Chapter - 14

Climate of India

(Special Reference to Rajasthan)

Diversities in climate are found in various parts of our country due to vastness and varities of land forms. Due to the maximum effect of monsoon wind on Indias climate it is called the Monsoon climate.

Monsoon :

The word Monsoon is derived from an arabic word ''Mosim'' which means seasons or seasonal winds. Monsoon winds changes their direction according to the seasons in our country. This type of monsoon winds are the determiners of India's climate. The climate of our nation is affected by latitudinal position, altitude from sea level, distance from sea, direction of mountain winds and land structure etc.

Origin and development of Monsoon :

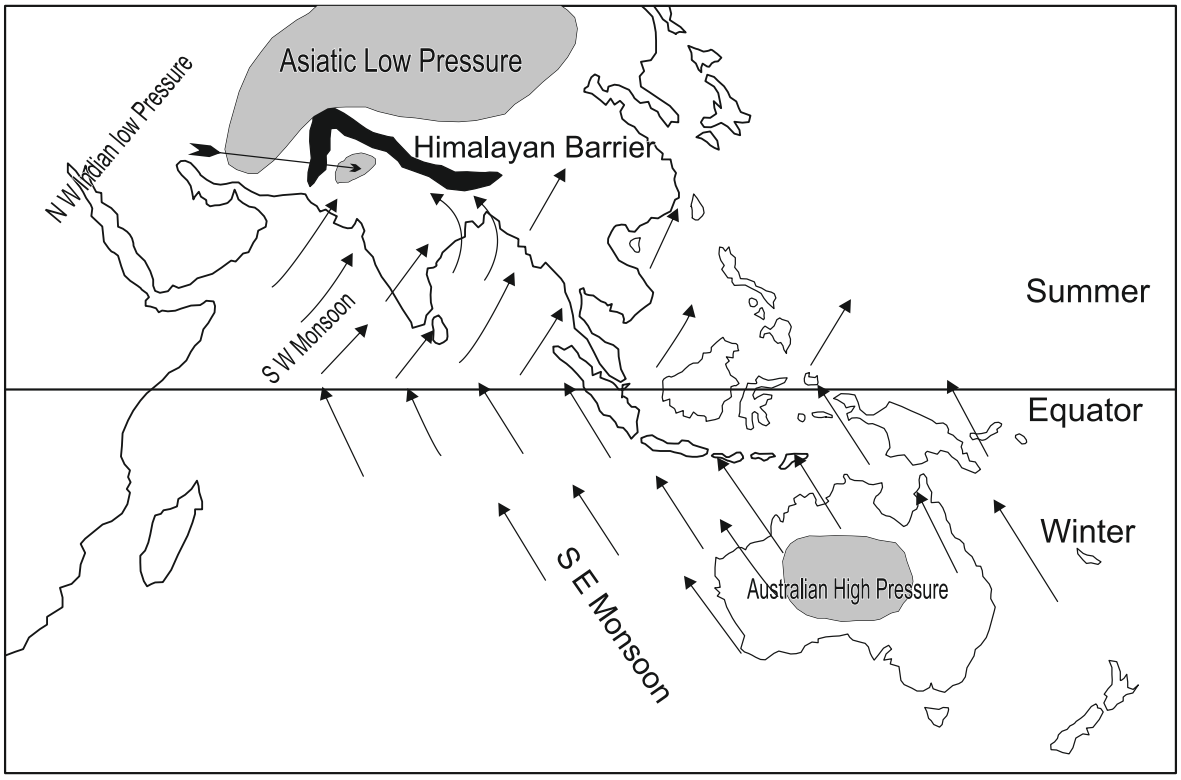
Onset of monsoon and progression of monsooni winds towards land area : The mechanism of south-west monsoon is highly complex. Its origin can be understood with the help of unequal rate of heating and cooling of land and water bodies (Oceans), displacement of air pressure belts along with the shifting of Inter Tropical Convergence Zone (ITCZ) and location, extent and shifting of jet-stream.

At the beging the origin Indian monsoon has been explained with the mechanism of unequal heating and cooling of land and water bodies, which leads to variation in air-pressure conditions. As a result of this, in summer season, winds start blowing from sea areas to the land areas. Later on, this simplistic explanation was considered inadequate.

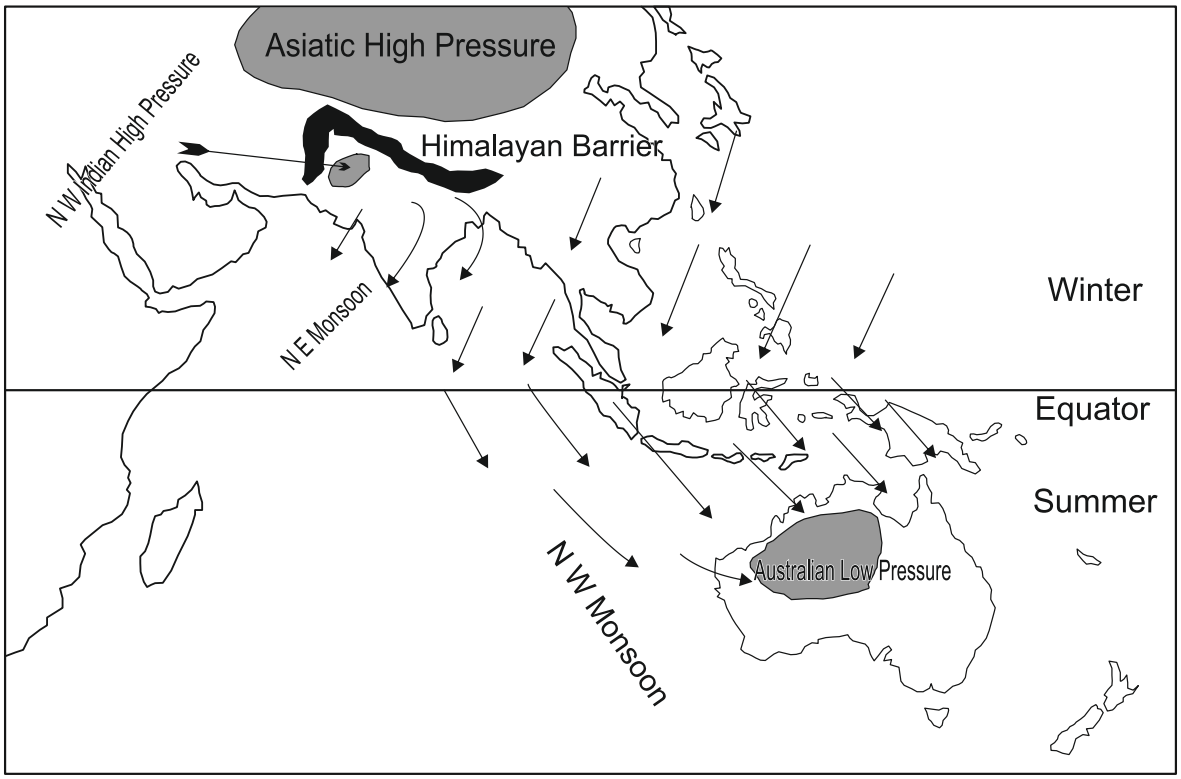
Due to the nothern shift of Inter Tropical Convergence Zone (ITCZ) alongwith nothern shift of the sun, winds are originated which flows from south-west to north-east direction. Due to the nothern shift of the sun low perssure areas are develop in the north-western part of India and on Tibbetian plateau.

