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Ionospheric Data Products of the GPS Receivers Onboard the Swarm-E/CASSIOPE Satellite

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The Global Positioning System (GPS) Attitude, Positioning, and Profiling (GAP) instrument is one of eight components of the enhanced polar outflow probe (e-POP) scientific instrument suite onboard the Swarm-E/CASSIOPE satellite. e-POP was designed to primarily study the physical processes coupling the polar ionosphere to the solar wind and magnetosphere. The GAP instrument consists of three GPS antennas oriented towards spacecraft zenith and one antenna oriented in the anti-ram direction, along with associated GPS receivers. This configuration allows for both radio occultation (RO) and topside ionosphere measurements, which are collected at data rates of up to 100 Hz. The elliptical, polar orbit of Swarm-E and high data rate of GAP allows for unique radio occultation and topside ionosphere observations including monitoring and characterization of multi-scale plasma irregularities , which is particularly useful for polar regions where much of the ionospheric structure and dynamic behaviour are not well observed or understood.

The presentation will discuss recent reprocessing of GAP data and ongoing research projects employing the GAP dataset. More than ten years of GAP data have been processed, with calibrated line-of-site total electron content (TEC), Vertical TEC (VTEC), and RO-derived electron density profile data products currently available on the epop-data website (https://epop.phys.ucalgary.ca/data/). The quality and availability of VTEC data and RO ionosphere density retrievals will be presented. A statistical analysis of polar cap VTEC is being conducted using the new VTEC data product, which provides insight into the climatological electron content in the polar cap above variable spacecraft altitudes of ~320-1500 km. In addition, concurrent GAP VTEC and observations of the Imaging and Rapid-scanning ion Mass spectrometer (IRM) of Swarm-E may provide insight into the connection between topside enhancements in plasma content and ion outflow.

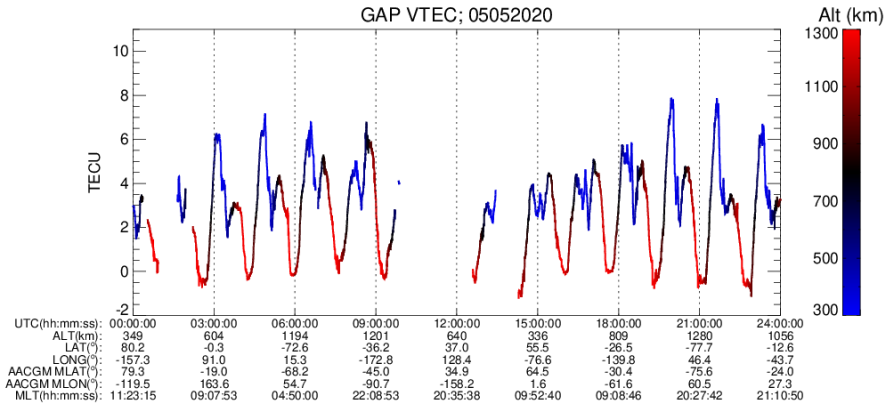

Figure 1. GAP Vertical TEC over a 24 hour period, color coded according to spacecraft altitude.