CHAPTER- 4

CLIMATE

It is very essential to understand Indian climate to understand the physical environment and the Geographical components that affect the Indian life style. Almost half of the land mass of the country lies south of the Tropic of Cancer which is a tropical region and half of its area is in North which, from the point of view of extension, is in sub - tropical region. The presence of the great Himalayas on the Northern boundary and location of Indian Ocean, Arabian Sea and Bay of Bengal on South- Eastern and South- Western boundaries respectively has affected the climate of India a great deal. The vast size and location of the country has created climate related diversities. Thus: it is said, that all the climate of the world is found in India.

In layman's terms we consider weather and climate as one but students of geography must understand the difference between the two. Climate is almost permanent but weather is temporary. The average sum total of weather or atmospheric specialties of a very large region for more than 30 years is called climate. The Atmospheric condition of a place or area for a particular time is called weather. Weather can change a number of times in a day but climate of a place remains the same for years together. The main components of weather and climate are – Temperature, Air pressure, Wind, Humidity and Precipitation. They keep on changing by the Insolation of the Sun. The atmospheric condition remains the same for a few months in a year like – Hot or Cold, Windy or Calm, Sky full of clouds or clean and Dry or humid, etc. On the basis of the average atmospheric conditions in these months, the year is divided into Summer, Winter and Rainy seasons and studied accordingly.

Monsoon type of climate is found in our country. The word Monsoon is derived from Arabic word "Mausim" which means weather or season. Slowly the word Monsoon began to be used for that wind which blows from sea

towards land during summer and from land towards sea in winters. The Asian regions affected by these winds are named as Monsoon Asia in which our country India has an important position. In Monsoon climate of India there is distinct unity along with regional diversity.

In Barmer area of Rajasthan on some days of June the temperature soars to 48 – 50°c on the same day the temperature of Pahalgam or Gulmarg of Kashmir is less than 20°c where as the temperature of Khilanmarg north of Gulmarg is less than 0°c. At this time (June) whole north India remains under the effect of hot and dry wind whereas Assam receives so heavy rainfall that the Brahamputra river experiences heavy floods. In India the temperature found in the coastal areas are moderate but in the land part it is extreme. All these differences are durinal. These differences can be seen annually as well. During December nights the minimum temperature goes down upto – 40°c at places like Kargil. In Thiruvananthapuram or Chenai the temperature ranges between 25° – 30°c during June . At this time in western Rajasthan it rises up to 50° C. From the point of view rainfall the average annual rainfall of Mawsynram is 1180 Centimeter whereas in Jaisalmer it is not more than 12 Centimeters. In October – November the eastern part of South India receives good rainfall due to retreating Monsoon whereas in North India Temperate Cyclones cause rainfall. When the farmers of Kashmir shiver in cold in December January, at the same time the Moplas (Local Tribe) of Kerala Coast only wear Lungi and cultivate Paddy crop with upper portion of their body without any cloth. The amount of rainfall decreases from East to West in North India and so the diversity in food, clothing and habitat of the people is found.

One word LANDFORMS is used for the factors controlling the climate, which affect the climate.

L – Latitude
A – Altitude
N – Nearness from Sea
D – Direction of wind
F – Forest
O – Ocean Current
R – Rainfall
M – Mountain
S – Soil

If the sun rays are vertical or inclined then there is difference in the amount of solar energy. The Sun rays fall vertically on lower latitudes and fall inclined on higher latitudes. This is the reason why the temperature falls when we move from Equator towards Pole. As altitude of the surface rises from sea level the atmosphere becomes rarer and there is fall in temperature. This is the reason why in Utakmund or Ooty (Tamil Nadu), which lies in lower latitude, temperature is low and during summer tourists in large number visit this place. In any place if the temperature rises, the air pressure becomes low and when the temperature decreases the air pressure rises. The wind begins to blow from high pressure towards low pressure and if the wind is coming from water body then it carries sufficient moisture which causes rainfall but wind coming from land part is dry. Climate is certainly affected by Sea. Water takes time to get hot and cold. Therefore, the Coastal areas do not become much cooler during winter and also it does not become much warmer during summers but the land part quickly becomes warm and cold. Therefore, the central part of the continent becomes extremely cold during winter and extremely warm during summers. The climate nearer to sea is found to be moderate and the climate away from the sea is found to be extreme. Cold or warm Oceanic currents affect those coastal areas through which they pass. High mountains stop the moisture laden wind that creates rainfall which causes heavy rainfall in windward parts of the mountains but leeward side of the mountain remains devoid of rainfall which is called Rain Shadow region. The forest attracts clouds and prevents from hot sun rays. The type of soil also affects temperature. Sandy soil or coarse soil becomes warm quickly and increases the temperature but alluvial soil does not become warm quickly.

