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Global monitoring of ionospheric weather by GIRO and GNSS data fusion

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Prompt imaging of the ionosphere is key to space weather monitoring, given a wide range of applications that rely on ionospherically propagating radio signals. Because of the vast spatial extent of the ionosphere and only fragmentary sensor coverage, data fusion has good potential for solving the imaging task. Data fusion blends multiple models and observations for the integrated, consistent views of various geosystems. Although a wide selection of plasma imaging instrumentation is now available not all of the sensors can be readily used for the ionospheric weather nowcast because of the specific practical requirements of the task. We describe a novel 4D data fusion service based on near-real-time data feeds from Global Ionosphere Radio Observatory (GIRO) and Global Navigation Satellite System (GNSS) called GAMBIT (Global Assimilative Model of the Bottomside Ionosphere with a Topside estimate). In coordinated operation of GIRO and GNSS, several types of maps are produced (e.g., the global ionospheric effective slab thickness, Figure 1). Because only ground-based sensors contribute measurements to GAMBIT computations, its rapid and accurate monitoring is possible with a few-minute latency of the real-time nowcast.

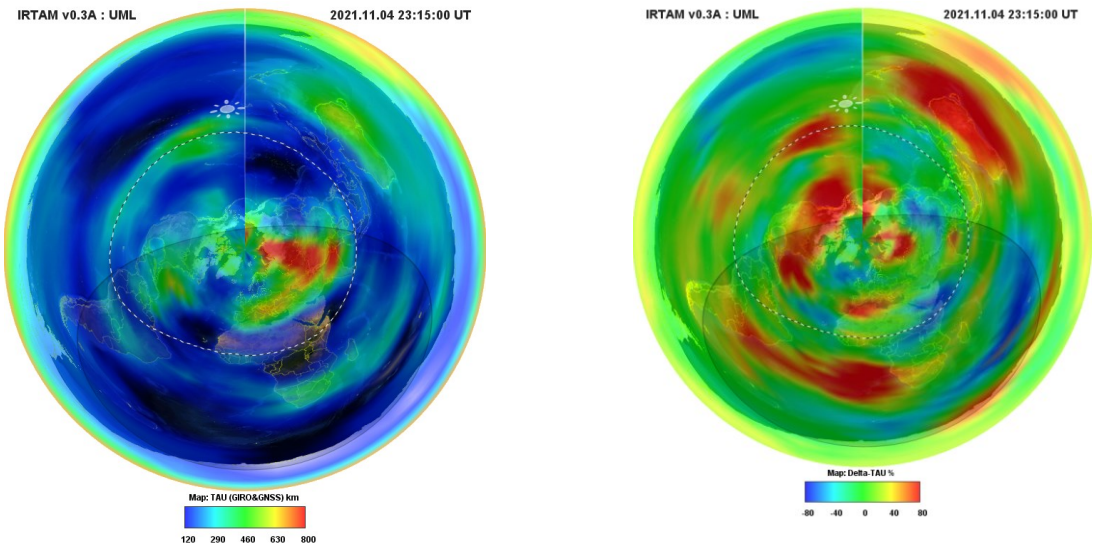

Figure 1. Coordinated GIRO and GNSS operation allows global mapping of the ionospheric effective slab thickness (EST) in near-real-time: (left) EST weather nowcast and (right) the "anomaly" map of EST percent deviations from the quiet-time expected behavior during a negative phase of the November 4-7, 2021 G3-category storm.