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トロムソにおけるナトリウムライダーを中心に用いた上部中間圏・下部熱圏変動の研究
Study of the upper mesosphere and the lower thermosphere by using the sodium LIDAR at Tromsoe

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We will overview latest results obtained with the sodium LIDAR at Tromsoe (69.6N, 19.2E) in northern Scandinavia. The sodium LIDAR at Tromsoe has been operated since October 2010 for five winter seasons (October-March). About 2800 hours of neutral temperature and sodium density data, and about 1800 hours of wind data between 80 and 110 km are obtained. By utilizing the datasets, we have studied several phenomena occurring in the polar upper mesosphere/lower thermosphere. We will present results about (1) altitude variations of the semidiurnal tide, (2) sporadic sodium layer, (3) response of the upper mesosphere/lower thermosphere to sudden stratospheric warmings (SSW), (4) comparison of the neutral temperature and the ion temperature, and (5) probablity of instabilities.

We have investigated altitude variations of the semidiurnal tide using wind and temperature data, whose temporal length is longer than or equal to 12 hours, obtained by the sodium LIDAR for 62 nights. There appear two typical altitude profiles of the amplitude. We will discuss its causes. Sporadic sodium layer (SSL) is a thin (about 1 km) and dense sodium layer in the normal sodium layer with a wide horizontal extent (typically, about 300 km or so). The generation mechanisms are not well understood, in particular, in the polar upper mesosphere. We have made a case study, and will present the results. Sudden Stratospheric Warming (SSW) is a large disturbance phenomenon occurring in the stratosphere in winter due to breaking of planetary waves. We have analyzed variations of the temperature and wind above Tromsoe during the 2012 SSW interval using sodium LIDAR data, meteor radar data, and EISCAT radar data in the upper stratosphere, mesosphere, and lower thermosphere. We will present those results and discuss differences of timing of the changes at different altitudes. Over five winter observational seasons between 2010 and 2015, simultaneous observations of the sodium LIDAR and the EISCAT UHF radar at altitudes between 100 and 110 km were conducted for 43 nights (about 250 hours). We have compared the neutral temperature obtained by the sodium LIDAR with the ion temperature by the EISCAT UHF radar between 100 and 110 km. We will present the comparison results and also discuss contributions of the Joule heating. By using temperature and wind data, we have investigated probability of the convective and dynamical instabilities in the polar upper mesosphere and lower thermosphere. We will present the results and compare them with published results at middle latitudes. We will also discuss expected improvements by the EISCAT_3D to these kinds of researches.

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