OH Airglow in the Auroral Zone

Makoto Taguchi[1]; Hidehiko Suzuki[2]; Yasunobu Ogawa[1]; Takehiko Aso[1]; Satonori Nozawa[3]

[1] NIPR; [2] Earth and Planetary Sci., Tokyo Univ; [3] STEL, Nagoya Univ

A simultaneous observation of the OH airglow by a spectrometer and the ionosphere by the EISCAT radar was conducted in order to find an evidence of an auroral particle effect to the mesopause region. The spectrometer is equipped with three gratings with different blaze wavelengths and groove frequencies and two detectors CCD and InGaAs covering a wide spectral range of 300 to 1500 nm. The spectral resolution is about 0.2 nm, which is high enough to resolve adjacent lines in an OH vibration-rotation band. Using this spectrometer intensity and rotational temperature of a OH vibration-rotation band are obtained.

The spectrometer and a digital camera for weather and aurora monitoring were installed in a building of University of Tromsoe which is located in the EISCAT radar site in the late October, 2006. The field-of-view of the spectrometer was set to the magnetic zenith to measure a total column intensity of an auroral emission along the magnetic field line. As a result of initial survey observations by the spectrometer the OH8-4 band was selected as the most suitable one from a number of OH vibration-rotation bands, because it is found that the emission lines in the OH8-4 band are less contaminated by auroral emissions. Rotational temperature is derived from intensities of the $2P_1$, $3P_1$ and $5P_1$ lines in this band.

The EISCAT radar observation was performed on December 11 and 12, 2006, while the spectrometer was continuously running in a fixed wavelength mode. The exposure time of the spectrometer was 5 min. The weather condition was mostly fine except for some thin cloud passing in the early night of December 11. Active auroras appeared several times during this observation period. Especially the electron density at an altitude of 92 km strongly increased during the time periods from 22:21 to 22:45 UT on December 11, from 16:53 to 17:05 UT and from 20:13 to 20:41 UT on December 12, and intense auroral emissions were observed during these periods. However, the intensity and rotational temperature of OH airglow show no clear relation with the variations in the auroral emission intensity of $N_2{}^+$ Meinel band and the electron density in the lower thermosphere.

This result does not completely deny existence of the auroral effect to the mesopause region, because the spectrometer does not have time resolution enough to detect a theoretically predicted rapid response in intensity and rotational temperature of the OH airglow to precipitation of high-energy auroral particles. It is concluded that a more sensitive and faster spectrometer is required for this purpose. We are preparing such a new device with a throughput ten times larger than the current spectrometer for a long term observation of the specific OH airglow band at Syowa Station in Antarctica.