

Ionization of the mesosphere during substorm growth phase

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We report two mesospheric ionization events, both occurred during a substorm growth phase. The ionization reached at 68 km altitude at 2305 UT on 25 May 2017, and at 0000 UT on 25 July 2018, as identified by the PANSY radar at Syowa Station. Theoretically, the deep ionization events can be caused by the thinning of the magnetotail because of the small curvature radius of magnetic field lines at equator, which is comparable to the gyro radius of energetic electrons. Fortunately, the footprints of the Arase satellite passed nearby the Syowa Station during these two events, and we cannot find associated plasma waves to scatter energetic electrons, as expected from the curvature theory. In this study, we quantitatively evaluate the mesospheric ionization profiles by comparing the intensity of cosmic noise absorption as observed by the imaging riometer at Syowa Station, and the simulated one using the PHITS code with the input data of energetic electron flux as observed by the Arase satellite.

Keywords: atmospheric ionization, energetic electron precipitation, substorm growth phase