Error distribution of COSMIC electron density profile retrieval: Simulation study

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In this study we investigated error distribution of the Abel inversion widely used by the radio occultation (RO) community for the electron density profile (EDP) retrieval through a simulation study. We simulated the occultation events observed by the COSMIC satellites during the spring equinox of 2008 and calculated the integrated total electron content (TEC) along the COSMIC occultation paths by using the NeQuick electron density profiles (True EDPs). The retrieval errors are computed by comparing the retrieved EDPs with the True EDPs. We found that the retrieved NmF2 and hmF2 are in good agreement with the true values, whereas the current Abel retrieval method introduces significant error in electron densities in the low latitude region and at low altitudes. Specifically, it overestimates the electron density aside or between (over the magnetic equator during daytime) the crests of the equatorial ionization anomaly (EIA), but underestimates the electron density around and underneath the EIA crests. At lower altitudes (E and F1 regions), it would result in three pseudo peaks in daytime electron densities along the magnetic latitude and a pseudo trough in nighttime equatorial electron densities.