Progress in Ionospheric Data Assimilation with the USC/JPL Global Assimilative Ionospheric Model

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The joint University of Southern California and Jet Propulsion Laboratory Global Assimilative Ionospheric Model (GAIM) data assimilation system is a mature, complex, and powerful tool for combining first principles physics understanding of the ionosphere, external driving parameters such as models of solar radiation, the upper atmosphere, and electrodynamics, and empirical data to specify the three-dimensional (3-D) ion and electron density structure of the ionosphere as a function of time. Applications of the models provided by this system include: space weather monitoring and high-quality ionospheric calibrations for tracking of NASA's interplanetary assets. Data sources for this system include a large global distribution (1000+) of scientific-grade Global Positioning System (GPS) receivers, some of which provide data in real time, and radio occultation to GPS-satellite total electron content (TEC) slant links measured from low Earth orbiting satellites such as the Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC). Independent and readily available data sources such as ionosondes, incoherent scatter radars, and space-born altimeters such as Jason 1 and its successor Jason 2 can be used for validation purposes, though quality control can sometimes pose challenges.

Ever more numerous data sources, such as the COSMIC-2 which is slated to soon supplant the aging COSMIC system, opportunities resulting from close scrutiny of specific results, and additional functionality developed to meet the growing and changing demands of the community provide the challenges to motivate further development, expansion, and refinement of the GAIM system. In this presentation, we will detail the latest GAIM advancements, including COSMIC radio occultation ingestion, electron density profile specification and the impacts COSMIC has on constraining the problem, our full simulation capabilities, and other developments.