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First identification of the high-latitude ionization trough from a satellite (SWARM) observation

Young-Sil Kwak (1,2), Su-In Kim (1,3), Hyosub Kil (4), Jaeheung Park (1,2), Khan-Hyuk Kim (3), J. Michael Ruohoniemi (5), Evan. G Tomas (6), Jaejin Lee (1,2)

(1) Korea Astronomy and Space Science Institute, Space Science Division, Daejeon, Korea, Republic Of (yskwak@kasi.re.kr), (2) University of Science and Technology, Daejeon, South Korea, (3) School of Space Research, Kyung Hee University, Yongin, South Korea, (4) Space Departments, the Johns Hopkins University Applied Physics Laboratory, USA, (5) Bradley Department of Electrical and Computer Engineering, Virginia Tech, USA, (6) Thayer School of Engineering, Dartmouth College, Hanover, NH, USA

Different ionization troughs develop in the sub-auroral and high-latitude F region by different physical processes. Mid-latitude trough at the sub-auroral region is a well-known phenomenon identified by many space-borne and ground-based observations, whereas the existence of a trough inside an auroral oval (we call it high-latitude trough) is identified by only a few radar observations. This study for the first time reports the detection of high-latitude trough from satellite observations. We distinguish mid- and high-latitude troughs by their locations relative to the auroral oval. Information of the auroral oval is obtained from the ionospheric radial current (IRC) derived with the SWARM magnetic field data and the DMSP particle data. Our preliminary results show that mid-latitude troughs are pronounced in the evening during local winter and high latitude troughs occur preferentially early in the morning during local summer. The location of the high-latitude trough coincides with the location of downward field-aligned current and significant eastward ion drift. These observations support the idea that the formation of the high-latitude trough is associated with field-aligned plasma flow and heating of the upper atmosphere by the ion-neutral collision.