**CLIMATE OF NORTHEAST INDIA**

North-East India is the rainiest region of the country. Cherrapunji (25°-15′ N, 91°-44′ E), a place on Meghalaya plateau, 50 km south of Shillong, receives a mean annual rainfall of 11,418.7 mm, the highest in the world. The highest recorded rainfall at the same station was 15,706 mm in 1951. With the exception of a few places like Guwahati and Lumding, the former lying in the rain shadow of Meghalaya and the latter of Barail range, most other places in the region receive around 2,000 mm of rain annually. Much of the rainfall occurs during the period of summer monsoon. The number of rainy days in a year, clustered largely in summer months, varies between 80 and 120 days. Moderate temperatures and relatively high humidity occur in the plains of Brahmaputra and Barak, the two main rivers of the region. These decrease with height in the hilly areas, and reach freezing point at the higher altitudes, in the Himalayan region where some patches of permanent snow are seen on the Indo-Tibet border.

**The Seasons**

Traditionally, the three seasons recognised in India are winter, summer and rainy season. The monsoon rains occur in summer, and the rainy season largely coincides with the summer season, which lasts from mid-April to mid-October. The winter season lasts in early November and lasts until mid-March. Mid-March to mid-April is a transitional period, which one may also call the spring season. The summer monsoon lasts from May to September, with the highest amount of rain falling in June and July. While the mean temperatures in the plain vary between 15 °C in January to 28 °C in August, the variations in the hilly areas move to a lower scale with around 9 °C in January (Shillong) to 21 °C in July and August. Closer to the Himalayan ranges, the mean temperatures in January are around 6 °C, and, even in summer seldom, move above 20 °C. No part in the North-East receives a rainfall of less than 1,200 mm, and the highest rainfall occurs in Cherrapunji which receives over 11,000 mm of rain.

**Temperature Conditions**

The temperatures in the region, as anywhere else, usually vary with height. In the plains of Brahmaputra and Barak, these are relatively equable, yet higher than the bordering mountains and plateaus. The temperatures in the plains, ranging in altitude from 50 to 100 m ASL, are 8–10 °C higher than the temperatures on the plateaus and hills which, with the exception of the Himalayan region, vary in heights between 1,200 and 1,500 m ASL. The temperatures in the higher ranges are much lower. In Brahmaputra valley, the mean summer temperatures linger around 28 °C in the entire valley with a mean daily maximum of around 31 °C for 5 months, from May to September. The mean winter temperatures vary between 16 and 17 °C. But, even in winter, the mean monthly maxima rise to 25 °C with a mean minimum of around 9 or 10 °C.

**General Observations About Temperature**

The temperatures in the plains as well as in the hills, with the exception of the Himalayas, are more equable in summer as they coincide with summer monsoon, heavy rainfall and cloudiness. The humidity, the atmospheric vapour and the cloud cover prevent quick terrestrial radiation in summer with the result that even in the warmest months that occur at different months in different areas depending on the burst of southwest monsoon, the temperature range is minimal in the warmest months. In Brahmaputra valley, it is June–July–August, coinciding with the rainy months, while in hilly areas like Shillong and Kohima, it is again July and August when the range of temperature is minimum. Despite a low range of temperature in the summer monsoon months, there are regional variations. Places with higher rainfall and cloud cover have a lower summer range of temperature. Thus, Cherrapunji with the highest summer rains has the lowest average temperature range of 4.4 °C in the month of July, the rainiest period of the year, while it is 9.3 °C in the month of September for Lumding, the place lying in the rain shadow of Barail range and receiving the lowest rainfall in North-E ast India. The variation in the summer range of temperature is moderate. Generally, the summers are more equable than the winters. The summer months coincide with the rainy season (June–September) and show higher mean temperature with a lower diurnal range of temperature. The winters have a higher range of temperatures essentially because of cooler nights; the day temperatures show a moderate lowering as compared to the fall in the night temperatures. The summer range of temperature varies from 4.4 °C for Cherrapunji to 9.3 °C for Dhubri in October. The areas close to the Himalayan mountains above 2,000 m ASL experience snowfall during winter and remain cool even during summer months. The winter range of temperatures varies between 9 °C for Aizawl and 9.7 °C for Haﬂ ong to 17.6 °C for Imphal in Manipur and 17.6 °C for Kailashahar and over 15 °C for Dhubri. The hilly places have relatively lower diurnal range of temperature than the areas in the plains. To summarise, one can divide the region into three thermal regimes:

1. The Himalayan areas with cool summer and snowy winter.

2. The Brahmaputra and Cachar plains with higher yet equable temperature during summer and higher diurnal range of temperature during winter. In the plains, the mean winter temperatures are 10–12 °C lower than in summer.

