Trans. Inst. Indian Geographers
Vol. 4, No. 1, January 1982

WATER BALANCE STUDIES OF TRIVANDRUM AND ITS VICINITY

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ABSTRACT : Water balance studies in relation to climatic studies is one of the important disciplines of applied climatology. The agricultural potential of any region is determined by the climate of the region, the most important of which being the amount of rainfall, temperature and duration of sunshine. In this paper an attempt has beed made to study the climatic features of Trivandrum and its vicinity by water balance approach.

General Description of the Area

Trivandrum district in Kerala State is situated in the extreme south and is bounded by the coast line bordering the Arabian sea on the west, inter-state border with Tamilnadu in the eastern and the southern side and by the Quilon dirtrict in the north. It lies between 8°0' and 8°18 N latitudes and 76°40' and 77°15' E longitudes. It consists of four revenue taluks Trivandrum, Neyyattinkara, Nedumangad and Chirayinkil. Physiographically it is bounded by western ghats on the east and Arabian sea in the west. The rivers Yamanapuram, Karmana and Neyyar originating in the western ghats flow from east to west into Arabian sea.

The low land extends over the sea coast and the high land includes the forests of the western ghats. The land lying in between them is the midland, traversed by rivers and a variety of crops are grown.

The district has a normal annual rainfall of about 2001 mm. Both the Southwest and Northeast monsoons give good rain to the district. It has an area of 2,16,096 hectares which is 5.6 per cent of the area of the state.

Soils

Climate, vegetation and topography are the dominant factors involved in the process of soil formation. Laterites are typical weathering products of gneissic and granitic rocks, developed under humid tropical conditions and found to cover a major portion of the mid-land and mid upland regions of Trivandrum district. Southern parts of the district conrists of red loams. Sandy loams are found in the western coastal region of the district. Brown hydromorphic soils are found in patches in the mid-land and mid-upland regions. Forest loams are the products of weathering of crystalline rocks under forest cover and are restricted to the eastern portion of the district.

Data and Methodology

Data regarding rainfall and temperature is taken from the records of India Meteorological Department. Water balances are calculated for climatic normal of the year (1931–60) and for the years 1951, 1961, 1971 and 1979 following the book-keeping procedure of Thornthwaite. Index of humidity, index of aridity, moisture index and moisture adequacy are calculated. In order to assess the moisture conditions to determine the seasonal surpluses or water deficiencies, the amount of water available from precipitation is compared with the

