Multi-GNSS Radio Occultation Algorithms Development for Ionosphere Irregularity Studies with Augmentation from Ground-Based GNSS Networks

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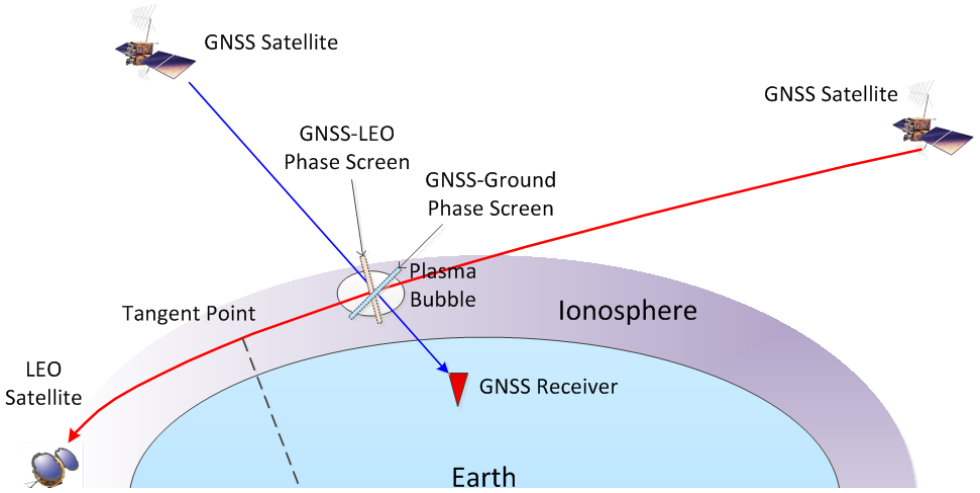

GPS radio occultation (RO) limb-sounding techniques have evolved in parallel with the advancement of global navigation satellite systems (GNSS) from a proof-of-concept to operational systems that provide data for global weather forecasting, climate monitoring, and ionosphere studies. The COSMIC-2 constellation will utilize the latest advancements in multi-constellation GNSS (multi-GNSS) through its tri-GNSS receivers to track open signals from GPS, GLONASS, and Galileo satellites. This new generation of RO systems is expected to increase the number of atmospheric and ionospheric profiles by an order of magnitude and to dramatically improve their measurement accuracy and resolution. There are, however, many challenges remaining in effectively utilizing the enormous multi-GNSS capabilities to *sense*, *localize,* and *characterize* irregularities in the ionospheric plasma. The objectives of this research are: (1) to develop robust and accurate multi-GNSS receiver algorithms to track strong ionospheric and lower tropospheric RO scintillation signals; (2) to develop data-driven, physics-based methodologies to accurately localize ionospheric irregularities and simulate RO scintillation signals; and (3)to perform mixed-scale multi-GNSS interferometry to characterize polar ionospheric irregularities with unprecedented high spatial and time resolutions.