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Seasonal Forecasts for the Horn of Africa: Evaluation of the Skill of Convection-Permitting Simulations

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Abstract

Global seasonal forecasts provide helpful information. Today's resolution is 30 km or lower, which is still too coarse in orographically structured terrain, specifically for precipitation forecasts. Dynamical downscaling of such forecasts to convection-permitting (CP) scale (grid size 1–4 km) has not yet been tested in African regions due to the lack of computational resources. In addition, the computational constraints limit the use of ensemble forecasts, which are generally more reliable: therefore the effectiveness of such strategy is not yet much analysed at the convection-permitting scale.

The Horn of Africa is a highly challenging area for global models due to its complex topography. The Ethiopian highlands strongly influence the climate and a relatively small area experiences very different precipitation regimes, sharp changes in temperature and seasonal fluctuations. Other projects have shown that downscaling seasonal forecasts at a lower resolution (25 km) has little to no impact on the forecast skill.

This work aims to study the ability of a convection-permitting model to provide seasonal forecasts for the Horn of Africa with added value with respect to their global counterparts. Specifically, air temperature and precipitation bias will be considered as key elements for the evaluation of the model performance. The weather research & forecasting (WRF) model is used, coupled with the Noah-MP land-surface model, to downscale the ensemble seasonal forecasts produced by the European Centre for Medium-Range Weather Forecasts (ECMWF).

Preliminary work shows that downscaling global model output using such a high-resolution model improves the precipitation patterns over the considered domain, both the location and the total amount.

Keywords: Convection-permitting scale, dynamical downscaling, Horn of Africa, seasonal forecasts, WRF

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