3. Hilly areas of Meghalaya, Nagaland, Manipur and Mizoram with lower winter temperatures have a cool summer and a cold winter, the range of temperature being low, both in summers and winters.

**Rainfall**

North-East India is the rainiest region in the country and receives much higher rain than the average of 1,000 mm for the whole country. Nowhere in North-East India, the annual rainfall is less than 1,200 mm, but for a large part of Brahmaputra valley, Meghalaya, Tripura and Mizoram, the annual rainfall is over 2,000 mm. Out of the 140 weather stations spread over the states of the North-East, for which monthly rainfall normals are available, the frequency distribution in each class of rainfall is as follows:

|  |  |  |
| --- | --- | --- |
| Classes of Rainfall (mm) | No. of Stations | % of stations in each category |
| Below 1000 | - | - |
| 1000-1500 | 5 | 3.57 |
| 1500-2000 | 30 | 21.42 |
| 2000-2500 | 48 | 34.27 |
| 2500-3000 | 25 | 17.85 |
| 3000-3500 | 15 | 10.71 |
| 3500-4000 | 8 | 5.71 |
| 4000-4500 | 7 | 5.00 |
| 4500-10000 | - | - |
| Over 10000 | 2 | 1.42 |
| Total | 140 | 99.95 |

What is clear is that more than 75 % of the weather stations receive more than 2,000 mm of rainfall and not even 5 % of the stations receive less than 1,500 mm of rain and no station receives less than 1,200 mm of annual rainfall. The ﬁve stations receiving less than 1,500 mm of rainfall are:

Lumding 1,233 mm

Imphal 1,412 mm

Lanka (in Nagaon district) 1,242 mm

Maibong (N. Cachar Hills) 1,454 mm

Amarpur (in Tripura) 1,435 mm

These stations lie either in the rain shadow of a mountain range or in an intermontane basin.

**Onset of Monsoons**

In most parts of North-East region, 1st of June is the date for the onset of monsoons; it may be slightly earlier in Cherrapunji and western hilly parts of Mizoram and Tripura where the monsoon bursts around the 25th of May. These places come under the direct impact of the Bay of Bengal monsoon, blowing over a short stretch of Bangladesh before hitting these areas. In Cherrapunji, the normal date for the onset of monsoons is 25th of May, whereas it is 1st of June at Dhubri and a few days later at Dibrugarh and Pasighat.

**Rainfall Regions**

No part of North-East India experiences drought conditions, and even in the rain shadow areas, the places receive 1,200–1,600 mm of rains. One can divide the region into the following pluvial categories:

1. Areas receiving over 3,000 mm rainfall (wet areas)

2. Areas receiving rainfall between 2,000 and 3,000 mm (humid areas)

3. Areas receiving rainfall between 1,500 and 2,000 mm (subhumid areas)

4. Areas receiving less than 1,500 mm of rains (moderately rainy areas)

1. Wet Areas: In this area, the southern part of Meghalaya in which Cherrapunji and Mawphlang fall; the Cachar plain; the North-Eastern part of Brahmaputra corridor Lakhimpur (3,258 mm), Pasighat (4,376 mm), Tezu (3,102 mm) and Dening (5,317 mm); and Central Mizoram are included. These areas besides having high rainfall have a prolonged rainy season and show minimum variability.

2. Humid Areas: In this category, the western part of Brahmaputra valley and northern part of Meghalaya plateau, much of Nagaland, Manipur and Tripura, are included.

3. Subhumid Areas: This includes the central part of Brahmaputra valley that appears like a wedge between the two ends of the Brahmaputra valley. This includes the districts Kamrup, Nagaon and Tezpur right up to Golaghat.

