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Sensitivity of cumulus and microphysics parameterization schemes in WRF model and impact of data assimilation on the forecast skill for Sri Lanka

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SENSITIVITY OF CUMULUS AND MICROPHYSICS PARAMETERIZATION SCHEMES IN WRF MODEL AND IMPACT OF DATA ASSIMILATION ON THE FORECAST SKILL FOR SRI LANKA

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Abstract

For Sri Lanka, accurate and timely weather forecast is vastly beneficial for many sectors such as agriculture, hydro-power, as well as mitigating and preparing for hydro-meteorological hazards. In this study, the forecast skill of the Weather and Research Forecasting model for Sri Lanka was assessed. This work investigated the spatio-temporal sensitivity of several Cumulus Parameterization Schemes (CPS) and Microphysics Parameterization Schemes (MPS) included in the WRF model. Also, data assimilation was applied to model forecast runs to determine changes in the model's forecast skills. Combination of four CPS and three MPS, totaling 12 permutations, are used to simulate 3 year period from 2013-15. High resolution (4km) simulated precipitation, 2m temperature and 10m wind velocity were validated using observed data from the Department of Meteorology (DOM) of Sri Lanka. The results show that the model was more sensitive to CPS choices than MPS. Moreover, overactive mass-flux type CPS (i.e. Kain-Fritsch) was found to produce too much precipitation over coastal areas in the inflow side during monsoons periods. Inter-comparison of parameterization schemes shows strong regional and seasonal sensitivity, which suggests the need for ensemble forecasting in the operational setting. Overall, BMJ, CPS, and WRF Double-Moment six-class (DM6) MPS show the highest skill score for most regions in all seasons. After which, BMJ-DM6 combination was used to simulate forecast runs with and without data assimilation. Using surface

observation and AMSU satellite in the assimilation, there was no significant improvement found.