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Impact of microphysics schemes on precipitation forecasting in WRF weather model: Application to the Nilwala river basin in Sri Lanka

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Natural disasters such as floods, landslides, spread of epidemics etc., are triggered by torrential rains proving their seriousness. A better prediction of rain could mitigate these negative impacts. The objective of the study was to check the impact of various microphysics schemes in Weather Research and Forecasting model (WRF), on precipitation predictions over the Nilwala river basin in southern Sri Lanka. Area of the basin is nearly 1,073 km^2. It lies mainly in the Matara district within latitude 5^o 55' - 6^o 13' and longitude 80^o 25' - 80^o 38'. WRF model was applied to the basin with Thompson, Morrison, WSM3, WSM6, Ferrier, Lin et al, and Kessler microphysics schemes keeping all the other factors such as domain configuration (45/15/5 km), domain size (1800x1800 km/645x 645 km/245x245 km), other physics options etc.., unchanged. For the study, two global data sets were downloaded from the Global Forecast System on 09/12/2008 and 19/03/2009 to provide the initial conditions for WRF. Model accuracy was monitored by comparing model predictions with observed point rainfalls from rain gauging stations at Mapalana, Kekanadura, Thihagoda, Thelijjawila, Goluwatta, and Mawarella. For accuracy check of predictions, differences between WRF predictions and observed precipitations (spatially distributed on 5 km x 5 km grid, since WRF predictions were at the same resolution) were plotted over the basin. The 0–5 mm over/under predictions were considered as acceptable forecasts. Area inside the basin in which the predictions were within the above specified +/- 5 mm range was expressed as a percentage of the total area of the basin (Correctly Predicted Area %, CPA). This was taken as the measure of success of predictions. Models that employed the WSM3 (CPA=80%), Ferrier (CPA=71%), Kessler (CPA=68%) and Lin (CPA=66%) microphysics schemes produced good rainfall predictions over the basin on 10/12/2008, while Morrison (CPA=46%), Thompson (CPA=40%) and WSM6 (CPA=50%) produced relatively poor predictions for the same day. On 20/03/2009 it was the Ferrier scheme (CPA=84%) which clearly generated the best predictions, overwhelming the forecasts of Thompson (CPA=37%), Morrison (CPA=16%), WSM6 (CPA=13%), Lin et al (CPA=55%), Kessler (CPA=19%) and WSM3 (CPA=37%) schemes. According to above results it was identified that Ferrier microphysics scheme in WRF produced the best rainfall forecast over the basin for both rain events on 10/12/2008 and 20/03/2009 with CPA's of 71% and 84% respectively.

Key words: WRF, Microphysics scheme, Weather forecasting

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