4. Moderately Rainy Areas: These areas are caused by rain shadow effect. This includes two areas: One in the lee of Barail range and Mikir Hills represented by Lumding (1,233 mm), and the other is the Kopili valley including places like Lanka and Kampur in Nagaon district.

**Climatic Divisions of the North-East**

W ith the exception of Brahmaputra plain having a width of 70–80 km, and Kopili and Dhansiri valleys and the small plains of Cachar and Tripura, much of North- East of India is hilly and mountainous, where terrain is an important climatic determinant. T he above mentioned plains, lying below 100 m ASL, have a climate, very different from the climate at higher altitudes in Meghalaya, Nagaland, Mizoram and Arunachal and peripheral regions of Manipur. The temperatures vary markedly as much as the amount and intensity of rainfall: One would divide the region into three type areas, each having a climate different from others. The similarity in climates of these areas is restricted to the source and seasonality of rainfall. All places receive rain largely during summers from southwest monsoon. The height and aspect also make the difference. If one goes by the simple primary classiﬁ cation of ‘Koeppen’, the region is divided into two zones. Part of Manipur, Tripura and Mizoram and Cachar plain lying below 25° N latitude fall in the category of ‘A’ climate (tropical climate), and the remaining northern part consisting of Meghalaya, much of Assam, northern Manipur, Nagaland and part of Arunachal Pradesh fall in ‘C’ climate (warm temperate mesothermal climate). These areas lying between 25° and 35° N latitudes show an average winter temperature above −3 °C but not above 18 °C. The northern part of Arunachal consisting of the Himalayan ranges is put under ‘D’ class (snow microthermal climate). The coldest month has an average temperature below −3 °C, and the warmest month shows a temperature of over 10 °C. Thus, the region has three classes of climate following Koeppen, i.e. ‘A’, ‘C’ and ‘D’. These could be further qualiﬁed. These classes are based on their latitudinal range and temperatures during summer and winter and could be qualiﬁed with rainfall conditions. By further subdivision, the following types of climate emerge in the North-East region.

1. A Type

Tropical wet–dry climate – (Aw) – This is tropical rainy climate with dry winters. This covers Tripura and Cachar plain and can be extended to Mizoram and southern Manipur despite their greater heights and slightly lower temperatures in winter as compared to Tripura. Tripura climate ‘Aw’ could be qualiﬁ ed with ‘a’, a subscript meaning the warmest month has a temperature above 22 °C. For Mizoram, the temperature of the warmest month being below 22 °C, subscript ‘b’ is afﬁ xed. Thus: ‘Awa’ – type – includes Tripura and Cachar plain ‘Awb’ – type – includes Mizoram and Southern Manipur.

1. C Type

The region north of 25° latitude is classiﬁed under ‘C’ category where further subdivisions are made. ‘C’ is warm temperate (mesothermal) climate, where the coldest month has a temperature of less than 18 °C but above −3 °C. The following subdivisions are found: ‘Cfa’ – Humid subtropical climate – rainy and hot summers ‘Cfb’ – Humid mesothermal with warm summers ‘Cfc’ – Humid mesothermal with short and cool summers All the three subtypes are alike, with changes only in the nature and length of summer. In case of North-East, it includes both, areas in higher latitudes and those at altitudes. The regional distribution is as follows: ‘Cfa’ – The entire Brahmaputra valley up to an altitude of 500 m ASL. This type of climate occurs in the Brahmaputra plain, from Dhubri to Pasighat, and extends into the valleys of the tributaries for some distance. ‘Cfb’ – The land from 500 to 1,500 m ASL, which includes the eastern ranges of Nagaland, Manipur and Arunachal Pradesh above 500 m and below 1,500 m ASL. Here the summers are warm. ‘Cfc’ – The land above 1,500 m ASL, which includes Meghalaya, part of Nagaland, northern Arunachal Pradesh, having short and cool summers.

1. D Type

The highland climate of the northern most part of Arunachal Pradesh where the temperatures in winter fall below 0 to −3 °C, and summers are also not warm. Thus, the region is divided into six types of climate.