Impact of cyclone bogusing and regional assimilation on tropical cyclone track and intensity predictions

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Abstract

The aim of this study is to assess the impact of tropical cyclone bogusing in WRF assimilation and forecast system for cyclone track and intensity prediction in short range forecast. The impact is demonstrated in terms of track error, central pressure, and maximum sustained wind speed. The study is based on the three cyclones; namely 'LAILA' (Bay of Bengal), 'GIRI' (Bay of Bengal) and 'PHET' (Arabian Sea), formed in the year 2010. The WRF model makes use of the operational NCMRWF T382L64 analysis and forecasts and the model is integrated upto 72 hrs for producing the cyclone track and intensity forecast. Four sets of experiments were performed: (i) The control experiment (CNTL) in which neither assimilation nor cyclone bogusing is done. The model is initialized using interpolated global model analysis. (ii) In assimilation experiment (VAR), model initial condition is prepared using WRF VAR data assimilation system (without cyclone bogusing). (iii) The cyclone bogusing experiment (BOG) featuring cyclone bogusing alone without assimilation. In this case the model first guess is modified using cyclone bogusing and used as the initial condition. (iv) In the forth experiment, the initial condition of the model is prepared with both cyclone bogusing followed with WRF data assimilation (BOGVAR). Results indicate remarkable impact of cyclone bogusing on the initial condition. All three cyclones can be located in the initial conditions (0000 UTC) of bogus (BOG and BOGVAR) experiments which were otherwise absent in nobogus (VAR and CNTL) experiments. Significant reductions in track errors occurred in BOGVAR experiment. The maximum reduction in track error in BOGVAR compare to VAR is 76.8 % in 'LAILA', 87.3 % in 'GIRI' and 51.5 % in 'PHET' respectively. Maximum sustained wind speed and minimum central pressure are close to observations in BOGVAR compared to VAR for 'LAILA' and 'GIRI'.