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An assessment of water potential contributed by tropical storms of Bay of Bengal during post monsoon period

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ABSTRACT. A few typical cases of tropicals torms which originated in the Bay of Bengal during the post monsoon months (October-December) have been studied with respect to their water potential. Isohyetal analysis has been carried out of the rainstorms associated with these disturbances in course of their movement. The total volume of water contributed over land south of Lat. 16°N by each of these cyclonic disturbances has been computed and presented.

1. Introduction

Widespread and heavy of rainfall occurs over south Peninsular India during the period October-December in association with the storms/depressions from the Bay of Bengal in the course of their westward movement particularly when they are in close proximity of the coastal areas or crossing coast. The study has been confined to a few typical cases which occurred during the period 1941 to 1960 when the centres of these systems were located near Tamil Nadu and adjoining coast and the associated rainfall confined to south of Lat. 16°N over Peninsulae India. The normal monthly rainfall yield for the area affected by the cyclone has been compared with the actual rainfall yield contributed by the cyclone.

A Preliminary study of storm tracks (India met. Dep. 1964) and associated rainfall distribution during October-December of 1941 to 1960 has revealed that whenever the storms are located east of Long. 82°E, the associated rainfall potential over Peninsular India is insignificant. Therefore, only those systems which are located to the west of Long. 82°E and confined within the sea area bounded by Lats. 8° to 15° N have been considered for the study. Further, this area has been divided into one-degree square each designated as 1, 2, 3....upto 14 as shown in Fig. 1.

2. Rainfall analysis

The normal monthly rainfall maps of Peninsular India for October-December have been prepared for the comparative study between the water potential associated with cyclones and corresponding normal monthly rainfall volume. For this purpose the available rainfall data of all the State raingauge stations and India Meteorological Department Observatories have been taken into consideration. These maps show that the rainfall generally diminishes from eastern coastal belt to interior upto about Long. 78°E and then increases slightly along Kerala coast.

With a view to ascertaining the volume of rainfall associated with the cyclones/depressions when these were centred in the one-degree squares mentioned earlier, the rainfall analysis was carried out with reference to the following aspects :

(*i*) The areal extent and intensity of rainfall *vis-a-vis* the severity and proximity of the cyclone/depression to the eastern coastal area.

(*ii*) The contribution of rainfall volumes covered by successive isohyets of rainstorm associated with cyclones. For this purpose the analysis has been extended upto to zero isohyet.

3. Discussion

3.1. *October storms*

3.1.1. A depression formed near Long. 84°E and Lat. 12°N on 25 October 1944 and intensified into a storm. It moved rapidly through square No. 3 on 26th causing fairly widespread rain extending from the coastal areas to the interior as can be seen from Fig. 1 (showing the rainfall distribution on 27 October). The rainfall volume yielded over land by this system on 26 October, has been assessed to be 10.11 million cm-hectares, whereas