In the upper part of troposphere, the air circulation is entirely different from the air circulation near earth surface. In the summer season, easterly jet-stream flows at the height of about 12 km. from the surface, which pushes the tropical depressions towards Indian sub-continent. As a result of this, these depressions influence the monsooni rain over Indian sub-continent. The areas affected by these depressions are the areas of maximum rainfall in Indian sub-continent. The frequency, direction and intensity of these depressions influence the rainfall due to south-western monsoon.

Retreating of Monsoon or Origin of North-East Monsoon : Monsoon starts retreating nearly the month of september. At the end of this month the sun starts its southern shift. In these conditions the low pressure areas over Indian sub-continent are changed into the high pressure areas. As a result of this, now winds strat flowing in north-east to south-western from land areas to the seas. At the middle of October month these winds are retreated from the entire Indian part of expect the part of Indian peninsula. Out of these winds few passes over the Bay of Bengal and get moisture from this region. These winds bring north-eastern monsooni rain in



Map 14.1 : Incoming monsoon conditions in Indian sub-continent



Map 14.2 : Retreating monsoon conditions in Indian sub-continent

eastern Tamilnadu and the adjoining areas.

Climate : Circumistances

The climate of India is of monsoon type. Here the climatic codintions can be normally divided into the chronology of pre- monsoon conditions, monsoon period and the withdrawal of monsoon stage.

In the pre monsoon condition the country faces severe heat. Heat waves and stromy winds blow fast in many areas. Here pressure is developed in northern India. This leads to change in the direction of winds. Winds start blowing from sea to the land in a fast pace.

On the arrival of the monsoon period the winds coming from south west cause rainfall in India in the form of Arabian sea and Bay of Bengal monsoon branches. This period is called rainy season. Withdrawal time of the Monsoon is asociated with winter season. The climate of India is affected by many geological factors.

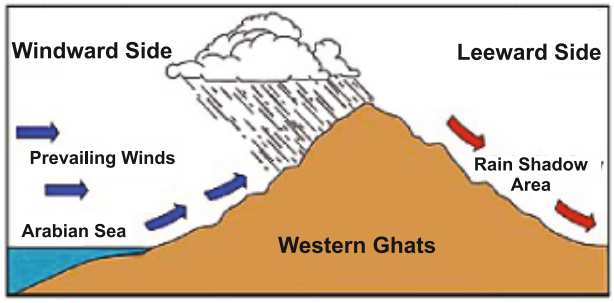
Factors affecting climate :

1. Height from the sea level : The height of any place is inversely related to the temperature of that place. Generally at every 165 meter of hight the temprature falls up to 1° C. As a result higher places like Himalayas are always remained covered with snow. Though situated at the same latitude the average temperatures of summer in Masuri remains 24° C, in Dehradoon 32° C and in Ambala it is near 40° C.

2. Distance from the sea : The difference in temperatures of the cities located at sea coasts remains very low and the climate always remains moist. As the distance increases from the sea in the interior parts of the continents, so did the dissimmilarity, in other words the temperature difference and the aridity also increase. The average annual rainfall in the western coastal areas remains more than 200 cm. and in the eastern coastal areas it is between 100 to 200 cm. Generally, it decreases towards the interior areas.

3. Latitude : This the most important factor affecting the temperature. The temperature decreases with the increasing latitudes because the slanting in the sunrays also increases. It affects the amount of solar heat. The tropic of cancer passes through almost middle of India.

4. Situation of Mountains : One of the factors that affect the climate is the situation of mountains that is very important. The position of western Ghats is close to the western coast of peninsular India. There fore its western slope receives abundant rainfall by south west monsoon. While the slopes opposite to it and the southern plateau comes under the rain shadow area of south west monsoon.



Diag. 14.1 : Impact of Mountain barrier on Rain

5. The direction of Mountains : Because of the position and direction of Himalayas Indias climate remains mild. Besides protecting our country from the cool siberian winds Himalyas stop the summer monsoon to enforce it to precipitate in India on the other hand. The reasons for the arid climate in western Rajasthan is that the direction of Aravali range lies parallel to the south west monsson, therefore it does not put any barrier in the path of the monsoon winds.

6. Direction of the winds : The winds bring the properties of the place and the path of their origion with them. In the summer monsoon winds are hot and humid because these are originating from Indian ocean. That is why they bring rain. In the winter monsoon winds originates from the land surfaces of cold regions so they are usually cold and arid.

7. Upper air circulation : Upper air

circulation is closely linked to monsoon. Climate of India is largely affected by the bustling in the troposphere due to its monsoon type nature. The timely and quantitative uncertainity of monsoon also depends on the conditions of powered air circulation.

Apart from this the amount of cloud covering, vegetation cover, sea currents etc also partly affect the climate of India. According to the metrological department of India the climatic condition are divided into four seasons.

1. Winter season - December to February
2. Summer season - March to mid June
3. Rainy season - Mid June to mid september
4. Autumn Season - Mid September to Mid December

There are six seaosns according to the Indian litrature and culture.

1. Basant Ritu (Spring) - Chaitra-Vaishakha
2. Greeshma Ritu (Summer) - Jyestha-Ashadha
3. Versha Ritu (Rain) - Shravan-Bhaishak
4. Sharad Ritu (Antumn) - Ashwin-Kartik
5. Hemant Ritu (Pre winter) - Magha-Phalguna
6. Sheet Ritu (Winter) - Margsheesh-Pousha

Due to vastness of the country differences at local level are found in above mentioned period of various seasons. In every season a variation in temperature, air pressure, winds and in the amount of rains are found.

