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Empirical modeling of the topside ionosphere and plasmasphere using GPS-TEC from precise orbit determination (POD) receivers onboard Low Earth Orbit (LEO) satellites.

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A global estimation of the plasma density in the topside ionosphere and plasmasphere is still a challenging task and the usually adopted techniques to measure it all have certain limitations. Radar observations, for example are sparsely located around the globe, and terrestrial GPS-TEC observations provide only integral measurements where a large part of the signal is generally dominated by the lower layers of the ionosphere.

Over the last few years slant TEC observations have become available from high precision dual-frequency GPS receivers onboard a fleet of LEO satellites. These Satellites include Swarm at 450/520 km, Sentinel-1 A/B at 700 km, Sentinel-2 A/B at 786 km, Sentinel-3 A/B at 815 km, GRACE/GRACE-FO at 450 to 500 km, and the COSMIC/Formosat satellites near 800 km altitude. From these satellites relative slant TEC can be computed which is used to determine a reference electron density at 1.000 km altitude and a reference scale height. Next, this information is used to estimate plasmasphere TEC maps. First results indicate, that even under quiet and solar minimum conditions the plasmaspheric slant TEC between 1.000 km and 20.000 km can reach values of up to 10 TECU. For this reason the model is intented to be used for removing the plasmasphere slant TEC from Swarm slant TEC observations to obtain a more precise slant TEC of the topside ionosphere.

We will present first results and will evaluate them by comparing to the USU GAIM model. In addition we will show how the P1-P2 receiver biases of the different LEO missions develop in time and assess the uncertainties in the code leveling to obtain a refined model supported slant TEC.