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The DKRZ project 1203 “NUKLEUS – Actionable local climate information for Germany” encompasses the HPC activities of the BMFTR research program RegIKlim (“Regionale Informationen zum Klimahandeln”).

The NUKLEUS subproject aims to provide up to date high resolution climate change information for Germany. Three dynamical regional climate models (RCM, namely CCLM, ICON-CLM and REMO) were applied within the project to cover the uncertainty range of the representation of regional scale processes. Three CMIP6 GCMs were downscaled under the ssp370 scenario (EC-Earth3-Veg, MPI-ESM-HR, MIROC6). In a first step a dynamical downscaling of the global climate simulation to the European 12km EURO CORDEX EUR-12 grid were performed, followed by a second step to convection permitting scales of 3 km resolution (CEU-3 domain). For ICON with its icosahedral grid, comparable model domains have been chosen. This forms a unique ensemble of convection permitting scale simulations. During the reporting period, the analysis and evaluation of the ensemble have included in several publications, which are partly already published (Beier et al., 2026; Heinrich et al., 2026) and partly still under revision (Sieck et al., 2026; Braun et al., 2026; Cusinato et al., 2026). See figure 1 as an example from Beier et al. (2026).

The subproject ISAP is developing a decision support tools for climate adaptation (https://klimaatlas.region-stuttgart.org/). Up to now it still uses the CMIP5 based KIT-KLIWA convection permitting ensemble, which has been used in several studies as well; Pinto et al. (2026) analyses climate change effects of user-relevant climate indicators. Voit et al. (2026) the climate change effects on flash floods in Germany.

Within RegIKlim the prototype of a web based support tool – now called “Klimafolgenhub” - for climate adaptation has been developed, which will soon be officially released (https://www.klimafolgenhub.de, a preliminary version is already accessible at: https://tier1.klimakataster.dkrz.de/de). There the high-resolution ensemble data will be provided to impact modellers vi the S3-cloud at DKRZ and to aid climate adaptation planning. For this purpose, a bias-correction of the NUKLEUS ensemble has been performed (e.g. Braun et al., 2026, or Fig 1.).

The backend of the of the Klimafolgenhub is the RegIKlim FREVA system. Several FREVA plugins have been developed and integrated in the Kimafolgenhub, to provide climate information to the users of the support tool. Specifically a tool to calculate local climate change factors for extreme precipitation over various return periods and event durations, which provides crucial information to include climate change effects in the generation of flood risk maps (idf_ccf plugin).

Data Management

The ensemble of simulations is now ingested in different FREVA instances at DKRZ. They are available to the project partners within the RegIKlim. In addition, the data are also used within ClimXtreme or by the DWD. The data also as well used for the backend of the Klimafolgenhub. All simulation data were transferred to the CMOR respective CORDEX (meta-)data standards.

Subsequently, we added reanalysis, observational and example model data to the data search engine. datasets provide the opportunity for project partners of the RegIKlim project to perform further impact modelling or analyses. First NUKLEUS simulations have already been published in the new ESGF. These data are not stored in the DKRZ project 1149 CCLM2ESGF, which allowed us to reduce the amount of data by about 1 Petabyte since last year.

During the project Freva will be extended as a backend for a climate change adaptation platform. Basic data analysis needs for most project participants were identified and plugins for application in Freva were developed accordingly. We also modified the Freva web part to display html-based plots enabling an interactive inspection of the results. Further Plug-ins will be incorporated.

Enabled by the FREVA implementation, partners from RegIKlim focus regions are working with the data. Therefore, we still need a large workspace to maintain the old data. In addition, they are needed to complete the publication process for the papers still under revision and further manuscripts in preparation.

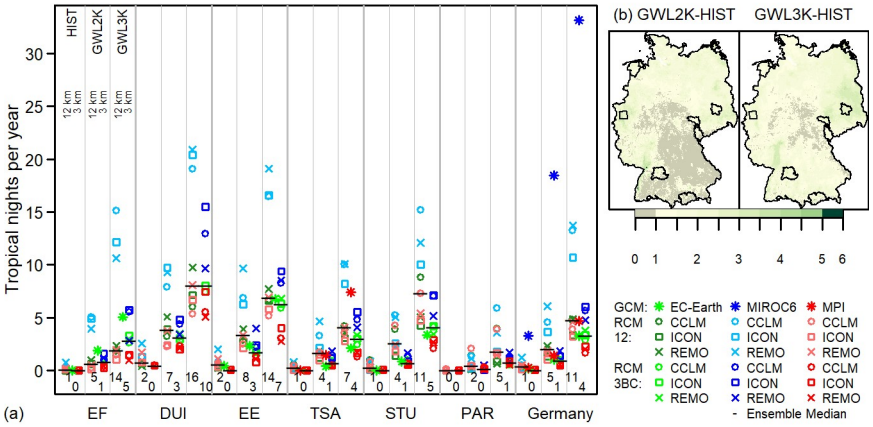


Fig 1: Tropical nights (Tmin > 20°C a): Spatial mean over the focus regions indicated in the maps. per model combination and region for HIST, GWL2K, and GWL3K of GCMs, RCM 12 km ensemble and RCM 3 km bias corrected ensemble. b) Right: Signal-to-noise ratio (|ensemble median|/ensemble standard deviation) of the absolute changes of the GWL periods with respect to the historical period. Note: Higher SNR values indicate greater reliability of the projected changes. From Beier et al. (2026).

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