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Simulation of Heavy Rainfall Events during Retreat Phase of Summer Monsoon Season over Parts of Andhra Pradesh

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ABSTRACT

The main aim of this paper is to simulate monsoon heavy rainfall episodes that caused floods across some parts of Andhra Pradesh (AP) state, India during 29th September through 2nd October, 2009. A heavy rainfall quantity of 21 cm was observed near Amaravathi station (16.15˚N; 80.5˚E) in Guntur district due to a meso-α low pressure system extended from the Bay of Bengal and widespread rainfall episodes were also appeared to many adjoining places in other three districts namely Mahaboob Nagar, Kurnool and Krishna in AP state simultaneously on 29th September. The rainy situation continued till 2nd October and caused floods over above districts of AP state which lead to a death toll of 33 people and heavy crop loss. To quantify the above catastrophic monsoon heavy precipitation events a high resolution (9 km) Weather Research and Forecast (WRF-ARW) model is centered at Amaravathi station to simulate rainfall episodes over the study region. In the present case study the simulated sensitive experiment highlights the dynamical characteristics of the meso-α system interms of circulation changes at different levels. Secondly, the thermodynamical characteristics for the generation of convective activity of this meso-α event in terms of Convective Available Potential Energy (CAPE) and Convective Inhibition Energy (CINE) are also simulated. Dynamical and thermodynamical simulated results support heavy rainfall episodes due to a low pressure system around Amaravathi station. Thus circulation changes, high CAPE and low CINE magnitudes have well defined not only the strength of meso-α system, but also quantum of rain-fall to a tune of 19 cm near Amaravathi station on 29th September. The observed rainfall was 21 cm on 29th September and thus this model underestimates rainfall about 9.5% not only at Amaravathi station, but also at other stations as well. Similar results are noticed over the study region on other three days. In this numerical study heavy rainfall events are better represented by Kain-Fritsch (KF) scheme than Betts-Miller-Janjic (BMJ) and Grell-Deveneyi (GD) schemes. Finally simulated circulation features and rainfall quantities are validated with observed rainfall of the India Meteorological Department (IMD) and satellite derived datasets of KALPANA-1, while CAPE and CINE quantities are checked against available Wyoming University observations. The results are promising.

KEYWORDS

Meso-α Low Pressure; Cumulus Parameterization; Heavy Rainfall; Floods

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