# Impact of Satellite Radiance Data on Simulations of Bay of Bengal Tropical Cyclones Using the WRF-3DVAR Modeling System

Ashish Routray, U. C. Mohanty, Krishna K. Osuri, S. C. Kar, and Dev Niyogi

**Abstract:** This study attempts to evaluate whether assimilating radiance observations in the Weather Research and Forecasting (WRF) model could improve track, intensity, and precipitation forecasts of tropical cyclones (TCs) that occurred over the Bay of Bengal. The bias correction coefficients obtained from offline statistics, along with the quality control for radiances, were computed in the variational assimilation system. For this study, three numerical experiments named CNTL (no assimilation), GTS (with Global Telecommunication System observations), and RAD (radiance data along with GTS observations) were carried out with ten different model initial conditions for two TCs. The averaged root-mean-square errors of the analysis were relatively lower in the RAD experiments in comparison to the GTS experiments for all assimilation cycles of the meteorological variables. The mean initial position errors of TCs were reduced by 30%–47% in the RAD runs over the other runs. The results indicate that the assimilation of radiance data has a positive impact on the prediction of track, intensity, thermodynamic structures, and reflectivity associated with the storms. Improvements in mean landfall position errors were shown to range from 40% to 70% in the RAD experiments as compared to the CNTL and GTS simulations. This is because the RAD analyses are able to successfully reproduce the initial vortex and vertical structures as well as the prominent synoptic features associated with TC storms; therefore, the performance of the WRF modeling system is enhanced for simulations of track, structures, and intensity of TCs.

**Index Terms**—Bias correction coefficients, radiance data, tropical cyclones (TCs), variational data assimilation, weather research and forecasting (WRF) model.