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Electron density retrieval from MetOp-A radio occultation truncated measurements

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Extended Abstract
Radio occultation (RO) measurements of Global Navigation Satellite System (GNSS) carrier phases onboard a Low Earth Orbiting (LEO) satellite enables the computation of the vertical electron density profile from the LEO satellite orbit height down to the Earth's surface. The ionospheric extension experiment performed by the GRAS RO receiver on board MetOp-A provides opportunities for ionospheric sounding, but with RO measurements only taken with impact parameter height below 600 km (although MetOp-A was flying above an orbit height of about 800 km). There are two main concerns which make the electron density reconstruction very challenging: 1) the plasmaspheric contribution above 600 km up to GNSS orbit height needs to be correctly modelled and 2) the extrapolation of the topside electron density above 600 km up to MetOp-A orbit height. Some aspects of the electron density retrieval and impact on EUMETSAT Polar System - Second Generation (EPS-SG) satellite are already studied by Hernández-Pajares et al. [1]. They developed a technique based on Vary-Chapman Extrapolation and denoted as Abel-VaryChap Hybrid density profile from topside Incomplete RO data (AVHIRO). Here we presented a model assisted RO inversion technique for electron density retrieval from MetOp-A truncated data at 600 km. The topside ionosphere and plasmasphere above the LEO orbit height are modelled by a Chapman layer function superposing with an exponential decay function representing the plasmasphere [2].

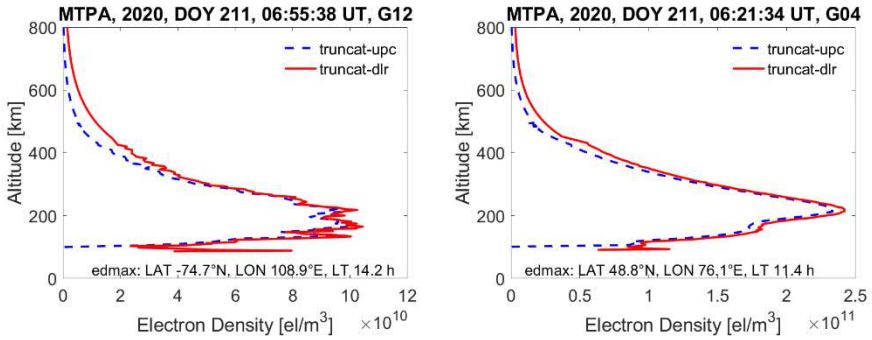

Figure 1: RO retrieval using truncated data at 500 km from MetOp-A extension experiment. Blue and red plots show the retrieval using AVHIRO technique (*truncat-upc*) and model assisted technique (*truncat-dlr*).

Our investigation shows that the developed approach can successfully retrieve the electron density values from the truncated MetOp-A data. We have found that the accuracy of the retrieved electron density profile is comparable to the electron density derived using the AVHIRO technique (see Figure 1). However, the model assisted technique is found much faster than the AVHIRO technique when compared their run times.

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Reference:
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