REQUEST FOR ADDITIONAL RESOURCES IN THE CURRENT YEAR FOR AN EXISTING SPECIAL PROJECT

Please email the completed form to special_projects@ecmwf.int.

MEMBER STATE: Germany

Principal Investigator[1]: Dr. Patrick Laux

Affiliation: Karlsruhe Institute of Technology, Institute of Meteorology and Climate Research, Department of Atmospheric Environmental Research (IMK-IFU)

Address: Kreuzeckbahnstrasse 19,
82467 Garmisch Partenkirchen
Germany

Other researchers: -

Project title: AGricultural Decision-Tailored (Sub)SEasoNal Drought ForecAsting for Sub-Saharan Africa (AGENDA-SSA)

Project account: spdelaux

Additional computer resources requested for		2022
High Performance Computing Facility	(units)	2,000,000
Data storage capacity (total)	(Gbytes)	5,000

Continue overleaf

[1] The Principal Investigator is the contact person for this Special Project

Technical reasons and scientific justifications why additional resources are needed

- WRF test simulations have been performed on Atos HPC during the last weeks. The limit of applied resources (2 Mio SBUs) has been exceeded during this time.
- Based on speedup performance tests using different compiler settings, different domain settings (nested vs single nest simulations) as well as different number of nodes, an optimal technical and domain setup has been identified now. Scalability on Atos is found to be much higher for a single nest and a big domain, and using OpenMPI.
- It is estimated that additional **2 Mio SBUs for the rest of the year 2022** are needed. Figure 1 is illustrating the speedup performance normalized to 4 nodes of 128 cores each. The configuration using 40 nodes is showing a speedup performance of about 13, and is found optimal with respect to the given wall time limit. It is expected that 48 hours are sufficient to conduct a full seasonal forecast simulation of 7 months.
  The requested resources will be needed to make additional test on optimum I/O quilting in order to estimate more reliable SBU numbers for 2023.
- WP 3 has been adapted as follows:
  - It is now aimed at convection-permitting (CP) simulations at 4 km, conducted for the whole African continent (see domain setup, Figure 2). It is expected that CP simulations will clearly outperform the simulations based on Cu parameterization. For this reason, less parameterization experiments will be required. However, the higher spatial resolution and domain size will also increase HPC usage tremendously. This will also affect the envisaged storage. To facilitate the simulations (temporarily) in parallel, an extension of disk space is applied.
  - The extension of the domain to whole African continent is not only justified technically in terms of higher scalability. While there exist only few studies of downscaled seasonal predictions for different regions across Africa (Mori et al., 2020; Siegmund et al., 2013), to the best of the PIs knowledge, it is the first time that seasonal CP simulations are being performed for whole Africa. It is aimed to publish the generated dataset, approaching impact modelers and decision makers mainly in western-, eastern-, and southern Africa. There is an increasing interest in sub-seasonal to seasonal predictions for various sectors (water resources management, agriculture, health), for which there exist many potential applications and project collaborations. The usage of the generated downscaled seasonal forecasts has just been discussed with members of the AgMIP community.

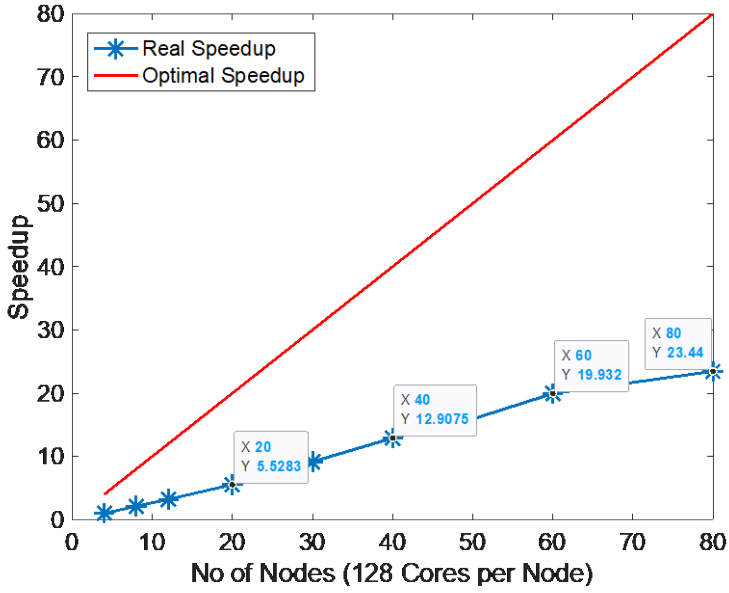

Figure 1: Speedup performance normalized to 4 nodes of 128 cores each.

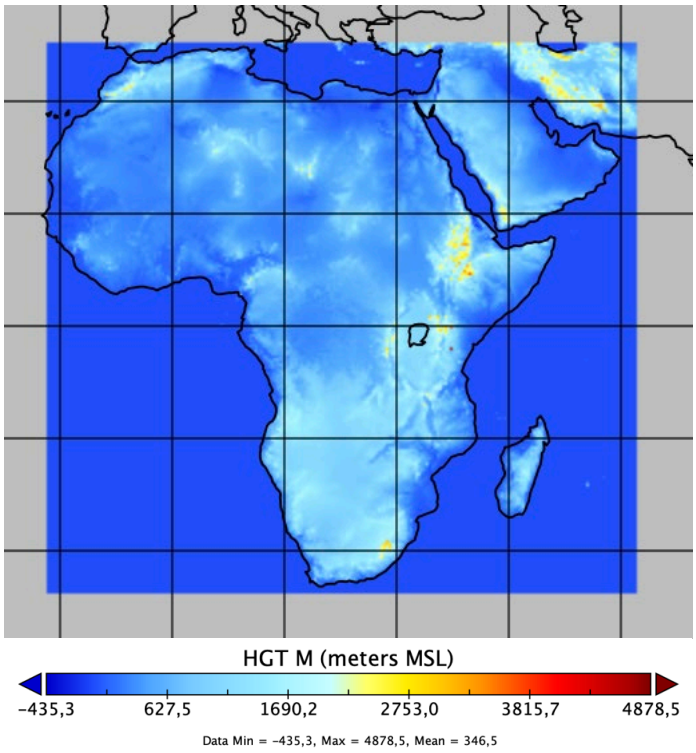

Figure 2: Geographical domain setup of WRF-SEAS5 simulations.

References:

Mori, P, Schwitalla, T, Ware, MB, Warrach-Sagi, K, Wulfmeyer, V. Downscaling of seasonal ensemble forecasts to the convection-permitting scale over the Horn of Africa using the WRF model. *Int J Climatol*. 2021; 41 (Suppl. 1): E1791–E1811. https://doi.org/10.1002/joc.6809.

Siegmund J, Bliefernicht J, Laux P, Kunstmann H. 2013. Toward a Seasonal Precipitation Prediction System for West Africa: Performance of CFSv2 and High Resolution Dynamical Downscaling. Journal of Geophysical Research Atmospheres 120(15), DOI:
10.1002/2014JD022692.