The Impact of a Special Filter on the Assimilation of GPS Radio Occultation Data in the Lower Tropical Troposphere

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Abstract:
Under the condition of strong inversion associated with stable marine atmospheric boundary layer (ABL) and moist convection, GPS radio occultation (RO) bending angle (BA) profiles often possess sharp vertical structure, which cannot be resolved by current operational weather prediction models. Substantial systematic errors (biases) can occur when the raw RO bending angle profiles are assimilated into weather models. This study examines the systematic errors (biases) associated with the assimilation of GPS RO data with different vertical grid resolution. The BA profiles calculated from the actual refractivity observations sampled at the vertical grids of the Weather Research and Forecast (WRF) and ECMWF model are compared with the raw BA observations to determine the biases. The statistics based on the RO data (atmprf) from the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) for April 2012 shows sizeable systematic biases in the moist lower troposphere where stable ABL and moist convection prevail. Filtering of BA data consistent with the model vertical resolution reduces the biases substantially. Assimilation experiments with the WRF model shows that the filtering of BA data prior to assimilation improves the fit of model short-range (6-h) forecast to RO BA data, and consequently, leads to improved forecast.