Characterisation of the main ionospheric trough in the Western European sector using the Electron Density Assimilative Model (EDAM)

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The main ionospheric trough is a large-scale spatial depletion in the ionisation that generally separates the auroral ionosphere from the more benign mid-latitude region. 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 the structure of its poleward and equatorward walls on either side of the minimum. 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. Steep gradients on the trough walls and their variability can cause problems to radio applications. The Electron Density Assimilative Model (EDAM) can be used to model the ionosphere at the trough latitudes by assimilating ionospheric observations into the International Reference Ionosphere (IRI).

Results given by EDAM are presented for a period from September to December 2002, showing the main characteristics of the mid-latitude trough in the Western European sector. Measurements of slant total electron content between GPS satellites and forty ground receivers in Europe were assimilated into EDAM to give the ionospheric electron density in the region of interest. The vertical Total Electron Content (vTEC) was then calculated through the model region, with the values at the longitude of 0.0°E considered further to investigate the characteristics of the trough. These characteristics are presented, including the latitude and vTEC at the trough minimum and gradients of the equatorward and poleward trough walls. The latitudinal structure of the trough is described in terms of a few parameters, and these are compared with previously reported trough parameters obtained using measurements from the satellites of NIMS (Navy Ionospheric Monitoring System) orbiting at altitudes lower than GPS.