

Composite characteristics of Nor'westers based on observations and simulations

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Abstract

The Nor'westers (severe thunderstorms) that form over northeast India and adjoining Bangladesh region during the pre-monsoon season of 2008 are studied employing observations from ground based radar, Tropical Rainfall Measuring Mission (TRMM) and synoptic stations. Subsequently, an attempt is made to simulate the storms using Weather Research and Forecasting (WRF) model at 9 km horizontal resolution, and 28 vertical levels. Analyses of radar data for 15 cases out of 108 during the study period showed that the Nor'westers typically propagate in the form of squall lines (parallel bow shaped bands) having horizontal length of about 200 km, reaching more than 400 km on some occasions. They propagate at typical speeds of about 50 km h^{-1} from northwest to southeast directions. The model underestimated the strength of the squall lines in terms of wind speed. The simulated results showed the presence of strong vertical wind shear and an advection of warm moist southerly wind from the Bay of Bengal during the formation of Nor'westers. Low level positive vorticity in combination with moist southerly wind from the Bay of Bengal and strong surface heating resulted in the formations of the Nor'westers in all the cases. Cloud tops reached as high as 18-20 km in some of the cases of the severe storms. The altitude of core of maximum precipitation was located between 3-5 km. Average cloud hydrometeor content of the Nor'westers was estimated to be about 3.5 g m^{-3} .