Types and Status of Rainfall Distribution in India

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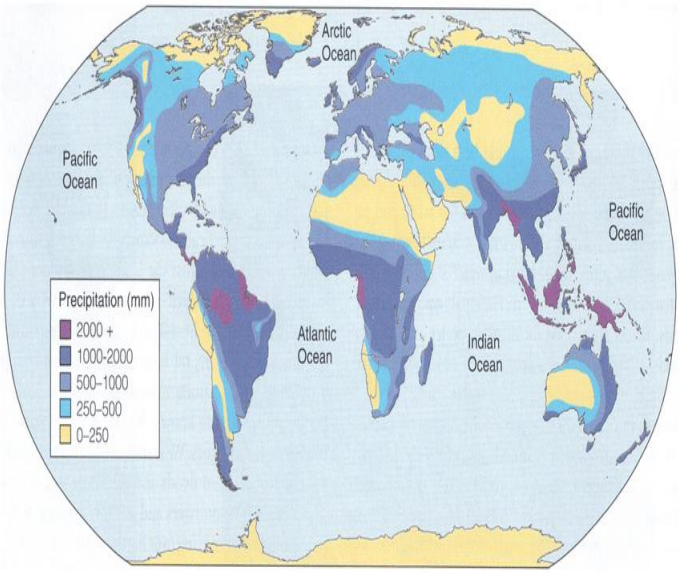
Precipitation is the process where the local air becomes saturated with water vapour and it starts to pour, as it no longer can maintain the water vapour in the gaseous form. There are various types of precipitation – liquid, freezing and frozen.

Liquid: Precipitation comes down to the earth in the form of liquid it is called as liquid precipitation

Freezing: Freezing rain occurs when the layer of freezing air is so thin that the raindrops do not have enough time to freeze before reaching the ground.

Frozen: The form of precipitation that reaches the ground in frozen form. Example: snow, snow pellets, snow grains, ice crystals, ice pellets, and hail.



The rainfall distribution in India is impacted by the Thar desert and the Himalayas. Temperature and pressure changes over the Indian ocean, the Arabian sea, the Bay of Bengal and the southern part of the Pacific Ocean which play a significant role in the intensity and distribution of monsoon rains over the country.

Precipitation in India is irregular over the course of a year, with a well-defined rainy season. South west monsoon over most part of the country starts from June and ends in September; North east monsoon starts from October and ends in December and Pre-monsoon rains starts from march and ends in May. The average annual rainfall in India is 118 cm according to India Meteorological Department.

Precipitation regions in India

The India is divided in to 5 different regions based on their amount of rain fall distribution

- **Extreme Precipitation regions:** North eastern regions and the windward side of the western ghats recives 400 cm of annual rainfall. The states like Assam, Meghalaya, Arunachal Pradesh and hilly tracts of the western ghats are host to tropical rainforests. The highest rainfall in India and the world is recorded at Mawsynram village of Meghalaya.
- **Heavy Precipitation regions:** The regions experiencing 200-300 cm rainfall belong to this zone. Most of eastern India is covered under this zone. These regions are also home to tropical rainforests. States such as West Bengal, Tripura, Nagaland, Manipur, Odisha and Bihar are included in this zone. Most of the areas in the sub-Himalayan belt also fall under this zone.
- **Moderate Precipitation regions:** Areas which experience 100 to 200 cm of rainfall include parts of West Bengal, Bihar, Odisha, Madhya Pradesh, Andhra Pradesh and the leeward side of the Western Ghats. Wet Deciduous forests comprise the most common natural vegetation of these regions.
- **Scanty Precipitation regions:** Areas having 50 to 100 cm of rainfall consisting of parts of Maharashtra, Gujarat, Karnataka, Tamil Nadu,

Andhra Pradesh, Madhya Pradesh, Punjab, Haryana and Western Uttar Pradesh. Tropical grasslands, savannah and dry deciduous forests are commonly found in these areas.

- **Desert and Semi-desert Regions**: These are the areas that receive below 50 cm of rainfall. The states of Rajasthan, Gujarat and adjacent areas are classified as desert or semi-desert based on the amount of rainfall they receive. Some parts of Jammu & Kashmir such as the Ladakh plateau are also included in this zone as cold deserts. The vegetation consists of hardy species which can withstand extended droughts. Some areas like parts of Gujarat have savannah vegetation in the wetter regions. The lowest rainfall in India has been recorded in Ruyli village, Rajasthan.