(A) North-Eastern or winter Monsoon period :

1. Winter Season -

(a) Temperature : The temperature gets a rise in this season while going north to south. Temperature remains low and the severe winter is observed in north India due to the factors like increased height from the sea and distance from the sea and equator. In South India the temperatures remain comparatively high due to the proximity from equator and the marine influence. In this season the temperature dips lower than the freezing point at many places in north India. At this time average temperature in north India remains lower than 21° C and in south it remains more than this.

(b) Pressure and Winds : In this season, the high air-pressure is found in North-Western part of India and in the areas of Tibbetian plateau and at Indian ocean air-pressure remains low. Therefore, the winds start running towards the oceanic low pressure region from the high pressure zone of Asia. They are called north-eastern monsoon winds.

(c) Rainfall : In this season the norht western part of the nation receives rain fall due to medeteranian cyclones and from the retreating monsoon. The rainfall due to the mediteranian cyclones (western disturbances) is a boon for the Rabi crop. In local language it is called 'Mavath'. This rainfall occures mainly in Jammu and Kashmir, Punjab Haryana, Rajasthan, Uttarakhand and in U.P. In south Tamilnadu gets the rainfall due to north-eastern monsoon.

2. Summer :

There is a lot of heat observed in this season due to high temperature in north India. Three reasons are stated for high temperatures in summers.

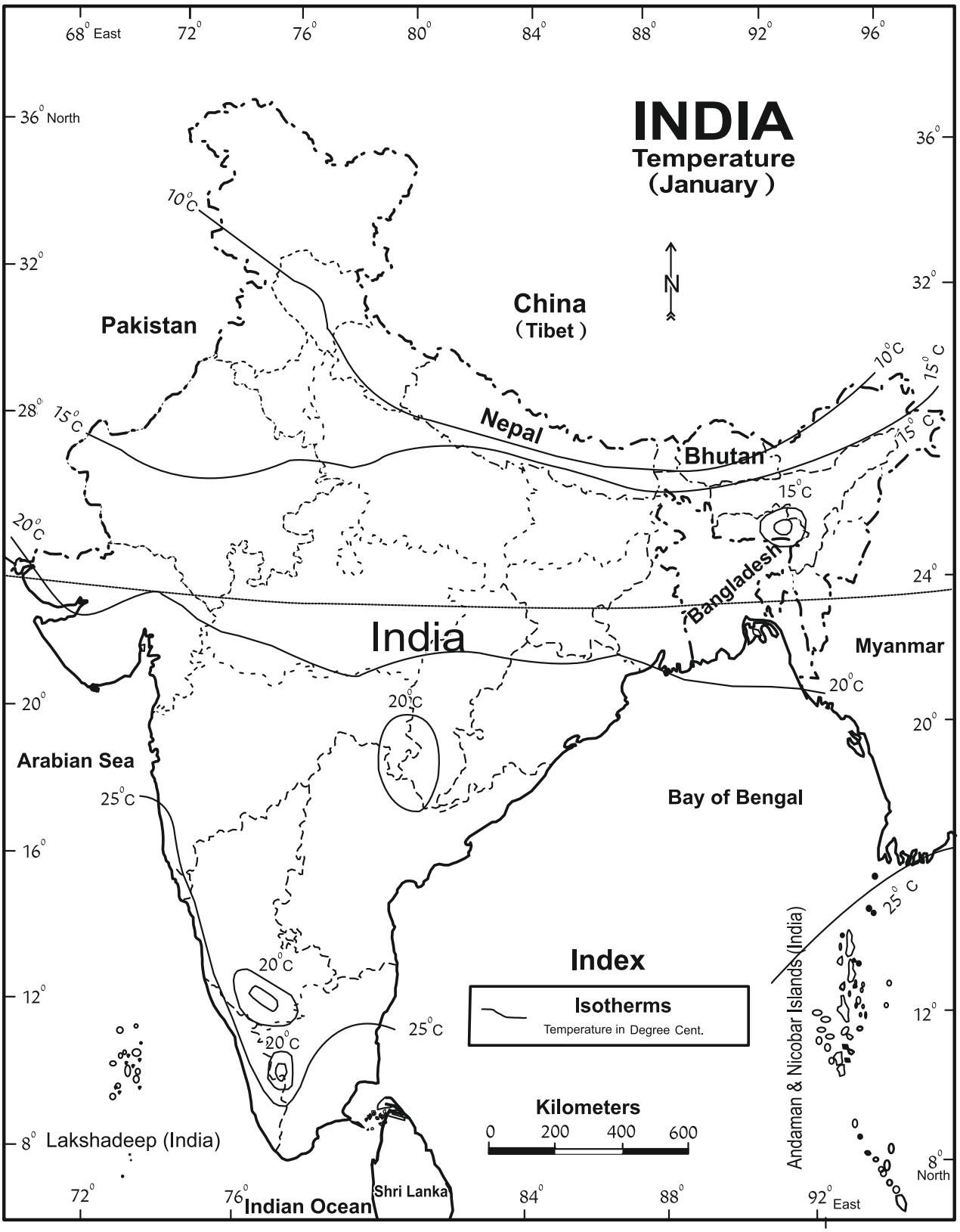
(i) Vertical fall of sun rays in the northern hemisphere.

