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Zenith Total Electron Content from the EUMETSAT Metops/GRAS instruments

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Extended Abstract

The GRAS (GNSS Receiver for Atmospheric Sounding) instrument onboard the EUMETSAT Polar System satellites (EPS) Metop-A and Metop-B has a zenith antenna used for obtaining a precise orbit of the satellite which is needed for RO processing. But GNSS signals acquired through this antenna cross solely the ionosphere, and can thus be used to monitor the electron content characterizing the top side region above the LEO satellite. In fact, each tracked dual frequency GNSS signal is sensitive to the Total Electron Content in the LEO-GNSS link, the so called slant Total Electron Content (sTEC), which can be routinely estimated by processing such data with the knowledge of the precise positions of the LEO and GNSS satellites.

This contribution summarizes the activities started at Eumetsat for generating a product focussed on ionospheric monitoring and interesting for space weather applications, derived by processing POD observations from the GRAS Radio Occultation receivers flying on board the Eumetsat Polar System (EPS) Metop-A and Metop-B satellites.

After having corrected for the POD antenna phase pattern effects and for the fluctuations induced by local multipath, the latter being quite significant for the Metops satellites, uncalibrated sTEC can be easily obtained by levelling the L1-L2 carrier phases information to the P2-P1 pseudoranges associated to each received GNSS signal. This result is offset from the true value due to the receiver and transmitter Differential Code Biases (DCB). As a preprocessing step, we estimate the receiver's DCB on a daily base as a least square solution of the more than 17000 linear equations available by assuming that paired sTECs, observed at different elevations, have the same vertical TEC. For this task only observations occurring during night local times and at high latitudes, with a separation angle lower than a certain threshold, are considered. GNSS transmitters DCBs are taken from external providers (for the time being we are using DCBs estimated by the MGEX - Multi-GNSS Experiment and Pilot Project).

Once calibrated sTECs are computed, individual vertical Total Electron Content (vTEC) values are estimated and geolocated at the corresponding Ionospheric Pierce Points (IPP).