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VARIATONS OF TEMPERATURE AND WINDS IN THE MESOSPHERE AND LOWER THERMOSPHERE ABOVE TROMSOE

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Based on sodium LIDAR observations together with other observations (EISCAT, meteor, and MF radars) conducted at Tromsoe, Norway (69.6N, 19.2E), we will present results of the following two topics: (1) variations of tides and gravity waves in the upper mesosphere and lower thermosphere, and (2) comparison of the ion and neutral temperature in the lower thermosphere.

A sodium LIDAR installed at Ramjordmoen, Tromsoe, Norway has been operated for 4 winter seasons (i.e., October – March) since 2010. We started LIDAR observations for the 5th season in October 2014. The sodium LIDAR is able to measure not only temperature and sodium density, but also wind velocity between approximately 80 and 110 km (since 2012). Because the sodium LIDAR is equipped with five sets of telescopes/receivers, it can measure simultaneously those parameters with five different directions: usually, vertical, north, south, east and west. At now, we have obtained about 2300 hours of neutral temperature data and sodium density data, as well as about 1200 hours of neutral wind data. Using the LIDAR data, we have investigated variations of temperature, wind, and sodium density, and have studied gravity waves (GWs), horizontal temperature structure, tides, sporadic sodium layer (SSL), and Joule heating effect at high latitudes.

Signatures of GWs and tides are often clearly seen in the temperature data as well as the velocity data. Altitude profiles of amplitudes and phases of waves are used to investigate their upward propagation and dissipation. Most GWs are usually dissipated around the mesopause region due to wave breaking and instabilities, but they propagate upwards through the mesopause into the lower thermosphere on some occasions. By using temperature data and wind data, we have investigated stabilities of the atmosphere as well as instabilities generated by GWs.

At high latitudes, the lower thermosphere is strongly influenced by energy input from the magnetosphere, consequently temperature and winds vary significantly. By using simultaneous observations of the EISCAT UHF radar and the sodium LIDAR, we have compared the ion and neutral temperatures between 100 and 110 km in height for about 25 nights to evaluate the effect of the Joule heating.

Furthermore, we will talk about our future plan to study the effect of aurora precipitation particles into the mesosphere and stratosphere.