The Factors Affecting the Indian Climate

Latitude – The Tropic of Cancer (23.5° N) crosses from the centre of India. In India North of Tropic of Cancer Sub tropical and South of it Tropical climate is found. Therefore, South India remains Hot and the North India remains comparatively cool.

Altitude – There is decrease in temperature as the height increases. In the North of India lies the Himalayan Range which has an average height (Great Himalaya) of about 6000 Meters. The height of Indian Plains and Coastal areas is 30 to 150 Meters. As a result the mountainous areas remain cooler and Plains or Coastal areas remains comparatively warmer. The icy

winds coming from central Asia during winter fail to cross the Himalayas as a result of which there is not much fall in temperature but in Summers the Himalayas stops the Monsoon winds and brings good rainfall in India.

Air Pressure and Wind – Air Pressure and direction of wind has given distinctness to Indian Climate. In India the North – Eastern monsoon winds blow from the Tropic of Cancer region towards the equatorial region. They blow from sub tropical high pressure belt towards tropical low pressure belt. In other words, they blow from land towards Sea as a result they do not cause any rainfall. In summers this situation gets reversed because the presence of Sun in the Northern Hemisphere a low pressure belt is created in Rajasthan Desert area and high pressure belt is created in Tropic of Capricorn region. Therefore, in summer, winds from the Tropic of Capricorn region of Southern hemisphere quickly cross the Indian Ocean and begin to reach India. After crossing the Equator, according to the Ferrel's law, it turns right and begins to blow in South - West direction and this is called South - West Monsoon. Through this wind there is wide spread rainfall in whole India.

The upper air circulation is dominated by westerly flow in India. Jet stream is the important component of this flow. Jet streams flow in the upper portion of atmosphere between 27° and 30^0 north Latitudes. Therefore, they are known as Sub Tropical Westerly Jet Stream. They shift to southern fringe of Himalayas from September to March and at times bring heavy rainfall in the North and North – Western part of the country in the form of Western Cyclonic disturbances. During summer, the Sun shines over Tropic of Cancer. Therefore, the Westerly jet stream shifts towards the northern fringe of the Himalayas. At this time another Easterly Jet stream which is called Tropical Easterly Jet Stream blows over Southern India on approximately 14° North Latitude during summer (April to August) and brings rainfall with stormy winds in the coastal areas of Bengal, Odisha, Andhra Pradesh etc. To bring about this type of condition, the difference in air pressure and direction of wind is a major factor.

Distribution of Water and Land Mass – The Climate of India has been affected by the distribution of Water and land mass. In the coastal areas there is not much difference of temperature in winter and summer because the water bodies take time to get warm and cold. The climate remains moderate there because of less range of temperature. The coastal areas of south India

remains in its effect but as the North India is far distant from the sea, so there is no sea effect here. As a result there is extreme cold in winter and extreme warm in summers. The range of temperature is very high here and so the climate becomes extreme and this is the reason why, in Delhi, warm clothes in winter and Ice during summers, both are sold in large amount.

EL NINO

El Nino is a Spanish word which means "Child". In fact El, Nino is a warm Ocean current that evolves after an interval of three to seven years on the coasts of Peru and Ecuador. Due to this warm current, there is sudden rise of water temperature upto 5° to 10° C. When this current reaches the Eastern Archipelago region a low pressure belt is created there and because of this some part of South – West monsoon is attracted towards this low pressure belt as a result of which in North India the rainfall is less than the average and drought like condition is created. As the meteorologists say the drought of 1987 was due to El Nino effect. On the other hand, when this warm ocean current does not appear in any year, the Monsoon remains normal in India and there is goon rainfall creating flood like situation at times. The forecast of Monsoon can be made by studying El nino.

LA NINA

It is also evolved, at times, on the Peru coast. This cold current increases the air pressure as it reaches the Eastern Archipelago region. From this high pressure humid air blows in all directions. Some amount of this reaches India and increases water content in Monsoon winds that causes more than average rainfall which creates flood problem in many parts of the country. Because of this, Australia, South East Asia and China also receive heavy rainfall.

THE INDIAN MONSOON

The word Monsoon has been derived from the Arabic word Mausim (Season). This word was, at first, used for those winds which used to blow in Arabian Sea by the Arabian sailors which used to change their direction with the change of the season. In India in common language the meaning of

Monsoon is rainfall. Meaning of good monsoon is good rainfall. In India the direction of these winds remains in South – West direction for 6 months and for another 6 months it remains in North – East direction. Therefore, they are called south – west and north – east monsoon respectively.

