Assimilation of Sparse Continuous Groundbased Ionosonde Data into IRI Using NECTAR Model Morphing

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Non-linear Error Compensation Technique for Associative Restoration (NECTAR) is a novel approach to the task of assimilating fragmentary sensor data into a global coverage model, in which an underlying model prediction is iteratively transformed (“morphed”) into a better agreement with the available sensor data. Similarly to the Kalman filter, NECTAR gleans the system nowcast from the observed mismatch of prediction and observations; however, each NECTAR *update* step trying to correct the observation-model disagreements is a non-linear recursive process of manipulating a large number of internal multiscale constituents of the underlying empirical model, both spatial and temporal. The NECTAR error compensation procedure is performed by the Hopfield feed-back neural network commonly used in associative memory architectures that restore full information from its fragments. When applied to the sparse spatial data from the contributing observatories, such neural network becomes an associative multiscale interpolator of missing information. To ensure the multiscale capability of NECTAR assimilation analysis in the time domain, the spatial interpolation is performed individually for each diurnal harmonic of the differences between observation and prediction computed for each sensor location. Early results of the NECTAR model morphing applied to the assimilation of measured data from the Global Ionosphere Radio Observatory (GIRO) into the International Reference Ionosphere (IRI) model reveal its intriguing capability to predict system dynamics over no-data areas (spatial interpolation) and in time (short-term forecast).