Analysis of Slant STEC Methodologies

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The era of Global Navigation Satellite Systems (GNSS) and burgeoning world-wide receiver networks have increased the fidelity of ionospheric models and capacity of their applications. Precise slant total electron content (STEC) measurements are critical for a plethora of modern applications including precision navigation and geolocation, radio communication, surveillance, and weather modeling. The precision of STEC estimates from dual-frequency Global Positioning System (GPS) data is bounded by carrier phase noise, multipath effects, and systematic errors of estimating satellite and receiver biases (C. Brunini and F. Azpilicueta, Geodesy, 84:293-304). Through a collaborative effort, this presentation investigates precision of STEC estimates by analyzing disparities in STEC derived from International GNSS Service (IGS) GPS data among three independent processing chains: an open source algorithm developed at the Applied Research Laboratories at the University of Texas at Austin (ARL:UT) and algorithms developed at the Jet Propulsion Laboratory (JPL) and Haystack Observatory at the Massachusetts Institute of Technology (MIT). A common data set consisting of RINEX files from nearly 150 IGS stations in early March 2012 was processed by all three algorithms. After removing satellite and receiver biases from the STEC estimates, three ΔSTEC comparisons were analyzed over a period of quiescent ionospheric conditions on March 4th, 2012 and a period following a coronal mass ejection on March 7th, 2012. The debiased ΔSTEC values represent the inherent processing noise due to the Kalman filtering technique of obtaining STEC from dual-frequency GPS observations. Results of the ΔSTEC distributions and impact of the processing error will be presented.