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INDIA METEOROLOGICAL DEPARTMENT

हिमाचल प्रदेश की जलवायु

CLIMATE OF HIMACHAL PRADESH

CLIMATOLOGICAL SUMMARIES OF STATES SERIES - No. 15

ISSUED BY

OFFICE OF THE
ADDITIONAL DIRECTOR GENERAL
OF METEOROLOGY (RESEARCH)
INDIA METEOROLOGICAL DEPARTMENT
PUNE - 411 005

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PREFACE

The importance of meteorology and its economic and social benefits are being increasingly realised all over the world. In our country also, various sectors like agriculture, aviation, energy, industry require climatological information pertaining to different regions of the country, for planning and executing projects, with a view to derive maximum advantage from meteorological and/or climatological conditions. Keeping these requirements in view, it was decided by India Meteorological Department to publish a series of “Climatological Summaries” for each state in the country incorporating the district climatological summaries. The fifteenth issue in the series of ‘State Climatological Summaries’is “Climate of Himachal Pradesh”.

The present publication contains extensive information on rainfall in Himachal Pradesh and various districts of the state based on the available rainfall data for the period 1951-2000. The climatological data in respect of temperature, wind, clouds and other weather parameters for the period from 1961-1990 and information on droughts, excessive rainfall, depressions and cyclonic storms are also included in the publication.

The climatological summary and related maps were prepared by Shri S.M. Deshpande, Smt. U.S.Satpute, Smt. P.R.Iyer, Shri R.S.Wayal, Smt. P.P.Bhagwat and Shri A.B.Dhule from “Revision of Climatological Publications” section of the Office of the Additional Director General of Meteorology (Research), India Meteorological Department, Pune. The contributions of Shri B.V.Potdar and Shri V.W. Mhaske , have been very vital.

The designing and printing has been done by DTP unit, under the supervision of Shri Philipose Abraham.

The publication was prepared by Smt. P.G.Gore, Director and reviewed by Shri Thakur Prasad, DDGM(C)(Retd.) and Dr. A. L. Koppar DDGM(C). Dr. H.R.Hatwar, ADGM(R), provided the overall guidance for this publication. I appreciate their sincere efforts.

NEW DELHI
January, 2010

AJIT TYAGI
DIRECTOR GENERAL OF METEOROLOGY

INDIA METEOROLOGICAL DEPARTMENT
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15	End users	State Gazetteers Unit, Central and State Ministries of Agriculture, Science & Technology, Education, Irrigation and Power, Disaster Management Agencies.
16	Abstract	The publication contains extensive information on the climate of Himachal Pradesh state as a whole and its districts based on rainfall, temperature, winds, clouds and other weather parameters. The information on droughts, excessive rainfall, depressions and cyclonic storms are also included in the publication.
17	Key words	State Summary, District Summary, Physical Features, Climatic Classification, Heaviest Rainfall, Highest Maximum, Lowest Minimum Temperature.

INTRODUCTION

The climatology of the state of Himachal Pradesh in terms of various meteorological parameters is described in the first chapter. It is followed by a detailed description of the climate of each district in the succeeding chapters. In this publication, the districts of Himachal Pradesh state which were in existence as on 1st January 2006, have been considered and the climatology of these districts, arranged in alphabetical order is presented.

The normals of meteorological parameters used for describing the climate are generally based on data for the period 1961 to 1990, except in the case of rainfall. The normals of rainfall are based on the data for the period 1951 to 2000. These data are obtained from National Data Centre, Pune. The extreme values of temperature and rainfall presented in the publication are based on the data updated upto the year 2003 and 2005 respectively.

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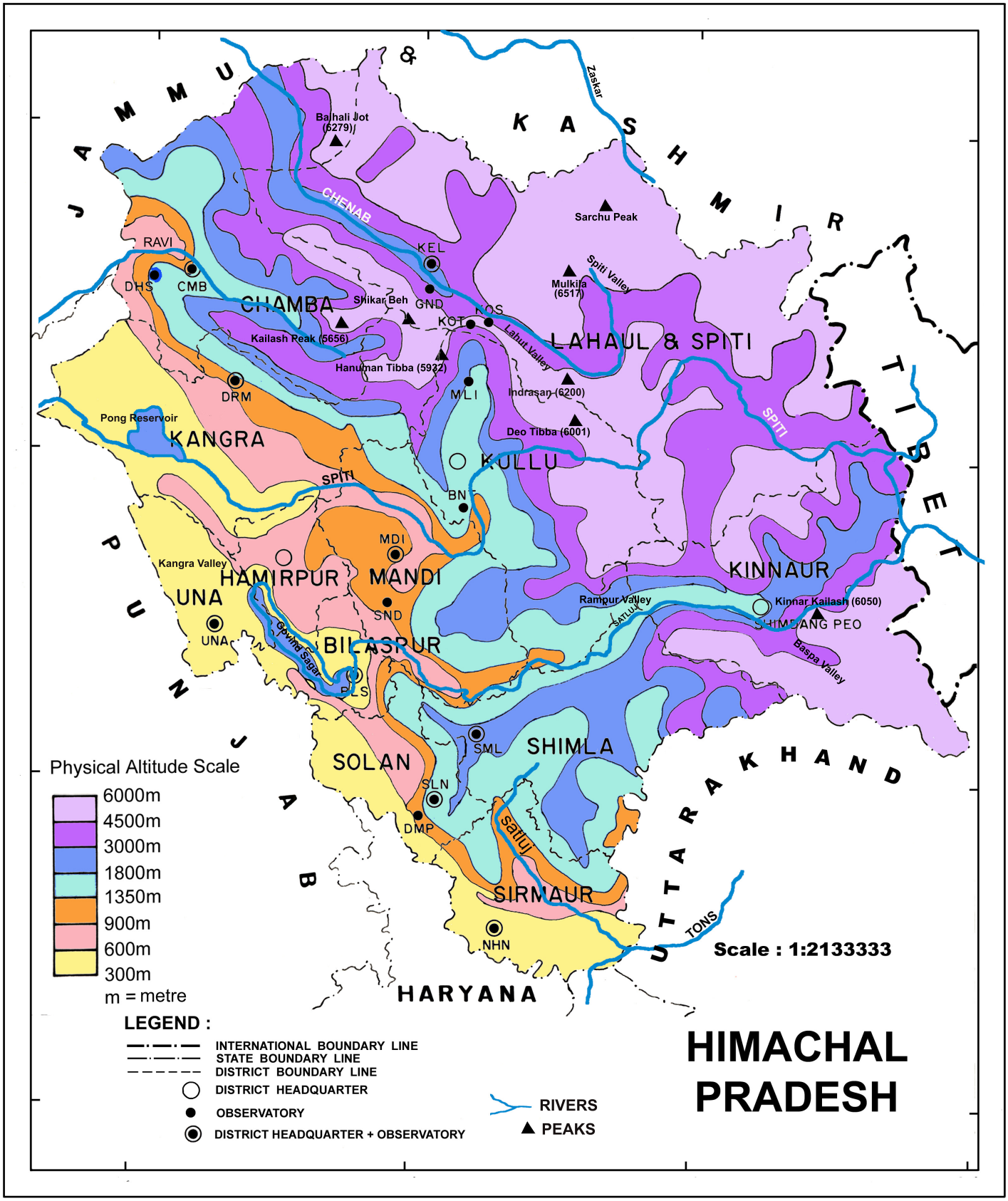

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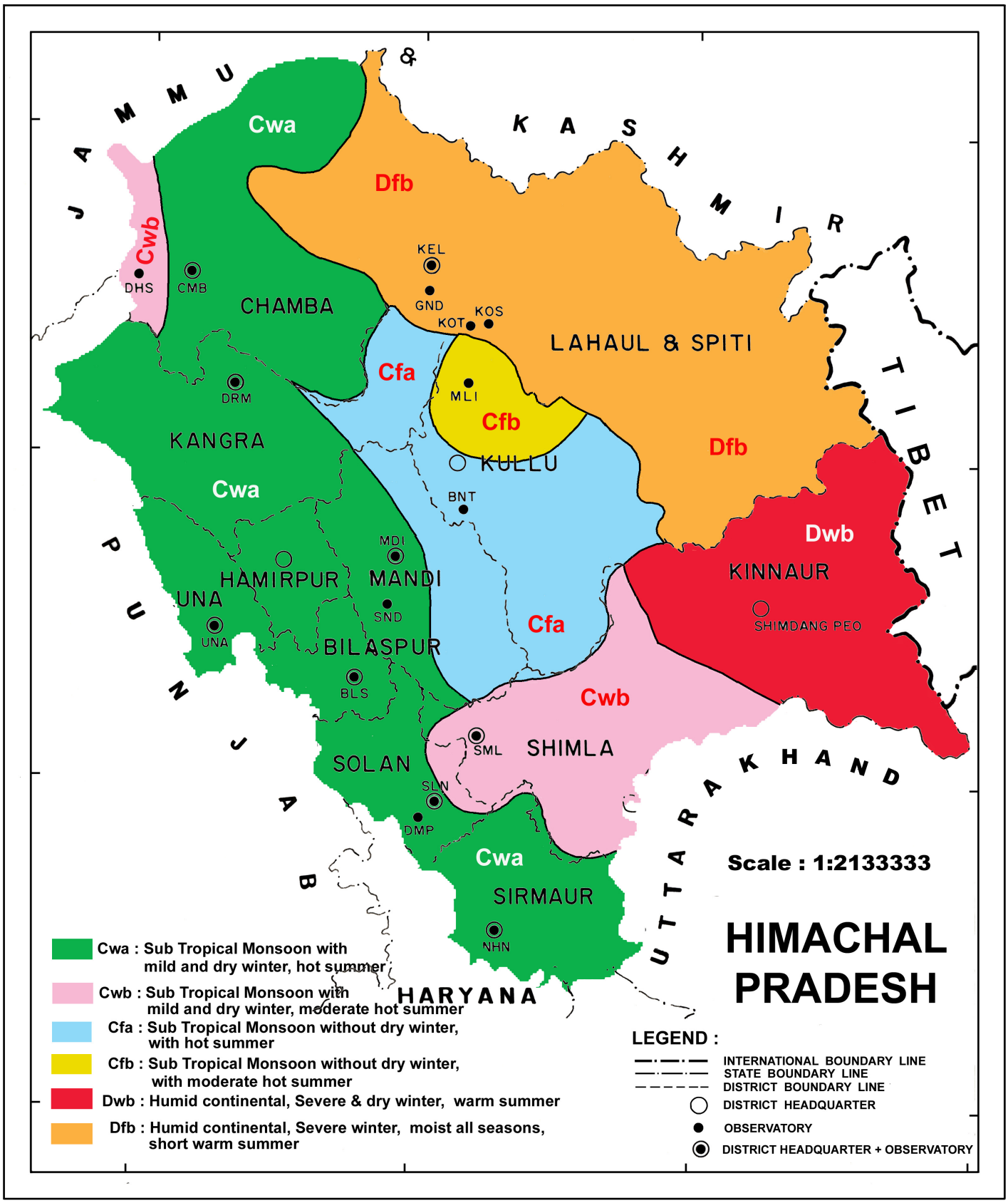

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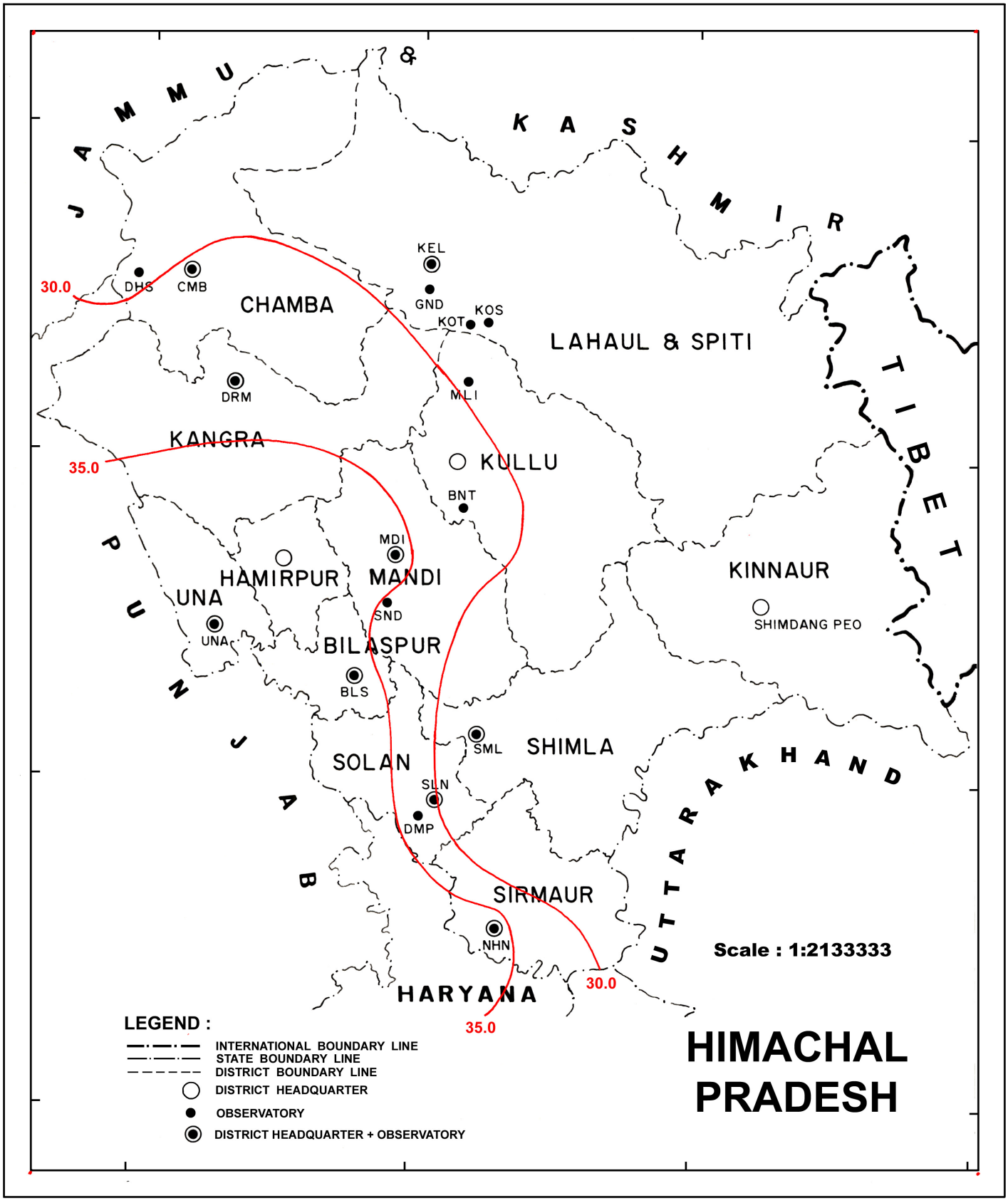

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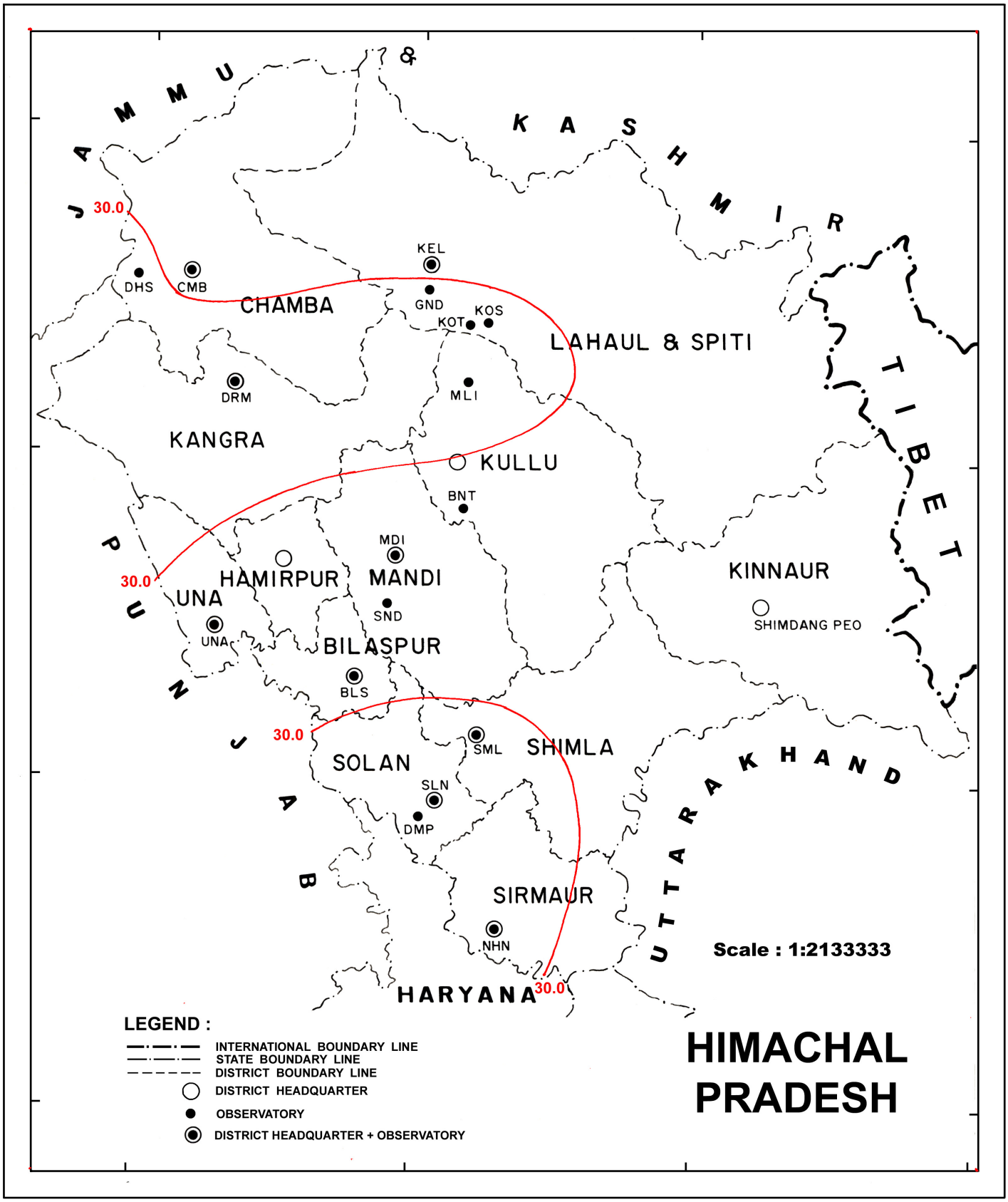

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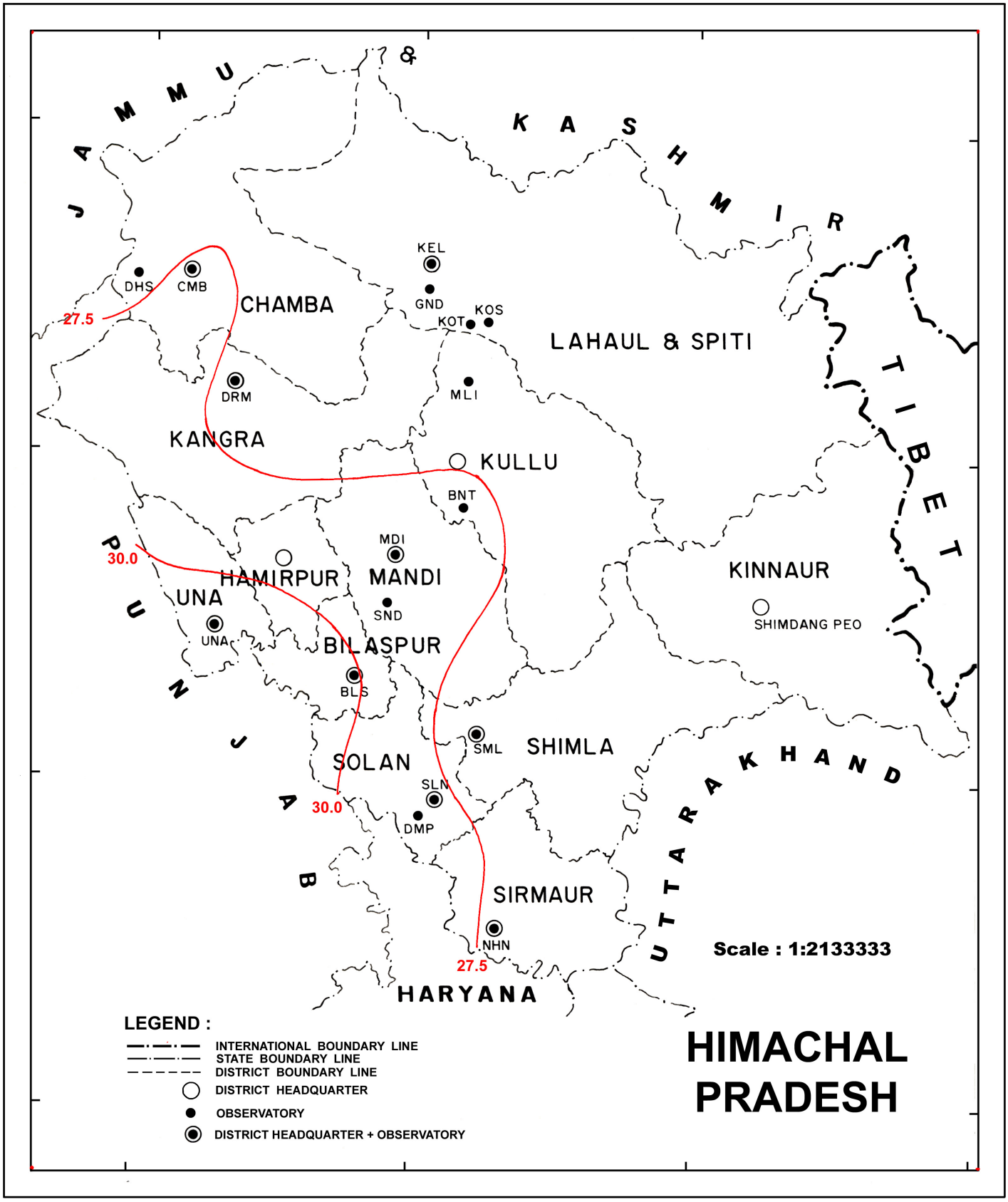

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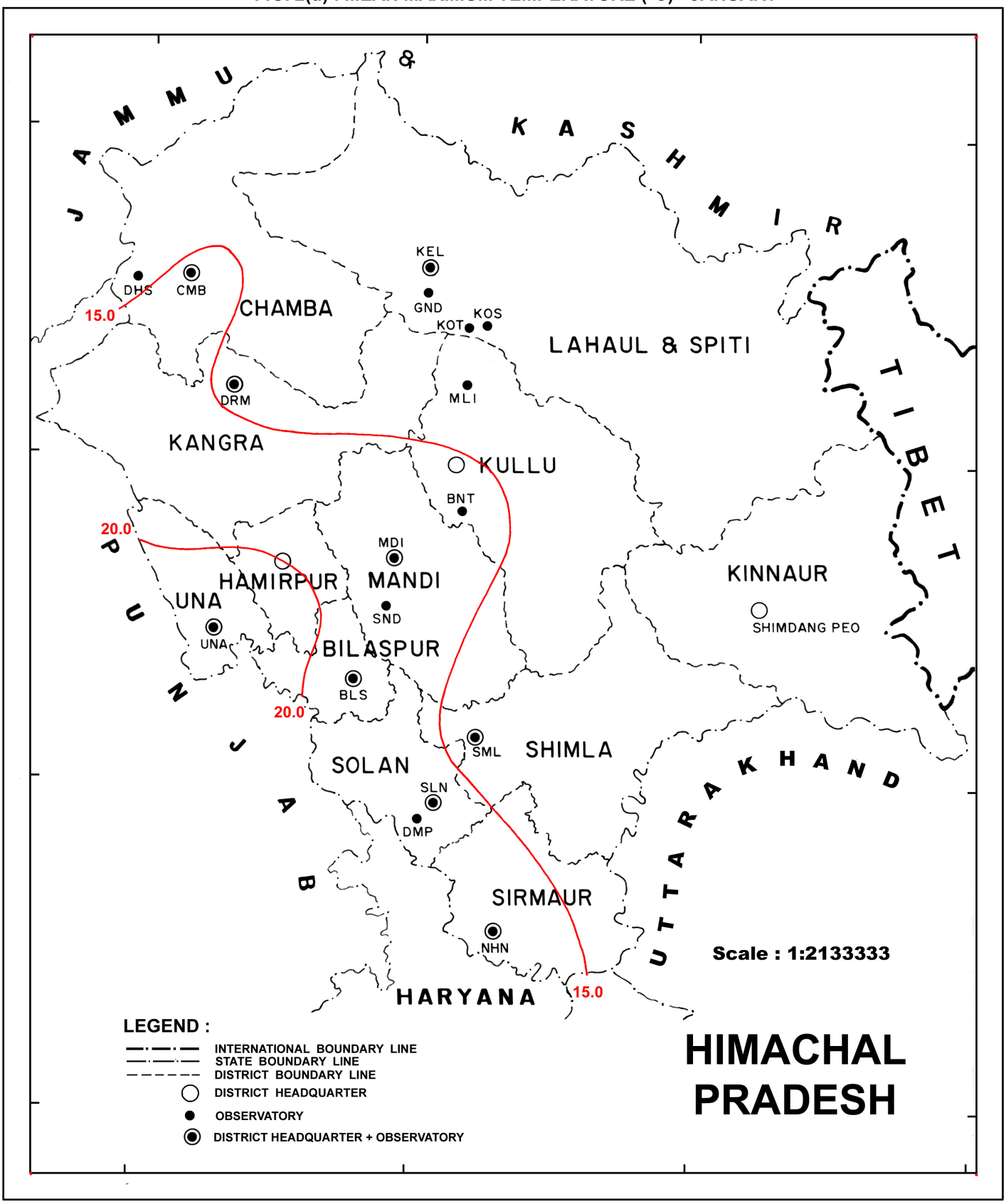

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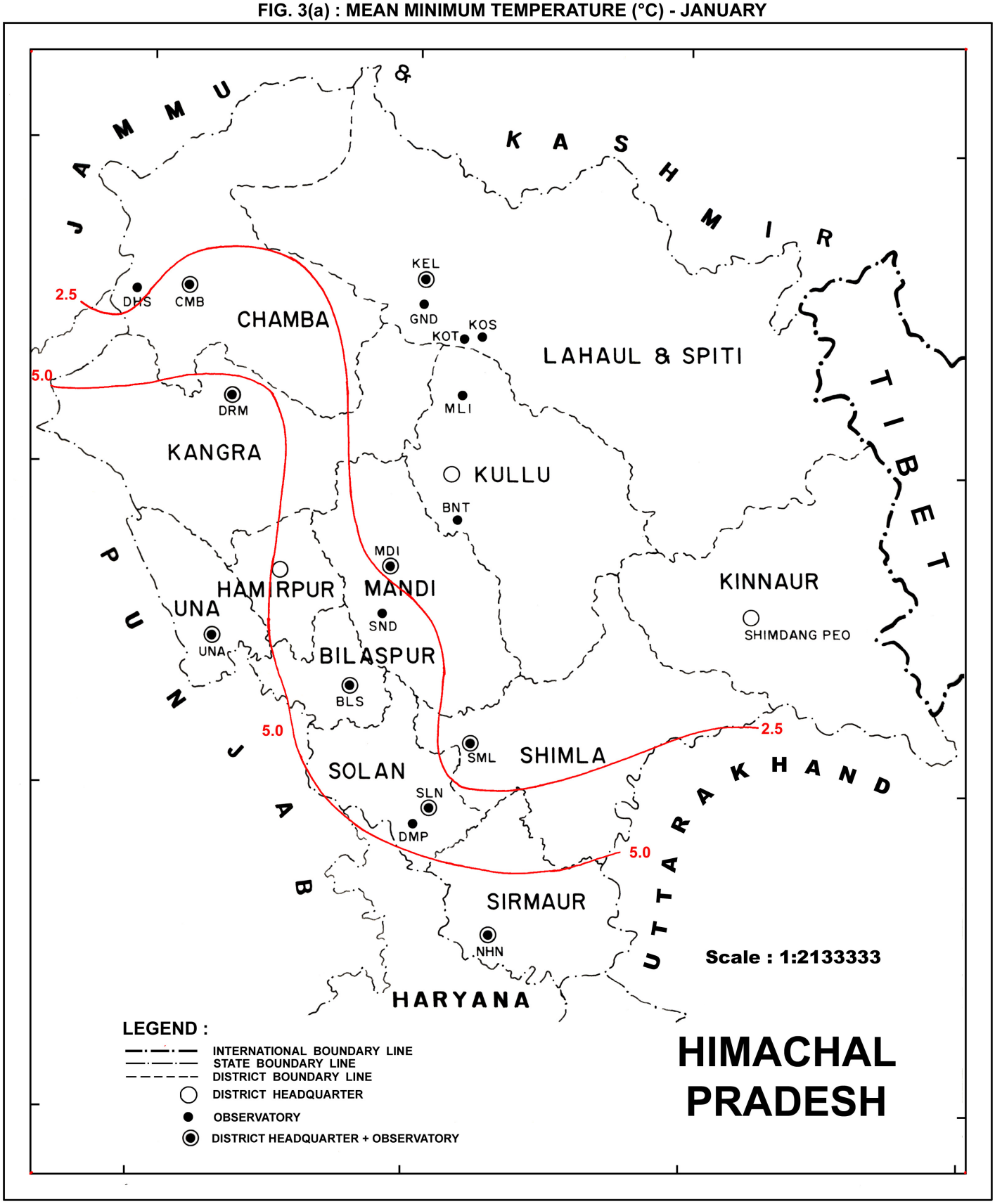

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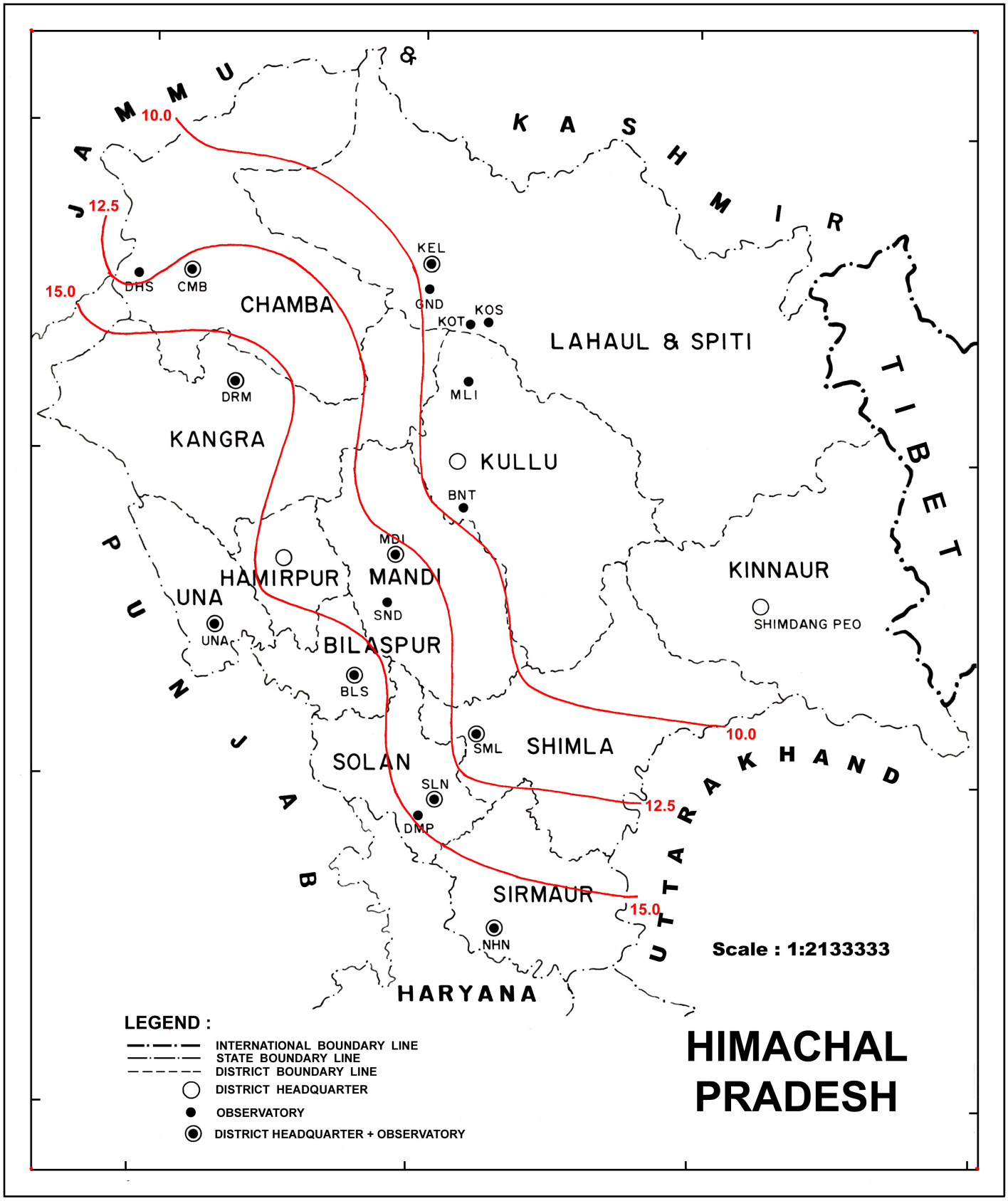

