Project: **1373**

Project title: **Impetus4Change - Improving near-term climate predictions for social transformation**

Principal investigator: **Claas Teichmann**

Report period: **2025-05-01 to 2026-04-30**

Project overview

The overarching objective of Impetus4Change (I4C) is to improve near-term climate information and services at local to regional scales where impacts are most keenly felt, and on-the-ground adaptation is implemented. Further, I4C will strengthen and support the alignment of said services with end-user adaptation planning needs through improved accessibility and usability.

For the I4C modeling activities, our regional climate model REMO is extended by the Town Energy Balance Model (TEB model) to incorporate a sophisticated representation of urban surfaces. Using the improved version of REMO, non-hydrostatic long-term climate simulations are performed over two selected regions in Europe which cover the four demonstrator cities of Impetus4Change.

Project partners are also performing convection-permitting regional climate model (CPRCM) simulations over similar model domains to obtain an ensemble of climate simulations over the demonstrator cities which enables us to assess the bandwidth in climate change information due to different modelling approaches. These simulations will on the one hand be directly used in the co-development of climate services in the demonstrator cities, on the other hand, they will feed into the project's machine learning activity, i.e., emulators, where the ensemble of climate simulations will be used as training data.

Planned work and performed simulations

The regional climate model simulations are performed using the non-hydrostatic version of the regional climate model REMO over two sub-domains of the EURO-CORDEX domain covering central northern Europe (NSEA-3) and central southern Europe (ALPX-3) at 0.0275° (Fig. 1).

We have finished the evaluation (driven by ERA5, 2000-2009) simulation, the historical reference period (1995-2014) and SSP3-7.0 scenario global warming level +3°C (GWL3), both driven by CMIP6 MPI-ESM1.2-HR. The data has been cmorized and shared within our project and with the WCRP CORDEX Flagship pilot study (FPS) URBan environments and Regional Climate Change (URB-RCC).

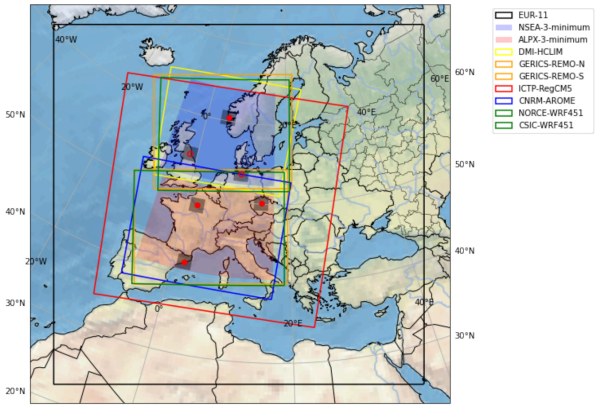

Figure 1: European simulation domains of all I4C partners. GERICS REMO-TEB domains are shown in orange. (Source code for the Plot: https://github.com/jesusff/domains/tree/i4c)

Progress, delays and new allocation of resources

In the upcoming allocation period, the final simulations of the European domains, i.e., the SSP3-7.0 scenario GWL +1.5°C (2025-2044), are scheduled to finish in the next 2-3 months.

The data of all 3km-European simulations is currently used, e.g., for analysis on heat extremes in European cities (Fig. 2 and 3). Here, we are evaluating the urban heat island signal and tropical nights in I4C cities. Within I4C, we are also planning to publish our simulations on ESGF before the end of the project.

Furthermore, in an effort to have modeling activities include "outter-European" domains in I4C, project partners had agreed in the project proposal to also perform simulations for a Caribbean domain (Fig. 4). The Caribbean climate is characterised by seasonal tropical cyclone activity, which require high spatial resolution like our CPRCMs to be resolved. Due to the domain size, we have committed to the minimum required domain. Plans for the simulations are listed in the request document. The data will further be used to compare to REMO simulations done for the EUCP project.

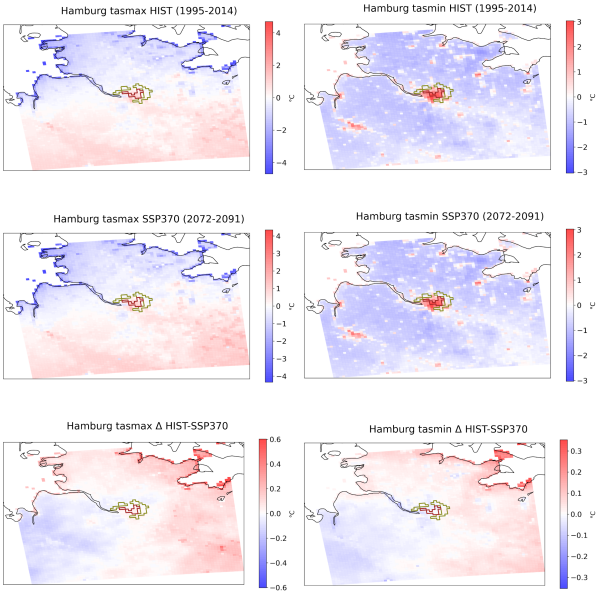

Figure 2: Urban and rural day- (tasmax, left) and nighttime (tasmin, right) climatologies (relative to mean rural tasmax/-min) for historical (HIST, 1995-2014) and future scenario (SSP3.70, 2072-2091) simulations for Paris and Hamburg.

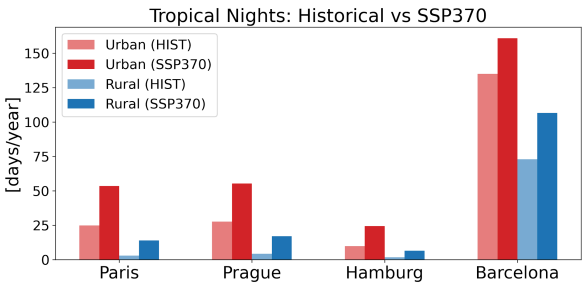

Figure 3: Fig 5: Days/year of tropical nights (tasmin > 20°C, top) and summer days (tasmax > 25°C, bottom), for HIST (1995-2014) and SSP3-7.0 (2072-2091) simulations for urban (red) and rural (blue) grid points for I4C demonstrator cities.

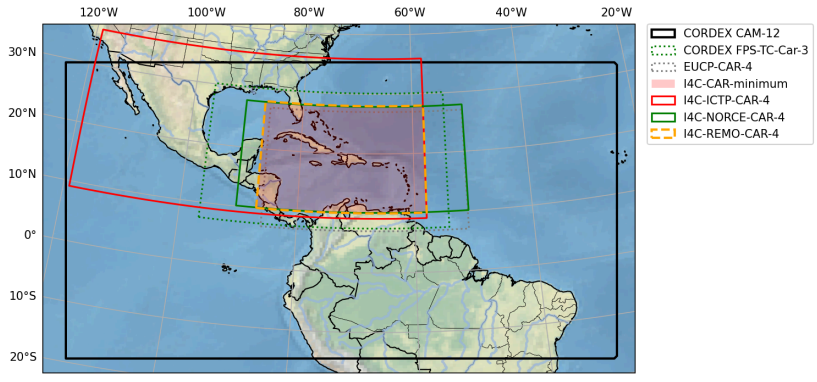

Figure 4: Caribbean simulation domains of all I4C partners. GERICS REMO-TEB domains are shown in orange. (Source code for the Plot: https://github.com/jesusff/domains/tree/i4c)