Impact to CWB/GFS for assimilation of the FORMOSAT-3/COSMIC GPS RO local refractivity observations

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Since the FORMOSAT-3/COSMIC launched in April 2006, many operational weather centers around the world have assimilated the Global Positioning System/Radio Occultation (GPS/RO) measurements from this mission, and have demonstrated positive impacts on daily forecasts. In order to assimilate GPS/RO observations into the Global Forecast System at Central Weather Bureau (CWB/GFS), we have built the local refractivity operator into the GFS three-dimensional variational system and have conducted the impact studies by using a “two-step” approach which assimilated all other non-GPS observation data in the first step to obtain a No-GPS analysis as the first guess of the second step, and then assimilated the GPS data exclusively in the second step. A latitude-dependent weighting function is applied over different geographical regions. By using most of the GPS observations after QC screening (~73% used), two post-run experiments for a summer month (July 2007) and a winter month (January 2008) were examined. Results show that the assimilation of GPS/RO local refractivity data has neutral-to-positive impacts to forecasts of geopotential height, temperature and wind in the Southern Hemisphere up to 6 days, and a less degree of improvement has been found in the Northern Hemisphere and Tropics. Positive impacts in the summer hemisphere are more significant than those in the winter hemisphere. Inclusion of GPS data in the GFS analysis may result in warm and dry biases and the analysis increments in winter month are larger than in summer month. On the other hand, we have also conducted 2 typhoon cases experiments, Typhoon Jangmi(2008) and Morakot(2009), to show the impacts to forecasting typhoons tracks. The results show that the track error are reduced after 24hr forecasting, after assimilating GPSRO data. Based of these systematic evaluation results, the CWB has officially included the COSMIC data in the assimilation system for operational forecasts since 1 July 2009.

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