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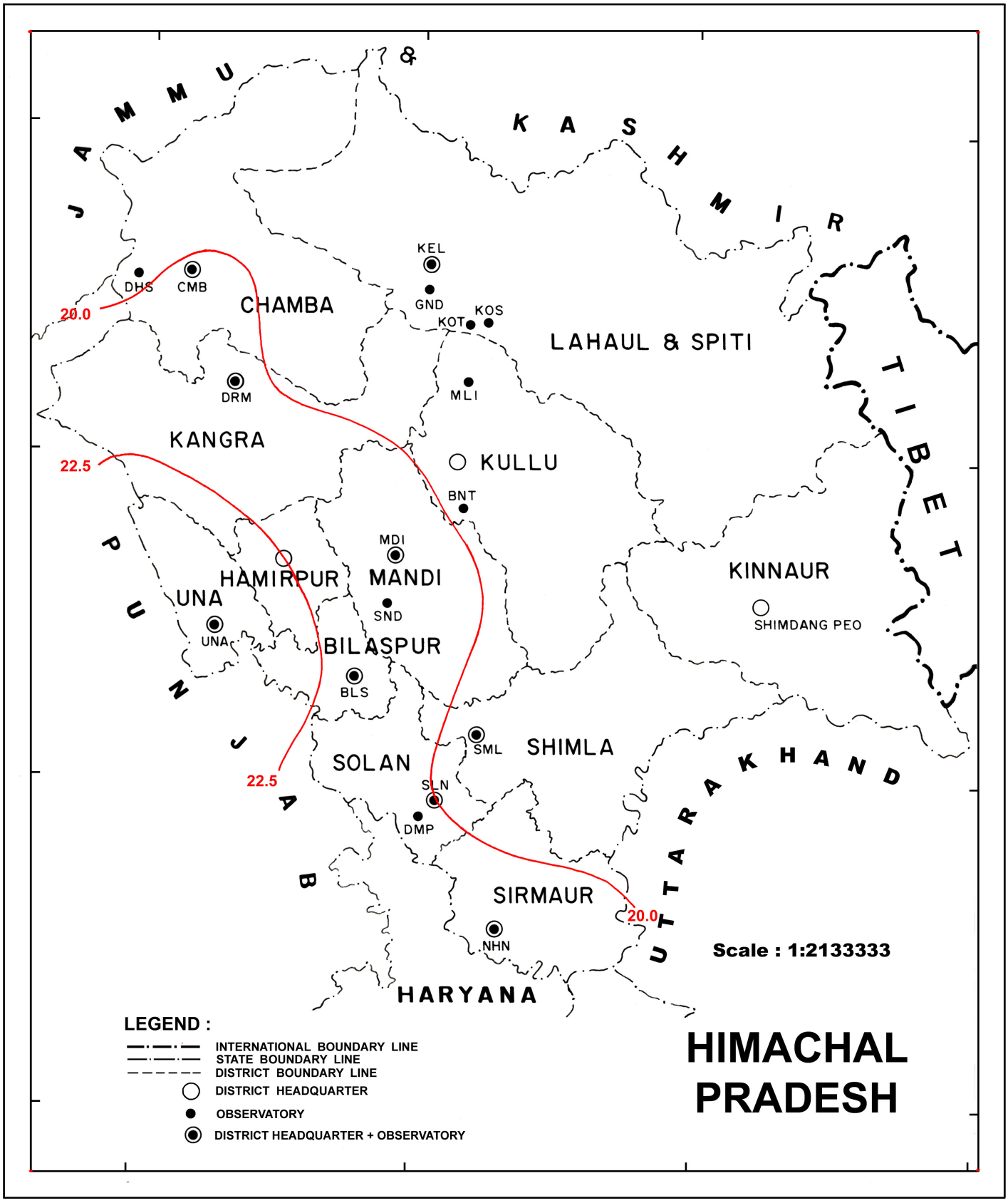

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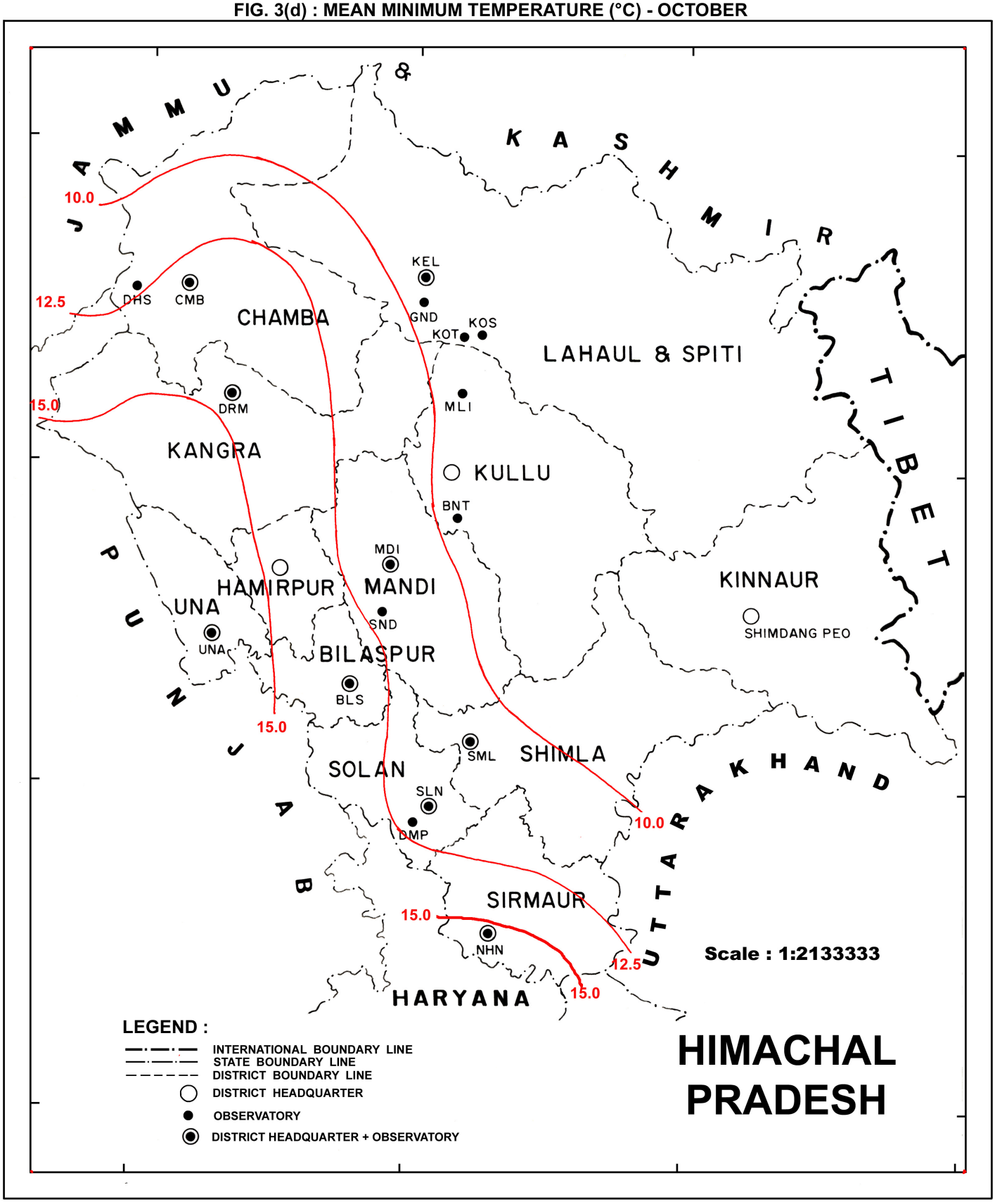

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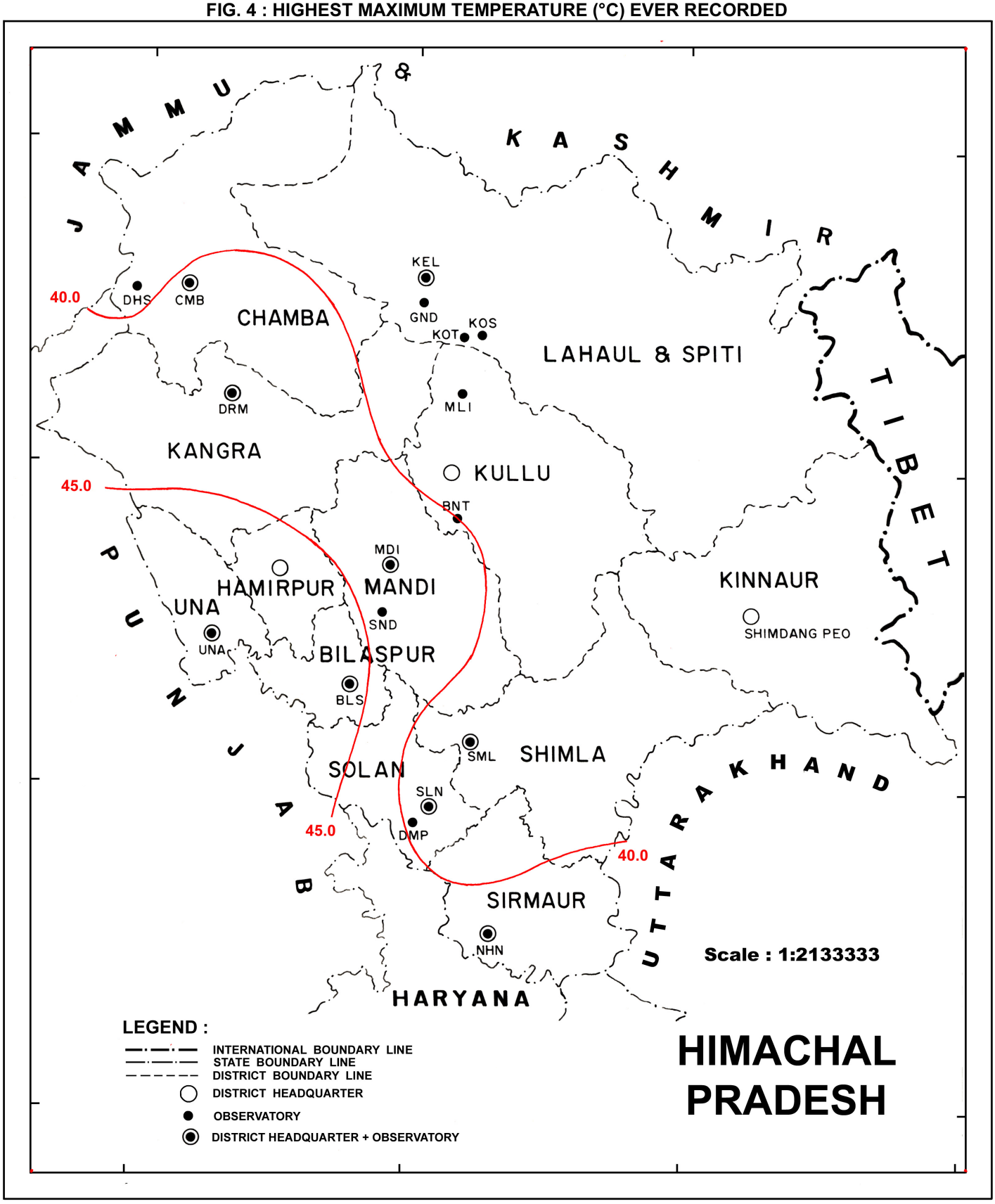

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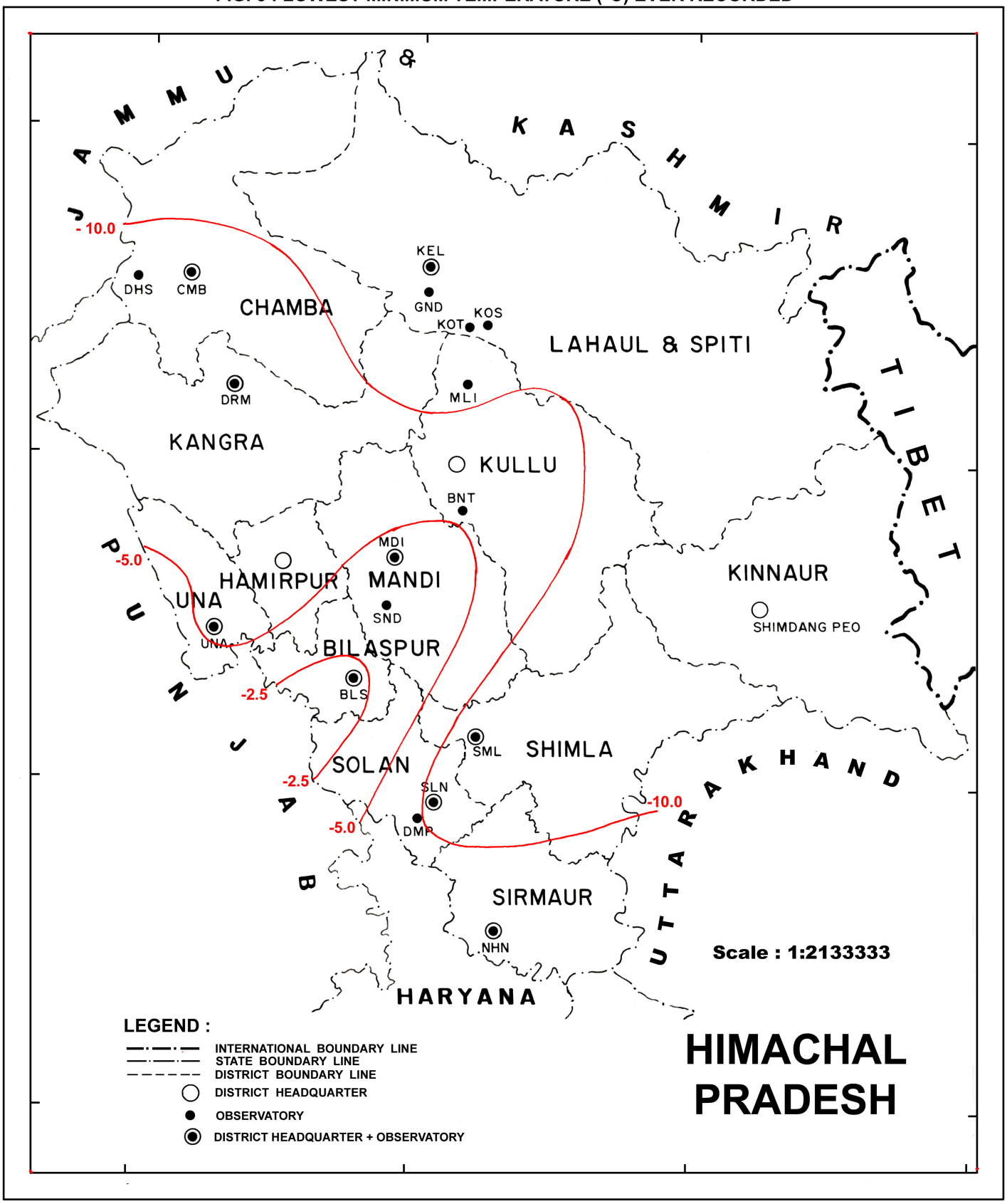

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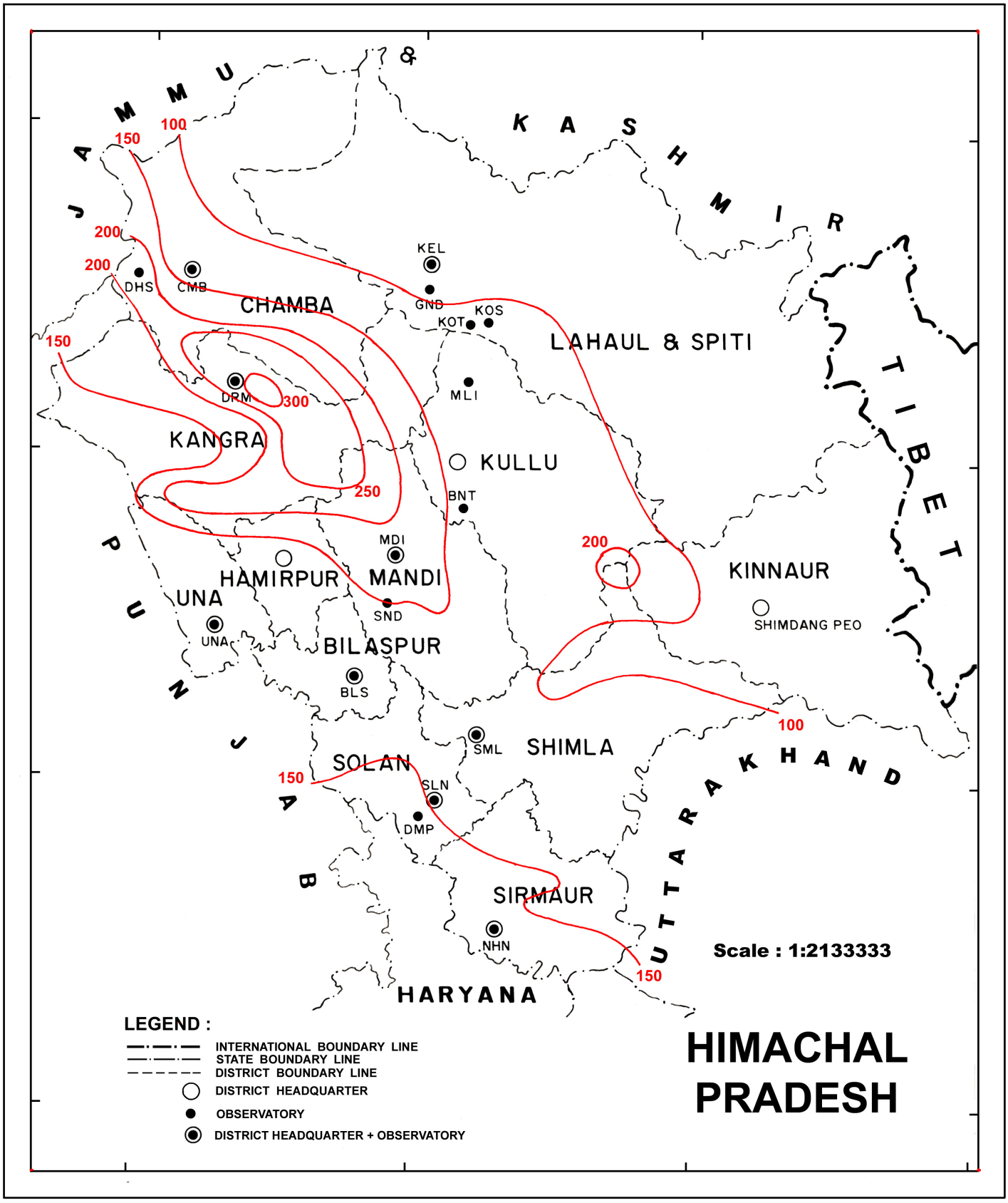

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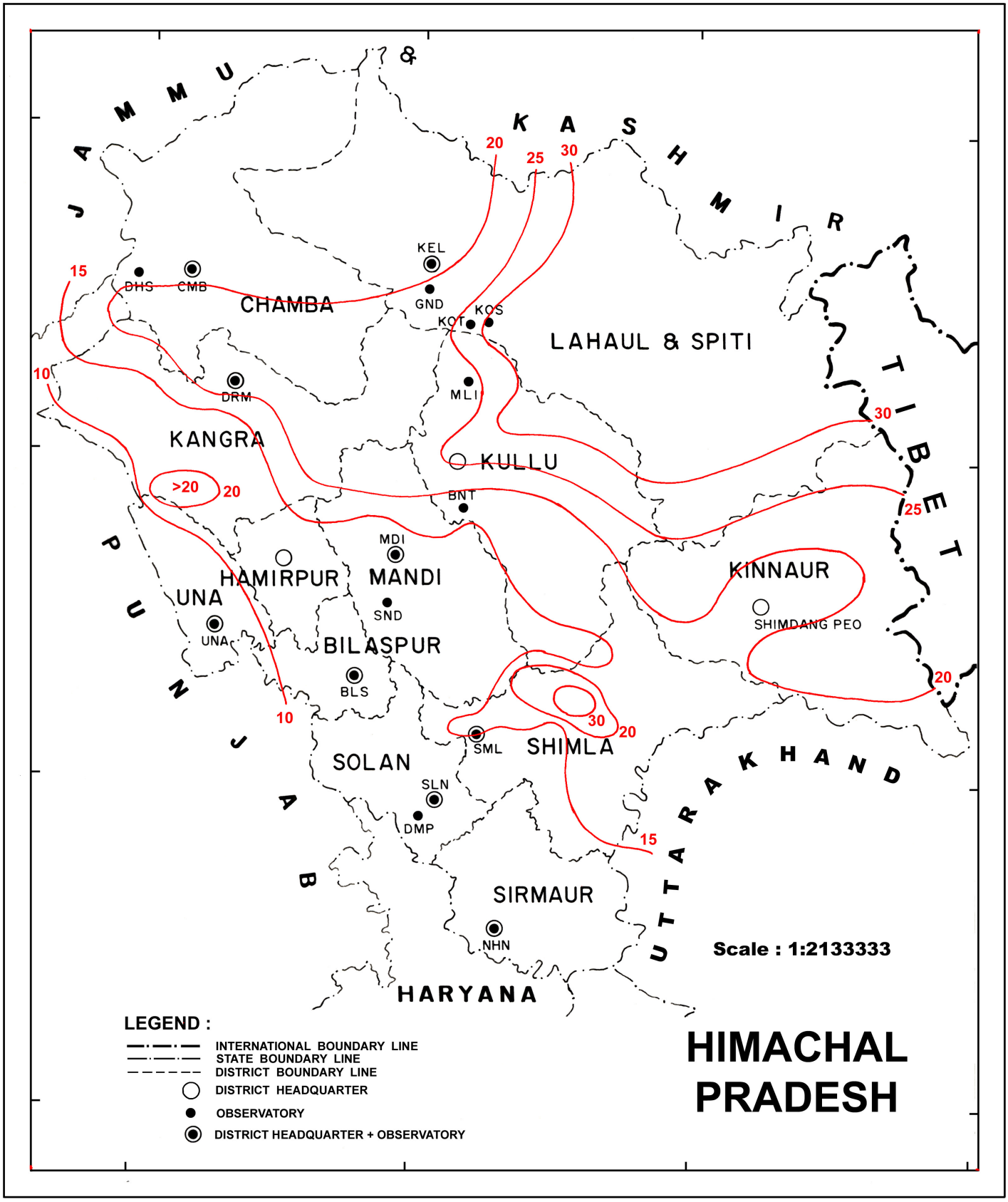

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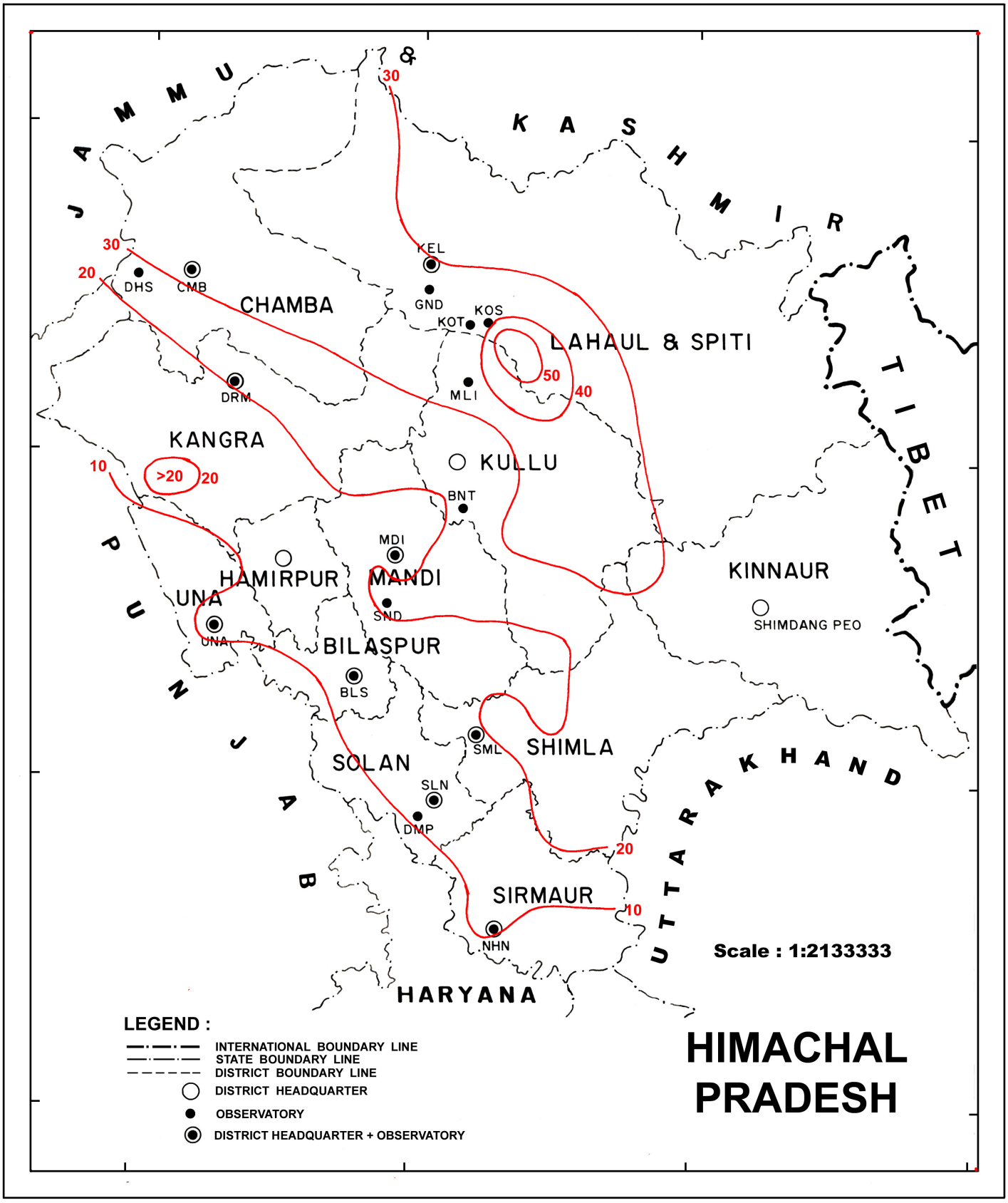

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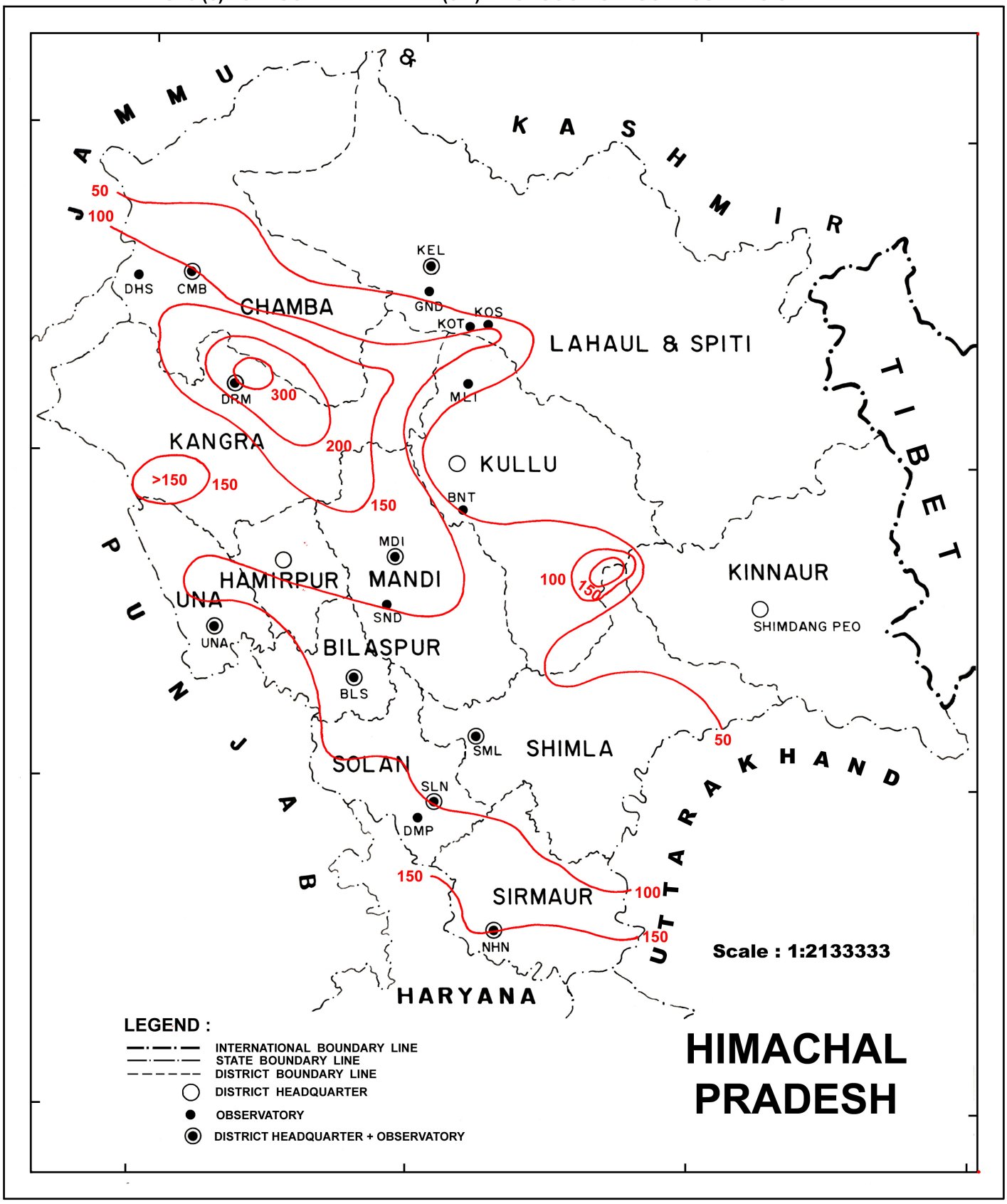

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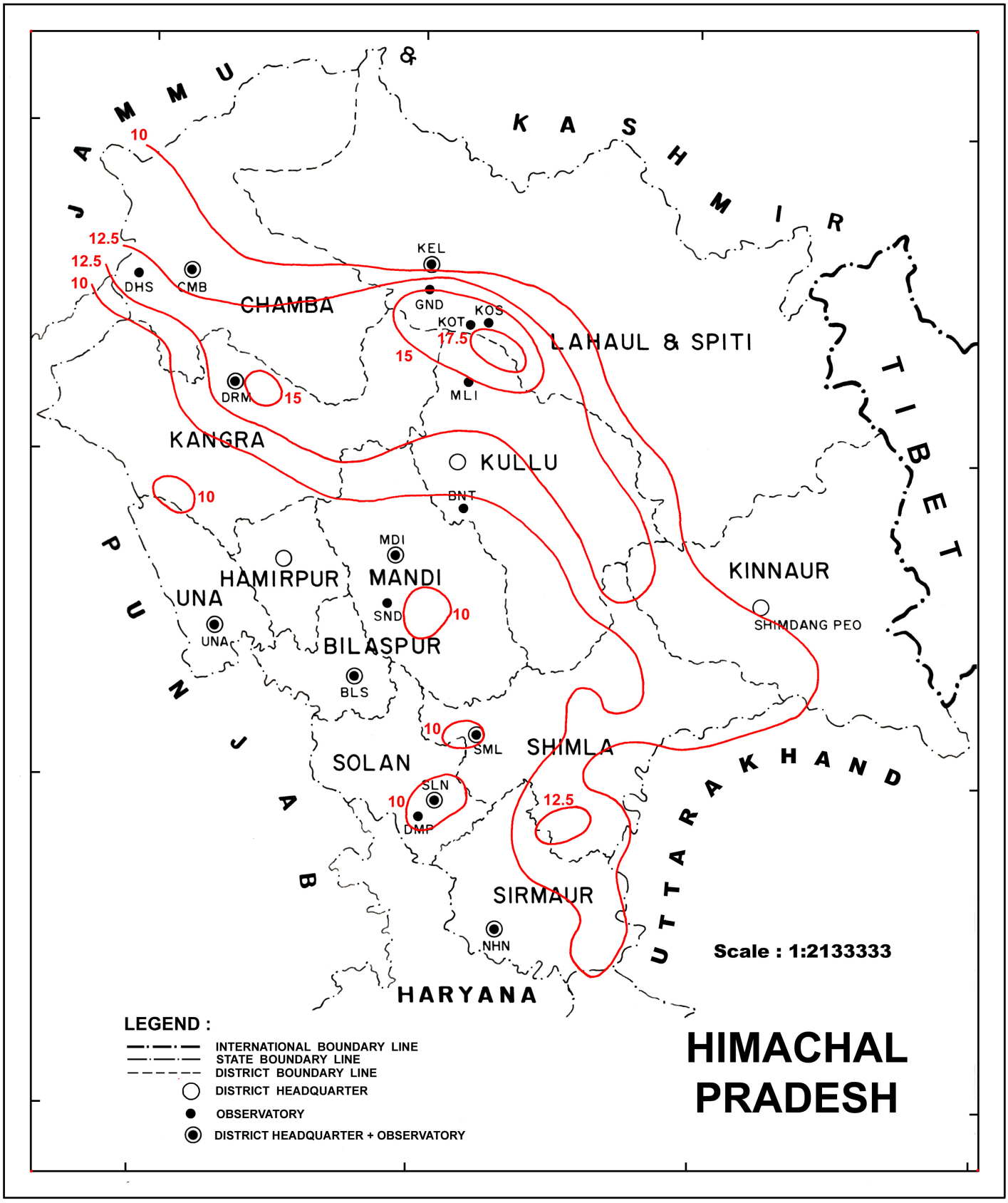

