Geophysical Research Abstracts
Vol. 21, EGU2019-8351, 2019
EGU General Assembly 2019

GPS/Galileo-based Regional Ionosphere Model performance for European mid-latitude region

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One of the main error sources in GNSS, causing a delay of the signals while traveling through the atmosphere to receivers on the Earth, is the ionosphere. The ionosphere has to be considered as dispersive medium in the microwave band. Therefore, an appropriate way to eliminate the major part of this delay is to track dual-frequency observations, which enable the computation of an ionosphere-free linear combination. However, observations derived from single-frequency (L1-signal) receivers have to rely on external corrections in form of ionosphere models in order to reduce the influence of the ionospheric delay and thus provide improved site positions.

The European GNSS Agency (GSA) has issued a call for provision of various data to the Galileo Reference Center (GRC), which started its operations recently. The Technical University in Vienna, as one of the partners of the GRC-MS consortium, provides regional IONEX files to this project. The Ionospheric maps are based on a spherical harmonics expansion, covering the mid-latitude European region with a spatial resolution of 0.5° and temporal resolution of 1h. The model is computed using dual-frequency zero-difference GPS+Galileo code and carrier phase observations from 35 IGS and Multi-GNSS permanent stations, distributed within +30° to +65° in latitude and -15° to + 45° in longitude.

The performance of different ionosphere models (global and regional) is investigated in this study. For example, the TUW model is compared to the GPS Klobuchar and the NeQuick G models. Additionally, in order to check the quality of the given models, the derived ionospheric delay has been added to single-frequency observations. These ranges are compared to ionospheric-free ranges gained from dual-frequency receivers on chosen stations in the European mid-latitude region.