Study of 8 hr and 6 hr atmospheric waves in the polar upper mesosphere and lower thermosphere by using sodium LIDAR data

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Characteristics of 8 hr and 6 hr atmospheric waves in the polar upper Mesosphere and Lower Thermosphere (MLT) region over 7 years between 2012 and 2019 will be presented. Wind velocity and temperature data obtained by the solid state sodium lidar located at Tromsoe (69.6 deg N, 19.2 deg E), Norway have been used to analyze these waves. Short periodic tidal waves are poorly known in comparison with 12 hr and 24 hr tidal waves even though an amplitude of the 8 hr tide becomes sometimes comparable to that of 24 hr tidal wave in the polar MLT region [Thayaparan, 1997; Younger et al., 2002]. Previous studies based on observations [Thayaparan, 1997; Akmaev, 2001; Younger et al., 2002; Moudden et al., 2013] and a model [Smith, 2001] indicated that solar heating and nonlinear interactions of 12 hr and 24 hr tides can be considered to generate the 8 h tide. Moudden and Forbes [2013] using TIMED/SABER observations showed that the 8 hr tide achieved maximum amplitudes of order of 5 K (10 K) at 90 km (110 km) at the equatorial region. Pancheva et al. [2021] using wind data by meteor radar at Tromsoe over 16 years (2003-2018) showed that, in general, the 8 hr and 6 hr tides had inter annual variability with a quasi-2-year-period, and vertical upward propagating of these waves had different wavelength according to season.

By utilizing both temperature and wind velocity data, we have investigated the characteristics of 8 hr and 6 hr atmospheric waves between 80 and 105 km in terms of altitude variations and day-to-day variations above Tromsoe. We have analyzed the data of about 1400 hours (85 nights) for 8 hr wave, and about 1700 hours (138 nights) for 6 hr wave. We will report relationships between these waves and the 12 hr wave in order to discuss generations of these waves, and possible contributions to a temperature structure and atmospheric static and dynamic instabilities between 80 and 105 km. These results are expected to help better understanding of roles of 8 hr and 6 hr waves in the polar MLT region.

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