A new millimeter-wave spectrometer in Tromsø, Norway for coordinated observations with Syowa

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Energetic particle precipitations (EPPs) related to solar activity induce changes of chemical composition around mesosphere and lower thermosphere in the polar regions. We have been carrying out ground-based millimeter-wave monitoring of nitric oxide (NO) emission at 250.796 GHz and ozone at 235.709 GHz since January 2012 at Syowa Station and revealed so far that NO partial column density in upper mesosphere and lower thermosphere above Syowa shows two types of temporal variations; one is seasonal variation increasing in polar winter mainly due to photochemistry, and the other is short-term (several days) sporadic enhancement related to EPPs (Isono et al. JGR, 2014). However, during the midnight sun period, the photo-dissociation and EPP induced ionization/dissociation occur simultaneously, and this makes difficult to distinguish and evaluate the pure contribution of the EPP effects on the chemical composition change. Thus, we planned to implement coordinated observations from both the polar regions and installed a new millimeter-wave spectrometer at the EISCAT Tromsø facility in Norway. The basic feature of the millimeter-wave spectrometer is almost the same as the one operating at Syowa, i.e., equipped with a low-noise superconductive SIS receiver and a digital FFT data processor. Though the instrument is not yet fully operational at present, we succeeded detecting a clear ozone spectrum of S/N ~ 12 with 30-second integration as a result of test observation. In near future, the SIS receiver will be upgraded to multi-frequency SIS receiver system that enables us to observer several molecular lines simultaneously.
In this presentation, we will present the summary of the observational results at Antarctic Syowa, current status of the instruments in Arctic Tromsø, and future plan of the research.

Keywords: Polar Region, Energetic Particle Precipitation, Millimeter-wave Spectroscopy

