

A real-time operational procedure for GPS TEC - based reconstruction of the electron profile at a single ionosonde location

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The propagation delays in GNSS, introduced by the ionosphere, can be estimated and corrected much easier if the (vertical) electron density profile is available at a given location on a real-time basis. As the theoretical ionospheric models are not sufficiently good for the purpose, actual on-line measurements immediately available should be considered.

Presented is a robust procedure for real-time reconstruction of the electron density profile from concurrent GPS TEC and ionosonde measurements. On the one hand, the on-line ionosonde measurements are used primarily for the reconstruction of the bottom-side profile. On the other hand, the ionosonde data together with simultaneously-measured TEC and upper transition level information, are required and used for determination of the topside electron profile. It is important that the method provides variable topside scale height, and the crucial information for this variability comes from measurements of the oxygen-hydrogen ion transition height, where the largest change in the electron density gradient occur.

The procedure is demonstrated and tested on actual GPS TEC and digital ionosonde data obtained at the Dourbes Geophysics Centre of the Royal Meteorological Institute of Belgium. At this center, a GPS receiver is collocated with a digital ionosonde, capable of producing TEC values every 15 minutes. Measurements have been conducted since 1994 and a large TEC database created for the best part of the current solar activity cycle.