

Initial results of OH airglow observation at Syowa Station in Antarctica

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The OH Meinel band emissions are the brightest night airglow emissions in the near infrared regions, and peak in the altitudes of mesopause. Since the intensity distribution in these vibration-rotation bands is quickly equalized to that determined by local kinetic temperature, OH rotational temperature can be derived from the spectrum of OH airglow. This technique has been widely used as a conventional and reliable method of temperature measurement in the mesopause region, especially in the middle and low latitude regions. However, it has been regarded that this method is not valid in the polar regions, because auroral emissions contaminate OH airglow spectra. There are only few examples of OH rotational temperatures derived in the Antarctica using spatially or temporally selected spectra free from auroral emissions.

Syowa Station has become a comprehensive observation site of the upper atmosphere in Antarctica with a suite of remote sensing instruments that include HF radars, a MF radar, all-sky imagers, a scanning photometer, a Fabry-Perot imager (currently not in operation), VLF and ULF receivers, an imaging riometer and an ionosonde. In addition OH rotational temperature measurements have been introduced at Syowa Station in Antarctica in order to study the dynamics in the polar mesopause region and its relation with auroral activities. Firstly as a result of survey observations in the Arctic an OH (8-4) band was selected as the most suitable vibration-rotation band for observation in the polar region. Then a new spectrograph has been developed consisting of a fast optical system, a transmission grating and a CCD camera. The operating spectral region just fits the OH (8-4) band (900-990 [nm]) and a moderate spectral resolution (0.27 [nm]) is realized. A back-illuminated CCD with an infrared enhanced QE is used as an imaging device.

Sensitivity and spectral resolution of the spectrograph have been calibrated at NIPR. The instrument was installed in the Optical Building at Syowa Station in February, 2008 by the 49th Japanese Antarctic Research Expedition. The instrumental field-of-view (4.5x0.007 [deg]) is fixed at the local magnetic zenith. Nominal exposure time is 1 minute. The instrument has been operated automatically without any trouble as expected. Initial results of OH airglow spectra and rotation temperatures derived from the spectrograph data show variations associated with gravity waves. In the presentation polar upper atmosphere studies to be promoted by simultaneous observations by the OH airglow spectrograph and the other instruments including the proposed Antarctic Syowa MST/IS radar will be discussed.