**Climate of Pakistan**

**Weather**

Weather refers to the atmospheric conditions (Temperature, Rainfall, Humidity, Air Pressure, Speed of winds, Direction of winds) of any place for a short period of time, usually consist of one day. It is often localized.

**Climate**

Climate refers to the average weather conditions (Temperature, Rainfall, Humidity, Air Pressure, Speed of winds, Direction of winds) of a place for long period of time usually consist of 30 years.

**Climatic Zones**

Pakistan’s topographical features range from lofty mountains in the North to coastal plains in the South. The diversity of terrain leads to a variety of climates. Climatic divisions / regions of Pakistan are the following.

A. Highland climate  
B. Lowland climate  
C. Coastal climate  
D. Arid climate

Fig.1 shows the climatic regions / zones of Pakistan.
A. **Highland climate**

Zone A indicates highland climate of Pakistan prevailing over Northern, North-Western and Western mountains.

B. **Lowland climate**

Zone B has lowland climate, which prevail over the whole of the Indus Plain.

C. **Coastal climate**

Zone C has Coastal climate experienced by the Makran Coast and Sindh Coast.

D. **Arid climate**

Zone D has arid climate and includes the South-eastern desert and the South-western part of Balochistan.

**Season**

Pakistan has four seasons that can be distinguished as follows.

- **Winter** December to March.
- **Summer** Early summer (April to June), Late summer (July to September).
- **Post Monsoon** October to November.

**Elements of Climate**

There are four main climatic elements like, **Air Pressure**, **Winds**, **Temperature** and **Rainfall**. These are responsible for the regional and seasonal variations in the climate of Pakistan.

1. **Air Pressure**

As air is a mixture of gases and these gases have a certain weight, the air has weight too. The weight of air presses down on the earth and this is called the atmospheric pressure. It is measured by Barometer in millibar (mb). Air pressure and temperature run opposite side.

2. **Winds**

A current of air, moving with sped in any direction, but generally assumed to be parallel to the earth’s surface. The speed of wind is measured by an instrument called an Anemometer. For wind direction a wind rose is used. Winds always blow from high pressure to low pressure, it’s a natural principle.

During **summer season**, the temperature in central Pakistan is high. This causes the hot air to rise up and form a low-pressure zone. At the same time oceans and seas have comparatively low temperature. This is because water absorbs and discharges heat slowly as compared to the land. The air pressure over the oceans and seas is higher than over the land during summer. This leads to the movement of winds from sea to land called **Sea Breeze**. These are moisture laden and bring heavy rainfall to the upper and lower Indus Plain in the months of **July** and **August**.
During **winter season** the whole situation is reversed because the pressure over the land gradually increases and a high-pressure area is created in the north-west of Pakistan. Then winds move from land to sea called **Land Breeze**. These are generally light and dry.

**Photograph of Winds.**

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**3. Temperature**

The degree of heat of a body, usually expressed in degrees on the Centigrade or the Fahrenheit scale and measured by Thermometer. Temperature decreases in general from the equator towards the poles and temperature decreases with altitude.

**Diversity (of temperature in various regions is due to the following factors).**

1. Large spread of latitudes from 24 N to 37 N.
2. Diversity of relief ranging from the very high mountains in the north to low lying coastal areas in the south.
3. The upper and lower Indus Plain heat up during the summer season e.g. Jacobabad, located in the lower Indus Plain is known as the ‘thermal pole’ of the sub-continent the maximum temperature reaches 53 C in June.

**Temperature Key**

1. 40 C and above Very hot
2. 31 C – 39 C Hot
3. 21 C – 30 C Warm
4. 10 C – 20 C Mild
5. 03 C – 09 C Cool
6. - 5 C – 02 C Cold
7. Below - 5 C Very cold
**Factors** (Affecting Temperature of Pakistan)

1. Latitudinal Effect.
2. Continental Effect.
3. Altitude and Temperature.
4. Cloud cover and Temperature.
5. Latitude and the angle of the Sun.

Study Fig. 2, shows the average January temperature for Pakistan.

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**Q.1.** Describe the distribution of the area with an average January temperature below 10°C.

**Ans.** Whole Northern Areas. North Western areas. Western mountains. Western NWFP and Northern western Baluchistan is included.

**Q.2.** Explain the distribution of the area with an average January temperature below 10°C.

**Ans.** Higher in altitude (above sea level). Mountainous areas. Temperature remains below zero C. Precipitation in the form of snow.

