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Measurements by a sodium lidar at Tromsoe, Norway

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Of vital importance is to qualify significance of the magnetospheric energy input to the upper atmosphere in the polar region, in order to obtain better understanding of the energy process from the Sun to the Earth. Many observations by Incoherent Scatter (IS) radars and Fabry-Perot Interferometers (FPIs) demonstrated neutral wind variations in the polar lower thermosphere during geomagnetically active intervals. These results suggest that the neutral wind dynamics is influenced by the thermal (due to Joule and particle heating) and/or kinetic (due to ion drag) energy input from the magnetosphere. A case study, which is based on IS radar data, determined contributions of the Joule heating and the ion drag on an observed neutral wind variation, and intended that the Joule heating was a major important factor. However, there was no observational evidence of the expected temperature increase due to the Joule heating. To detect the temperature increase, it is worthwhile to conduct simultaneous observations by a sodium temperature lidar as well as an IS radar.

Since 2007, we have developed a new sodium lidar and prepared to install this lidar at Tromsoe, European Incoherent SCATter (EISCAT) radar site (69.6 deg N, 19.2 deg E). The lidar system has now been nearly completed. Using the lidar, we performed test observations in November and December 2009 at Wako, RIKEN (35.8 deg N, 139.6 deg E), and detected backscatter signals from the sodium layers (80-100 km in height). The lidar will be ready for operation at Tromsoe in February 2010. In this presentation, we will briefly introduce the new sodium lidar system, and then present results of the test observations at Wako. Furthermore, we will report first measurements by the lidar in February-March 2010, and discuss accuracy of the obtained temperature data.

Keywords: Sodium lidar, Tromsoe, EISCAT