Factors affecting rainfall distribution

Factors controlling the distribution of rainfall over the earth's surface are the belts of converging-ascending air flow (see doldrums; polar front), air temperature, moisture-bearing winds, ocean currents, distance of inland from the coast and mountain ranges. Ascending air is cooled by expansion, which results in the formation of clouds and the production of rain. Conversely, in the broad belts of descending air (see horse latitudes) are found the great desert regions of the earth, descending air being warmed by compression and consequently absorbs moisture instead of releasing moisture. If the temperature is low, the air has a small moisture capacity and is able to produce little precipitation. When wind blows over the ocean, especially over areas of warm water (where evaporation of moisture into the air is active) towards a given coastal area, that area receives more rainfall than a similar area where the winds blow from the interior toward the oceans. Areas near the sea receive more rain than inland regions, since the wind constantly lose moisture and may be quite dry by the time they reach the interior of a continent.

Various Types of Rainfall

Rainfall has been classified into three main types based on their origin

- Convectional rainfall
- Orographic or relief rainfall
- Cyclonic or frontal rainfall

Major Characteristics of Convectional Rainfall –

The air on getting heated becomes light and rises in convection currents.

- As the air rises, it expands and drops the temperature and subsequently, condensation takes place and cumulus clouds are formed.
- Heavy rainfall with lightning and thunder takes place which does not last long.
- Such rain is usually occurs in the summer or the hotter part of the day.
- This type of rainfall generally takes place in the equatorial regions and internal parts of the continents, predominantly in the northern hemisphere.
- This rainfall is usually associated with hail and graupel.

Major Characteristics of Orographic Rainfall

- When the saturated air mass come across a mountain, it is forced to rise.
- The rising air expands, eventually the temperature falls and the moisture gets condensed.
- The principal characteristic of this type of rain is that the windward slopes get more rainfall.
- After giving rain on the windward side when these wind reach the other slope, they drop

away, and their temperature increases. Then their ability to obsorb moisture increases and hence, these leeward slopes remain dry and rainless.

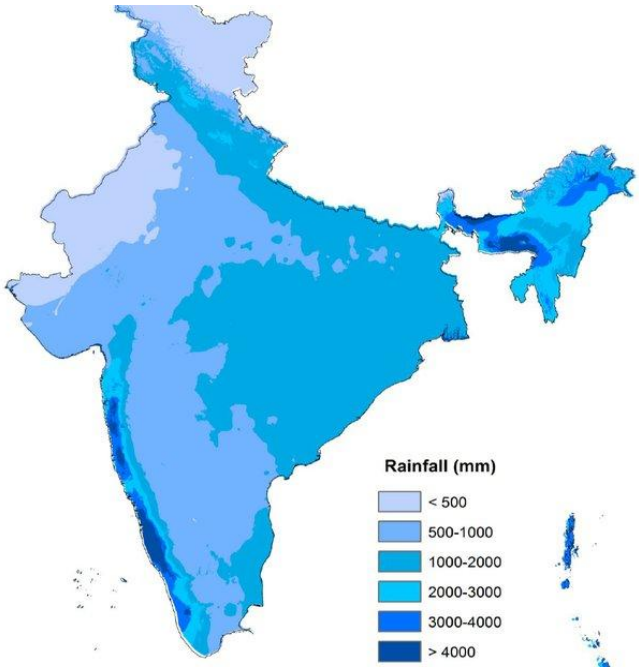
- The region situated on the leeward side is known as the rain-shadow area.
- The windward slopes of mountain ranges generally receive heavy rainfall; the leeward slopes receive almost no rain.

Major Characteristics of Cyclonic Rainfall

- Cyclonic activity causes cyclonic rains and it occurs along the fronts of the cyclone.
- When two air masses of different density, temperature, and humidity meets then cyclones are formed.
- The layer that separates them is known as the fronts of the cyclone.
- A warm front and the cold front are the two parts of the cyclone.
- At the warm front the warm lighter wind increases slightly over the heavier cold air.
- As the warm air rises, it cools and the moisture present in it condenses to form clouds
- This rain falls gradually for a few hours to a few days is called as cyclonic rains

