# Simulation of Heavy Rainfall Events due to Intense Vortex over Indian Region: Impact of DWR Data

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Severe weather events like tropical cyclones, monsoon depressions, thunder storms etc occurred due to the presence of intense vortex. The heavy rainfall is associated with these extreme weather events over Indian region and the heavy rainfall events are the most dangerous threat to life and property. These intense vortexes are caused due to the organized meso-convective systems. The mesoscale models are suitable to predict the mesoscale convective systems, which influence the large scale flows. The initial and boundary conditions are provided to the mesoscale models from large scale global analyses. However, the models are not able to comprehensively capture the prominent features associated with organized convective processes. Therefore, an acceptable improvement in the large scale analyses is essential through assimilation of additional observations. An easy way to get a lot of information over the surface and the upper levels is through remote sensing techniques (satellites, radars, etc where observations are scarce). It provides an ample amount and quality of data that can be used to improve the initial condition and forecast skill of the model. In this study two intense vortexes that occurred in 02-04 August 2006 (case-1) and 04-07 July 2007 (case-2) over Bay of Bengal (BOB) due to the presence of monsoon depression (MDs) are considered. The majority of the heavy rainfall events and related natural hazards are occurred mainly over the eastern part of India due to MDs during monsoon season. The present study evaluates the impact of assimilation of Doppler Weather Radar (DWR; Kolkata) radial velocity (RV) and reflectivity (RF) on the prediction of the MDs using Weather Research and Forecasting-three dimensional variational (WRF-Var) data assimilation system. In order to evaluate the impact of DWR data in simulating these extreme weather events, three numerical experiments: CNTL (no assimilation); GTS (only assimilated GTS observations) and DWR (assimilation of both GTS and DWR) are carried out. The WRF model with 30 km horizontal resolution is integrated up to 54 hours in both experiments from the initial time 00 UTC of 02 August 2006 and 05 July 2007 for case-1 and case-2 respectively. The low resolution FiNaL analyses (FNL; $1^o$ X $1^o$) are provided as first guess and boundary conditions for CNTL. The results show that assimilation of DWR data has a positive impact on prediction of initial location of vortexes, propagation and rain bands associated with the MDs. The track errors are significantly reduced in assimilation experiment mainly due to utilization of DWR compared with CNTL and GTS simulations. The magnitude of wind forecast at different pressure levels of the depressions and their track could be predicted satisfactorily in the assimilation experiments. The vertical cross-sections of

wind and temperature forecasts show well vertical structures of the depressions in DWR simulation.

**Key words:** Doppler weather radar, monsoon depression, variational data assimilation, mesoscale model