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Simulations of the COSMO model on the CHPC

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The South African Weather Service (SAWS), as a national meteorological service provider for South Africa (SA) and Southern African Development Community (SADC) communities, aims to provide useful and innovative weather, climate, and related products and services. Part of SAWS services and products are derived from Numerical Weather Prediction (NWP) models, of which Unified model (UM) from the UK Metoffice is the lead model. Weather forecast models perform differently across different parts of the globe and for different weather phenomena. In order to ensure continuous delivery of high quality weather forecasts to SAWS stakeholders, other NWP models are examined. The Consortium for Small-scale Modelling (COSMO) model is evaluated and analysed in order to investigate whether it is more/less suitable for predicting high impact weather events over SA.

The COSMO model is a European limited area model driven from Icosahedral Non-hydrostatic (ICON) global model. The ICON model has a grid spacing of 13km globally, which allows the COSMO to be simulated at a fine horizontal resolution of less than 5km. In this study, the COSMO model is being run with a grid spacing of 4.4km and 40 vertical levels, which allows for accurate numerical prediction of near-surface weather conditions (e.g. clouds, fog, frontal precipitation) and simulation of severe weather events triggered by deep moist convection (supercell thunderstorms, intense mesoscale convective complexes, prefrontal squallline storms and heavy snowfall from wintertime mesocyclones.

Simulations of five high impact weather events over SA were done on the CHPC system. The COSMO model is run with a grid spacing of 4.4km (0.036°) over SADC with a domain ranging from 5 – 56 °E and 40 – 5 °S (1276 x 1026 grid points), using a timestep of 30 seconds and a 30 hour lead-time. The model is run on a large queue using 1728 cores with using default science settings. Both the pre-processing and model run completed in +/- 2.5 hours and the model output was in hourly intervals for 86 variables (80 in sigma coordinates and 6 in pressure coordinates).

The selected variables (parameters) from model output are then evaluated against ground observations from SAWS network, radar data, satellite observations, Global Precipitation Measurement (GPM) and National Centers for Environmental Prediction (NCEP) Reanalysis data. Selected parameters for evaluation include wind speed, surface temperature, total precipitation, cloud cover, mean sea-level pressure, surface pressure and geopotential height. The outcome of the model evaluation will be discussed in detail at the conference.

Presenter Biography

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