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Four years measurements of the mesospheric nitric oxide (NO) and ozone with a ground-based millimeter-wave spectral radiometer at Syowa station, Antarctica

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The mesospheric chemical composition largely varies caused by environmental changes of the earth inside and outside. Recent studies reported enhancement of NO_x and HO_x and ozone depletion in the polar mesospheric region caused by precipitating the energetic particles such as a solar proton and an electron in the radiation belt (e.g., Andersson et al. 2014). The ISEE and NIPR started a joint research project on monitoring the composition changes in the mesosphere and lower thermosphere (MLT) region by using a ground-based millimeter-wave spectral radiometer equipped with a high-sensitivity superconducting (SIS) mixer receiver operated in 230-250 GHz band at Syowa station in Antarctica (69˚S, 40˚E). Since January 2012, we have been measuring the emission spectra of nitric oxide (NO) at 250.796 GHz and ozone at 239.093 GHz, respectively, and the partial column amount of NO ranging from 75 to 100 km in altitude and vertical profile of ozone in stratosphere and mesosphere are retrieved from the observed spectra integrated every day. From the dataset in more than 4 years, we find that the NO column amount in MLT region shows the maximum in winter except for the case in 2014 that the peak value is about a half of those in other years. In addition to the seasonal variations, we find several events of sporadic enhancement of the NO column amount during a few weeks. Comparison with a flux of high energy electrons indicates that may be associated with solar activity.

In the presentation, we report the features of temporal variations of the observed NO column amount and ozone distribution as well as the detail comparison with physical properties of precipitating solar protons and the electrons from the radiation belt.