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Letters to the Editor

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ONSET OF NORTHEAST MONSOON - A CASE STUDY

1. Like summer monsoon, the winter or northeast monsoon equally plays an important role for the water management in the southern parts of peninsular India. As the sun starts its movement towards south, after attaining its extreme northern limit, the Intra tropical Convection Zone (ITCZ) gradually loses strengths and also follows movement of the sun with some lag of months. Similar is the case for withdrawal of southwest monsoon and rainfall zone. Though for withdrawal of southwest monsoon no one-to-one relation is seen, but objectively by watching the changes in wind pattern over the region, shifting eastwards of the precipitation zone and reduction in dew point temperature, withdrawal is being declared. For this reason, it is well known that the further withdrawal of southwest monsoon from peninsular India and simultaneously onset of northeast monsoon during depression or cyclonic storm period is difficult because of the intense perturbation in the mean flow.

1.1. Though little attention has been paid to the changes in atmospheric circulation associated with the withdrawal of the Indian summer monsoon in comparison with its onset, the study of Matsumoto (1990) is much significant in this aspect. He studied the large scale circulation over south Asia during the withdrawal phase of the Indian summer monsoon from August to November during 1979-94 and found the following three distinct changes during onset of northeast monsoon:

(*i*) The southward shifts of 200 hPa Sub Tropical Westerly Jet Stream,

(*ii*) Weakening of 850 hPa westerlies around the India region,

(*iii*) Decrease of rainfall along west coast of India.

A brief review is also given in India Meteorological Department (1973) and Das (1968). Rao (1963) also discussed about northeast monsoon and found the changes of wind pattern during northeast monsoon season over India.

1.2. In the present case, a synoptic study has been made for the year 1995 to find out the significant changes in circulation, rainfall and surface pressure distribution that occurred over India during the onset of northeast monsoon. The pressure distribution over Siberian High is also taken during onset days to see different changes in the regional scale circulation that forms the northern boundary of the winter circulation.

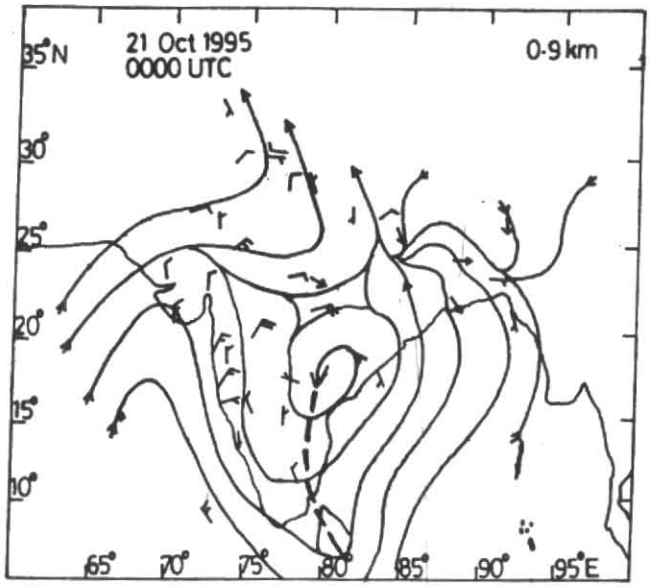

Fig.1. Streamlines analysis of 21 October 1995, 0000 UTC, (0.9 km asl)

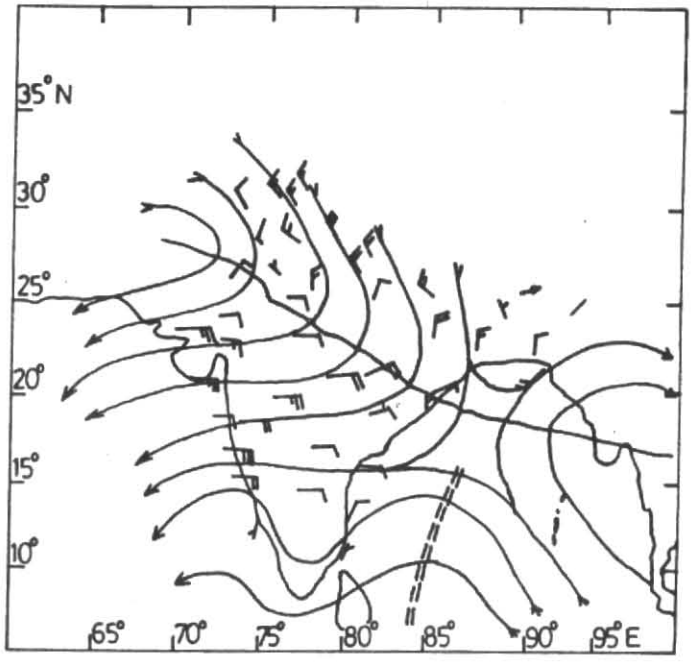

Fig. 2. Streamlines analysis of 23 October 1995, 0000 UTC, (0.9 km asl)

