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Combined strategies for filtering COSMIC ionospheric profiles over a low latitude region

Gabriel O. Jerez* [1,2], Manuel Hernández-Pajares [2], Daniele B. M. Alves [1] and João Francisco G. Monico [1]
(1) Sao Paulo State University (UNESP), Faculty of Science and Technology, Department of Cartography, Presidente Prudente, Brazil; e-mail: gabriel.jerez@unesp.br; daniele.barroca@unesp.br; galera.monico@unesp.br
(2) Universitat Politècnica de Catalunya (UPC), Department of Mathematics, UPC-IonSAT and UPC-IEEC Research Groups, Barcelona, Spain; e-mail: manuel.hernandez@upc.edu

With global coverage, radio occultation (RO) is an important technique for probing the Earth's atmosphere. Due to its distribution, RO measurements can complement and fill gaps left by other sources of data. RO profiles are commonly integrated into assimilation methods to enhance atmospheric products, including ionospheric models and numerical weather predictions. Since the advent of GPS/Met, many other missions included receiver for RO in their satellites, the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) (2006-2020) has particular significance, especially due to the number of ionospheric observations provided. For the validation of electron density profiles, comparisons with data from different models, altimeters, vessels, ionosondes, and in situ measurements are typically applied. Besides the assessment of RO missions, some approaches have been discussed to identify and exclude electron density profiles with questionable information. A strategy commonly used is to avoid negative values or to exclude complete profiles with negative electron density values, or with negative values above 100 km [1]. But it is worth it highlighting that negative values below 100 km can result of the horizontal gradients and the assumption of spherical symmetry of atmosphere in the retrieval methods [2]. Besides that, irregular behavior observed in the profiles can be related to physically meaningful ionospheric phenomena and not always corresponding to noisy or erroneous data [3]. In this context, this work aims to report the main findings obtained with the expansion of previous studies [4] related to RO ionospheric profiles filtering methods. Also, in this case, the combination of different filtering strategies is analyzed. The validation of the filtering strategies is performed by means of ionosonde data over a challenging scenario, for two years (2014 and 2015) of data and focusing on four ionosondes in the Brazilian region. Three search windows (20°, 10°, and 5° in latitude and longitude) are used, assuming the ionosondes positions as references. The use of outliers identification and minimum electron density limit leads to the best rates of profiles kept between all the filtering methods (95.36 %), leading to 4.12 % of improvement in the foF_2 error. Another approach combines the previous strategy with a hmF_2 occurrence range limit, leading to significant improvements in the foF_2 error (8 % against 21 %), while the number of profiles kept is not influenced (82 % against 78 %). Many factors may influence the choice of the best strategy for filtering COSMIC profiles, but in the cases analyzed, no indicative evidence of seasonal or geomagnetic storm-related influences was found.

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