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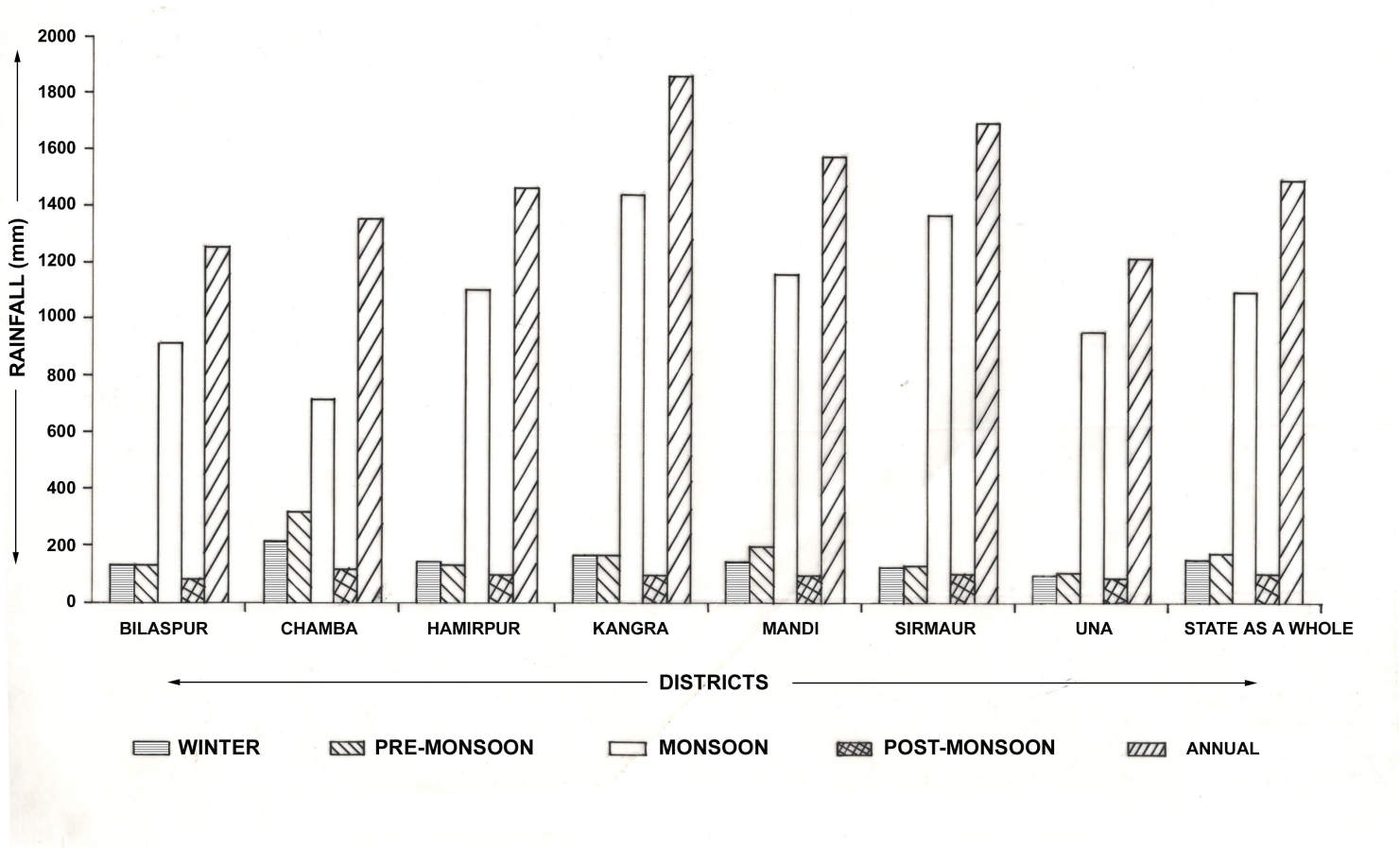

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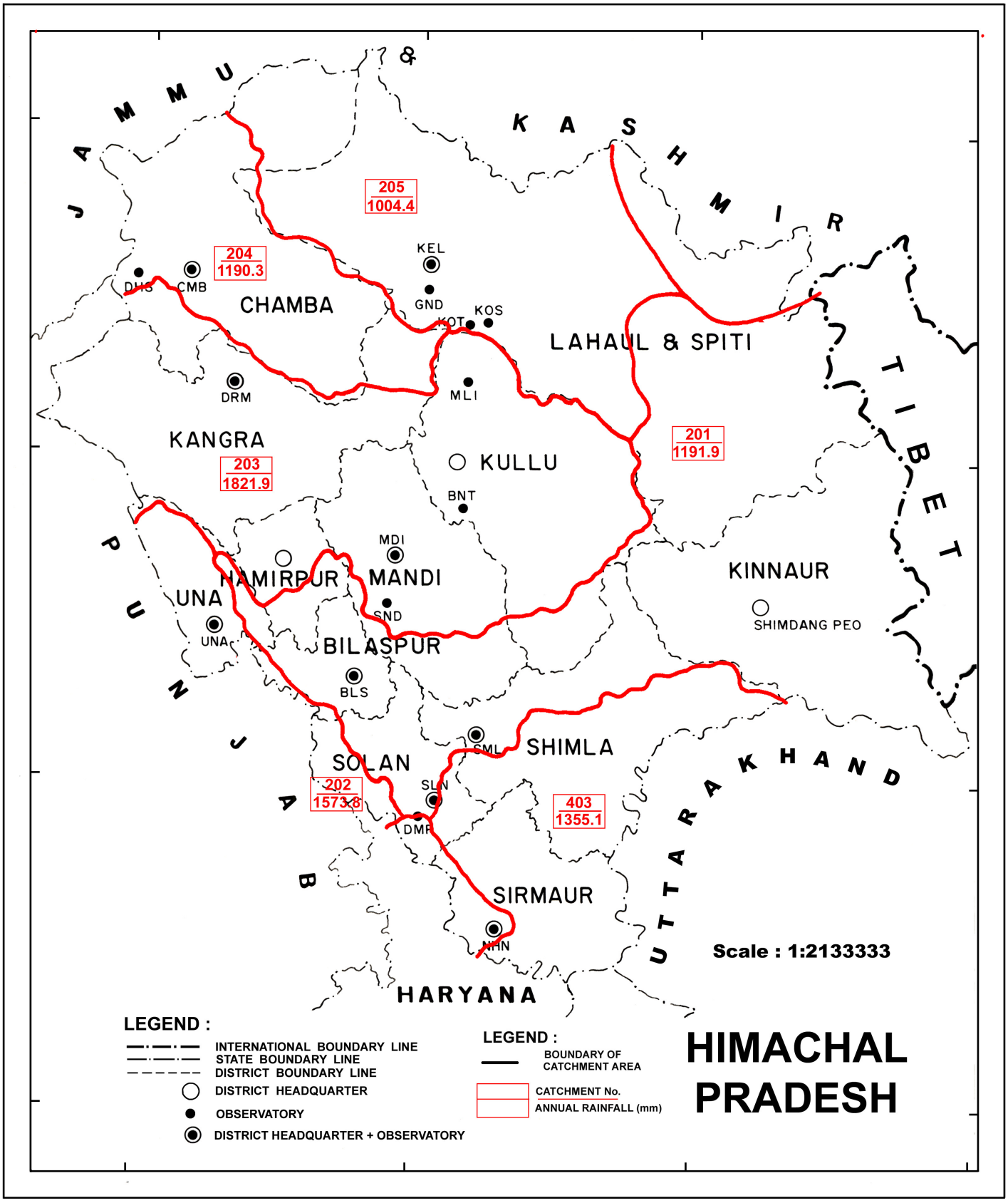

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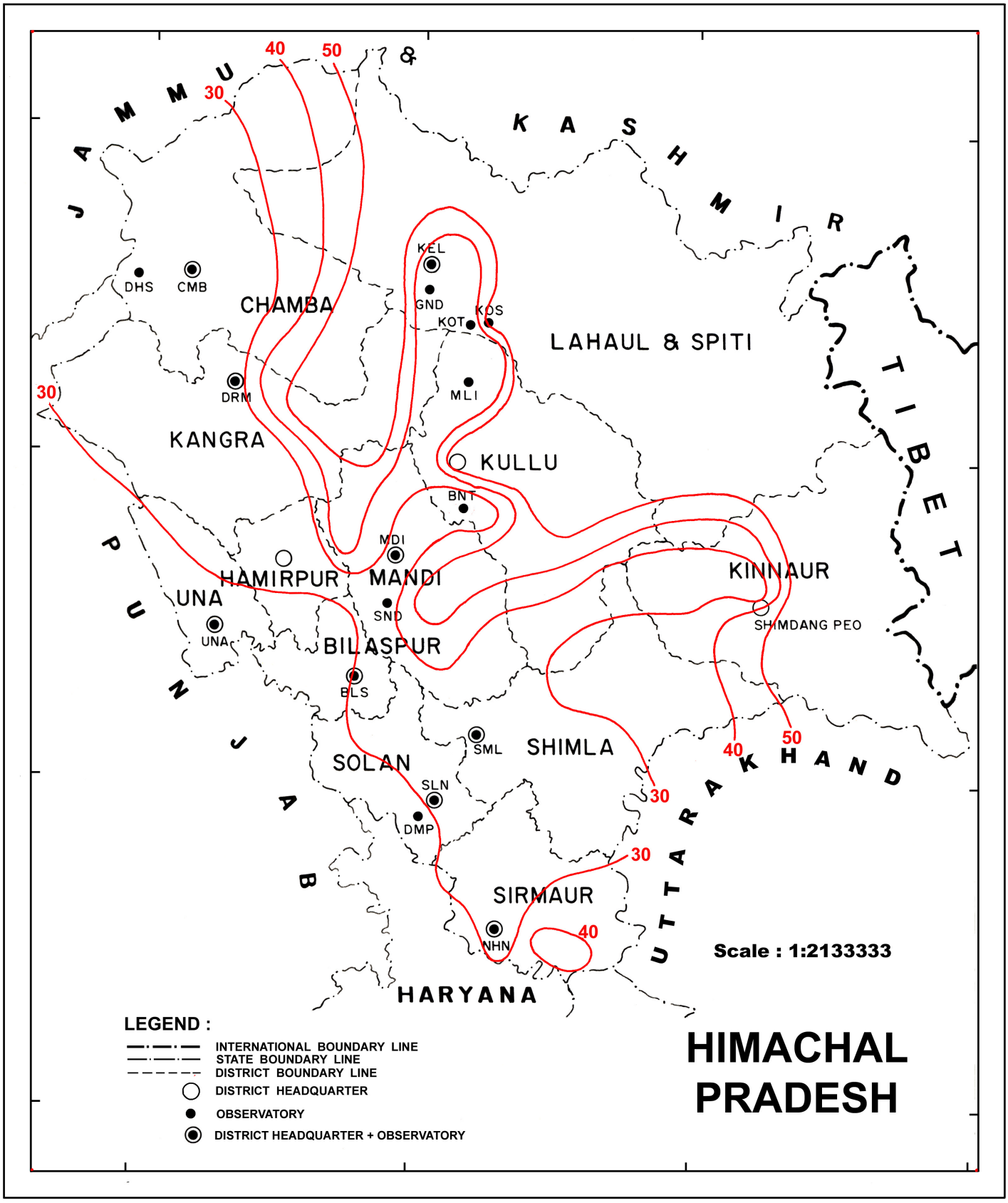

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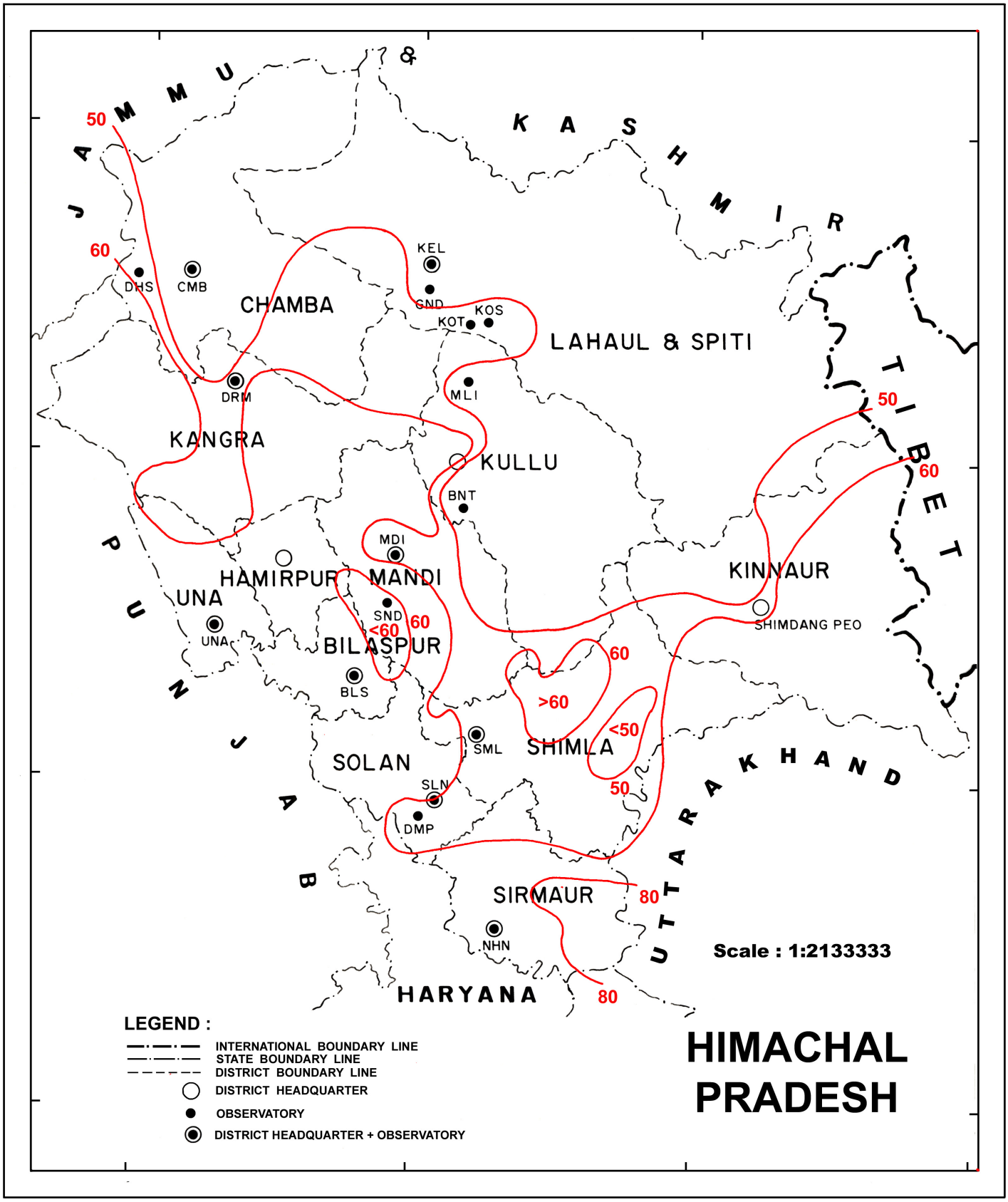

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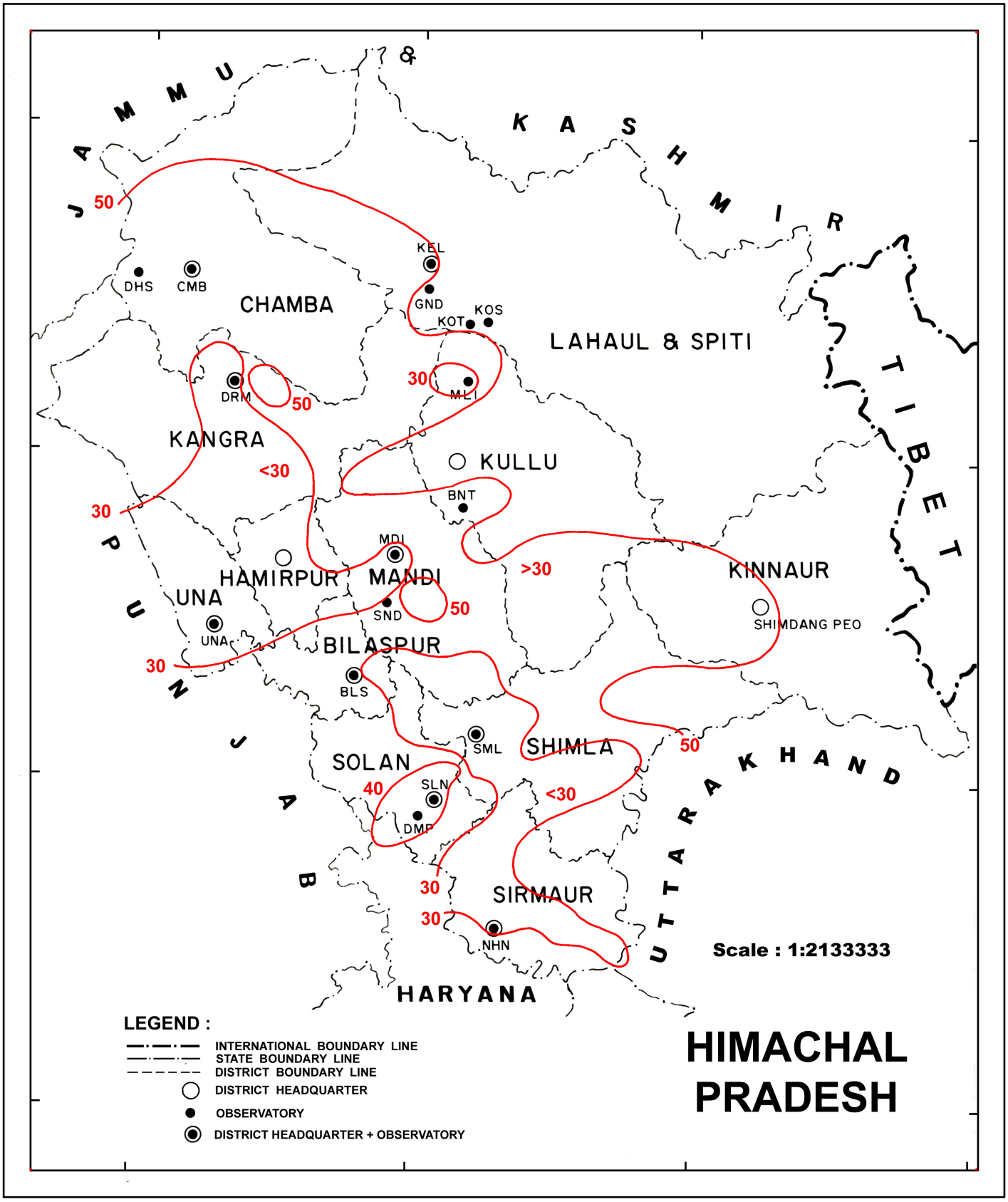

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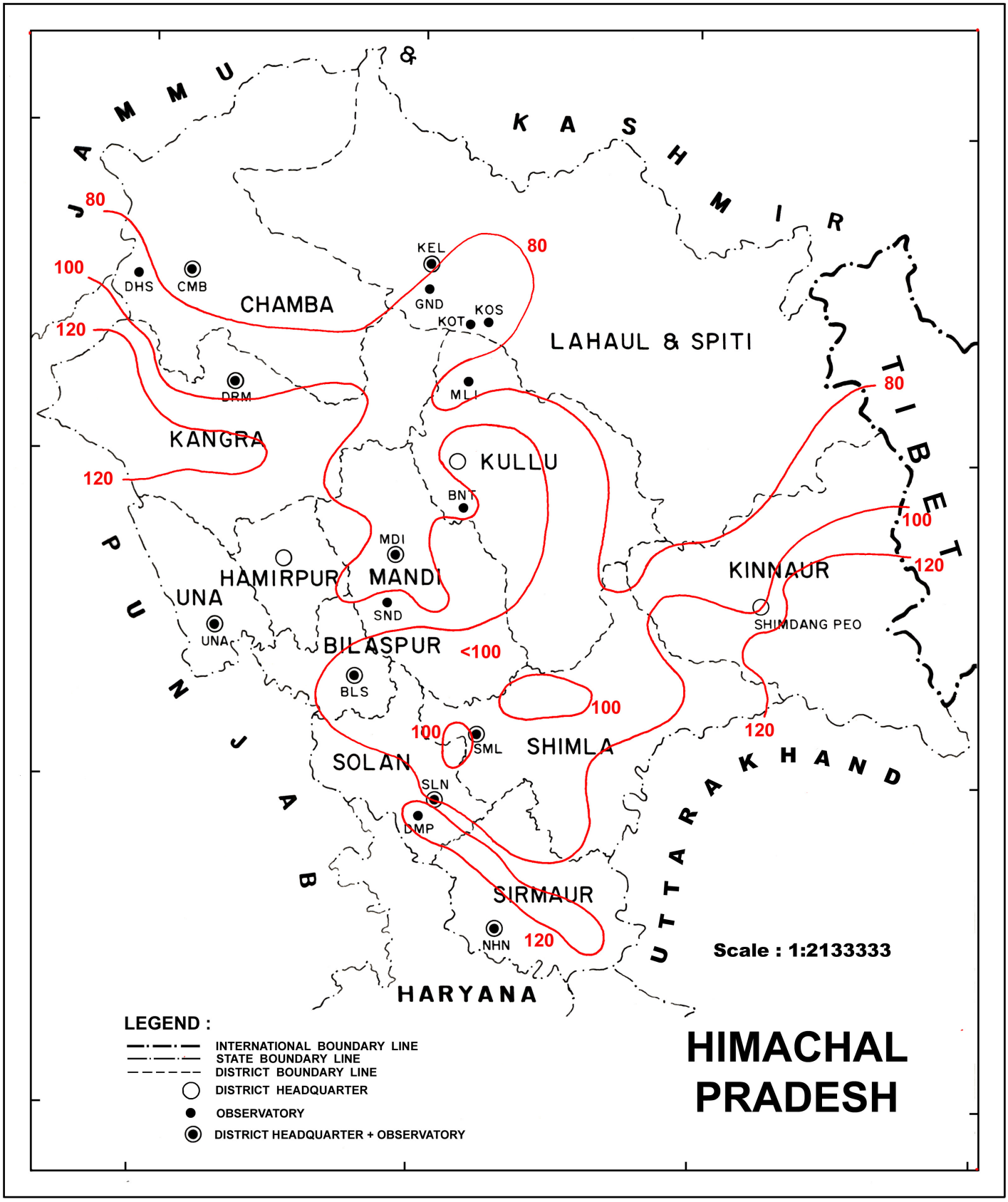

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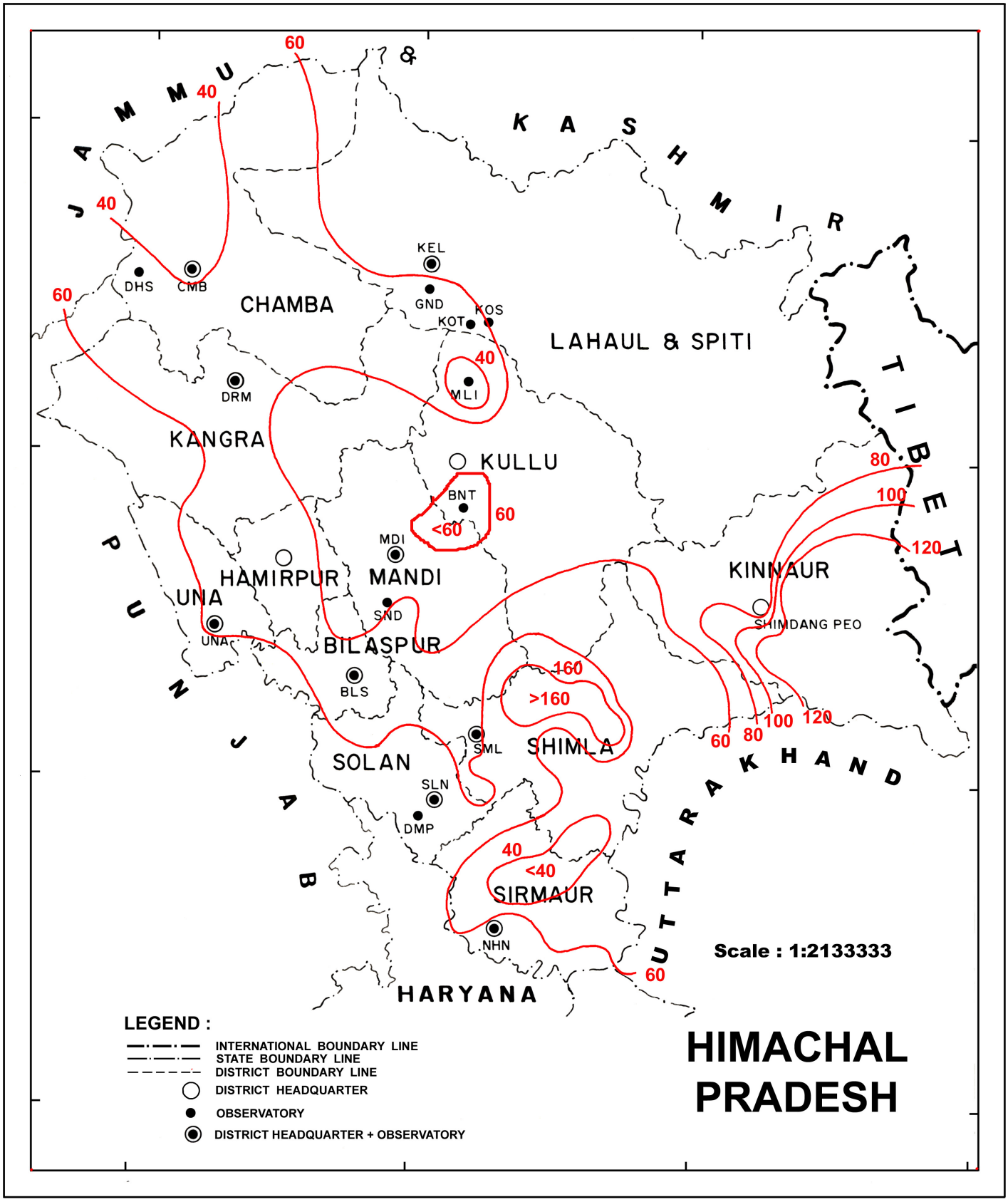

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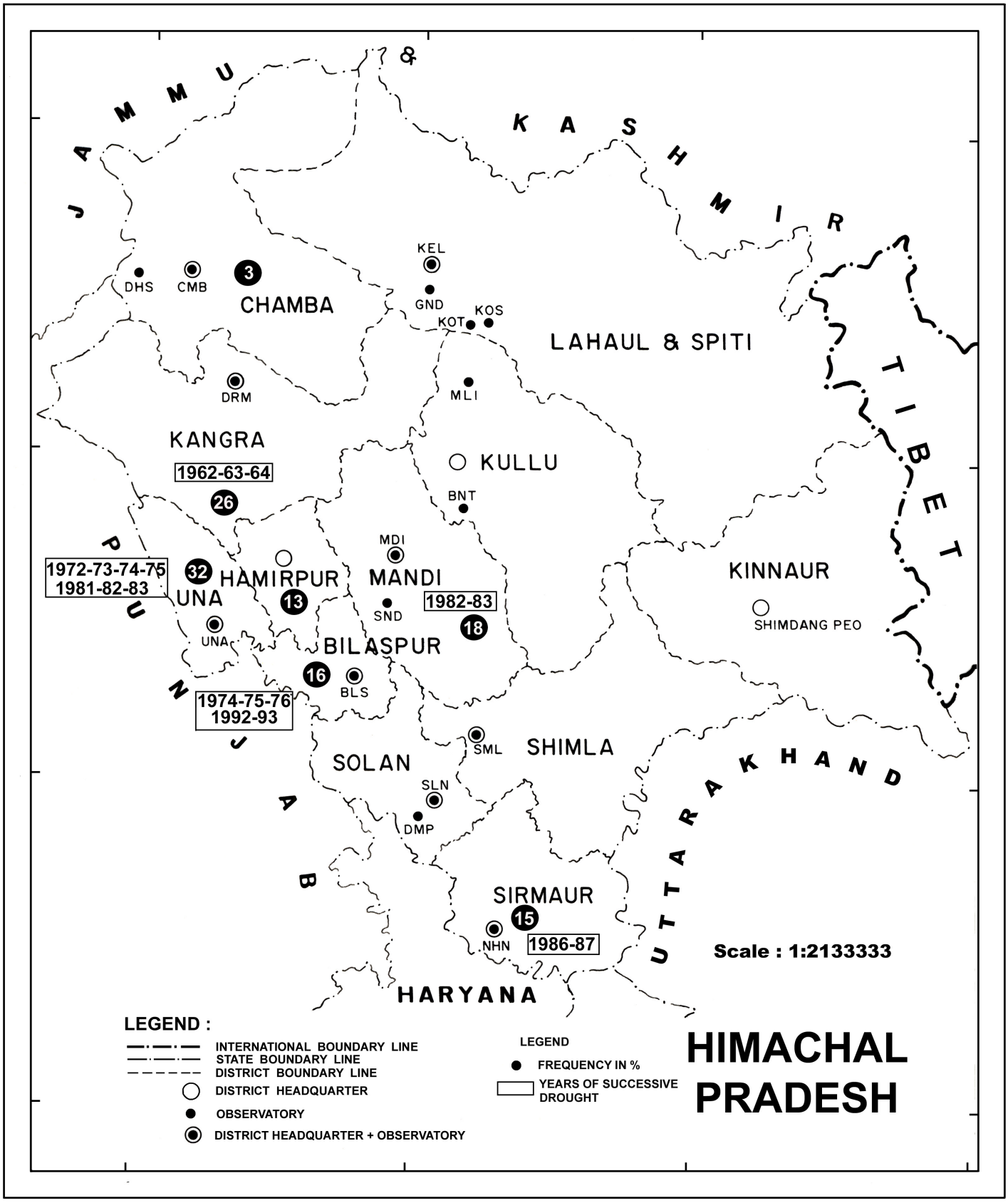

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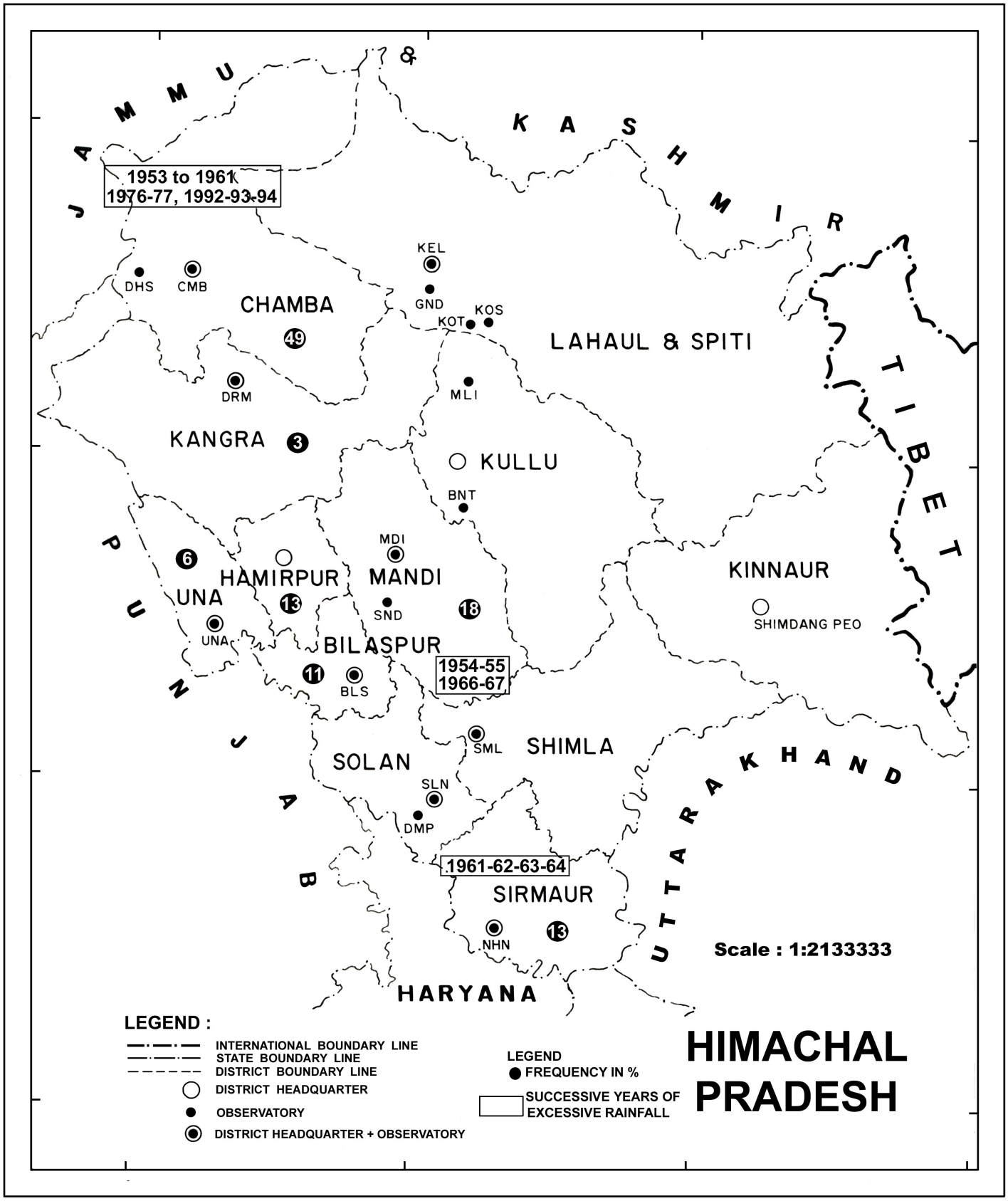

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STATE SUMMARY

CLIMATE OF HIMACHAL PRADESH

General Description

Himachal Pradesh is a state of the Indian Union at the extreme north of the Indian sub-continent roughly between latitudes 30°22′N and 33°12′N and longitudes 75º45′E and 79º04′E, occupying a region of scenic splendor in the western Himalayas. Himachal means Snowy Mountain (hima, “Snow”, achal, “Mountain”), the state (Pradesh) taking its name from the Great Himalayas. The state has an area of 55,673 sq.km and consists of 12 districts. The state is bounded by Jammu and Kashmir on north, Nepal and Tibet on east, Uttaranchal on southeast, Haryana on south and Punjab on west and southwest. The climate of the state varies from place to place depending on the altitude. It varies from hot and sub-humid tropical (450-900 m) in the southern low tracts, warm and temperate (900-1800 m), cool and temperate (1900-2400 m) and cold alpine and glacial (2400-4800 m) in the northern and eastern high mountain ranges. The physical features of the state are shown in Fig. 1. The inset Fig. 1(a) indicates its position in the country.

The state may be broadly divided into 3 geographical regions, viz. outer Himalayas, the lesser Himalayas and the greater Himalayas or the Alpines. The outer Himalayas includes the districts of Bilaspur, Hamirpur, Kangra, Una and the lower parts of Mandi, Sirmaur and Solan. The lesser Himalayas includes the parts of Mandi, Sirmaur and parts of Chamba, Kangra and Shimla. The Alpine zone is at an altitude of 4500 m and beyond, includes Kinnaur and parts of Lahaul and Spiti, Chamba districts. The areas of the state increase in elevation from west to east and from south to north.

