STUDY OF BOB CYCLONE AILA: MOISTURE EFFECTS ON HEAVY RAIN AND FLOODING IN BANGLADESH, BHUTAN, NE-INDIA AND NEPAL

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ABSTRACT

Cyclone AILA-2009 was of moderate intensity that ravaged southwestern part of Bangladesh badly. Alongside, it ravaged West Bengal of India, eastern Nepal and southern Bhutan. Due to torrential rain these four countries experienced flooding effects. A series of heavy rainfall events caused devastating floods across portions of south central and southwest Bangladesh into Northwestern Bangladesh, Southeastern Nepal and Bhutan from May 26-27, 2009. The occurrence of both a frontal and mesoscale convection pattern and the entrainment of tropical moisture from western Bay of Bengal (BoB) combined to produce heavy rainfall. The wet spell episode persisted over a two days period. An extensive area with storm totals of 25 to 50 mm stretched from southwest Bangladesh into southeastern Nepal and Bhutan. This is a case study examining the meso-scale, upper air and hydro-logic aspects which led to the prolonged heavy rain and flood episode. Advanced Research WRF (ARW) Model with horizontal resolution of 9 km x 9 km, 50s time step and 27 vertical levels has been used to simulate the nature of Cyclone AILA and its associated wind, rainfall etc. Six hourly Final Reanalysis (FNL) data of National Centers for Environmental Prediction (NCEP) were used as input to WRF-ARW Model for the simulation of "AILA". The model results are compared with the TRMM, Kalpana-1 images and the India Meteorological Department (IMD) predicted results. Further, the intensity of the events generated from the simulations is also compared with the national meteorology predictions in order to evaluate the model performance.

Keyword: ARW, Final Analysis (FNL), TRMM, Kalpana-1.

1. INTRODUCTION

Tropical cyclones, hurricanes or typhoons, which form over the warm oceans (Lin et al., 2008), are the most destructive meteorological events causing extensive damage to life and property along the coastal areas at the time of landfall. Aila, moderate intensity cyclonic storm developed in the Bay of Bengal which hit low-lying delta of West Bengal and Bangladesh in May 2009 killing more than 300 people. Mortality associated with the tropical cyclones in the North Indian Ocean is considerably high mainly due to socio-economic conditions of the bordering countries. Damages to the life and property depend also on near-shore bathymetry and coastal topography in addition to the severity of the systems. Accurate prediction of landfall and intensity of tropical cyclone is of paramount importance in taking proactive mitigation measures for reducing damages to life and property in the vulnerable region.

2. DATA AND METHODOLOGY

The Weather Research and Forecasting (WRF) model has been used for the simulation of the Cyclone Aila moisture effect in this study (Rao et al., 2005). The model was run at 9 km horizontal resolutions with 27 vertical levels using initial & boundary conditions obtained from NCEP. The domain covers 79.41^0 E - 98.08^0

E and 18.66^0 N - 31.02^0 N. The grids were centred at 88.75^0 E, 25^0 N with 211x155 grid points.

3. RESULTS AND DISCUSSION

3.1 Doppler Weather Radar and Kalpana-1 Satellite Analysis

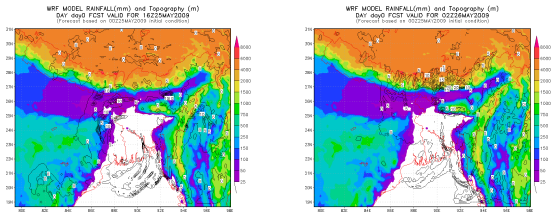
DWR Kolkata recorded the vertical extent of the system of about 17 km and the RADAR reflectivity 55 dBz.

Moderate convection was seen over north Bay (CTT-70^{0}C) which was moving eastwards and expanded over Bangladesh and merged with convection over Jharkhand, Orissa, West Bengal, Neapl and Bhutan (CTT-70^{0}C).

3.2 Simulated Characteristics: Rainfall, SLP with 10 m wind

In Bangladesh, the observational data is not enough to clarify the rainfall phenomena during the cyclone. Figure 1 depicts the rainfall with topography and sea level pressure (SLP) with wind at 10 m simulated by WRF model at 1600 UTC 26 May and 0200 UTC of 27 May 2009. Figure 2 depicts time sequence of SLP at four different locations of the study.

(a)



(b)

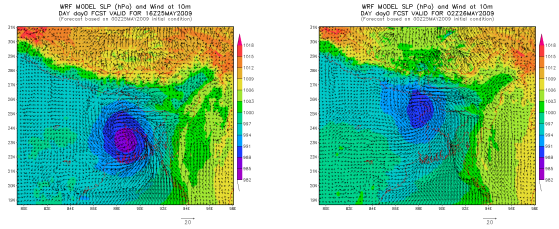


Fig. 1 WRF Model simulated parameters (a) Rainfall, (b) SLP with 10 m wind.

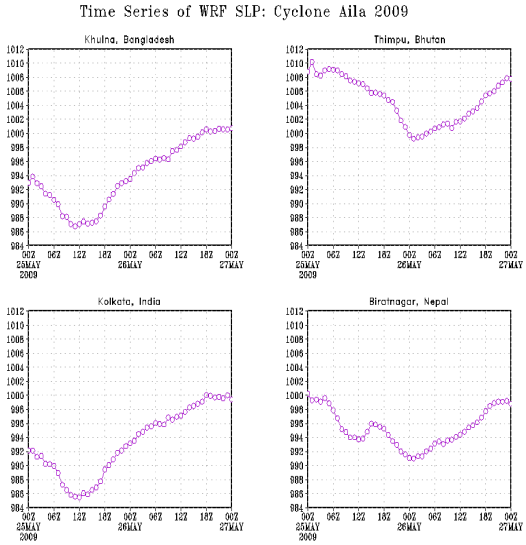


Fig. 2 Time series of SLP

4. CONCLUSION

WRF model is able to simulate some salient features such as SLP with associated rainfall, vertical and horizontal extents and movement of Aila cyclone, quite closer to the observations. However, more experiments are needed with data assimilation for better understanding of such events.

5. REFERENCES

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