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An investigation of ionospheric upper transition height variations at low and equatorial latitudes deduced from combined COSMIC and C/NOFS measurements

Biqiang Zhao

Institute of Geology and Geophysics, Chinese Academy of Sciences, Division of Space Electromagnetic Environment, Beijing, China (zbqjz@mail.igcas.ac.cn)

In this study we propose the combination of topside in-situ ion density data from the Communication/Navigation Outage Forecast System (C/NOFS) along with the electron density profile measurement from Constellation Observing System for Meteorology, Ionosphere & Climate (COSMIC) satellites Radio Occultation (RO) for studying the spatial and temporal variations of the ionospheric upper transition height (hT) and the oxygen ion (O+) density scale height. The latitudinal, local time and seasonal distributions of upper transition height show more consistency between hT re-calculated by the profile of the O+ using an a-Chapman function with linearly variable scale height and that determined from direct in-situ ion composition measurements, than with constant scale height and only the COSMIC data. The discrepancy in the values of hT between the C/NOFS measurement and that derived by the combination of COSMIC and C/NOFS satellites observations with variable scale height turns larger as the solar activity decreases, which suggests that the photochemistry and the electrodynamics of the equatorial ionosphere during the extreme solar minimum period produce abnormal structures in the vertical plasma distribution. The diurnal variation of scale heights (Hm) exhibits a minimum after sunrise and a maximum around noon near the geomagnetic equator. Further, the values of Hm exhibit a maximum in the summer hemisphere during daytime, whereas in the winter hemisphere the maximum is during night. Those features of Hm consistently indicate the prominent role of the vertical electromagnetic (E$\times$B) drift in the equatorial ionosphere.