A comparison of LPIM-COSMIC and IRI(CCIR) F2 peak parameters determinations

F. Azpilicueta*[1], C. Brunini[1] and B. Nava[2]

[1]GESA, Universidad Nacional de La Plata -CONICET, La Plata, ARGENTINA.
(E-mail: f.azpilicueta@fcaglp.unlp.edu.ar)

[2]The Abdus Salam International Centre for Theoretical Physics, Strada Costiera 11, 34151, Trieste, ITALY. (E-mail: bnava@ictp.it)

ABSTRACT

During the last decade the amount of ionosphere measurements, from ground and space born sources, has substantially increased along with the development of high end processing systems. This constitutes a perfect scenario for the International Reference Ionosphere (IRI) to assimilate this huge database and to satisfy the new needs of the Aeronomy Community: an IRI with meteorological capability [1].

The first step before the implementation of an assimilative procedure is to validate the new data. This work intends to contribute in this direction by studying the differences (systematic and statistical) between the F2 peak parameters (hmF2 and NmF2) predicted by the IRI(CCIR) and those obtained from the electron density profiles computed with LPIM-COSMIC/Formosat3 (LPIM-C/F3) technique [2, 3].

The analyzed period extends from January 2007 to October 2012, thus covering all the different seasonal Sun–Earth configurations and a range of solar activity going from low to mid-high level. Figure 1 clearly summarizes the main results obtained in terms of the monthly mean differences for NmF2 (left panel) and hmF2 (right panel), represented as functions of year. Three curves are depicted: black corresponds to the global mean, blue to the Northern Hemisphere and red to the Southern Hemisphere regions. The analysis shows that there is no significant systematic bias between the IRI and LPIM-C/F3 values on both parameters. At the same time, the three curves show a clear correlation with solar activity (last minimum occurred between 2008 and 2009).

The obtained differences are similar to those found between IRI and other models and data sources [4]. The analysis performed is also helpful to study and assess the potentiality of the meteorological information contained in the LPIM-C/F3 by analyzing the standard deviation of the differences. This extra information could represent the key element to improve the IRI predicting capabilities.

Key words: Ionospheric F2-layer, CCIR, LPIM, COSMIC/Formosat3

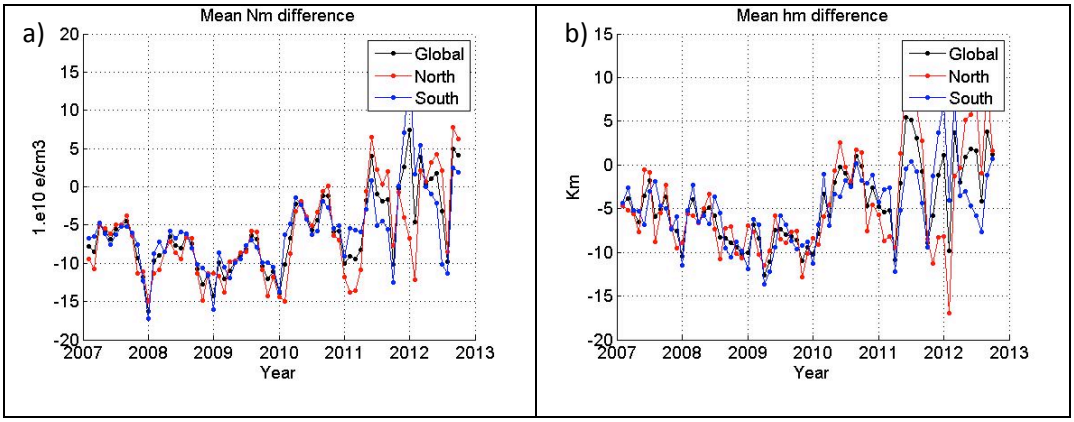

Figure 1. Temporal evolution of the monthly mean difference of a) NmF2 (in 1.e10 electrons/m3) and b) hmF2 (km) for the period studied. Black, red and blue dots correspond to: global, Northern Hemisphere region and Southern Hemisphere region.

References:

[1] Bilitza, D., McKinnell, L.-A., Reinisch, B., Fuller-Rowell, T., (2011). The International Reference Ionosphere (IRI) today and in the future. J. Geodesy, 85:909-920, DOI 10.1007/s00190-010-0427-x.

[2] Brunini, C., Azpilicueta, F., Nava, B., (2013). A technique for routinely updating the ITU-R database using radio occultation electron density profiles. J Geod, 87, 813–823, doi: 10.1007/s00190-013-0648-x.

[3] Anthes, R. A., Bernhardt, P. A., Chen, Y., Cucurul, L., Dymond, K. F., Ector, D., Healy, S. B., Ho, S.-P., Hunt, D. C., Kuo, Y.-H., Liu, H., Manning, K., Mccormick, C., Meehan ,T. K., Randel, W. J., Rocken, C., Schreiner, W. S., Sokolovskiy, S. V., Syndergaard, S., Thompson, D., Trenberth, K. E., Wee, T.-K., Yen, N. L., Zeng, Z., (2008). The COSMIC / FORMOSAT 3 mission – Early results. Bulletin of the American Meteorology Society, March 2008, 313 – 333.

[4] Altadill, D., Magdaleno, S., Torta, J. M., Blanch, E. Global empirical models of the density peak height and of the equivalent scale height for quiet conditions, Adv Space Res, 52, 1756–1769, 2013.