Data Management stories at DKRZ

Issue 4, January 2019

Data Management for ReKliEs-De at DKRZ

Research area of ReKliEs-De at a resolution of 12 km: Germany (red line) and the catchment areas of the rivers Danube, Rhine, Elbe, Weser and Ems (black lines)

German Climate Computing Center (DKRZ)

The mission of DKRZ is to provide high performance computing platforms, sophisticated and high capacity data management and services for premium climate science.

Besides providing HPC services, DKRZ supports projects in all aspects relevant to data management. This includes preparation, quality assessment, distribution, and long-term archiving of data.

www.dkrz.de

DKRZ data management contributions:

- Provision of forcing data
- CMOR post processing
- Archive design for climate index data
- Data quality control
- Dissemination of all results via ESGF
- Long-term archiving, including
  - Metadata generation
  - Storage at World Data Centre for Climate

ReKliEs-De extends the CORDEX EUR-11 simulations

ReKliEs-De extends the CORDEX (Coordinated Regional Downscaling Experiment) simulations for the EUR-11 domain by additional regional model simulations forced with global model data. The region used for the analysis, the "ReKliEs-De area", consists of Germany and the connected river catchments. From both, the CORDEX data and the new simulations, climate indices for various variables (e.g. precipitation, temperature) have been derived.

Comparison of dynamical and statistical downscaling

Unlike CORDEX, ReKliEs-De includes statistical regional models. The forcing data are the same as used for CORDEX and the ReKliEs-De extensions. The results of statistical and dynamical regional models for various quantities have been compared.

The project ReKliEs-De (Regionale Klimaprojektionen Ensemble für Deutschland / Regional Climate Projection Ensemble for Germany) aims at

- comparing dynamical and statistical downscaling
- a better understanding of differences in model results
- studying the robustness of regional ensembles
- deriving climate indices based on scientific questions and end user needs
- summarizing regional climate change signals based on climate indices for decision makers

http://reklies.hlnug.de/

ESGF publication

All CORDEX extensions done by ReKliEs-De partners and the produced climate index data have been made available at DKRZ's Earth System Grid Federation (ESGF) data portal: *https://esgf-data.dkrz.de/projects/reklies-de/*

GCM,RCP | RCM/ESD	CCLM	REMO	WRF	WR13	STARS3	RCA4	RACMO	HIRHAM5
EC-EARTH, RCP2.6	EURO-CORDEX				ReKliEs-De	EURO-CORDEX	EURO-CORDEX	EURO-CORDEX
HadGEM2-ES, RCP2.6					ReKliEs-De	EURO-CORDEX	EURO-CORDEX	
MPI-ESM-LR, RCP2.6	ReKliEs-De	EURO-CORDEX*	ReKliEs-De	ReKliEs-De	ReKliEs-De	EURO-CORDEX		
MPI-ESM-LR, RCP8.5	EURO-CORDEX	EURO-CORDEX*	EURO-CORDEX	ReKliEs-De	ReKliEs-De	EURO-CORDEX		
CNRM-CM5, RCP8.5	EURO-CORDEX	ReKliEs-De		ReKliEs-De	ReKliEs-De	EURO-CORDEX		
HadGEM2-ES, RCP8.5	EURO-CORDEX	ReKliEs-De	ReKliEs-De	ReKliEs-De	ReKliEs-De	EURO-CORDEX	EURO-CORDEX	
EC-EARTH, RCP8.5	EURO-CORDEX	ReKliEs-De	ReKliEs-De	ReKliEs-De	ReKliEs-De	EURO-CORDEX	EURO-CORDEX	EURO-CORDEX
CanESM2, RCP8.5	ReKliEs-De	ReKliEs-De		ReKliEs-De	ReKliEs-De			
MIROC5, RCP8.5	ReKliEs-De	ReKliEs-De	ReKliEs-De**	ReKliEs-De	ReKliEs-De			
IPSL-CM5A-MR, RCP8.5			EURO-CORDEX			EURO-CORDEX		

EURO-CORDEX: available at DKRZ; link points to the ESGF published data.

EURO-CORDEX*: here runs 1 and 2 of MPI-ESM-LR were run.

ReKliEs-De: available at DKRZ; used for calculation of indices; link points to the ESGF published data.

ReKliEs-De**: this run was not included into calculation of climate indices and pictures.

Regional climate projection ensembles for Germany.

