Impacts of FORMOSAT-7/COSMIC-II RO Data on Typhoon Forecasts

Ching-Yuang Huang\textsuperscript{1,2}, Nien-Ching Lee\textsuperscript{1}, Wen-Hsin Teng\textsuperscript{1}, and Xin Zhang\textsuperscript{3}

\textsuperscript{1}Department of Atmospheric Sciences, National Central University, Jhong-Li, Taiwan
\textsuperscript{2}GPS Science and Application Research Center, National Central University, Jhong-Li, Taiwan
\textsuperscript{3}National Center for Atmospheric Research, Boulder, Colorado, U.S.A.

Abstract

This study investigates the impact of GNSS RO observations on typhoon prediction by utilizing the real observations from COSMIC, and from OSSE (Observing System Simulation Experiments) for FORMOSAT-7/COSMIC-II (F7/C2) that can deliver about daily 10000 RO samples at the later phase. The cases chosen for impact study are Typhoon Morakot (2009) and Typhoon Haiyan (2013). For hypothetic RO data, the background form MM5 was used to provide the atmospheric condition used for a 2-D ray-tracing model to generate RO refractivity.

The WRF adjoint was used to study the forecast sensitivity to RO observations for the two typhoons. For forecast sensitivity, the cost function is defined as the kinetic energy in the selected zone. Preliminary results from 12-h and 24-h forecasts indicate that the RO data from F7/C2 show positive impacts on reducing the error of kinetic energy typical of steering flow, which are larger than the conventional GTS soundings, while the COSMIC RO impacts are slightly smaller than the GTS. The positive impacts are larger for Typhoon Morakot than Typhoon Haiyan, and are present mostly at upper troposphere and lower stratosphere (UTLS). These positive impacts are verified by the forward model forecasts of 48 h with full physics for both typhoons. F7/C2 RO may provide a further improvement of 10% in track prediction for Typhoon Haiyan, compared to COSMIC.