

SHORT CONTRIBUTION

A power spectrum analysis of the mean daily pressure over the Mediterranean and neighbourhood during November 1967 to April 1968

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(Manuscript received July 21; in final form November 8, 1976)

1. Introduction

Pressure oscillation having a periodicity of 4 to 6 days has been reported by many workers over different parts of the globe. Yanai et al. (1968) found a westward propagating wave with a 4- to 5-day period in certain regions of the tropics in the meridional component of the wind at lower tropospheric levels. Wallace & Chang (1969) found an easterly wave with a period of 4 to 5 days and also a 4-day period of planetary scale pressure fluctuation at the equator. Misra (1971) found a pressure oscillation of a 4- to 5-day period on a global scale. Misra (1972) also found a westward propagating planetary pressure wave of a 4- to 5-day period in the tropics. Madden & Julian (1972) also showed further evidence of a global 5-day pressure wave. Gupta (1972) showed a pressure oscillation having a 5-day periodicity over the region of the Siberian anticyclone.

In most of the above works periodicities have been derived by considering pressure values at a number of individual stations. But Gupta (1972) considered the mean daily pressure over a large area instead of pressures at a number of individual stations over a large area. This method has an advantage; since by considering pressures at a number of grid points derived from the analyzed charts, and then taking their means, it eliminates the local effects in the pressure values, at the same time mean daily pressure over a large area is obtained which may be considered as representative

of the mean pressure characteristic of that area. In this paper a similar study has been made for the area over the Mediterranean sea, bounded by latitude 30° to 50° N and longitude 0° to 40° E.

2. Data

In Fig. 1 is shown the region and the grid points over which the average daily pressure values have been obtained. In the present study the 12 GMT surface daily northern hemispherical analysis centre (NHAC) charts prepared at New Delhi are utilized for the period November 1, 1967, to April 30, 1968. For each day the pressure values at each of the 15 grid points as shown in Fig. 1 are read out from the NHAC charts. The mean of these 15

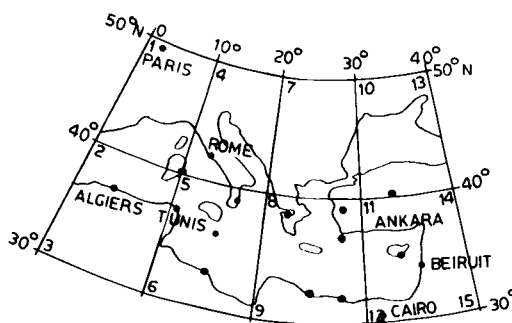


Fig. 1. The Mediterranean region and the 15 grid points over which the pressure values have been considered.

daily pressure values is considered to be the mean daily pressure over the Mediterranean area. Departures from the monthly mean pressures are obtained. Departures are also obtained from the three monthly means, viz. November 1967 to January 1968 and February 1968 to April 1968. A close study of these departures suggests approximately 4- to 6-day periodicities.

3. Power spectrum

The daily pressure values so derived are subjected to power spectrum analysis as given in WMO technical note No. 79 and also earlier used by Gupta (1972). The power spectrum has been computed separately for the two periods: (i) November 1, 1967, to January 31, 1968, for which

$n = 92$ and $m = 15$, (ii) February 1, 1968, to April 30, 1968, for which $n = 90$ and $m = 15$. Here n is the total period in days and m is the maximum lag. The smoothing of the spectral estimates have been done by the Hamming process. The null continuum and the 95% confidence limit of the null continuum have also been computed.

4. Results and conclusion

The power spectrum, the null continuum and the 95% limit of the null continuum of the above two groups are shown in Figs. 2 and 3 respectively. It is clearly seen from Figs. 2 and 3 that peaks at periods around 4 to 5 days are present and these peaks are significant as they are above the 95% confidence level. Thus it can safely be inferred that

