Abstract

Mesoscale prediction of track and intensity of land-falling tropical cyclones (TCs) is one of the challenging tasks. As for as single model forecast is concerned, a high resolution mesoscale model is expected to provide better forecast of the TCs. This thesis deals with the mesoscale prediction of land-falling Bay of Bengal (BoB) cyclones.

In this study, the mesoscale modeling systems ARW-WRF is customized for the prediction of BoB cyclones through sensitivity studies on parameterization of PBL and cumulus convection processes. The results indicate that the model simulated track and intensity of the storms are sensitive to PBL and cumulus parameterization schemes. The track and intensity of the storms is better simulated by the model with combination of YSU planetary boundary layer and Simplified Arakawa-Schubert cumulus convection parameterization schemes. Impact of lateral boundary condition (LBC) of different spatial and temporal resolution is also investigated. The first 48 hours simulation is not affected by lateral boundary condition but subsequent simulation is significantly influenced by the LBC. The track and intensity of the storm are better simulated with high resolution GFS forecast as LBC updated every 3 hourly. The track, intensity and trends of the intensification and dissipation of the cyclone Sidr improved significantly with assimilation of conventional and non-conventional observations. The investigation of the impact of radiance from various sensors indicates that assimilation of radiance from AMSU-B has more significant impact on the prediction of track and intensity. The performance of the customized mesoscale modeling system ARW-WRF with improved initial condition (with the assimilation of available observations) is evaluated towards predictions of the cyclonic storms in 2013. The results indicate that the track of the storms upto 60 hours are better simulated by the customized ARW-WRF compared to other operational global and regional model. The intensity and trends of the intensification and dissipation of the storms are also reasonably well predicted by the model.

Keywords: Tropical cyclone, Bay of Bengal, WRF, cumulus convection, planetary boundary layer, initial condition, data assimilation