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K. K. Nathan
Water Technology Centre, Indian Agricultural Research Institute, New Delhi 110 012, India

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Characteristics of Drought in Kerala, India

Kerala state in India, which is the first area of the country to experience the southwest monsoon, has a moist and wet climate. Kerala is in the extreme southwestern part of the Indian subcontinent; it borders Karnataka state in the north, Tamil Nadu in the east, and the Arabian Sea in the west (Figure 1). The entire state is one of the 35 meteorological subdivisions in India.

Kerala's climate is tropical monsoon and tropical savanna, according to Koppen's climatic classification (Figure 1). The state normally experiences excessive seasonal rainfall, with hot summers (except in the extreme southern districts like Trivandrum, where dry season and hot summer climate prevails). The three main seasons of the state are the hot season (March–May), southwest monsoon season (May–September), and northeast monsoon season (October–February).

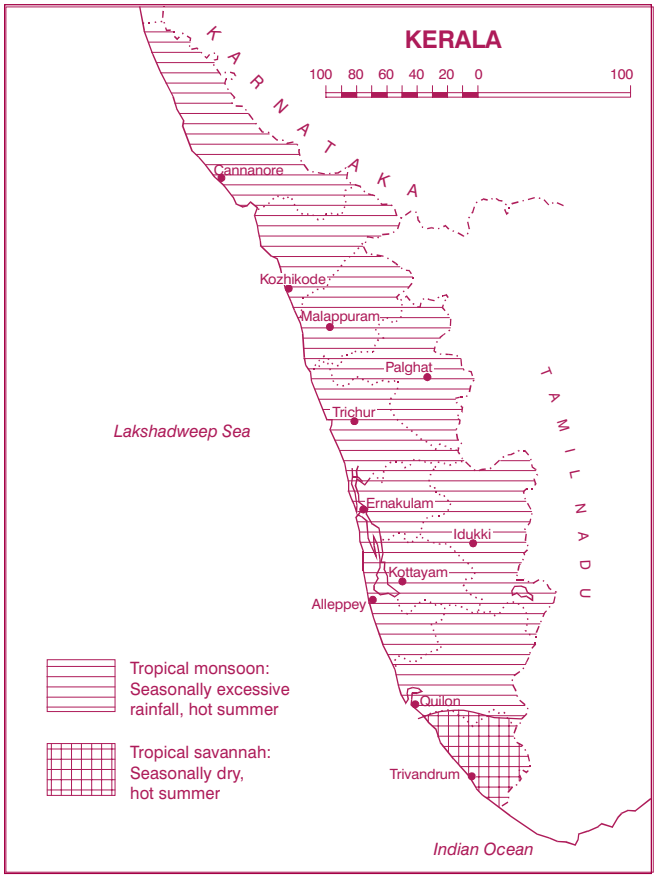

Figure 1. Climatic classification of Kerala.

The annual rainfall of the state varies from 3,800 mm over the north to 1,800 mm in the extreme south. The potential rainy season for Kerala is the southwest monsoon period, which contributes more than 80% of the annual rainfall. The monsoon rain decreases from the north to the south. In recent years, a trend of decreasing rainfall has been seen both in seasonal rainfall and 10-day extreme rainfall duration.

There is significant rainfall variation in north and south Kerala. North and south Kerala have two rainfall distribution subzones. In north Kerala, northeast monsoon rainfall shows a decreasing trend and contributes about 15% of the annual rainfall. This may adversely affect cultivation of the second rice crop in the area. Southwest monsoon rain, which contributes 82% of the area's total rainfall, does not show any increasing trend. Similarly, in south Kerala, southwest and northeast monsoon rains have decreased by 5% and 8.3%, respectively. Mean annual rainfall is also decreasing in south Kerala.

The decreasing rainfall over the region, late onset of the monsoon, failure of the monsoon, and break in the monsoon in the state lead to many drought situations. Kerala had severe dry spells and droughts in 1983, 1985, 1986, and 1987, even though the state has a wet climate. There were dry spells of 5 and 4 weeks in 1985 and 1986, respectively, during the southwest monsoon period.

