

Simultaneous observation of PMWE and plasma waves with PANSY radar and Arase satellite

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We investigate Polar Mesosphere Winter Echoes (PMWE) accompanied by an isolated substorm around 04 UT on March 21, 2017, which occurred during the passage of corotating interaction region (CIR). Various phenomena associated with the substorm were detected by the coordinated observation with ground-based instruments at Syowa station (SYO), Antarctica, and its geomagnetic conjugate station, Husafell (HUS), Iceland, and Arase (ERG) satellite whose footprints were located close to SYO and HUS. PMWE was observed at 65-80 km altitude with Program of the Antarctic Syowa Mesosphere, Stratosphere and Troposphere/Incoherent Scatter (PANSY) radar at SYO and appeared to be related to the substorm. This implies that the electron density enhancement in the mesosphere due to high-energy electron precipitation during the substorm is one of the important factors causing PMWE. Such an existence of energetic electron precipitation was supported by the simultaneous observation of cosmic noise absorption (CNA) with riometer and backscatter echo from 55-70 km with medium frequency (MF) radar. During this interval, whistler-mode chorus waves and electromagnetic ion cyclotron (EMIC) waves were observed near the magnetic equator in the morning side magnetosphere by Arase. In this study we compared PMWE with the whistler-mode chorus waves and EMIC waves simultaneously observed in the magnetosphere for the first time. The results suggest that the whistler-mode chorus waves and EMIC waves are possible candidates for driver of energetic electron precipitation that causes PMWE.

Keywords: Polar Mesosphere Winter Echoes, Arase satellite, chorus waves, electromagnetic ion cyclotron waves, aurora, high-energy electron precipitation