*4th URSI AT-RASC, Gran Canaria, 19-24 May 2024*

# Assessment of electron density retrieval from MetOp-A truncated RO measurements

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*Extended Abstract*
EUMETSAT conducted MetOp-A end-of life testing campaigns during summer 2020 which offered an opportunity to test an updated configuration of the GRAS (GNSS Receiver for Atmospheric Sounding) instrument, extending its vertical measurement range up to 300 km and 600 km into the lower and middle of ionosphere. The test campaign lasted for three months and a large set of GPS radio occultation (RO) measurements had been recorded by the GRAS instrument during the two different experiments up to 300 km and 600 km heights. We assessed the GRAS ionospheric data quality by processing RO observations to ionospheric products [1]. A new model assisted RO inversion technique is developed for electron density retrieval from MetOp-A truncated data [2]. The topside ionosphere and plasmasphere above the LEO orbit height are modelled by a Chapman layer function superposed with an exponential decay function representing the plasmasphere.

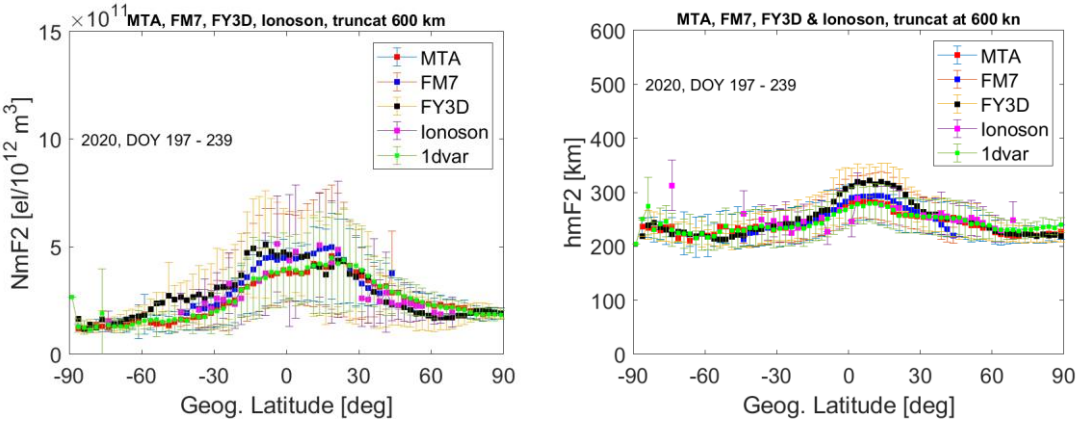


Figure 1: Mean variation of NmF2 and hmF2 obtained from MetOp-A RO profiles (red square- labeled as MTA), FormoSat-7/COSMIC-2 (blue square- labeled as FM7), Fengyun-3D (black square- labeled as FY3D), ionosonde data (magenta square- labeled as Ionoson) and MetOp-A bending angle (BA) profiles (green square- labeled as 1dvar).

The quality of RO electron density (Ne) profiles is assessed by investigating systematic differences between similar products from other LEO satellite missions. We compared peak parameters (e.g., NmF2, hmF2, NmE and hmE) of MetOp-A Ne profiles with independent RO (e.g., COSMIC-2, Fenguyn-3D) and ground vertical sounding data from numerous ionosonde stations. We found that the peak density parameters such as the NmF2 and NmE derived from MetOp-A Ne profiles match most cases with corresponding values when compared with other data sources (see Figure 1). In general, the retrievals from 600 km extension campaign show better results than the 300 km extension campaign as expected. We have found that the accuracy of MetOp-A RO derived NmF2/foF2 and hmF2 is similar or better than the corresponding COSMIC-2 parameters when compared with reference ionosonde data.

*Acknowledgement*:
The work is funded by the GIMA (Assessment of **G**RAS **I**onospheric **M**easurements for Ionospheric Model **A**ssimilation) project under the contract EUM/CO/21/4600002530/RN Order n°4500021039.

*Reference*:

1. Hoque, M. M., F. S. Prol, M. Hernandez-Pajares, R. Notarpietro, et al. 2023. "Assessment of GRAS Ionospheric Measurements for Ionospheric Model Assimilation" Remote Sensing 15, no. 12: 3129. https://doi.org/10.3390/rs15123129.

2. Hoque, M. Mainul, Liangliang Yuan, Fabricio S. Prol, Manuel Hernández-Pajares, Riccardo Notarpietro, et al.. 2023. "A New Method of Electron Density Retrieval from MetOp-A's Truncated Radio Occultation Measurements" Remote Sensing 15, no. 5: 1424. https://doi.org/10.3390/rs15051424.