During summer when the Sun shines vertically near the Tropic of Cancer, the north – western part of India becomes very warm. As a result of which there develops a large and intense low pressure belt but due to inclined sun rays near Tropic of Capricorn, the Thermal effect is less which from comparison point of view becomes a high pressure belt. When the air mass from here is attracted towards Indian low pressure belt and crosses the Equator then due to coriolis force (Ferrell's law) it turns towards right and blows in North – East direction and reaches Kerala coast. This wind is known as South – West Monsoon which, in fact, is an extension of south – eastern circulating winds. They travel thousands of Kilometers over sea and carry moisture in large quantity. South – West monsoon reaches Kerala coast by 1st June and by mid July through Mumbai and Kolkata covers the whole India (Fig. – 4.1). If any mountain comes on the way of Monsoon wind they rise and get condensed there to give very heavy rainfall. This is the main reason for very heavy rainfall on western slope of the Western Ghats (Sahyadri) and southern slope of the Himalayas. Normally, the windward slope of the mountains receives heavy rainfall but leeward slope of the mountain falls in rain shadow area and receives very less rainfall. The eastern portion of Western Ghats falls in rain shadow area and therefore receives less rainfall.

In November – December, the Sun shines vertically over Tropic of Capricorn. As a result of which a low pressure belt develops here. At this time our country experiences extreme cold conditions which begin to develop high pressure belt.

The areas which the South – West Monsoon vacates, there the North – East monsoon takes its effect. As such the duration of North – East monsoon remains effective from mid November upto mid March. It brings rainfall at some places of Southern Coastal parts of India. At this time, there is a shift in westerly wind belt towards south which creates westerly wind depression

and it brings rainfall in the Northern Plains of India which benefits the Rabbi crop.

As a result, the progress of the South – West Monsoon slowly becomes less. By 1st September it fails to reach Rajasthan Desert and by 15th September it stops near Delhi, Chandigarh and Srinagar. By 1st October it vacates Mumbai, Bhopal and Lucknow. By 10th October it vacates North India and by 15th November it vacates whole India. This is called 'Retreating monsoon'.

NATURE OF MONSOON

Uncertainty is found in the nature of the Monsoon, still following are his

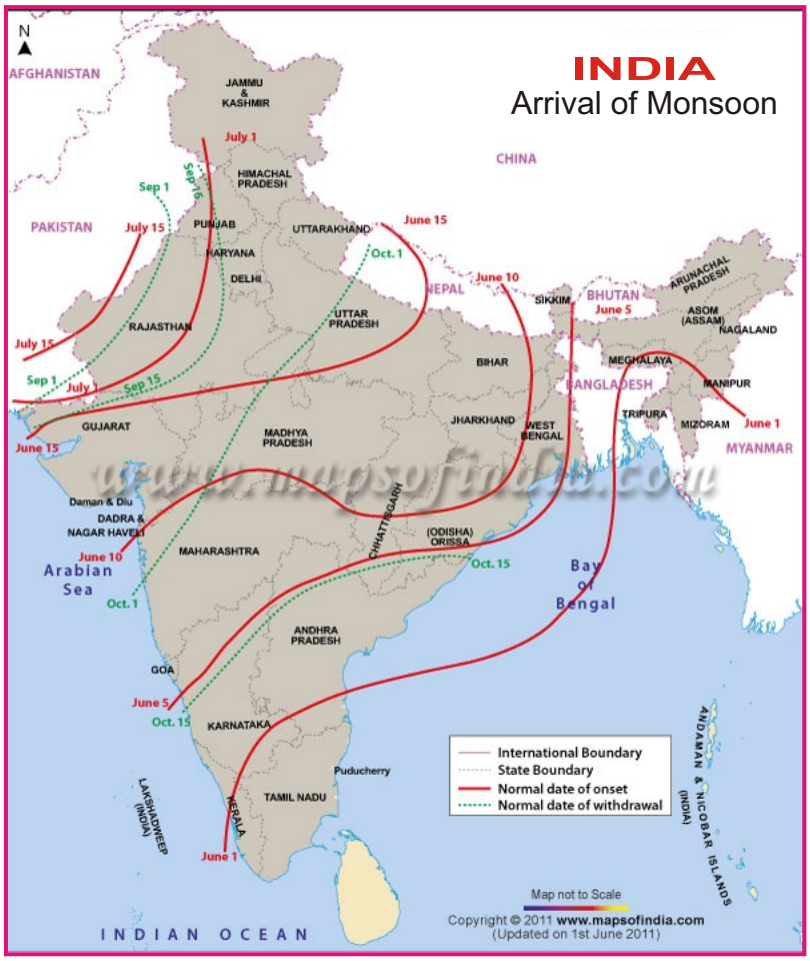

Fig. 4.1 - Expected dates of Arrival of Monsoon

Fig. 4.1 - Average date of retreating Monsoon

normal behavior:

