

Complimenting regional GPS-TEC computerized ionospheric tomography (CIT) with ionosonde data assimilation

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The accurate probing of the three-dimensional (3-D) structure of the ionosphere endures a unique set of challenges that include for example high campaign costs, poor distribution of instruments and collected data, and geometric limitations. To remedy these challenges, over the East-Asian sector (covering 110°–160°E and 10°–60°N, and extending from 80 to 20,000 km in altitude) a near real-time regional 3-D computerized ionospheric tomography (CIT) technique has been developed using a plethora of GPS (Global Positioning System) observations of total electron content. A validation of the CIT results using ionosonde and occultation data shows the technique adequately reconstructs the regional ionosphere vertical structure, however, with room for improvement in estimating the peak height and avoiding physically unrealistic negative densities in the final solution. This paper presents preliminary results from a technique that addresses these problems, by incorporating CIT results into a data assimilation (DA) technique. The DA technique adds ionosonde bottomside measurements into CIT results, thereby improving the accuracy of the reconstructed peak height and bottomside 3-D structure. Further, we assume that ionosphere electron densities are better described by probability log-normal distribution, which introduces the non-negativity constraint.

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