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Assessment of different microphysics schemes in simulating the recent 2018 heavy rainfall event over Kerala, India using the WRF model

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Heavy to extreme heavy rainfall events on 15th and 16th August 2018 over Idukki, Palakkad and some other districts of Kerala (India) have resulted in large-scale flooding, affected millions of people with huge loss of life, and damaged billions (∼USD5.6) of property. The event was forecasted with lesser lead time by current operational model i.e. Global Forecast System (GFS), therefore to correctly assess it (in terms of intensity and location), some experiments are conducted using a non-hydrostatic mesoscale Weather Research and Forecasting (WRF) model. Two interactively nested domain with a horizontal resolution of 9 km and 3 km for lead time up to 72 hours starting from 00 UTC on 14th August 2018 have been used. Initial and Boundary Condition are used from NCEP-FNL ($0.25^\circ \times 0.25^\circ$) data. Sensitivity experiments are carried out using six different microphysics schemes. The results are validated using the European Centre for Medium-Range Weather Forecasts (ECMWF) reanalysis data (ERA5, $0.125^\circ \times 0.125^\circ$) and Indian Meteorological Department (IMD) high resolution merged rainfall data. Cloud Top Temperature observation from IMD indicates that there are no deep convective clouds over this region. The reanalysis from ERA5 shows a strong lower level moisture convergence and a low-pressure system moving from the eastern coast (Bay of Bengal) to central India. However, there is hardly any moisture convergence beyond 600 hPa. The model with all microphysics schemes (except the Thomson scale aware scheme) is able to capture the intensity of the rainfall event with 24 hour lead time which is due to the presence of a large number of hydrometeors. Although the high-resolution model was able to capture the rainfall intensity reasonably, the hydrometeors generation appears to be unrealistic. As the analysis reveals the event to be an orographic heavy rainfall case and not due to deep convective clouds. Further research needs to be carried out for the realistic representation of orographic processes in the model.