0.0	0.0	20.7	(1961)	(1951)		
Alipur	21 a	11.7	10.6	3.3	3.6	6.0	26.7	146.1	137.1	87.7	13.7	1.3	1.1	448.9	202	12	162.1	1961 Jul 17
	b	1.3	0.7	0.4	0.4	0.4	1.5	4.7	6.0	2.9	0.7	0.1	0.1	19.3	(1961)	(1959)		
Narela	19 a	19.9	14.5	10.6	4.9	7.2	20.6	184.7	190.4	111.2	14.8	1.1	1.4	581.3	196	29	184.1	1947 Sep 15
	b	1.5	0.9	1.1	0.4	0.4	1.6	6.4	8.2	4.0	0.5	0.1	0.2	25.3	(1961)	(1965)		
Delhi	a	14.5	13.2	9.9	5.5	9.2	38.8	191.6	197.4	105.3	19.3	2.8	4.3	611.8	251	44		
(District)	b	1.2	1.0	0.8	0.5	0.8	2.1	7.4	7.9	4.0	0.8	0.1	0.4	27.0	(1933)	(1951)		

(a) Normal rainfall in mm.

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

* Based on all available data upto 1980.

** Years given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1901 - 1980)
(D E L H I)

Range in mm	No. of years	Range in mm	No. of years
201 - 300	4	901 - 1000	6
301 - 400	5	1001- 1100	1
401 - 500	14	1101- 1200	3
501 - 600	10	1201- 1300	0
601 - 700	9	1301- 1400	0
701 - 800	14	1401- 1500	0
801 - 900	6	1501- 1600	1

(Data available only for 73 years).

TABLE - 3
Normals of Temperature and Relative Humidity
(N E W D E L H I)
SAFDARJANG

MONTH	Mean Daily Maximum Temperature °C	Mean Daily Minimum Temperature °C	Highest Maximum ever recorded °C	Lowest Minimum ever recorded °C	Relative Humidity 0830 1730* % %
			Date	Date	
January	21.3	7.3	29.4 1946 Jan 24	-0.6 1935 Jan 16	72 41
February	23.6	10.1	33.3 1934 Feb 26	1.7 1950 Feb 11	59 28
March	30.2	15.1	40.6 1945 Mar 31	4.4 1945 Mar 06	47 21
April	36.2	21.0	45.6 1941 Apr 29	10.7 1965 Apr 02	32 16
May	40.5	26.6	47.2 1944 May 29	17.0 1964 May 22	31 18
June	39.9	28.7	46.7 1945 Jun 17	18.9 1932 Jun 23	48 32
July	35.3	27.2	45.0 1931 Jul 01	21.4 1974 Jul 04	73 60
August	33.7	26.1	40.0 1945 Aug 12	21.2 1965 Aug 23	77 65
September	34.1	24.6	40.6 1938 Sep 16	17.6 1964 Sep 26	70 54
October	33.1	18.7	39.4 1951 Oct 17	9.4 1937 Oct 31	54 35
November	28.7	11.8	35.0 1943 Nov 05	3.9 1938 Nov 28	48 31
December	23.4	8.0	28.9 1959 Dec 15	1.1 1945 Dec 26	63 38
Annual	31.7	18.8			56 37

* HOURS IST

TABLE - 4
Mean Wind Speed in Km/hr.
(D E L H I)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
8.4	10.1	10.8	10.9	12.9	14.6	10.3	9.1	9.6	6.3	6.7	7.6	9.8

TABLE - 5
Special Weather Phenomena
(D E L H I)

Mean No. of Days with *	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	1.5	1.7	3	3	5	5	7	8	4	1.3	0.4	0.7	41
Hail	0.1	0.1	0.4	0.1	0.1	0	0	0	0	0	0	0	0.8
Dust-storm	0	0	0.5	1.0	3	3	0.5	0	0.1	0.3	0	0	8
Squall	0.3	0.4	1.0	1.6	3	2	1.5	1.0	0.6	0.1	0.1	0	12
Fog	3	0.5	0.1	0	0.7	0.2	0.1	0	0	0.1	0.6	1.7	7

* No. of days two and above are given in whole numbers.