1. The rainfall of the South – West monsoon is seasonal which occurs from June to September.
2. The amount of rainfall decreases as the distance from the Sea increases. In Kolkata 162.5 cm, in Patna 135 cm, in Allahabad 100 cm and in Delhi only 67 cm rainfall occurs.
3. The Monsoon rains are controlled by the Geomorphology.
4. During summer the rainfall is very heavy which increases the water flow and the rate of soil erosion increases. Many areas are affected by the floods.
5. Monsoon has a significant contribution in the agriculture dominated economy of India.
6. The distribution of Monsoon rainfall, in India, is also uneven which on the average ranges from 12 cm to 1180 cm.
7. The arrival of Monsoon at times is earlier and at times it is very late; at times it brings very heavy and at times scanty rainfall. As a result the crops are effected causing disasters like drought and floods.

RAINFALL AND ITS TYPES

India receives both summer and winter rainfall.

THE SUMMER RAINFALL: - In India the summer rainfall occurs through south – west Monsoon winds. Because of the triangular shape of the south India the south – west monsoon progresses ahead after getting divided into two branches. One branch is Arabian Sea branch which brings heavy rainfall on the western coastal parts and western slope of the Western Ghats. The second branch is Bay of Bengal branch. Andaman and Nicobar Islands receive very heavy rainfall through this branch. Moving further the monsoon reaches between Poorvanchal and Meghalaya and turns towards west and

Brings rainfall to the Eastern India and Ganga – Brahmaputra Plains. As it moves towards west, due to continuous rainfall, the amount of moisture keeps on decreasing. As a result the amount of rainfall keeps on decreasing from east to west. In Eastern India it is more than 250 cm (in Mawsynram 1187 cm) whereas in western part of Rajasthan the total rainfall is less than 25cm.

THE WINTER RAINFALL

India has limited area of winter rainfall. The Eastern Coastal parts of India, Tamil Nadu and Kerala receive rainfall through retreating Monsoon and North – East Monsoon. The land breeze while passing through Bay of Bengal gathers moisture and causes this rainfall.

In winter season when the wind belts shift towards south then the western part of India comes under the effect of the westerly wind. This wind entering India from south – west direction brings rainfall in Rajasthan, Punjab, Haryana, Uttar Pradesh and Bihar. This is due to the western Disturbance. This Rainfall keeps on decreasing from west to east.

Whereas the summer rainfall is useful to Kharif crops similarly the winter rainfall is useful to Rabbi Crops.

SEASONS

In India total six seasons are found which is a remote possibility in any other country of the world – they are Basant, Grishm, Versha, Sharad, Hemant and Shishir but from the Geographical point of view and according to Metrological department , In India there are mainly four seasons:

1. Winter Season – From mid November to mid March.
2. Summer Season – From mid March to mid June.
3. Rainy Season – From mid June to mid September and
4. Retreating monsoon season – From mid September to mid November

THE WINTER SEASON

During winter season, the Sun remains in Southern hemisphere, therefore the Northern Hemisphere remains cold. In January the average

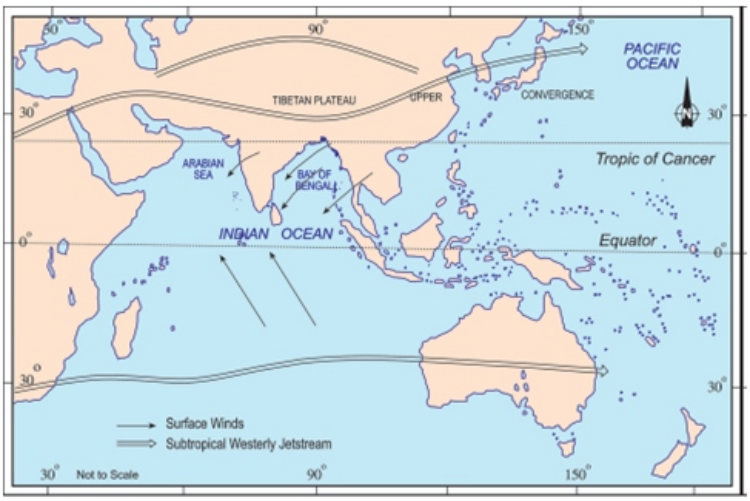

Fig. 4.3 – Atmospheric Condition over Indian Sub – Continent in the month of January.

