Clarity

The climate impact assessment marketplace

Data, tools and services for the efficient check of urban infrastructure

CLARITY's Climate Services: Using EURO-CORDEX simulations and including dynamical-statistical downscaling to allocate current and future climate-related hazard patterns at different spatial scales

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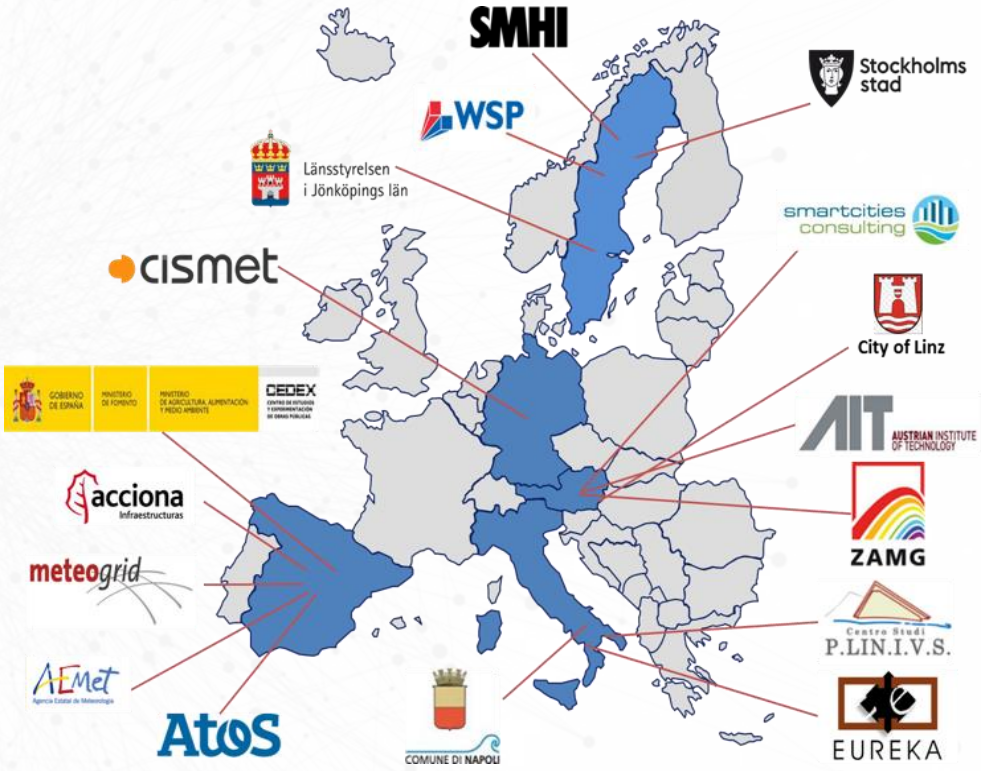
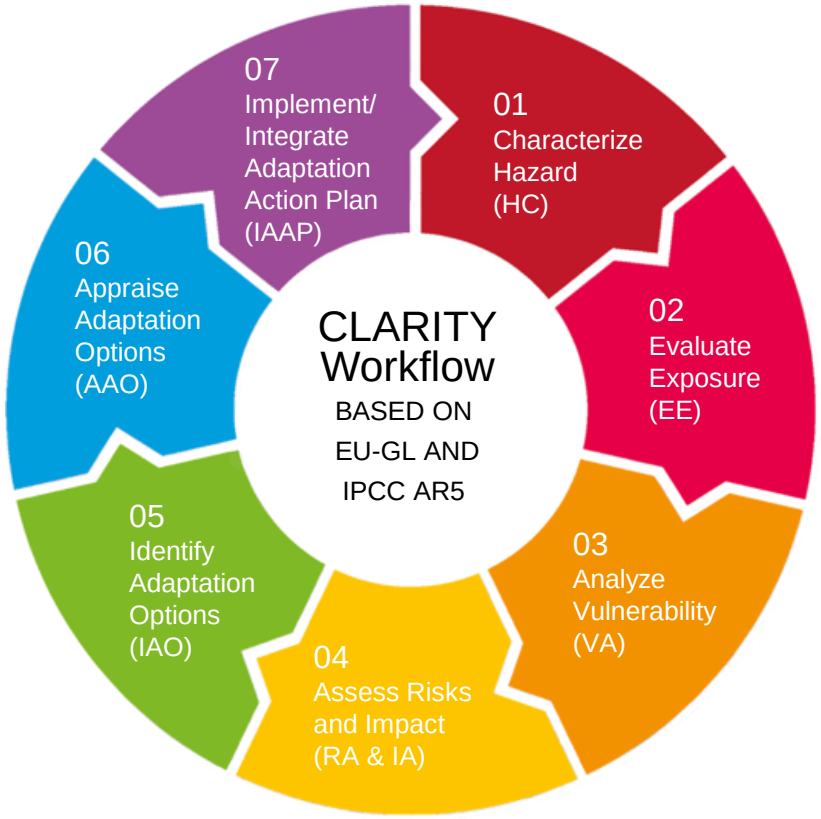
- Development of a **Climate Services Information System (CSIS)** to support climate change adaptation planning in **urban areas** and **transport infrastructure** projects
- **Co-creation** with suppliers, purveyors and end-users
- Demonstration and validation of added value in **4 pilots**





