

Application of FORMOSAT-3/COSMIC Data to Weather Prediction

Ying-Hwa Kuo, Lidia Cucurull, Hui Liu, and Zaizhong Ma
COSMIC Program Office, UCAR
Boulder, CO 80307

Abstract

The radio occultation (RO) technique, which makes use of radio signals transmitted by the Global Position System (GPS) satellites, has emerged as a powerful and relatively inexpensive approach for sounding the global atmosphere in all weather and over both land and ocean. As demonstrated by the proof-of-concept GPS/Meteorology (GPS/MET) experiment and more recently by the CHAMP (CHALLENGING Minisatellite Payload) and SAC-C (Satellite de Aplicaciones Cientificas-C) missions, GPS RO data are shown to be of high precision, accuracy and vertical resolution. On 15 April 2006, the joint Taiwan-U.S. FORMOSAT-3/COSMIC mission, a constellation of six microsattellites, was launched into a 512-km polar orbit from Vandenberg Air Force Base. Using on-board propulsion these satellites are being deployed to their final orbits at 800 km with 30 degrees of separation. This process will take about 17 months following the launch. During the early weeks of the deployment, the satellites were spaced closely, offering a unique opportunity to verify the high precision of RO measurements. Since 28 July 2006, COSMIC has been providing a large number of RO soundings to support the research and operational communities. The number of soundings will increase to about 2,500 soundings per day by mid 2007 as the satellites are further separated and reach their final orbits. Currently, about 500 users have signed up for the use of the FORMOSAT-3/COSMIC data.

Preliminary assessments have shown that the GPS RO data from COSMIC are of better quality than those from the previous missions and penetrate much farther down into the troposphere; more than 90- percent of the soundings reach to within 1 km of the surface on a global basis. COSMIC data are making a positive impact on operational global weather forecast models. Following several months of testing, European Centre for Medium Range Forecasts (ECMWF) began using the COSMIC data operationally on 12 December 2006. Several other global operational centers, e.g. the National Centers for Environmental Prediction (NCEP), the Canadian Meteorological Centre, the UK Meteorological Office and Météo France, plan to use COSMIC data operationally in 2007. Recent global data assimilation of FORMOSAT-3/COSMIC data has shown a significant impact on short-range to medium-range prediction. Experiments using the WRF-based ensemble Kalman filter system (EnKF) have also demonstrated the impact of FORMOSAT-3/COSMIC data on the analysis and prediction of tropical cyclones. This paper reviews the objectives and status of the FORMOSAT-3/COSMIC mission and presents highlights of the research on the assimilation of FORMOSAT-3/COSMIC GPS RO data for numerical weather prediction.