# Seasonal forecasts for the Horn of Africa: evaluation of convection-permitting simulations

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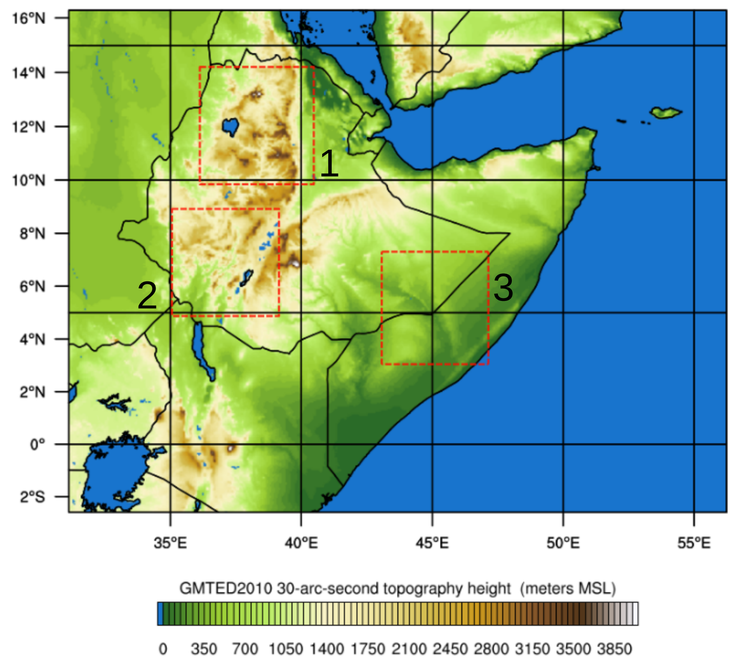
## Introduction

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.
The Horn of Africa is a highly challenging area for global models due to its complex topography and heterogeneous climate patterns.
For this reason regional models are expected to provide additional value when applied at CP scale.




Model domain topography. The red boxes show subdomains with different climates used for preliminary analyses

## Objectives

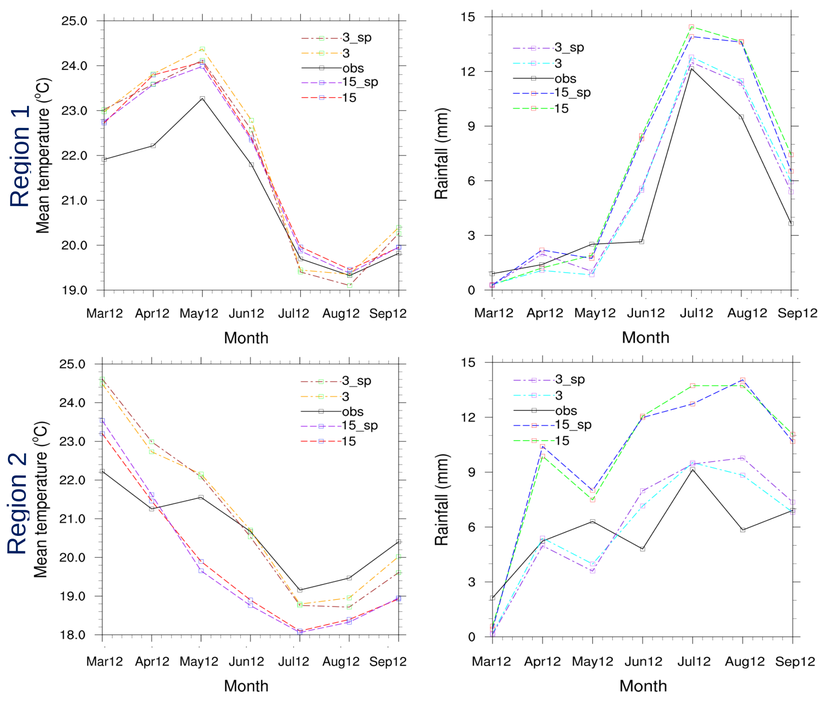
**A) Set up the regional model using the WRF [1] model to perform the downscaling of the global model [2] to 3-km resolution**

**B) Assessment of the effect of different spin-up strategies on air temperature and rainfall forecasts (3-months, one-year long)**

**C) Evaluation of the accuracy of the convection-permitting forecast and its added value compared to coarser resolution models**

