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Comparison of NmF2 and hmF2 values derived from IRI and FORMOSAT-3/COSMIC ionospheric radio occultations

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The electron density, NmF2, and the height, hmF2, of the ionospheric F2 peak are key parameters for modeling the electron density distribution in the ionosphere (e.g. within the International Reference Ionosphere (IRI) model), for radio-communication forecast (e.g. in the radio-communication sector of the International Telecommunication Union Recommendations (ITU-R)), and other space weather related issues. A commonly applied procedure to compute the values of these parameters, in case that direct measurements are not available, is the use of the ITU-R global maps which were established in the early 60s but still belong to the ITU-R standards.

Accompanying the efforts the community is making to update those maps, we have recently presented a technique based on the assimilation of FORMOSAT-3/COSMIC (F3/C) ionospheric radio occultations (IRO) in the La Plata Ionospheric Model (LPIM). The global mean error of our maps, estimated by the data assimilation algorithm, ranged from 0.5×10**10 el/m3 and 3.6×10**10 el/m3 for NmF2 (which is equivalent to approximately 7% of the value of the estimated parameter), and from 2.0 to 5.6 km for hmF2 (around 2 %), depending on the solar activity. Further, we compared the NmF2 and hmF2 values retrieved with our technique to the ones computed by IRI, and found systematic differences between both estimations. The comparison has been made for low solar activity and showed systematic differences up to 50% for NmF2 and 12% for hmF2.

It seems reasonable to conjecture that the aforementioned differences are caused by systematic errors in IRI as well as in the F3/C IRO + LPIM. Hence, a comparison to a third data source could help to assess the contribution of each party. In this paper we compared the vertical Total Electron Content (vTEC) provided by the Jason mission to the corresponding values derived from F3/C IRO + LPIM and from IRI. We found that approximately 50% of the systematic differences reported in our previous paper could be attributed to systematic errors in the F3/C IRO + LPIM technique, and the remaining 50% to systematic errors in IRI.