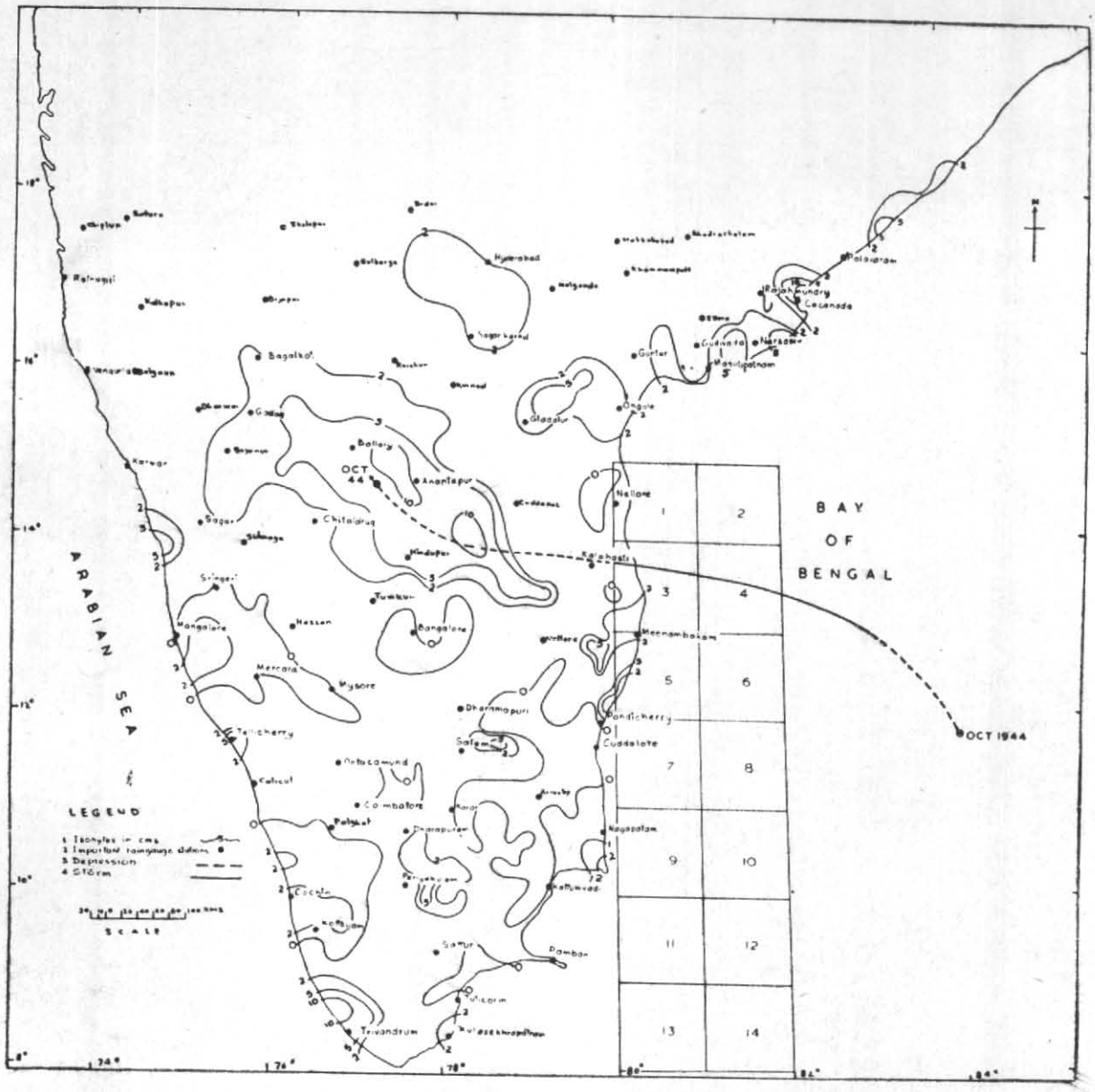

Fig. 1. Isohyetal pattern of 27 October 1944

for 27 October 1944, the yield comes out to be 10.60 million cm-hectares. The total water potential thus realised from this disturbance is 20.71 million cm-hectares. The volume of the normal monthly (October) rainfall for the corresponding area covered by the isohyetal pattern (upto zero isohyet) of 27 October 1944 storm, comes out to be 87.09 million cm-hectares. Thus the contribution to water potential in one day is about 12 per cent of the normal monthly total volume. Further about 50 per cent of the total water yield is contributed by low isohyet values which obviously cover larger areas, whereas the high isohyet values are localised in coastal areas.

3.1.2. Another October situation examined is that of a storm which was centred in square No. 1 on 16 October 1943 and weakened into a depression on the same day. The isohyetal pattern on 16th depicted evenly distributed rainfall over Tamil Nadu and adjoining coastal Andhra Pradesh. The rainfall volume assessed comes to be 8.80 million cm-hectares. On the next day the heavy rainfall region was located ahead of the storm track with the southernmost portion of the Peninsula practically remaining unaffected. The water yield on this day comes to be 8.61 million cm-hectares.