(ii) Distance from the sea

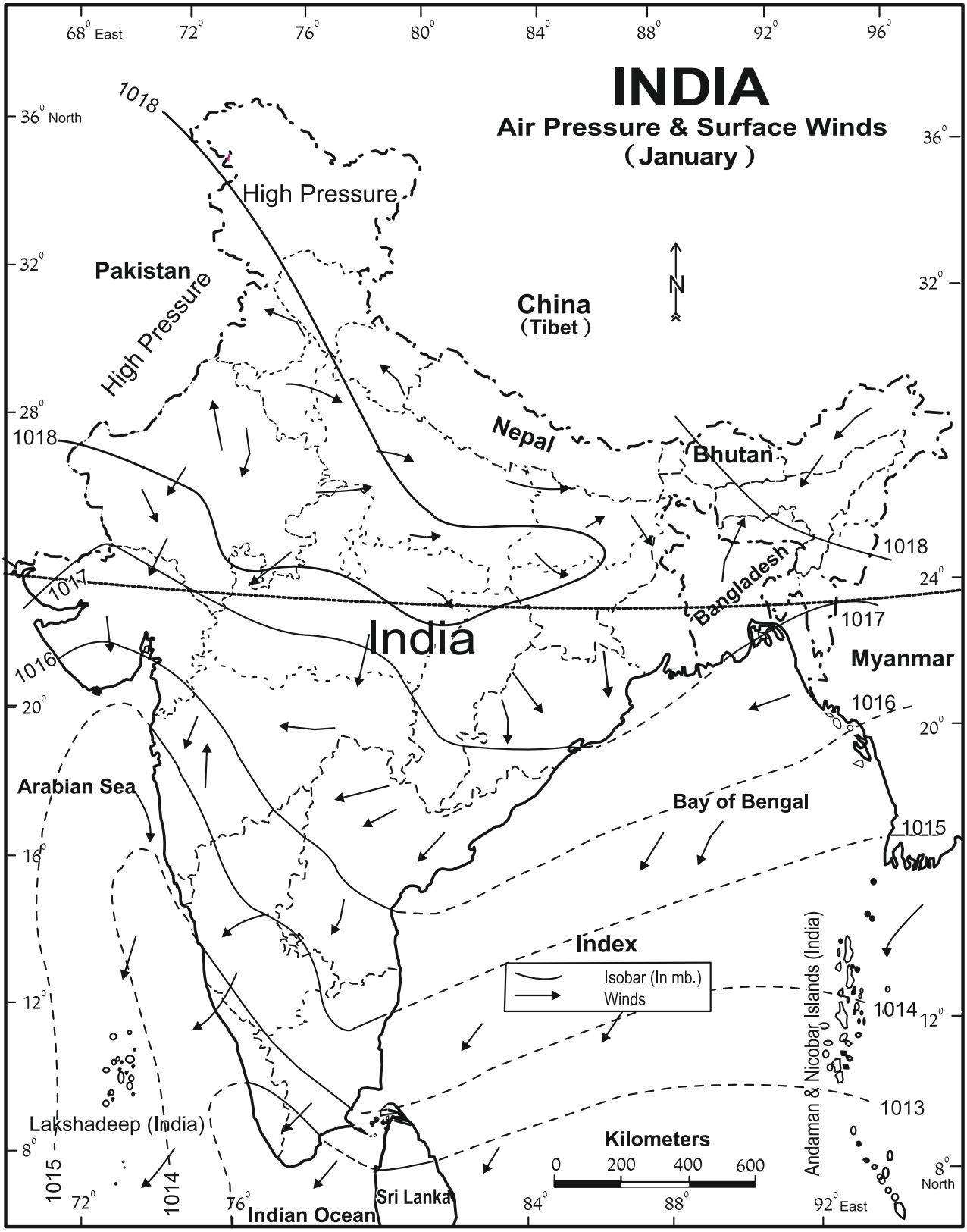
(iii) Rise in the temperature due to anti cyclons.

Temprature can reach up to 50° C in this season in north India. Due to marine influence the temperature remains low. In south India hilly areas and its adjoining parts remain cool in this season.

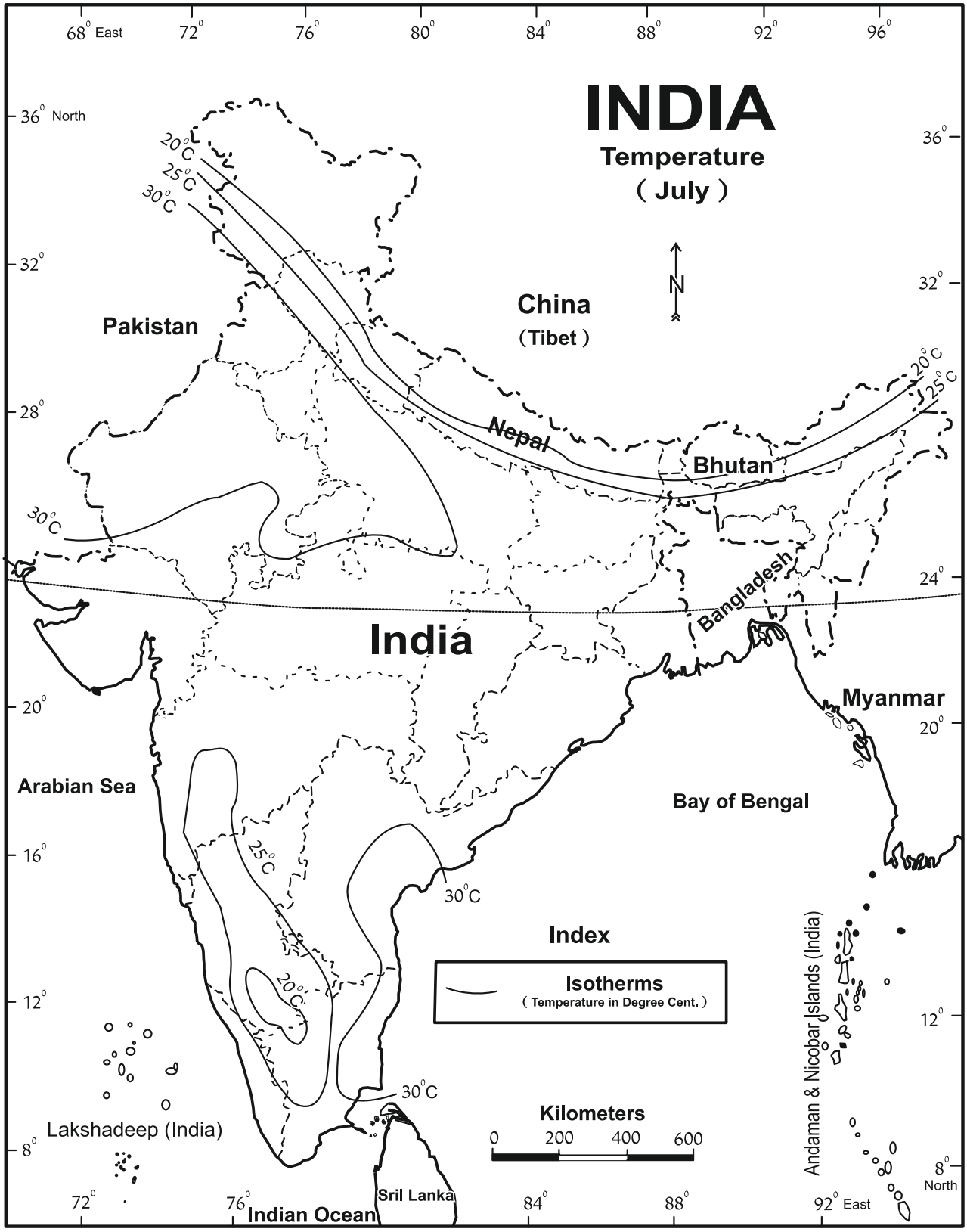
(a) Pressure and winds : A low pressure area is developed in north India due to excessive heat at this time. A low pressure area is developd in the desert region of Rajasthan and Punjab. But on the contrary a very high pressure zone is formed in the



