Seasonal Oscillations of air temperature in India and neighbourhood*

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ABSTRACT. The annual and the half-yearly oscillations in the mean temperature of air at 4 feet above ground level at 167 meteorological stations in India and neighbourhood have been separated. The dependence of the components of the vectors of the different oscillations on the location of the stations have been determined. Regression equations for representing the components of the oscillations as a linear function of latitude, longitude and elevation have been derived. The fit of these representations has been found to be fairly good, the correlation between the actual and the calculated values being of the order of 0·8 to 0·9 generally. The significance of the gradients with respect to the positional co-ordinates have been discussed.

1. Introduction

It is well known that next to the availability of water, the temperature of the air governs the important phytophases of the crop like the germination of seeds etc. Most plants will grow only within narrow ranges of temperature; and for each species and variety there is a minimum below which growth is not possible, an optimum at which growth is most rapid, and a maximum beyond which growth stops. These critical temperatures may vary from crop to crop (Lundegårdh 1931). Also, the seasonal course of air temperature is a characteristic of the location of the station and is a major factor in defining the climate as 'temperate' or 'severe', 'maritime' or 'continental' etc. A study of the annual course of air temperature is important therefore for such and other purposes. The annual march of air temperature is primarily dependent upon the variation in the amount of heat received from the sun. The daily rate of solar radiation received at any point on earth’s surface depends upon the quantity of radiation that emanates from the sun, the duration of the sun’s presence above the horizon and the meridian altitude of the sun. There are, however, other factors also, such as, the distribution of land and water, in the neighbourhood of the station, its elevation, the atmospheric and oceanic circulations etc, which disturb to a marked extent this picture of the annual march of temperature as determined by the sun.

2. Scope of the Study

The march of temperature of the air at any particular station is to a large extent a systematic oscillation repeating practically in a similar manner year after year. In Fig. 1 the variation of the mean temperature (see footnote on p.156) in respect of a few stations are shown graphically. These curves have certain general features common to all and certain distinguishing features peculiar to a few. For example, the temperature is lowest during the winter months and increases during the hot weather season. However, the slight variation in the course of the year at the coastal places like Cochin and Pamban distinguish themselves from the high ranges in the interior stations like Lucknow, Jacobabad etc. The highest mean temperature at places like Dras, Srinagar and Quetta occur in July-August, while at the other stations we have a double wave with the primary maximum occurring during May or June and a secondary maximum about October. The character of the variation in the air temperature during the course of the year, and the relationship between these distinguishing characters and the location of the stations form the subject matter of study in this paper.

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