Predictability of Pre-Monsoon Heavy Rainfall Events in Haor Regions of Bangladesh using WRF under the Changing Climate

Mohan K. Das[1,2,3], A. K. M. Saiful Islam[3], Md. Golam Rabbani Fahad[3], Partho Das[3], M. Rubaiat Islam[2,4] and Md. Abdul Mannan Chowdhury[2]*

[1]SAARC Meteorological Research Centre (SMRC), Dhaka, Bangladesh
[2]Jahangirnagar University, Savar, Bangladesh
[3]Institute of Water and Flood Management (IWFM), BUET, Dhaka
[4]Bangladesh Meteorological Department, Dhaka,*Bangladesh*

*Email: mohan.smrc@gmail.com

Abstract

During the pre-monsoon season (March to May) of 2006 to 2014, three hundred fifty one cases of squalls were reported over Bangladesh. Maximum number of cases (76) was reported at Chittagong followed by 52 cases in Sylhet. Out of the 12 cases of squalls studied in the present paper which is related to flash flood and heavy rainfall over Haor (wetland) region of Bangladesh. This study examines the ability of the cloud-resolving weather research and forecasting (WRF) model to reproduce the convective cells associated with the flash-flooding heavy rainfall over wetland ecosystem region of Bangladesh on pre-monsoon season.

In this study, meteorological observations of Bangladesh Meteorological Department (BMD) are used during flash flood events in order to update the initial and boundary conditions through the Advanced Research WRF model (WRF-ARW). For the purpose of simulating the flash flood events the model was run on single domain at 4 km resolutions with 40 vertical levels using initial and boundary conditions data obtained from NCEP FNL (Final) Operational Global Analysis. Several sensitivity experiments were conducted with different combinations of physical parameterization schemes of the model and found that the best skill scores were obtained by the combinations of Milbrandt, no cumulus and YSU schemes for the simulation of pre-monsoon weather events over Bangladesh and neighborhood region. This combination of physics has been used in the present study. The simulated precipitation, mean sea level pressure and 950 hPa wind fields from the experiments are presented in this study in order to analyze the observed and simulated features of the flash flood events. The model results are also compared with the Kalpana-1 satellite imagery and the Tropical Rainfall Measuring Mission (TRMM) observed results. Further, the intensity of the events, generated from the simulations is also compared with the BMD observations in order to evaluate the model performance. This study also examines long term changes of flash flood event under the changing climate.

Keywords Haor, flash flood, WRF-ARW, climate change.