An Impact Study of COSMIC Refractivity Data on the CWB Global Forecast System

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Satellites from the FORMOSAT-3/Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) mission provide vertical profiles of pressure, temperature, and moisture, using the GPS radio occultation (RO) retrieval technique. Using the three-dimensional variational technique, the Central Weather Bureau (CWB) in Taiwan has successfully developed the capability of assimilating refractivity profile into its Global Forecast System (GFS). The impacts of the GPS RO data on GFS analyses and forecasts in a winter month (2008 January) and a summer month (2007 July) are investigated in this study. Results show that assimilation of GPS RO refractivity data has neutral-to-positive impacts on geopotential height, temperature, and wind in the Southern Hemisphere, and a less degree of improvement is found in the Northern Hemisphere and Tropics. Inclusion of GPS data in the GFS analysis may result in warmer temperature at low levels and colder temperature at middle levels in the Southern Hemisphere, and drier moisture at low-to-middle levels globally. The neutral-to-positive impacts of GPS/RO data on the CWB/GFS model performance over different seasons clearly demonstrate their operational benefits, thus the CWB has included the COSMIC data in daily operation since July 2009.

Keyword: COSMIC, GPS, RO, CWB, data assimilation, global model