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Comparison of Ionospheric Vertical Total Electron Content modelling approaches using spline based representations

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Since electromagnetic measurements show dispersive characteristics, accurate modelling of the ionospheric electron content plays an important role for positioning and navigation applications to mitigate the effect of the ionospheric disturbances. Knowledge about the ionosphere contributes to a better understanding of space weather events as well as to forecast these events to enable protective measures in advance for electronic systems and satellite missions. In the last decades, advances in satellite technologies, data analysis techniques and models together with a rapidly growing number of analysis centres allow modelling the ionospheric electron content with an unprecedented accuracy in (near) real-time.
In this sense, the representation of electron content variations in time and space with spline basis functions has gained practical importance in global and regional ionosphere modelling. This is due to their compact support and their flexibility to handle unevenly distributed observations and data gaps.
In this contribution, the performances of two ionosphere models from UWM and DGFI-TUM, which are developed using spline functions are evaluated. The VTEC model of DGFI-TUM is based on tensor products of trigonometric B-spline functions in longitude and polynomial B-spline functions in latitude for a global representation. The UWM model uses two dimensional planar thin plate spline (TPS) with the Universal Transverse Mercator representation of ellipsoidal coordinates. In order to provide a smooth VTEC model, the TPS minimizes both, the squared norm of the Hessian matrix and deviations between data points and the model.
In the evaluations, the differenced STEC analysis method and Jason-2 altimetry comparisons are applied.