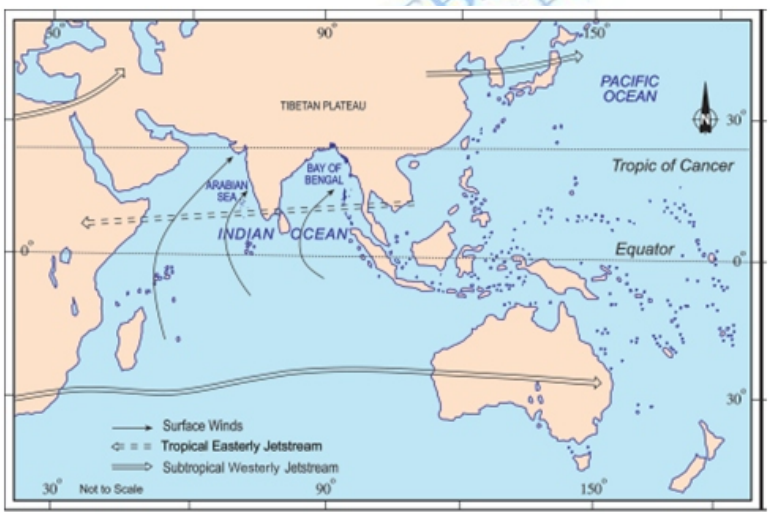

Fig. 4.4 – Atmospheric Condition over Indian Sub – Continent in the month of June.

temperature of South and Central India ranges from 210c to 270c and in the Ganga plains it ranges beetween 12^0 & 18^0 c (Fig. 4.3). At this time the average temperature found at Chennai is 25^0c, Kolkata 20^0c, Patna 17^0c and Delhi 14^0c. The maximum cold remains in North-Western parts and so a high pressure area develops there. At this time the breeze blows from land

towards sea which is dry and does not cause rainfall.

The sky remains clean and due to cloudless sky the thermal radiation is very quick during night and because of this there is fall in temperature. Jammu and Kashmir, Himachal Pradesh and Uttrakhand of Himalayan region experiences snowfall at this time. In this season two areas of India experience rainfall. They are North – Western portion and South – Eastern Coastal parts. North – Western India experiences cyclonic rainfall which reaches India from Eastern Mediterranean Sea through Iraq, Iran and Pakistan from December to March. The total rainfall is only up to 3 to 6 cm but it is highly useful for Rabbi Crops. The North – Eastern dry winds, in January February, pass through the Bay of Bengal and absorb moisture and bring rainfall in the South – Eastern parts (Tamil Nadu) of India. This rainfall is useful for Paddy cultivation in winter season.

THE SUMMER SEASON

As the sun rays begin to become vertical towards north, heat begins to rise in India. By June the Sun becomes vertical over Tropic of Cancer as a result of which extreme hot condition grips India. In South India due to the height of the plateau and nearness from the Sea the temperature remains low but in North India average temperature in the month of May remains more than 38°c. The Day temperature rises up to 40°c (Fig. 4.4).The wind becomes very dry. The sky becomes totally cloudless. The vegetation, Ponds, Wells, etc. all becomes dry. The rivers of South India remains only like a line of water. Generally, the North India remains cooler in winters and hotter in summers in comparison to South India. Thiruvanthapuram has only 2.8°c as annual range of temperature where as Delhi's annual range of temperature rises up to 30°c.

The wind comes from Arabian Sea in the South – Western coast of India which brings rainfall but weather in other parts of the country remains dry. At this time the westerly winds that blow in Northern India are very hot and dry. They are called 'Loo'. During this time dusty storm blows in Bihar and west Bengal. In west Bengal it is called 'Norwester' or 'Kaal Baisakhi'.Generally this wind strikes round about 3 in the afternoon and brings some rains with them. This rainfall is highly useful for the Tea crop of

Assam but it causes huge damage to the Mango crop. As such, this storm is called 'Mango showers' in Karnataka.

