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CCAM Heavy Rainfall Simulations: Sensitivity to Initialization Datasets

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Heavy rainfall events are among the most damaging weather hazards worldwide, yet they remain difficult to simulate accurately. One key source of uncertainty is the choice of input data used to initialize weather and climate models. In this study, we tested how sensitive the Conformal Cubic Atmospheric Model (CCAM) is to different initialization datasets, including ERA5, GFS, GDAS, and JRA-3Q. Using the CHPC Lengau cluster, we ran high-resolution (3 km) convection-permitting simulations, which allowed us to capture the fine-scale features of a 3-4 June 2024 heavy rainfall event over the eastern parts of South Africa.

We evaluated the simulations against radar and IMERG satellite precipitation estimates. While all runs reproduced the evening peak in rainfall timing, they generally underestimated intensity. Among the datasets, ERA5 produced the most reliable simulations, showing the closest match to IMERG with the lowest errors and highest correlation. In contrast, JRA-3Q and GFS-FNL performed less well. These results show that the choice of initialization dataset has a clear impact on rainfall prediction skill, and highlight the value of HPC-enabled sensitivity studies for improving extreme weather forecasting in the region.

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Yes

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Yes

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