Comparison of a global B-spline VTEC model with a spherical harmonic expansion

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In this paper, we present two global multi-dimensional approaches for modelling the spatial-temporal variations of the ionospheric vertical total electron content (VTEC). One approach is based on B-spline functions, i.e. we use periodic trigonometric B-splines for representing the longitudinal behavior and quadratic polynomial B-splines for representing the latitudinal and the temporal behavior. Additional constraints have to be taken into account, e.g. for the poles.

We compare our global B-spline approach with the well-known spherical harmonic expansion. Again we introduce quadratic polynomial B-splines for the temporal evolution of the spherical harmonic coefficients.

As input data we use (1) model data from the International Reference Ionosphere (IRI) as well as (2) real data from GNSS and/or the COSMIC/Formosat-3 mission. In both cases all series coefficients are calculated by parameter estimation.