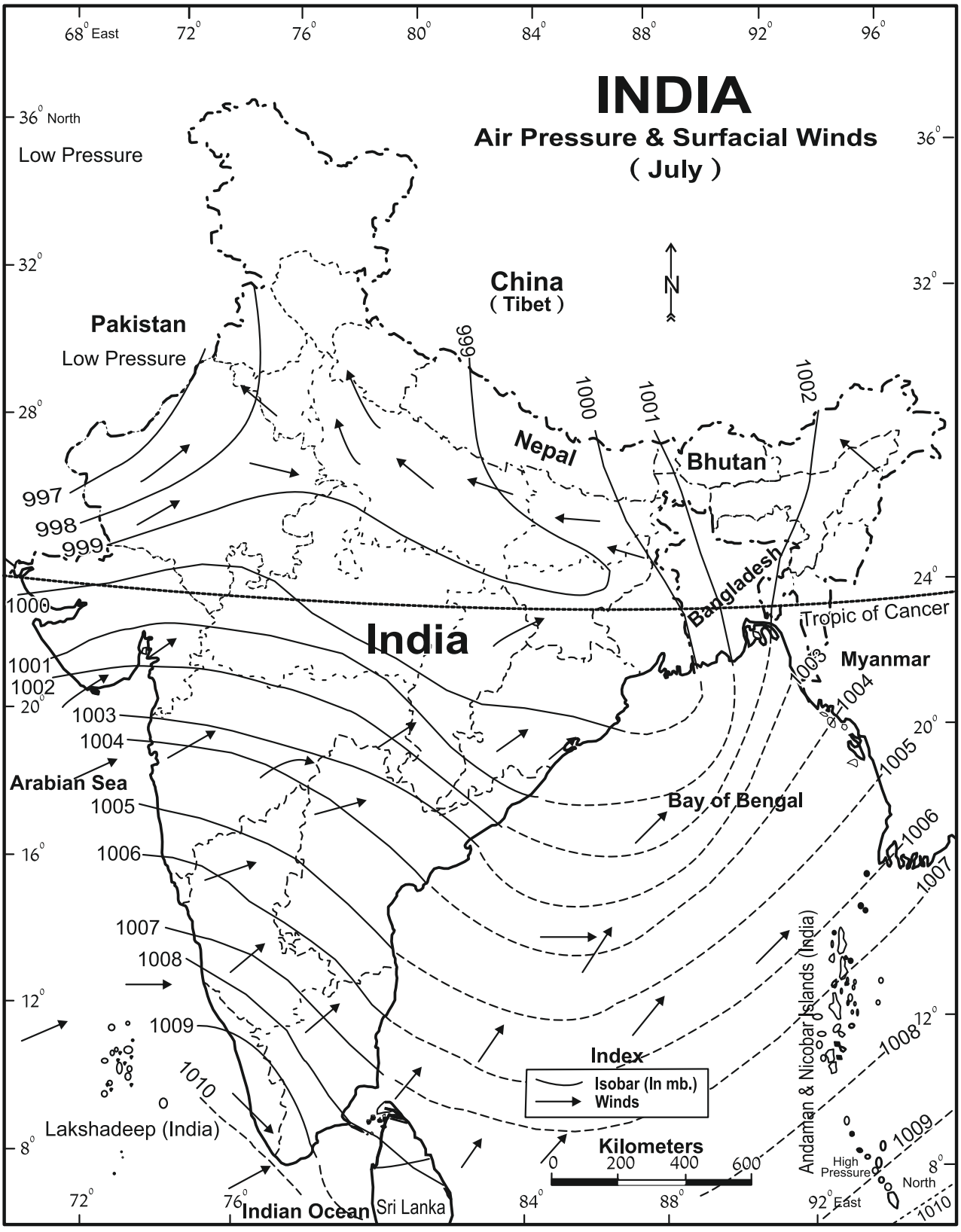
Map 14.3 : Average temperature conditions in India (January)



Map 14.4 : Average pressure conditions and direction of flow of winds in India (January)



Map 14.5 : Average temperature conditions in India (July)



Map 14.6 : Average pressure conditions and direction of flow of winds in India (July)

Indian ocean region. In this region the winds blow in north India are called 'Loo' Sometimes a light rain also occurs there with storms. In western Bengal such storms are called 'Kall Vaishaki'.

(b) Rainfall : There is a little rainfall appears in this season. In west Bengal the rainfall occurs with 'Kall Vaishaki' storms. In south India rainfall near the Malabaar cost is called 'Aamra Varsha' and the rainfall in coffee production area is known as 'Phoolon ki Bouchar' (shower of flowers). Hail storms occur in Punjab, Haryana, Uttarakhand and Asam with rainstorms.

(B) South-West or Summer Monsoon Period :

3. Rainy Season : This season gives life to agriculture of our country. Rain occurs in most parts of the country at this time. The period of Rainy season depends entirely on the monsoon.

(i) Temperature : In this period due to high termerature in the North India, low pressure centers are developed in summer season and in their influence monsoon events advanced towards Indian sub continents. In this season with increasing rainfall tempereture start declining in this region. After July-August temperature declines in some areas. In Rajasthan the temperature of September goes up to 38° Celsius.

(ii) Pressure and winds : At this time the low air pressure is densely concentrated on the desert of Rajasthan and Punjab and in the areas of Tibbetian plateau. In South the high pressure is centered in Indian ocean. So due to the south-west diversion of the winds it is called south-west monsoon. Along with the moving of the center of the monsoon, it is known as 'Monsoon' with this sliding of pressure center the monsoon winds keep going ahead.

(iii) Rainfall : Due to the location of southern peninsulla the south west monsoon causes rainfall in our country by dividing itself into two branches. The two branches are -

(i) Arabian sea branch

(ii) Bay of Bengal branch

(i) Arabian sea branch : This branch is more powerful than the Bay of Bangal branch. It first strikes at western ghats. It causes 250 to 300 cm rainfall here. The velocity of this branch gets weaker here. It causes scanty rainfall in the interior parts of the plateau. Because this region lie in the rain shadow area.