Damage due to drought was particularly significant in Kerala in 1987. About 1,500 villages in 14 districts were affected, and 9.82 lakh[1] hectares of cropland and 6 lakh cattle were also affected. During January–May 1987, the entire Kerala region was affected by drought. About 30% of the rabi season

[1] **1 lakh = 100,000**

paddy crop was lost, and cash crops like coconuts, arcanuts, cashews, and bananas were damaged, resulting in a loss of Rs. 1,000 crores.

Kerala also experienced a significant drought in 1983. About 323,000 hectares of paddy were lost, at an estimated cost of Rs. 106.86 crores. Other major cash crops affected were coconuts, rubber, coffee, and tea. In Ernakulam district of Kerala, 36,000 hectares of paddy were lost; in Tiruchur, 33,000 hectares were lost. Coconut losses of Rs. 14 crores and Rs. 11 crores were reported in Kozikode and Trivandrum districts and Kottayam district, respectively. In 1989, drought resulted in the loss of 60% of the cropped area in Kerala, and about 3 million kilograms of tea, worth one crores rupees, withered under stress and drought.

Figure 2 shows the departure of seasonal rainfall from normal for different years (1981–87) in the region. Summer rains were deficient (-80%) in 1983. The southwest monsoon was about 40% of normal during 1989 in the state. Similarly, the northeast monsoon was highly deficient in 1986. Large rainfall deficiencies in the various districts of the state are shown in Table 1. Figures 3a–3c reveal large water deficits in almost all of the representative stations during December to April. The seasonal dry period and water deficits led to severe dry spells and droughts.

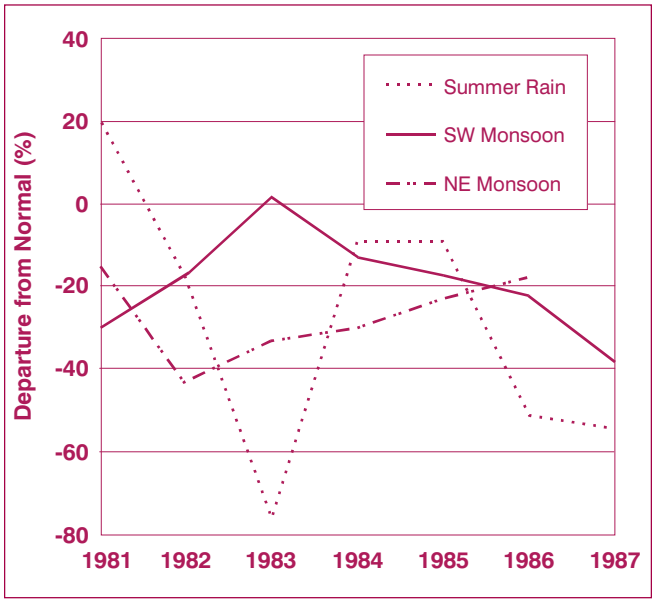

Figure 2. Precipitation departure from normal for Kerala, 1981–87.

Districts	1983	1984	1985	1986	1987
Alleppey	21	-17	-5	-26	-17
Cannanore	-5	-2	1	-15	-35
Ernakulam	16	9	1	19	-24
Idukki	-20	-3	1	1	-45
Kasargode	NA	-3	-14	-8	-33
Kottayam	-28	-15	-14	-15	-28
Kozikode	15	-7	-5	-14	-43
Mallapuram	12	19	-7	-18	-50
Palghat	17	4	2	-8	-48
Pattinamathi.	NA	-24	-21	-35	-50
Quilon	29	-18	-5	-21	-29
Trichur	2	-4	-5	-25	-23
Trivandrum	-22	-57	-29	-44	-37
Wayanad	-16	9	-18	-31	-68

Table 1. Percentage departure of rainfall from normal for districts of Kerala.

The low pressure waves from the east (the Gulf of Thailand), which move across the South Bay of Bengal toward Tamil Nadu, may temporarily increase rainfall over Kerala. Also, an upper tropospheric easterly jet stream with an axis of 12°N is believed to influence the rainfall over the state. However, a detailed study is needed to determine this.

During weak monsoons and droughts in Kerala, the orographic contribution is almost nil, but this is not attributed to a weaker westerly component during the dry spell. The Nepha (or cloud) analysis from satellite pictures over Kerala also gives good information about drought. During 1966, a year of weak monsoons and drought, satellite pictures showed a zone of cloudiness shifting far into southern India. During drought situations over the state, there is no high-level moving system of waves in the upper tropospheric easterlies.