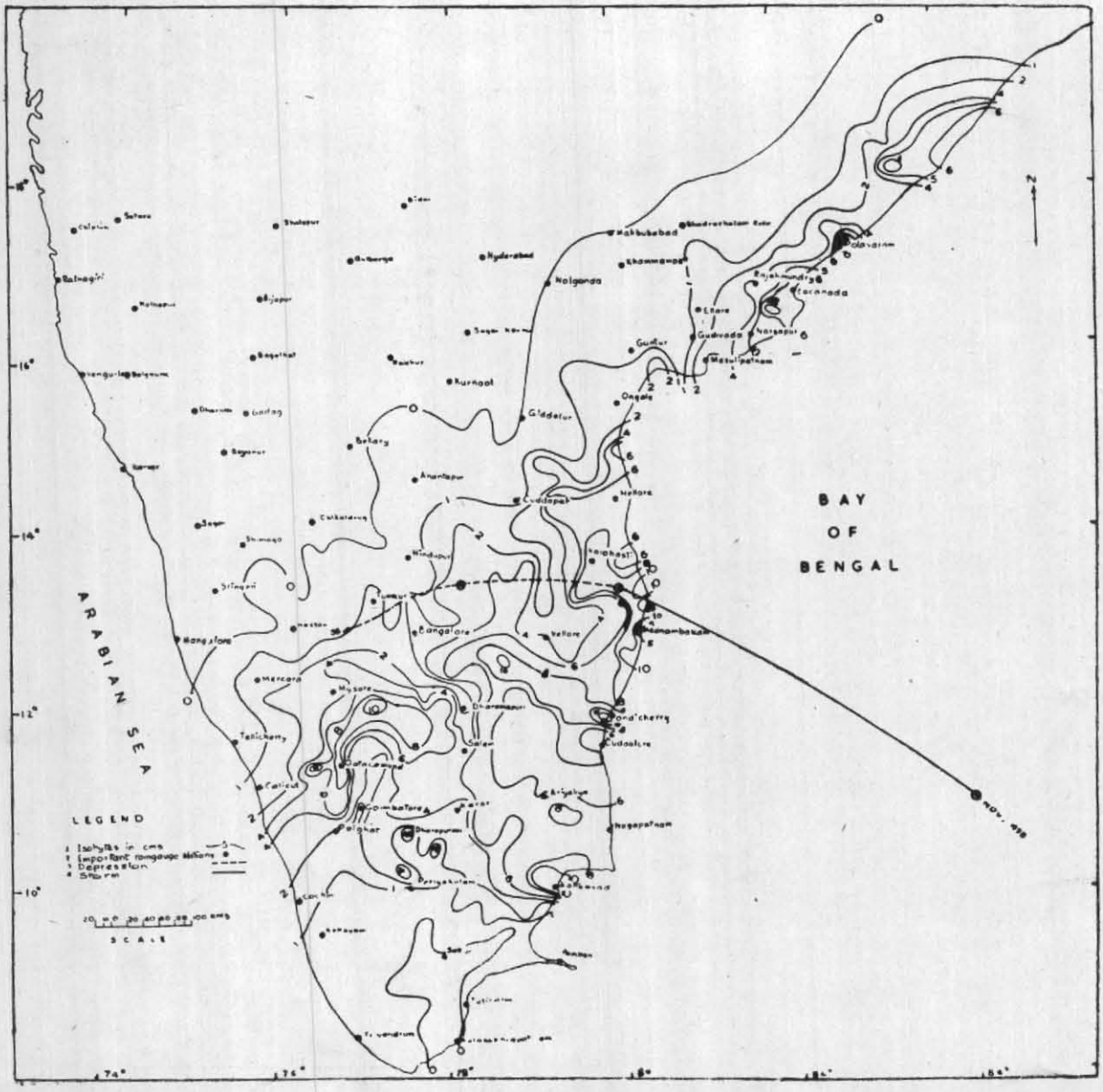

Fig. 2. Isohyetal pattern of 21 November 1958

Thus the total water potential yielded by the 1943 storm is 17.41 million cm-hectares.

3.2. *November storms*

3.2.1. A depression was centred near Long 87°E and Lat. 9°N on 19 November 1958, which developed into a cyclonic storm on 20th with centre located in square No. 6. It moved rather rapidly in a northwesterly direction and was centred in square No. 3, north of Madras on 21 November 1958 where it began to dissipate into a depression. Widespread rainfall occurred on 21 and 22 November 1958 in association with the system and the isohyetal analysis carried out for the assessment of water potential gives the yield as 10.28 million cm-hectares on 21 November and 8.90 million cm-hectares on 22 November 1958 respectively. Thus the total yield comes out to be 19·18 million cm-hectares. The isohyetal pattern of 22 November 1958 is shown at Fig. 2. In this case also 50 per cent contribution comes from low isohyet values extending over large areas. The normal monthly (November) rainfall volume for the corresponding areas covered by the isohyetal pattern (upto zero isohyet) of 22 November 1958 storm comes out to be 47.36 million cm-hectares. Thus the contribution to water potential from the storm for one-day during this month is about 22 per cent of the normal monthly values.

