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Title:	Statistical Views of Cold Plasma in the Ionosphere from GNSS TEC
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Title:
Statistical Views of Cold Plasma in the Ionosphere from GNSS TEC

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Abstract: Dynamics of the ionosphere and plasmasphere form a crucial part of the life cycle of cold plasma through the coupled sun-Earth system. In the modern era, these regions are observed at inner magnetospheric footprints by a combination of many data sources: ground-based total electron content derived from thousands of GNSS receivers with lines of sight to dozens of near-GEO orbit satellites, partial total electron content from the JASON satellite, COSMIC I/II radio occultation based electron density profiles, and Millstone Hill mid-latitude collective Thomson / incoherent scatter radar full altitude profiles of density, temperature and velocity. Recently, these measurements have been fused into TIDAS, a new TEC-based regional ionospheric data assimilation system. TIDAS uses a hybrid Ensemble-Variational technique to assimilate multi-instrument ionospheric TEC/electron density measurements and produces altitude-resolved information over wide spatial regions on the morphology and variations of cold plasma in the coupled ionosphere-thermosphere system.

TIDAS was initially developed for the continental US and adjacent regions with the primary goal of studying midlatitude ionospheric electron density gradients, particularly focusing on the 3-D morphology and evolution of storm enhanced density (SED) which is magnetically connected to plasmaspheric plumes. We will focus in the talk on comprehensive SED observations in the TIDAS framework from 49 storms with DsT < -100 nT, including in-depth analysis of key features (e.g. width, local time extent, plume duration, associated F2 region behavior) over the North American continent where enhanced density features are bright. Results demonstrate activity dependence of SED features and clear sub-corotation features, and we will make connections to earlier studies identifying associated mechanisms such as flow stagnation, tongue of ionization polar cap patch production, and expanding convective electric fields. Such information provides a useful addition to the evolving cold plasma story.