The hills in the outer Himalayas are about 600 m above sea level. The inner Himalayas are marked by gradual elevation towards the Dhauladhar and Pir Panjal

ranges and abruptly rises in the Shimla hills, to the south of which is the high peak of Church-Chandni (3647 m) and the rise is gradual towards the north of river Sutlej.

The principal peaks are Mount Parbati (6633 m), Gaya (6794 m), Mulkila (6517 m), Indrasan (6220 m), Sikarveh (6200 m), Jeopango (5870 m), Sarcho peak (5741 m) in Lahaul and Spiti district, Leo-Pargial (6791m),Mani Range (6554 m), Kinnaur Kailash (6050 m), Shrikhand Mahadev (5227 m), in Kinnaur district, Mukarbeh (6060 m), DeoTibba (6001 m), Hanuman Tibba (5932 m) in Kullu district, Churdhar peak (3647 m), Hatu peak (3631 m) in Shimla district and Kailash peak (5656 m) in Chamba district.

The principal rivers of the state are Chenab, Ravi, Beas, Sutlej and Yamuna. These perennial rivers are fed by snow and rainfall. The Beas rises in the Pir Panjal range near the Rohatang Pass. This river is formed by a number of tributaries, the important being the Parbati, the Hurla, the Sainj, the Uhl, the Suheti, the Luni, the Banganga and the Chaki. The northern and eastern tributaries of the Beas are snow fed and perennial, while the southern affluents are seasonal. It passes through parts of Manali, Kullu, Sujjanpur and Dehra. The river Chenab, which is the largest river is formed by confluence of two streams, Chandra and Bhaga at Tundi, in Lahaul and Spiti district. The origin of the river Ravi is Bara Banghal in Kangra district as a joint stream formed by the glacier fed Bhadal and Tant gari. Chamba lies on its right bank.The Sutlej originates in distant Tibet. It cuts through both the great Himalayan and the Zaskar ranges and crosses the Indo-Tibetan border near Shilpakila. The river Spiti joins from the north. The river passes through parts of Kinnaur, Rampur, Tatapani (Shimla).The Yamuna has its origin in Yamunotri in Uttar Kashi (Uttaranchal). Its main tributaries are the Tons, the Giri and the Bata and passes through Ponta Sahib.

The Himachal Pradesh representing only one meteorological sub –division consists of the following 12 districts:-

1	Bilaspur	7	Lahaul and Spiti
2	Chamba	8	Mandi
3	Hamirpur	9	Shimla
4	Kangra	10	Sirmaur
5	Kinnaur	11	Solan
6	Kullu	12	Una

Climate

Areas in the state under each climatic pattern based on Koppen's classification are shown in Fig. 2. This broad classification is based on the variation of temperature and rainfall. The state as a whole mainly comes under the climatic type as stated below :

The districts Bilaspur, Kangra, Mandi, Sirmaur and Una fall under the climatic type Cwa; Sub-tropical monsoon, mild and dry winter and hot summer. Only Shimla district has got the climatic type Cwb; Tropical upland, mild and dry winter, short warm summer; Chamba district has a climatic type Cfa; Humid subtropical, mild winter, moist all seasons, long hot summer. Kullu district has a climatic type varying between Cfa and Cfb; Humid sub tropical, mild winter, moist all seasons, long hot summer and marine. As the sufficient temperature data for the districts Lahaul and Spiti and Kinnaur is not available, climatic type of these districts is not mentioned.

The year may be divided into four seasons. The winter season from January to February is followed by the pre-monsoon or hot weather season from March to May. The period from June to September constitutes the southwest monsoon season and the period from October to December is the post monsoon season.

During the period from January to February, generally low temperature prevails over the entire state and is generally very unpleasant due to biting cold. In this season, a series of western disturbances affect the climate of the state. Heavy snowfall occurs during this season. In the summer months from March to May, weather is very dry. In the hilly regions, due to lower temperature, the climate of the state is comfortable. 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.

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 winter and 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 decreases towards south or

southeast. During January to April, winds are mainly from south, southwest and southeast directions. In July, winds are mainly from south, southwest directions. October is the month of transition with the weakest pressure gradient. From October onwards, the change over of the pressure pattern to winter type commences. Table – I gives the mean monthly wind speed (kmph) and predominant wind direction at observatory stations in the state.

Temperature

Table II gives the mean daily maximum and mean daily minimum temperature and table II(a) gives the ever recorded highest maximum and the lowest minimum temperature at observatory stations in the state.

The spatial distribution of the mean daily maximum temperature for the representative months of four seasons of a year is depicted in Fig. 2 (a,b,c,d). It is observed that the temperatures of hilly districts with deep valleys vary considerably from place to place depending on elevation. June is the hottest month with the mean daily maximum temperature at 35.5ºC in the plains and 28.7ºC in hilly places. During June, the mean daily maximum temperature ranges from 24ºC to 38.4ºC over the state, the values increasing southwest wards. The highest values are observed over the extreme southwestern region (Fig. 2(a)). With the onset of monsoon, the day temperatures fall appreciably. During August, an appreciable drop in the mean daily maximum temperature is observed with the values ranging between 20.4ºC and 32.6ºC (Fig.2(b)). The value of mean daily maximum temperature in October ranges between 18.8ºC to 30.6ºC with the values generally increasing southwest wards (Fig.2(c)). From Fig. 2(d), it is observed that the mean daily maximum temperature of January ranges between 9.3ºC and 20.3ºC. The temperature pattern of January (Fig. 2(d)) is quite similar to that of October (Fig. 2(c)).

The spatial distribution of the mean daily minimum temperature for the representative months of four seasons of a year is depicted in Fig. 3 (a,b,c,d). In the month of January, the minima of the mean daily minimum temperature are observed over the northeast region of the state (Fig. 3(a)). The values range between -1.7ºC to 7.3ºC. Over the southern region of the state, temperature higher than 5ºC is observed. During the winter months, cold waves associated with western disturbances may bring down night temperatures appreciably, even 5-10ºC below the freezing point of water on some occasions. In the month of April, the values range between 6.2ºC to 18.4ºC (Fig. 3(b)). The temperature is more than 18ºC over

the extreme southern region of the state. The lowest value of the mean daily minimum temperature is observed over the northern region of the state. In the month of July the values of minimum temperature range between 14.7ºC to 24.5ºC (Fig. 3(c)). The values of mean daily minimum temperature over the hilly region of the state are generally lower than 20ºC. During the month of October (Fig. 3(d)), the values of mean daily minimum temperature range between 5.3ºC to 17.5ºC. The temperature over the hilly region is observed to be lower than 11ºC except Dharamsala observatory.

The highest maximum temperature and the lowest minimum temperature ever recorded are depicted in fig. 4 and 5 respectively. The highest maximum temperature ever recorded in the state is 49.9ºC on 8th May 1958 at Gondla observatory and the lowest minimum temperature ever recorded in the state is -25.9ºC at Keylong observatory on 21st February 1978 in Lahaul and Spiti district.

Thus, day temperatures in the state increase uniformly from April to October. In general, the night temperatures are lower in the higher latitude districts. Both day and night temperatures are lower over the hilly stations than those over the plains.

Maximum temperatures rise rapidly from February onwards till June and it ranges from about 10ºC to 16ºC at plains and about 14ºC to 16ºC over the hill stations, whereas minimum temperatures rise rapidly during the period from February to July and it ranges from 13ºC-18ºC at plains and 12ºC-16ºC at hill stations.

In the state, from the beginning of June to the end of July, the maximum temperature falls by about 2ºC-6ºC whereas the minimum temperature falls only by about 2ºC-3ºC from July to September. Both day and night temperatures start falling rapidly after October and attain the lowest value by January over the state. August has the lowest diurnal range of temperature, about 9ºC in plains and about 8ºC in hill stations. The diurnal range increases rapidly after the withdrawal of southwest monsoon. During the period from November to June, the diurnal range is of the order of 14ºC-17ºC at plains and 11ºC-14ºC at hills stations.

Humidity

Table III gives the mean relative humidity at 0830 and 1730 hours IST for observatory stations in the state. The relative humidity is generally high during the

period from July to September and is least during the summer afternoons when it ranges between 32% and 50% over major parts of the state. The diurnal variation of relative humidity is the least during the southwest monsoon season, and the highest during the winter period.

Cloudiness

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

The period October to November, is generally cloudless or lightly clouded. Afternoons are however, comparatively more clouded than forenoons, particularly during summer. During the southwest monsoon season June to September, the skies are heavily clouded particularly during July and August. On an average, in each of the two months, the sky remains overcast for more than about 8 days per month except Chamba and Dalhousie in Chamba district. It remains clear on an average for three to five days per month over the plains and one to two days per month over the hill stations during these two months. Some hill stations have no clear days in a month. By October, clouding decreases considerably over the entire state.

Rainfall

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

The total annual rainfall in the state is the maximum over the region of Kangra district and neighbourhood (Fig.6). The total annual rainfall for the state is 149 cm and the total annual number of rainy days is 65. Kangra district receives the maximum amount of rainfall (185 cm) in a year, whereas Una receives the minimum amount of rainfall (121 cm) in a year. Fig. 6(a) and 6(b) show rainfall pattern during winter season (January to February) and pre- monsoon season (March to May). The rainfall over the state increases towards northeast region during winter and pre-monsoon. The pattern of spatial distribution of the rainfall over the state during the

southwest monsoon season Fig. 6(c) generally resembles to that of the spatial distribution of the annual rainfall Fig.6. In both the cases rainfall is the maximum in northwest region and isopleths are concentrated in this region. From Fig. 6(d), it is observed that, during the post-monsoon season, the rainfall pattern over the north and eastern parts is uniform and rainfall decreases towards west/southwest region.

The southwest monsoon season is the principal rainy season over the state. Of the total annual rainfall, about 73% is received in the southwest monsoon season (June to September), about 9% is received in the winter season (January and February), about 11% is received in the pre-monsoon season (March to May) and about 6% is received in the post-monsoon season (October to December). The percentage of the seasonal number of rainy days with respect to the annual number of rainy days is 63% for the southwest monsoon season, 16% for the pre-monsoon season, 7% for the post monsoon season and 13% for the winter season. During the southwest monsoon season, the state receives rainfall mainly due to low pressure areas and monsoon depressions originating from the Bay of Bengal.

The southwest monsoon extends over the entire state by the last week of June. July and August are the rainiest months accounting individually to about 27% of the annual rainfall. The number of rainy days ranges from 6 to 14 in the southwest monsoon season, the number being maximum (14) for the month of July and August.

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

The most common rain-giving systems over the state during post-monsoon season are the depressions and cyclonic storms originating from the Bay of Bengal. The storms and depressions cause heavy to very heavy rainfall and contribute substantially to the season's total rainfall.

During winter, the state receives about 14 cm of rainfall. This rainfall, though small in amount, is of utmost significant for agriculture. This rainfall generally occurs in association with induced low pressure areas over the surface due to western disturbances moving from west to east, across the northern parts of the country.

The features of rainfall described above are also evident from Fig. 7, which shows the annual and seasonal rainfall for the individual districts as well as for the

state. It provides a measure for comparison of seasonal rainfall with the annual, for both, district-wise and state-wise rainfall.

Table VI gives the monthly and annual rainfall for various river catchments (No. 201, 202, 203, 204, 205 and 403) in the state. The annual rainfall of these river catchments is shown in Fig. 8. It is seen from Table VI and Fig. 8 that, the river Beas has a catchment (No. 203) in the state, which receives the maximum amount of annual rainfall (182.2 cm) as well as the maximum rainfall (130 cm) during the southwest monsoon season.

Rainfall Variability

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

$$CV = \frac{\text{Standard Deviation } (\sigma)}{\text{Normal } (N)} \times 100$$

It is observed from Fig. 9 that the values of CV of annual rainfall range between 30% and 50% over the entire state of Himachal Pradesh. The values of CV over northwestern and southern parts are less than 30%, while those over some parts of the northern and eastern Himachal Pradesh are higher than 50%.

The spatial distribution of CV of seasonal rainfall over Himachal Pradesh is shown in Fig 9(a), 9(b), 9(c) and 9(d) for the seasons: pre-monsoon season (March to May), southwest monsoon season (June to September), post-monsoon season (October to December) and the winter season (January and February) respectively. It is observed that the values of CV range between 40% and 80% for the pre-monsoon season Fig.9(a). The regions of extreme southern Himachal Pradesh exhibit the highest variability, with values of CV exceeding 70%. During the southwest monsoon season, the rainfall variability is low with the values of CV ranging between 20% and 50% Fig. 9(b). From Fig. 9(c), it is observed that the values of CV of the rainfall during the post-monsoon season, range between 80% and 120%. During the winter season also, the variability of rainfall is very high (Fig. 9(d)). The values of CV range between 40% and 120%. Thus, the variability of annual rainfall and rainfall during the southwest monsoon season, over Himachal Pradesh is relatively lower. On the other hand, the variability of seasonal rainfall for

the other three seasons is very high. The contribution of southwest monsoon rainfall to the annual rainfall is the highest.

Drought and Excessive Rainfall

(a) Droughts:

Meteorologically, drought over an area or a place may be defined as a situation when the annual rainfall over the area or place is less than 75% of the normal. It is classified as “Moderate drought”, if rainfall deficit is between 25 and 50% and severe drought when it is more than 50%. Areas where frequency of drought as defined above is 20% of the years examined are classified as “drought area” and areas having drought condition for more than 40% of the years under consideration represent “chronically drought affected areas”.

There are two districts in the state viz. Kangra and Una, during 1951-99, which satisfy the criteria for “drought area” and there is not a single district in the state which satisfies the criteria for “chronically drought affected area”.

All the districts of the state were affected by drought during some year or the other during the period 1951-99. The details of year wise occurrence of drought over each district are given below. The figures within the brackets against each district indicate the number of occasions during the 49 year period when these districts were affected by drought.

During the 49 year period from 1951 to 1999, drought conditions as prevailed over the state are described below:

Bilaspur (6), Chamba (1), Kangra (10), Mandi (8), Hamirpur (4), Sirmaur (7) and Una (10).

Individual districts had one or two occasions of successive years of drought. Severity of the drought not only depends upon the rainfall deficiency in a single year, but also on the continued occurrence of deficient rain in successive years, even though the deficiency in each successive year may not be as high as in a single year. The following table depicts district wise years of successive drought during the 49 year period, 1951 to 1999.

Table (i)

Sr. No.	Districts	Years of successive drought
1.	Bilaspur	1974-75-76, 1992-93
2.	Kangra	1962-63-64
3.	Mandi	1982-83
4.	Sirmaur	1986-87
5.	Una	1972-73-74-75,81-82-83

Fig.10 shows the percentage frequency of drought and years of successive drought in the districts during the period 1951-1999. The following Table shows the years of severe drought for various districts, with the actual rainfall expressed as percentage of normal rainfall, given in brackets, against each district.

Table (ii)

Sr. No.	Districts	Years of Severe Drought R/F < 50%
1.	Bilaspur (37 %)	1975
2.	Hamirpur (45 %)	1974
3.	Mandi (44%)	1983
4.	Sirmaur (48%,41%)	1979,1986
5.	Una (43%, 40 %)	1975, 1981

It is observed that the lowest annual rainfall was 37% of the normal rainfall in the year 1975 in Bilaspur district.

Incidence of widespread drought over the state was observed in year1972. In the years 1965, 1974 and 1987, fairly widespread drought affected the state. During the years 1972 and 1974, the state was worst affected by drought, about 7 to 8 districts of the state reporting drought.

There was no drought anywhere in the state in the following 25 years: 1953, 1954, 1955, 1956, 1957, 1958, 1959, 1961, 1966, 1967, 1969, 1970, 1971, 1978, 1980, 1984, 1985, 1988,1990, 1994, 1995, 1996, 1997, 1998 and 1999.In the

following 13 years, only one district of the state was affected by drought conditions; 1951, 1952, 1960, 1963, 1964, 1968,1973, 1976, 1977, 1986, 1989, 1992, 1993. The districts Kangra and Una experienced the maximum number (10) of drought years during the 49 year period.

(b) Excessive Rainfall

Rainfall, sufficiently in excess of the normal, is a predominant factor for occurrence of floods, particularly in high rainfall regions. For the purpose of present description, annual rainfall of 125% or more of the normal is considered as excessive rainfall.

Fig. 11 shows the percentage frequency of excessive rainfall and successive years of excessive rainfall during the period 1951 to 1999. It is seen from this figure that the frequency of excessive rainfall for Chamba district in northwest region of the state, is highest and the number of successive years of excessive rainfall are more,

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

Table (iii)

Sr. No.	Districts	Years of excessive Rainfall > 125%	Highest amount of rainfall expressed (as % of the normal with year)
1.	Bilaspur	1973,94, 96,98.	218.7 cm in 1998 (174 %)
2.	Chamba	1953,54,55,56,57,58, 59,60,61,64,76, 77, 79,88,92,93,94.	268.3 cm in 1977 (198 %)
3.	Hamirpur	1955, 61, 70, 90	210.6 cm in 1990 (144%)
4	Kangra	1976	233.4 cm in 1976 (126 %)
5.	Mandi	1954, 55, 63, 66, 67, 88, 90, 97.	336.4 cm1988 (215 %)
6.	Sirmaur	1959,61, 62,63,64,88	288.8 cm in 1963(215%)
7.	Una	1955, 88.	237.0 cm in 1988 (196 %)

From the above table, it is seen that during the 49 year period 1951-1999, there were 27years in which some districts or the other in the state recorded excessive rainfall, the maximum amount being 215 % of the normal annual rainfall in the year 1988 for the district Mandi. The district Chamba has maximum number of years (17) of excessive rainfall and Kangra has minimum number of years (1) of such rainfall. In the year 1988, a large number of districts of the state (4) experienced excessive rainfall. The successive years of excessive rainfall against each district are as listed below:

Successive years of excessive rainfall (Districtwise)

Sr. No.	District	Successive years of excessive rainfall
1.	Chamba	1953-54-55-56-57-58-59-60-61, 1976-77, 1992-93-94.
2.	Mandi	1954-55, 1966-67
3.	Sirmaur	1961-62-63-64

The heaviest one day rainfall on record at any station in the state was 800.0 mm on 19th October 1874 at Kangra observatory and on 19th October 1899 at Shimla observatory.

Weather Hazards

Cyclonic storms & depressions

Table VII gives the total number of storms/depressions which affected the state during the period 1891-1990. 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. So the Himachal Pradesh situated far inland does not experience the full fury of the cyclonic storms or depressions like the coastal regions. During the course of movement, the disturbances sometimes turn or recurve towards north or northeast under the influence of deep westerly system moving across Pakistan and northwest India. The point of recurvature progressively

shifts westwards till September. The disturbances in May recurve while still out in Bay of Bengal. As such, exceptionally a few of them cross the coast and travel inland, weaken far away from the state and therefore cannot affect it.

In the months, November to May, the state has not been affected by the storms/depressions, except once in April 1892, when it was affected by a system which originated in the Arabian Sea. The maximum number of storms/depressions originating from Bay of Bengal affect the state during August and September. The monsoon disturbances during June to September, generally form over the head Bay of Bengal and travelling west or northwestwards, they move across Orissa, Chattisgarh, Madhya Pradesh and Uttar Pradesh. With further advance of the year, the Bay storms and depressions progressively take southerly course. Therefore the track of the Bay of Bengal cyclones is still more southerly in October and November and these have no influence on Himachal Pradesh weather. During the period 1891-1990 only one cyclonic storm in October in the year 1955 affected the state. During the period 1891-1990, 32 depressions influenced the weather of Himachal Pradesh.

Thunderstorms and Dust storms

Thunderstorms occur throughout the year. Convective activity is essential for occurrence of thunderstorms and dust storms. With the advance of the summer, thunder activity becomes more pronounced due to land heating. Pre-monsoon and monsoon thunderstorms are sometimes severe and accompanied by Hail. When moisture in the atmosphere is insufficient, dry thunderstorms or dust storms do occur occasionally in these months. The maximum number of thunderstorm occurs, with the approach of the monsoon current while dust storms are mainly confined to the summer months of April to June. Occasionally there is intense rainfall due to cloud burst phenomenon leading to disaster. Thunderstorm activity continues in southwest monsoon season and attains the peak in the months of May, June and July. Its frequency decreases as season progresses. In winter months thunderstorms do occur ahead of western disturbances. Thunderstorm activity is the minimum in December.

Fog

Hill fog is frequent in the rainy months of July and August. Favourable conditions for formation of radiation fog such as light to calm wind, clear skies, low temperature, relative humidity more than 75% etc., do exist after the withdrawal of

the monsoon till March, especially rear of ‘Western Disturbances’ when sufficient moisture is available, fog occurs frequently. Its frequency is more in winter months.

Snowfall

Hills of Himachal Pradesh receive considerable amount of precipitation in the form of snowfall. Snowfall is experienced throughout the year except in southwest monsoon season. In winter season, amount of snowfall received varies from 2 to 130 cm and number of days of snowfall varies from 2 to 23. In pre-monsoon season, amount of snowfall received varies from 1 to 42 cm and number of snowfall days varies from 1 to 30. In post monsoon season amount of snowfall received varies from 2 to 39 cm and the number of snowfall days varies from 1 to 17. Annual amount of snowfall varies from 25 to 204 cm and number of snowfall days varies from 6 to 77. In hills of Himachal Pradesh, north western sector receives maximum snowfall.

TABLE – I
MEAN WIND SPEED (kmph) AND PREDOMINANT WIND DIRECTION

STATION		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
HIMACHAL PRADESH														
Bilaspur	a m e	2.5 C C/SE	2.9 C C/SE	3.1 C C/SE	3.4 C C/SW	4.1 C C/W	3.2 C C/W	2.2 C C/SW	2.0 C C/SE	2.0 C C/SE	1.5 C C/SW	1.8 C C/SE	1.8 C C/SE	2.5
Chamba	a m e	0.8 C C	0.9 C C	1.1 C/NE C/NE/SE	2.1 C C/NE/SE	2.1 C/NE C/SE/NE	2.3 C/NE C/SE/NE	1.1 C C/NW	1.1 C C/NW/SW	1.6 C C/NW	1.6 C/SE C/S	1.2 C C/SE	0.9 C C	1.4
Mandi	a b c	- Data not available -												
Nahan	a m e	6.5 SE/C NW	7.2 SE/C/NW NW	7.6 SE/C/NW NW	7.7 C/SE NW	8.1 NW/C/SE NW	7.3 SE/C NW	6.5 SE/C C/NW/SE	5.7 C/SE C/NW/SE	6.0 C/NW NW/C	5.7 C/SE/NW NW	5.6 C/SE/NW NW	5.6 C/SE NW	6.6
Sundernagar	a m e	1.2 C C/SW	1.6 C C/SW	2.1 C C/SW	2.6 C C/SW	2.7 C C/NW	2.7 C C/NW/SW	2.0 C C/SW	1.6 C C/SW	1.4 C C/SW	1.2 C C/SW	1.0 C C/SW	1.1 C C	1.8
Sub-Div.Mean	**a**	**2.7**	**3.1**	**3.5**	**3.9**	**4.3**	**3.9**	**2.9**	**2.6**	**2.7**	**2.5**	**2.4**	**2.3**	**3.1**

TABLE – I (Contd…)
MEAN WIND SPEED (kmph) AND PREDOMINANT WIND DIRECTION

HIMACHAL PRADESH

STATION		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
HILL STATIONS														
Bhuntar (A)	a	2.9	3.7	4.3	5.0	4.8	5.9	6.3	6.1	5.6	4.5	3.4	2.4	4.6
	m	C	C	C/N	C/N	C	C	C	C	C	C	C	C	
	e	C/SE	C/S	C/S	C/S	C/S	S/SE	SE/S	SE	SE	SE/S	C/SE	C/SE	
Dalhousie	a	2.5	2.7	2.4	2.1	3.0	1.6	0.4	0.2	0.4	0.5	0.7	1.1	1.5
	m	C	C	C	C	C	C	C	C	C	C	C	C	
	e	C	C	C	C	C	C	C	C	C	C	C	C	
Dharamsala	a	3.6	4.2	4.4	4.5	5.3	4.3	3.0	2.6	2.7	2.9	3.0	2.5	3.6
	m	C	C	C	C	C	C	C	C	C	C	C	C	
	e	C/SW/W	C/SW/W	C/SW/W	C/SW	C/SW	C/SW	C/SW	C/SW	C/SW	C/SW	C/SW	C/SW	
Manali	a	1.5	1.9	3.2	2.7	4.9	2.5	1.2	0.8	1.4	1.8	1.9	1.5	2.1
	m	C/N/NE	C/N/NE	C/N/NE	C/NE	C	C/NE	C	C/SE/E	C/E/NE	C/NE/N	C/N/NE	C/N/NE	
	e	C/N	C/N	C/N/NW	C/N/NW	C/SE/NW	C/SE/S	C/SE	C/SE	C/SE	C/N/NW	C/N	C/N/NW	
Shimla	a	4.4	4.8	4.9	4.4	4.1	3.1	2.1	1.3	1.6	2.8	3.2	3.8	3.4
	m	SE/C	S	SE/C	C/SE	C/SW	C/SW/SE	C/SE	C/SE	C/SE	C/SE	C/SW	C/SE	
	e	S	S	S	S	S	S	C/S	C/S	C/S	S	S	S	

a: Mean Wind Speed in km per hour.
m: Predominant wind direction in the morning.
e: Predominant wind direction in the evening.
Var Variable.
C: Calm.
* Hill stations not considered for sub-divisional mean.

TABLE-II

MEAN DAILY MAXIMUM AND MEAN DAILY MINIMUM TEMPERATURE(°C)

HIMACHAL PRADESH

STATION		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
Bilaspur	**Max**	19.5	21.7	26.3	32.4	36.1	36.7	32.6	31.4	31.4	30.2	26.0	21.4	28.8
	Min	4.9	6.7	10.3	15.7	19.5	23.1	22.4	22.3	20.1	14.6	9.6	5.9	14.6
Chamba	**Max**	17.9	20.5	22.9	28.8	33.5	32.3	32.6	30.7	29.2	28.2	23.4	19.7	26.6
	Min	4.2	5.6	7.3	13.2	17.3	20.5	21.5	21.1	18.5	13.7	8.9	5.7	13.1
Mandi	**Max**	18.9	21	26	30.9	34.8	35.7	32.2	31.3	30.9	29.3	25.1	20.4	28.0
	Min	2.3	3.9	8.7	13.6	17.3	19.5	20.7	20.1	17.8	11.9	6.8	2.8	12.1
Nahan	**Max**	18.0	20.8	25.3	31	34.2	35.7	29.9	28.9	28.8	27.4	23.6	19	26.9
	Min	7.3	8.9	12.3	18.4	20.8	23.1	22.0	21.7	20.8	17.5	12.5	8.9	16.2
Solan	**Max**	18.4	20.0	24.1	31.6	31.9	30	27.8	28.3	28.2	27.9	24.7	21.5	26.2
	Min	3.5	2.4	7.3	13.1	17.7	18.1	20.0	19.2	17.9	10.6	5.6	2.6	11.5
Sundernagar	**Max**	17.2	18.9	23.1	28.9	32.9	34.2	30.7	30.1	30.3	28.2	23.9	18.9	26.4
	Min	2.9	4.9	8.8	12.8	17.1	19.9	21.4	21.4	18.4	11.9	6.3	3.3	12.4
Una	**Max**	20.3	22.6	26.3	34	36.2	38.4	33.8	32.6	33	30.6	27	21.1	29.7
	Min	5.1	6.8	10.7	15.3	19.2	23.2	24.5	24.1	21.9	15.5	9.6	6.4	15.2
Subdiv Mean	**Max**	**18.6**	**20.8**	**24.9**	**31.1**	**34.2**	**34.7**	**31.4**	**30.5**	**30.3**	**28.8**	**24.8**	**20.3**	**27.5**
	Min	**4.3**	**5.6**	**9.3**	**14.6**	**18.4**	**21.1**	**21.8**	**21.4**	**19.3**	**13.7**	**8.5**	**5.1**	**13.6**
HILL STATIONS														
Bhuntar (A)	**Max**	15.2	17.3	21.7	27.1	31	33.2	31.2	30.6	30.3	27.7	22.9	17.2	25.5
	Min	1.5	3.5	6.5	9.8	12.5	16.9	19.6	19.6	16.3	9.8	4.4	1.6	10.2
Dalhousie	**Max**	11.5	12.7	17.3	21.3	24.9	26.6	23.6	22.7	22.8	22.0	17.8	14.4	19.8
	Min	2.3	2.7	6.3	10.5	13.8	16.2	15.7	15.5	13.9	10.9	6.9	4.4	9.9
Dharamsala	**Max**	14.6	16.2	20.8	26.1	30	31	27.2	26.4	26.4	24.9	20.8	16.6	23.4
	Min	5.6	7.1	11.1	15.8	19.4	21.3	20.4	20.0	18.3	14.8	10.3	6.9	14.3
Manali	**Max**	10.7	11.6	16.0	22.1	25	27.3	25.9	25.3	25.1	22.7	18.8	13.9	20.4
	Min	-1.7	-0.7	2.6	6.2	8.6	12.3	15.2	14.8	11.1	5.3	1.4	-0.2	6.2
Shimla	**Max**	9.3	10.4	14.6	19.4	22.8	24	21.2	20.4	20.3	18.8	15.1	11.9	17.3
	Min	1.7	2.6	6.3	10.9	13.7	15.3	14.7	14.4	13.1	10.6	6.7	4.0	9.5

*Hill stations not considered for sub-divisional mean.

TABLE II (A)
EVER RECORDED HIGHEST MAXIMUM AND LOWEST MINIMUM TEMPERATURE (°C)

HIMACHAL PRADESH

S.No.	Station	Highest	Date	Lowest	Date
1	Bhuntar (Aero)	40.0	31 May 1988	-4.9	31 Dec 1976
2	Bilaspur	45.5	30 May 1988	-2.0	04 Jan 1967
3	Chamba	42.3	23 May 1989	0.0	16 Apr 1995
4	Dalhousie	35.5	09 Jun 1960	-8.6	27 Jan 1967
5	Dharamsala	38.6	18 Jun 1995	-1.9	13 Jan 1972
6	Gondla	49.9	08 May 1958	0.1	04 Jan 1978
7	Keylong	30.1	29 Jun 1973	-25.9	21 Feb 1978
8	Manali	35.0	31 May 1988	-11.6	02 Jan 1996
9	Mandi	42.7	18 Jun 1958	-2.9	21 Dec 1965
10	Nahan	43.0	08 Jun 1987	-7.9	28 Dec 1989
11	Shimla (Mashobra)	31.4	11 Jun 1995	-5.3	12 Jan 1992
12	Shimla	31.2	28 May 1988	-12.2	13 Dec 1963
13	Solan	37.8	05 Jun 2003	-3.0	17 Jan 2000
14	Sundernagar	41.6	31 May 1988	-10.6	29 Dec 1983
15	Una	45.2	30 May 1988	-5.8	15 Jan 2003

TABLE - III
MEAN RELATIVE HUMIDITY (%)
HIMACHAL PRADESH

Stations		*Jan*	*Feb*	*Mar*	*Apr*	*May*	*June*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
	M	90	86	80	64	53	66	87	90	89	85	87	89	81
Bilaspur	**E**	60	53	48	38	35	47	69	75	66	51	53	58	54
	M	82	79	80	69	61	64	80	84	81	77	76	77	76
Chamba	**E**	77	75	78	67	58	62	78	81	80	73	72	75	73
	M	83	82	75	68	60	**66**	78	85	80	79	81	83	77
Mandi	**E**	58	54	45	44	44	49	68	74	65	60	60	62	57
	M	69	67	54	49	40	57	85	89	81	70	64	67	66
Nahan	**E**	65	62	51	42	32	49	79	84	77	64	59	62	61
	M	73	70	50	43	52	68	86	84	88	67	56	66	67
Solan	**E**	58	45	31	24	40	56	78	80	76	50	44	44	52
	M	88	85	78	66	57	66	83	88	88	83	86	88	80
Sundernagar	**E**	53	47	43	35	35	44	67	71	66	49	48	54	51
	M	91	89	85	64	67	67	86	91	90	85	84	92	83
Una	**E**	67	64	68	40	47	50	75	79	74	67	61	68	63
Sub-	**M**	**76**	**74**	**66**	**57**	**54**	**64**	**83**	**87**	**83**	**73**	**69**	**72**	**71**
Div.Mean	**E**	**63**	**58**	**52**	**43**	**42**	**52**	**74**	**79**	**72**	**60**	**57**	**60**	**59**
HILL STATIONS														
	M	89	87	80	71	63	65	81	86	80	78	83	88	79
Bhuntar(A)	**E**	54	50	47	40	37	42	60	64	56	46	44	53	49
	M	60	60	58	57	51	58	81	87	78	63	56	57	64
Dalhousie	**E**	72	67	64	57	50	54	78	85	79	70	70	68	68
	M	61	58	50	45	40	55	81	85	76	60	56	58	60
Dharamsala	**E**	58	54	46	37	33	49	78	84	74	54	52	57	56
	M	74	73	63	57	60	70	85	90	86	75	64	64	72
Manali	**E**	66	65	56	49	52	58	73	79	73	67	58	57	63
	M	50	50	39	36	39	60	84	87	74	49	39	37	54
Shimla	**E**	64	62	51	43	42	60	84	89	81	65	58	56	63

Hill stations not considered for sub-divisional mean.

M-Morning E-Evening

TABLE IV

MEAN CLOUD AMOUNT**(OKTA OF THE SKY) AND MEAN NUMBER OF DAYS OF CLEAR AND OVERCAST SKIES AT 0830 HOURS IST.

