Keith
Groves
Boston College
Charles Carrano, Boston College
William McNeil, Boston College
Charles Rino, Boston College
Invited Talk
(Invited Talk)
Radio occultations (RO) with Global Navigation Satellite Systems (GNSS) have been successfully employed for remote sensing of tropospheric parameters and estimation of ionospheric electron density profiles for the purposes of improving both terrestrial and space weather forecasts. The use of RO data to measure ionospheric irregularities has also been attempted through the measurement of amplitude scintillations. At low latitudes such irregularities are often associated with post-sunset equatorial bubbles that frequently cause significant distortions to radio waves passing through the disturbed ionosphere and impact the performance of space-based communications and navigation systems. Ground-based regional nowcasting techniques have been developed and implemented and real-time low-latitude monitoring networks, such as SCINDA and LISN have been deployed to support this capability, but such networks are limited in scope, difficult to maintain, often unreliable in remote locations and incapable of providing coverage over the open seas. And while the dedicated AFRL Communication/Navigation Outage Forecast System (C/NOFS) satellite has done much to advance our understanding of the equatorial ionosphere, attempts to produce real-time space- based forecasts have enjoyed limited success. Thus, a reliable global scintillation forecast capability remains a worthy goal for the future. RO monitoring of scintillation is advantageous in that it can be performed on a global basis much more readily than using ground-based monitoring techniques, particularly over the oceans. Dual frequency GPS receivers onboard several low Earth orbiting (LEO) satellites (e.g., PICOSat4, SAC-C, CHAMP, COSMIC, and C/NOFS) have routinely collected radio occultation observations using signals transmitted by the GPS constellation of satellites; currently there are more than 1000 occultations recorded daily. While this has provided a rich source of information about the global occurrence climatology and morphology of plasma bubbles and ionospheric scintillation, significant efforts are still needed to exploit RO scintillation measurements for useful scintillation nowcasts. The principal technical challenges stem from the oblique propagation geometries of RO measurements relative to typical satellite-to-ground applications,

resulting in long slant paths through the stratified medium often nearly parallel to the magnetic field. It is thus difficult to geo-locate the sources of the scintillations accurately as well as to translate the propagation effects observed on RO links into the more vertical geometries of concern to users of space-based radio frequency services. We remain optimistic that these challenges can be met to achieve meaningful scintillation nowcasts, though it appears a combination of techniques will be needed to address the primary issues. We present a hybrid approach to characterizing low latitude scintillation with RO observations that combines the application of both apriori knowledge of low latitude irregularities and fundamental complex propagation techniques. The potential for the approach is particularly exciting in view of the planned launch of the COSMIC-2 six satellite constellation in 2018 which promises a ten-fold increase in low-latitude occultations available in near real-time.

OSTS session

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