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Poster
Accurate retrieval of absolute Total Electron Content (aTEC) from Global Navigation Satellite System (GNSS) measurements onboard Low Earth Orbit (LEO) satellites is essential for space weather monitoring but demands rigorous calibration and correction of systematic errors. This study details the development of an end-to-end processing algorithm at NOAA/STAR to derive aTEC from PlanetiQ precise orbit determination (POD) measurements. The processing chain enhances aTEC accuracy through: 1) pseudorange multipath calibration; 2) carrier phase–pseudorange leveling; and 3) estimation of GNSS-LEO Differential Code Biases (DCBs).

The PlanetiQ GNSS-LEO mission's pseudorange multipath, caused by spacecraft reflections, introduces structured biases that degrade TEC accuracy. To mitigate this, spacecraft-specific multipath correction models were developed using four months of GNSS data, parameterized by antenna off-boresight and solar array drive angles. Additionally, an iterative approach was developed to estimate optimal LEO multi-GNSS DCBs by minimizing relative inconsistencies among inter-GNSS zenith TEC arcs. These correction methods result in significant improvements in receiver DCB stability, with substantial reductions in variability.

NOAA/STAR thoroughly evaluated the PlanetiQ aTEC products' performance, focusing on accuracy, stability, coverage, and latency. The aTEC products were assessed through two primary comparison methods: 1) inter-comparison with PlanetiQ and UCAR TEC products to examine biases and cross-GNSS consistency; and 2) comparison with collocated COSMIC-2 observations, which serve as independent reference data for verifying absolute TEC uncertainty requirements.
Poster session day
Thursday, April 30, 2026
Poster location
30
Meeting homepage
2026 Space Weather Workshop
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