551.577.38 : 551.513 (540)

## INDIAN DROUGHTS OF 1965 AND 1966 — A PRELIMINARY STUDY

One of the questions often asked is whether the behaviour of the monsoon can be predicted a few months in advance. In this connection one can, as a first step, examine the monthly mean state of the atmosphere over India, from May to August, during a few contrasting years. The authors conducted such a preliminary study, of the large scale drought years of 1965 and 1966 in contrast to a good monsoon year 1964.

The following parameters were examined : (1) The precipitable water, (2) The lifting condensation level, (3) An exponential constant $\beta$ fitted to describe the vertical variation of the mixing ratio of the water vapour, (4) Temperature, (5) East-west wind velocity ($u$), (6) Vertically averaged vertical gradient of the east-west velocity ($\overline{du}/dz$) (7) North-south wind velocity ($v$), (8) Vertical gradients of north-south velocity ($dv/dz$) and (9) The stability parameter. Also the climatological mean temperture and pressure fields were spectrally analysed to find out which wave numbers can create pressure anomalies of 1 mb or more just by phase shifts. We give briefly the results below.

The parameters (1), (2) and (3) described above do not show any appreciable contrast between a drought year (D.Y.) and a normal year (N.Y.). The temperatures at 700 mb were nearly 2°C colder in 1965 from January to May when compared with 1964. However in 1966 for the same period the air over India was warmer than in 1964. Thus even if one wants to interpret lower temperatures of 1965 as persistence of winter conditions resulting in bad monsoon, the 1966 result shows that the temperature, does not show any consistent behaviour in constrasting years. Thus it may have only a limited predictive value. Even the east-west component does not show any predictive value. But during the drought month of August the surface winds over northern India were consistently westerly in comparison to easterly winds in a normal year, like 1964. This result is well known to Indian meteorologists. The parameter ($\overline{du}/dz$) is positive over northern India during a D.Y. and negative during an N.Y. consistent with the above said result regarding $u$. However this too does not show any predictive value. Regarding the north-south velocity ($v$), except in May and June at 300-mb level no significant differences could be descerned between a D.Y. and N.Y. Both in 1964 and 1966 at 300-mb level no trough line was found over India as was found in 1964. Such changes can occur due to phase shifts. In the case of the parameter ($dv/dz$), except in a drought month like August, no significant differences were noticed. Even the stability parameter and the related parameters do not show any consistent variation in May and June between a D.Y. and an N.Y. The spectral analysis shows that only long waves (wave number $\leq 6$) can contribute 1 mb surface pressure changes by phase shifts. Even the monthly mean divergence and vorticity pattern were examined, though it was felt that they can be erroneous. They too showed no consistent differences.

Hence it is concluded that the study of the monthly mean dynamic and thermodynamic parameters over India is of little help to predict a drought, a month or more in advance. It is very doubtful whether an extension of this type of study to the global scale is of any use. The drought may be a transient dynamical phenomenon interlinked with the general circulation. One of the mechanisms envisaged is that the change in the general circulation introduces changes in the reverse Hadley cell, *via*, the large scale eddy fluxes. The results of Ramaswamy (1962) suggest this. At Present a programme to calculate the eddy fluxes during the monsoon seasons of 1964, 1965 and 1966, for about 12 stations covering the northern hemisphere along 80°E is taken up. The idea is to study the correlation between Indian rainfall with some of these eddy parameters and to compute the forced mean meridional circulation within the frame work of a model such as Kuo's (1956). Any suggestions regarding this line of study may kindly be communicated to the authors.

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