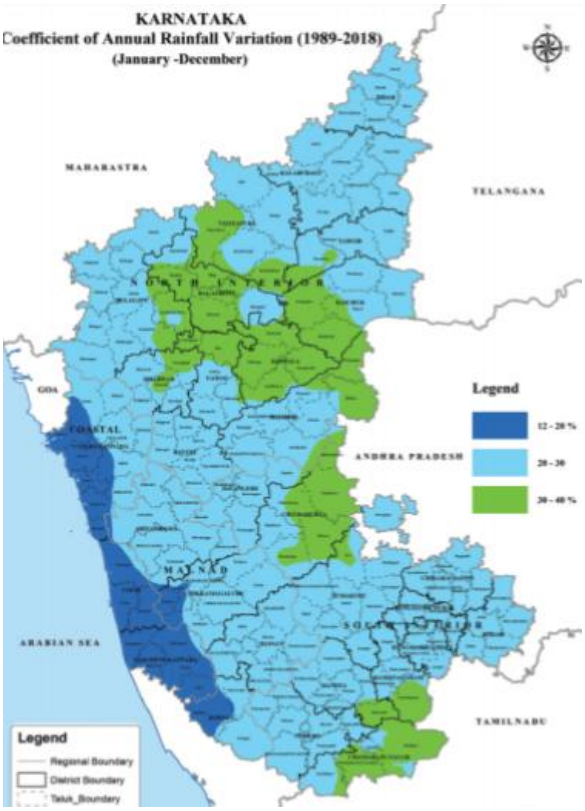
Impact of rainfall distribution over the years in India

The temperature and moisture distribution over the Indian subcontinent are changing in recent decades with the accelerated global temperature rise. These changes in distribution result in shifting wet/dry and warm/cold zones within India. The differential warming rate over land and surrounding ocean determine intricate dynamics of the Indian summer monsoon (ISM) and make the Indian region a more susceptible towards drought and flood events. In recent time, the frequent flooding over northwest India viz., over Gujrat and southern Rajasthan is attributed to the weakening of prevailing heat-trough circulation (northerly wind) and gradual increase in the convective activity (enhanced moist static energy).

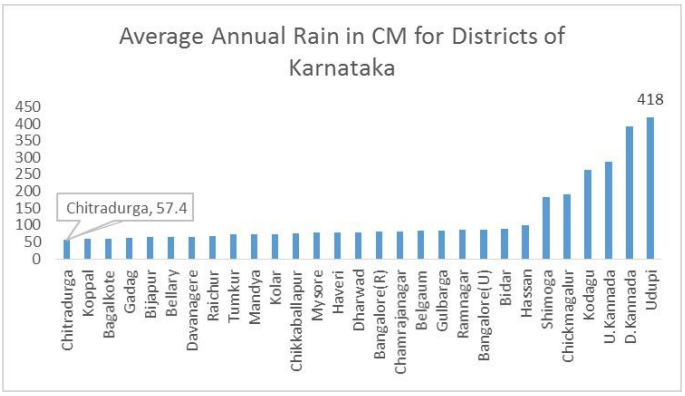


The recent weakening of the southwesterly reduced transport of moisture leading to reduced rainfall over Indo-Gangetic Plain (IGP) and northeast India; while the strengthening of the same enhanced the moisture transport and hence the rainfall over northwest India. In addition, northward shift of the sinking airmass over equatorial region, in recent time, leads to the decrease of the rainfall over the southern Indian region. The recent changes in rainfall pattern have shifted the climate of IGP and northeast India towards the relatively arid regime and that of western India towards a relatively moist regime, which supports the possible greening of the Thar region. The recent change in rainfall distribution in the form of wet and dry zones across the country will impact the water resource, food security as well as the fragile local ecosystem.

Status of rainfall distribution over the years in Karnataka



The average annual rainfall in Karnataka is 124 cm. The state is divided into three meteorological zones viz. North Interior Karnataka, South Interior Karnataka and Coastal Karnataka. Coastal Karnataka receives an average annual rainfall of 345 cm is one of the most rainy regions in the country. Contrasting this, the region of South Interior Karnataka and North Interior Karnataka receive only 128 and 73 cm of average annual rainfall respectively. In Karnataka the lowest annual rainfall



of 41 cm is observed in Parshurampura chitradurga district and highest annual rainfall of 411 cm is observed in udupi district.

Karnataka state is having the second largest rainfed agricultural area in the Country and food production is mainly depending on the south-west monsoon. The State's mean annual rainfall is found to be in decreasing trend along with its sixteen years cyclic periodicity. The normal sowing season rains are being delayed due to the shift of July rains to the August month and September peak rainfall is being shifted to October month. The maximum water available period for the grand growth period is shifting towards the end of September and beginning of October in many districts. Major portion of the annual rainfall received during monsoon season and majority of the farmers depends on rainfed agriculture, this failure of rains can have a crippling effect on the economy of the state.

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