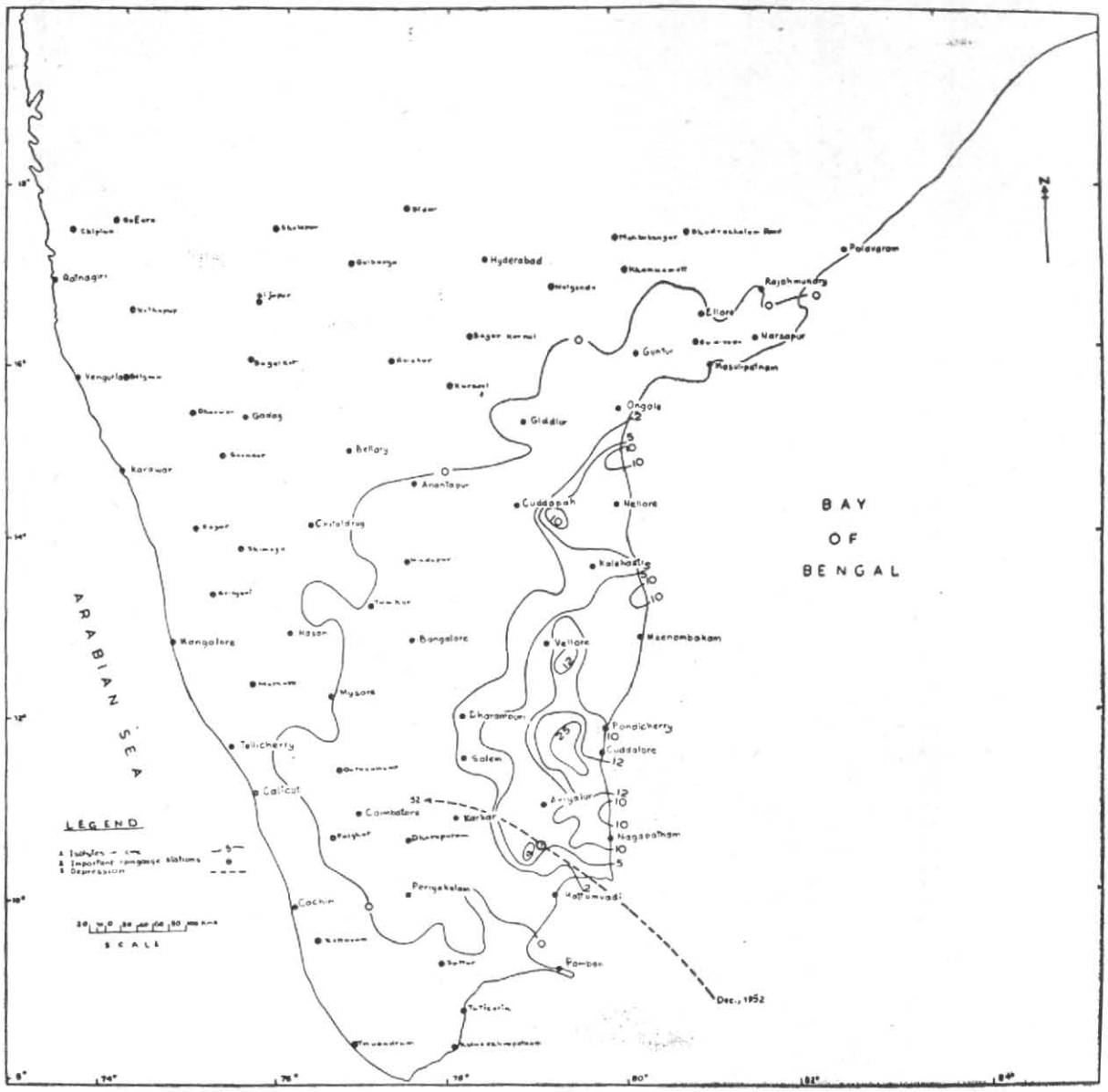

Fig. 3. Isohyetal pattern of 7 December 1952

3.2.2. The other November cyclone examined was a severe one which moved in a westnorthwesterly direction and entered square No. 9 on 30 November 1952. Heavy rain was recorded on 1 December 1952 over Tamil Nadu and adjoining areas, and the corresponding total water yield realised in 1-day is 10.30 million cm-hectares. But a depression located further south in square No. 11 on 28 November 1959, yielded water potential of 11.32 million cm-hectares on 29 November 1959.

3.3. *December storms*

3.3.1. The storms in the month of December originate further south in the Bay of Bengal. The storm of 1941 formed near Andaman Island, moved into square No. 4 on 13 December as a depression. The associated rainfall volume yield on 14 December was 6·21 million cm-hectares.

3.3.2. Another December situation is the depression that formed further south near Long. 81°E and Lat. 8½°N in square No. 14 on 6 December 1952. Moving in a northwesterly direction, it crossed square No. 11 almost diagonally and lay near Pudukkottai on 7th. The associated rainfall yield over coastal areas on 7th is 8.52 million cm-hectares. The corresponding isohyetal pattern of 7 December 1952 is shown in Fig. 3. Moving