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A phenomenological model of ionospheric electron density based on GPS radio occultation data

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A numerical and phenomenological model of global ionospheric electron density (ne) is investigated. The three-dimensional ne model has been named the TaiWan Ionospheric Model (TWIM) and constructed from monthly-weighted and hourly vertical ne profiles retrieved from FormoSat3/COSMIC GPS radio occultation (RO) measurements. The TWIM exhibits vertically-fitted Chapman layers, with distinct F2, F1, E, and D layers, and surface spherical harmonics approaches for the fitted Chapman-layer parameters including peak density, peak density height, and scale height. These results are useful in investigation of near-Earth space and large-scale ne and total electron content (TEC) distributions with diurnal and seasonal variations, along with geographic features such as the equatorial anomaly (EA). This paper also investigates the diurnal and seasonal variations of EA within different ionospheric layers and specifically attempts to account for the latitudinal and longitudinal structures caused by atmospheric tides.