HIMACHAL PRADESH														
STATION		***JAN***	***FEB***	***MAR***	***APR***	***MAY***	***JUN***	***JUL***	***AUG***	***SEP***	***OCT***	***NOV***	***DEC***	***ANNUAL***
Bilaspur	a	15	16	19	19	20	13	6	9	18	24	24	20	202
	b	7	3	3	2	3	4	9	8	2	1	1	2	43
	c	2.9	2.0	2.0	1.7	1.6	2.9	4.9	4.0	1.6	0.7	0.6	1.6	2.2
Chamba	a	16	17	13	18	16	14	7	6	13	24	25	19	188
	b	11	3	1	6	7	4	4	7	3	2	2	6	55
	c	3.2	2.1	2.0	2.5	3.0	2.5	4.7	2.9	1.9	0.9	1.0	2.3	2.4
Mandi	a	17	14	18	19	18	11	6	5	9	24	25	20	184
	b	8	2	4	2	1	6	7	8	6	1	0	1	45
	c	2.8	2.3	2.2	1.3	1.6	3.1	4.6	4.4	3.6	0.6	0.4	1.2	2.4
Nahan	a	17	13	14	21	22	14	8	6	10	26	24	21	196
	b	1	4	0	1	2	4	10	11	4	1	1	1	39
	c	2.1	2.9	2.6	1.2	1.5	2.6	4.6	5.1	4.0	0.5	0.8	1.6	2.5
Sundernagar	a	12	8	8	10	13	9	2	0	7	20	18	11	117
	b	7	7	7	4	3	5	11	10	4	2	2	6	66
	c	3.4	4.0	3.8	2.9	2.4	3.2	5.7	5.7	3.6	1.1	1.5	3.4	3.4
Una	a	14	9	8	13	11	8	4	3	10	13	21	13	126
	b	2	5	7	1	4	4	9	7	3	1	0	3	46
	c	2.2	3.6	4.1	1.8	2.9	3.5	5.2	5.3	3.4	1.8	0.8	2.8	3.1
Sub-Div. Mean.	**a**	**15**	**13**	**13**	**17**	**17**	**11**	**6**	**5**	**11**	**22**	**23**	**17**	**169**
	b	**6**	**4**	**3**	**3**	**3**	**4**	**8**	**8**	**4**	**1**	**1**	**3**	**49**
	c	**2.8**	**2.8**	**2.8**	**1.9**	**2.2**	**3.0**	**5.0**	**4.6**	**3.0**	**0.9**	**0.9**	**2.2**	**2.7**

TABLE IV (Contd…)

MEAN CLOUD AMOUNT(OKTA OF THE SKY) AND MEAN NUMBER OF DAYS OF CLEAR AND OVERCAST SKIES AT 0830 HOURS IST.**

HIMACHAL PRADESH														
HILL STATIONS														
STATION		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
Bhuntar(a)	a	8	6	7	10	11	3	0	0	2	14	18	12	91
	b	6	7	7	4	2	3	8	8	3	1	1	4	54
	c	3.8	4.0	3.8	2.9	2.3	3.2	5.4	5.7	3.5	1.5	1.5	3.1	3.4
Dalhousie	a	14	11	14	13	21	17	5	7	14	23	23	17	180
	b	1	2	3	1	0	1	4	6	1	0	1	0	19
	c	1.9	3.0	2.6	2.2	0.8	1.6	4.1	4.2	1.9	0.3	0.7	1.7	2.1
Dharamsala	a	11	10	10	13	16	12	3	2	10	21	20	13	140
	b	5	5	5	3	2	4	8	10	3	1	1	3	47
	c	3.7	3.8	3.7	3.0	2.3	3.2	5.5	5.6	3.2	1.3	1.5	3.1	3.3
Manali	a	12	12	13	17	20	13	3	3	10	21	21	17	163
	b	10	8	9	5	5	6	11	12	5	2	3	7	84
	c	3.8	3.7	3.5	2.3	2.0	3.0	5.1	5.4	3.0	1.3	1.6	2.9	3.1
Shimla	a	13	12	12	14	18	11	2	1	10	22	21	16	153
	b	5	4	3	2	2	5	12	12	4	1	1	2	52
	c	3.0	2.9	3.0	2.2	1.9	3.3	5.7	5.8	3.3	1.0	1.1	2.2	3.0

a :- Days with clear sky.
b :_- Days with sky overcast.
c :- Mean Cloud Amount.
** Okta = Unit,equal to area of one eighth of the sky used in specifying cloud amount.
For example:- 1 okta means 1/8 th of the sky covered.
* Hill stations not considered for sub-divisional mean.

TABLE IV (A)

MEAN CLOUD AMOUNT**(OKTA OF THE SKY) AND MEAN NUMBER OF DAYS OF CLEAR AND OVERCAST SKIES AT 1730 HOURS IST.

HIMACHAL PRADESH

STATION		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
Bilaspur	a	15	13	14	14	14	11	4	6	14	24	24	19	171
	b	4	4	3	3	4	3	5	6	3	1	1	2	39
	c	2.6	2.7	2.5	2.5	2.3	2.9	4.5	4.4	2.3	0.8	0.7	1.8	2.5
Chamba	a	22	15	11	13	19	11	9	4	9	18	25	19	173
	b	4	3	0	7	4	4	4	7	5	1	2	8	49
	c	1.7	2.4	2.4	3.4	2.5	3.1	3.5	5.0	2.9	1.3	0.9	2.4	2.6
Mandi	a	21	11	14	14	13	8	5	3	3	20	24	19	156
	b	4	3	4	4	4	5	7	9	3	1	0	2	45
	c	1.8	3.1	2.7	2.3	2.5	3.7	4.4	5.0	4.2	1.2	0.6	1.5	2.7
Nahan	a	17	11	10	20	20	13	6	4	8	21	22	21	173
	b	1	4	1	1	3	2	5	6	3	1	0	2	27
	c	2.0	3.2	3.3	1.4	1.8	2.8	4.5	4.6	3.8	1.0	1.0	1.5	2.6
Sundernagar	a	7	4	2	1	3	1	0	0	1	5	13	9	46
	b	7	7	8	5	6	4	10	8	4	1	2	6	69
	c	4.0	4.6	5.1	4.6	4.3	4.5	6.0	5.9	4.6	2.4	1.9	3.7	4.3
Una	a	14	10	6	7	9	8	3	1	8	12	19	12	108
	b	2	3	3	1	2	1	6	2	2	1	1	3	28
	c	2.3	2.9	4.0	2.8	2.5	2.7	5.0	4.4	2.6	1.9	1.0	2.9	2.9
Sub-Div. Mean.	**a**	**16**	**11**	**9**	**12**	**13**	**9**	**5**	**3**	**7**	**17**	**21**	**16**	**138**
	b	**4**	**4**	**3**	**4**	**4**	**3**	**6**	**6**	**3**	**1**	**1**	**4**	**43**
	c	**2.4**	**3.2**	**3.3**	**2.8**	**2.7**	**3.3**	**4.7**	**4.9**	**3.4**	**1.4**	**1.0**	**2.3**	**2.9**

TABLE IV (A) (Contd…)

MEAN CLOUD AMOUNT(OKTA OF THE SKY) AND MEAN NUMBER OF DAYS OF CLEAR AND OVERCAST SKIES AT 1730 HOURS IST.**

HIMACHAL PRADESH
HILL STATIONS

STATION		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	DEC	ANNUAL
Bhuntar (A)	a	5	3	2	1	2	0	0	0	0	4	11	9	37
	b	8	6	7	6	5	3	5	6	3	1	2	4	56
	c	4.3	4.6	4.9	4.6	4.3	4.2	5.2	5.2	3.9	2.5	2.0	3.3	4.1
Dalhousie	a	12	8	10	11	15	12	3	2	4	19	22	15	133
	b	2	2	4	1	1	1	3	6	1	0	2	0	22
	c	2.3	3.4	3.4	2.6	1.8	2.1	4.5	5.2	3.6	0.8	1.2	2.0	2.7
Dharamsala	a	6	4	3	3	4	2	0	0	1	7	11	9	49
	b	6	5	3	3	3	3	6	7	2	0	1	4	42
	c	4.3	4.4	4.5	4.1	3.7	4.2	5.9	6.2	4.9	2.5	2.0	3.5	4.2
Manali	a	9	9	9	11	10	5	1	2	5	14	18	15	109
	b	11	9	11	8	8	8	13	14	7	4	3	7	103
	c	4.4	4.2	4.4	3.8	3.8	4.7	5.8	6.1	4.4	2.6	2.0	3.2	4.1
Shimla	a	9	8	6	8	10	5	1	0	4	16	19	14	99
	b	9	6	6	4	5	5	16	18	10	3	2	4	86
	c	3.9	3.8	3.9	3.3	3.2	4.1	6.3	6.7	4.8	2.0	1.5	2.6	3.8

a :- Days with clear sky.
b :_- Days with sky overcast.
c :- Mean Cloud Amount.
** Okta=Unit,equal to area of one eighth of the sky used in specifying cloud amount.
For example :- 1 okta means 1/8 th of the sky covered.
* Hill stations not considered for sub-divisional mean.

TABLE – V

MEAN RAINFALL (mm) AND NUMBER OF RAINY DAYS
HIMACHAL PRADESH

DISTRICT		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
Bilaspur	a	64.9	65.4	59.8	28.5	44.4	110.9	333.8	310.5	158.3	30.2	15.4	34.6	1256.7
	b	3.8	3.8	3.7	2.0	3.0	5.6	13.9	13.8	7.1	1.6	1.0	2.1	61.4
Chamba	a	90.6	121.3	144.5	93.0	78.0	96.4	268.1	229.7	119.9	36.0	25.7	51.9	1355.1
	b	5.0	6.0	7.0	5.7	5.4	5.7	11.8	11.0	5.6	2.3	1.6	3.0	70.1
Hamirpur	a	73.5	65.2	61.0	25.9	41.1	143.7	394.7	399.4	165.6	44.9	15.4	32.2	1462.6
	b	4.2	3.7	4.3	2.1	3.3	5.7	14.6	14.9	6.9	1.7	0.9	1.9	64.2
Kangra	a	82.9	79.1	78.5	41.8	41.0	133.1	546.9	575.3	183.7	38.0	14.8	37.2	1852.3
	b	4.6	4.2	4.4	2.8	2.7	5.5	15.4	15.3	7.2	1.7	1.0	2.0	66.8
Mandi	a	68.3	66.2	79.6	43.5	65.9	168.7	457.2	371.6	157.8	40.1	17.1	28.6	1564.6
	b	4.6	4.6	5.3	3.6	4.3	8.3	16.1	15.2	7.8	2.1	1.1	2.0	75.0
Sirmaur	a	56.9	58.7	54.6	31.2	35.5	156.3	514.6	496.8	192.7	40.4	11.1	39.9	1688.7
	b	3.1	3.3	3.3	2.0	2.6	7.0	15.0	15.9	7.1	1.5	0.7	1.6	63.1
Una	a	38.3	48.9	38.7	20.1	36.1	101.6	350.9	324.7	171.5	32.3	21.3	24.6	1209.0
	b	3.2	3.0	3.6	1.7	1.8	6.2	11.1	11.8	7.2	1.7	1.2	1.1	53.6
Sub.Div.	**a**	**67.9**	**72.1**	**73.8**	**40.6**	**48.9**	**130.1**	**409.5**	**386.9**	**164.2**	**37.4**	**17.3**	**35.6**	**1484.3**
Mean.	**b**	**4.1**	**4.1**	**4.5**	**2.8**	**3.3**	**6.3**	**14.0**	**14.0**	**7.0**	**1.8**	**1.1**	**2.0**	**65.0**

TABLE – V(a)

MEAN RAINFALL (mm) AND NUMBER OF RAINY DAYS
HIMACHAL PRADESH
HILL STATIONS

STATIONS		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
Arki	a	73.0	65.6	60.5	29.0	53.5	124.7	322.4	269.8	19.9	28.2	11.9	30.6	1189.1
	b	4.2	4.2	4.0	2.5	3.2	6.3	13.8	12.7	5.9	1.3	0.8	1.8	60.7
Banjar/	a	76.6	76.0	102.3	64.5	71.7	80.8	228.7	177.8	104.0	38.5	16.0	36.3	1073.2
Saraj Teh	b	5.3	5.6	7.5	5.8	6.0	6.8	12.9	12.8	6.6	2.4	1.4	2.7	75.8
Bashla	a	160.5	77.6	73.8	53.0	81.7	82.8	251.6	234.3	151.6	54.4	16.0	79.9	1317.2
	b	4.5	3.9	5.6	4.7	6.4	6.8	14.8	14.3	8.0	2.7	1.1	2.0	74.8
Bhuntar (A)	a	83.7	102.8	127.7	79.4	70.1	53.9	137.7	127.8	61.0	27.7	23.5	39.6	934.9
(Obsy)	b	5.6	6.5	7.8	6.1	6.3	4.8	9.5	9.3	4.6	2.1	1.7	2.5	66.8
Chini/Kalpa	a	97.7	103.4	107.1	76.8	70.0	34.7	44.1	41.9	54.4	34.7	14.6	40.6	719.5
	b	5.9	5.9	6.4	5.6	5.4	2.4	5.2	4.7	4.3	2.0	1.2	2.7	51.7
Chopal	a	40.4	93.5	91.2	71.8	74.8	72.4	205.0	225.6	113.2	46.1	26.3	52.9	1113.2
(Hydro)	b	2.5	4.3	6.8	5.9	5.9	5.7	12.1	12.4	6.0	2.4	1.4	1.4	66.8
Dharampura	a	79.5	66.5	63.3	28.4	49.0	172.4	406.7	330.9	206.9	59.6	15.2	33.4	1511.8
	b	4.5	4.1	4.4	2.5	3.5	8.0	15.8	15.3	8.5	2.6	1.0	2.1	72.3
Dalhousie	a	155.1	122.2	155.7	96.2	62.5	130.8	588.0	573.2	245.7	73.0	37.7	70.9	2311.0
(Obsy)	b	6.5	5.9	6.5	5.3	4.2	6.4	18.3	19.8	8.8	2.7	1.8	3.4	89.6
Dharamsala	a	103.2	106.7	112.2	59.1	66.1	200.6	872.4	862.6	385.7	59.1	21.1	56.3	2905.1
(Obsy)	b	5.7	5.6	6.2	4.6	4.7	9.4	21.5	22.2	13.0	2.9	1.2	3.0	100.0
Dharamsala	a	120.9	107.2	104.8	72.4	70.0	162.8	1275.2	1202.9	443.0	76.6	26.5	60.2	3722.5
(Lower)	b	5.8	4.5	4.9	3.6	3.3	5.2	19.3	20.9	10.8	2.1	1.3	2.4	84.1
Gondla	a	120.2	115.7	159.4	124.8	97.1	28.3	68.4	52.8	74.1	55.7	34.8	59.6	990.9
(Obsy)	b	8.2	7.4	9.7	7.8	6.4	2.5	5.7	5.3	4.1	3.0	2.3	5.0	67.4
Janjehli	a	53.1	61.9	111.5	73.3	92.2	184.8	351.5	273.3	145.7	45.1	11.2	39.9	1443.5
	b	3.2	4.3	6.3	5.7	6.5	9.1	16.3	14.9	7.4	2.2	1.1	1.7	78.7
Jhungi	a	66.6	67.6	81.8	47.1	66.7	166.5	368.2	255.8	121.5	27.9	12.7	34.5	1316.9
	b	4.7	3.8	4.8	4.2	4.6	9.0	15.8	12.9	6.2	1.8	1.0	2.0	70.8
Jogindarnagar	a	108.8	100.6	128.3	76.3	73.7	215.7	636.0	760.9	291.9	46.3	27.3	42.6	2508.4
	b	5.1	5.3	6.5	4.2	4.3	8.3	18.1	20.1	11.0	2.6	1.4	2.2	89.1
Jubbal	a	82.4	81.2	87.2	60.0	75.4	81.3	213.7	193.3	125.2	41.3	13.8	38.8	1093.6
	b	5.0	5.3	6.5	5.4	6.1	7.0	13.1	12.5	7.0	2.4	1.2	2.1	73.6
Jubbal	a	84.0	76.5	99.5	64.2	88.2	83.2	196.5	186.4	141.2	31.8	15.4	62.2	1129.1
(Hydro)	b	4.2	5.5	8.0	5.8	6.9	7.4	12.5	12.3	7.1	1.9	1.1	2.1	74.8
Junga	a	74.3	46.3	62.1	27.9	60.7	137.5	336.5	271.9	120.2	42.4	8.3	27.0	1215.1
	b	4.4	3.1	4.7	2.2	4.3	8.0	15.0	14.5	6.9	2.3	0.6	1.4	67.4
Kalpa	a	74.0	100.0	104.1	76.6	63.4	37.5	42.9	45.3	49.9	27.8	13.8	35.0	670.3
(Obsy)	b	6.0	7.8	7.7	6.3	5.6	2.7	4.6	5.7	5.1	1.3	1.5	2.4	56.7
Kandaghat	a	77.8	76.4	67.6	33.7	51.6	119.5	324.6	263.3	150.2	61.3	11.0	37.8	1274.8
	b	4.4	4.2	4.6	2.7	3.5	6.7	14.5	13.8	6.9	2.2	0.8	1.9	66.2
Karsog	a	69.6	69.9	76.7	40.5	55.0	90.2	234.0	198.0	103.8	30.6	16.5	28.8	1013.6
	b	4.8	4.5	5.7	3.6	4.7	6.4	12.6	12.2	6.1	1.8	1.1	1.9	65.4
Kasumpti	a	62.3	54.9	60.3	30.8	53.1	139.0	365.9	312.6	159.3	47.0	9.1	22.3	1316.6
	b	4.5	4.2	5.1	2.7	4.4	8.6	18.0	16.3	9.3	3.3	1.0	1.9	79.3
Kataula	a	81.2	79.1	69.2	47.1	63.4	146.0	448.6	391.4	104.5	31.5	12.5	35.5	1510.0
	b	5.0	4.2	4.9	3.6	3.8	7.3	16.1	16.1	7.1	2.1	1.0	2.1	73.3
Keylong	a	45.3	68.2	114.7	81.7	48.0	25.9	61.3	50.4	31.2	12.2	19.3	48.6	606.8
	b	3.2	4.1	6.1	5.5	3.5	1.7	4.5	3.7	1.9	1.2	1.3	3.1	39.8
Keylong	a	78.0	92.8	141.1	88.2	71.1	25.8	60.3	42.1	55.5	24.4	25.8	35.3	740.4
(Obsy)	b	6.3	5.9	8.7	6.5	5.4	2.2	5.6	4.3	3.5	2.0	1.6	3.1	55.1

TABLE – V(a) (Contd…)

MEAN RAINFALL (mm) AND NUMBER OF RAINY DAYS
HIMACHAL PRADESH
HILL STATIONS

STATIONS		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
Khadrala	a	310.1	170.3	112.0	51.3	81.0	35.5	298.8	275.3	163.6	50.2	21.2	177.4	1806.7
	b	5.3	5.2	5.8	4.4	6.9	7.9	16.3	15.3	9.3	2.7	0.9	2.4	82.4
Kohru	a	75.6	95.2	90.1	65.4	69.5	64.7	173.2	182.3	147.2	60.5	15.2	33.4	1072.3
(Hydro)	b	4.7	5.3	5.9	5.0	5.9	5.2	11.7	12.3	7.5	3.0	1.2	1.5	69.2
Koksar	a	160.6	174.1	166.0	96.6	105.1	52.5	134.5	108.8	112.6	68.0	33.9	69.2	1281.9
(Obsy)	b	8.9	8.1	8.8	6.8	6.7	3.6	8.1	7.2	5.5	3.4	2.4	4.6	74.1
Kotaram	a	186.0	71.1	96.9	44.5	37.4	88.4	292.7	190.2	145.7	62.3	4.4	28.3	1274.9
	b	5.9	3.1	7.9	4.7	3.7	7.5	16.3	13.9	7.6	3.9	0.8	2.7	78.0
Kothi	a	203.6	203.1	268.9	153.6	118.5	104.4	409.6	363.1	204.8	82.9	32.2	80.6	2225.3
(Obsy)	b	8.9	9.1	10.9	8.6	6.8	8.1	21.2	21.3	11.9	4.1	2.0	4.6	117.5
Kotkhai	a	68.1	59.9	67.6	40.6	69.1	86.5	189.0	167.7	108.3	31.4	13.5	25.2	926.9
	b	4.7	4.1	5.5	3.8	5.6	6.7	11.7	11.5	6.1	2.2	1.0	1.9	64.8
Kotkhai	a	31.9	84.4	110.2	60.5	122.4	76.7	163.4	172.8	67.7	40.1	6.7	22.1	958.9
(Hydro)	b	3.2	5.1	6.7	4.1	5.8	5.5	11.0	11.0	5.0	2.8	0.6	1.7	62.5
Kullu	a	131.4	127.4	120.4	81.7	50.2	39.2	150.6	126.1	96.4	49.3	19.8	44.7	1037.2
	b	7.6	6.4	7.2	6.0	3.8	3.4	9.1	8.8	5.2	2.5	1.1	2.8	63.9
Kumarsain	a	59.9	59.0	74.9	44.4	60.3	82.9	182.6	143.1	89.6	26.2	14.8	23.6	861.9
	b	4.4	4.8	5.7	4.3	4.9	6.1	10.1	9.9	5.2	1.6	1.1	1.7	59.8
Manali	a	114.1	134.0	201.7	115.6	80.3	83.2	215.8	232.8	104.7	51.9	40.1	56.8	1431.0
(Obsy)	b	7.0	8.2	9.1	6.2	5.7	6.9	14.8	15.3	8.7	3.6	2.5	3.3	91.3
Nichar	a	118.3	119.4	127.1	74.5	88.1	52.3	136.0	157.0	105.1	39.9	16.9	46.3	1080.9
	b	5.5	5.8	7.8	6.1	6.6	5.5	10.9	12.8	7.8	2.4	1.2	2.5	74.9
Pachhad	a	75.4	65.3	56.9	31.1	40.1	131.7	457.6	371.4	183.8	46.7	13.9	35.8	1509.7
	b	4.0	3.7	3.7	1.9	2.8	6.3	15.1	14.8	7.0	1.7	0.7	1.7	63.4
Pachhad	a	67.0	60.8	81.2	44.4	50.3	165.4	362.9	356.7	178.2	49.9	14.2	38.1	1469.1
(Hydo)	b	3.1	3.8	4.7	2.9	3.7	8.6	14.9	15.1	7.1	1.9	0.9	1.8	68.5
Palampur	a	109.2	111.1	131.9	60.8	61.4	196.2	771.7	804.2	311.9	58.1	22.5	57.1	2696.1
	b	5.2	4.9	6.4	3.8	4.0	7.4	19.4	21.5	10.8	2.6	1.1	2.9	90.0
Parola	a	81.7	63.6	58.3	39.2	84.9	76.2	244.6	186.0	138.2	31.9	15.4	17.4	1037.4
	b	4.5	3.8	4.3	2.6	3.9	6.0	12.8	11.0	5.8	2.1	0.7	1.5	59.0
Phancha	a	91.3	104.7	124.8	99.0	92.0	147.3	589.2	726.9	269.6	72.4	22.4	32.8	2372.4
	b	6.4	5.4	7.6	6.8	6.9	9.2	21.4	23.0	13.1	4.5	1.7	2.4	108.4
Purbani	a	96.9	97.3	98.1	65.5	52.2	32.0	26.7	25.9	40.7	27.0	18.7	44.2	625.2
	b	5.5	4.2	6.1	4.9	4.3	1.9	3.4	2.7	3.0	1.8	1.0	1.9	40.7
Rajgarh	a	57.5	50.3	86.4	65.7	47.6	108.5	272.9	311.8	145.2	41.4	9.0	64.9	1261.2
(Hydro)	b	3.0	3.2	5.9	4.6	3.9	6.9	12.9	14.5	6.9	3.0	0.7	2.4	67.9
Rampur	a	62.8	69.1	97.6	47.9	55.7	63.7	169.2	158.9	89.5	26.6	14.0	29.8	884.8
	b	4.4	4.8	5.5	4.2	5.0	5.0	11.7	11.2	6.1	1.9	1.0	2.0	62.8
Rohru	a	90.8	93.4	93.1	53.7	56.6	74.3	179.0	178.0	126.4	40.2	14.9	30.4	1030.8
	b	5.5	5.2	6.0	4.4	4.7	5.4	11.5	11.8	6.5	2.3	1.0	1.9	66.2
Sangla	a	107.5	110.8	92.6	79.4	60.3	27.7	59.4	66.3	64.7	32.4	16.9	57.1	775.1
	b	4.8	5.6	5.9	5.8	5.3	2.9	7.6	7.3	5.1	2.2	1.3	2.3	56.1
Shillaru	a	107.7	62.0	74.6	53.4	70.7	125.0	349.1	242.1	130.3	42.9	11.9	18.9	1288.6
	b	4.3	3.6	5.5	4.8	5.6	8.3	16.9	14.7	7.3	2.7	0.9	1.4	76.0
Shimla	a	76.5	48.7	63.8	38.0	58.4	131.8	435.2	377.9	177.6	61.6	9.2	18.5	1497.2
	b	5.5	3.9	5.4	3.9	4.8	8.7	20.4	18.4	9.4	3.4	0.6	1.8	86.2

TABLE – V(a) (Contd…)

MEAN RAINFALL (mm) AND NUMBER OF RAINY DAYS
HIMACHAL PRADESH
HILL STATIONS

STATIONS		*JAN*	*FEB*	*MAR*	*APR*	*MAY*	*JUN*	*JUL*	*AUG*	*SEP*	*OCT*	*NOV*	*DEC*	*ANNUAL*
Shimla	a	56.0	56.6	67.4	49.9	71.4	168.7	362.5	323.5	172.6	44.6	17.9	24.3	1415.4
(Obsy)	b	4.6	4.8	5.7	4.2	5.6	9.9	18.0	17.3	9.3	2.7	1.4	2.0	85.5
Sundernagar	a	79.5	68.5	75.8	39.8	64.7	165.3	417.6	346.7	140.1	34.2	18.9	29.1	1480.2
	b	4.8	4.4	4.8	3.0	3.8	7.6	15.6	14.1	6.5	1.7	1.0	1.9	69.2
Theog	a	69.5	80.2	95.6	56.1	73.3	120.9	240.9	193.6	121.3	26.3	14.3	29.9	1121.9
	b	3.8	4.9	5.9	4.3	5.7	7.9	13.7	11.4	6.6	1.8	1.1	2.0	69.1

Hill stations not considered for subdivisional mean.

TABLE – VI

MEAN RAINFALL (mm) OVER DIFFERENT RIVER CATCHMENTS OF HIMACHAL PRADESH

Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
1. River Sutlej upto Bhakra Dam site (Catchment No. 201) **Districts/parts of districts within this Catchment:** **Shimla, Solan, Kinnaur, Mandi, Bilaspur**												
93.5	86.1	89.1	53.3	63.0	99.8	256.6	231.6	120.6	38.7	15.4	44.2	1191.9
2. River Sutlej between Bhakra Dam site and the Beas excluding Beas (Catchment No. 202) **Districts/parts of districts within this Catchment:** **Solan, Sirmaur, Una**												
66.1	61.0	59.5	30.5	40.0	150.5	444.9	427.1	202.0	44.2	13.7	34.3	1573.8
3. River Beas (Catchment No. 203) **Districts/parts of districts within this Catchment:** **Kangra, Hamirpur, Kullu, Lahaul&Spiti, Mandi, Chamba**												
93.7	91.7	106.7	60.3	62.4	139.0	497.9	474.5	188.9	45.0	19.5	42.2	1821.9
4. River Ravi (Catchment No. 204) **Districts/parts of districts within this Catchment:** **Chamba**												
73.6	117.1	159.8	100.0	88.4	103.5	169.2	168.3	101.7	32.7	25.8	50.8	1190.3
5. River Chenab (Catchment No. 205) **Districts/parts of districts within this Catchment:** **Lahaul & Spiti**												
119.6	127.5	155.5	103.2	91.1	35.5	87.7	67.9	80.7	49.4	31.5	54.7	1004.4
6. River Yamuna upto its confluence with river Chambal (excluding Chambal) (Catchment No. 403) **Districts/parts of districts within this Catchment:** **Shimla, Sirmaur**												
71.9	64.4	65.9	39.8	56.1	117.5	354.6	314.1	157.3	44.8	12.4	35.4	1355.1

TABLE – VII

DEPRESSIONS AFFECTING HIMACHAL PRADESH

DURING 1891 – 1990

MONTH	***NO. OF DEPRESSIONS***
January	NIL
February	NIL
March	NIL
April	1
May	NIL
June	2
July	2
August	9
September	17
October	1
November	NIL
December	NIL
Total	**32**

DISTRICT SUMMARIES

BILASPUR DISTRICT

The climate of this district is generally temperate compared to the plains of Punjab, although the heat in summer is sometimes trying. The terrain is mountainous particularly in the portion of the district to the southwest of Sutlej. The portion to the north and west of Sutlej is slightly hilly with elevations generally between 500 and 700 metres with some well defined ridges going upto higher elevations. The year may be divided into four seasons. The summer is from March to about the end of June. The southwest monsoon starts thereafter and lasts till about the third week of September. October and November constitute the post monsoon season and the period from December to February is the cold season.

RAINFALL

Records of rainfall in the district are available for three stations for period ranging from 32 to 39 years. The details of the rainfall at these stations and for the district as a whole are given in Tables 1 and 2. It will be seen from Table 1 that the monsoon rainfall occurs mainly during July to September, July being the rainiest month. The average annual rainfall in the district is 1256.7 mm. The rainfall during the monsoon season constitutes about 64% of the annual rainfall normal. During the winter season also there is some rainfall mostly in association with passing western disturbances. In the premonsoon month of June and in October some rainfall in the form of thundershower occurs. Considering the district as a whole, during the 50 year period from 1951 to 2000, the highest annual rainfall occurred in 1998 when it amounted to 174% of the normal. 1975 was the year with the lowest annual rainfall which was 37% of the normal. During the same period there are eight years when annual rainfall is less than 80 percent of the annual normal rainfall and there is one occasion when such a rainfall occurred in four consecutive years i.e. (1974-1977) and one occasion when such a low rainfall occurred in two consecutive years i.e. (1992-1993).

On an average there are 61 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 300.0 mm at Ghumarwin on 30 January 1988.

TEMPERATURE

There is only one observatory in the district located at Bilaspur. Climatic conditions prevailed at Bilaspur may be taken to be broadly representative of the whole district, except for regions at higher elevations where the temperatures would generally be less than those at Bilaspur. From beginning of March, temperatures begin to rise steadily till June, which is usually the hottest month of the year with the mean daily maximum temperature of 36.7°C and the mean daily minimum temperature of 23.1°C. With the advance of the southwest monsoon over the district by about the beginning of July, the day temperature drops appreciably while the night temperatures continue to be as warm as in June. After about the middle of September, temperatures begin to decrease, the fall in night temperature being more rapid than that of day temperature. January is the coldest month of the year with the mean daily minimum temperature of 4.9°C. In the cold season from December to February, the cold waves affect the district in wake of passing western disturbances and at times minimum temperature may drop down to about freezing point of water and frosts may occur.

The highest maximum temperature ever recorded at Bilaspur was 45.5°C on 30 May 1988 and the lowest minimum temperature ever recorded was –2.0°C on 04 January 1967.

HUMIDITY

In the southwest monsoon season the values of relative humidity are high. The values of relative humidity in the early mornings are generally high during throughout the year except in the latter part of summer. In the summer, particularly in afternoons, the values of relative humidity are low about 40 percent.

CLOUDINESS

Skies are clear or lightly clouded in the post monsoon and winter season. Heavily clouded to overcast skies prevail in the southwest monsoon season.

WINDS

Winds are generally light throughout the year. Winds are mainly southeasterly or calm throughout the year.

SPECIAL WEATHER PHENOMENA

Thunderstorms occur in all the months, its frequency being least during October to December and highest in latter part of summer and early part of southwest monsoon season. Dust storms occur occasionally in summer months. Occasional hail occurs in summer months. Fog is common in post monsoon and winter months.

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

TABLE – 1

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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Bilaspur (Obsy)	38	a	69.0	62.9	71.4	30.9	54.7	119.5	377.0	315.6	162.2	34.2	17.6	41.6	1356.6	188 (1973)	59 (1965)	226.0	07 Aug 1971
		b	4.0	4.0	4.3	2.2	3.2	5.8	14.7	14.4	7.1	1.6	1.2	2.4	64.9				
Bilaspur (Sadar)	32	a	57.6	61.6	56.4	22.7	30.9	101.0	308.3	274.6	144.8	33.7	13.0	28.1	1132.7	144 (1978)	60 (1965)	203.2	26 Sep 1954
		b	4.1	3.5	3.3	1.7	2.7	5.4	14.0	13.2	7.1	1.8	0.8	2.0	59.6				
Ghumarwin	39	a	68.1	71.8	51.6	31.9	47.7	112.2	316.2	341.4	168.0	22.7	15.6	34.1	1281.3	171 (1998)	35 (1974)	300.0	30 Jan 1988
		b	3.3	3.9	3.6	2.1	3.0	5.6	12.9	13.8	7.2	1.4	0.9	1.8	59.5				
Bilaspur (District)		a	64.9	65.4	59.8	28.5	44.4	110.9	333.8	310.5	158.3	30.2	15.4	34.6	1256.7	174 (1998)	37 (1975)		
		b	3.8	3.8	3.7	2.0	3.0	5.6	13.9	13.8	7.1	1.6	1.0	2.1	61.4				

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 2005.
** Years of occurrence given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1951 - 1999)
(BILASPUR)

Range in mm	No. of years	Range in mm	No. of years
401 – 500	1	1301 – 1400	2
501 – 600	0	1401 – 1500	3
601 – 700	1	1501 – 1600	6
701 – 800	1	1601 – 1700	0
801 – 900	3	1701 – 1800	0
901 – 1000	2	1801 – 1900	1
1001 – 1100	4	1901 – 2000	1
1101 – 1200	3	2001 – 2100	1
1201 – 1300	7	2101 – 2200	1

(Data available for 37 years only)

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

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	19.5	4.9	26.5	1990 Jan 20	-2.0	1967 Jan 04	90	60
February	21.7	6.7	30.7	1993 Feb 16	0.0	1964 Feb 23	86	53
March	26.3	10.3	35.0	1977 Mar 30	0.9	1964 Mar 07	80	48
April	32.4	15.7	40.7	1958 Apr 27	5.6	1964 Apr 19	64	38
May	36.1	19.5	45.5	1988 May 30	5.9	1964 May 22	53	35
June	36.7	23.1	44.2	1958 Jun 17	10.9	1962 Jun 13	66	47
July	32.6	22.4	42.1	1991 Jul 02	10.5	1964 Jul 24	87	69
August	31.4	22.3	37.5	1962 Aug 06 1987 Aug 02	13.9	1964 Aug 30	90	75
September	31.4	20.1	36.5	1979 Sep 05	7.6	1964 Sep 30	89	66
October	30.2	14.6	39.6	1983 Oct 08	4.5	1964 Oct 19	85	51
November	26.0	9.6	34.8	1964 Nov 20	2.3	1966 Nov 30	87	53
December	21.4	5.9	27.4	1966 Dec 23	0.0	1960 Dec 20	89	58
Annual	28.8	14.6					80	54

TABLE - 4
Mean Wind Speed in km/hr.
(BILASPUR)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2.5	2.9	3.1	3.4	4.1	3.2	2.2	2.0	2.0	1.5	1.8	1.8	2.5

TABLE - 5
Special Weather Phenomena
(BILASPUR)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	1.2	0.8	1.1	1.8	2.6	3.8	2.8	1.7	1.5	0.6	0.6	0.3	18.8
Hail	0.0	0.2	0.1	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.8
Dust storm	0.0	0.0	0.2	0.3	0.8	0.5	0.0	0.0	0.0	0.1	0.0	0.0	1.9
Squall	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Snow	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	4.9	3.2	0.7	0.0	0.0	0.0	0.5	0.8	0.6	0.8	2.0	5.9	19.4

CHAMBA DISTRICT

The climate of different parts of the district is largely dependant on the altitude which varies from 600 to 6400 metres. The climate of the lower tracts resembles that of the plains of the Punjab, though the heat in summer is less intense. The summer season is from March to about the middle of June. Thereafter, the southwest monsoon season commences and lasts till about the middle of September. The period from the middle of September to the middle of November constitutes the post monsoon season. The winter season is from mid November to end of February.

