ASSESSMENT OF GRAS IONOSPHERIC MEASUREMENTS FROM METOP-A END-OF-LIFE TESTING CAMPAIGN

M. Hoque (1), L. Yuan (1), F. S. Prol (1), M. Hernandez Pajares (2), R. Notarpietro (3), A. Von Engeln (3), and C. Marquardt (3)

(1) German Aerospace Center (DLR), Germany
(2) UPC-IonSAT, Barcelona, Spain
(3) EUMETSAT, Darmstadt, Germany

The GRAS instrument on-board of the Metop satellites of the EUMETSAT Polar System (EPS) programme uses the radio occultation (RO) technique to obtain information about the temperature and humidity profiles. RO soundings are also capable of providing information on the vertical structure of the electron density if the measurements cover an appropriate height range (e.g., 90 - 500 km). In the framework of the Metop-A end-of-life testing campaign, the EUMETSAT conducted an ionospheric extension experiment enabling the GRAS instrument to extend its vertical measurement range for ionosphere soundings (up to 300 and 600 km height) for a two months period during summer 2020. During the test campaign a large set of GNSS radio occultation measurements (e.g., carrier phases and pseudoranges) had been recorded by onboard GRAS instrument. The ionospheric measurements were taken with impact parameter height below 600 km and 300 km whereas the Metop-A was flying at an orbit height of about 800 km which makes the electron density reconstruction very challenging.

A study called GIMA (assessment of GRAS Ionospheric Measurements for ionospheric model Assimilation) has been undertaken to complement the GRAS instrument assessment by processing RO observations to ionospheric products. Ionospheric electron density profiles were generated up to the Metop-A orbit height using an adaptive topside ionosphere/plasmasphere model technique. The impact of the limitation in the vertical measurement range on the data quality of the retrieved parameters has been investigated.

A comprehensive validation study is done by comparing the key ionospheric parameters (NmF2, hmF2, NmE) obtained from Metop-A extension campaign with other RO mission reconstructions (e.g., COSMIC-2, Fengyun-3D) and ground vertical sounding observations (ionosonde stations from GIRO network). The investigation shows an overall very good agreement of Metop-A electron density reconstructions with other independent data. Furthermore, the suitability of used electron density extrapolation is checked for operational use with respect to memory use and timeliness.