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GAMBIT Database and Explorer for Analysis of Real-Time IRI Maps of F2 Layer Peak Height and Density

Abstract:

The Global Assimilative Modeling of Bottomside Ionospheric Timelines (GAMBIT) service is a recent addition to the Global Ionosphere Radio Observatory (GIRO) Internet-accessible data resources provided for public access by the Lowell GIRO Data Center (LGDC). The GAMBIT Database is an online retrospective repository of records that are computed in real-time every 15 minutes by the IRI-based Real-Time Assimilating Mapping (IRTAM) algorithms. The IRTAM morphs the empirical “climatology” IRI model into agreement with the GIRO measurements, so that the new model representations of the ionosphere closely follow its “weather” variability. These ionospheric weather timelines can be acquired from LGDC-operated GAMBIT in their compact form of expansion coefficients for visualization and applications. The GAMBIT explorer offers a suite of tools for validation of the IRTAM results obtained by using partial or complete input GIRO data sets, and by comparisons with coincident global GNSS TEC maps acquired from the MIT Madrigal repository. We will present initial results of the statistical IRTAM validation, making use of the 13+ million records in GAMBIT collected over a 15–year period from 2000 to 2015. We will also look at timelines of well-known and studied space weather events, a Sudden Stratospheric Warming (SSW) of January 2013, and an interplanetary shock and subsequent storm of 7-8 November 2004. The conducted analysis sheds lights on the capabilities of the IRTAM technologies to describe global ionospheric timelines and reveals their intriguing capability to predict system dynamics over no-data areas (spatial interpolation) and in time (short-term forecast). Additionally, we will look into the potential of the GIRO-driven assimilative maps to go beyond the underlying IRI formalism to describe events that have a finer time resolution than the ionospheric climatology was intended to represent.