RAINFALL

Records of rainfall are available for 5 stations in the district for period ranging from 18 to 47 years, out of which Dalhousie is the hill station. The details of the rainfall at these stations and for the district as a whole are given in Tables 1 and 2. All the 5 stations are in the southwestern half of the district. In the region of the Ravi valley, the rainy season is well marked and rainfall in considerable. In the southwestern half of the district the average annual rainfall is 1355.1 mm. In the Chenab valley in the northwestern part of the district, the rainfall is scanty and heavy rain is unusual. There are two rainy seasons in the year, one from December to March associated with the passage of western disturbances and the other in the southwest monsoon season. Some rain is also received in the post monsoon month of October. Nearly half of the annual rainfall is received in the southwest monsoon season, while the winter rains amount to a little less than a third of the annual rainfall. The precipitation is often in the form of snow in the high altitudes, the snow line coming down occasionally to 1200 m. Heavy snowfall occurs in winter in the higher ranges.

In the southwestern half of the district for which alone some rainfall data are available, the number of rainy days (days with rainfall of 2.5 mm or more) varies from 54 at Kilar to 90 at Dalhousie observatory.

The heaviest rainfall recorded in 24 hours at any station in the district was 409.00 mm at Dalhousie observatory on 09 September 1966.

TEMPERATURE

There are two meteorological observatories in the district, one at Dalhousie and other at Chamba. The data of these observatories may be taken as representative of the climatic conditions over the whole district. Tables 3 and 3(a) give the data of temperature at Chamba and Dalhousie observatories respectively. As mentioned earlier, on account of the mountainous terrain of the district, the climate depends very much on the altitude. The temperature at Chamba given in Table 3 can be taken as representative of those in the Ravi valleys generally and the temperature at Dalhousie given in Table 3(a) can be taken as representative of those in the higher regions. Temperatures begin to increase from April till July which is generally the hottest month. The summer is generally mild in regions of higher elevations. With the advance of the southwest monsoon season by about the end of June, the temperatures drop a little. After the withdrawal of the monsoon by mid-September, the day temperatures show a slight increase. From October onwards both day and night temperatures begin to drop. January is usually the coldest month of the year. At Dalhousie the mean daily maximum temperature in this month is 11.5^{o}C while the mean daily minimum is 2.3^{o}C and at Chamba, mean daily maximum temperature is 17.9^{o}C and the mean daily minimum is 4.2^{o}C. In association with cold waves, in the wake of western disturbances, which affect the district during the winter the minimum temperatures may go down to the freezing point of water at Chamba while they may be very much below the freezing point of water in the higher regions of the district, where heavy snowfall occurs often.

The highest maximum temperature ever recorded at Chamba and Dalhousie observatory was 42.3^{o}C and 35.5^{o}C on 23 May 1989 and 09 June 1960 respectively. The lowest minimum temperature ever recorded at Chamba and Dalhousie observatory was 0.0^{o}C on 31 December 1994 and 16 April 1995 and –8.6^{o}C on 27 January 1967 respectively.

HUMIDITY

Relative humidities are generally high in the monsoon season at about 80 percent. In the post monsoon season the humidity is less particularly in the regions of high altitude. The summer is the driest part of the year.

CLOUDINESS

The skies are frequently clouded mostly with high and medium clouds due to western disturbances in the winter season, the clouding being more in northeastern part of the district. During the summer skies are moderately clouded with an increase in cloudiness by June. In the southwest monsoon season, the skies are moderately to heavily clouded. In the post monsoon season skies are clear or very lightly clouded.

WINDS

Winds are generally light throughout the year. During the monsoon season they are generally southeasterly. In the rest of the year winds are generally northwesterly or northerly. In the higher altitude, winds are generally calm throughout the year.

SPECIAL WEATHER PHENOMENA

Thunderstorms are frequent in the summer and monsoon months, being more frequent nearer the hills. Morning haze in the valleys is common in the winter season, clearing up with the advance of the day.

Tables 3, 4, 5 and Tables 3(a), 4(a), 5(a) give the details of temperature and relative humidity, mean wind speed and frequency of special weather phenomena respectively for Chamba and Dalhousie observatories.

TABLE – 1

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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Chamba	18	a	73.6	117.1	159.8	100.0	88.4	103.5	169.2	168.3	101.7	32.7	25.8	50.8	1190.9	180	90	166.2	24 Sep 1988
(Obsy)		b	5.0	6.0	7.6	5.5	5.5	6.6	10.8	10.0	4.9	2.2	1.9	3.0	69.0	(1988)	(1980)		
Chowari	47	a	125.9	115.0	121.3	49.6	54.2	135.4	574.5	479.1	237.3	49.5	22.3	59.5	2023.6	178	67	315.0	10 Aug 1997
		b	5.5	4.7	5.2	3.5	3.5	6.2	17.0	16.4	8.7	2.1	1.3	2.7	76.8	(1961)	(1972)		
Kilar	31	a	77.6	124.1	143.8	131.8	86.4	30.0	52.3	48.4	47.2	27.4	27.2	48.4	844.6	180	35	235.0	02 Aug 1997
		b	4.8	6.2	7.3	7.3	6.4	3.0	4.3	4.6	2.7	2.1	1.7	3.2	53.6	(1975)	(1967)		
Sahu	19	a	85.1	129.1	153.0	90.4	83.0	116.8	276.2	223.1	93.2	34.5	27.5	48.7	1360.6	146	84	134.0	24 Sep 1988
		b	4.7	7.1	7.9	6.3	6.2	6.9	15.0	13.1	6.1	2.9	1.5	3.1	80.8	(1988)	(1983)		
Chamba (District)		a	90.6	121.3	144.5	93.0	78.0	96.4	268.1	229.7	119.9	36.0	25.7	51.9	1355.1	198	73		
		b	4.7	7.1	7.9	5.7	5.4	5.7	11.8	11.0	5.6	2.3	1.6	3.0	70.1	(1977)	(1972)		
HILL STATION																			
Dalhousie	41	a	155.1	122.2	155.7	96.2	62.5	130.8	588.0	573.2	245.7	73.0	37.7	70.9	2311.0	215	58	409.0	09 Sept 1966
(Obsy)		b	6.5	5.9	6.5	5.3	4.2	6.4	18.3	19.8	8.8	2.7	1.8	3.4	89.6	(1959)	(1970)		

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 2005.

* * Years of occurrence given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1951 - 1999)
(CHAMBA)

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

(Data available for 35 years only)

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

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	17.9	4.2	25.3	1978 Jan 29	0.1	1981 Jan 24	82	77
February	20.5	5.6	26.2	1978 Feb 09	0.4	1981 Feb 06	79	75
March	22.9	7.3	29.9	1985 Mar 05	2.1	1991 Mar 02	80	78
April	28.8	13.2	38.5	1980 Apr 26	0.0	1995 Apr 16	69	67
May	33.5	17.3	42.3	1989 May 23	6.0	1995 May 19	61	58
June	32.3	20.5	38.6	1981 Jun 18	8.5	1994 Jun 24	64	62
July	32.6	21.5	39.5	1989 Jul 15	8.0	1994 Jul 28	80	78
August	30.7	21.1	36.6	1981 Aug 19	10.5	1994 Aug 11 1995 Aug 30	84	81
September	29.2	18.5	35.2	1990 Sep 08	5.0	1994 Sep 26	81	80
October	28.2	13.7	32.6	1979 Oct 27	1.0	1994 Oct 31	77	73
November	23.4	8.9	28.3	1979 Nov 07	0.5	1994 Nov 14	76	72
December	19.7	5.7	25.0	1987 Dec 28	0.0	1994 Dec 31	77	75
Annual	26.6	13.1					76	73

TABLE - 4
Mean Wind Speed in km/hr.
(CHAMBA)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0.8	0.9	1.1	2.1	2.1	2.3	1.1	1.1	1.6	1.6	1.2	0.9	1.4

TABLE - 5
Special Weather Phenomena
(CHAMBA)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	1.2	1.4	1.4	0.9	3.0	2.2	2.8	2.0	0.7	1.2	0.7	0.2	17.7
Hail	0.0	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0	0.5

TABLE – 3(a)

Normals of Temperature and Relative Humidity

(DALHOUSIE)

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	11.5	2.3	21.7	1952 Jan 20	-8.6	1967 Jan 27	60	72
February	12.7	2.7	29.4	1953 Feb 13	-8.0	1963 Feb 21	60	67
March	17.3	6.3	30.7	1959 Mar 24	-1.2	1976 Mar 10	58	64
April	21.3	10.5	32.6	1970 Apr 27	0.6	1976 Apr 06	57	57
May	24.9	13.8	34.4	1970 May 21	2.0	1963 May 08	51	50
June	26.6	16.2	35.5	1960 Jun 09	8.0	1974 Jun 06 1980 Jun 14	58	54
July	23.6	15.7	32.8	1954 Jul 01	8.3	1951 Jul 15	81	78
August	22.7	15.5	28.4	1986 Aug 17	11.1	1966 Aug 27	87	85
September	22.8	13.9	28.0	1968 Sep 14	8.0	1963 Sep 18	78	79
October	22.0	10.9	27.9	1961 Oct 06	-2.2	1959 Oct 28	68	70
November	17.8	6.9	25.7	1958 Nov 02	0.1	1960 Nov 29	56	70
December	14.4	4.4	23.9	1952 Dec 03	-8.0	1962 Dec 21	57	68
Annual	19.8	9.9					64	68

TABLE – 4(a)

Mean Wind Speed in km/hr.

(DALHOUSIE)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2.5	2.7	2.4	2.1	3.0	1.6	0.4	0.2	0.4	0.5	0.7	1.1	1.5

TABLE – 5(a)

Special Weather Phenomena

(DALHOUSIE)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.2	0.5	0.9	0.8	0.8	1.4	2.0	0.9	1.4	0.7	0.6	0.3	10.5
Hail	0.4	0.4	0.3	0.5	0.3	0.0	0.0	0.0	0.0	0.3	0.5	0.4	3.1
Dust storm	0.0	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4
Fog	0.6	1.3	0.8	0.3	0.8	0.1	0.2	2.0	2.4	0.3	0.0	0.6	9.4

HAMIRPUR DISTRICT

The climate of different parts of this district depends much on the elevation. The terrain is hilly with elevation ranging below 300 metre in valleys to above 1000 metre over hills. The year may be divided into four seasons. The summer is from April to about the end of June. The southwest monsoon starts thereafter and lasts till about the middle of September. The latter half of September and October constitute the post monsoon or transition period. The period from November to March is the cold season.

RAINFALL

There is only one raingauge station in the whole district for which records are available for sufficiently long period. The details of rainfall at the station and for the district as a whole are given in Tables 1 and 2. The description that follows is mainly based on the records of this station. The average annual rainfall in the district is 1462.6 mm. The rainfall in the district is mainly received in the southwest monsoon season. About 66 percent of the rainfall in the district is received during the southwest monsoon season. July and August are the rainiest months. Considerable amount of rainfall amounting to about 17 percent of the annual normal is received during the cold season in association with passing western disturbances. The variation in the rainfall from year to year in the district is not large. During the 49 years period from 1951 to 1999 the highest annual rainfall amounting to 144 percent of the normal occurred in 1990, while the lowest annual rainfall amounting to 45 percent occurred in 1974. The annual rainfall in the district which was less than 80 percent of the normal occurred in five years during the period under consideration.

On an average there are 64 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at Hamirpur was 351.0 mm on 28 June 1970.

TEMPERATURE

There is no meteorological observatory in the district. The description which follows is based on the records of the observatories in the neighbouring districts. The

temperature conditions in the district vary with space owing to the topography of the district. The period from March to about the end of June is one of the continuous increase of temperatures. June is the hottest month of the year when the mean daily maximum temperature is about 36°C and the mean daily minimum is about 21^0C. The maximum temperature on individual days may go upto about 40°C. In the valleys the daily maximum temperature may be a couple of degree higher and at places of higher elevation the temperatures are lower and the weather is pleasant. With the onset of the monsoon early in July, there is an appreciable drop in the temperature. After the withdrawal of the monsoon by middle of September, both day and night temperatures decrease, the drop in the night temperature being more rapid. January is the coldest month with the mean daily minimum temperature of about 4°C and the mean daily maximum of about 20°C. Temperature is lower at places of higher elevation by a degree or two depending on the elevation. The cold season is quite bracing. During this season, cold waves in the rear of western disturbances, which move across Punjab and Kashmir affect the district. Consequently the minimum temperature occasionally drops down to about a degree or so below the freezing point of water and frosts occur.

HUMIDITY

In the southwest monsoon season the values of relative humidity are high about 80 to 90 percent. In the rest of the year except summer season the values of relative humidity in the morning are generally high about 70 to 80 percent. The summer season is the driest part of the year, when the values of relative humidity in the afternoon are between 30 and 50 percent.

CLOUDINESS

In post monsoon season skies over the district are clear or lightly clouded. During winter cloudiness increases and skies are moderately clouded but in April and May clouding decreases slightly and it again increases from June onwards. July and August are the most clouded months when on an average 10 to 12 days per month, the skies are overcast over the district.

WINDS

Due to hilly terrain of the district, the wind is highly local and varies with space. The wind is generally from the sector southwest to west in the afternoon and from north to east or calm in the morning.

SPECIAL WEATHER PHENOMENA

During the cold season, western disturbances affect the weather over the district. Thunderstorms occur throughout the year, its frequency being least during October to December. Thunderstorms are occasionally associated with hail. Fog occurs during post monsoon and winter months, particularly in the valleys.

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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Hamirpur	41	a	73.5	65.2	61.0	25.9	41.1	143.7	394.7	399.4	165.6	44.9	15.4	32.2	1462.6	144 (1990)	45 (1974)	351.0	28 Jun 1970
		b	4.2	3.7	4.3	2.1	3.3	5.7	14.6	14.9	6.9	1.7	0.9	1.9	64.2				
Hamirpur (District)	41	a	73.5	65.2	61.0	25.9	41.1	143.7	394.7	399.4	165.6	44.9	15.4	32.2	1462.6	144 (1990)	45 (1974)		
		b	4.2	3.7	4.3	2.1	3.3	5.7	14.6	14.9	6.9	1.7	0.9	1.9	64.2				

a: Normal rainfall in mm.
b: Average number of rainy days (days with rainfall of 2.5 mm or more)
* Based on all available data upto 2005.
** Years of occurrence given in brackets.

TABLE - 2

Frequency of Annual Rainfall in the District

(Data 1951 - 1999)

(HAMIRPUR)

Range in mm	No. of years	Range in mm	No. of years
601 – 700	1	1401 – 1500	5
701 – 800	0	1501 – 1600	4
801 – 900	0	1601 – 1700	1
901 – 1000	0	1701 – 1800	3
1001 – 1100	3	1801 – 1900	2
1101 – 1200	1	1901 – 2000	1
1201 – 1300	4	2001 – 2100	1
1301 – 1400	5	2101 – 2200	1

(Data available for 32 years only)

KANGRA DISTRICT

The climate of different parts of the district depends much on the elevation. The terrain is mountainous with deep valleys and high ridges and peaks. The elevation generally ranges from about 2000 metres to about 6000 metres. In some of the valleys the elevation at some places is as low as about 500 metres. The climate of the lower parts of the district near the southwestern border is somewhat like that of the adjoining plains of the Punjab, except for a milder hot season and higher rainfall. The cold season is extremely bracing. The year may be divided into four seasons. The period from November to March is the winter season. The next three months form the summer season. The following period lasting upto about the middle of September is the southwest monsoon season. The latter half of September and October form the post monsoon season or transition period.

RAINFALL

Records of rainfall in the district are available for eight stations for period ranging from 13 to 47 years. The details of the rainfall at these stations and for the district as a whole are given in Tables 1and 2. The precipitation in the district increases from the southwest to the northeast in the Kangra region and thereafter in the Saraj region decreases rapidly towards the north and northwest. The annual normal precipitation in the district varies from 1387.0 mm at Dehra-Gopipur to 3722.5 mm at Dharamsala (Lower). It will be seen from Table 1 that southwest monsoon season i.e. period from June to September is the chief rainy season and August being the rainiest month. There is some precipitation all the year round, though in November the precipitation is not much generally. The average annual rainfall in the district is 1852.3 mm. Rainfall during the monsoon season constitutes about 78% of the annual rainfall normal. The rainfall in the summer season is mostly in the form of thundershowers. The precipitation during cold season is in association with the passage of western disturbances and often in the form of snowfall at elevations above 1800 metres. Occasional slight snowfall continues to occur at elevations above 4500 metres even during June and July. But at elevations below 2400 metres

the snowfall becomes less after April. Considering the district as a whole, during 49 years period from 1951-1999, the highest annual rainfall occurred in 1976 when it amounted to 126 percent of the normal. 1963 was the year with the lowest annual rainfall, which was 56 percent of the normal. During the same period, there are 12 years when annual rainfall was less than 80 percent of the annual normal rainfall. There is one occasion when such a low rainfall occurred in five consecutive years i.e. 1960 to 1964.

On an average there are 67 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 53 at Dehra-Gopipur to 100 at Dharamsala (Obsy).

The heaviest rainfall in 24 hours recorded at any station in the district was 800.0 mm at Kangra on 19 October 1874.

TEMPERATURE

There is one meteorological observatory in the district at Dharamsala, situated at an elevation of about 1211 metres above sea level. The temperature conditions in the different parts of the district are influenced to a great extent by their topography and hence the records of the observatory at Dharamsala gives some idea of the meteorological conditions prevalent in the district. The period from March to about the end of June is one of continuous increase in temperature. At Dharamsala during June, which is the hottest month, with the mean daily maximum temperature of about 31.0^{o}C and the mean daily minimum temperature of about 21.3^{o}C. The maximum temperature on individual days in May and June may go upto about 38^{o}C at Dharamsala. At lower elevation in Kangra region temperatures may be higher. At places at higher elevations, however the temperatures are lower and the weather is pleasant. With the onset of the southwest monsoon early in July, there is an appreciable drop in day temperatures, however, nights are as warm as in summer months. After the withdrawal of the monsoon by about the middle of September, both day and night temperatures decrease, the drop in night temperatures being more rapid. January is the coldest month of the year with the mean daily maximum temperature of about 14.6^{o}C and the mean daily minimum temperature of about 5.6^{o}C. At places at higher elevations, the temperatures are much lower, depending on elevations. The cold season is extremely bracing, severe frost occur on many days at higher elevations. During cold waves which affect the district in the rear of western disturbances which move across lower Punjab and Kashmir, the minimum

temperature even at places below 1200 metres drop down to about a degree below the freezing point of water and frosts occur. Snowfall occur in the Kangra district during the period December to April at elevations as low as about 1500 metres on quite a few occasions, at times the snow accumulations being quite appreciable. Some snowfall continues to occur at elevations as low as about 1500 metres even in May.

However, later during the southwest monsoon season, snowfall is rare below 4500 metres.

The highest maximum temperature ever recorded at Dharamsala was 38.6^{o}C on 31 May 1988 and 18 June 1995. The lowest minimum temperature ever recorded was –1.9^{o}C on 13 January1972.

HUMIDITY

The values of relative humidity are generally above 75 percent during the monsoon months. In the rest of the year humidity is moderate, its value generally being between 50 to 65 percent except during April and May, the driest months, when its values are about 40 percent.

CLOUDINESS

The skies are generally clear or lightly clouded in the post monsoon season. On few days in the winter season skies are heavily clouded when the district is affected by passing western disturbances. The skies are heavily clouded during the southwest monsoon season.

WINDS

Due to mountainous terrain of the district the wind is highly local. Winds are generally light and mostly calm in the morning. In the afternoon winds are from southwest or west throughout the year, with its highest frequency in southwest monsoon season.

SPECIAL WEATHER PHENOMENA

During the cold season, western disturbances affect the weather over the district. Thunderstorms occur throughout the year, its frequency is more in latter part of summer and southwest monsoon season. Thunderstorms in the cold season are occasionally associated with hail. Occasional dust storms occur in the latter part of summer. Fog occurs occasionally during the cold season, particularly in the valleys.

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

TABLE – 1

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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Dehra-Gopipur	46	a	65.7	61.1	52.0	19.9	37.4	105.1	386.2	425.8	148.5	39.9	10.8	34.6	1387.0	257 (1970)	39 (1979)	300.0	09 Aug 1994
		b	3.8	3.5	3.7	1.9	2.3	4.7	11.8	11.5	5.8	1.6	0.7	2.0	53.3				
Dehra-Gopipur (Hydro)	13	a	62.0	79.6	55.6	53.4	38.2	141.7	463.0	556.6	109.0	22.5	13.0	20.0	1614.5	148 (1999)	87 (1985)	300.0	08 Aug 1994
		b	4.0	4.6	3.0	2.4	2.3	5.2	13.0	11.8	5.4	1.1	1.0	0.9	54.7				
Dharamsala Upper	16	a	125.2	103.0	130.5	60.1	58.0	159.2	862.8	767.7	263.0	30.6	22.4	54.6	2637.1	130 (1958)	68 (1954)	381.7	10 Jul 1998
		b	6.0	5.0	6.5	4.2	4.0	6.7	22.2	20.7	10.4	2.1	1.6	2.7	92.1				
Kangra	41	a	73.1	76.3	84.7	38.6	40.3	161.6	546.1	616.6	222.8	50.2	14.6	38.9	1963.8	136 (195)	45 (1972)	800.0	19 Oct 1874
		b	5.0	4.2	4.8	2.6	3.0	6.6	16.1	18.2	8.0	2.0	0.9	2.2	73.6				
Nurpur	41	a	88.7	75.4	69.9	37.1	31.0	98.1	476.3	510.1	175.3	46.6	13.1	38.0	1659.6	207 (1976)	65 (1972)	293.4	05 Oct 1955
		b	4.3	3.9	4.2	2.7	2.1	4.5	14.0	14.1	6.5	1.6	0.9	2.1	60.9				
Kangra (District)		a	82.9	79.1	78.5	41.8	41.0	133.1	546.9	575.3	183.7	38.0	14.8	37.2	1852.3	126 (1976)	56 (1963)		
		b	4.6	4.2	4.4	2.8	2.7	5.5	15.4	15.3	7.2	1.7	1.0	2.0	66.8				
HILL STATIONS																			
Dharamsala (Obsy)	47	a	103.2	106.7	112.2	59.1	66.1	200.6	872.4	862.6	385.7	59.1	21.1	56.3	2905.1	163 (1958)	55 (1965)	381.8	10 Jul 1998
		b	5.7	5.6	6.2	4.6	4.7	9.4	21.5	22.2	13.0	2.9	1.2	3.0	100.0				
Dharamsala Lower	17	a	120.9	107.2	104.8	72.4	70.0	162.8	1275.2	1202.9	443.0	76.6	26.5	60.2	3722.5	236 (1967)	63 (1951)	600.0	18 Jul 1967
		b	5.8	4.5	4.9	3.6	3.3	5.2	19.3	20.9	10.8	2.1	1.3	2.4	84.1				
Palampur	30	a	109.2	111.1	131.9	60.8	61.4	196.2	771.7	804.2	311.9	58.1	22.5	57.1	2896.1	149 (1994)	49 (1965)	344.2	21 Aug 1930
		b	5.2	4.9	6.4	3.8	4.0	7.4	19.4	21.5	10.8	2.6	1.1	2.9	90.0				

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 2005.

** Years of occurrence given in brackets.

Hill stations not considered for subdivisional mean

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1951 - 1999)
(KANGRA)

Range in mm	No. of years	Range in mm	No. of years
1001 – 1100	3	1701 – 1800	3
1101 – 1200	1	1801 – 1900	2
1201 – 1300	4	1901 – 2000	4
1301 – 1400	3	2001 – 2100	4
1401 – 1500	1	2101 – 2200	1
1501 – 1600	5	2201 – 2300	2
1601 – 1700	5	2301 – 2400	1

(Data available for 39 years only.)

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

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	14.6	5.6	24.7	1991 Jan 28	-1.9	1972 Jan 13	61	58
February	16.2	7.1	28.0	1971 Feb 21	-1.6	1961 Feb 08	58	54
March	20.8	11.1	30.4	1971 Mar 27	2.4	1982 Mar 07	50	46
April	26.1	15.8	35.3	1970 Apr 26	7.3	1960 Apr 23	45	37
May	30.0	19.4	38.6	1988 May 31	8.8	1969 May 02	40	33
June	31.0	21.3	38.6	1995 Jun 18	12.8	1968 Jun 24	55	49
July	27.2	20.4	35.3	1957 Jul 05	11.6	1996 Jul 26	81	78
August	26.4	20.0	31.5	1987 Aug 02	16.0	1982 Aug 29	85	84
September	26.4	18.3	30.6	1950 Sep 01	11.2	1962 Sep 28	76	74
October	24.9	14.8	30.5	1983 Oct 07	8.0	1987 Oct 20	60	54
November	20.8	10.3	26.6	1990 Nov 12	4.8	1966 Nov 30	56	52
December	16.6	6.9	24.6	1993 Dec 06	-1.0	1964 Dec 10	58	57
Annual	23.4	14.3					60	56

TABLE - 4
Mean Wind Speed in km/hr.
(DHARAMSALA)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
3.6	4.2	4.4	4.5	5.3	4.3	3.0	2.6	2.7	2.9	3.0	2.5	3.6

TABLE - 5
Special Weather Phenomena
(DHARAMSALA)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	1.3	1.6	2.9	4.1	5.6	7.8	6.2	6.2	5.2	2.1	0.6	0.6	44.2
Hail	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Dust storm	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Snow	0.0	0.1	1.7	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	2.7
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.0	0.0	0.0	0.1	0.8

KINNAUR DISTRICT

The climate of different parts of this district depends much on the elevation. The terrain is mountainous with deep valleys and high ridges and peaks, ranging in elevation from 5000 to 6500 metres. The summer season is from March to about the end of June. The southwest monsoon season, which follows thereafter, continues till about the middle of September. The period from mid-September to November constitutes the post monsoon season or transition period. The winter season is from December to February.

RAINFALL

Records of rainfall in the district are available for 6 stations for 10 to 49 years. Table 1 gives the details of the rainfall at these stations and for the district as a whole. Being a hilly district, Table 2 which gives frequency of the annual rainfall in the district is not given. All these stations are in the southwestern sector of the district. On account of the mountainous terrain there are likely to be sharp contrasts in the amount of rainfall even between stations only few kilometers apart. But broadly speaking the rainfall decreases rapidly from the southwestern to the northeast in the district. The eastern regions bordering Tibet are almost semi arid. There are two wet seasons in a year in the district. About 48 percent of the annual rainfall is received, mostly as snow, during the period from December to March. The second wet season is from July to September and the rainfall during this period amounts to about 24 percent of the annual. In the extreme southwestern parts of the district, the rainfall in the southwest monsoon season is heavier than in the cold weather season. But over the rest of the district the rainfall in the cold season is heavier. The variation in the rainfall from year to year is very large. For example at Sangla, the highest annual rainfall which was 292 percent of the normal occurred during 1959 while in 1970 it was only 43 percent of the normal.

The average number of rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district varies from 41 at Purbani to 75 at Nichar.

The heaviest rainfall in 24 hours recorded at any station in the district was 609.6 mm at Kilba on 27 December 1958.

TEMPERATURE

There is no meteorological observatory in the district. However, the records of the observatories in the neighbouring district can be taken as fairly representatives of the conditions prevailing in this district in general. The temperatures in the different parts of the district vary according to the elevation. Temperatures begin to rise rapidly from about the end of February, till June, which is the warmest month. The weather is cool and pleasant in the summer except perhaps in the deep valleys. With the onset of the southwest monsoon by about the third week of June, the temperatures begin to decrease gradually. However, the drop is rapid only after October. January is the coldest month. In association with the passage of western disturbances, in the cold season, the district experiences spells of cold weather when the temperatures sometimes, go down several degrees below the freezing point of water and frosts occur.

HUMIDITY

The relative humidity begin to increase from June. They are the highest during the southwest monsoon season when they are between 70 and 90 percent. In the rest of the year they are low and generally between 45 and 55 percent in the afternoon.

CLOUDINESS

Skies are heavily clouded to overcast during the southwest monsoon season. Clear or lightly clouded skies prevail during the rest of the year. However skies become cloudy in the cold season in association with the eastward passage of western disturbances. Cloudiness increases in the afternoons during May and June.

WINDS

In the southwest monsoon season winds are mostly southerly to southeasterly. In the rest of the year, winds are mostly from directions between northeast and northwest.

SPECIAL WEATHER PHENOMENA

Thunderstorms occur generally throughout the year, being most frequent during the period from April to July. Some of the thunderstorms during the summer season are accompanied with squalls and occasionally with hail Dust storms occur sometimes in the summer months. Western disturbances that move eastward in the neighbourhood of the district during the period from December to May, affect the weather over the district, causing cloudiness and precipitation mostly as snow.

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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Kilba	49	a	88.5	102.8	130.4	84.6	60.9	28.1	59.2	62.4	60.3	35.0	19.2	54.7	786.1	259 (1982)	50 (1970)	609.6	27 Dec 1958
		b	5.1	5.8	7.6	5.3	5.2	3.1	7.3	7.3	5.0	2.1	1.4	2.5	57.7				
Sangla	46	a	107.5	110.8	92.6	79.4	60.3	27.7	59.4	66.3	64.7	32.4	16.9	57.1	775.1	292 (1959)	43 (1970)	558.8	21 Dec 1958
		b	4.8	5.6	5.9	5.8	5.3	2.9	7.6	7.3	5.1	2.2	1.3	2.3	56.1				
Kinnaur (District)		a	98.0	106.8	111.5	82.0	60.6	27.9	59.3	64.4	62.5	33.7	18.1	55.9	780.7	269 (1982)	47 (1970)		
		b	5.0	5.7	6.8	5.6	5.3	3.0	7.5	7.3	5.1	2.2	1.4	2.4	57.3				
HILL STATIONS																			
Chini/ Kalpa	49	a	97.7	103.4	107.1	76.3	70.0	34.7	44.1	41.9	54.4	34.7	14.6	40.6	719.5	195 (1964)	43 (1999)	479.0	03 Mar 2002
		b	5.9	5.9	6.4	5.6	5.4	2.4	5.2	4.7	4.3	2.0	1.2	2.7	51.7				
Kalpa (GL) Obsy	10	a	74.0	100.0	104.1	76.6	63.4	37.5	42.9	45.3	49.9	27..8	13.8	35.0	670.3	143 (1994)	53 (1999)	274.3	22 Mar 2005
		b	6.0	7.8	7.7	6.3	5.6	2.7	4.6	5.7	5.1	1.3	1.5	2.4	56.7				
Nichar	49	a	118.3	119.4	127.1	74.5	88.1	52.3	136.0	157.0	105.1	39.9	16.9	46.3	1080.9	159 (1955)	41 (1968)	275.0	31 Mar 1990
		b	5.5	5.8	7.8	6.1	6.6	5.5	10.9	12.8	7.8	2.4	1.2	2.5	74.9				
Purbani	33	a	96.9	97.3	98.1	65.5	52.2	32.0	26.7	25.9	40.7	27.0	18.7	44.2	625.2	233 (1959)	25 (1970)	355.6	21 Dec 1958
		b	5.5	4.2	6.1	4.9	4.3	1.9	3.4	2.7	3.0	1.8	1.0	1.9	40.7				

a: Normal rainfall in mm.
b: Average number of rainy days (days with rainfall of 2.5 mm or more)
* Based on all available data upto 2005.
** Years of occurrence given in brackets.

KULLU DISTRICT

The district has a mountainous terrain with valleys, ridges and peaks, as such the climate of different parts of the district depends largely on the elevation. The climate of the low-altitude areas of the district near the southwestern border is somewhat similar to the adjoining plains of the Punjab, except for a milder hot season. The cold season is extremely bracing. The year may be divided into four seasons. The period from November to March is the winter season. The next three months April to June form the summer season. The following period lasting upto about the middle of September is the southwest monsoon season. The later half of September and October form the post monsoon or transition period.

RAINFALL

Rainfall records are available for 4 stations in the district for period ranging from 19 to 36 years. The details of the rainfall at these stations are given in Table 1. Being a hilly district, Table 2 which gives the frequency of the annual rainfall in the district is not given.

It can be seen from Table – 1 that the monsoon rainfall occurs mainly during July to September. July and August are the rainiest months. The rainfall during the monsoon season constitutes about 39 percent of the annual rainfall. The precipitation in the district increases from southwest to northeast. The annual precipitation varies from 934.9 mm at Bhuntar Aero observatory to 1431.0 mm at Manali observatory. There is some precipitation in the district all the year round, though in October and November, it is much less. The rainfall during the winter months, December to March is quite significant and is as much as 35 percent of the annual total. Winter precipitation generally occurs in association with the passage of western disturbances and is mostly in the form of snowfall, where as during the summer months, i.e. April to June, it is in the form of thundershowers and this constitutes about 19 percent of the annual total. In the early part of summer, snowfall

may also occur. Occasional snowfall may occur at higher elevations even during June and July. The spatial variation in the annual precipitation at various stations is not large.

