Indian, J. Met. Hydrol. Geophys. (1976), 27, 2, 201-208

Letters to the Editor

551.511.13 : 551.510.62 : 551.557(54)

ON OSCILLATIONS OF PERIOD AROUND ONE MONTH IN THE INDIAN SUMMER MONSOON*

1. While analysing the power spectra of zonal component of wind one of the authors (Keshavamurty 1971) noticed a peak around one month at Indian stations. As the data was only for one season much reliance could not be placed on this. Ananthakrishnan and Keshavamurty (1970) noticed large power in the periods longer than ten days in surface pressure and zonal wind at several stations. Wallace and Chang (1969) observed large power in longer periods in the zonal component of wind at many stations.

In this note, we report the results of power spectrum analysis of the zonal and meridional components of wind at Indian stations during a five-year period.

2. The data for the five monsoons 1965 and 1969 have been utilized. Power spectrum analysis of zonal and meridional components of wind at 850 mb for the stations Calcutta, New Delhi, Gauhati Nagpur, Visakhapatnam, Madras, Port Blair, Trivandrum and Minicoy have been made. In order to study the vertical structure, analysis have been carried out at all stations at standard levels (900, 850, 700, 500, 300 and 200 mb) for the data of Calcutta, New Delhi, Nagpur and Trivandrum. As the phenomenon we are investigating is characteristic of the season and as the characteristics of the monsoon are fairly different from those of the rest of the year, it was thought worthwhile to analyse the data of the monsoon season separately. However, as an experimental measure, the data of the five monsoon seasons have been combined and analysed as one time sequence. The authors know perfectly well this would introduce an artificial period of one monsoon season and phase shift after monsoon period.

This effect is partially removed by using a band pass filter centred around 30 days (Brier 1961). However, it was observed that individual raw spectra for different seasons are also statistically significant for 30-day period. But the low degrees of freedom for the single year's data prevents us to show the results in this report. In order to have more statistically significant results, the length of the data series was made artificially into a single sequence by combining four seasons. The length of the record in each case is $N = 610$. Different truncation points were tried for the analysis of the spectrum. Results with $M = 150$ days are reported here.

* Paper presented in the Symposium on 'Numerical Weather Prediction' held in New Delhi during 25-27 July 1973

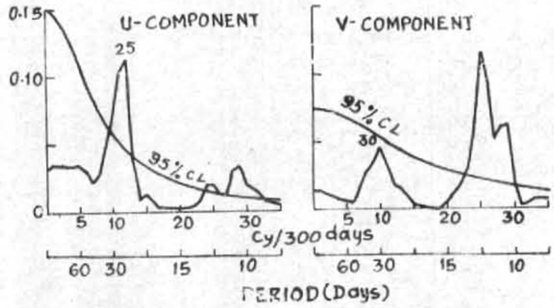

Fig. 1(a). Normalized power spectra for Delhi June-September 1965-69 at 850 mb, N=610; M=150 days

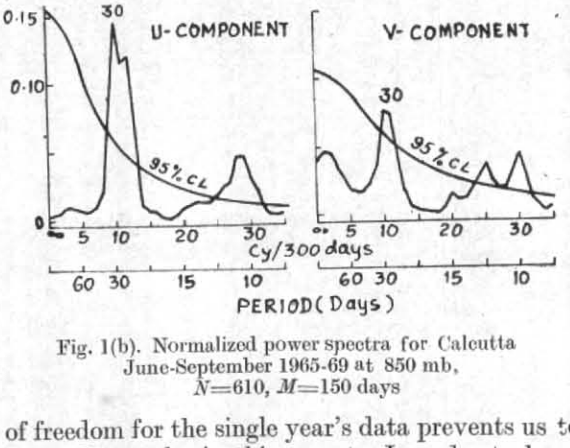

Fig. 1(b). Normalized power spectra for Calcutta June-September 1965-69 at 850 mb, N=610, M=150 days

3. Figs. 1(a)-1(d) show the power spectra of zonal and meridional components of wind at 850 mb at New Delhi, Calcutta, Madras and Port Blair. Power spectra for the other stations have not been presented here. It is seen that a dominant peak around a month is seen at most of the stations in the u-component. It is seen that the peak is more marked at stations over north India.

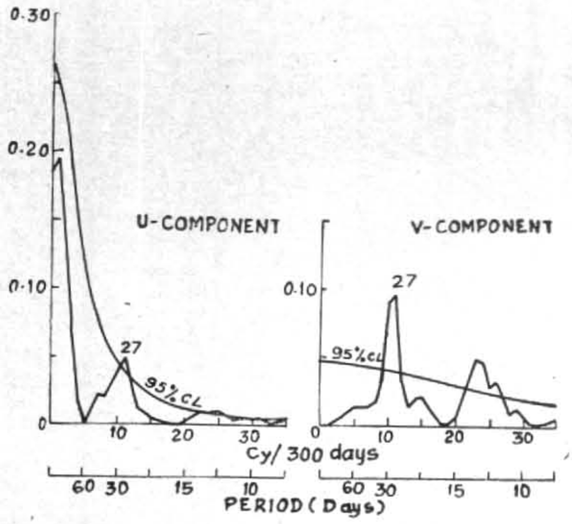

Fig. 1(c). Normalized power spectra for Madras, June-September 1956-69 at 850 mb.
N=610, M=150 days

