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Modeling Chinese ionospheric layer parameters based on EOF analysis

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Using 24-ionosonde observations in and around China during the 20th solar cycle, an assimilative model is constructed to map the ionospheric layer parameters (foF2, hmF2, M(3000)F2, and foE) over China based on empirical orthogonal function (EOF) analysis. First, we decompose the background maps from the International Reference Ionosphere model 2007 (IRI-07) into different EOF modes. The obtained EOF modes consist of two factors: the EOF patterns and the corresponding EOF amplitudes. These two factors individually reflect the spatial distributions (e.g., the latitudinal dependence such as the equatorial ionization anomaly structure and the longitude structure with east-west difference) and temporal variations on different time scales (e.g., solar cycle, annual, semiannual, and diurnal variations) of the layer parameters. Then, the EOF patterns and long-term observations of ionosondes are assimilated to get the observed EOF amplitudes, which are further used to construct the Chinese Ionospheric Maps (CIMs) of the layer parameters. In contrast with the IRI-07 model, the mapped CIMs successfully capture the inherent temporal and spatial variations of the ionospheric layer parameters. Finally, comparison of the modeled (EOF and IRI-07 model) and observed values reveals that the EOF model reproduces the observation with smaller root-mean-square errors and higher linear correlation co- efficients. In addition, IRI discrepancy at the low latitude especially for foF2 is effectively removed by EOF model.