

Spectral riometer observation of atmospheric ionization due to energetic electron precipitation

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We introduce the observation of atmospheric ionization due to energetic electron precipitation by the spectral riometer, which is planned to be installed at Syowa Station, Antarctica, in summer of 2020-2021 during the period of JARE-62 (the 62nd Japanese Antarctic Research Expedition). The spectral riometer observation was adopted as an exploratory research project during the period of JARE-61 to 62. The spectral riometer measures cosmic noise absorption (CNA) in the frequency range from 20 to 60 MHz, and we can estimate the electron density height profile between about 50 and 120 km and the electron energy spectra in the energy range from several keV to about 1 MeV from the CNA by solving the inverse problem with atmosphere model. The purpose of this project is to quantitatively investigate the effect of energetic electron precipitation from the magnetosphere on the middle atmosphere. We will compare the spectral riometer data with various data observed in the mesosphere and ionosphere by the PANSY radar, MF radar, HF radar, millimeter-wave spectroscopic radiometer, and all-sky imagers at Syowa Station to investigate how minor molecules and polar mesosphere winter echoes (PMWE) are associated with the energetic electron precipitation. In addition, we are interested in the relationship between the energy distribution of precipitating electrons and auroral types. One of difficulties in the spectral riometer observation at Syowa is the interference with the existing instruments, in particular, the PANSY radar, which transmits high-power signals at 47 MHz. Thus, we use only the signals when the PANSY radar is not transmitting by receiving the transmission timing pulses from the radar. We expect that the spectral riometer will be substituted for the existing two broad-beam riometers with single observation frequency (30 MHz and 38.2 MHz) in future.