**Q.3.** Describe the distribution of the area with an average January temperature above 15°C.

**Ans.** Lower Indus Plain. Southern Balochistan.
Q.4. Explain fully the distribution of the area with an average January temperature above 15°C.
Ans. Close to Tropic of Cancer.
Effect of sea.
Effect of mountains due to nearer of Balochistan / desert.
Sindh is low land, so temperature is not affected by altitude.

Study Fig. 3, shows the mean monthly temperature of Lahore and Quetta.

Q.5. Compare the mean monthly temperatures of Lahore and Quetta.
Ans. Both graph have a similar range / both 20 – 22.
Lahore warmer and Quetta colder.
Lahore sharp drop after June and Quetta smooth curve.
Lahore increases then decreases and Quetta slight drop May to July.

Q.6. Explain the seasonal changes in temperature at Lahore.
Ans. Effect of latitude / angle of the suns rays.
Rising in dry season / lack of cloud cover before monsoon.
Drop in July related to start of monsoon season / heavy rainfall.

Study Fig. 4, which shows the desert climate of Nok Kundi.
Q.7. Describe the yearly distribution of temperature in a desert climate.

Ans. Increases January to July and Decreases July to December. 
Rises to maximum in June and July. 
Falls to minimum in December / January. 
Hot summers and mild / cool winters.

4. Rainfall

Separate water drops which fall to the earth from the clouds, formed by the condensation of water vapour in the atmosphere called rain.

Most of the areas of Pakistan are arid or semi-arid. Only in a few northern areas humid conditions are found. The rainfall as a whole decreases from north to south.

Arid

Are those where there is a deficiency of rainfall, which is less than 250 millimeters. The arid areas like whole of Sindh, Southern part of Punjab and southern part of Balochistan.

Semi-Arid

Are those where there is a moderate rainfall, that ranges between 250 – 750 millimeters. The semi arid areas like, Northern Balochistan, Northern Punjab and major part of NWFP.

Humid

Are those where there is sufficient rainfall, which is more then 750 milliters. The humid areas are Northern strip of Punjab, the adjoining parts NWFP and a small area around Parachinar.

Sources of Rain

1. Monsoon Winds
2. The Western Depressions
3. Convectional currents / Thunder Storm
4. Relief Rainfall
5. Cyclone

Monsoon (July to September)

The word monsoon is derived from the Arabic word ‘Mousim’ mean season, it means these are seasonal winds, which blow during summer and winter.

Pakistan receives the tail end of the monsoon winds which enter the country after crossing India. They usually reach Pakistan in early July and sometimes continue to early September. Most of rainfall which takes places by this source. These winds come from east side ‘Bay of Bengal’ and heavy rain occur in northern areas of Pakistan e.g. Murree. So the amount of rain decreases towards south and because most the of moisture is robbed due long journey. This system is called Primary Monsoon System.

When monsoon winds come from ‘Arabian Sea’ and heavy rain occur in Karachi and its adjacent areas by this source then this system is called Secondary Monsoon System.
Factors (For the Development of Rain by Monsoon)

1. Strong heating of land.
2. Low pressure created.
3. Rising air (warm).
4. Space created / gap.
5. High pressure created over Bay of Bengal / Arabian Sea.
6. Winds blow from high pressure to low pressure and bring moisture.
7. Condensation takes place.
8. Clouds form at higher altitude
9. Rain occur.

Study the map Fig.5, which shows the main monsoon wind and the rainfall distribution from July to September.

Fig.5

Q.1. Describe the rainfall distribution shown in Fig.5.
Ans. Lowest / less than 25 mm in West Balochistan and extreme NW.
Large areas / Lower Indus Plain less than 125 mm.
Most of Balochistan less than 125 mm.
Decreasing towards NW and SW / increasing towards SE and NE.
Highest in NE Punjab / Murree area / over 500 mm.

Q.2. Describe the route of the main monsoon across Pakistan.
Ans. East to West / from NE / from East.
From Bay of Bengal / Northern India.
Towards the Northern areas / Mountains.
Across Punjab / upper Indus Plain.
Q.3. Explain why there are differences in amounts of rainfall caused by the monsoon in different areas of Pakistan.

Ans. Depends on moisture content / humidity. Pakistan receives tail end of the monsoon. More rain as it rises over hills. Rain shadow effect on lee slopes. Climate change with reason e.g. global warming, ozone layer. Condensation / clouds caused by cooling of rising air.

Q.4. Explain why the monsoon wind that is shown develops.

