

PANSY レーダー観測で解明する磁気嵐時の中間圏の応答： 2015年の2度の巨大磁気嵐時の冬季極域中間圏エコー

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Mesospheric response to magnetic storms as seen in by the PANSY radar: Polar Mesosphere Winter Echo during two big magnetic storms in 2015

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Polar Mesosphere Winter Echo (PMWE) is known as back scatter echo from 55 to 85 km in the mesosphere, and it has been observed by MST and IS radar in polar region during non-winter period. Since density of free electrons as scatterer is low in the dark mesosphere during winter, it is suggested that PMWE requires strong ionization of neutral atmosphere associated with Energetic Particles Precipitations (EPPs) during Solar Proton Events [Kirkwood et al., 2002] or during geomagnetically disturbed periods [Nishiyama et al., 2015]. However, the detailed relationship between PMWE and ionization process triggered by EPPs, in particular during magnetic storms, has not been revealed yet, partly because the PMWE occurrence rate is known to be quite low (2.9%) [Zeller et al., 2006].

The PANSY (Program of the Antarctic Syowa MST/IS) radar, which is the largest MST radar in Antarctica, observed many PMWE events since it has started mesosphere observations in June 2012. In this presentation, we would like to focus on occurrence characteristics of PMWE during two big geomagnetic storm events as St. Patrick's Day and the Summer Solstice 2015 Event. On 19 and 22 March corresponding to recovery phase of St. Patrick's Day Storm, strong PMWE was suddenly detected near 60 km altitudes by the PANSY radar. In order to estimate background electron density for PMWE altitudes, we established an application method of the PANSY radar as riometer using measured temporal variations of background noise level. As a result, strong Cosmic Noise Absorptions (CNA) of ~ 0.8 dB and 1.0 dB were detected at the same time as the intensifications of PMWE on 19 and 22 March, respectively. This strongly suggested that EPPs generated on the recovery phase of the storm triggered electron density enhancement at PMWE altitudes. It should be noted that this is the first simultaneous measurement of PMWE and CNA in the exact common volume during such a large magnetic storm by single MST radar. Moreover, we will report intensification of nighttime PMWE detected around 16 UT, which is equal to 19 LT at Syowa station, corresponding to onset of the Summer Solstice 2015 Event. Since PMWE observations are primarily confined to daytime because of relatively abundant free electrons in the illuminated mesosphere, this strong and long-lived nighttime PMWE implies that EPPs related to the storm caused the sporadic ionization sufficient for PMWE even in dark mesosphere. In the presentation, we are going to calculate electron density profiles in the storm events using Ionospheric Model for the Auroral Zone [McKinnell and Friedrich, 2007] and compare between observed PMWE characteristics and estimated background electron density.

References

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