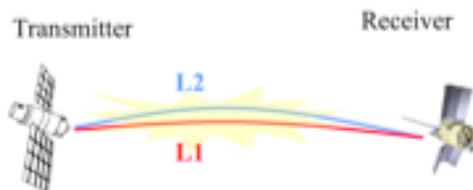
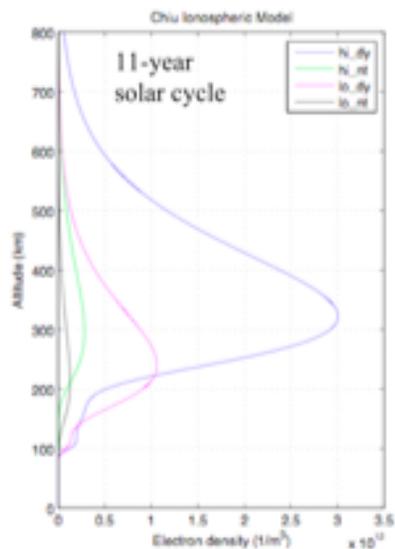


The Impact of Large Scale Ionospheric Structure on Climate Benchmark Atmospheric Soundings Using GNSS Radio Occultation Data

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Atmospheric soundings derived from Global Positioning System radio occultations (GPSRO) acquired in low-Earth orbit have the potential to be global climate benchmark observations of significant value to the Global Earth Observing System (GEOS). Geophysical observables such as atmospheric pressure and temperature are derived by measuring propagation delay induced by the atmosphere, a measurement whose fundamental unit—the second—is absolutely determined by calibration against atomic clocks. We present an analysis of ionospheric bending impact on the GPS signal raypath to set an upper limit on residual retrieval errors that may affect accuracy over the solar cycle period of ~11 years. Three-dimensional ray tracing through realistic radio occultation geometries is combined with estimates of ionospheric structure based on the Global Assimilative Ionosphere Model (GAIM) at JPL. We present conditions characteristic of solar maximum and during intense geomagnetic storm conditions that significantly elevate ionospheric densities.



$$L_3 = \frac{1}{f_1^2 - f_2^2} (f_1^2 L_1 - f_2^2 L_2)$$

"Ionosphere-free" linear combination

Raypath separation (L1 vs. L2) causes incomplete calibration of ionospheric delay

