

## MEAN ZONAL WIND CIRCULATION OVER INDIA

In a recent paper, Mooley (1956) has computed the mean geostrophic zonal winds over India along longitude  $75^{\circ}\text{E}$  for summer and winter with the aid of radiosonde data for the period 1944-49. He found two wind maxima (Jet streams) in the upper troposphere—one at  $31^{\circ}\text{N}$  and the other at  $22\frac{1}{2}^{\circ}\text{N}$  at the 200 mb-level.

In support of the double maxima, Mooley has prepared a cross-section of 'observed' mean zonal winds. This has been constructed from pibal 'normals' based on data up to 1950. It is seen that the number of observations available for locating the maxima from these 'normals' were very scanty—10 at Ambala, 27 at Agra and 20 at latitude  $23^{\circ}\text{N}$  at 12 km. In the zone of weaker winds to the south there were naturally more observations, *e.g.*, 40 along latitude  $21^{\circ}\text{N}$  at 12 km. One would hardly expect these very few observations in the zone of strong winds to indicate the correct location of the mean wind

maxima with any degree of confidence, particularly since pibal ascents often fail to reach high levels on days of strong winds.

An examination of the 'observed wind' cross-section (Fig. 5 of Mooley's paper) indicates only a single wind maxima between 25° and 27°N below 10 km, where pibal data are more plentiful. It is only in the region of scanty data that three maxima are marked. It is very unlikely that three maxima should appear above 10 km, while there is no trace of them at lower levels. Fig. 6 of Mooley's paper which gives the frequency distribution of strong winds (speed  $\geq 70$  knots) at different levels from 6 to 12 km, however, clearly indicates the location of the wind maxima at about 26°N. It is, therefore, obvious that no confidence can be placed on the triple maxima indicated by the pibal 'normals' and that the most likely position of the mean jet is near 26°N.

The double maxima in the geostrophic wind cross-section has apparently resulted from consideration of the radiosonde data of Jodhpur, which according to experience are not very reliable. In a previous investigation by the author and others (Koteswaram, Raman and Parthasarathy 1953) it was found that the mean geopotential data of Jodhpur were also low and it was considered advisable to combine the data of three longitudinal sections in order to get a representative picture of the mean jet over India, in order to eliminate the spurious effects of individual stations like Jodhpur. A single wind maximum could be found approximately at 27°N which is in agreement with the broad indications of the pibal data mentioned in the previous paragraph.

Reliance on Jodhpur data has also led Mooley to another untenable conclusion regarding the wind circulation in summer. In Fig. 2 of his paper he has indicated mean westerly winds in the upper troposphere between 20° and 25°N with easterlies to the south and north of them. This would suggest a mean high level trough running east to west at 27°N and a ridge at 22°N. It is well-known that in summer, the sub-tropical

ridge in the upper troposphere lies over northern India and neighbourhood and as such, there is no possibility of a mean high level trough there, with westerlies to the south and easterlies to the north.

P. KOTESWARAM

*Meteorological Office,  
Calcutta  
July 17, 1956*

#### REFERENCES

- |   |      |  |
|---|------|--|
| Koteswaram, P.,<br>Raman, C.R.V. and<br>Parthasarathy, S. | 1953 | <i>Indian J. Met.<br/>Geophys.</i> , <b>4</b> , 2, p. 111. |
| Mooley, D.A.  | 1956 | <i>Ibid.</i> , <b>7</b> , 2, p. 113.                       |