THE RAINY SEASON

By the beginning of June the summer heat rises. Most of the animals take shelter under tree to escape from the scorching heat but by mid June there is sudden change in the weather conditions. Stiff wind begins to blow from the South – West direction. The clouds fill the sky and heavy rainfall begins to occur with thunderstorm. This is also known as 'Monsoon Burst'. By first week of July, Monsoon covers the whole country and brings heavy rainfall at number of places. In fact, the South – East trade winds cross the Equator and in accordance with the Ferrel's law they turn towards right and they change into South – West monsoon and strike Kerala coast by 1st June

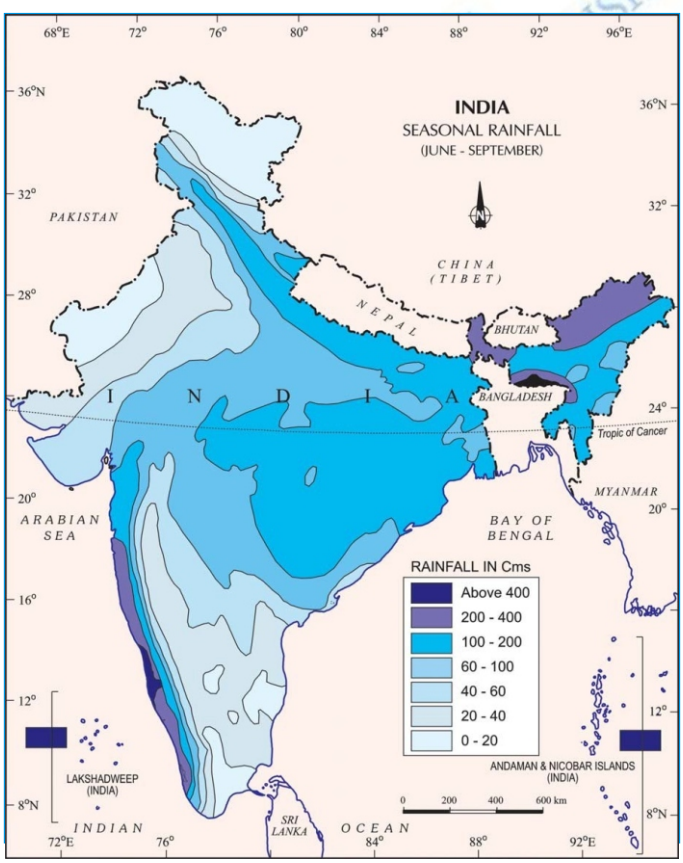

Fig. 4.5 - Seasonal Rainfall (June - September)

