Two types of electron density depletion observed bu VIPIR/Dynasonde in the polar cap Ionosphere

Hyuck-Jin Kwon[1], Geonhwa Jee[1], Khan-Hyuk Kim[2], Changsup Lee[1], Young-Bae Ham[1], Terrence Bullett[3]*

[1] *Korea Polar Research Institute*

[2] *Kyunghee University*

[3] *NOAA National Centers for Environmental Information*

Korea Polar Research Institute (KOPRI) has been operated multi-instruments at Jang Bogo Station (JBS, 74.6°S, 164.2°E) to monitor upper atmosphere and magnetic field. In this study, we examined the F-region electron density depletions observed by VIPIR/Dynasonde (JVD). The JVD observed long-lasting (> 11 hr) severe depletion during moderate geomagnetic storm on 11 May 2019. Other instruments installed at JBS also observed phenomena associated with electron density depletion and the geosynchronous orbit, located ~2.5 hr west of JBS, also observed negative magnetic field perturbations in the azimuthal component, which is related to the field-aligned currents. We confirmed that the reduction of O/N2 ratio as a result of TIEGCM model. From these observations and modelling, we concluded that transpolar ionospheric currents connected to the field-aligned current corresponding to substorm contributed to the ionospheric density depletion. Under quiet geomagnetic conditions, JVD observed the electron density depletion, especially during winter/nighttime. We investigated 45 depletion (known as polar hole) events in 2019 when Kp ≤ 1+ for 6 hr. All of events started over a wide range of nighttime and JVD measured exponential density decrease with e-fold decay times distributed in the range of 0.5 to 4 hr. The horizontal drift velocity (Vhor) estimated from JVD monotonically goes down from ~190 m/s at dusk to ~100 m/s at post-midnight. Such relation between density depletion and Vhor implies that the ionospheric density depletion is due to the enhancement of plasma residence time without the source of ionization under quiet conditions.

Keywords: Electron density depletion, Polar Ionosphere, VIPIR/Dynasonde