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Tidal periodicity of mesospheric gravity waves observed with MF radar at Poker Flat, Alaska and at Tromso, Norway

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The interaction between gravity waves and tidal waves has been studied by using observations, although the phase relation between them was not fully understood (e.g., Saskatoon, Canada (Manson et al. 1998), Rothera, Antarctica (Beldon and Mitchell, 2010)). The neutral wind velocity data from mesosphere to lower thermosphere observed by MF radars at Poker Flat in Alaska and Tromso in Norway has been observed since the late 1990s. The long-term wind velocity data at Poker Flat and Tromso was analyzed for 10 years of 1999 ? 2008 to show daily and seasonal behaviors and climatology of mesospheric gravity waves and horizontal wind of the 12 and 24 hour components. First, we extracted these waves from the MF radar observation data. In this study, harmonic analysis was carried out for periods of 48, 24, 12, and 8 hours, which are extracted from the 5 day time series of wind velocity using. Gravity waves are defined as the 1 ˜12 hour period component of difference between observed wind velocity and these harmonic components. The method is applied to 30-minute-average data to calculate the 5 day running mean amplitude and phase of zonal wind of the 12 and 24 hour components. We made 1- day composite plots of kinetic energy of gravity waves for periods of 1 ˜4 hours and harmonic components. The results show that the kinetic energy of gravity waves in Tromso has a peak in 6UT from November to February which tends to coincide with the time when zonal wind of 24 hour component is easterly maximum and easterly wind of 12 hour components is switched westerly. This feature is different from results in Poker Flat and Saskatoon. On the other hand, the phase relation between 12 hour components of zonal wind and kinetic energy of gravity waves shows that their phase agrees for more than 10 days in several years in both observation points. We confirmed the phase agreement in Tromso continued about 10 days at the same time when that in Poker Flat is continued more than 20 days from November to December in 2000. However, the phase of gravity wave kinetic energy is shifted 90 degrees between Tromso and Poker Flat. We plan to discuss more detail of underlying physical processes, focusing on migrating and non-migrating tidal waves and background state of horizontal wind velocities.