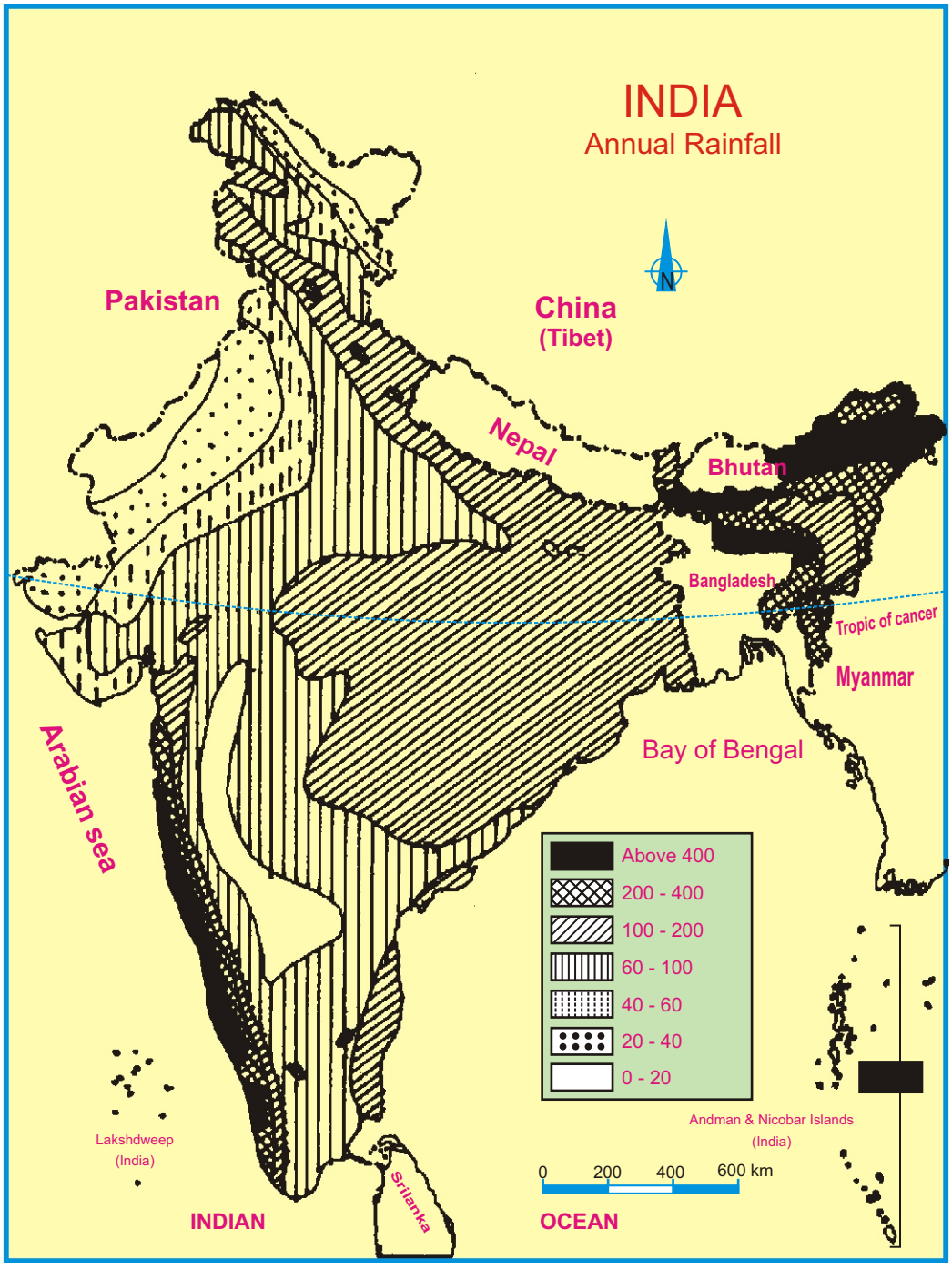

Fig.4.6 – Annual Rainfall

bring rainfall in this area.

Because of the triangular shape of southern peninsula of India the monsoon winds are divided into two branches. One branch is Arabian Sea branch and the other one is Bay of Bengal branch. Rainfall occurs in North India through Bay of Bengal branch and South – West part receives rainfall from Arabian Sea branch. The amount and distribution of rainfall is affected by the Geomorphology and relief of a place. The Arabian Sea branch rises along the slopes of Western Ghats (Sahyadris) and brings very heavy rainfall in the western parts but as they cross over the Mountain, on the leeward side, the rainfall is less because winds, while climbing down, becomes warm and their moisture retaining capacity increases.

The Bay of Bengal Monsoon branch, while advancing towards North, strikes with the Poovanchal and Garo, Khasi and Jaiantia Mountains after reaching Assam – Meghalaya and brings very heavy rainfall in Meghalaya and Assam Valley.

These winds start advancing towards low pressure belt of North-West India and as they advance towards west the amount of rainfall begins to become less. From June to September in Kolkata 118 cm, in Patna 100 cm, in Allahabad 90cm and in Delhi 55cm of rainfall is recorded. As we move away from Himalayas towards south the amount of rainfall begins to become less. In Nainital 202 CM, Bareilly 90 CM and Agra 58 CM of rainfall is received. The maximum rainfall occurs in Assam and Meghalaya Hills. Here in Cherrapunji and Mawsynram, from June to September 823cm (Fig. 4.5) rainfall is received whereas the annual rainfall is 1187cm (Fig. 4.6). The winds of Bay of Bengal branch completely dry out before reaching low pressure belt of North – West. The Arabian Sea branch after reaching there, begins to advance further moving parallel to the Aravallis and so in both the cases this area remains dry. This is the reason why the western part of Rajasthan has become a desert. In India 85 percent of the rainfall occurs through South – West monsoon (Fig.4.5). The farmers sow seeds in their fields expecting good rainfall but at times due to uncertainty of the Monsoons their crops get damaged and at times very good crop is received. Therefore, it is said that “Indian Agriculture is gambling with Monsoon’.

During rainy season the temperature remains little lower than the dry summer season. After first rainfall the temperature becomes low. In Patna, the average temperature in May is 35°c, in June 32°c and in July temperature comes down to 30°c. The dry vegetation becomes green during rainy season. Widespread greenery can be seen everywhere. Rivers, Ponds get filled up with water and farmers began their agriculture work.

RETREATING MONSOON SEASON

In the end of September with the apparent movement of the Sun towards south, the low pressure trough over the North West parts ends and it shifts towards south. As a result the South West monsoon weakens. In September Monsoon withdraws from Rajasthan, Gujrat, west Gangetic plains and central India. In October it is located at North of Bay of Bengal. By November it advances only up to Tamil Nadu and Karnataka and by mid November the monsoon totally withdraws from whole India. This is called the retreat of the Monsoon. At this time there is fall in temperature in India. Because the wind blows from the land the weather becomes dry, but at this time on the coastal areas of peninsular India good amount of rainfall is received through North East monsoon.