Ans. 1. Strong heating of land.
2. Low pressure created.
3. Rising air (warm).
4. Space created / gap.
5. High pressure created over Bay of Bengal / Arabian Sea.
6. Winds blow from high pressure to low pressure and bring moisture.
7. Condensation takes place.
8. Clouds form at higher altitude
9. Rain occur.

Q.5. Explain how the rainfall caused by the monsoon winds.

Ans. Winds from N India forced to rise by mountains. Winds from Arabian Sea / Secondaries rise over SE Sindh Wind has lost moisture over India and Bangladesh / tail end, so less rain in Pakistan than India. Balochistan remote from monsoon winds so less rain. High mountains in NE increase rainfall. Plains have less rain than mountains.

Study Fig.6, a bar chart showing precipitation for Peshawar.
Q.6. Describe the precipitation in the months from June to September.
Ans. Increases June – August.
    Decreases in September.
    Maximum in August 68 mm.
    Minimum in June 8 mm.
    Ranges from 8 mm to 68 mm.

Q.7. Explain how this precipitation is caused by the monsoon winds in these months.
Ans. Low pressure over Himalayas.
    High pressure over the Bay of Bengal.
    Moist winds (from the E / SE).
    Air rises.
    Cools.
    Vapour condenses.
    Droplets form.

Study Fig.7, rainfall charts for Chitral and Lahore.

![Chitral Rainfall Chart](image1)

![Lahore Rainfall Chart](image2)

Fig.7
Q.8. Compare the amounts of rainfall for Chitral and Lahore.

A. From January to May
B. From June to September.

Ans. 

CHITRAL

Higher in C than L.
High range 35 – 106 mms / 71 mms
Lowest in January
Highest in March
Increases then decreases Jan – May
Same pattern at both places.

LAHORE

Lower in L than C.
Low range 23 – 41 / 18 mms.
Lowest in April.
Highest in March
Increases then decreases Jan – May.

B. June to September.

CHITRAL

Lower in C than L.
Low range 5 – 9 mms / 4 mms
Highest in September
Rises June – September

LAHORE

Higher in L than C.
High range 62 – 205 mms.
Highest in July.
Decreases July – September.

The map Fig.8 shows the locations of two weather stations and their records of rainfall and mean monthly temperature.
Q.9. Compare the amount and seasonal distribution of rainfall at Quetta and Lahore.

Ans. QUETTA
Winter Maximum
Max December to March
Lower total than L
No rain in June and September
Highest in February
Equal rain in March and November at both stations.

LAHORE
Summer Maximum.
Max July to August.
Higher total than Q.
Rain in all months.
Highest in July.

Q.10. Give reasons for the differences in amount and seasonal distribution of rainfall at these locations.

Ans. QUETTA
More rain from western depression.
Summer convectional rainfall.
No / negligible monsoon rainfall.

LAHORE
Less rain from western depression.
Little convectional rainfall.
Monsoon winds this should include both the SE and NW monsoon.
Monsoon brings more rain than depressions.

Q.11. What are the benefits and problems for farmers in the area of Lahore which result from the rainfall?

Ans. Benefits
Some rain in all months / throughout year.
Enough without irrigation / for barani farming.
Monsoon rain for Kharif crops.
Depression and convectional for Rabi crops.

Problems
Uneven distribution.
Too much in July – August / too little in October / November.
Flooding in wet season.
Lack of sunshine for ripening crops.
High evapo-transpiration in April – June.
Heavy rain damages cereals, cotton.
Pests, Diseases, virus in wet season.
Heavy rain ineffective / does not soak in.

Q.12. Chose one of the problems from (Q.11) and explain how it can be reduced.

Ans. Uneven distribution / too little in some months
Storage in reservoirs, ponds, tanks, barrages.
Canals from storage in mountains.
Use of underground supplies in dry season, tubewells.

Flooding / too much in some months
Storage of water in dams, barrages.
Strengthen the river embankments / levees.
Planting trees.
Weather forecasts.
Study Fig.9, which shows the desert climate of Nok Kundi.

**Q.13.** With reference to Fig.9, describe the yearly distribution of rainfall in a desert climate.

**Ans.**
- Wetter in winter than summer.
- Decreases January to May.
- Increases in December.
- Variable May to November.

**Q.14.** Heavy rain and thunderstorms affect Business and Industry in urban areas. Explain the advantages and disadvantages of the rain and storms.

**Ans.**

**Advantages**
- Water supply.
- Reservoirs filled for HEP / power supply.

**Disadvantages**
- Floods.
- High winds.
- Erosion of land.
- Loss of water supply.
- Damage and blockage of roads.
- Damage to buildings, trees.
- Effect on roads / railways / runways.
- Loss of production, Business.
- Loss of raw material e.g. cotton, sugar cane.
- Disruption of fishing / trade.
- No flights for businessmen.