## First results

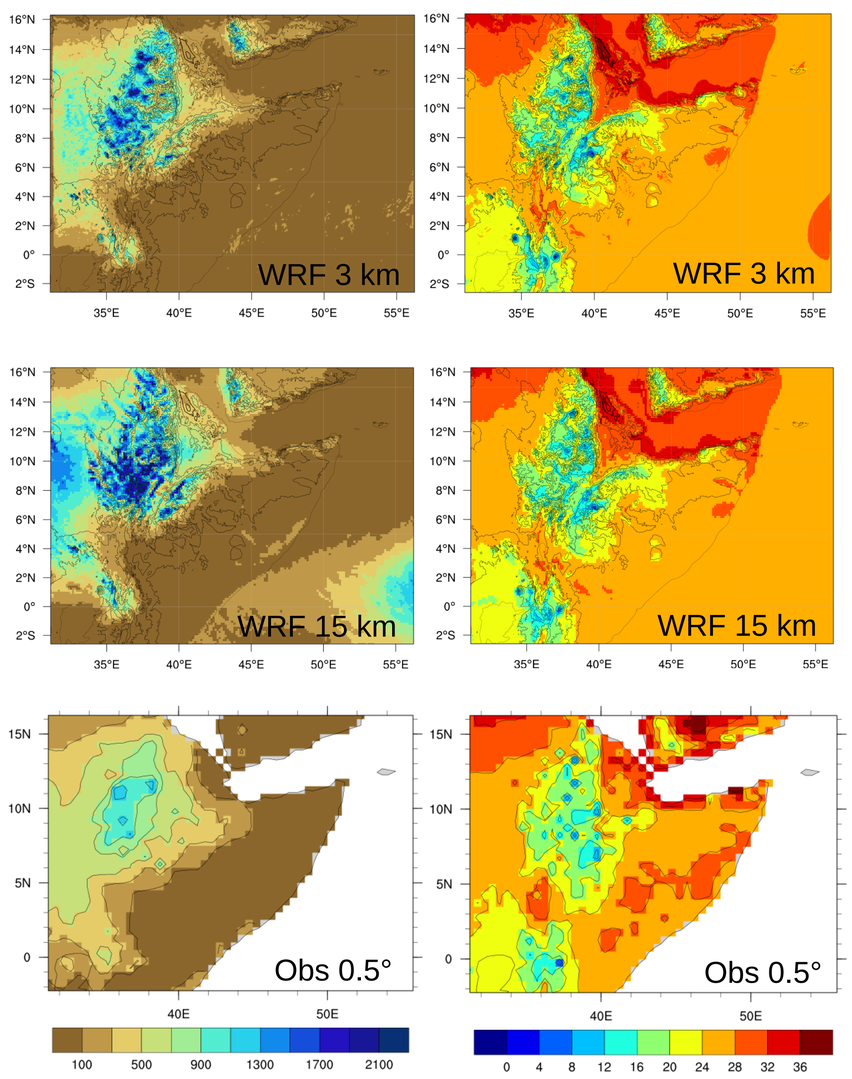
Spin-up effects on temperature and precipitation at the monthly scale: spatial-averaged fields over the mountainous sub-domains




**Mean air temperature** **Mean daily precipitation**

- 15: 15-km WRF model
- 15_sp: 15 km WRF model with spin-up
- 3: 3-km WRF model
- 3_sp: 3-km WRF model with spin-up
- obs: observational dataset [3]

Spatial comparison of model hindcasts and observation dataset [3] for summer 2012




**Total precipitation (mm)** **Mean air temperature (°C)**

## Conclusions

- 3-km resolution model results are generally accurate after some spin-up (2 to 3 months)
- A longer spin-up does not affect the results on a monthly scale compared to the standard 3-months long spin-up
- The convection-permitting model is more accurate than the 15-km resolution model: the wet bias at montly and seasonal scale is largely reduced with respect to the coarser model

## Outlook

- The ECMWF SEAS5 seasonal ensemble forecast will be dynamically downscaled for summer 2018
- High-resolution satellite-based datasets will be used to evaluate model accuracy
- Field significance tests [4] will be used to evaluate the added value provided by the downscaling, taking into account temporal and spatial correlations
- Ensemble forecasts will allow to estimate the prediction uncertainty

## References

**[1] Weather Research and Forecasting model (WRF) with NOAH-MP - Skamarock et al. 2008. NCAR Technical Note**
**[2] European Center for Medium-range Weather Forecasts (ECMWF) - ERA-Interim reanalyses (Dee, D. P. & al (2011), Q.J.R. Meteorol. Soc.**
**[3] Delaware university temperature and precipitation dataset - Willmott, C. J. and K. Matsuura (2001), http://climate.geog.udel.edu/~climate/html_pages/README.ghcn_ts2.html.**
**[4] Ivanov at al (2017), Theor Appl Climatol.**

**Computation performed at the HLRS supercomputing center Stuttgart**

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