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Evaluation of high resolution WRF forecasts for Extreme Rainfall Events over Karnataka against high density in-situ observations

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Extreme Rainfall Events (EREs) in India has increased many folds in recent decades. These severe weather events are generally destructive in nature causing flash floods, catastrophic loss of life and property over densely populated urban cities. Various cities in Karnataka, a southern state in India, witnessed many EREs recently. Appropriate advanced warning systems to predict these events are crucial for preparedness of mitigation strategy to reduce human casualty and socio economic loss. Mesoscale models are essential tools for developing an integrated platform for disaster warning and management. From a stakeholder/user pint of view, primary requirement to tackle ERE related damages is accurate prediction of the observed rainfall location, coverage and intensity in advance. Weather prediction models have inherent limitations imposed primarily by approximations in the model and inadequacies in data. Hence, it is important to evaluate the skill of these models for many cases under different synoptic conditions to quantify model skill before using them for operational applications. The objective of the study is to evaluate performance of the Weather Research and Forecasting (WRF) model for several ERE cases in Karnataka at different model initial conditions. The EREs were identified from the distribution of rainfall events over different regions in Karnataka and those events comes under 1% probability were considered. We examined 38 ERE's distributed over Karnataka for the period June to November for the years 2015-2019. WRF model is configured with 3 nested domains with outer, inner and innermost domains having resolution of 12 km, 9 km and 3 km respectively. Two sets of simulations are conducted in this study, i) staring at 12 hours prior to the ERE day (i.e. -1200 UTC) & ii) starting at 0000 UTC of the ERE day. Performance of the WRF model forecast is validated against 15 minutes rainfall observations from ~6000 rain gauge stations over Karnataka. During initial hours forecasts initiated at 1200 UTC has distinct advantage in terms of accuracy compared to those initiated at 0000 UTC for most of the cases. In general, model underpredict EREs and underprediction is relatively low for forecasts initiated at 12 00 UTC.