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GROUND- AND SPACE-BASED GNSS DATA INGESTION INTO THE NEQUICK MODEL

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Summary: This paper presents a methodology for ingesting ground- and space-based dual-frequency GNSS observations into a semi-empirical global electron density model.

Abstract: The NeQuick-2 model is used as the basis for describing the global electron density distribution. NeQuick is mainly driven by the F2 parameters, i.e.: N_mF2 and h_mF2 which, in absence of measurements, are computed from the ITU-R database. This database was established using observations collected from 1954 to 1958 by a network of around 150 ionospheric sounders with uneven global coverage. It allows computing monthly mean values N_mF2 and h_mF2 for low and high solar activity. For intermediate solar activity a linear interpolation must be performed.

Ground-based GNSS observations from a global network of more than 200 receivers are processed with the La Plata Ionospheric Model (LPIM) in order to retrieve sTEC information. LPIM relies upon a single layer ionospheric approximation and on a spherical harmonics expansion with time dependent coefficients for representing the spatial and temporal variability of the vTEC.

Space-based GNSS observations (radio occultation measurements from the FORMOSAT3/COSMIC constellation) are pre-processed in order to retrieve 4-D electron density information by applying the Abel inversion technique to the L1 phase excess upgraded with the separability concept.

Both, preprocessed sTEC and electron densities are ingested into the NeQuick model in order to improve the F2 peak parameters, N_mF2 and h_mF2, as well as for improving the representation of the electron density provided by the NeQuick model in the ionospheric topside. Besides, the results are validated by comparing: i) the vTEC computed with the improved NeQuick model and the one provided by the TOPEX/Poseidon and Jason missions; and ii) the bottom-side electron density computed with the improved NeQuick model and measured with ground-based ionospheric sounder in selected locations.