

A plan of new millimeter-wave observations of atmospheric molecules from stratosphere to lower-thermosphere at Tromsø

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Minor constituents in the middle atmosphere play important roles in the radiation energy transfer and photo-chemistry. Energetic particle precipitation (EPP) onto the middle atmosphere triggers the ion-molecular reactions resulting in the enhancement of NO_x and HO_x and depletion of ozone in the polar regions. In order to study such EPP effects on the atmospheric composition observationally, we installed a millimeter-wave spectroscopic radiometer at Syowa Station in the 52th Japan Antarctic Research Expedition (JARE52) and have carried out monitoring of NO since January 2012 with the space and upper atmospheric science group in National Institute of Polar Research, NIPR. As a result of the monitoring, we have found that NO column density shows seasonal variation increasing in the polar night periods and short-term variation (enhancement) within a few days. We revealed that the photo-dissociation and total amount of precipitating electrons play major role for the seasonal variation and that the short-term enhancements are caused by energetic electron from the radiation belt precipitated due to the geo-magnetic storms.

In order to study these phenomena in detail, we plan to install a new millimeter-wave radiometer at the EISCAT site in Tromsø, Norway. In collaboration with the preexistent instruments, such as EISCAT radar, meteor radar, sodium lidar, aurora imager, we can more precisely assess the environmental chemical and dynamical condition where the NO column density changes due to the energetic particle precipitation. We will present the plan in more detail and discuss the aim of this project in this presentation.

Keywords: millimeter-wave spectroscopy, polar atmosphere, stratosphere, mesosphere, lower thermosphere