EFFECT ON HUMAN LIFE

Monsoon is synonym to Indian climate. Form North to South and from East to West, the Indian farmers await eagerly for the arrival of the Monsoon. It affects the economy system of the country. The regional diversity of Monsoon Climate helps in the cultivation of different crops. The arrival of Monsoon on time or its late arrival or its early departure or its absence for longer period of time etc. affects the life of the people of whole India. The distribution of Monsoon rainfall has been affecting the food habits, clothing and habitat of the people of India. The devastating floods and drought brought by Monsoon affect lakhs of people every year. The fast current caused by rains of Monsoon has given birth to the problem of soil erosion. The Mountainous regions are affected by landslides due to heavy rain. Thus, it can be said that Indian Monsoon Climate is gift on one hand and curse on the other.

EXERCISE QUESTIONS

1. Objective Questions

(i) What is the reason of rainfall in winter in the coastal areas of Tamil Nadu?

(a) South – West Monsoon
(b) North – East Monsoon
(c) Temperate Cyclones
(d) Local wind flow

(ii) Which fact is wrong in reference to South India?

(a) Daily range of temperature is less.
(b) Annual range of temperature is less.
(c) Range of temperature remains high for whole year.
(d) Extreme climate is found.

(iii) When the Sun shines vertically over the Tropic of Cancer, then what is its effect?

(a) High pressure exists in North – West India.
(b) Low pressure exists in North – West India.
(c) No change occurs in temperature and air pressure in North – West India.
(d) Monsoon begins to retreat from North – West India.

(iv) In which place of the World maximum rainfall occurs?

(a) Silchar
(b) Cherrapunjee
(c) Mawsynram
(d) Guwahati

(v) What name is given to dusty storm blowing in west Bengal in the month of May?

(a) Loo
(b) Trade wind
(c) Kaal Baisakhi
(d) None of these

(vi) When does the South – West Monsoon arrive in India?

(a) 1st May
(b) 1st June
(c) 1st July
(d) 1st August

(vii) Which is the coolest place in winter?
- (a) Gulmarg
- (b) Pahalgam
- (c) Khilanmarg
- (d) Jammu

(viii) What is the reason of winter rainfall in north – West India?
- (a) North – East Monsoon
- (b) South – West Monsoon
- (c) Western Disturbance
- (d) Tropical cyclone

(ix) Which local storm of summer season is useful for Coffee cultivation?
- (a) Mango shower
- (b) Shower of Flowers
- (c) Kaal Baisakhi
- (d) Loo

2. Fill in the blanks selecting right word from the bracket?

(A) The temperature of Chennai is ..... from Kolkata. (Less/More)

(B) The rainfall in North India is..... towards west in comparison to East. (More/Less)

(C) The word Monsoon was at first used by..... sailors. (Arab/Indian)

(D) Western part of Western Ghats receives..... rainfall.(Less/More)

(E) ..... side of Mountain is called rain shadow area.(Windward/Leeward)

3. Give Geographical reasons of the following –

(A) Western Rajasthan is a desert.

(B) In Tamil Nadu rainfall occurs in winter.

(C) Indian agriculture is a gamble with Monsoon.

(D) Mawsynram receives highest rainfall in the world.

(E) The temperature in Ooty remains low throughout the year.

SHORT ANSWER QUESTIONS

4. Answer Following questions.

(a) In what places of India does winter rainfall occur?

(b) What is Ferrel's law?

(c) What is Jet stream?

(d) Mention three important specialties of Indian monsoon.

(e) What do you understand by 'Loo'?

(f) What is Monsoon burst?

(g) Name the hottest and coldest areas of India?

5. LONG ANSWER QUESTIONS

(a) Explain regional diversity of Monsoon climate of India with examples?

(b) How many seasons are found in India? Give Geographical description of any one of them?

(c) Explain the important factors of Indian Climate?

(d) What is jet Stream and what is its effect on Indian climate?

(e) Explain the Monsoon rainfall and its specialties in India?

(f) Differentiate between El Nino and La Nina?

6. MAP WORK

(a) Area of more than 400 cm rainfall.

(b) Area of less than 20 cm rainfall.

(c) Direction of South – West monsoon in India.

(d) Areas of winter rainfall.

(e) Cherrapunjee, Mawsynram, Jodhpur, Mangalore, Ooty, Nainital.

7. PROJECT WORK

Construct a Table and make an index of song and dance, important items and ingredients of food according to the climate and season.