NeQuick model and GNSS-derived TEC comparison over the last two solar cycles

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NeQuick 2 [1] is a three-dimensional and time dependent ionospheric electron density model developed at the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy in collaboration with the University of Graz, Austria. It is an empirical model, specifically designed for trans-ionospheric propagation applications, which allows calculating the electron concentration at any given location in the ionosphere and therefore the total electron content (TEC) along any given ray-path by means of numerical integration.

The main purpose of this work is to deepen the understanding about the level of agreement between NeQuick-derived and LPIM [2,3] GNSS TEC determinations, with the support of a database spanning over the two last solar cycles.

Indeed, for this contribution we have processed the complete series of GPS data files from a set of IGS stations (International GNSS Service) with LPIM software, resulting in a database of TEC for the period 1998 to 2016. The stations considered for the statistics have been 20+ for solar cycle 23 and 40+ for solar cycle 24 and the temporal resolution of the TEC series has been 15 min.

The global geographic coverage of the data, combined with ~20 year time span and the high temporal resolution gave us a unique opportunity to analyze and crosscheck the NeQuick 2 model and the corresponding TEC retrieved using the LPIM technique.

The approach for analyzing the results is based on several statistical parameters like mean, median, standard deviations and tools like Fourier transform and geographic analysis, applied on a wide range of strategies to combine the data: from the one-to-one 15 minutes comparison to the most complex ones like the monthly average daily patterns.

References

1. B. Nava, P. Coïsson, S. M. Radicella (2008), "A new version of the NeQuick ionosphere electron density model", *Journal of Atmospheric and Solar-Terrestrial Physics,* doi:10.1016/j.jastp.2008.01.015.

2. C. Brunini, F. Azpilicueta. "GPS slant total electron content accuracy using the single layer model under different geomagnetic regions and ionospheric conditions", Journal of Geodesy, DOI: 10.1007/s00190-010-0367-5, 2010.

3. F. Azpilicueta, C. Brunini, and S. Radicella (2006), "Global ionospheric maps from GPS observations using modip latitude", Adv. Space Res., 38(11), 2324–2331.