Project: **1364** Project title: **UDAG - Updating the data basis for adaptation to climate change in Germany** Principal investigator: **Christian Steger** Report period: **2023-05-01 to 2024-04-30**

UDAG is a joined project of BTU, DKRZ, DWD, HEREON and KIT. The aim of *UDAG* is the provision of up-to-date regional climate projections for the use in the German adaptation strategy. The regional climate projections currently used for taking adaptation measures are based on the global climate projections produced within the Coupled Model Intercomparison Project Phase 5 (CMIP5). These global climate projections have been updated in recent years in the framework of CMIP6. The Shared Socioeconomic Pathways (SSPs) newly introduced in CMIP6 and the further development of the climate models make an update of the regional climate projections for Germany necessary. *UDAG* will provide a quality-checked ensemble of regional climate projections for Europe (at approx. 12 km, EUR-12) and for the 'hydrological D-A-CH region' (i.e. Germany, Austria, Switzerland including the river basins draining into these countries at approx. 3 km; DACHhydro-3).

UDAG is funded by the Federal Ministry of Education and Research (BMBF). The project started in September 2023 and will continue until August 2026. The first months of the project were used for preparatory steps, incl. tests for the optimal configuration of ICON-CLM at 12 km resolution for the European domain and at a resolution of 3 km for the DACHhydro-3 region.

The tests for the 12 km configuration included test simulations with different settings of important tuning parameters and tests to improve model biases that were detected in the first reference simulation (esp. shortwave downward radiation and 2m temperature). The tests for the 12 km configuration are almost completed and the remaining candidates for the final configuration all show much improved results compared to the initial configuration.

The tests for the 3 km configuration have also started. In a first step, tests for different domain sizes and resolutions have been conducted to figure out if a resolution of 2 km has a significant advantage compared to 3 km and how large the domain can be to be able to produce the simulations within a reasonable time. As a result, we will not use a resolution of 2 km, because we could not find major improvements at this resolution compared to the 3 km and the 2 km would be even more resource intensive. With a resolution of 3 km we are able to run the model for a slightly larger domain, which gives us the opportunity to include also Austria and Switzerland plus their river catchments into the domain. The data set can then also be used in Austria and Switzerland, e.g. in the D-A-CH collaboration of DWD, GeoSphere Austria and MeteoSwiss. Furthermore, different options related to the convection parameterization and microphysics for the high-resolution configuration were tested. The two-moment microphysics scheme and the gray-zone tuning improve the simulation results, but especially the two-moment scheme is expensive and we have to decide if this parameterization can be used for the production runs.

The computing and storage resources granted in the last allocation period were used for the test simulations described above and the storage and analysis of the output (together with resources in the COPAT2 project (1155)). The 15505 node hours were completely used and 9259 (status 29.04.2024) in were used in addition (24764 in total), because we had to run more tests than we initially expected, especially to tackle the bias problems in the 12 km runs. The tests for the larger domains for the 3 km simulations were also not factored in in the last allocation request, because we initially planned to use only a domain that only covers Germany plus river catchments. But we think, that the extension of the domain is very reasonable and will make this unique high-resolution data set also useful for users and scientists in Austria and Switzerland. 52 TB storage was granted on Levante (/work) and 50 TB are currently used.

In summary, the resources provided in the last allocation period were very helpful to optimize the configuration of ICON-CLM and improve the quality of the results. The production simulations that will start in May/June 2024 will benefit from this.