The heaviest rainfall recorded in 24 hours at any station in the district was 502.0 mm at Manali observatory on 20 June 1995.

TEMPERATURE

There are two meteorological observatories in the district, one at Manali and other at Bhuntar Aerodrome. The records of these observatories may be taken as representative of the climatic conditions in the district in general. The temperature distribution in different parts of the district are influenced to a great extent by their altitudes and geographical locations. The period from March to about the end of June is one of continuous rise in temperature. June is the hottest month when the mean daily maximum temperature is 27.3°C and 33.2°C and the mean daily minimum is 12.3°C and 16.9°C at Manali and Bhuntar (A) observatories respectively. The maximum temperature on individual days may go upto about 40°C at Bhuntar (A) observatory and upto 35°C at Manali observatory. With the onset of the monsoon early in July, there is an appreciable drop in temperature. After the wihdrawal of the monsoon by about the middle of September, both day and night temperatures decrease, the drop in night temperature being more rapid. January is the coldest month with the monthly mean of daily maximum temperature and monthly mean of daily minimum temperature at Manali is 10.7°C, -1.7°C and at Bhuntar (A) is 15.2°C, 1.5°C respectively. At lower elevations and in the valleys the temperatures may be higher and at higher elevations the temperatures may be lower. The cold season is extremely bracing, frost occur on many days at higher elevations. During cold waves, which affect the district in the rear of western disturbances moving across lower Punjab and Kashmir, the minimum temperature even at places below 1200 metres may drop down to about 4 to 5°C below the freezing point of water resulting in frost. Snowfall occurs in the district during the period December to April at elevations as low as about 1500 metres on quite a few occasions, and at times the snow accumulations may be quite appreciable. Sometimes snowfall continues to occur at elevations as low as about 1500 metres even in May. However later during the monsoon season, snowfall is rare at altitudes below about 4500 metres.

The highest maximum temperature ever recorded at Manali and Bhuntar Aero observatory is 35.0°C and 40.0°C on 31 May 1988 respectively. The lowest minimum

temperature ever recorded at Manali and Bhuntar Aero observatory is -11.6°C on 02 January 1998 and –5.2°C on 18 December 1976 respectively.

HUMIDITY

Relative humidity is maximum during the monsoon months while it is minimum in April-May. Humidity is normally higher in the mornings than during the afternoons.

CLOUDINESS

The skies are generally heavily clouded during monsoon season and on few days during the cold season when the district is affected by passing western disturbances. Skies are mostly clear or lightly clouded during the rest of the year.

WINDS

Due to mountainous terrain of the district, the wind is highly local and variable. Winds are generally light, but at elevations above 4500 metres, they are likely to be moderate to strong. During the southwest monsoon season, winds are southeasterly to southerly. In the rest of the year winds are northerly or southerly.

SPECIAL WEATHER PHENOMENA

During the cold season, western disturbances affect the weather, over the district. Thunderstorms occur mainly during the period February to October, the period April to June having the maximum incidences. The thunderstorms occur in the cold season and summer seasons are occasionally associated with hail. Fog occurs occasionally during the cold season particularly in the valleys.

Tables 3, 4, 5 and Tables 3(a), 4(a), 5(a) give the temperature and humidity, mean wind speed and frequency of special weather phenomena respectively for Manali and Bhuntar Aero observatories.

TABLE – 1

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 ANNUAL RAINFALL AS % OF NORMAL & YEARS **		HEAVIEST RAINFALL in 24 HOURS * Amount (mm)	HEAVIEST RAINFALL in 24 HOURS * Date
Banjar/Saraj-TEH	30	a	76.6	76.0	102.3	64.5	71.7	80.8	228.7	177.8	104.0	38.5	16.0	36.3	1073.2	145 (1955)	51 (1960)	127.0	21 Sep 1962
		b	5.3	5.6	7.5	5.8	6.0	6.8	12.9	12.8	6.6	2.4	1.4	2.7	75.8				
Bhuntar (Aero Obsy)	36	a	83.7	102.8	127.7	79.4	70.1	53.9	137.7	127.8	61.0	27.7	23.5	39.6	934.9	148 (1988)	64 (1984)	132.0	04 Aug 1977
		b	5.6	6.5	7.8	6.1	6.3	4.8	9.5	9.3	4.6	2.1	1.7	2.5	66.8				
Kullu	19	a	131.4	127.4	120.4	81.7	50.2	39.2	150.6	126.1	96.4	49.3	19.8	44.7	1037.2	153 (1957)	65 (1970)	400.0	19 Jun 1892
		b	7.6	6.4	7.2	6.0	3.8	3.4	9.1	8.8	5.2	2.5	1.1	2.8	63.9				
Manali (Obsy)	31	a	114.1	134.0	201.7	115.6	80.3	83.2	215.8	232.8	104.7	51.9	40.1	56.8	1431.0	140 (1995)`	65 (1974)	502.0	20 Jun 1995
		b	7.0	8.2	9.1	6.2	5.7	6.9	14.8	15.3	8.7	3.6	2.5	3.3	91.3				

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 2005.
** Years of occurrence given in brackets.
Hill stations not considered for subdivisional mean.

TABLE - 3

Normals of Temperature and Relative Humidity

(MANALI)

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	10.7	-1.7	19.5	1987 Jan 27 1974 Jan 01 1988 Jan 02	-11.6	1998 Jan 02	74	66
February	11.6	-0.7	23.0	1988 Feb 04	-11.0	1972 Feb 15	73	65
March	16.0	2.6	27.0	1974 Mar 21	-6.0	1998 Mar 07	63	56
April	22.1	6.2	30.0	1970 Apr 26	-1.0	1972 Apr 19 1976 Apr 05 1990 Apr 02	57	49
May	25.0	8.6	35.0	1988 May 31	1.0	1977 May 04	60	52
June	27.3	12.3	33.2	1978 Jun 06	4.4	1978 Jun 01	70	58
July	25.9	15.2	32.6	1979 Jul 04	8.0	1989 Jul 04	85	73
August	25.3	14.8	30.6	1979 Aug 08	7.0	2000 Aug 03	90	79
September	25.1	11.1	29.2	1987 Sep 08	3.0	1972 Sep 30	86	73
October	22.7	5.3	30.0	1991 Oct 01	-1.5	1973 Oct 30	75	67
November	18.8	1.4	25.6	1972 Nov 07	-5.0	1972 Nov 26 2000 Nov 29	64	58
December	20.4	6.2	21.5	1969 Dec 04	-10.0	1968 Dec 27	64	57
Annual	20.4	6.2					72	63

TABLE - 4

Mean Wind Speed in km/hr.

(MANALI)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1.5	1.9	3.2	2.7	4.9	2.5	1.2	0.8	1.4	1.8	1.9	1.5	2.1

TABLE - 5

Special Weather Phenomena

(MANALI)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.0	0.0	0.2	0.1	0.3	0.6	0.2	0.1	0.0	0.2	0.0	0.0	1.7
Hail	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dust storm	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1	0.0	0.0	0.0	0.5

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

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	15.2	1.5	25.4	2001 Jan 31	-4.7	1977 Jan 29	89	54
February	17.3	3.5	26.7	1985 Feb 28	-4.5	1973 Feb 01 1977 Feb 07	87	50
March	21.7	6.5	32.3	1999 Mar 31	0.2	1982 Mar 11	80	47
April	27.1	9.8	37.3	1970 Apr 26	3.5	1993 Apr 01	71	40
May	31.0	12.5	40.0	1988 May 31	4.6	1987 May 16	63	37
June	33.2	16.9	39.4	1972 Jun 18	8.7	1986 Jun 01	65	42
July	31.2	19.8	37.4	1987 Jul 04	12.3	1989 Jul 04	81	60
August	30.6	19.6	37.8	1983 Aug 24	10.9	1988 Aug 29	86	64
September	30.3	16.3	35.2	1980 Sep 01	7.8	1982 Sep 29	80	56
October	27.7	9.8	33.2	1974 Oct 07	3.5	1987 Oct 20	78	46
November	22.9	4.4	29.4	2001 Nov 03	-1.5	1976 Nov 30	83	44
December	17.2	1.6	24.5	1993 Dec 02 1999 Dec 01	-5.2	1976 Dec 18	88	53
Annual	25.5	10.2					79	49

TABLE – 4(a)
Mean Wind Speed in km/hr.
(BHUNTAR (A))

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2.9	3.7	4.3	5.0	4.8	5.9	6.3	6.1	5.6	4.5	3.4	2.4	4.6

TABLE – 5(a)
Special Weather Phenomena
(BHUNTAR (A))

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	1.1	2.6	6.6	9.0	12.0	10.3	6.8	3.9	4.9	3.1	1.0	0.6	61.9
Hail	0.1	0.3	0.8	0.8	0.4	0.1	0.0	0.0	0.1	0.2	0.1	0.1	2.9
Dust storm	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
Fog	0.3	0.2	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.2	1.2

LAHAUL AND SPITI

This district, which lies between the western or main Himalayas on the north and the mid Himalayas on the south, has a bracing climate. The general elevation in the district is above 2700 metres with the greater part of the area having elevations ranging from about 4000 metres to about 6000 metres, some of the peaks being above 6400 metres. The seasons follow more like that of the temperate zone. The winter season from about the middle of November to March is followed by the spring, which lasts upto the end of May. The next four months may be termed the summer season. October and the first half of November constitute the transition season.

RAINFALL

Records of rainfall are available for 5 stations for period ranging from 23 to 44 years. The normals of rainfall and rainy days based on data 1951 to 2000 are given in Table 1 for all stations. Being a hilly district, Table 2 which gives the frequency of the annual rainfall in the district is not given. The precipitation in the areas towards the north and east of Keylong is expected to be much less than at Keylong and mostly in the form of snowfall. The district is set in a basin, the edge of which consists of enormous mountain ranges. These barriers keep off the monsoon currents and as a consequence the summer rainfall is scanty. The period from December to May is the season with good precipitation, almost mainly associated with the passage of western disturbances.

Rainfall varies from place to place depending on topography of the place. It varies from 606.8 mm at Keylong to 2225.3 mm at Kothi observatory. The rainfall during the period June to September constitutes only 20 to 50% of the annual rainfall. The annual number of rainy days (i.e. days with 2.5 mm or more) varies from 40 at Keylong to 117 at Kothi observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 600.0 mm at Keylong observatory on 19 October 1892.

TEMPERATURE

There are four meteorological observatories in the district at Koksar, Keylong, Gondla and Kothi. But recent record of temperatures is not available. From some very old records of temperatures available for Keylong, it is seen that the maximum temperatures at that station range from 26.8ºC in July to 6.0ºC in February. The minimum temperatures range from –17.7ºC in February to 6.7ºC in August. July and August are the warmest months. In the Spiti region the temperatures may be somewhat less than in the Lahaul region.

HUMIDITY

The air is generally very dry over the district particularly in the summer and transition seasons. In the winter also the air is dry except during spells of rain or snowfall.

CLOUDINESS

During the period December to May skies become heavily clouded or overcast when the district is affected by western disturbances. In the summer season, there is some moderate cloudiness. In the rest of the year the skies are mostly clear or lightly clouded.

WINDS

Winds are generally light in the valleys and at lower elevations. But at higher elevations winds are stronger. Wind directions at the surface will depend very much on the nature of the terrain. But generally speaking, winds are northerly to northeasterly in summer season and westerly to northwesterly in the rest of the year.

SPECIAL WEATHER PHENOMENA

During the winter and the early part of the spring, the district is affected by a series of western disturbances, which cause snowfall sometimes heavy at the higher elevations and rain at lower elevations. Fog occurs in the valleys in winter.

Tables 3 and 4 give the details of temperature and relative humidty and mean wind speed respectively for Keylong observatory.

TABLE – 1

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 ANNUAL RAINFALL AS % OF NORMAL & YEARS **	LOWEST ANNUAL RAINFALL AS % OF NORMAL & YEARS **	HEAVIEST RAINFALL in 24 HOURS * Amount (mm)	HEAVIEST RAINFALL in 24 HOURS * Date
Keylong	23	a	45.3	68.2	114.7	81.7	48.0	25.9	61.3	50.4	31.2	12.2	19.3	48.6	606.8	197 (1995)	20 (1973)	90.0	15 Feb 1998
		b	3.2	4.1	6.1	5.5	3.5	1.7	4.5	3.7	1.9	1.2	1.3	3.1	39.8				
HILL STATIONS																			
Gondla (Obsy)	36	a	120.2	115.7	159.4	124.8	97.1	28.3	68.4	52.8	74.1	55.7	34.8	59.6	990.9	170 (1975)	55 (1960)	158.8	04 Oct 1955
		b	8.2	7.4	9.7	7.8	6.4	2.5	5.7	5.3	4.1	3.0	2.3	5.0	67.4				
Keylong (Obsy)	27	a	78.0	92.8	141.1	88.2	71.1	25.8	60.3	42.1	55.5	24.4	25.8	35.3	740.4	136 (1957)	63 (1960)	600.0	19 Oct 1892
		b	6.3	5.9	8.7	6.5	5.4	2.2	5.6	4.3	3.5	2.0	1.6	3.1	55.1				
Koksar (Obsy)	42	a	160.6	174.1	166.0	96.6	105.1	52.5	134.5	108.8	112.6	68.0	33.9	69.2	1281.9	201 (1957)	26 (1970)	190.0	05 Sep 1995
		b	8.9	8.1	8.8	6.8	6.7	3.6	8.1	7.2	5.5	3.4	2.4	4.6	74.1				
Kothi (Obsy)	44	a	203.6	203.1	268.9	153.6	118.5	104.4	409.6	363.1	204.8	82.9	32.2	80.6	2225.3	205 (1988)	60 (1974)	210.0	10 Oct 1985
		b	8.9	9.1	10.9	8.6	6.8	8.1	21.2	21.3	11.9	4.1	2.0	4.6	117.5				

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 2005.

** Years of occurrence given in brackets.

Hill stations not considered for subdivisional mean.

TABLE - 3

Normals of Temperature and Relative Humidity

(KEYLONG)

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	6.7	-16.5	13.1		-19.4		74	
February	6.0	-17.7	9.0		-19.7		76	
March	9.8	-13.8	16.7		-16.1		75	
April	14.8	-7.4	18.7		-13.6		66	
May	22.1	-0.9	25.9		-1.9		62	
June	25.9	2.9	27.7		-0.2		62	
July	26.8	5.3	28.7		1.7		74	
August	26.7	6.7	28.2		4.6		77	
September	25.6	1.3	27.1		-0.1		64	
October	21.8	-4.1	22.9		-8.9		52	
November	16.3	-7.7	20.2		-10.4		54	
December	12.1	-14.1	13.9		-17.5		67	
Annual	17.9	-5.5					67	

TABLE - 4

Mean Wind Speed in km/hr.

(KEYLONG)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1.1	1.1	1.6	2.4	2.6	2.4	2.4	2.1	1.9	1.9	1.4	1.1	1.8

MANDI DISTRICT

The climate of different parts of this district depends much on the altitude. The range of altitude is large, the highest point being about 4000 metres on the Kullu border and the lowest about 600 metres near the northwestern border of the district. The heat in summer is oppressive in the low lying tracts and the cold is severe in the hilly regions during winter. The year may be divided into four seasons. The summer is from March to about the end of June. The southwest monsoon season starts thereafter and lasts till about the middle of September. The period from mid September to November constitutes the post monsoon season and December to February is the winter season.

RAINFALL

Records of rainfall are available for 13 stations out of which six are hill stations. Rainfall at these stations and for the district as a whole are given in Tables 1and 2. It will be seen from Table 1, that the average annual rainfall in the district is 1564.6 mm. The rainfall in the district increases from the southeast towards the northwest, varying from 1010.0 mm at Karsog to 2520.9 mm at Jogindernagar. The rainfall during the southwest monsoon season is about 74 percent of the annual normal rainfall, July being the rainiest month. Some rains, mostly in the form of thundershowers occur in the summer season and in October. During the winter period December to March also, some rain is received in association with passing western disturbances. The district experiences snowfall during the period November to March in general and sometimes even a little later at the higher elevations. The snowline comes down to about 1200 metres and snowfall is known to occur at Mandi proper. But, below 2100 metres it remains on the ground for short period only. Considering the district as a whole, during the 49 year period from 1951to 1999, the highest annual rainfall occurred in 1988 when it amounted to 215 percent of the annual normal, 1983 was the year with the lowest annual rainfall which was 44 percent of the normal. During the same period there are 9 years when annual rainfall

is less than 80% of the annual normal rainfall. There is one occasion when such a low rainfall occurred in the two consecutive years, viz. 1982-83.

On an average there are 75 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 65 at Karsog to 90 at Jogindernagar.

The heaviest rainfall recorded in 24 hours at any station in the district was 600.0 mm at Jogindernagar on 14 August 1996.

TEMPERATURE

There are two meteorological observatories in the district at Mandi and Sundernagar. The records of these observatories may be taken as broadly representative of the climatic conditions in the district as a whole except for regions of higher elevation where the temperatures are lower by a few degrees depending on the altitude. From about the middle of February, temperatures being to rise steadily till June which is the hottest month of the year. The mean daily maximum temperature during June are 35.7°C and 34.2°C at Mandi and Sundernagar respectively where the mean daily minimum temperatures are of about 19.5°C and 19.9°C at Mandi and Sundernagar respectively. On individual day maximum temperature reach upto about 42°C and the weather is oppressive in the low lying portions of the district, but nights are generally cool in the summer months. With the onset of the monsoon over the district by about the end of June, day temperartures decrease appreciably but night temperatures are little higher than the summer season. During this season the weather is pleasant even at lower elevations. With the withdrawal of the monsoon by about the middle of September both day and night temperatures decrease progressively, the drop in night temperatures being more rapid. January is the coldest month with the mean daily minimum temperature of 2.3°C and 2.9°C at Mandi and Sundernagar respectively. In the winter season from December to February, in association with cold waves which affect the district in the wake of passing western disturbances, the night temperatures go down to two to three degrees below the freezing point of water and frosts occur.

The highest maximum temperature ever recorded at Mandi and Sundernagar was 42.7°C on 18 June 1958 and 41.6°C on 31 May 1988 respectively. The lowest minimum temperature ever recorded was -2.9°C on 21 December 1965 at Mandi and –10.6°C on 29 December 1983 at Sundernagar.

HUMIDITY

The summer season is the driest part of the year, when the values of relative humidity in the afternoon are between 30 and 50 percent. In the rest of the year the values of relative humidity are higher, especially in mornings when the values are above 80 percent.

CLOUDINESS

Skies are clear or lightly clouded in winter, summer and post monsoon season. In the passage of western disturbances which affect the district, spells of cloudy weather occur during the winter season. Heavily clouded to overcast skies prevail in the monsoon season.

WINDS

Being mountainous terrain, the wind in the district is highly local and varies with space. The wind is mostly calm in the morning and mostly from southwest direction in the afternoons.

SPECIAL WEATHER PHENOMENA

Thunderstorms occur in all months of the year, its frequency being least during the period November to February. Thunderstorms during the cold and summer seasons are occasionally accompanied with hail. In summer and southwest monsoon season occasional dust storm occurs. During the monsoon and winter months mists and fogs occur particularly in the valleys. Occasional snowfall occurs at Mandi and Sundernagar in winter.

Tables 3, 4, 5 and tables 3(a), 4(a), 5(a) give the temperature and humidity, mean wind speed and frequency of special weather phenomena respectively for Mandi and Sundernagar observatories.

TABLE – 1
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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Bhangrotu	22	a	66.0	66.5	85.8	33.0	49.7	209.6	571.7	397.0	188.7	33.9	12.0	29.8	1743.7	247 (1966)	59 (1972)	375.0	15 Jul 1967
		b	4.6	4.0	4.6	3.6	3.1	7.8	16.6	15.7	7.9	1.7	0.8	1.9	72.3				
Chachiot/ Chichot	23	a	91.1	73.6	83.4	52.0	84.0	173.9	502.4	344.2	164.2	63.9	20.6	39.2	1692.5	139 (1961)	68 (1987)	228.6	21 Aug 1951
		b	5.6	4.4	6.2	3.7	4.8	8.9	17.5	15.8	8.7	2.8	1.2	2.6	82.2				
Mandi (Obsy)	44	a	67.5	57.4	76.6	48.2	50.6	128.0	432.5	404.7	166.3	37.8	13.0	21.1	1503.7	168 (1971)	65 (1999)	271.1	31 Aug 1960
		b	4.4	4.1	4.6	4.0	4.1	7.6	17.1	16.5	9.0	2.5	1.0	1.8	76.7				
Mandi (Sadar)	46	a	82.0	66.0	72.4	33.8	70.9	164.3	515.7	445.8	151.4	33.3	14.9	35.1	1685.6	199 (1988)	14 (1977)	430.0	07 Jul 1986
		b	4.5	4.1	4.6	3.0	3.9	7.8	15.9	16.7	7.5	1.8	1.0	2.1	72.9				
Panjain	32	a	56.5	62.9	86.4	61.0	81.6	128.5	310.2	237.9	120.6	43.8	25.6	26.8	1241.8	256 (1963)	63 (1968)	206.2	15 Sep 1963
		b	4.9	5.6	6.7	5.2	5.6	8.2	13.9	12.5	6.5	2.9	1.6	1.6	75.2				
Sarkahat	50	a	58.8	55.6	63.9	30.8	45.6	178.9	463.0	438.0	180.7	34.0	13.2	25.7	1588.2	198 (1955)	13 (1987)	205.7	30 Aug 1960
		b	3.8	3.9	4.2	2.3	2.9	7.6	15.6	14.7	7.7	1.6	0.9	1.9	67.1				
Sundernagar (Obsy)	13	a	56.3	81.5	88.7	45.8	79.1	197.9	404.9	333.9	132.4	34.3	20.7	22.4	1497.9	124 (1997)	75 (1989)	164.0	12 Aug 1997
		b	4.1	6.1	6.1	3.5	6.0	10.5	16.1	14.8	7.5	1.5	1.5	1.9	79.6				
Mandi (District)		a	68.3	66.2	79.6	43.5	65.9	168.7	457.2	371.6	157.8	40.1	17.1	28.6	1564.6	215 (1988)	44 (1983)		
		b	4.6	4.6	5.3	3.6	4.3	8.3	16.1	15.2	7.8	2.1	1.1	2.0	75.0				
HILL STATIONS																			
Janjehli	29	a	53.1	61.9	111.5	73.3	92.2	184.8	351.5	273.3	145.7	45.1	11.2	39.9	1443.5	141 (1964)	55 (1974)	425.0	15 Jun 1964
		b	3.2	4.3	6.3	5.7	6.5	9.1	16.3	14.9	7.4	2.2	1.1	1.7	78.7				
Jhungi	28	a	69.0	70.2	84.8	48.9	69.2	172.9	381.0	265.2	126.2	29.0	13.2	35.7	1365.3	157 (1978)	21 (1955)	128.0	02 Aug 1952
		b	4.9	4.0	5.0	4.4	4.8	9.3	16.2	13.4	6.4	1.9	1.0	2.0	73.3				
Jogindernagar	44	a	108.1	101.3	127.3	75.3	75.0	229.9	638.9	758.3	292.8	45.1	27.3	41.6	2520.9	188 (1996)	44 (1968)	600.0	14 Aug 1996
		b	5.1	5.4	6.5	4.2	4.4	8.6	18.2	20.1	11.0	2.6	1.4	2.2	89.7				
Karsog	50	a	69.3	70.1	76.4	39.9	56.0	91.4	235.5	195.3	101.7	30.0	16.2	28.2	1010.0	144 (1988)	71 (1965)	150.0	31 Jul 1989
		b	4.8	4.5	5.7	3.5	4.8	6.4	12.6	12.0	6.0	1.8	1.1	1.9	65.1				
Kataula	36	a	81.2	79.1	69.2	47.1	63.4	146.0	448.6	391.4	104.5	31.5	12.5	35.5	1510.0	136 (1977)	25 (1964)	228.3	27 Jul 1970
		b	5.0	4.2	4.9	3.6	3.8	7.3	16.1	16.1	7.1	2.1	1.0	2.1	73.3				
Sundernagar	50	a	79.1	68.8	74.2	39.2	65.8	168.0	415.0	345.4	138.7	33.5	18.5	28.5	1474.7	134 (1954)	59 (1972)	245.4	31 Aug 1960
		b	4.8	4.5	4.7	3.0	3.9	7.7	15.6	14.1	6.5	1.7	1.0	1.9	69.4				

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 2005.

** Years of occurrence given in brackets.

Hill stations not considered for subdivisional mean.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1951 - 1999)
(MANDI)

Range in mm	No. of years	Range in mm	No. of years
601 – 700	1	2001 – 2100	4
701 – 800	0	2101 – 2200	0
801 – 900	1	2201 – 2300	3
901 – 1000	0	2301 – 2400	0
1001 – 1100	2	2401 – 2500	0
1101 – 1200	5	2501 – 2600	0
1201 – 1300	2	2601 – 2700	0
1301 – 1400	3	2701 – 2800	0
1401 – 1500	6	2801 – 2900	0
1501 – 1600	6	2901 – 3000	0
1601 – 1700	4	3001 – 3100	0
1701 – 1800	4	3101 – 3200	0
1801 – 1900	2	3201 – 3300	0
1901 – 2000	1	3301 – 3400	1

(Data available for 45 years only)

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

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	18.9	2.3	27.7	1972 Jan 02	-2.7	1955 Jan 01	83	58
February	21.0	3.9	31.3	1978 Feb 09	-2.0	1972 Feb 13	82	54
March	26.0	8.7	39.0	1977 Mar 29	0.0	1971 Mar 06 1972 Mar 14	75	45
April	30.9	13.6	39.5	1970 Apr 26	4.3	1976 Apr 05	68	44
May	34.8	17.3	42.1	1978 May 31	5.4	1977 May 04	60	44
June	35.7	19.5	42.7	1958 Jun 18	8.5	1974 Jun 25	66	49
July	32.2	20.7	40.0	1975 Jul 28	12.0	1974 Jul 18	78	68
August	31.3	20.1	36.7	1975 Aug 01	11.4	1975 Aug 27	85	74
September	30.9	17.8	35.9	1965 Sep 07 1968 Sep 15 1970 Sep 16	9.7	1965 Sep 26	80	65
October	29.3	11.9	33.6	1965 Oct 03	4.3	1964 Oct 26	79	60
November	25.1	6.8	33.2	1963 Nov 07	1.0	1974 Nov 18 1975 Nov 30	81	60
December	20.4	2.8	30.2	2003 Dec 13	-2.9	1965 Dec 21	83	72
Annual	28.0	12.1					76	57

TABLE - 4
Mean Wind Speed in km/hr.
(MANDI)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1.7	2.2	2.8	2.9	3.3	2.9	2.3	2.0	1.6	2.0	1.4	1.3	2.2

TABLE - 5
Special Weather Phenomena
(MANDI)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.4	0.6	1.7	2.3	3.0	3.5	2.8	1.5	1.1	0.6	0.2	0.2	17.9
Hail	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3
Dust storm	0.1	0.0	0.2	0.1	0.5	0.9	0.2	0.2	0.2	0.0	0.1	0.1	2.6
Snow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Fog	5.1	1.8	0.3	0.0	0.0	0.1	0.1	0.0	0.2	1.1	1.9	4.7	15.3

TABLE – 3(a)
Normals of Temperature and Relative Humidity
(SUNDERNAGAR)

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	17.2	2.9	23.9	1991 Jan 28	-2.7	1984 Jan 07	88	53
February	18.9	4.9	28.1	1985 Feb 28	0.0	1984 Feb 24	85	47
March	23.1	8.8	32.6	1984 Mar 31	-0.4	1982 Mar 11	78	43
April	28.9	12.8	36.4	1986 Apr 22	5.1	1986 Apr 28	66	35
May	32.9	17.1	41.6	1988 May 31	8.6	1982 May 16	57	35
June	34.2	19.9	41.5	1995 Jun 08	11.4	1986 Jun 01	66	44
July	30.7	21.4	39.2	1987 Jul 04	16.5	1983 Jul 06	83	67
August	30.1	21.4	38.1	1987 Aug 05	17.5	1991 Aug 11	88	71
September	30.3	18.4	33.9	1986 Sep 12	10.2	1982 Sep 29	88	66
October	28.2	11.9	33.6	1983 Oct 07	5.4	1984 Oct 31	83	49
November	23.9	6.3	28.2	1990 Nov 04	1.8	1982 Nov 28	86	48
December	18.9	3.3	24.6	1985 Dec 02	-10.6	1983 Dec 29	88	54
Annual	26.4	12.4					80	51

TABLE – 4(a)
Mean Wind Speed in km/hr.
(SUNDERNAGAR)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1.2	1.6	2.1	2.6	2.7	2.7	2.0	1.6	1.4	1.2	1.0	1.1	1.8

TABLE – 5(a)
Special Weather Phenomena
(SUNDERNAGAR)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	1.6	3.7	6.3	8.3	10.8	12.2	12.2	11.3	8.7	3.6	0.5	1.5	80.7
Hail	0.2	0.2	1.2	0.4	0.4	0.1	0.0	0.0	0.2	0.1	0.0	0.0	2.8
Dust storm	0.0	0.0	0.2	0.9	0.6	0.3	0.0	0.1	0.0	0.2	0.0	0.1	2.4
Fog	4.2	1.4	0.8	0.1	0.2	0.1	1.4	3.4	4.0	3.1	1.1	3.3	23.1
Snow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2

SHIMLA DISTRICT

Due to mountainous terrain with deep valleys, high ridges and peaks, the climate of the district depends much on elevation which generally varies from 1000 metres in the western portion rising sharply to about 5000 metres in the eastern parts of the district. Fairly severe cold weather season (December to March), pleasant summer (April to June), rather short lived monsoon (July to mid September) and a mild post monsoon season (mid September to November) constitute the salient features of the climate of the district.

RAINFALL

There are twenty three raingauge stations in the district for the period ranging from 13 to 49 years. The normals of rainfall and rainy days based on these data are given in Table 1 for all the stations. Being a hilly district, Table 2 which gives the frequency of the annual rainfall in the district is not given. In view of the extremely hilly terrain and the fact that all the raingauge stations are located in the western side, that too within one third area of the district, the mean rainfall for the district has not been given, as it will not be representative for the district as a whole.

Rainfall varies widely from place to place, depending upon elevation and extent to exposure to rain-bearing winds. It varies from 861.3 mm at Kumarsain to 2372.4 mm at Phancha. About 50 to 70 percent of the annual precipitation is realized during the monsoon season. July and August are the most rainiest months. The rainfall in these two months together generally contribute more than 35 percent of the annual total. Significant precipitation in the form of snow on high ground and mostly as rain in the valleys occurs during the winter season also. Between 10 to 30 percent of the annual total is realized during January to March. The variation in the rainfall from year to year is moderate. The lowest annual rainfall recorded, was 14 percent of the annual normal at Kumarsain in 1968 and the highest being 316 percent at Khadrala in 1968.

The annual number of rainy days (i.e. days with rainfall of 2.5 mm or more) varies from 59 at Parala to 108 at Phancha. The heaviest rainfall in 24 hours recorded at any station in the district was 800.0 mm at Shimla observatory on 19 October 1899.

TEMPERATURE

There is only one observatory in the district at Shimla recording meteorological observations. Table 2 gives the means and extremes of temperatures as well as mean humidities at the station.

The terrain has profound influence on temperature as in case of rainfall. Broadly speaking, temperatures begin to rise from beginning of March till June which is the warmest month with 24.0°C as the mean maximum temperature, and 15.3°C as the mean minimum temperature at an elevation of 2 km. On individual days in the month of May and June, the maximum temperature occasionally reaches 31°C. The weather is, thus mild and pleasant during the summer season on elevated land, but it is hot and oppressive in the valleys where higher temperatures are experienced. With the onset of the monsoon over the district by the end of June, temperatures begin to fall. The fall in day temperatures is rapid compared to that in night temperatures. By September, maximum temperatures drop to about 20°C and minimum to about 13°C at elevation of 2 km. With the withdrawal of monsoon by mid September, the fall in night temperatures becomes more rapid than in day temperatures. In January which is the coldest month, the mean daily maximum temperature is 9.3°C and the mean minimum is 1.7°C at an elevation of 2 km. In the wake of western disturbances in winter, the temperatures fall appreciably when the minimum temperature may go down well below the freezing point.

The highest maximum temperature recorded at Shimla was 31.2°C on 28 May 1988 and the lowest minimum temperature was –12.2°C on 13 December 1963.

HUMIDITY

Humidities are high, being over 80% during the monsoon months of July to September. The driest pat of the year is from March to May when the humidity drops to about 35 to 40%.

CLOUDINESS

During July and August, the skies are heavily clouded to overcast for about 14 days in each month. The clouding is the least in October and November when the skies are clear to lightly clouded for about 20 days in the month. During December to March, in association with the western disturbances, heavy clouding may be expected on an average of 12 days in a month.

WINDS

Winds are generally light throughout the year. The mean wind speed for Shimla for different months is shown in Table 3.The local orography greatly affects the surface winds and its direction. However, the winds are mainly from directions between south and southeast throughout the year. Valley winds are often strong with pronounced Katabatic influence.

SPECIAL WEATHER PHENOMENA

Thunderstorms mostly occur throughout the year, being more frequent in April, May and June. In winter, they occur in association with the western disturbances and are often accompanied with hail. Fog occurs occasionally in winter and also sometimes in monsoon season.

