Correlation Analysis of the Westward-Propagating Semidiurnal Tide with Wave Number One at the South Pole and Planetary Waves with Wave Number One in the Opposite Hemisphere

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Theoretical studies have elucidated that the only components of the semidiurnal tide that can be observed above the geographical poles have wave number zero (for scalar parameters like temperature and pressure) and wave number one (for vector parameters like wind). Experimental studies have corroborated those conclusions. Analyses of wind data have also shown that this westward-propagating component of the semidiurnal tide reaches its maximum amplitude during the summer months and disappears in the winter, that it exhibits significant amplitude variability during the summer, and the amplitude is as large as that of the migrating component at middle latitudes.

One hypothesis formulated to explain the source and behavior of the westward-propagating component of the semidiurnal tide with wave number one is the nonlinear interaction of a stationary planetary wave with wave number one and the migrating semidiurnal tide (wave number two). Modeling studies using the Middle Atmosphere Circulation Model at Kyushu University have strengthen this hypothesis and determined that the nonlinear interaction occurs in the winter stratosphere and the resulting wave propagates into the summer hemisphere.

Measurements of the meridional wind semidiurnal tide amplitudes in the mesosphere and lower thermosphere above the South Pole are available from a meteor radar that operates at the Amundsen-Scott South Pole station. Measurements of amplitudes of planetary wave parameters with wave number one are available from the SABER satellite instrument. In this study we correlate these observations to study the link between these two atmospheric oscillations and also determine time and vertical propagation information.