Geophysical Research Abstracts
Vol. 14, EGU2012-5198, 2012
EGU General Assembly 2012

Multi-scale model of the ionosphere from the combination of modern space-geodetic satellite techniques – project status and first results

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Near real-time high resolution and high precision ionosphere models are needed for a large number of applications, e.g. in navigation, positioning, telecommunications or astronautics. Today these ionosphere models are mostly empirical, i.e. based purely on mathematical approaches. In the DFG project 'Multi-scale model of the ionosphere from the combination of modern space-geodetic satellite techniques (MuSIK)' the complex phenomena within the ionosphere are described vertically by combining the Chapman electron density profile with a plasmasphere layer. In order to consider the horizontal and temporal behaviour the fundamental target parameters of this physics-motivated approach are modelled by series expansions in terms of tensor products of localizing B-spline functions depending on longitude, latitude and time. For testing the procedure the model will be applied to an appropriate region in South America, which covers relevant ionospheric processes and phenomena such as the Equatorial Anomaly. The project connects the expertise of the three project partners, namely Deutsches Geodätisches Forschungsinstitut (DGFI) Munich, the Institute of Astronomical and Physical Geodesy (IAPG) of the Technical University Munich (TUM) and the German Aerospace Center (DLR), Neustrelitz.

In this presentation we focus on the current status of the project. In the first year of the project we studied the behaviour of the ionosphere in the test region, we setup appropriate test periods covering high and low solar activity as well as winter and summer and started the data collection, analysis, pre-processing and archiving. We developed partly the mathematical-physical modelling approach and performed first computations based on simulated input data. Here we present information on the data coverage for the area and the time periods of our investigations and we outline challenges of the multi-dimensional mathematical-physical modelling approach. We show first results, discuss problems in modelling and possible solution strategies and finally, we address open questions.