3.2.1 PROPAGATING TIDES IN THE MESOSPHERE

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A preliminary search has begun for evidence of tides in the 1-hr average line-of-sight mesospheric velocity data from the Urbana radar in the period 1978-1982, inclusive. Since the Urbana antenna has only a single pointing direction, 1.6 deg away from vertical toward the southeast, observations are restricted to the southeasterly component of those velocities. Since observations are only available for a fraction of a day due to the absence of nighttime ionization in the Urbana mesosphere, it was decided to adopt an unusual procedure in the search; namely, to perform a Fourier analysis in the vertical direction and look for rotation in phase of vectors representing spatial frequency components. Propagating tidal modes would then show as vectors with a net rotation corresponding to their downward phase velocity.

Figures 1 and 2 show 5-year monthly averages of hourly mean horizontal velocities inferred from the Urbana data. Consistent diurnal variation is seen for a number of months. These data were analyzed for vertical spatial periods of 3, 4.5, 6, 9, 12, and 24 km. When plotted as a function of time of day, many of the phasors tended to show a net rotation; for example, Figures 3 and 4 show data for January and June at a period of 24 km.

The sense of rotation of a spinning vector in the complex plane can be determined objectively by computing the signed area swept out by the vector in moving from point to point. This calculation, performed on two separate components, indicated downward motion in 8 out of 12 months for the 9-km component and in 11 out of 12 months for the 24-km component. A comparison of the magnitudes of the 6 modes showed that the primary component was the 24-km component, a result confirmed by the tidal models of Forbes.

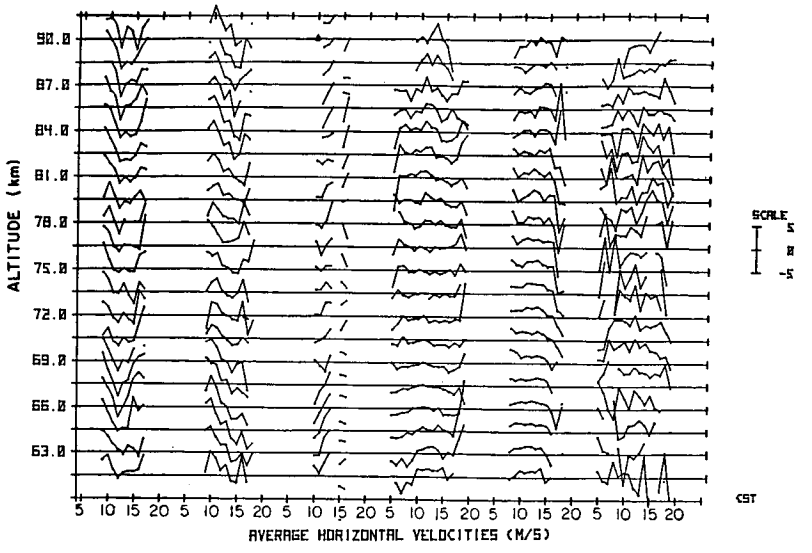

Figure 1. Average northwesterly horizontal velocity for the months January through June (1979 - 1982 average).

