R005-07
Zoom meeting C ：11/1 AM2 (10:45-12:30)
11:00〜11:15

Statistical investigation of polar mesosphere winter echoes by the PANSY radar: Superposed epoch analysis to substorm activities

#Kiyoka Murase[1)],Takanori Nishiyama[1,2)],Ryuho Kataoka[1,2)],Yoshimasa Tanaka[1,2,4)],Kaoru Sato[3)],Masaki Tsutsumi[1,2)], Yasunobu Ogawa[1,2)]
([1]Polar Science, SOKENDAI,([2]NIPR,([3]Graduate School of Science, Univ. of Tokyo,([4]ROIS-DS

One of the interesting aspects of the polar atmosphere is the effect of geomagnetic activities on the neutral atmosphere. Polar mesosphere winter echo (PMWE) is a coherent echo observed by VHF radars in the polar region during the winter period. The enhancement of echo power is influenced by not only the existence of the atmospheric turbulence (Yamamoto et al., 1986) but also the ionization due to energetic particle precipitation (EPP) during geomagnetically disturbed periods (Nishiyama et al., 2018). Recent studies reported enhancements of PMWE during substorms corresponding to EPP in a shorter timescale from several minutes to hours (Kataoka et al, 2019; Tanaka et al., 2019).

In this study, we statistically investigated the dependence of PMWE appearance on EPP during substorms. We used the data of the mesospheric echo power observed by the PANSY radar (Sato et al., 2014) at Syowa station (39.6E, 69.0S; CGMLAT=-66.5) in the Antarctic region in two austral winter seasons from 2017. The substorm activity is categorized by the amplitude of the southward excursion of the local magnetic field at Syowa station, which is a proxy of the amplitude of auroral electrojets. The timing of the minimum values of the north-south component (H_{min}) is used as zero epoch time, and the altitude-resolved echo powers are superposed.

First, positive dependencies of PMWE duration to the substorm activities are found during nighttime. The cosmic noise absorption at Syowa station is larger on average for larger activities, suggesting statistical dependencies of PMWE on ionization due to EPP during substorms. PMWE is enhanced at 75-85 km on average for any activity level, while they reach 70 km before and after the zero epoch time for larger substorms, where H_{min} is less than -600 nT (shown in the figure). On the other hand, PMWE in the daytime does not show clear dependence against substorm activities in terms of intensity and duration. It is suggested that the variation of electron density by EPP, which is much smaller than the background electron density during the daytime, does not have significant effects on the appearance of PMWE. In this presentation, we will also discuss the contribution of EPP to PMWE appearance by comparing our analysis to an empirical model for electron density in the mesosphere.