

GNSS and HF radar measurements for detecting F-region irregularities in the Taiwan-Philippines sector

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In this study, a multi-station and multi-instrument system, developed for ionospheric scintillation and equatorial spread-F (ESF) specification in the Taiwan-Philippines sector, is outlined. The issues related to the scintillation and ESF event observed on Oct. 26, 2021, and at magnetic quiet conditions are presented and discussed. We first indicate the existence of a plasma bubble in the Taiwan-Philippines sector using the FormoSat-7 / Constellation Observing System for Meteorology, Ionosphere and Climate-2 (FS7/COSMIC2) GPS/GLONASS radio occultation (RO) observations. We verify the latitudinal extent of the tracked plasma bubble using the recorded ionograms from the Vertical Incidence Pulsed Ionospheric Radar (VIPR) located at Hualien (23.89°N, 121.55°E, dip latitude 17°N), Taiwan. We further discuss the spatial and temporal variabilities of two-dimensional vertical scintillation index VS4 maps based on the simultaneous GPS L1-band signal measurements from 133 ground-based receivers located in Taiwan and the surrounding islands. We also operate two high-sampling software-defined GPS receivers and characterize the targeted plasma irregularities by carrying out spectrum analyses of the received signal. As a result, the derived plasma irregularities moved eastward and northward, and smaller irregularity scale higher the spectral index and stronger scintillation intensity at lower latitudes on the aimed irregularity feature.

Keywords: ionosphere, HF radar, ionospheric irregularity