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Assimilation of FORMOSAT-3/COSMIC electron density profiles into a coupled Thermosphere/Ionosphere model

I-Te Lee (1,2), Tomoko Matsuo (3,4), Arthur D. Richmond (2), Jann-Yeng Tiger Liu (1,5)

(1) Institute of Space Science, National Central University, Chung-Li, 32001, Taiwan, (2) High Altitude Observatory, National Center for Atmospheric Research, Boulder, CO, 80301, USA, (3) Cooperative Institute for Research in Environmental Sciences, University of Colorado at Boulder, Boulder, CO, 80309, USA, (4) Space Weather Prediction Center, National Oceanic and Atmospheric Administration, Boulder, CO, 80305, USA, (5) National Space Organization, Hsinchu, 30078, Taiwan

This paper presents our effort to assimilate FORMOSAT-3/COSMIC (F3/C) GPS Occultation Experiment observations into the National Center for Atmospheric Research (NCAR) Thermosphere Ionosphere Electrodynamics General Circulation Model (TIE-GCM) by means of ensemble Kalman filtering (EnKF). The F3/C EDP are combined with the TIE-GCM simulations by EnKF algorithms implemented in the NCAR Data Assimilation Research Testbed open-source community facility to compute the expected value of electron density, which is 'the best' estimate of the current ionospheric state. Assimilation analyses obtained with real F3/C electron density profiles during geomagnetic quiet time and disturbed period are further compared with independent ground-based observations and global ionospheric map as well as the F3/C profiles themselves. The comparison shows the improvement of the primary ionospheric parameters such as NmF2 and hmF2 and further display some small scale physical meaning structures which might either generally ionospheric features or storm effects. Nevertheless some unrealistic signatures appearing in the results and high rejection rates of observations due to the applied outlier threshold and quality control are also found in the assimilation experiments. These features are additionally analyzed to identify and correct the model biases in the future.