2. The daily weather charts for the period 30 September-25 October 1995 alongwith the vertical time section charts of Madras, Minicoy and Delhi and the Indian Ocean and Southern Hemisphere Analysis Center (INOSHAC),

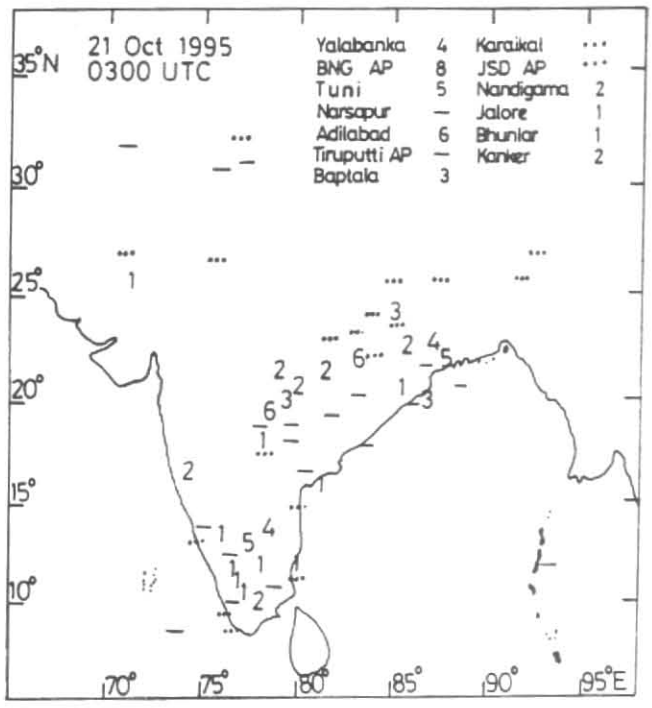

Fig.3. Rainfall on 21 October, 0300 UTC

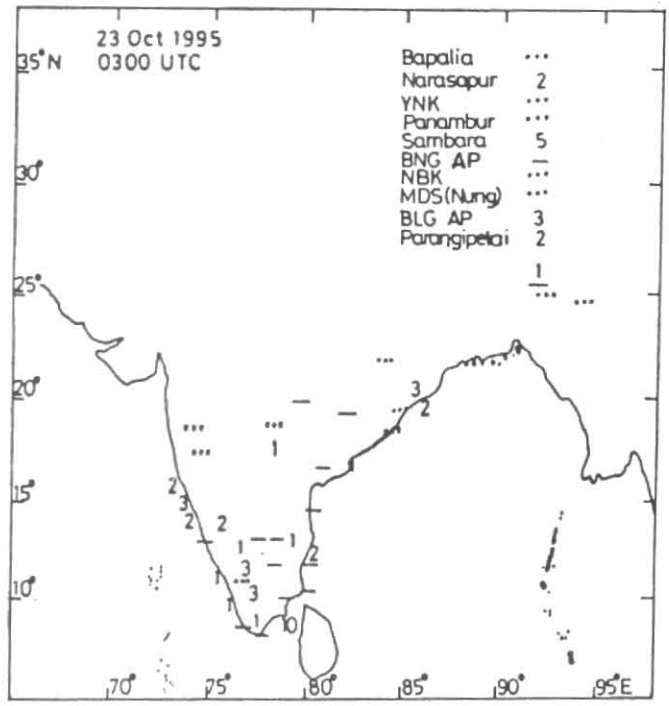

Fig.4. Rainfall on 23 October, 0300 UTC

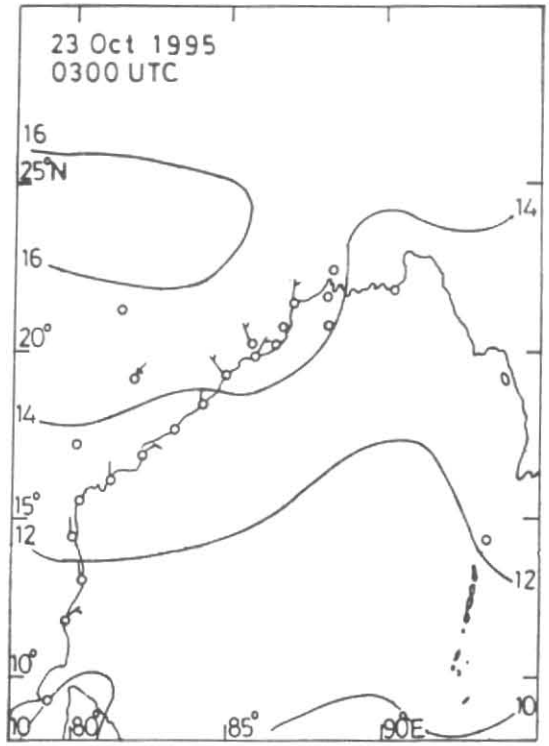

Fig.5. Mean Sea level surface pressure chart of 23 October, 1995, 0300 UTC

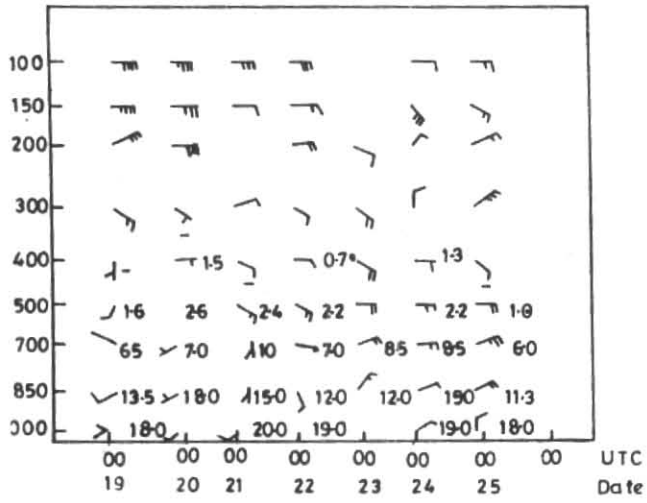

Fig. 6. Vertical time section of Madras for the week 19-25 October, 1995

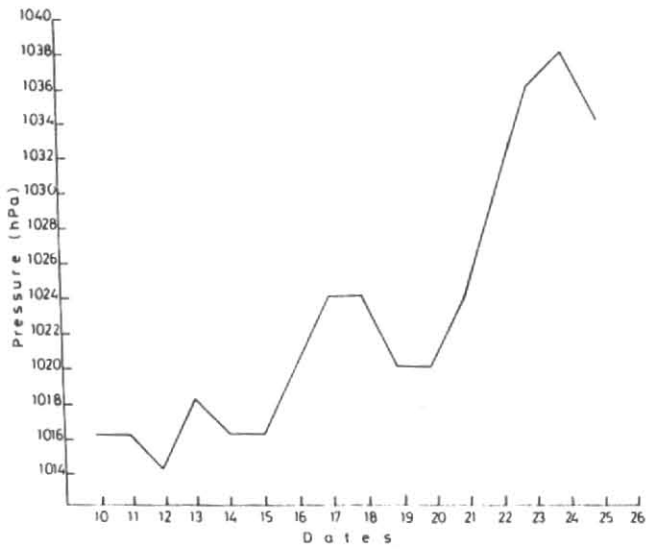

Fig. 7. Maximum isobaric surface mean sea level pressure of Siberian High within the block 35°- 40°N and 100°–110°E during 10 - 25 October 1995

Pune's charts for the period 1-25 October, 1995 are utilised for the present study.

3. Withdrawal of southwest monsoon setting of northeast monsoon and the synoptic features are briefly described below:

(*i*) The southwest monsoon withdrew from Andhra Pradesh, Karnataka, Kerala and Tamil Nadu and northeast monsoon simultaneously commenced on 23 October.

(*ii*) On 21 October 1995, cyclonic circulation extending upto 5.8 kms asl lay over east Vidarbha and neighbourhood. On 22 October, 1200 UTC it became less marked and on 23 October, the entire country was under the flow of easterly to northeasterly winds. This was the last perturbation during which southwest monsoon produced rainfall over penisular India.

(*iii*) The winds over India at 0.9 km on 21 and 23 October are shown in Figs. (1 & 2) with corresponding rainfall in Figs. (3 & 4). It is seen that after 21 October, the wind pattern over peninsula in low levels changed from westerly component to easterly component and the easterly trough over southern peninsula at 0.9 km asl was established. The rainfall zone also shifted towards southern peninsula.

(*iv*) The surface pressure on 23 October in Fig. 5 shows that the mean sea level pressure gradient at surface along east coast of peninsula has been reversed for the first time after the withdrawal started in October which also shows that the westerly or southwesterly component of southwest monsoon across equatorial flow has completely stopped over the peninsular India and adjoining Bay and this signified the onset of northeast monsoon.

(*v*) The vertical time sections of Madras, Fig. 6 for the period 19-25 October show that after 23 October, the lower level westerlies reversing into easterlies right from the surface to 100 hPa. The Isohygric analysis for this period also indicate the moisture incursion upto 400 hPa after 20 October. The values of higher order are reported in the lower levels over Madras from 20 October onwards in comparison with earlier days. Winds in vertical time section of Minicoy also shows similar changes. Vertical time section of Delhi shows gradually strengthening of westerlies during the week.

