The Impacts of GPS Radio Occultation Data on the Analysis and Prediction of Tropical Cyclones

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The atmospheric limb sounding technique making 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. The GPS radio occultation (RO) sounding data have several important attributes, including high precision, accuracy and vertical resolution. In addition, GPS RO data are minimally affected by clouds and precipitation, and are self-calibrating with no concerns of instrument drifts. The launch of the joint U.S.-Taiwan COSMIC/FORMOSAT-3 (hereafter COSMIC) mission, a constellation of six microsatellites, in April 2006 marked the beginning of a new era of GPS atmospheric remote sensing. Since its launch, COSMIC has been providing large number GPS RO soundings to support the research and operational communities. As of August 2012, COSMIC has taken more than 3.3 million neutral atmospheric RO soundings, serving more than 1900 users from 65 countries. With the ability to penetrate deep into the lower troposphere using an advanced open-loop tracking technique, COSMIC data have shown the capability to observe the structure of the tropical atmospheric boundary layer, providing valuable information on low-level atmospheric water vapor. This is particularly important for tropical cyclone prediction. In this paper, we will present results from real data experiments that examine the impacts of GPS RO data on the analysis and prediction of tropical cyclones. We show that the assimilation of COSMIC GPS RO data can significantly improve the model’s ability to predict the genesis of tropical storms, as well as the forecast of hurricanes including both track and intensity. A follow-on mission, known as COSMIC-2, will be launched in 2016, and will provide an order of magnitude more RO soundings to support the prediction of tropical cyclones.