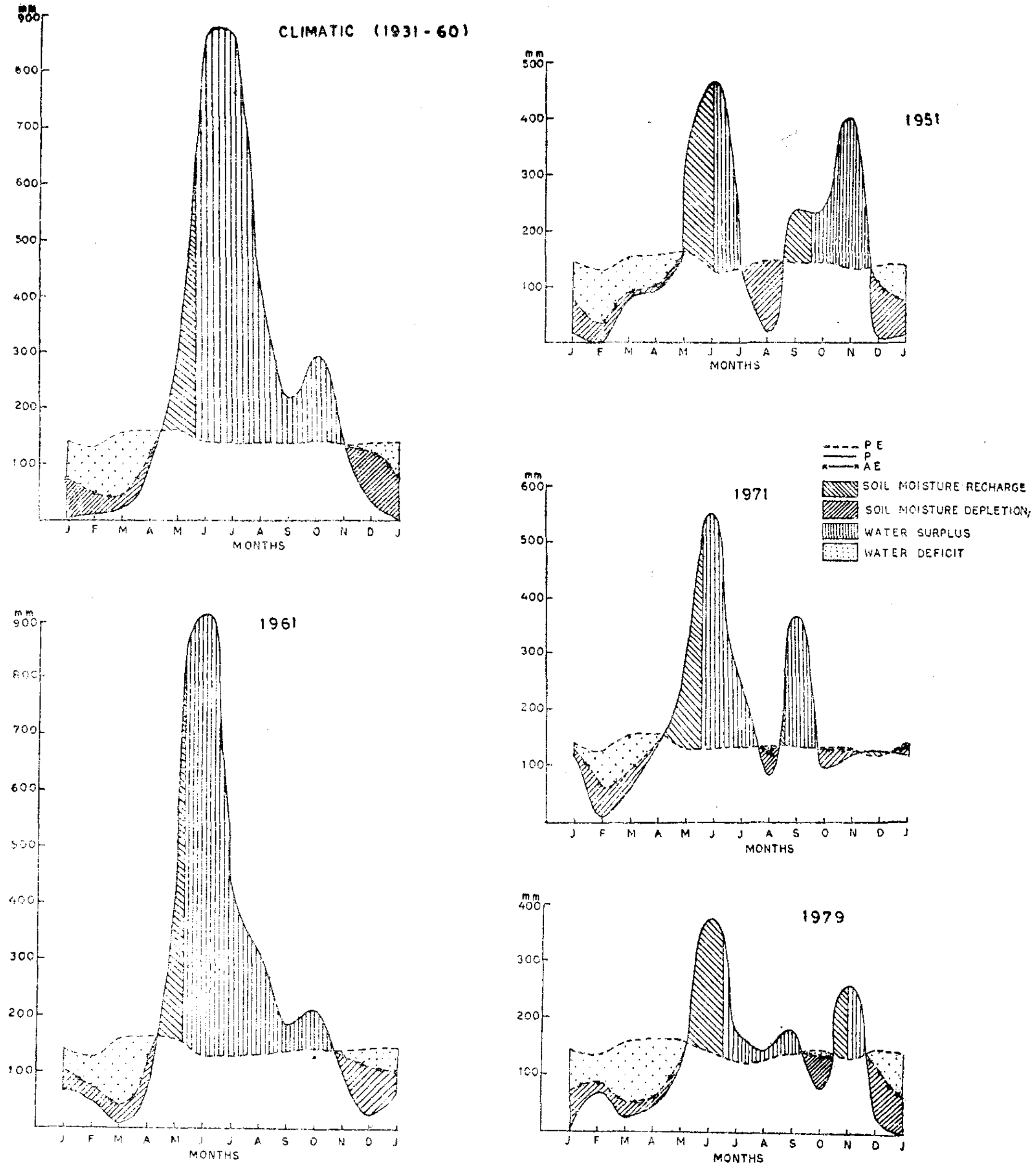

FIG.1 WATER BALANCES OF TRIVANDRUM.

water need. Hence, water balance diagrams are drawn for the years climatic normal (1930-60), 1951, 1961, 1971 and 1979.

Discussion

In order to assess the moisture conditions to determine the seasonal surpluses or water deficiencies, the amount of water available from precipitation is compared with the water need. (Fig. 1)

It can be seen from the climatic water balance that a surplus of 1891 mm is experienced from the beginning of June to middle of November. A deficit of 322 mm is experienced during the periods, middle of November to December and January to May. Soil moisture recharge is found during the months May to 1st week of June.

Water balance of the year 1951 shows two appreciable peaks of rainfall during the months June and November. A surplus of 452 mm is experienced during the periods middle of June to middle of July and Octoboto November. A deficit of 303 mm is experienced from January to middle of May and in the month of December. Soil moisture recharge is found during the periods middle of May to middle of June and September to October.

It can be seen from the water balance of 1961 that water surplus amounts to 1446 mm and is experienced during the period June to October. Water deficit follows till the end of the year. The period Jaunary to April also experiences water deficit. Soil moisture recharge is found in the month of May.

Water balance of the year 1971 also shows two peaks of rainfall, during the months June and September. Water surpluses are observed during the two periods June to July and September to October. Water deficit is observed during the period January to April. May is the month of soil moisture recharge. The period October to December has a little amount of soil moisture depletion.

Water balance of the year 1979 indicates that a water surplus of 168 mm is experienced during the period July to 3rd week of September and middle of November to 1st week of December. Water deficit follows till the end of 1979. Water deficit is also experienced from January to 3rd week of May and there onwards soil moisture recharge is found till June.

With a view to understand the changes in water balance indices during each decade for an evaluation of the climate of Trivandrum information is provided in Table-I.

Table I

Water Balance Indices at Trivandrum

Year	$I_h(\%)$ $(=\frac{W.S.}{W.N.} \times 100)$	$I_a(\%)$ $(=\frac{W.D.}{W.N.} \times 100)$	$I_m(\%)$ $(=I_h - I_a)$	Climatic type or index	$I_{ma}(\%)$ $(=\frac{A.E.}{P.E.})$
Climatic (1931-60)	110.3	18.8	+91.5	B_4 Humid	81
1951	33.7	18.6	+15.1	C_2 Moist sub-humid	81
1961	85.9	17.8	+68.1	B_3 Humid	82
1971	41.4	13.5	+27.9	B_1 Humid	90
1979	9.8	23.0	-13.2	C_1 Dry Sub-humid	77

I_h = Humidity index
I_a = Aridity index
I_m = Moisture index
I_{ma} = Index of moisture adequacy

W.S = Water surplus
W.D = Water deficit
W.N = Water need
P.E = Potential evapotranspiration
A.E = Actual evapotranspiration

An analysis of the above table reveals a stable humid climatic conditions at Trivandrum. However, currently a shift towards dry climates is evidenced by the information presented for 1979 when Trivandrum experienced dry sub-humid climate ($I_{m} = -13.2\%$)

The general study indicates an assured level of moisture adequacy over 80 per cent enabling support of various crops requiring high moisture levels and horticultural and sylvicultural crops with adequate response from climate. This study is general and preliminary in character. Attempt has been made to make use of immediately available data. Further work is in progress with more data on climate and crops in and around Trivandrum.

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