Simultaneous Observations of Polar Mesosphere Winter Echoes and Cosmic Noise Absorptions in a Common Volume by the PANSY Radar (69.0°S, 39.6°E)

T. Nishiyama[1,2], K. Sato[3], T. Nakamura[1,2], M. Tsutsumi[1,2], T. Sato[4], Y.-M. Tanaka[1,2,5], K. Nishimura[1,2,] Y. Tomikawa[1,2], and M. Kohma[3]

[1]*National Institute of Polar Research, Japan*

[2]*Department of Polar Science, The Graduate University for Advanced Studies, SOKENDAI, Japan*

[3]*Department of Earth and Planetary Science, The University of Tokyo, Japan*

[4]*Department of Communications and Computer Engineering, Kyoto University, Japan*

[5]*Polar Environment Data Science Center, Joint Support-Center for Data Science Research, Research Organization of Information and Systems, Japan*

This study focuses on the one-to-one relationship between the morphology of polar mesosphere winter echo (PMWE) and cosmic noise absorption (CNA) as determined by measurements made with a single atmospheric radar, the Program of the Antarctic Syowa mesosphere-stratosphere-troposphere/incoherent scatter (PANSY) radar. CNA was calculated using the noise level in radar signal data collected during May 2013, including data of a solar proton event on 23 May. Using PMWE and CNA data in a common volume, their temporal variations and relation were examined in detail. PMWE altitude was clearly anticorrelated with CNA magnitude in a statistical sense: When a large CNA exceeding 0.50 dB took place, PMWE seemed to concentrate around 65 km and disappear above 70 km. The electron density behind the PMWE was estimated by using the ionospheric model for the auroral zone for the solar proton event. PMWE occurrence roughly coincided with a high electron density in the model, except that no PMWE was observed above 70 km at 0730 UT despite the electron density being higher than 10^8 m^{-3}. Additionally, the estimated radar volume reflectivity with the Schmidt number Sc less than or equal to 1 is qualitatively consistent with the observed PMWE. Although weak turbulent energy dissipation rate can also play a dominant role in the observed PMWE decay, a plausible mechanism was small Sc or reduction of Sc that is equal to an increase in electron diffusivity resulting from an unusually high electron density, which significantly reduced radar volume reflectivity above 70 km.