



Climatology of Small-Medium Scale Ionospheric Plasma Irregularities Observed by FormoSat-3/COSMIC GNSS Radio Occultation Receivers

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Extended Abstract

Ground and satellite-based Global Navigation Satellite System (GNSS) receiver measurements provide a high-resolution technique for monitoring ionospheric plasma irregularities, including scintillation activity, and non-scintillation-producing ionization structures. Studies involving radio occultation (RO) satellite measurements have shown that observed fluctuations in RO signal phase can be used to resolve the vertical structure of small and medium scale (up to ~50 km) ionospheric irregularities [1,2,3], and provide insight into the mechanisms that generate these irregularities.

GNSS receivers onboard six low-Earth orbiting (LEO) FormoSat-3/COSMIC satellites have provided global RO measurements since 2006. Data products include absolute ionospheric TEC and amplitude scintillation index (S4) from two precise orbit determination (POD) receivers and associated antennas onboard each satellite. This study investigates the climatology and characteristics (e.g. scale size, magnitude, vertical gradient, altitude) of small-medium scale plasma irregularities, including the diurnal, seasonal, solar cycle, and solar wind/IMF dependence of these characteristics. The climatology and characteristics of both non-scintillation producing irregularities and irregularities with associated scintillation signatures are presented. Statistical analysis of one year of COSMIC data has revealed that irregularities with corresponding scintillation signatures were observed in predominantly low and high latitude regions, while non-scintillation producing irregularities were observed in both mid and high latitude regions. Occurrence and characteristics of scintillation and non-scintillation producing irregularities had a significant dependence on local time, season, solar wind condition, and geomagnetic activity level. This dependence provides insight into the source and generation mechanisms of irregularities observed at particular latitude regions, including gravity wave perturbations and solar wind/magnetospheric sources. Analysis of ten years of COSMIC RO measurements is currently in progress.

References

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