COMPARISONS OF VHF BROADBAND AND GPS DUAL-FREQUENCY TEC MEASUREMENTS

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In this study we compare the Total Electron Content (TEC) at Los Alamos, New Mexico derived from the FORTE (Fast Onboard Recording of Transient Events) VHF broadband signals and the GPS dual-frequency TEC measurements from two Allen Osborne Associates (AOA) ICS-4000Z GPS receivers mounted at the Physics Building at Los Alamos National Laboratory. Comparisons are made for the diurnal cycle and seasonal change during the solar maximum years (2000-2001). The 27-day solar cycle TEC variations are also examined for the FORTE-derived TECs and the AOA GPS TEC measurements where data are available. Our results show good agreement on average between the GPS TEC measurements and the VHF TECs derived with refractive bending and high-order moments (the quartic effects) included. We address the uncertainties related to the variations of the central frequency and width of the broadband VHF signals used in deriving VHF TECs of a first-order dispersive ionosphere and demonstrate the importance of the frequency-dependent quartic effects at VHF band on TEC estimations. The changes in the magnitude of quartic effects with elevation angle are examined and the critical elevation angles, at which the quartic terms begin to have a significant effect, are evaluated. Beginning at the critical elevation angles of 30-to-40 degrees, the quartic effect increases exponentially from around 10%-to-15% relative contributions to over 60% at the lowest possible elevation angles of about 15 degrees. Point-to-point comparisons are made between the GPS TECs and the VHF TECs to evaluate the effects of fluctuations in the protonospheric TEC contributions and of the approximation of the local F2-region heights. Issues in the GPS TEC measurements related to elevation angle and the use of individual GPS satellites are also examined. Techniques for combining VHF broadband and GPS dual frequency data to improve our TEC determinations will be discussed.

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