Its Nagpur sub-branch meets with bay of Bengal branch by going ahead between Narmada Tapti Valleys. An another sub branch reaches western Himaalaya by going through Gujrat and Rajasthan. Rajashtn receives less rainfall because of the parallel position of Aravali ranges and the monsoon winds.

(ii) Bay of Bengal branch : This branch gets divided into two sub branches. One sub branch leads towards Arunachal and Assam in North-Eastern part of India. This sub branch causes heavy rainfall by hitting the garohills in this region. Mausinram gets maximum rainfall here.

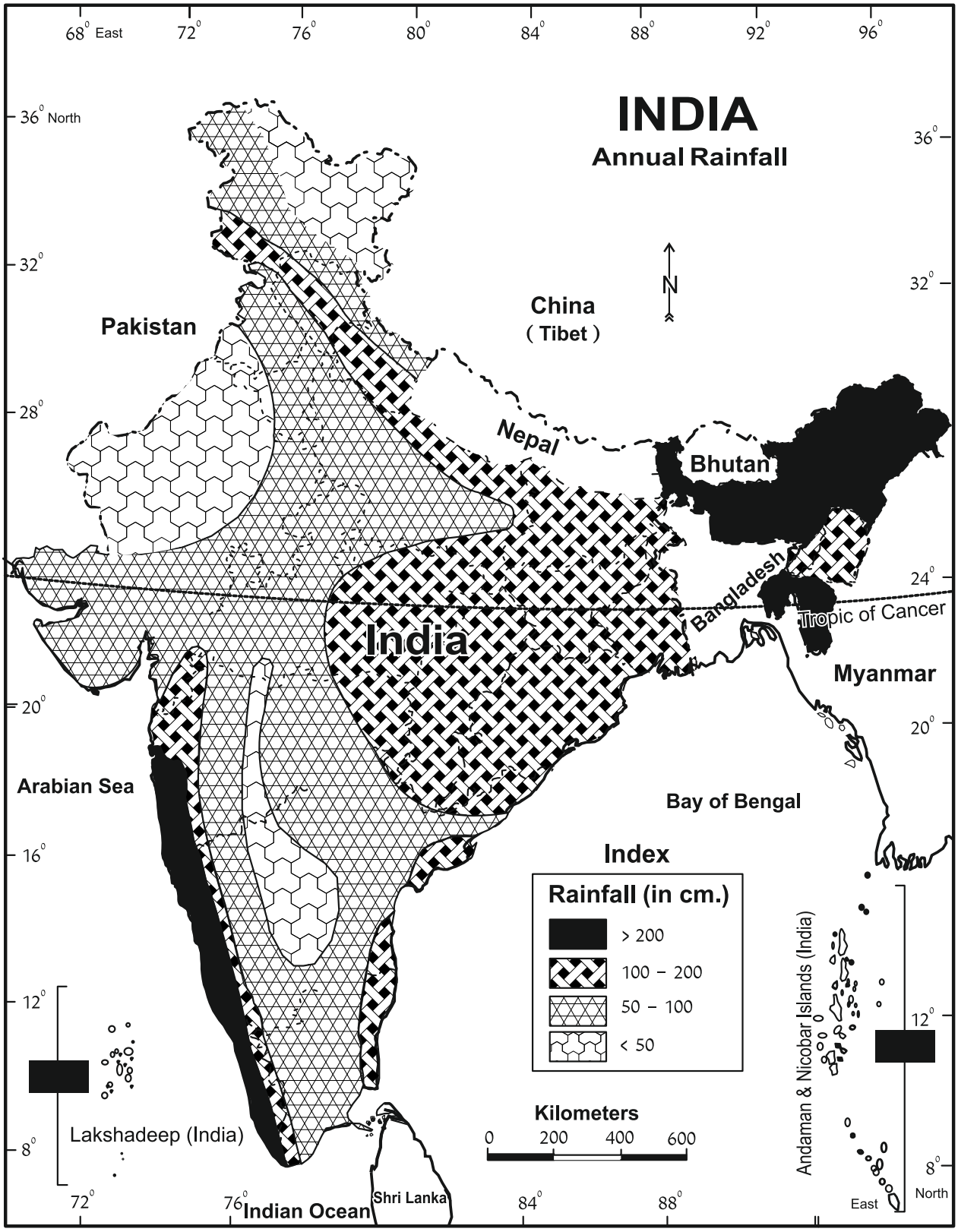
Its second branch proceeds along the low land of Himalayas.' Bihar, Uttar Pradesh, Chattishgarh, Jharkhand. Uttarkhand get maximum rainfall from it. The attainment of rainfall decreases along the west. So western Punjab and Rajasthan get scanty rainfall by it.

(iii) The Sharad Season : It is the return time of monsoon. At this time the sun visits in southern hemisphere and due to the withdrawal of monsoon the temperature goes down. Due to change in the temperature the pressure also keep sliding. The direction of winds changes from south west to north east now. It causes rainfall in Tamilandu.

The Distribution of Rainfall in India :

The distribution of rainfall is not equal in our country. The nation can be divided into four parts on the basis of regional distribution of rainfall.

(a) The high rainfall areas : Assam, Meghalaya, Arunachala pradesh, Tripura, Nagaland, Mizoram and the southern lowland of



Map 14.7 : Average annual distribution of rainfall in India

Himalayas, west Bengal, Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, western coastal plain and the area of western slope all are included in it. This area receives more than 200 cms of rainfall every year. Due to the exerssive rainfall tropical evergreen forests are found there.

(b) Ordinary rainfall areas : The eastern slopes of western Ghats south west Bengal, Chattisgarh, Jharkhand, Orrisa, South western UP. lowland areas of Himalaya and eastern Tamilandu come under this region. This region gets 100 to 200 cm of rainfall annually. Monsson forests are found here.

(c) Scanty rainfall areas : It includes the interim part of southern peninsula, eastern Rajasthan, Punjab, Haryana, Southern UP, northern and southern Andhra Pradesh and middle east part of Maharashtra. This part receives a rainfall between 50 to 100 cm.

(d) Insufficient rainfall areas : This portion covers Royal seema region of Tamilandu, Kaccha, western Rajasthan, western Punjab and Laddakh etc. Here the rainfall average is less than 50 cm.

Climate of Rajasthan :

The climate of Rajasthan is broadly a part of monsoon climate but many spatial diversities are found here. Most part of Rajasthan comes under the temperate tropical climate zone. Factors influencing the climate of the state are :- latitudinal positon, distance from the sea, height direction of mountains, winds direction, types of soil and vegetation are important.