**Q.15.** Explain the importance (benefits and problems) of the arrival of the monsoon to people who live and work in urban areas.

**Ans.**

**Benefits**
- Cooler – better working and living conditions / pleasant climate.
- Fresher – less dust, cleaner air, no pollution.
- Water supply – for drinking, factories, market gardens, buffalo.

**Problems**
- Flooding.
- People cannot get to work.
- Loss of production.

**Early Arrival Monsoon** (Rain from April to June).

**Late Arrival Monsoon** (Rain from July to September).

**Post Monsoon.** (Rain from October to November).
**The Western Depression** (December to March)

The western depression originates in the Mediterranean Sea, travel across Afghanistan then reach the western areas of Pakistan. **Quetta** receives most of its rainfall during the winter season.

**Factors** (For the Development of Rain by Western Depression)

1. Temperature increases in winter season.
2. Comparative low pressure beyond the Mediterranean Sea.
3. Come from Mediterranean Sea.
4. Enter Pakistan through Afghanistan.
5. Bring moisture.
6. Condensation takes place.
7. Clouds form on higher altitude
8. Rain occur.
Q.1. What are the advantages and disadvantages of winter rainfall in Northern Pakistan.

Ans. **Advantages**

- Fills reservoirs / rivers / more storage.
- Water for irrigation.
- Water for HEP.
- Water for barani crops.
- Water for winter crops / fruit trees.
- Lighter form of rain – can soak in.
- Snow for tourism.

**Disadvantages**

- May fall as snow.
- Rivers / lakes frozen.
- Temperature too cold for growth.
- Damage to environment – landslides, mudslides, floods etc.
- Damage to roads – blockage, slippery etc.
- Silt collects in reservoirs / dams.
- Difficulties meaning farmers must do transhumance / nomadism.
Convectional Currents / (April – June and Oct - Nov)

At the start of summer, hot air rises up which also contains a high moisture content. When it reaches the higher layers of the atmosphere, condensation takes place. This causes rainfall, often as thunderstorms. Strong winds accompanying the storms may pick up dust as well.

Only the northern and north-western areas of Pakistan receives rainfall from this source. Southern Pakistan is deprived of convectional rainfall due to a temperature inversion layer. Temperature Inversion Layer (On clear winter nights the temperature increases with the altitude) does not allow condensation to take place at the height of 1600 m due Criss-Cross system of winds. As a result warm air descends and no rainfall occurs. That is why Karachi and adjoining areas do not receive rainfall by this source.

Factors (For the Development of Rain by Convection currents / Thunderstorm)

1. Strong heating of land.
2. Low pressure created.
3. Rising air (warm).
4. Space created / gap.
5. Winds blow from high pressure to low pressure.
6. Moisture evaporated from rivers / lakes.
7. Air cooled as it rises.
8. Condensation takes place.
9. Clouds (Cumulonimbus) form at higher altitude.
10. Strong winds blow.
11. Lightning and thundering.
12. Rain occur.

Fig.10, shows the Criss-Cross system of winds.
Relief Rainfall / Orographic

Relief rainfall is related to the height of land. It occurs where moist unstable air moves up a mountain or scarp edge and it is chilled. This chilling causes heavy condensation and precipitation, on the windward side. The leeward slopes tend to receive sinking, warming air and a dry ‘rain shadow’ are may lie leeward of the barrier.
**Tropical Cyclone**

When the wind is spirally moving in towards the low pressure called **cyclone**.

A tropical cyclone is a severe storm which takes place largely in South Asia, South East Asia, Northern Australia, South America and the South-Eastern part of North America. In South Asia, it is referred to as the **Cyclone**, in South-East Asia as the **Typhoon**, in Australia as the **Willy-Willy** and in America as the **Hurricane**.

**Cyclones in Pakistan**

In Pakistan, cyclones originate in the Arabian Sea, gradually moving towards the land. Very often, they die out before reaching the coast. Sometimes they attack the coast and cause damage with violent winds, high ocean waves and cyclone surge.

Tropical cyclones occur either in the Pre-monsoon season from **May to June** or in the Post-Monsoon season in **September** and **October**. The life of a tropical cyclone is **seven to ten** days. In **90s** Pakistan has been struck by tropical cyclones.

**Natural / Physical Conditions** (Occurring of cyclone)

1. Low pressure created in Sea / Ocean.
2. High winds blow.
3. High waves produced.
4. Heavy rainfall.
5. Floods.
6. Thunderstorm / Thundering / Lightening.
7. Damage.