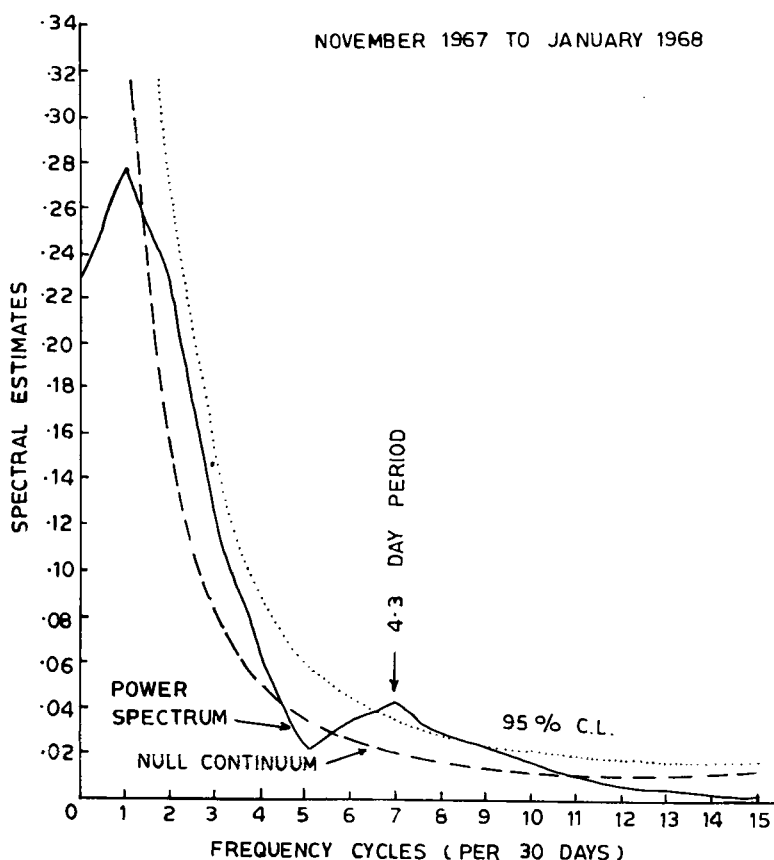


Fig. 2. Power spectrum of the mean daily pressure over the Mediterranean from November 1, 1967, to January 31, 1968.

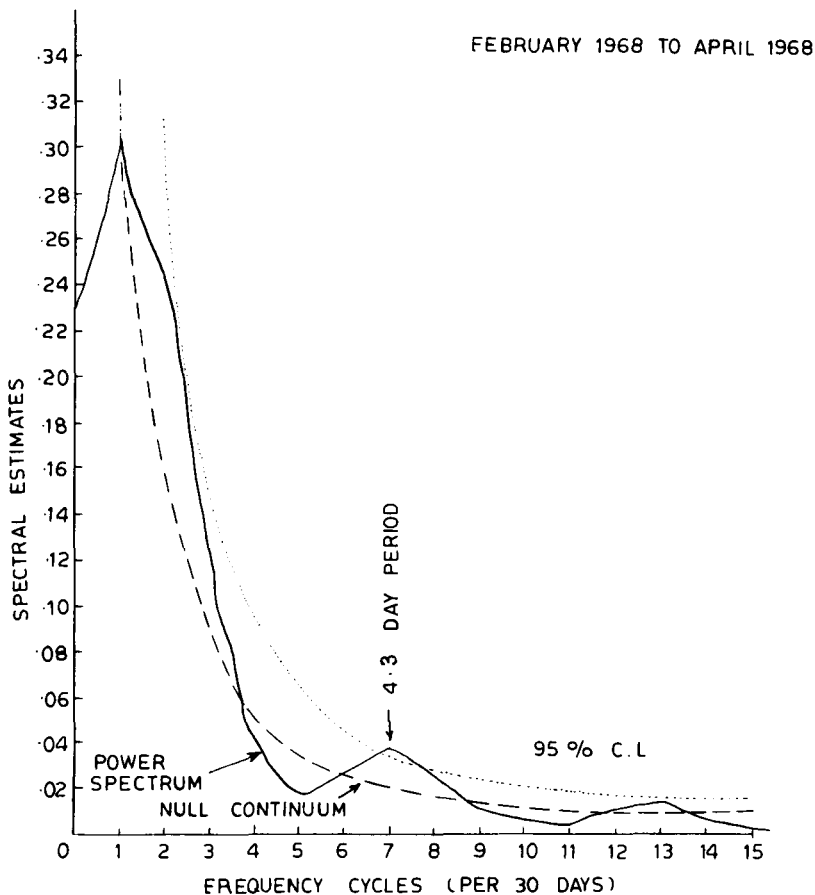


Fig. 3. Power spectrum of the mean daily pressure over the Mediterranean from February 1, 1968, to April 30, 1968.

the Mediterranean region has at least a pressure oscillation with a period of 4 to 5 days.

The present study thus reveals yet another region over the globe where 4- to 5-day periodicity in the pressure oscillation is present. This may be a part of the 4- to 6-day periodicity of the pressure oscillation over different parts of the world obtained by various investigators.

5. Acknowledgements

The authors express their sincere thanks to Professor H. S. Rathor, Head of the geophysics department, for encouragement, and the Indian Meteorological Department, New Delhi, for allowing them to consult NHAC charts.

REFERENCES

- Gupta, B. R. D. 1972. Periodicity in the average daily strength of Siberian anticyclone from November 1967 to April 1968. *Tellus* 24, 380–382.
- Madden, R. A. & Julian, P. R. 1972. Further evidence of global scale 5-day pressure waves. *J. Atmos. Sci.* 29, 1464–1469.
- Misra, B. M. 1971. A time series analysis of the global atmospheric pressure. *Proc. Int. Sym. on Probability and Statistics in Atmospheric Sciences*, Honolulu, Am. Met. Soc. Boston, pp. 41–46.
- Misra, B. M. 1972. Planetary pressure wave of 4- to 5-day period in the tropics. *Mon. Weather Rev.* 100, 313–316.
- Wallace, J. M. & Chang, C. P. 1969. Spectrum analysis of large-scale wave disturbances in the tropical lower tropospheres. *J. Atmos. Sci.* 26, 1010–1025.
- W.M.O. 1966. On climatic changes. Technical Note No. 79.
- Yanai, M., Nitta, T. & Hayashi, Y. 1968. Power spectra of large-scale disturbances over the tropical Pacific. *J. Meteor. Soc. Japan* 46, 308–323.