Climate conditions :

Traditionally on the basis of climate Rajasthan is largely divided into 3 main seasons.

1. Summer season
2. Rainy season
3. Winter season

According to the metrological department of India, on the basis of monsoon period the whole year is devided into following seasons.

1. Winter season	-	December to February
2. Summer season	-	March to mid June
3. Rainy season	-	Mid June to mid september
4. Autumn Season	-	Mid September to Mid December

1. Winter Season :

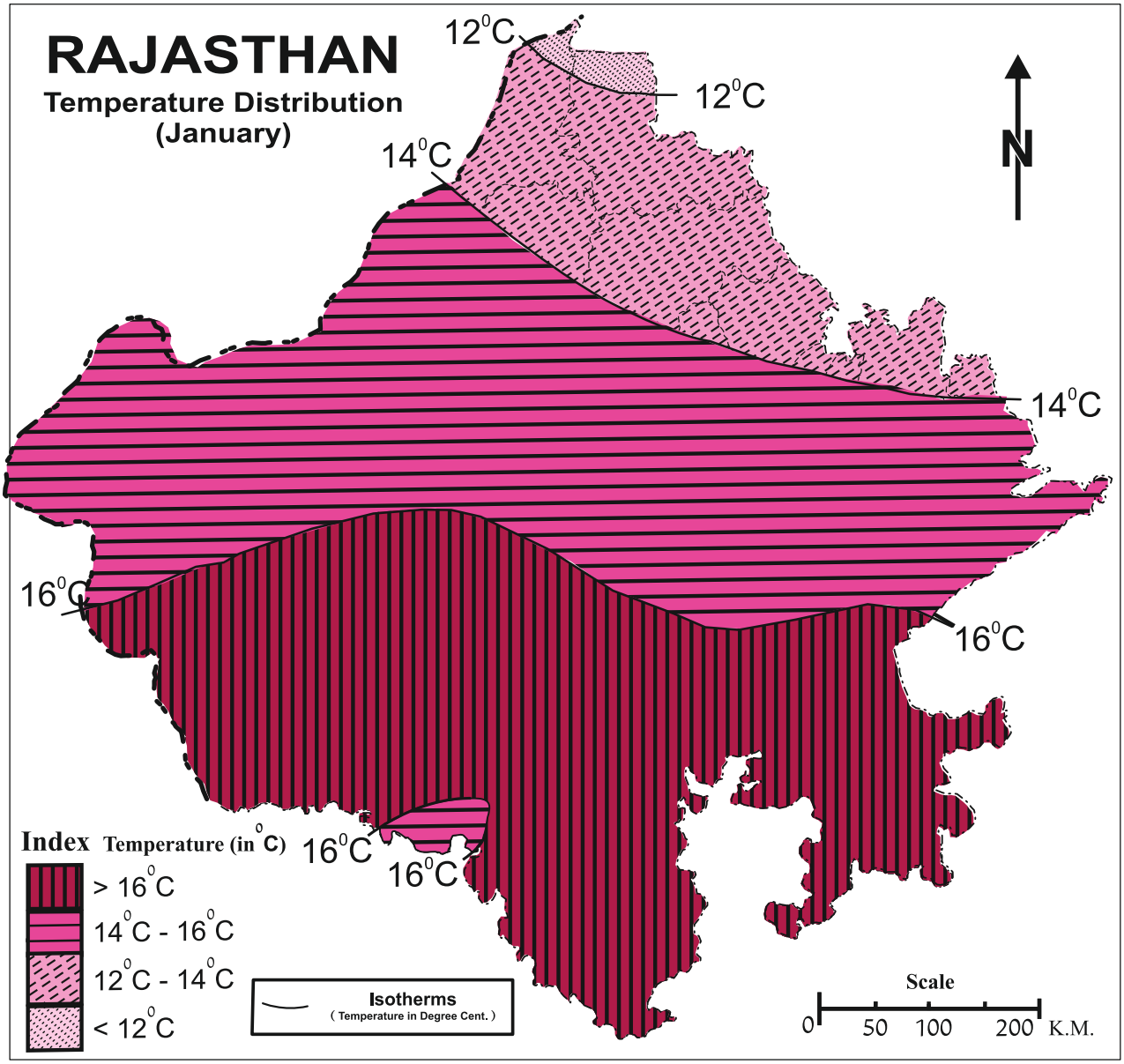
Temperature : From December to Febaury the position of the sun lies is in southern hemispher. So the temperature goes down in the state. Many times mercury dips below zero at several places like Sikar, Churu, Degana, Phalaodi, Mount Abu. The temperature remains very low. According to common territorial distribution, the lowest temperature in north remains less than 12° C and in south it remains more than 16° C.

Pressure, Winds and Rainfall : A highly developed pressure center near Bekal lake and Peshawar affect the monoson of sharad period. Pressure remains over Indian ocean in this season so the winds start blowing from terrestrial high pressure area to oceanic low pressure area. Due to their terrestrial origin these winds remain dry. But some of these winds bring rain after coming into contact with mediteranian cyclones. It is called 'Mavath' in the local language.

2. Summer Season :

Temperature : In March the temperature gradually rises because the sun starts to achieve the solstice position. The temperature reaches maximum in the month of June. The average temperature of the state at this time remains more than 38°C, but the highest temperature is measured between 40°C to 45°C

Pressure winds and Rain : Due to extreme heat low air pressure is developed in the western part of Rajasthan. The cloudless sky and the direct and fierce rays of sun make the surface hot. Due to this impact hot dry and dusty winds start blowing which are called ''Loo". Fast hot winds and storms in this reason are the characteristics of the climate of



Map 14.8 : Average temperature conditions in Rajasthan (January)

Western Rajasthan. Pre monsoon showers occur sometimes in this season at several places.

3. Rainy Season :

Temperature : Due to rain the summer temperature goes down in this season. After the beginning of rainy season the temperature in various parts of Rajasthan remains between 18°C to 30°C

Pressure and winds : Due to excessive heat the pressure in western Rajasthan goes very low. Contrary to this the pressure in Indian ocean remains very high. So the monsoon winds start moving from oceanic high pressure to the terrestrial low pressure. This leads to the origin of two branches:- Bay of Bengal monsoon and Arabian sea Monsoon. Both the branches cause rain in Rajasthan.

