

Simulation of severe storm of tornadic intensity over Indo-Bangla region

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Abstract: Many severe thunderstorms of tornadic intensity were reported in the northwestern parts of Bangladesh during 30 August to 14 September, 2008. Two among them occurred at Nilphamari and Kurigram districts on 30th August, and at Nilphamari district on 3rd September. The tornadic storms are studied based on a field survey, surface data, radar and satellite observations and model simulations. Low level moisture influx by southerly flow from the Bay of Bengal coupled with an upper level westerly jet stream causing intense instability and shear in the wind fields triggered a series of storms for two weeks. The exact time and locations of the storm are investigated by using the hourly precipitation data retrieved from a S-band radar of Bangladesh Meteorological Department (BMD) locate at Dhaka. Subsequently, the storms are simulated by using the WRF-ARW model on double nested domains at 9 and 3 km horizontal resolutions based on 6 hourly FNL analyses and boundary conditions of NCEP.

Among the typical characteristics of the storms, the CAPE, Storm-Relative Environment Helicity (SREH), Bulk Richardson Number Shear (BRNSHR), dew point depression, and potential vorticity are studied. Results show that while there are differences of 2-3 hours between the observed and simulated time of the storms, the distances between observed and simulated locations of the storms are several tens of kilometres. The maximum CAPE is generally above 2400 J kg^{-1} . The maximum amount of vorticity transferred by directional shear in the storm updraft (helicity) due to convective motion simulated by the model is $766 \text{ m}^2 \text{ sec}^{-2}$, and the highest value of BRNSHR that define the region in which low-level mesocyclogenesis is more likely is $168 \text{ m}^2 \text{ sec}^{-2}$ among the 2 cses, which is generally supposed to produce rotating storms according to the prescribed range.

Keywords: Tornado, Storm, Simulation, WRF, Model, Indo-Bangla.