During the drought of 1966, high-level wave flows were more or less straight easterly flows with less speed variation than in a good strong monsoon season. Cloud analysis during active and strong monsoons such as occurred in 1967 shows at least 7 oktas of cloudiness on any given day over the state, extending from the interior of the southern peninsula across

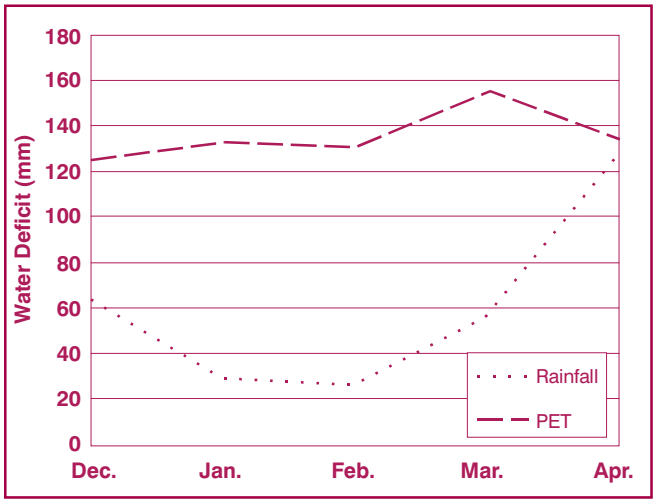

Figure 3a. Seasonal water deficit, Alleppey, Kerala.

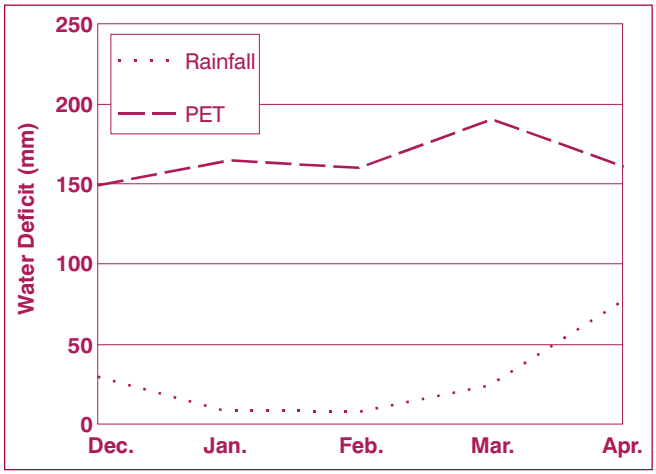

Figure 3b. Seasonal water deficit, Palghat, Kerala.

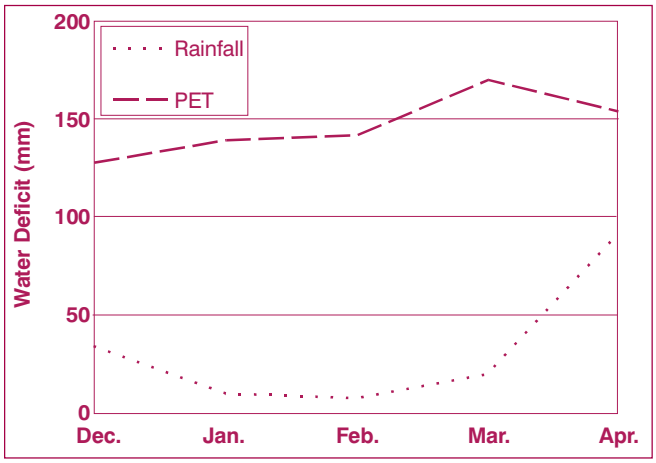

Figure 3c. Seasonal water deficit, Calicut, Kerala.

Kerala southward and westward (1,200 km from the Kerala coast of the Arabian Sea). There is also a secondary maxima of 7 oktas of cloudiness south of the equator. This type of situation did not exist during the 1966 drought over the state. Thus cloud analysis and orographic rainfall patterns may give a good indication of the drought situation in a wet state like Kerala.

K. K. Nathan
Water Technology Centre
Indian Agricultural Research Institute
New Delhi 110 012
India