Project: **1229**

Project title: **CliWaC**

Principal investigator: **Uwe Ulbrich**

Report period: **2023-11-01 to 2024-10-31**

Report

For project CliWaC ("**Cli**mate and **Wa**ter under **C**hange") extreme precipitation and urban flooding in Berlin was studied at FU Berlin. In order to investigate the probability for such events and the range of possible severities short episodes with a high potential of impacts were re-simulated at convection permitting resolution.

The events were identified from NUKLEUS regional climate simulations at a convection permitting resolution of 3 km (MIROC6-CCLM, EC-Earth3-Veg-CCLM) conducted within DKRZ project bb1187. Six 30-year period simulations forced with observed and projected SSP370 greenhouse gas concentrations were available. From these we identified the annual maximum 1-hour duration events affecting Berlin. The temporal resolution of data from the original simulation is 1 hour. As the forcing data is stored in the Levante archive, it was possible to re-simulate the selected events. For each event a 9-member ensemble using the CCLM climate model at a resolution of approximately 3 km was created. The ensemble generation was based on the domain-shift method (Mazza et al. 2017). This allows to study sub-hourly precipitation intensities and the probability of being affected by even more severe events under the same large-scale conditions. It was found that about 30% of the ensemble members exhibited precipitation intensities exceeding those of the original simulation. From radar observations it can be inferred that about 60% of the annual maximum 5-minute-intensitiy events are also annual maximum 1-hour-intensity events. We therefore stored precipitation of the re-simulations with a temporal resolution of 5 minutes to be able to infer information on the climate change signal of sub-hourly intensities from these simulations although such values where not stored for the original simulations.

The statistical distribution of the extreme events under present day and climate change conditions was determined using the method of Fauer et al. (2021). This served as input to hydrodynamical simulations conducted for the centre of Berlin. With this approach the hazard can be translated into impacts such as flooding and combined sewer overflow. Moreover, the effects of mitigation measures can be studied. An important output of the project are pluvial flood hazard maps for present-day and climate scenario conditions (Fig. 1).

Results from this research were presented at Deutsche Klimatagung Potsdam (Nissen et al. 2024a) and EMS Barcelona (Nissen et al. 2024b). A publication is about to be submitted to NHESS (Tügel et al. 2024).

The simulations conducted within CliWaC will be further analysed by partner project Spreewasser:N (bb1230). As CliWaC ends at 31.12.2024 we ask for a transfer of the CliWaC data stored at DKRZ under account bb1229 to Sprewasser:N in the next application for resources.

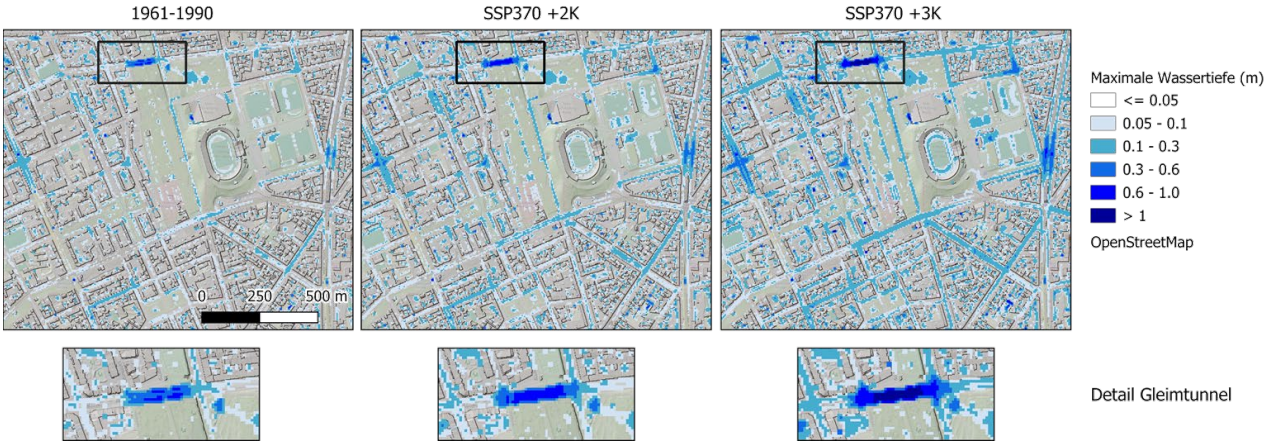

Figure 1: Maximum water depth in central Berlin following after a 1-hour 100-year event under different climate scenarios.

References:

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Nissen, Katrin, Franziska Tügel, Felix Fauer, Henning Rust, Uwe Ulbrich, Reinhard Hinkelmann, Hendrik Feldmann, Marie Hundhausen, and Joaquim Pinto (2024): Starkniederschläge und Überschwemmungen in Berlin im Klimaänderungsszenario, https://doi.org/10.5194/dkt-13-15.

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