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

TABLE – 1
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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Chopal/ Chaupahal	47	a	102.5	83.1	101.8	44.2	64.4	80.9	225.0	217.4	135.8	48.9	18.1	40.9	1163.0	159 (1956)	68 (1987)	250.0	30 Jan 1979
		b	4.9	5.3	6.7	4.0	5.2	6.3	12.5	12.7	6.0	1.9	1.0	2.3	68.8				
Mashobra	27	a	74.3	99.1	95.2	49.4	85.4	176.3	284.9	272.1	130.7	61.3	14.3	39.4	1382.4	142 (1997)	37 (1974)	225.2	08 Oct 1998
		b	4.0	5.3	7.0	3.8	5.7	9.6	14.6	13.6	6.6	3.0	1.1	2.1	76.4				
Rohru	45	a	90.8	93.4	93.1	53.7	56.6	74.3	179.0	178.0	126.4	40.2	14.9	30.4	1030.8	257 (1966)	56 (1972)	170.0	25 Jul 1966
		b	5.5	5.2	6.0	4.4	4.7	5.4	11.5	11.8	6.5	2.3	1.0	1.9	66.2				
Suni/Seoni	49	a	63.6	60.6	66.0	39.4	56.2	125.4	260.7	178.1	93.0	28.6	11.9	31.2	1014.7	136 (1973)	71 (1974)	191.0	16 Jul 1970
		b	4.4	4.5	5.0	3.3	4.0	6.8	12.5	10.4	5.4	1.8	1.0	2.1	61.2				
Theog	42	a	69.5	80.2	95.6	56.1	73.3	120.9	240.9	193.6	121.3	26.3	14.3	29.9	1121.9	161 (1998)	68 (1972)	182.0	08 Apr 1974
		b	3.8	4.9	5.9	4.3	5.7	7.9	13.7	11.4	6.6	1.8	1.1	2.0	69.1				
Shimla (District)		a	80.1	83.3	90.3	48.6	67.2	115.6	238.1	207.8	121.4	41.1	14.7	34.4	1142.6	152 (1988)	63 (1972)		
		b	4.5	5.0	6.1	4.0	5.1	7.2	13.0	12.0	6.2	2.2	1.0	2.1	68.4				
HILL STATIONS																			
Bashla	30	a	160.5	77.6	73.8	53.0	81.7	82.8	251.6	234.3	151.6	54.4	16.0	79.9	1317.2	150 (1953)	52 (1970)	304.8	16 Feb 1963
		b	4.5	3.9	5.6	4.7	6.4	6.8	14.8	14.3	8.0	2.7	1.1	2.0	74.8				
Chopal (Hydro)	16	a	40.4	93.5	91.2	71.8	74.8	72.4	205.0	225.6	113.2	46.1	26.3	52.9	1113.2	132 (1995)	70 (1980)	290.0	28 Dec 1982
		b	2.5	4.3	6.8	5.9	5.9	5.7	12.1	12.4	6.0	2.4	1.4	1.4	66.8				
Jubbal	48	a	82.4	81.2	87.2	60.0	75.4	81.3	213.7	193.3	125.2	41.3	13.8	38.8	1093.6	140 (1988)	71 (1974)	175.5	25 Sep 1988
		b	5.0	5.3	6.5	5.4	6.1	7.0	13.1	12.5	7.0	2.4	1.2	2.1	73.6				

TABLE – 1 (Contd…)
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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
HILL STATIONS																			
Jubbal (Hydro)	18	a	84.0	76.5	99.5	64.2	88.2	83.2	196.5	186.4	141.2	31.8	15.4	62.2	1129.1	176 (1988)	61 (1984)	360.0	25 Dec 1988
		b	4.2	5.5	8.0	5.8	6.9	7.4	12.5	12.3	7.1	1.9	1.1	2.1	74.8				
Junga	35	a	74.3	46.3	62.1	27.9	60.7	137.5	336.5	271.9	120.2	42.4	8.3	27.0	1215.1	136 (1954)	35 (1972)	196.0	06 Aug 1971
		b	4.4	3.1	4.7	2.2	4.3	8.0	15.0	14.5	6.9	2.3	0.6	1.4	67.4				
Kasumpti	23	a	62.3	54.9	60.3	30.8	53.1	139.0	365.9	312.6	159.3	47.0	9.1	22.3	1316.6	134 (1954)	52 (1972)	132.0	21 Sep 1962
		b	4.5	4.2	5.1	2.7	4.4	8.6	18.0	16.3	9.3	3.3	1.0	1.9	79.3				
Khadrala	41	a	310.1	170.3	112.0	51.3	81.0	95.5	298.8	275.3	163.6	50.2	21.2	177.4	1806.7	316 (1968)	28 (1977)	762.0	28 Jan 1968
		b	5.3	5.2	5.8	4.4	6.9	7.9	16.3	15.3	9.3	2.7	0.9	2.4	82.4				
Kotarh	13	a	186.0	71.1	96.9	44.5	37.4	88.4	292.7	190.2	145.7	62.3	4.4	28.3	1247.9	137 (1954)	79 (1960)	787.9	18 Feb 1877
		b	5.9	3.1	7.9	4.7	3.7	7.5	16.3	13.9	7.6	3.9	0.8	2.7	78.0				
Kotkhai	49	a	68.1	59.9	67.6	40.6	69.1	86.5	189.0	167.7	108.3	31.4	13.5	25.2	926.9	161 (1983)	36 (1999)	711.7	18 Feb 1877
		b	4.7	4.1	5.5	3.8	5.6	6.7	11.7	11.5	6.1	2.2	1.0	1.9	64.8				
Kotkhai (Hydro)	19	a	31.9	84.4	110.2	60.5	122.4	76.7	163.4	172.8	67.7	40.1	6.7	22.1	958.9	246 (1982)	34 (1999)	108.0	05 Sep 1995
		b	3.2	5.1	6.7	4.1	5.8	5.5	11.0	11.0	5.0	2.8	0.6	1.7	62.5				
Kumarsain	46	a	59.9	59.0	74.9	44.4	60.3	82.9	182.6	143.1	89.6	26.2	14.8	23.6	861.3	151 (1992)	14 (1968)	139.7	07 Jul 1959
		b	4.4	4.8	5.7	4.3	4.9	6.1	10.1	9.9	5.2	1.6	1.1	1.7	59.8				

TABLE – 1 (Contd…)

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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
HILL STATIONS																			
Parala	31	a	81.7	63.6	58.3	39.2	84.9	76.2	244.6	186.0	138.2	31.9	15.4	17.4	1037.4	172 (1971)	29 (1974)	300.0	31 May 1971
		b	4.5	3.8	4.3	2.6	3.9	6.0	12.8	11.0	5.8	2.1	0.7	1.5	59.0				
Phancha	28	a	91.3	104.7	124.8	99.0	92.0	147.3	589.2	726.9	269.6	72.4	22.4	32.8	2372.4	147 (1967)	68 (1974)	211.6	31 Jul 1967
		b	6.4	5.4	7.6	6.8	6.9	9.2	21.4	23.0	13.1	4.5	1.7	2.4	108.4				
Rampur	49	a	62.8	69.1	97.6	47.9	55.7	63.7	169.2	158.9	89.5	26.6	14.0	29.8	884.8	284 (1981)	49 (1999)	200.0	19 Mar 1981
		b	4.4	4.8	5.5	4.2	5.0	5.0	11.7	11.2	6.1	1.9	1.0	2..0	62.8				
Rohru (Hydro)	15	a	75.6	95.2	90.1	65.4	69.5	64.7	173.2	182.3	147.2	60.5	15.2	33.4	1072.3	143 (1998)	87 (1992)	168.0	26 Feb 1998
		b	4.7	5.3	5.9	5.0	5.9	5.2	11.7	12.3	7.5	3.0	1.2	1.5	69.2				
Shillaru	30	a	107.7	62.0	74.6	53.4	70.7	125.0	349.1	242.1	130.3	42.9	11.9	18.9	1288.6	153 (1957)	53 (1974)	252.0	29 Jan 1979
		b	4.3	3.6	5.5	4.8	5.6	8.3	16.9	14.7	7.3	2.7	0.9	1.4	76.0				
Shimla	14	a	76.5	48.7	63.8	38.0	58.4	131.8	435.2	377.9	177.6	61.6	9.2	18.5	1497.2	121 (1954)	58 (1965)	227.1	22 Aug 1901
		b	5.5	3.9	5.4	3.9	4.8	8.7	20.4	18.4	9.4	3.4	0.6	1.8	86.2				
Shimla (Obsy)	49	a	56.0	56.6	67.4	49.9	71.4	168.7	362.5	323.5	172.6	44.6	17.9	24.3	1415.4	137 (1995)	68 (1987)	800.0	19 Oct 1899
		b	4.6	4.8	5.7	4.2	5.6	9.9	18.0	17.3	9.3	2.7	1.4	2.0	85.5				

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 2005.
** Years of occurrence given in brackets.
Hill stations not considered for subdivisional mean.

TABLE - 3

Normals of Temperature and Relative Humidity

(SHIMLA)

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	9.3	1.7	18.9	1949 Jan 14	-10.6	1945 Jan 11	50	64
February	10.4	2.6	20.6	1953 Feb 26	-8.5	1972 Feb 14	50	62
March	14.6	6.3	24.5	1964 Mar 15	-6.1	1979 Mar 09	39	51
April	19.4	10.9	28.3	1941 Apr 29	-1.3	1983 Apr 17	36	43
May	22.8	13.7	31.2	1988 May 28	1.4	1987 May 03	39	42
June	24.0	15.3	30.6	1932 Jun 13	7.8	1922 Jun 02	60	60
July	21.2	14.7	28.9	1901 Jul 06	9.4	1972 Jul 08	84	84
August	20.4	14.4	27.8	1951 Aug 26	10.6	1957 Aug 01	87	89
September	20.3	13.1	25.7	1986 Sep 21	5.0	1940 Sep 29	74	81
October	18.8	10.6	24.4	1983 Oct 08	0.2	1961 Oct 30	49	65
November	15.1	6.7	22.4	1978 Nov 11	-1.1	1911 Nov 19	39	58
December	11.9	4.0	20.4	1960 Dec 05	-12.2	1963 Dec 13	37	56
Annual	17.3	9.5					54	63

TABLE - 4

Mean Wind Speed in km/hr.

(SHIMLA)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
4.4	4.8	4.9	4.4	4.1	3.1	2.1	1.3	1.6	2.8	3.2	3.8	3.4

TABLE - 5

Special Weather Phenomena

(SHIMLA)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.2	0.6	1.4	2.4	3.6	3.3	0.9	0.3	0.5	0.7	0.4	0.1	14.4
Hail	0.2	0.1	0.5	0.6	0.7	0.0	0.0	0.0	0.1	0.3	0.1	0.1	2.7
Dust storm	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Fog	0.0	0.0	0.0	0.0	0.2	0.0	2.3	0.6	0.4	0.0	0.0	0.1	3.6

SIRMAUR DISTRICT

The climate of this district varies according to the elevation. The terrain is mountainous with deep valleys lying between ranges with varying altitudes. The elevations range between 500 metres in the southwestern border to about 2500 metres as one proceeds towards the northeast with individual peaks going higher. The portion of the district, beyond the Giri river is mostly wild mountainous region. The summer is from March to about the end of June. The southwest monsoon season starts thereafter and lasts till about the mid September. Mid September to November constitutes the post monsoon season and December to February is the winter season.

RAINFALL

Records of rainfall in the district are available for eleven stations for period ranging from 11 to 48 years, out of which Pachhad and Rajgarh are hill stations. The details of the rainfall at these stations and for the district as a whole are given in Table 1and Table 2. The average annual rainfall in the district is 1688.7 mm. It will be seen from Table 1 that the southwest monsoon season is the chief rainy season and rainfall during the southwest monsoon season constitutes to about 71% of the annual rainfall normal. July is the rainiest month. In association with passing western disturbances, some rain occurs in the period January to March. The precipitation in the winter season is mostly in the form of snow in the northeastern portion of the district at higher elevation. Considering the district as a whole, during the 49 years period from 1951 to 1999, the highest annual rainfall occurred in 1963 when it amounted to 171% of the normal. 1986 was the year with the lowest annual rainfall which was 41% of the annual normal. During the same period there are ten years when annual rainfall is less than 80 percent of the annual normal rainfall and there is one occasion when such a low rainfall occurred in two consecutive years i.e. (1986-1987).

On an average there are 63 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district. This number varies from 57 at Renuka/Rainka to 69 at Pachhad (Hydro).

The heaviest rainfall in 24 hours recorded at any station in the district was 400.0 mm at Dhaulakuan on 14 July 1994 and at Nahan observatory on 15 August 1992.

TEMPERATURE

There is only one observatory in the district at Nahan. Climatic conditions prevailed at Nahan may be taken to be broadly representative of the whole district. The temperatures in different parts of the district vary according to the elevation. The region near south and southeastern border of the district is somewhat like plains of Punjab and West Uttar Pradesh. From beginning of March temperature increase gradually till June which is the hottest month of the year with the mean daily maximum temperature of about 35.7^{o}C and the mean daily minimum temperature of about 23.1^{o}C. With the advance of the southwest monsoon over the district by about the beginning of July, the day temperature drops appreciably while the night temperatures continue to be as in summer. After withdrawal of the monsoon by about the middle of September, temperatures decrease gradually at first and fairly rapidly after October, the fall in night temperature being more rapid than that of day temperature. January is the coldest month of the year with the mean daily maximum temperature of about 18.0^{o}C and the mean daily minimum temperature of about 7.3^{o}C. In association with cold waves in the wake of western disturbances which affect the district during the winter season, the minimum temperature go down to about the freezing point of water in the regions at lower altitude in the south and southwestern border and several degrees below the freezing point of water at high altitude in the north and northeastern portions.

The highest maximum temperature ever recorded at Nahan was 43.0^{o}C on 08 June 1987 and the lowest minimum temperature ever recorded was –7.9^{o}C on 28 December 1989.

HUMIDITY

The values of relative humidity are high during the southwest monsoon season and early part of the post monsoon season. In winter, the values of relative

humidity are about 60 to 70 percent. Driest part of the year is the summer when its values are less than 50 percent. In general values of relative humidity are high in the morning than in afternoon throughout the year.

CLOUDINESS

Skies are clear or lightly clouded in the summer and post monsoon season. Frequent cloudiness occurs in the winter season due to western disturbances. Heavily clouded to overcast skies prevail in the southwest monsoon season.

WINDS

Winds are generally light to moderate throughout the year. Winds are mainly southeasterly or northwesterly throughout the year, with its frequency more southeasterly in the morning and northwesterly in the evening except in the southwest monsoon season when winds are predominant in the southeasterly direction.

SPECIAL WEATHER PHENOMENA

Thunderstorms occur in winter and summer seasons, its frequency is more in latter part of summer. Occasionally thunderstorms in winter are accompanied by hail. Fog occurs in winter and early part of southwest monsoon season.

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

TABLE – 1
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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Dadupur	11	a	58.6	75.5	80.5	40.8	46.0	126.3	414.6	407.9	178.0	11.7	16.3	51.9	1508.1	153	134	180.5	22 Aug 1991
		b	2.8	4.0	4.4	2.0	3.0	6.5	12.2	14.6	6.2	0.7	0.6	1.9	58.9	(1988)	(1990)		
Dhaulakuan	33	a	51.6	55.9	37.5	15.5	22.1	136.4	582.1	616.3	216.8	43.3	6.3	33.7	1817.5	152	76	400.0	14 Jul 1994
		b	3.3	3.4	2.7	1.3	2.1	7.3	15.9	17.7	8.3	1.5	0.6	1.6	65.7	(1973)	(1993)		
Jaton (Hydro)	18	a	59.6	71.2	69.6	41.4	52.7	178.4	554.7	438.7	165.6	49.1	10.2	45.5	1736.7	165	67	205.0	17 Oct 1998
		b	3.2	3.9	4.1	3.1	3.6	7.7	15.5	14.3	6.1	1.5	0.8	1.8	65.6	(1988)	(1991)		
Nahan	48	a	59.0	51.6	48.3	15.2	27.8	173.6	598.7	591.8	215.4	42.8	12.1	37.6	1873.9	243	43	355.3	17 Jul 1963
		b	3.5	3.0	2.8	1.1	2.1	6.4	15.9	16.3	7.2	1.7	0.6	1.6	62.2	(1963)	(1979)		
Nahan (Obsy)	21	a	62.9	61.9	68.5	57.6	28.0	191.6	447.3	490.1	194.5	27.2	19.8	35.6	1685.0	137	95	400.0	15 Aug 1992
		b	2.8	3.3	4.0	3.1	2.7	8.2	14.6	15.9	7.7	1.6	1.1	1.5	66.5	(1990)	(1983)		
Paonta	33	a	59.4	46.6	38.9	11.6	32.4	146.9	626.4	624.0	238.0	60.4	7.6	39.3	1931.5	184	62	274.0	28 Aug 1989
		b	3.1	2.4	2.2	0.8	2.0	5.4	16.9	17.8	8.0	1.9	0.5	1.3	62.3	(1962)	(1968)		
Paonta (Hydro)	18	a	40.5	55.4	46.0	34.8	41.3	166.0	497.6	452.3	178.1	43.5	6.3	36.0	1597.8	133	72	251.4	18 Jul 1995
		b	2.8	3.4	3.1	2.6	2.8	7.6	15.4	17.2	7.8	1.7	0.5	1.7	66.6	(1988)	(1987)		
Renuka/ Rainka	48	a	63.7	51.5	47.1	32.3	33.9	130.9	395.1	352.9	155.4	45.1	10.0	39.4	1357.3	175	51	264.0	24 Aug 1962
		b	3.4	3.0	3.0	2.0	2.6	6.9	13.6	13.0	5.8	1.4	0.7	1.4	56.8	(1954)	(1986)		
Sirmaur (District)		a	56.9	58.7	54.6	31.2	35.5	156.3	514.6	496.8	192.7	40.4	11.1	39.9	1688.7	171	41		
		b:	3.1	3.3	3.3	2.0	2.6	7.0	15.0	15.9	7.1	1.5	0.7	1.6	63.1	(1963)	(1986)		

TABLE – 1 (Contd…)
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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
HILL STATIONS																			
Pachhad	42	a	75.4	65.3	56.9	31.1	40.1	131.7	457.6	371.4	183.8	46.7	13.9	35.8	1509.7	147 (1964)	59 (1974)	228.6	22 Aug 1958
		b	4.0	3.7	3.7	1.9	2.8	6.3	15.1	14.8	7.0	1.7	0.7	1.7	63.4				
Pachhad (Hydro)	18	a	67.0	60.8	81.2	44.4	50.3	165.4	362.9	356.7	178.2	49.9	14.2	38.1	1469.1	140 (1985)	64 (1984)	300.4	21 Jul 1999
		b	3.1	3.8	4.7	2.9	3.7	8.6	14.9	15.1	7.1	1.9	0.9	1.8	68.5				
Rajgarh (Hydro)	14	a	57.5	50.3	86.4	65.7	47.6	108.5	272.9	311.8	145.2	41.4	9.0	64.9	1261.2	140 (1996)	88 (1997)	200.0	12 Jul 1988
		b	3.0	3.2	5.9	4.6	3.9	6.9	12.9	14.5	6.9	3.0	0.7	2.4	67.9				

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 2005.
** Years of occurrence given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1951 - 1999)
(SIRMAUR)

Range in mm	No. of years	Range in mm	No. of years
601 – 700	1	1801 – 1900	6
701 – 800	0	1901 – 2000	4
801 – 900	1	2001 – 2100	2
901 – 1000	0	2101 – 2200	1
1001 – 1100	0	2201 – 2300	0
1101 – 1200	4	2301 – 2400	2
1201 – 1300	4	2401 – 2500	0
1301 – 1400	1	2501 – 2600	1
1401 – 1500	6	2601 – 2700	0
1501 – 1600	3	2701 – 2800	1
1601 – 1700	4	2801 – 2900	1
1701 – 1800	4		

(Data available for 46 years only)

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

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	18.0	7.3	26.1	1991 Jan 28	-0.9	1996 Jan 17	69	65
February	20.8	8.9	28.8	1980 Feb 27	0.1	1996 Feb 27	67	62
March	25.3	12.3	32.9	1995 Mar 24	4.1	1979 Mar 09	54	51
April	31.0	18.4	37.8	1980 Apr 23	6.1	1996 Apr 01	49	42
May	34.2	20.8	40.6	1996 May 30	10.0	1987 May 03	40	32
June	35.7	23.1	43.0	1987 Jun 08	10.5	1996 Jun 05	57	49
July	29.9	22.0	41.0	1987 Jul 05	13.7	1995 Jul 03	85	79
August	28..9	21.7	36.8	1987 Aug 04	12.8	1995 Aug 30	89	84
September	28.8	20.8	36.0	1992 Sep 27	11.7	1995 Sep 06	81	77
October	27.4	17.5	33.6	1987 Oct 02	7.9	1997 Oct 25	70	64
November	23.6	12.5	30.2	1987 Nov 02	2.6	1995 Nov 28	64	59
December	19.0	8.9	28.8	1987 Dec 07	-7.9	1989 Dec 28	67	62
Annual	26.9	16.2					66	61

TABLE - 4
Mean Wind Speed in km/hr.
(NAHAN)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
6.5	7.2	7.6	7.7	8.1	7.3	6.5	5.7	6.0	5.7	5.6	5.6	6.6

TABLE - 5
Special Weather Phenomena
(NAHAN)

Mean No. of Days With	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Thunder	0.1	0.1	0.2	0.6	0.3	0.7	0.0	0.0	0.0	0.0	0.2	0.0	2.2
Hail	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3
Dust storm	0.0	0.0	0.0	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.3
Snow	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fog	0.1	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.2	0.0	1.2

SOLAN DISTRICT

The climate of different parts of this district depends much on the elevation. The terrain is hilly with elevation below 300 m in valleys and over the southwestern region. The elevation increases towards northeastern region of the district where over the hilly region the elevation is above 1500 metres. The climate of the district over the plains is somewhat similar to that of the adjoining plains of Punjab except for a milder hot season and higher rainfall. The year may be divided into four seasons. The period from November to March is the winter season. The next three months, April to June form the summer season. The southwest monsoon season starts thereafter and lasts till about the middle of September. The latter half of September and October constitute the post monsoon or transition period.

RAINFALL

Records of rainfall in the district are available for 5 stations for period ranging from 41 to 48 years. The details of the rainfall at these stations are given in Table 1. Being a hilly district, Table 2 which gives the frequency of the annual rainfall in the district is not given. The rainfall varies widely from place to place depending upon elevation and the extent of exposure to rain bearing winds. Generally the rainfall increases from southwest to northeast in the district. About 60 to 70 percent of the annual precipitation is realized during the southwest monsoon season. July is the rainiest month. Significant precipitation in the form of snow on hilly region and mostly as rain in the valleys occur during the winter season also. The variation in the rainfall from year to year is moderate. The order of variation in the annual rainfall is reflected in the rainfall records of the stations given in the Table I.

The annual number of rainy days (i.e. days with rainfall of 2.5 mm or more) varies from 51 at Nalagarh to 72 at Dharampur observatory.

The heaviest rainfall in 24 hours recorded at any station in the district was 416.6 mm at Arki on 12 August 1963.

TEMPERATURE

There are two meteorological observatories in the district, one at Solan which started recently and another is at Dharampur where there is only self recording raingauge station. Therefore the description that follows is mainly based on the records of the observatories in the neighbouring districts. The temperature conditions in the different parts of the district are influenced to a great extent by their elevation and geographical location. The period from March to about the end of June is one of continuous increase in temperature. June is the hottest month of the year when the mean daily maximum temperature over the foothills is about 37^{o}C and the mean daily minimum is about 23^{o}C. The maximum temperature on individual days may go upto about 45^{o}C. At places of higher elevation the temperatures are lower and the weather is pleasant. With the onset of the monsoon early in July there is an appreciable drop in temperature. After the withdrawal of the monsoon by about the middle of September, both day and night temperatures decrease, the drop in the night temperature being more rapid. January is the coldest month with the mean daily maximum temperature of about 20 ^{o}C and the mean daily minimum of about 5 ^{o}C. Temperature is lower at places of higher elevation depending on the elevation. The cold season is quite bracing. During this season cold waves in the rear of western disturbances, which move across Punjab and Kashmir affect the district. Consequently the minimum temperature occasionally drops to about a degree or so below the freezing point of water and frosts occur.

HUMIDITY

During the monsoon months the humidity is about 80 percent. During the rest of the year humidity is moderate generally about 70 percent except during April to June, which are the driest months when the humidity is below fifty percent in the afternoons. Humidity is higher in the mornings than during the afternoons.

CLOUDINESS

October and November are the months when the skies over the district are least clouded i.e when the skies are mostly clear. During winter (December to March), the skies are moderately clouded but in April to May the clouding decreases

slightly and it again increases from June onwards. July and August are the most clouded months.

WINDS

Due to hilly terrain of the district the wind is highly local and variable. The winds are predominantly northwesterly except during the monsoon when they blow from east-southeast-southerly directions in the plains of southwest sector of the district.

SPECIAL WEATHER PHENOMENA

During the cold season, western disturbances affect the district. Thunderstorms occur mainly during the period March to October. The thunderstorms in the cold season are occasionally associated with hail. Fog occurs occasionally during the cold season, particularly in the valleys.

TABLE – 1
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 in 24 HOURS*	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Kandaghat	42	a	77.8	76.4	67.6	33.7	51.6	119.5	324.6	263.3	150.2	61.3	11.0	37.8	1274.8	361 (1955)	52 (1997)	294.0	19 Feb 1979
		b	4.4	4.2	4.6	2.7	3.5	6.7	14.5	13.8	6.9	2.2	0.8	1.9	66.2				
Nalagarh	41	a	49.9	52.4	37.7	12.4	35.1	77.9	379.0	374.1	182.8	33.1	6.8	26.7	1267.9	189 (1977)	54 (1965)	241.0	19 Aug 1978
		b	2.7	2.8	2.6	1.2	2.1	4.3	13.4	12.4	6.7	1.4	0.5	1.4	51.5				
Solan (District)		a	63.9	64.4	52.7	23.1	43.3	98.7	351.8	318.7	166.5	47.2	8.9	32.3	1271.5	238 (1955)	61 (1965)		
		b	3.6	3/5	3/6	2.0	2.8	5.5	14.0	13.1	6.8	1.8	0.7	1.7	59.1				
HILL STATIONS																			
Arki	48	a	73.0	65.6	60.5	29.0	53.5	124.7	322.4	269.8	119.9	28.2	11.9	30.6	1189.1	227 (1963)	51 (1999)	416.6	12 Aug 1963
		b	4.2	4.2	4.0	2.5	3.2	6.3	13.8	12.7	5.9	1.3	0.8	1.8	60.7				
Dharampur (Obsy)	48	a	79.5	66.5	63.3	28.4	49.0	172.4	406.7	330.9	206.9	59.6	15.2	33.4	1511.8	257 (1977)	63 (1965)	229.0	14 Aug 1995
		b	4.5	4.1	4.4	2.5	3.5	8.0	15.8	15.3	8.5	2.6	1/0	2.1	72.3				
Kasauli	41	a	69.1	68.5	60.5	24.1	49.9	140.9	462.3	475.0	252.5	50.0	13.7	33.0	1699.5	182 (1990)	03 (1972)	298.5	27 Jul 1930
		b	3.7	3.7	3.6	1.9	2.6	6.2	15.6	15.6	8.2	1.8	0.9	1.6	65.4				

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 2005.
** Years of occurrence given in brackets.
Hill stations not considered for subdivisional mean.

UNA DISTRICT

The climate of different parts of the district depends to some extent on the elevation. The terrain is hilly with elevation below 300 metres in valleys and western region and the elevation gently increases by a few hundred metres over the northeastern region of the district. The climate of the district is somewhat like that of the adjoining plains of the Punjab, except for a milder hot season and higher rainfall. The cold season is quite bracing. The year may be divided into four seasons. The period from November to March is the winter season. The next three months, April to June, form the summer season. The following period lasting upto about the middle of September is the southwest monsoon season. The latter half of September and October form the post monsoon or transition period.

RAINFALL

Records of rainfall in the district are meager. There are only two raingauge stations in the district for which the records are available for 48 and 10 years respectively. Details of rainfall at these raingauge stations and for the district as a whole are given in Tables 1and 2. The description that follows is mainly based on the records of these stations along with the records of other raingauge stations in the neighbouring districts. The average annual rainfall in the district is 1209.0 mm. About 70 percent of the annual rainfall in the district is received during the short monsoon season July to September. July is the month with the heaviest rainfall. Rainfall amounting to about 14 percent of the normal is received during the cold season in association with passing western disturbances. The rainfall in the district generally increases from southwest towards northeast. The variation in the rainfall from year to year is large. During the fifty year from 1951 to 2000, the highest rainfall amounting to 196 percent of the normal occurred in 1988 while the lowest annual rainfall which was only 40 percent of the normal occurred in 1981. The annual rainfall in the district was less than 80 percent of the normal in 11 years in this 50 years period. Three and four consecutive years of rainfall less than 80 percent of the normal occurred once at Una.

On an average there are 54 rainy days (i.e. days with rainfall of 2.5 mm or more) in a year in the district.

The heaviest rainfall in 24 hours recorded at any station in the district was 323.4 mm at Una on 24 September 1988.

TEMPERATURE

There is a meteorological observatory in the district at Una. The description which follows is mainly based on the records of Una observatory. The temperature conditions in the different parts of the district are influenced to a great extent by their elevation and geographical locations. The period from March to about the end of June is one of continuous increase in temperature. June is the hottest month of the year when the monthly mean of daily maximum temperature is about 38.4°C and the monthly mean of daily minimum temperature is about 23.2°C. The maximum temperature on individual days may go upto about 45°C. In the valleys the daily maximum temperature may be a couple of degrees higher and at places of higher elevation the temperatures are lower and the weather is pleasant. With the onset of the southwest monsoon early in July, there is an appreciable drop in day temperatures. After the withdrawal of the monsoon by about the middle of September, both day and night temperatures decrease, the drop in night temperatures being more rapid. January is the coldest month of the year with the mean daily maximum temperature of about 20.3°C and the mean daily minimum temperature of about 5.1°C. Temperature is lowest at places of higher elevation by a degree or two, depending on elevation. The cold season is quite bracing. During this season, cold waves in the rear of western disturbances which move across Punjab and Kashmir, affect the district. Consequently, the minimum temperature occasionally drops down to about a degree or so below the freezing point of water and frost occurs. The highest maximum temperature ever recorded at Una observatory was 45.2 °C on 30 May 1988 and the lowest minimum temperature ever recorded was -5.8 °C on 15 January 2003.

HUMIDITY

Humidity is generally high throughout the year about 80 to 90 percent in the mornings and above 60 percent in the afternoons except during April to June, the driest months, when the humidity is mostly below 50 percent in the afternoons.

CLOUDINESS

October and November are the months when the skies over the district are least clouded i.e. when the skies are mostly clear. During winter (December to March) the skies are moderately clouded but in April and May the clouding decreases slightly and it again increases from June onwards. July and August are the most clouded months when on an average on 10 to 12 days per month, the skies are overcast over the district.

WINDS

Due hilly terrain of the district, the wind is highly local and variable. However, the wind is generally from the sector southwest to west in the afternoons and from north to east in the mornings. In general, the wind is calm throughout the year (on 50% or more occasions), in the mornings except in the southwest monsoon season.

SPECIAL WEATHER PHENOMENA

During the cold season, western disturbances affect the weather over the district. Thunderstorms occur mainly during the period March to October. The thunderstorms in the cold season are occasionally associated with hail. Fog occurs occasionally during the cold season, particularly in the valleys.

Table 3 gives normals of temperature and relative humidity, for Una observatory.

TABLE – 1
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 in 24 HOURS *	
																ANNUAL RAINFALL AS % OF NORMAL & YEARS **		Amount (mm)	Date
Una	48	a	47.2	49.2	41.5	17.8	27.2	65.4	332.2	307.1	151.3	35.3	16.7	26.3	1117.2	212 (1988)	43 (1981)	323.4	24 Sep 1988
		b	3.1	3.0	3.3	1.4	2.1	4.1	11.1	11.2	5.5	1.3	0.9	1.5	48.5				
Una (Obsy)	10	a	29.4	48.6	35.8	22.5	44.9	137.8	369.5	342.3	191.7	29.4	25.8	22.9	1300.6	117 (1998)	86 (1999)	173.8	14 Aug 2001
		b	3.3	3.0	3.8	2.0	1.5	8.3	11.0	12.3	8.8	2.0	1.5	0.6	58.1				
Una (District)		a	38.3	48.9	38.7	20.1	36.1	101.6	350.9	324.7	171.5	32.3	21.3	24.6	1209.0	196 (1988)	40 (1981)		
		b	3.2	3.0	3.6	1.7	1.8	6.2	11.1	11.8	7.2	1.7	1.2	1.1	53.6				

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 2005.
** Years of occurrence given in brackets.

TABLE - 2
Frequency of Annual Rainfall in the District
(Data 1951 - 1999)
(UNA)

Range in mm	No. of years	Range in mm	No. of years
401 – 500	1	1401 – 1500	4
501 – 600	1	1501 – 1600	0
601 – 700	2	1601 – 1700	0
701 – 800	4	1701 – 1800	0
801 – 900	2	1801 – 1900	0
901 – 1000	1	1901 – 2000	1
1001 – 1100	4	2001 – 2100	0
1101 – 1200	3	2100 – 2200	0
1201 – 1300	4	2201 – 2300	0
1301 – 1400	3	2301 – 2400	1

(Data available for 31 years only)

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

MONTH	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest Maximum ever recorded		Lowest Minimum ever recorded		Relative Humidity (%)	
	^{0}C	^{0}C	^{0}C	Date	^{0}C	Date	0830 IST	1730 IST
January	20.3	5.1	28.4	1991 Jan 30	-5.8	2003 Jan 15	91	67
February	22.6	6.8	30.8	2003 Feb 28	-0.9	2002 Feb 04	89	64
March	26.3	10.7	35.2	2002 Mar 22	3.4	1997 Mar 02 2002 Mar 03	85	68
April	34.0	15.3	41.8	2002 Apr 23	6.7	2000 Apr 06	64	40
May	36.2	19.2	45.2	1988 May 30	8.6	2003 May 05	67	47
June	38.4	23.2	45.0	1995 Jun 17	15.2	2000 Jun 05 2002 Jun 15	67	50
July	33.8	24.5	42.2	1987 Jul 03	15.6	1994 Jul 01	86	75
August	32.6	24.1	38.4	1987 Aug 03	17.5	1999 Aug 27 2000 Aug 03 2002 Aug 22	91	79
September	33.0	21.9	35.8	1987 Sep 28 1988 Sep 06	13.2	2002 Sep 28	90	74
October	30.6	15.5	35.0	1987 Oct 02 2002 Oct 07	8.1	1993 Oct 23	85	67
November	27.0	9.6	33.4	2002 Nov 03	1.8	1996 Nov 30	84	61
December	21.1	6.4	28.2	2001 Dec 07 2002 Dec 01	-2.0	2001 Dec 31	92	68
Annual	29.7	15.2					82	63