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Session 9A Paper 3

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Localization of Structure on Extended RO Propagation Geometries

GPS-to-low-earth-orbiting (LEO) radio occultation (RO) geometries are designed for measurements in avertical plane. Reconstruction of atmospheric and ionospheric profiles is facilitated by the planar geometry. Interpreting scintillation that develops over the extended propagation path is more challenging. The point of closest approach is a natural reference for reporting scintillation on occultation paths. However, the structure variation provides information that can be exploited to localize the structure along the extended path. Carrano, et al. demonstrated the principle. A companion presentation will discuss more recent results based on Irregularity Parameter Estimation (IPE).

Although IPE has proven to be a fairly robust method for localizing an equivalent phase screen it relies on two-dimensional propagation and phase-screen equivalence. The theory breaks down where propagation paths approach magnetic field alignment. Additionally, the structure should be uniformly distributed. Field-aligned curvature is one source of non-uniformity.

A configuration-space model has been developed that generates ionospheric structure realizations from distributions of magnetic-field-aligned striations. The striation size distribution can be structured to generate one or two-component inverse power law spectral distributions. The model can populate a representative volume that captures the occultation plane. The model is being applied to investigate the structure configurations that can be resolved by interpreting the occultation intensity variation. Our preliminary results confirm that the ideal field-crossing geometry works well. In this paper we will investigate localization for a range of representative RO geometries.

References:

(1) Carrano, Groves, Caton, Rino, and Straus, “Multiple phase screen modeling of ionospheric scintillation along radio occultation raypaths,” doi:10.1029/2010RS00459

(2) Carrano and Rino "A theory of scintillation for two-component power law irregularity spectra: Overview and numerical results,’ doi:10.1002/2015RS005903