An observation of the mesospheric column amount of nitric oxide observed with a millimeter-wave spectral radiometer at Syowa station in Antarctica

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Since 2011, the ISEE and NIPR started a joint research project on monitoring the composition changes in mesosphere and lower thermosphere (MLT) by using a millimeter-wave spectroscopy technique, and installed a millimeter-wave spectral radiometer with a high-sensitivity superconducting (SIS) mixer receiver operated in 250 GHz band at Syowa station in Antarctica (69°S, 40°E) for measuring the emission spectrum of nitric oxide (NO) in January 2012. The partial column of NO ranging from 75 to 100 km in altitude is retrieved from the observed emission spectrum. 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). From the dataset observed with the radiometer in more than 4 years, we find that the NO column amount shows the maximum in winter, but the peak amount in 2014 is about a half of those in other years. In addition, we detect sporadic enhancement of the NO column amount during a few weeks in June, August and October of 2015 that may be associated with solar activity. In the presentation, we report the features of temporal variations of the observed NO column amount as well as the detail comparison with physical properties of precipitating solar protons and the electrons from the radiation belt.

Keywords: mesosphere, atmospheric composition change, millimeter-wave measurement

