

Characteristics of Short Period Tidal Components in Antarctic MLT above Syowa and Davis

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The behaviour of short period atmospheric tidal components in the Antarctic mesosphere and lower thermosphere is studied based on long term observations over Syowa (69.0S, 39.6E) and Davis (68.6S, 78.0E) stations. Semidiurnal tides in the Antarctic mesosphere and lower thermosphere have been extensively studied through the recently established Antarctic radar network [e.g., Murphy et al., 2006; 2008]. However, details of shorter period components such as terdiurnal and six-hour tides are less investigated and poorly known because of their smaller amplitudes compared to the semidiurnal and diurnal tides in the height region of conventional MF radar observations of around 70-90 km. These short period tides also fall in the frequency range of inertial gravity waves and are often hard to distinguish from these waves.

The characteristics of the terdiurnal tide above Davis and Syowa have been measured on a short-term to seasonal basis in the mesosphere and lower thermosphere using long-term simultaneous MF radar data at the two sites (1999-). The terdiurnal tide achieves moderate amplitudes in the winter at these heights but there are subtle differences between the two stations. These differences are explored further by differencing tide phasors in local time and checking the amplitude of the result on a seasonal basis. If the terdiurnal tide was made up entirely of migrating components, this difference would yield a zero-average amplitude. However, the observed non-zero values suggest that the terdiurnal tide at these latitudes contains strong non-migrating tidal components.

The Syowa MF radar has a great advantage over other MF radars in that it has been conducting simultaneous meteor wind measurements together with the conventional correlation based measurements, which enables wind observations in a very wide height range of 65-120km [Tsutsumi and Aso, 2005]. A clear enhancement in terdiurnal amplitudes is seen in early winter months of March-June. The amplitudes can reach 20 m/s around 110 km even in the composite plot made with more than 10 years of data. These amplitudes can be comparable or sometimes even larger than those of diurnal and semidiurnal tides, and indicate a possible significant role of short period tidal components in the polar lower thermosphere.

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