Adaptivity Assessment of Regional Semi-Parametric VTEC Modeling to Different Data Distributions

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Semi-parametric modelling of Vertical Total Electron Content (VTEC) combines parametric and non-parametric models into a single regression model for estimating the parameters and functions from Global Positioning System (GPS) observations. The parametric part is related to the Differential Code Biases (DCBs), which are fixed unknown parameters of the geometry-free linear combination (or the so called ionospheric observable). On the other hand, the non-parametric component is referred to the spatio-temporal distribution of VTEC which is estimated by applying the method of Multivariate Adaptive Regression B-Splines (BMARS). BMARS algorithm builds an adaptive model by using tensor product of univariate B-splines that are derived from the data. The algorithm searches for best fitting B-spline basis functions in a scale by scale strategy, where it starts adding large scale B-splines to the model and adaptively decreases the scale for including smaller scale features through a modified Gram-Schmidt ortho-normalization process. Then, the algorithm is extended to include the receiver DCBs where the estimates of the receiver DCBs and the spatio-temporal VTEC distribution can be obtained together in an adaptive semi-parametric model. In this work, the adaptivity of regional semi-parametric modelling of VTEC based on BMARS is assessed in different ground-station and data distribution scenarios. To evaluate the level of adaptivity the resulting DCBs and VTEC maps from different scenarios are compared not only with each other but also with CODE distributed GIMs and DCB estimates .