



Verification of the modelling of the main ionospheric trough by the Electron Density Assimilative Model (EDAM)

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The main ionospheric trough is a large-scale spatial depletion in the ionospheric electron density that commonly separates the auroral and mid-latitude regions. The feature covers several degrees in latitude and is extended in longitude. It exhibits substantial day-to-day variability in both the location of its minimum ionisation density and in its latitudinal structure. Observations from the UK have shown the trough to be a night-time feature, appearing in early evening to the north of the mainland and progressing equatorward during the course of the night. At dawn, photoionisation fills in the feature. Under increasing levels of geomagnetic activity, the trough moves progressively to lower latitudes. Steep gradients on the trough walls and their variability can cause problems for radio applications. EDAM can be used to model the ionosphere at the trough latitudes by assimilating ionospheric observations from this region into the International Reference Ionosphere (IRI). In this study troughs modelled by EDAM, assimilating data for a period from September to December 2002, are presented and are verified by comparisons with independent observations.

Measurements of slant total electron content (sTEC) between GPS satellites and forty ground receivers in Europe were assimilated into EDAM to model the ionospheric electron density. The Vertical Total Electron Content (VTEC) was then calculated through the model, with the values at the longitude of $0.0 [U+F0B0] E$ considered to obtain statistical characteristics of identified troughs parameters. Comparisons of the parameters with those obtained previously, using transmissions from the satellites of NIMS (Navy Ionospheric Monitoring System) orbiting at altitudes lower than GPS, revealed consistent results.

Further support for the EDAM trough was obtained by comparisons of the model with independent GPS measurements. For this a GPS ground station not used in the assimilation was used to observe the sTEC to this “truth” station. Comparisons of these independent truth data with sTEC calculated through the model were used to determine the accuracy of EDAM in the vicinity of the trough.