Rainfall : Generally monsoon reaches Rajasthan by the last week of June. Rajasthan gets rainfall from the monsoon of Bay of Bengal and Arabian sea. 95% of the total rainfall in Rajasthan is received by these winds only. Arabian sea monsoon

passes through the state without giving much rainfall to it because there is no proper obstruction available in the passage of it. The branch of Bay of Bengal monsoon becomes much dry when it reaches here after causing rains in the whole country. For above stated reasons the western part of the state remains deprived of rainfall. But the annual rainfall in the south western part of Aravalli averages more then 100 cm. The average rainfall in the western Rajasthan remains 25 cm and it is 75 to 100 cm in the south western part and the rest north eastern Rajasthan receives 50 to 70 cm. While going towards south-east to north-west and west particularly, the uncertainity of the rain keeps increasing and the amount of rainfall also becomes less.

4. Autumn (Sharad) Season :

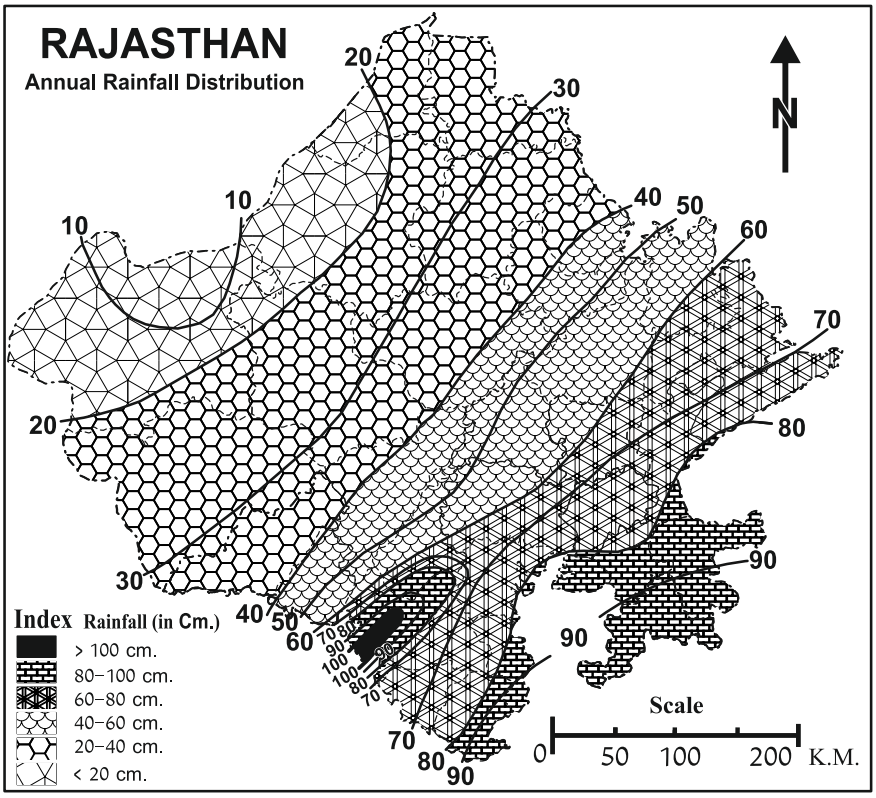
Temperature : In this season the temperature grows up to 38^0C because of the clear sky after the rainfall but the temperature decreases gradually due to the winter solstice. The temperature ranges 20^0 to 30^0C from north to south in Rajasthan.

Pressure, Winds, Rainfall : In this season no explicit order is formed regarding to pressure, so winds also remain calm. Therefore no rainfall is received here in this season.

Rajasthan : Annual Rainfall :

The average rainfall is not high in Rajasthan because it is located in the interior part. Also the distribution of rainfall is uneven. The western desert receive minimum rainfall with the annual average of 25 cm. From desert to the eastern Aravalli ranges the annual rainfall averages 25 to 50 cm. Most of the rainfall is received by southern Rajasthan where it averages more than 75 cm. The 95% of total rainfall of state is brought by the monsoons of Arabian sea and Bay of Bengal. In winters little amount of rainfall is received through 'Mavath'.

The extension of the Aravalli ranges is parallel to the monsoon winds and the arrival of south-western winds, especially the bay of Bengal branch, after causing rainfall some where else in the country are the major reasons for the low rainfall in the state.



Map 14.9 : Average annual distribution of rainfall in Rajasthan

Important Points

1. 90% part of the total rainfall of India is received by the south-west monsoon.
2. Regional distribution of rainfall in India is extremely unequal.
3. The winter is usually dry. The 10% of the country's rainfall is obtained from Autumn monsoon and cyclones.
4. There are six seasons according to Indian culture.
5. After dividing itself in to two branches the south west monsoon causes rainfall in the country by- Arabian sea branch and Bay of Bengal branch.
6. The climate of Rajasthan is odd.
7. In summer the hot winds called 'Loo' blow in Rajasthan and the rainfall received in winter is called 'Mavath'.
8. Rajasthan receives most of its rainfall from south west monsoon.

Objective type Questions :

1. The world monsoon is a transformation of -

   (a) Mosim (b) Monis

   (c) Manas (d) All one correct

2. The rainfall ''Mavath'' is -

   (a) Autumn rainfall (b) Winter rainfall

   (c) Summer rainfall (d) General rainfall

3. According to Indian culture the number of seasons are -

   (a) Two (b) Four

   (c) Three (d) Six

Very Short Answer type Questions :

1. From which language the word 'Mosim'' has been taken?
2. Where does the high pressure zone formed when the sun shines vertically above the tropic of cancer?
3. Where does the low pressure zone formed when the sun shines vertically above the topic of capricorn?
4. Where does the jet stream blow?
5. Where does the summer zone low pressure area develop in Rajasthan?

Short answer type Questions :

1. Give reasons which affect the climate of India.
2. Write the names with duration of the seasons which come under winter and summer monsoon.
3. Explain the monsoon of Arabian sea.
4. Explain the jet stream ideology about the origin of Monsoon.
5. Explain the relationship of rainfall in Rajasthan with Aravalli range of mountain.

Essay Type Questions :

1. Describe the temperature, pressure, wind conditions and the rainfall of south west monsoon.
2. Write about the distribution of rainfall in India.
3. Explain the circumstances related to climate of Rajasthan.

Mark in maps :

1. Show the position of south west monsoon winds in the map of India.
2. Show the distribution of annual rainfall is the map of Rajasthan.

Answers to objective type Questions

1. (a) 2. (b) 3. (d)