# 南極昭和基地およびDavis基地で観測された中間圏下部熱圏8時間周期潮汐波

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# Characteristics of the Terdiurnal tide in the MLT above Davis and Syowa

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The behaviour of terdiunal (eight hour) atmospheric tidal components in the Antarctic mesosphere and lower thermosphere is studied based on long term observations over Syowa (69.0°S, 39.6°E) and Davis (68.6°S, 78.0°E) 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 be distinguished from these waves.

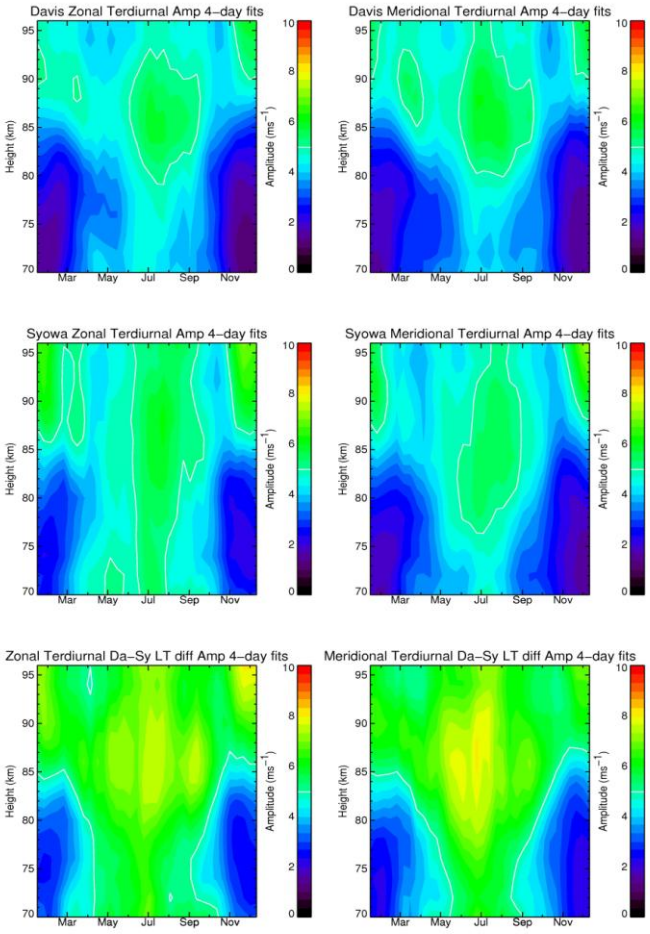
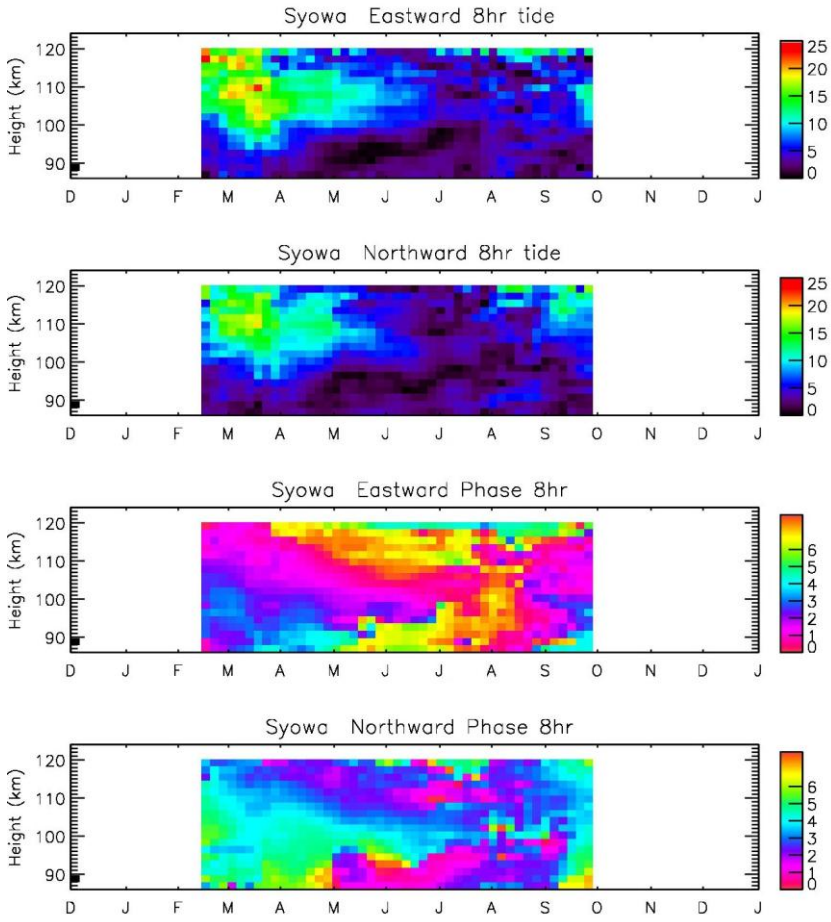



Figure 1.　Seasonal characteristics of the terdiurnal tide in the MLT region.

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 MF radars. The seasonal characteristics presented in Figure 1 are compiled from 4-day fits to the tide at each station over the interval 1999 to 2010, which are then averaged into a single year with a 30-day sliding window. The upper four panels show that the tide achieves moderate amplitudes in the winter at these heights but that there are subtle differences between the two stations. These differences are explored further in the lower panels where tide phasors are differenced in local time and the amplitude of the result is plotted on a seasonal basis. If the terdiurnal tide was made up entirely of migrating components, this difference would yield a zero-average amplitude. In the absence of contaminating inertial gravity waves, the observed non-zero values suggest that the terdiurnal tide at these latitudes contains strong non-migrating tidal components.

The consequences of the potentially non-migrating nature of the terdiurnal tide are explored in a number of ways. The phase variations of the tide, as measured at a single station, can attenuate the amplitude of the fitted tide when the fit window is too long. As a result, the amplitude of the terdiurnal tide can be underestimated. This is investigated, along with the potential for contamination by inertial period waves, through comparisons of tidal character for various fit window lengths.

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]. Seasonal behavior of terdiurnal tide above 90 km based on the meteor observations is shown in Figure 2, which is synthesized in a similar manner to Figure 1 except the fitting widow is 30-day long due to the limited number of meteor echoes. A clear enhancement in 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 (not shown), and indicate a possible significant role of short period tidal components in the polar E-region.

Figure 2. Seasonal characteristics of the terdiurnal tide over Syowa in the lower E-region obtained with MF radar meteor echo observations.

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