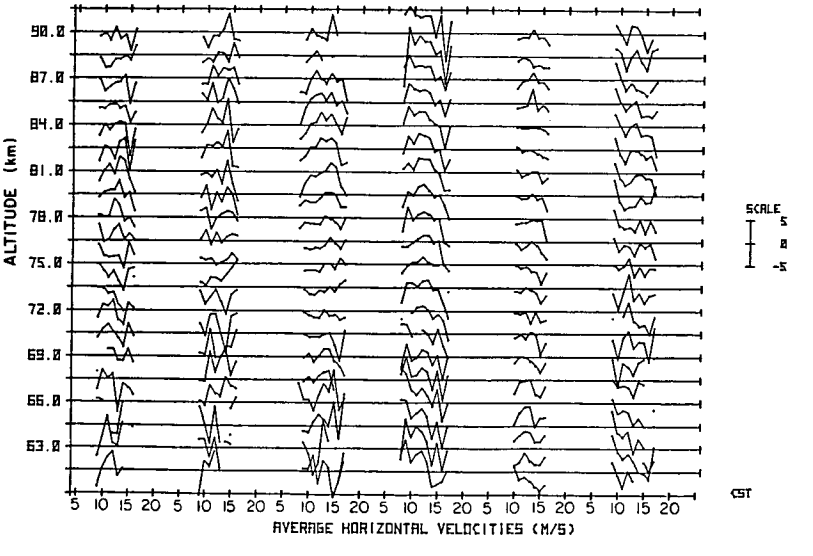

Figure 2. Average northwesterly horizontal velocity for the months July through December (1979 - 1982 average).

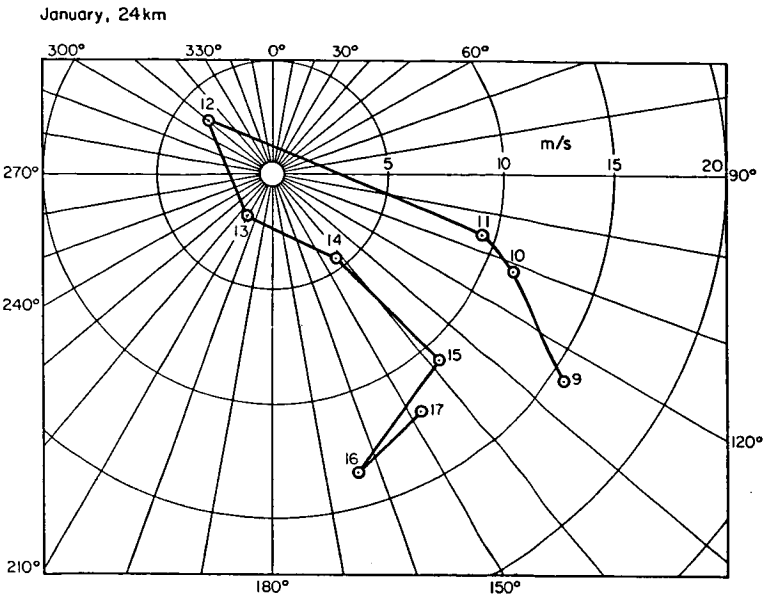

Figure 3. Phasor for the 24-km vertical wavelength in the hourly mean northwesterly horizontal velocity, for 09 through 17 local time, January 1979 - 1982.

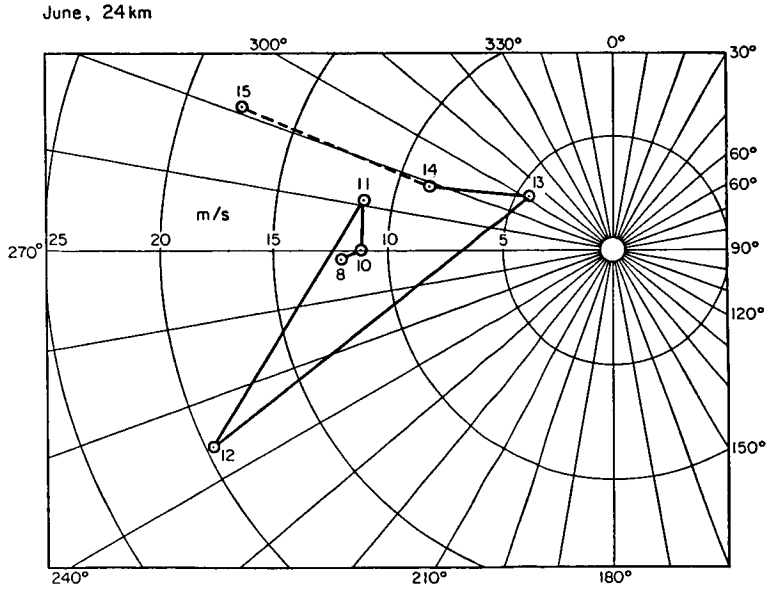

Figure 4. Same as Figure 3, but for 08 through 15 local time, June 1979 - 1982.