Allocation request for project: **1340** Project title: **Long-term simulations with improved and extended REMO versions** Principal investigator: **Heiko Paeth** Allocation period: **2024-01-01 to 2024-12-31**

Project title

Long-term simulations with improved and extended REMO versions

Principal investigator

Prof. Dr. Heiko Paeth Institute of Geography and Geology University of Würzburg Am Hubland 97074 Würzburg Tel.: +49 931 318 4688 Email: heiko.paeth@uni-wuerzburg.de

Short report

Our ongoing work is related to the development of the regional climate model REMO and is funded by the BMBF-project WASCAL WRAP2.0 LANDSURF, having a regional focus on West Africa. The model development concentrates on land surface processes by using an interactive vegetation scheme and a multilayer soil scheme. Additionally, we have achieved the coupling of these two advanced schemes for the first time. Thus, a more realistic representation of the land surface and related interactions with the atmosphere is now available.

During the last five years, the climate modelling group at the University of Würzburg (Prof. Heiko Paeth) has tested and further developed a series of extensions and improvements within the regional climate model REMO that are dedicated to providing a regional Earth system model. The improvements comprise an interactive vegetation scheme, a five-layer soil hydrology scheme, more diverse and higher-resolution land surface parameters, new methods soil temperature computation, an irrigation scheme, an inland-lake scheme, and a non-hydrostatic version. The work has been and is still funded in the framework of several third-party funded projects (BMBF, DFG, EU).

The overall aim consisted in developing a regional Earth system model that synergizes the advantages of high-resolution climate modelling and provides a new instrument of improving our understanding of the Earth's climate system and of assessing the regional dimension of man-made climate change. For the estimate of requested computing and storage resources (see tables below), we have conducted a series of short-term control simulations during the last year with different domains and node partitioning in parallel computing.

Recent publications based on research using DKRZ resources

- Bangelesa, F., Abel, D., Pollinger, F., Rai, P., Ziegler, K., Ebengo, D., Tshimanga, R.M., Mapatamo, M.A.,
 Knight, J. and Paeth, H. (2023): Projected changes in rainfall amount and distribution in the Democratic Republic of Congo evidence from an ensemble of high-resolution climate simulations. In:
 Weather and Climate Extremes 42, 100620, doi:10.1016/j.wace.2023.100620.
- Bangelesa, F., Pollinger, F., Sponholz, B., Mapatano, M.A., Hatløy, A. and Paeth, H. (2023): Statisticaldynamical modelling of the maize yield response to future climate change in West, East and Central Africa using the regional climate model REMO. – In: Science of the Total Environment, in press.
- Paeth, H., Schönbein, D., Keupp, L., Abel, D., Bangelesa, F., Baumann, M., Büdel, C., Hartmann, C., Kneisel, C., Kobs, K., Krause, J., Krech, M., Pollinger, P., Schäfer, C., Steininger, M., Terhorst, B., Ullmann, T., Wilde, M., Ziegler, K., Zimanowski, B., Baumhauer, R. and Hotho, A. (2023): Climate change information tailored to the agricultural sector in Central Europe, exemplified on the region of Lower Franconia. In. Climatic Change, doi:10.1007/s10584-023-03613-1.
- Abel, D., Ziegler, K., Gbode, I.E., Weber, T., Ajayi, V.O., Traoré, S.B. and Paeth, H. (2023): Robustness of climate indices relevant for agriculture in Africa deduced from GCMs and RCMs against reanalysis and gridded observations. In: Climate Dmanics, in press.
- Libanda, B. and Paeth, H. (2023): Future photovoltaic solar power resources in Zambia: a CORDEX-CORE multi-model synthesis. – In: Meteorology and Atmospheric Physics, in press.