(*vi*) During the period of study it was found that there is an increase in the intensity of Siberian High (Fig. 7) over southern parts in the block between 100° - 110°E and 35° - 40°N towards the onset period. The maximum surface mean sea level isobaric pressure which was 1020 hPa on 20 October rose upto 1038 hPa on 24 October around the date of onset of northeast monsoon. From Figs. 8 & 9 it is also inferred that the outflow from above high region increased significantly on 24 October, (strong northeasterly wind of 30 kt) in comparison with 21 October, towards south at lower levels (850 hPa) over large area of winter monsoon over southeast Asia.

4. From the above study, it is found that though there is no definite condition for the onset of northeast monsoon over the peninsular India as a part of global winter monsoon

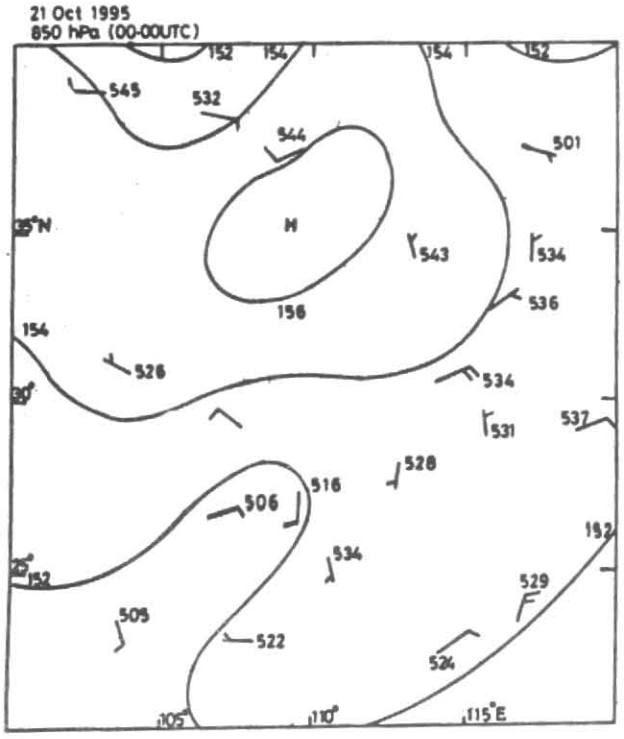

Fig.8. The gpm and winds at 850 hPa on 21 October at 0000 UTC.

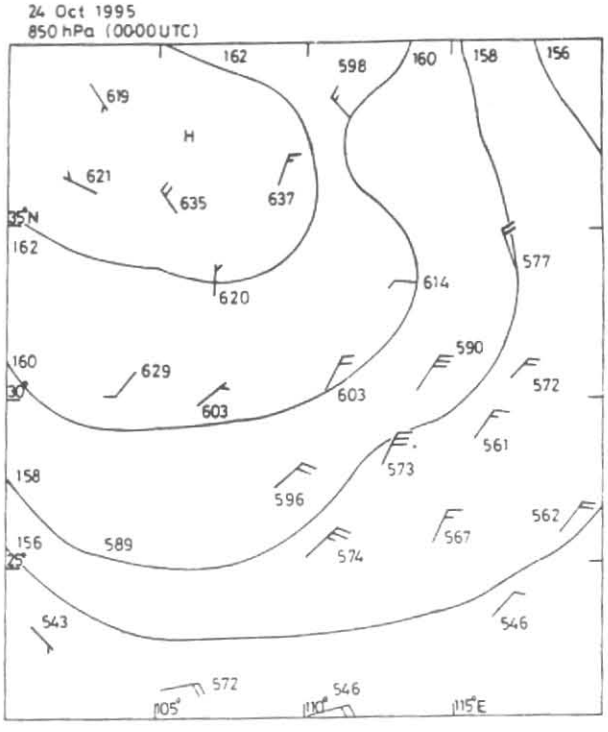

Fig.9. The gpm and winds at 850 hPa on 24 October at 0000 UTC.

over south Asia, however, the following synoptic features have been noticed:

(*i*) Total reversal of pressure gradient with minimum at extreme southern parts of east coast of peninsular India.

(*ii*) The establishment of easterlies or northeasterly winds at the surface and at lower levels over southern peninsular stations.

(*iii*) The shifting of rainfall zone from northern latitudes to southern peninsula.

(*iv*) Strengthening of westerlies over northern parts of India at upper levels.

(*v*) Increase in moisture content over peninsular stations.

(*vi*) The strengthening of Siberian High will give a confirmed picture about the onset of northeast monsoon over peninsular India.

5. We are thankful to the Deputy Director General of Meteorology (Weather Forecasting), India Meteorological Department, Pune for supplying the data and to Mr. H. P. Deshmukh and Bharati Kulkarni for DTP work.

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