Request for DKRZ resources for the project:

Title: 'Simulating Southern African precipitation during the last 65 years with a high-resolution atmospheric CCLM simulation'

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Application for resources to run the atmospheric regional model CCLM (COSMO Climate Limited-area Model) simulation for the historical time period (~1950-2013) with a horizontal resolution of approx. 16 km. The requested resources are:

- 18000 node hours
- 10 TB hard disk space
- 3 TB archive space

The simulation is part of the BMBF project CASISAC, started in July 2018.

Recent water shortage due to an extensive drought as well as flooding events, like the tropical cyclone Idai, emphasis the urge for high-resolution atmospheric simulations over Southern Africa. Extreme events in precipitation and also long-term trends and variations on decadal and interannual time scale are worth investigation due to the strong dependence on rainfall for agriculture and portable water in the region.
This planned simulation is one of a set of simulations foreseen with the CASISAC project, driven by atmospheric reanalysis and global Earth System runs. This simulation is a reference simulation driven by the model FOCI (Geomar) for the historical period. We will investigate the impact of the South Atlantic and Indian Ocean on rainfall in the coastal areas, focusing on the impact of the variations of the warm Agulhas Current along the east and south coast of Southern Africa and the cold Benguela Current along the west coast. Furthermore, observed changes in the Southern Hemisphere westerlies impact the position of the Agulhas Current which in turn impact the precipitation along the southeast coast. This warm current causes the advection of warm and humid air masses towards the coastline and, thus, precipitation.

Currently, we are running a hindcast simulation of CCLM with the same model domain driven by the Japanese reanalysis data set JRA-55. This simulation is used to validate the model setup for the planned simulation.
The planned CCLM simulation will be driven by FOCI (GEOMAR) coupled ocean-atmosphere simulation with the ocean model NEMO and the atmospheric model ECHAM. NEMO is used in a nested setup (called INALT10x) where a nest over Southern Africa and the adjacent oceans is high resolved with a 1/10 degree. The global ocean (ORCA05) has a resolution of 1/2 degree whereas the atmospheric component is coarser resolved with T63 (250km). Furthermore, this model setup uses interactive atmospheric chemistry. Thus, the ozone concentrations are not prescribed. This is quite important for this region as ozone concentrations/recovery plays a key role in driving wind variations with in turn impact the precipitation over the coastal region.

These modeling activities are embedded in the BMBF-funded project 'CASISAC'. It is a joint project of Helmholtz-Zentrum Geesthacht, GEOMAR, University of Siegen, and Christian-Albrecht-University in Kiel. The overall research goal is to detect changes in the

Agulhas System and analyze its impact on southern African coasts with regards to sea level changes, flooding events and precipitation.