The Topside Ionospheric Effective Scale Heights (HTeff) Derived with In-situ Data from LEOs and Ground-based Ionosonde Observations

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We propose the assimilation of topside in situ electron density data from LEOs along with the ionosonde measurements for accurate determination of topside ionospheric effective scale heights (H_{Teff}) using α-Chapman function. This method demonstrates that one in-situ electron density measurement around 200 km above the F2-layer peak (hmF2) is sufficient to determine the topside ionospheric "effective" scale height (H_{Teff}). The reconstructed topside Ne(h) profiles using the H_{Teff} are found in good agreement with Jicamarca Incoherent Scatter Radar (ISR) profiles up to O/H^+ transition height. This will greatly reduce the computational complexity against the continuously variable scale height (vary-Chap). The another advantage with this method is that it facilitates the assimilation of widely available in-situ density data from various scientific LEO's such as AE-E, DE-E, DMSP, ROCSAT-1, CHAMP, DEMETER and C/NOFS, etc., which have splendid temporal and spatial coverage as well as at different solar and geomagnetic activity levels. More importantly, this method allows the accurate reconstruction of topside Ne(h) profiles at a dense network of ionosonde/digisonde stations where no ISR facilities are available. The demonstration of the method is applied by investigating the diurnal, seasonal and solar activity variations of H_{Teff} over the dip-equatorial station Jicamarca and the mid-latitude station Grahamstown. The results consistently indicate that the diurnal variation of the effective scale height (H_{Teff}) do not follow the plasma temperature variation at equatorial latitudes and is largely controlled by the vertical ExB drift.