The Taiwan Ionospheric Model (TWIM) and model prediction using autocorrelation method

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A three-dimensional ionospheric electron density (*Ne*) model (L.-C. Tsai, C. H. Liu, T. Y. Hsiao, and J. Y. Huang, Radio Sci., 44, doi:10.1029/2009RS004154, 2009) has been named the TaiWan Ionospheric Model (TWIM) and constructed from global distributed ionosonde *foF2* and *foE* data and vertical *Ne* profiles retrieved from FormoSat3/COSMIC GPS radio occultation measurements. The TWIM exhibits vertically-fitted α-Chapman-type layers, with distinct F2, F1, E, and D layers, and surface spherical harmonics approaches for the fitted 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* distribution. This way the continuity of *Ne* and its derivatives is also maintained for practical schemes for providing reliable radio propagation predictions. The ray-tracing methodology also has potential applicability to ionospheric correction as applied to GPS positioning. However, the ionosonde and RO data are usually collected from several hours to one day after the observations, and the resulting TWIM is not a real-time model. We have developed an autocorrelation method for temporal prediction of model layer characteristics. The fitted TWIM layer parameters are considered as a realization of a periodic process, and the autocorrelation functions and their autocorrelation coefficients are determined from the derived TWIM parameter values over a window of 30 days. On that basis a TWIM prediction model can be obtained and then evaluated by the ionosonde data.