**Photograph of Cyclone.**

![Photograph of Cyclone](Image)

**Photograph of cyclone**
Photograph of Cyclone (Waves).

Q.1. What effects do these storms have on the economy and lives of the people who live in the coastal area?

Ans. Strong / violent winds
     Floods ...... 
Q.2. Which area is affected by tropical cyclones?
Ans. Sindh coast, (Indus delta).
     Balochistan coast, (Makran coast).

Q.3. Describe the physical effects of tropical cyclones in this area.
Ans. High winds blow.
     High waves produced.
     Heavy / high rain occur.
     Floods.
     Thunderstorms / thunder / lightening.
     Damage.
**Storm**
A very bad weather with strong wind, precipitation and sometimes with lighting and thundering.

**Dust Storm**
A storm in which dense masses of dust are carried by the winds.

Dust storms are most common in **Sindh**, particularly in the **desert** areas. Dust storms are usually experienced in **summer** season in May and June. In the absence of moisture, dust is whipped up to form dust storm. Dust is created by intense heating of desert. Areas where an intense low pressure develops temporarily. This low pressure attract winds from nearby region. These strong winds pickup dust, sand and dust storm is created. About 15 to 20 dust storms take place every year.

**Photograph of Dust Storm.**

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**Flood**
The excessive water in rivers which over flow the banks or not called flood.

**Flash Flood**
Sudden flood which disappears quickly called flash flood.

**Causes of Flood**
There are two causes of flood which are as follows.

1. **Natural**
   i. Melting of snow.
   ii. Heavy rain by monsoon.

2. **Human**
   i. Cutting of the trees on the foothills increases surface run-off.
   ii. Weak embankment.
   iii. less storing capacity (water) of dams.
Advantages of Flood

1. Floods return nutrients to the land.
2. Floods refresh the streams.
3. Floods spread a layer of alluvium which increases the fertility of the land.
4. Store maximum water in dams.
5. Rise water level.
6. Promotes inland fishing industry.

Effects of Flood / Problems

1. Destruction of crops.
2. Loss of food supply.
3. Mud houses and huts could be severely damaged.
4. Danger of diseases.
5. Interrupt communication / roads / railway.
6. Kill livestock.
7. Little / no supply of raw material to industries.
8. Destroy bridges.
9. Interrupts services / utilities / electricity supplies.

Measures (To reduce the flood risk)

1. Planting trees on the foothills to check the flow of running water.
2. Enlarging the river channel so that it can be hold more water.
3. Building embankments on either side of the river to prevent the spread of water.
4. Building reservoirs on the river to store water and control peak discharge.
5. Preventing building in areas where flooding is most likely.
7. Providing necessary facilities for rehabilitation in flooded areas.
**Drought**

Extreme dryness due to lack of rain. It is almost found in deserts areas like Cholistan and Tharparkar.

**Causes of Drought**

There are two factors which causes the drought in Pakistan.

1. **Natural Factors**
2. **Human Factors**

1. **Natural Factors**
   1. Unreliability of monsoon.
   2. Dry and hot dusty winds can reduce the moisture content.

2. **Human Factors**
   1. Deforestation.
   2. Unfair distribution of water between Punjab and Sindh Province.
   3. Over grazing of land by goat and sheep.

Fig.12, shows the areas affected by Drought.

![Drought Map](image_url)
Effects of Drought on the Physical Environment

Desertification: The processes of turning the land into a desert. Exposed soil leading to soil erosion, dust storms. Extension of desert areas, rise in temperature, Loss of vegetation.

Drying up of Rivers, Lakes and Streams: Harm to fisheries and other aquatic life, growth of Algae in shallow water bodies, unsafe drinking Water.

Drop in water table: Less water available to plants and humans from ground sources.

Effects of Drought on the Human Environment

Population: Widespread famine, Migration from affected areas, Health problem, Loss of lives, Break-up of rural social Set-up, Nomadic life.

Economy: Crop failure, Death of livestock, Shortage of raw material to industries, reduced exports and increased imports.

Strategies to reduce negative impacts of Drought

1. People are settled in temporary refugee camps specially sick.
2. Supplied of food by charities and international relief agencies.
3. Water storage schemes (construction of Dams and tanks) Irrigation canals to grow crops, planting of trees.
4. Use of new technology (Desalination of sea water, Reclaiming waste water and turning into clean water, using drought resistant varieties of crops).
5. Lining the canals.