The sensitivity of vertical velocity to microphysics parameterisation

Jyoti Bhate*, Amit Kesarkar, Abhishek Panchal and G. Pavani
National Atmospheric Research Laboratory, Gadanki 517 112, India

Sensitivity experiments have been conducted for two thunderstorm events over a tropical station in Gadanki, India, using the Weather Research and Forecasting (WRF) model for four microphysics schemes, viz., Thompson, Morrison, WSM7, and WDM7. The model's initial conditions improved using cyclic four-dimensional ensemble Kalman filter-based data assimilation. The simulated vertical velocity was compared with that of the Mesosphere-Stratosphere-Troposphere (MST) radar profile, and it was found that the Thompson scheme simulates it better. Morrison and WDM7 schemes best represent the magnitude of simulated rainfall.

Keywords: Microphysics, numerical weather prediction, parameterisation, radar, thunderstorm, vertical velocity

Data and methodology

Vertical velocity is one of the important parameters for understanding convection in the atmosphere. Hence, validating the model-derived vertical velocity with the observed data is necessary. The MST radar is an active phased array, which operates at a 53 MHz frequency, comprising 1024 half-wave dipole antennas arranged in a 32×32 square matrix[1]. In the present study, the model-derived vertical velocity was validated using this facility located at Gadanki. The wind velocities from the MST radar are available at heights of 3.6–20 km with 150 m height resolution and temporally between 16:30 IST and 17:30 IST in a common mode of operation. In addition, the model rainfall was validated with the automatic weather station (AWS) tipping bucket rain gauge at Gadanki. The mesoscale model Advanced Research-WRF (Version 4.3.3)