

Project: **1229**

Project title: **CliWaC**

Principal investigator: **Uwe Ulbrich**

Report period: **2021-11-01 to 2022-10-31**

## Report

CliWaC (“**C**limate and **W**ater under **C**hange”) started in January 2022. The first milestone included the simulation of ensembles of past extreme precipitation events affecting Berlin. Based on an impact catalogue 21 relevant episodes were identified and simulated at convection permitting resolution (2.7 km x 2.7 km) with the COSMO-CLM non-hydrostatic regional climate model. Each episode lasted between a few hours and a few days. Downscaling was realized in two steps. In a first step the 50 km resolution of the ERA5 driving data was downscaled to the 12 km EURO CORDEX-11 domain and resolution. This simulation was then used to drive the 2.7 km ensemble simulations.

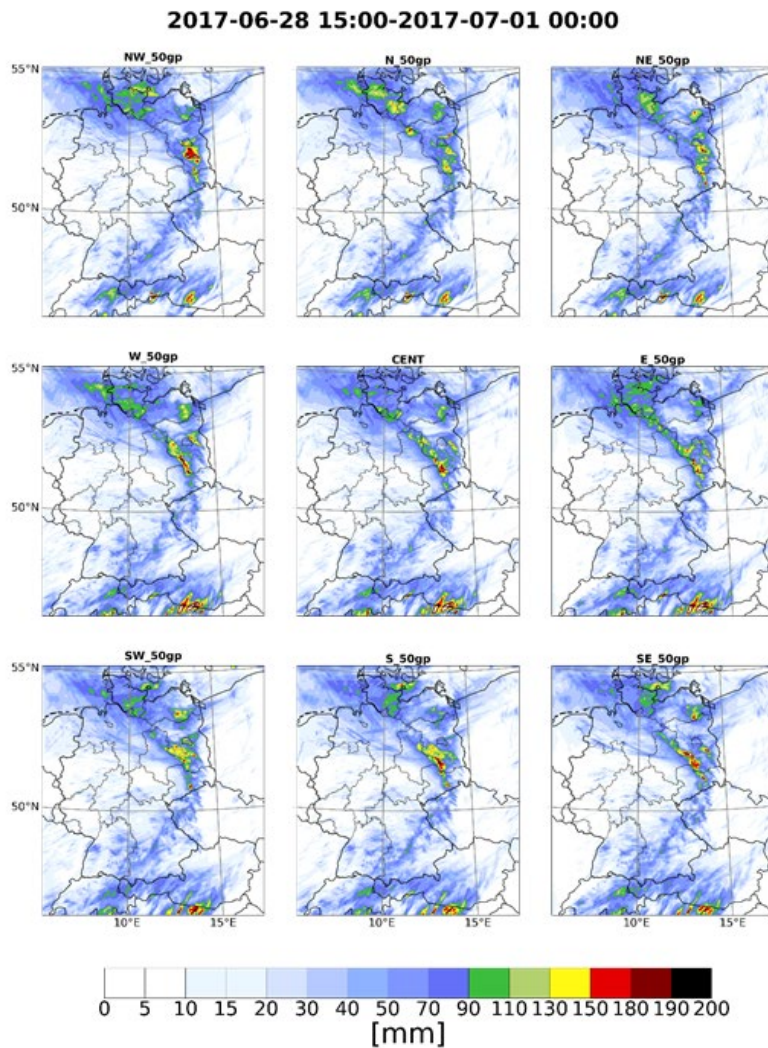
With the help of the ensemble the range of rain amounts and intensities possible under the given large-scale conditions is evaluated. Fig. 1, for example, shows an ensemble of simulations for the extreme event “Rasmund” which effected Berlin at the end of June 2017. A band of high precipitation was located over Eastern Germany. The position of the embedded cells exhibiting precipitation extremes varies between the simulations and leads to the ensemble spread that is analysed within CliWaC (Fig.2). The ensembles are generated by varying the location of the RCM domain relative to the domain of the driving data set. This method ensures that all ensemble realizations are equally plausible under the large-scale conditions provided by the forcing data set.

Precipitation was written out in 5-minute temporal resolution. These and further variables build the basis for hydrological and hydrodynamic simulations which will be conducted at a CliWaC partner institute in order to determine the flood risk associated with the different precipitation realizations.

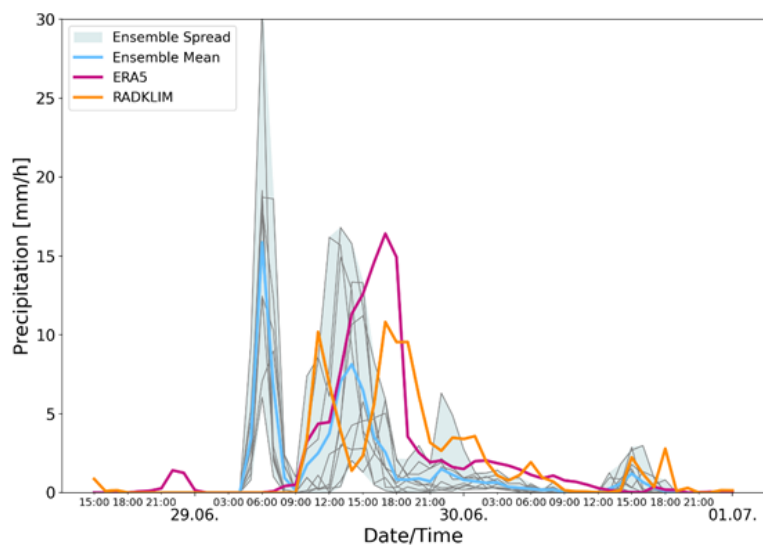
Further resources were used to conduct a sensitivity study comparing COSMO-CLM version 5 with COSMO-CLM version 6. So far no set-up recommendations exist for COSMO-CLM-v6. It was found that using the default values of version 6 leads to an overestimation of precipitation extrema. Further simulations were therefore run using version 5. We also conducted a comparison of episodes simulated on Mistral and Levante.

Postprocessing of the model simulations and visualization using Jupyter Notebook took place using DKRZ resources.

In contrast to the original application, continuous convection-permitting simulations are no longer planned for the project. Instead we will collaborate with project NUKLEUS and analyse their continuous simulations. This explains why CliWaC consumed less resources than anticipated in the original proposal.



**Figure 1: Precipitation accumulated over event duration in mm for 9 ensemble members. Simulations for extreme event "Rasmund".**



**Figure 2: Time series of hourly precipitation averaged over the area of Berlin. Ensemble members and spread (grey), driving model (purple), observations (orange).**