

Space Weather observed by ionospheric GNSS Radio Occultation

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GNSS radio occultation (RO) observations by 6 micro satellites of FORMOSAT-3/COSMIC (F3/C) in 2006-2020 and by 6 small satellites of FORMOSAT-7/COSMIC-2 (F7/C2) in 2019-present for the first time provide a good chance to uniformly, timely, and globally observe the ionospheric three-dimensional (3D) electron density structure from 100 to 600 km altitude. Assimilating F3/C and/or F7/C2 RO data into existing empirical or physical models can be employed to construct monitoring (near real-time), nowcast (few minutes to hours), forecast (few hours to days), and S4 index scintillation models for studying/forecasting the accuracy of positioning and navigation, and quality of telecommunication. Moreover, F3/C and F7/C2 ionospheric RO soundings also allow us examining the 3D electron density structure and related electrodynamics associated with the long-term trends of diurnal, seasonal, solar activity, and geographical location variations, especially in regions of the equatorial ionization anomaly, middle latitude trough, and Weddell/Okhotsk Sea Anomaly; as well as exploring new sciences, such as plasma caves, plasma depletion bays, tsunami traveling ionospheric disturbances, ionospheric storm fluctuations, and seismo-ionospheric precursors.