The Impact of FORMOSAT-3/COSMIC Data on Regional Weather Predictions

Shu-Ya Chen1, Yong-Run Guo2, Chin-Tzu Fong1, Ying-Hwa Kuo2,3,
Chun-Tzu Terng4, Pan Chi1

Meteorological Information Center, Central Weather Bureau, Taiwan1
National Center for Atmospheric Research, USA2
University Corporation for Atmospheric Research, USA3
Marine Meteorology Center, Central Weather Bureau, Taiwan4

Six FORMOSAT-3/COSMIC (FORMOSA Satellite #3 / Constellation Observing System for Meteorology, Ionosphere and Climate) satellites, which provide soundings with high vertical resolution, have been launched successfully in April 2006. The characters of Global Positioning System (GPS) radio occultation (RO) are unaffected by cloud and rain, and do not need to be calibrated, which are different from other satellites. The GPS RO data has been applied in several operational centers, e.g. ECMWF, NCEP and Météo France etc. The Center Weather Bureau (CWB) in Taiwan incorporated the FORMOSAT-3/COSMIC data into its operational system starting in July 2009.

In this study, we use the WRF (Weather Research and Forecasting) 3DVAR (three-dimensional variation) as the assimilated system. Error covariance plays an important role on the data assimilated model. Hence, we are focus on the observational error tuning to expect that an appropriated observational error would give a better initial condition. The local refractivities got from FORMOSAT-3/COSMIC are assimilated into WRF 3DVAR, and they show improvements in the regional model prediction before the error tuning. Two error factors are estimated by using one month GPS RO data in June and December 2008, respectively. Then, these error factors are applied into data assimilations in corresponding months. The verifications against GPS RO soundings show that assimilations with error tuning would get a further improvement than that without error tuning, no matter the analysis or forecasts. However, the improvements decrease with the simulated time. A sensitivity test for the summer month was used from the error tuning factor estimated from the winter month. This shows a larger bias and root-mean-square error as expected. We also make data thinning for GPSRO by choosing observations, which are closest to model levels, to get a comparable weighting between observation and model first guess. However, data thinning does not show a significant impact on the numerical weather prediction.