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What happens when the ionosphere almost disappears in the polar region?

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The Vertical Incident Pulsed Ionospheric Radar (VIPIR) has been operated with Dynasonde analysis software at Jang Bogo Station (JBS), Antarctica to monitor the state of the ionosphere in the polar cap and/or the auroral oval together with other ground instruments including Fabry-Perot Interferometer (FPI) for thermospheric winds and temperature, All Sky Cameras (ASCs) for aurora, and magnetometers for the variations of the geomagnetic fields. It is found from the radar observations that no echoes can be reflected from the ionosphere for several hours as if the ionospheric density does not exist at all over the JBS as shown in Figure 1. The number of the events of seemingly 'disappearance of the polar ionosphere' (DPI) was 123 during the observation period of Jan. 2017 to Aug. 2021. The DPI events last about 1~2 hours up to 6 hours and mostly occur at polar night in winter when the ionospheric density becomes small. DPI begins with the density of 9.5-11.5 $\log_{10}N_e$ (m^{-3}) and occurs regardless of the geomagnetic activity level (Kwon et al., 2022). Since DPI mostly occurs when the ionospheric density becomes extremely low with corresponding GPS TECs of 1~2 TECU, it may provide an excellent opportunity to investigate the corresponding changes in the thermosphere and the magnetosphere using simultaneous observations at JBS. In this paper, we will present the observed characteristics of the DPI events with possible explanations and preliminary results of the changes simultaneously appeared in the thermosphere and the magnetosphere.

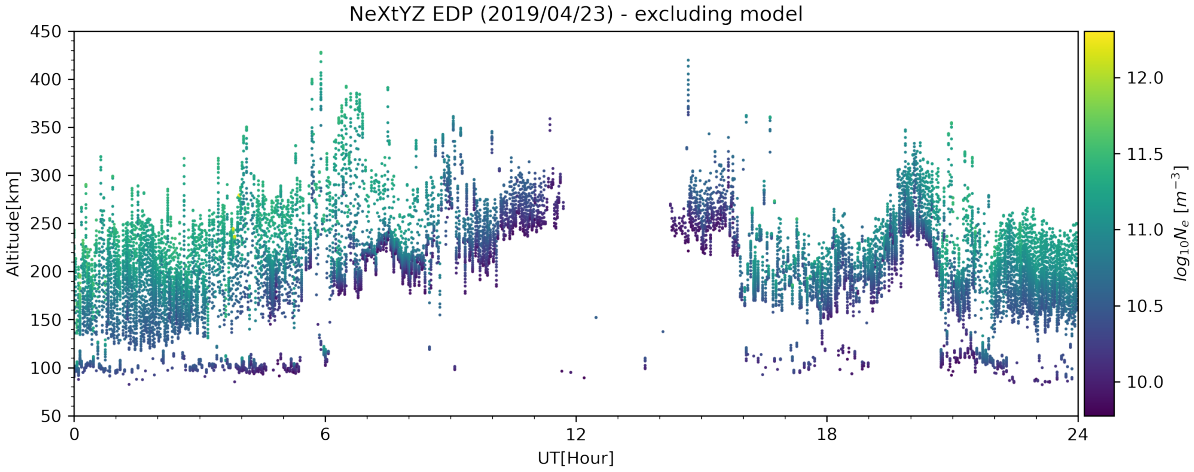

Figure 1. The Jang Bogo VIPIR/Dynasonde (JVD) observation of the disappearance of the polar ionosphere (DPI) occurred at April 23, 2019.

References

[1] Kwon, H. -J., Kim, K. -H., Jee, G., Seon, J., Lee, C., Ham, Y. -B., et al. (2022). "Disappearance of the Polar Cap Ionosphere During Geomagnetic Storm on 11 May 2019," *Space Weather*, 20(6). https://doi.org/10.1029/2022sw003054.