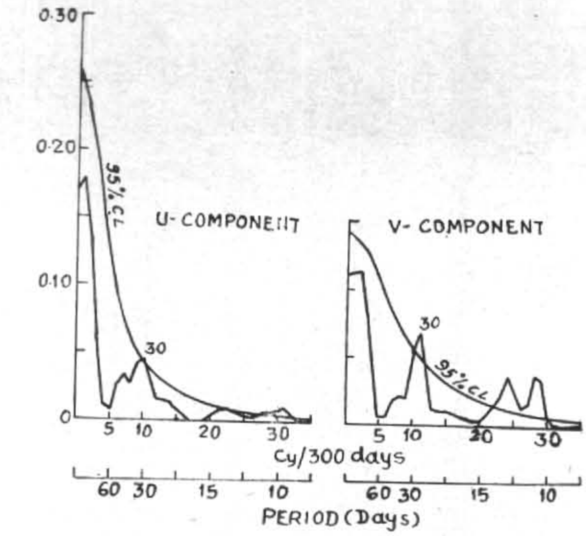

Fig. 1(d). Normalized power spectra for Port Blair June-September 1965-69 at 850 mb.
N=610, M=150 days

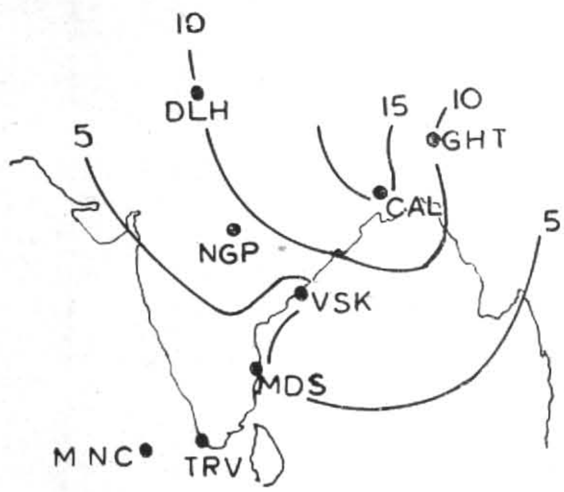

Fig. 2 Percentage of total variance corresponding to 30 days

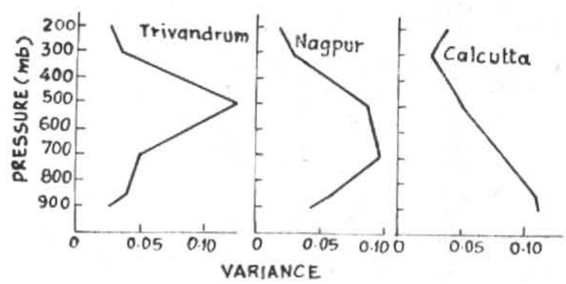

Fig. 3. Vertical profile of power spectral density of v-component

Fig. 2 shows the horizontal distribution of power-spectral density of u-component at around one month at 850 mb. Largest power is seen over north India in the vicinity of the monsoon trough. This would suggest that this oscillation of one month may be associated with the north-south oscillation of the monsoon trough.

Fig. 3 shows the vertical profile of power spectral density of u-component at Calcutta, Nagpur and Trivandrum. Maximum power is seen in the lowest levels at Calcutta, at 3 km, at Nagpur and at 6 km at Trivandrum. This is in conformity with the southward tilt of the monsoon trough with height.

It is seen (Fig. 1) that the one-month peak is noticed in the v-component at several stations and is statistically significant. This would lead us to believe that this oscillation may not be due to Kelvin waves (Wallace and Kousky 1968). Further work is under progress to understand the horizontal and vertical scale and nature of this oscillation.

It is also seen that there are marked peaks around 10-15 days in the *u* and *v* components at many stations. This period will be dealt with elsewhere.

4. The authors wish to express their grateful thanks to Dr. G.C. Asnani and Dr. R. Ananthakrishnan for stimulating discussions and Shri G. M. Pathan and M. B. Gajare for assistance.

Indian Institute of Tropical Meteorology, Poona J. DAKSHINAMURTI

Meteorological Office, Poona R. N. KESHAVAMURTY

29 November 1973

REFERENCES

Ananthakrishnan, R. and Keshavamurty, R. N. 1975 Proc. Symp. Trop. Met., Honolulu, Hawaii, 1970, pp. L III, 1-5.

Brier, G. W. 1961 *Annals of N. Y. Acad. Sci.*, **95**, pp. 173-181.

Keshavamurty, R. N. 1971 On the maintenance of mean monsoon circulation and the structure and energetics of monsoon disturbances, Ph. D. Thesis, Univ. Poona.

Wallace, J. M. and Chang, C. P. 1969 *J. atmos. Sci.* **26**, pp. 1010-1025.

Wallace, J. M. and Kousky, V. E. 1968 *Ibid.*, **25**, p. 900.