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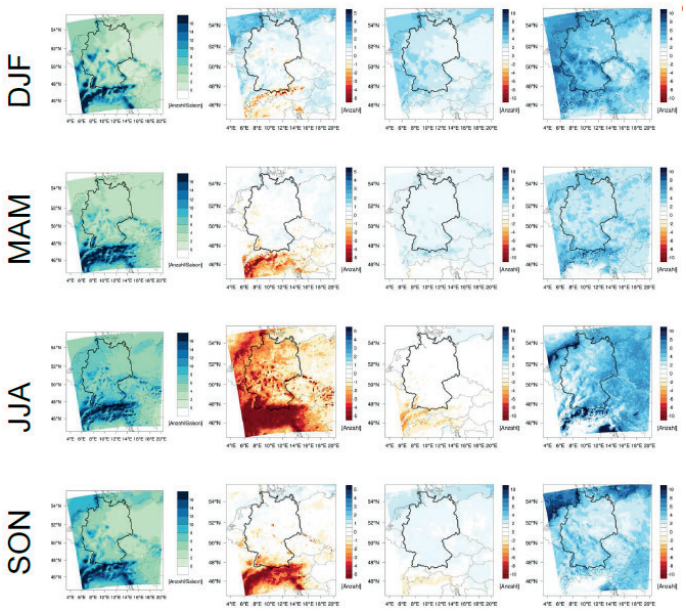
Climate indices

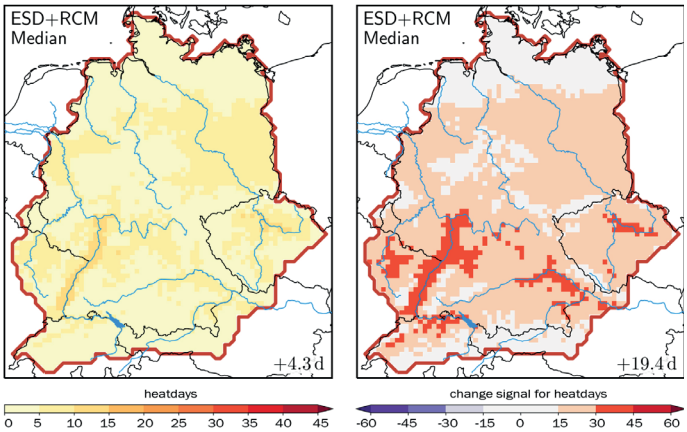
For storing the climate indices derived for the ReKliEs-De area, the metadata design (NetCDF headers) developed within the Climate Information Platform for Copernicus (ClipC) project was extended and used.
The figures on the right and below show examples of climate indices for temperature and precipitation.



Precipitation: The figure shows for the period 1971-2000 the number of days per season with more than 10 mm of precipitation (left column) and the projected changes for 2071-2100 relative to 1971-2000 for scenario RCP8.5 (ensemble minimum, mean, and maximum, columns 2-4).

Robust bandwidth of a climate change signal

Another goal of the ReKliEs-De project was to find the minimum number of ensemble members needed for a so-called "robust" ensemble, i.e. an ensemble, whose mean values and bandwidth don't change significantly when further members are added to it. First, a sensible agreement on the definition of the threshold for the robustness had to be found. A comparison of different model ensembles has shown that, e.g., for the surface temperature in an RCP8.5-simulation, an ensemble of about nine members proved to be robust.

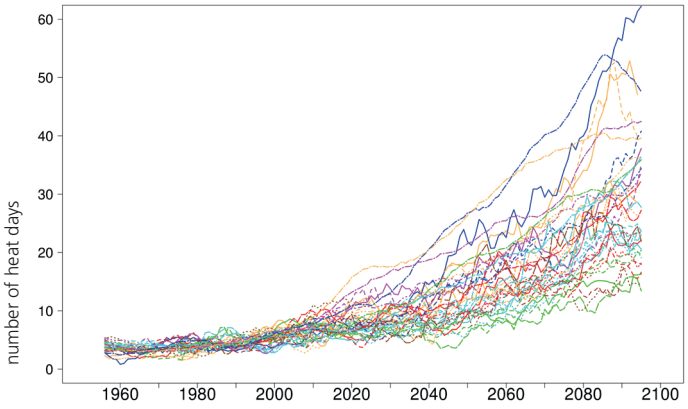


Temperature: The figure on the left shows the simulated number of heat days for the period 1971-2000, i.e. days with a maximum temperature of 30 deg C or more (ensemble median). The projected change in the number of heat days in 2071-2100 relative to 1971-2000 for the pessimistic scenario RCP8.5 is shown on the right (ensemble median).

Comparison of Climate Projections

The climate scenarios used for both CORDEX and ReKliEs-De are the "Representative Concentration Pathways" (RCP8.5 and RCP2.6) also used for CMIP5, the simulations carried out with respect to IPCC AR5.

Results and data: http://reklies.wdc-climate.de



Temperature: For scenario RCP8.5, the figure shows the large bandwidth of the number of heat days simulated with various combinations of dynamical or statistical regional models forced with different global model data.

Key benefits of DKRZ data services

For data users:

- Consistent data and metadata structure
- Quality controlled and well documented data
- Stable and uniform access interface
- Long-term data availability

For data producers:

- Long-term data archiving, curation and dissemination in a certified repository
- Quality controlled data
- DOI registration
- Consistent citations by data users

ReKliEs-De Partners:

With financial support of: