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Concept for a global near real-time VTEC model using B-spline expansions and Kalman filtering

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Within the last years much work towards real-time ionosphere modeling has been done. However, most of the near real time (NRT) ionosphere models are still under development as the computation of reliable maps of the vertical total electron content (VTEC) is a great challenge, mainly for global models because of the uneven data distribution.

The International Reference Ionosphere (IRI) has been widely used as a background model to test tomographic and radio occultation algorithms related to signals from LEOs. Space-geodetic techniques including ionosonde and incoherent scatter radar measurements are currently used for data assimilation into the IRI and allow a real-time extension (RT-IRI).

Recently at DGFI a global VTEC model was developed based on trigonometric and polynomial B-spline expansions related to longitude and latitude in an Earth-fixed geocentric coordinate system. The corresponding series coefficients of the model are estimated from the combination of different observation techniques such as GNSS, COSMIC/FORMOSAT#3 or radar altimetry.

In this contribution we describe a concept for a global NRT VTEC model based on the two-dimensional B-spline expansion. The corresponding series coefficients are estimated via Kalman filtering. Since B-spline expansions allow for a multi-scale representation, the derived model can consider the uneven distribution of the input data.