Characteristics of quasi 2-day wave and atmospheric tide observed at Tromsoe and Poker-Flat (2)

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In order to understand the upward propagating waves quantitatively, we have investigated characteristics of quasi 2-day (Q2DW) and atmospheric tidal wave 24 hrs, 12hrs) in the polar mesosphere between 70 and 91 km, using the wind data obtained with two MF radars located at high latitudes such as the Tromsoe MF radar (69.58 deg N, 19.22 deg E) and the Poker Flat MF radar (65.1 deg N, 147.5 deg W), Alaska.

We have assembled four-year wind data obtained from November 1998 to November 2002, and derived amplitudes and phases of Q2DW and diurnal and semidiurnal tides using Lomb-Scargle period gram method. Mean winds were also computed as well. In the last talk (September, 2002, SGEPPS), we reported the characteristics of the quasi 2-day wave observed at Tromsoe and Porker-Flat, and suggested that Q2DW observed in the polar mesosphere have features more consistent with the Rossby-gravity wave mode as suggested by Salby [1981] than due to an instability, but the amplitude and phase of Q2DW are affected significantly by local sources.

We have also examined characteristics of atmospheric tides (diurnal tide and semidiurnal tide) observed at the two sites. The result as follows:

(1) In terms of the amplitude of the diurnal tide, it is stronger in summer and weaker in winter at 70, 76 km in the both sites, while the amplitude is stronger in summer than in winter at 88 km. In addition to the seasonal variation, the amplitude has a short-time variation between 70 and 90 km. Compared with the amplitude of the two sites at 76, 82, 88 km, the ratio of the amplitude of the diurnal tide varies between 0.5 and 2.0 in most cases, and there is no significant preference towards either site. However, in summer at 70 km the amplitude of the diurnal tide observed at poker-flat appeared to be stronger than that at Tromsoe every year.

(2) The amplitude of the semidiurnal tide is stronger in winter than in summer at 70, 76 km, while it has the maximum in the autumnal equinox at 82, 88 km. The ratio of the amplitude of the semidiurnal tide also varies mainly between 0.5 and 2.0, and there is no significant preference between 70 and 90 km. These results suggest the atmospheric tides observed in the both sites have features of the global-scale mode, but they are affected by the local forcing, implying an existence of the interaction between the atmospheric tides and Q2DW.

In this talk, firstly we will show these results, and secondly discuss the interaction between Q2DW and atmospheric tides (diurnal tide and semidiurnal tide). Thirdly, we will show the temporal variations of the amplitude and phase of the 16-hrs oscillation and 9.6- hrs oscillation as well as those altitude profiles. Finally, we will discuss relationships between the Q2DW (or the atmospheric tide) and these oscillations.

(Reference)

Salby, M. L., The 2-day wave in the middle atmosphere: Observations and theory, J. Geophys. Res., 86, 9654-9660, 1981.