Impact of FORMOSAT-7/COSMIC-2 RO on High-Resolution Hybrid 3DEnVar System at Central Weather Bureau of Taiwan

Jing-Shan Hong, Wen-Jou Chen, Ying-Jhen Chen, Siou-Ying Jiang, and Chin-Tzu Fong
Central Weather Bureau, Meteorological Information Center, Taiwan (mtn.hong@gmail.com)

The FORMOSAT-7/COSMIC-2 (simplified as FS-7/C-2 in the following descriptions) is the constellation of satellites for meteorology, ionosphere, climatology, and space weather research. FS-7/C-2 was a joint Taiwan-U.S. satellite mission that makes use of the radio occultation (RO) measurement technique. FORMOSAT-7 is the successor of FORMOSAT-3 which was launched in 2006. The FORMOSAT-3 RO data has been shown to be extremely valuable for numerical weather prediction, such as improving the prediction of tropical cyclogenesis and reducing the typhoon track error. The follow-on FS-7/C-2 mission was launched on 25 June 2019, and is currently going through preliminary testing and evaluation. After it is fully deployed, FS-7/C-2 is expected to provide 6,000 GNSS (Global Navigation Satellite System) RO profiles per day between 40S and 40N.

In this study, we conduct a preliminary evaluation of FS-7/C-2 GNSS RO data on heavy precipitation events associated with typhoon and southwesterly monsoon flows based on the operational NWP system of the Central Weather Bureau (CWB) in Taiwan. The FS-7/C-2 GNSS RO data are assimilated using a dual-resolution hybrid 3DEnVar system with a 15-3 km nested-grid configuration. In the 15km resolution domain, flow-dependent background error covariances (BECs) derived from the perturbation of ensemble adjustment Kalman filter (EAKF), will be used to conduct hybrid 3DEnVar analysis. In the 3 km resolution domain, the 15 km resolution flow-dependent BECs will be inserted to the 3 km grid using a Dual-Resolution (DR) technique, and then combined with 3 km resolution static BECs, to perform the high-resolution 3DEnVar analysis. The performance of the CWB operational NWP system on quantitative precipitation forecast of significant precipitation events with and without the assimilation of FS-7/C-2 GNSS RO data will be evaluated.