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Regional Analysis of Ionosphere Observables from Multi-Geodetic Sensors

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The next peak of 11-year solar cycle is expected in the next 1∼2 years, with a possibly huge fluctuation in space weather variables such as the electron density and associated total electron content (TEC). Since the space weather variation is a major uncertainty hindering radar signal propagation for altimetry, remote sensing, and other microwave radio relay techniques, accurate estimate of TEC is a key requirement to correct wave-front delays for all geodetic remote-sensing sensors associated with electromagnetic waves. In this study, we exploit the high-low GPS occultation data, arguably the best ionosphere sensors, retrieved from the currently operating FORMOSAT-3/COSMIC constellation, the ionospheric correction in radar altimetry satellites (Jason-1/-2), and TEC obtained from ground based GPS network (CMONOC), to validate the corresponding TEC observables generated by these multi-platform geodetic sensors. Here, we use two empirical TEC models, the coarse resolution Global Ionospheric Maps (GIM) and International Reference Ionosphere (IRI) model, to validate the other TEC observables and study its variations in terms of temporal and spatial spectra. Preliminary result shows that relative biases exist between various data types, notably that the Jason-2 ionosphere delay is about 6∼10 mm (95% confidence) shorter than the delay computed by GIM, Jason-1, or the regional model, and that the COSMIC TEC are biased versus the altimetry-derived TEC. The diurnal, 29-days, and semi-annual (spring and autumn) variations in the TEC are detected in models and in observations, while the major frequencies are aliased in scattered observables such as F-3/COSMIC. Finally, we conduct a regional tomography experiment using these data with spherical wavelet basis function capable of multi-resolution modeling.