Project: **1229**

Project title: **CliWaC**

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

Report

CliWaC ("**Cli**mate and **Wa**ter 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 downscales to the 12 km EURO CORDEX-11 domain and resolution. This simulation was then used to drive the 2.7 km ensemble simulations.

The output of these simulations was processed in order to be used for hydrological simulations (Fig. 1; Tügel et al. 2023a, Tügel et al. 2023b).

For 2023 we planned to downscale extreme precipitation episodes identified in climate scenario simulations. In order to ensure that forcing data for these episodes exist we decided to base the event selection on the NUKLEUS climate scenario simulations. These simulations were conducted on Levante (bb1187) and the forcing data is stored in the Levante archive. The NUKLEUS project planned to finish the simulations in spring 2023 and make results available shortly afterwards. Last year's application for DKRZ resources was based on this information. Unfortunately, completion and clearance of the simulations was delayed. We first gained access to NUKLEUS precipitation data in summer 2023.

Using simulated precipitation from the high-resolution NUKLEUS climate scenario simulations we fitted duration dependent Intensity-Duration-Frequency curves for the region Berlin-Brandenburg. This was realized by programming a Jupyter Notebook using DKRZ resources. Based on these results we identified the episodes which we intend to re-simulate.

In autumn 2023 we received forcing data for two of the selected episodes. Using these test episodes, we set up a configuration of int2lm and COSMO-CLM using NUKLEUS forcing data and the model configuration envisioned for CliWaC. Test runs were performed to determine the required spin up time and a consistent physical set up. The aim was to produce meaningful ensemble simulations that on the one hand show a sufficient model spread but on the other hand still capture the extreme convective events in the Berlin-Brandenburg area. In October 2023 we gained full access to the NUKLEUS simulations and the forcing data. The resimulation of the episodes is about to start.

The delays with the data availability explain why CliWaC consumed less resources than anticipated in the original proposal.

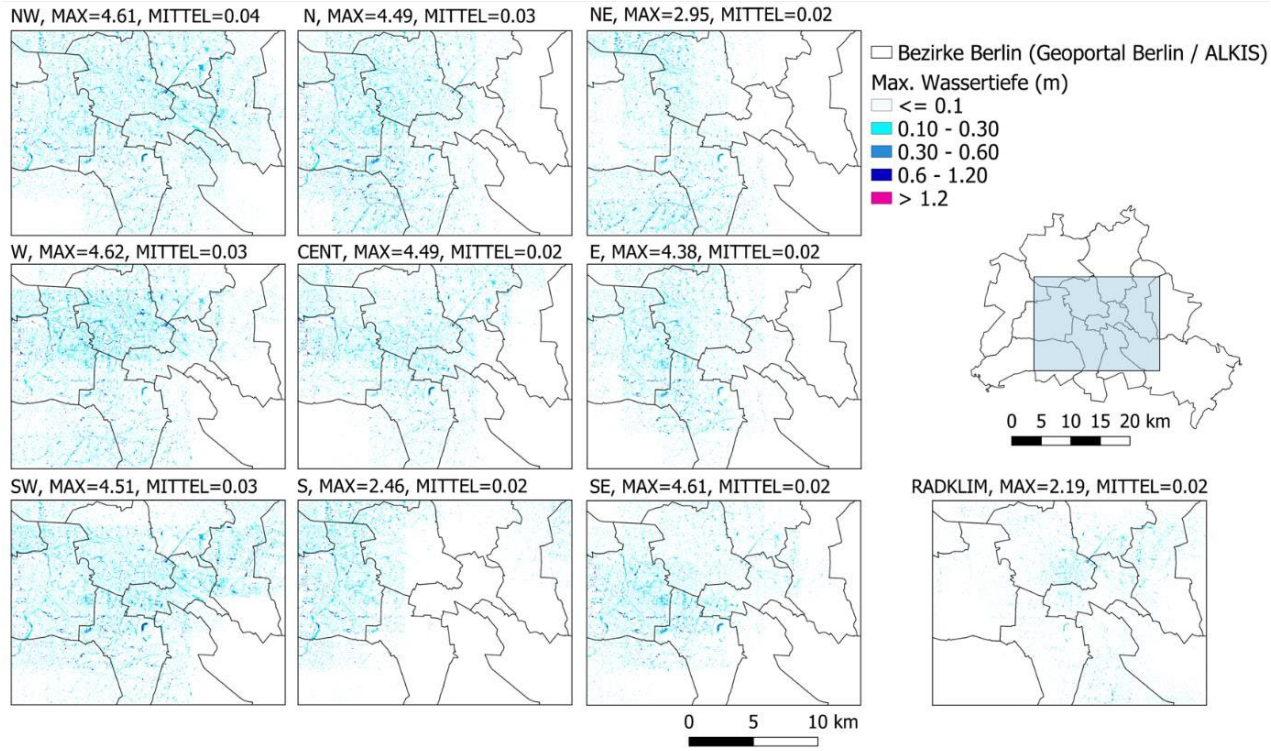

Figure 1: The extreme precipitation event affecting Berlin on 01.06.2018 was resimulated at convection permitting resolution. An ensemble of 9 members was created using ERA5 as forcing data and applying a domain shift for ensemble generation. The resulting water depth at the ground for this ensemble and the original observed event (RADKLIM) was simulated using a 2-D hydrodynamical model. The figure shows the resulting maximum water height.

References:

Tügel, Franziska; Kronke, Elsa; Steffen, Lennart; Nissen, Katrin; Ulbrich, Uwe; Hinkelmann, Reinhard, Hydrodynamische N-A-Ensemblesimulationen mit variablen räumlich-zeitlichen Verteilungen von Starkniederschlägen, Forum für Hydrologie und Wasserbewirtschaftung,Tag der Hydrologie,Bochum, Germany,22.-23.03.2023, Ruhr-Universität Bochum & Hochschule Bochum, Herausgeber: Fachgemeinschaft Hydrologische Wissenschaften in der DWA, Hennef,44.23 Edition, März 2023

F., Tügel; E., Kronke; L., Steffen; K., Nissen; U., Ulbrich; R., Hinkelann, Ensemble rainfall-runoff simulations with variable spatio-temporal distributions of heavy rainfall IAHR, Herausgeber: 40th IAHR World Congress - Rivers - Connecting Mountains and Coasts, Vienna, Austria, August 2023