



Using DORIS measurements for ionosphere modeling

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Nowadays, most of the ionosphere models used in geodesy are based on terrestrial GNSS measurements and describe the Vertical Total Electron Content (VTEC) depending on longitude, latitude, and time. Since modeling the height distribution of the electrons is difficult due to the measurement geometry, the VTEC maps are based on the assumption of a single-layer ionosphere. Moreover, the accuracy of the VTEC maps is different for different regions of the Earth, because the GNSS stations are unevenly distributed over the globe and some regions (especially the ocean areas) are not very well covered by observations.

To overcome the unsatisfying measurement geometry of the terrestrial GNSS measurements and to take advantage of the different sensitivities of other space-geodetic observation techniques, we work on the development of multi-dimensional models of the ionosphere from the combination of modern space-geodetic satellite techniques. Our approach consists of a given background model and an unknown correction part expanded in terms of B-spline functions. Different space-geodetic measurements are used to estimate the unknown model coefficients. In order to take into account the different accuracy levels of the observations, a Variance Component Estimation (VCE) is applied. We already have proven the usefulness of radio occultation data from space-borne GPS receivers and of two-frequency altimetry data. Currently, we test the capability of DORIS observations to derive ionospheric parameters such as VTEC.

Although DORIS was primarily designed for precise orbit computation of satellites, it can be used as a tool to study the Earth's ionosphere. The DORIS ground beacons are almost globally distributed and the system is on board of various Low Earth Orbiters (LEO) with different orbit heights, such as Jason-2, Cryosat-2, and HY-2. The last generation of DORIS receivers directly provides phase measurements on two frequencies.

In this contribution, we test the DORIS capability for ionosphere VTEC modeling in combination with other space-geodetic observations. For this purpose, we derive DORIS VTEC values in a pre-processing step and integrate them in our ionosphere model. From the analysis of VCE we get information on the quality of DORIS for ionospheric modeling and on the consistency with other observation techniques.