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# Simulation of Extreme Rainfall Events over Karnataka, Southern state in India: Impact of Lead Time and Data Assimilation

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In recent year's southern state of India, Karnataka, has witnessed many catastrophic rainfall events. These events have caused enormous loss of life, property and crops across the State. In the year 2019, till the month of August, state was facing drought like condition because of prolonged dry spell in pre-monsoon (March-May) and south-west monsoon (June-July) season. During 06 – 10 August state has received average rainfall of 224 mm whereas some parts of the state received heavy rainfall (2493 mm) due to deep depressions over the Bay of Bengal. This study aims to evaluate the impact of lead time and three dimensional variational (3DVAR) data assimilation in simulation of heavy rainfall events during this period using Weather Research and forecasting (WRF) model. The model is configured with 3 nested-domains having high-resolution over the Karnataka State. The high resolution forecasts over Karnataka are evaluated against high resolution (~4 km) in-situ telemetric rain-gauge observations to assess model performance. These events are simulated using initial and boundary conditions from Global Forecast System (GFS) data. Lead time effect is analyzed by initializing model at 1200 UTC (12 hours prior to event day) and at 0000 UTC (event day) and the model is integrated for 48 hours duration. The impact of 3DVAR data assimilation is examine by comparing forecasts with assimilation of data from various sources like balloon, satellite, ground station and buoy (AIRS, MODIS, BUOY, TWS, ASCAT, WINDSAT, SSMIS and Radiosonde) against control experiment (without data assimilation). The results show that the model is able to capture the high intensity observed rainfall though location errors are there in many cases. It is note that model skill is sensitive to lead time and model performance for different lead time varied from case to case. Simulations with assimilation of observations in initial condition improved the forecasts compared to control simulations. The model skill (Bias Score, Threat Score and Heidke Skill Score) is better in simulations with data assimilation.