R010-03
C 会場 ：11/4　PM1 （13:45-15:30）
14:15〜14:30

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Evaluation of atmospheric ionization by X-rays, solar protons, and radiation belt electrons in September 2017 space weather event

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On September 11, 2017, when the solar proton flux peaked at the geostationary orbit, the PANSY radar at Syowa Station observed mesospheric echoes at 42 km, the lowest altitude ever observed. The estimated ionization rate by PHITS (Particle and Heavy Ion Transport code System) air-shower simulation with the proton flux obtained by the GOES satellite peaked at ˜40 km, suggesting that the echo power is enhanced by the increase in electron density due to proton precipitation. The intensity of cosmic noise absorption (CNA) from the resultant ionization rate was ˜2.8 dB, which consistently explains the maximum intensity of observed CNA level of ˜3.0 dB. Further, we used the X-ray flux observed by the GOES satellite as the input data for PHITS to estimate the electron density enhancements as observed by the EISCAT radar at Tromso, Norway due to the two X-class flare events at ˜9 and ˜12 UT on September 6. Obtained density profiles and the time sequence are roughly consistent with the observed EISCAT data, within the error of a factor of two. At ˜1345 UT on September 6, a transient low-altitude PANSY echo at $<$50 km and CNA spike (˜2.0 dB) were accompanied by Pc1 geomagnetic pulsations, which can be a dayside relativistic electron precipitation event associated with EMIC waves. The ionization rate due to the energetic electrons is also evaluated by PHITS with the inputs from NOAA MEPED electron data, and the observed CNA level of ˜2.0 dB can be reproduced by the contribution of sub-MeV electrons. We conclude that the September 2017 space weather event with the cutting-edge space-borne and ground-based observations provides a rare opportunity to cross-validate the use of PHITS simulation with different types of inputs (X-rays, protons, and electrons) to evaluate the atmospheric ionization.