For more details about the EU-GL method please check:
http://climate-adapt.eea.europa.eu/metadata/guidances/non-paper-guidelines-for-project-managers-making-vulnerable-investments-climate-resilient/guidelines-for-project-managers.pdf

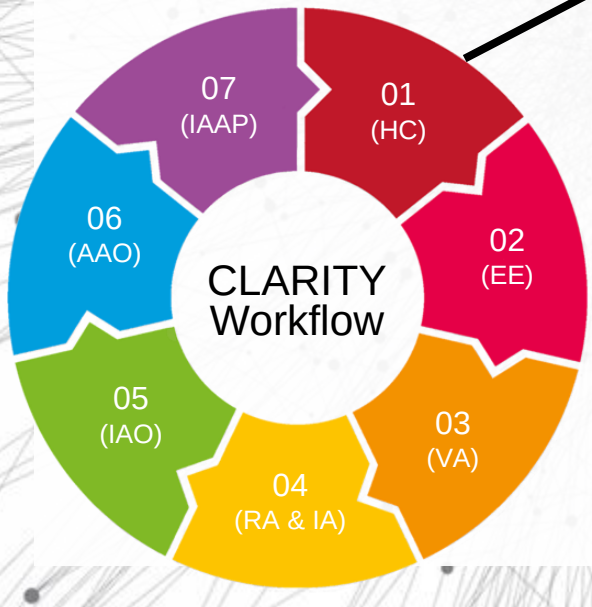
CLARITY WORKFLOW

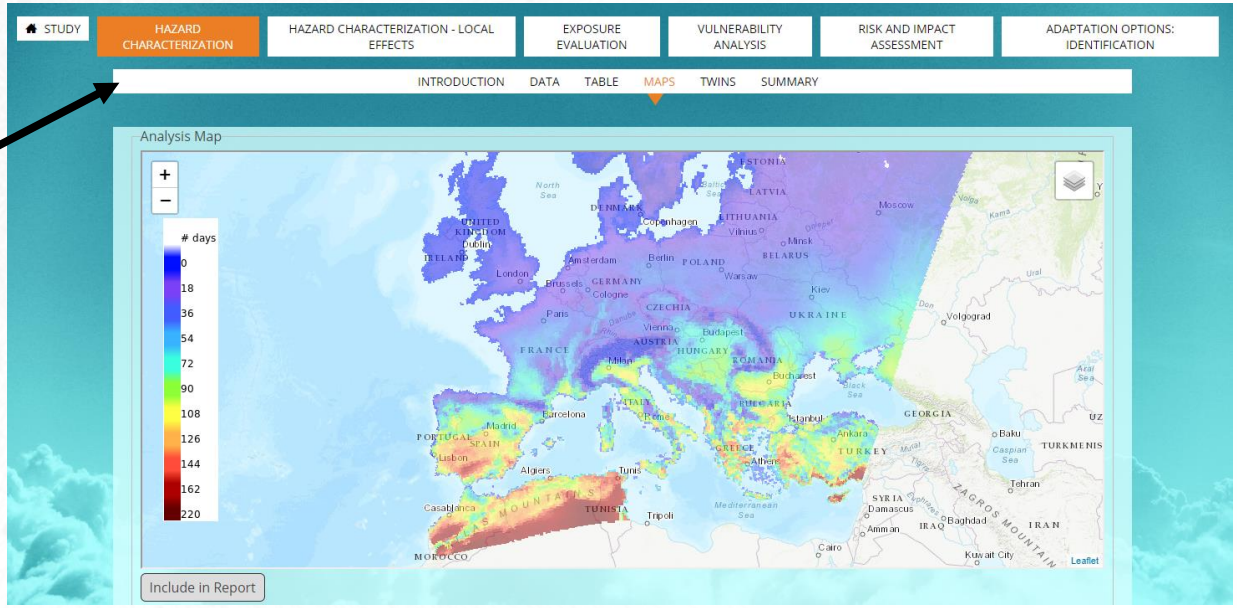
- Based on "Non-paper guidelines for project managers: making vulnerable investments climate resilient" (EC, 2011)

- Updated to comply with the 5th Assessment Report of the IPCC to promote integrated modelling approach for Disaster Risk Reduction and Climate Change Adaptation

Climate Services Information System (CSIS) – Online Screening Tool

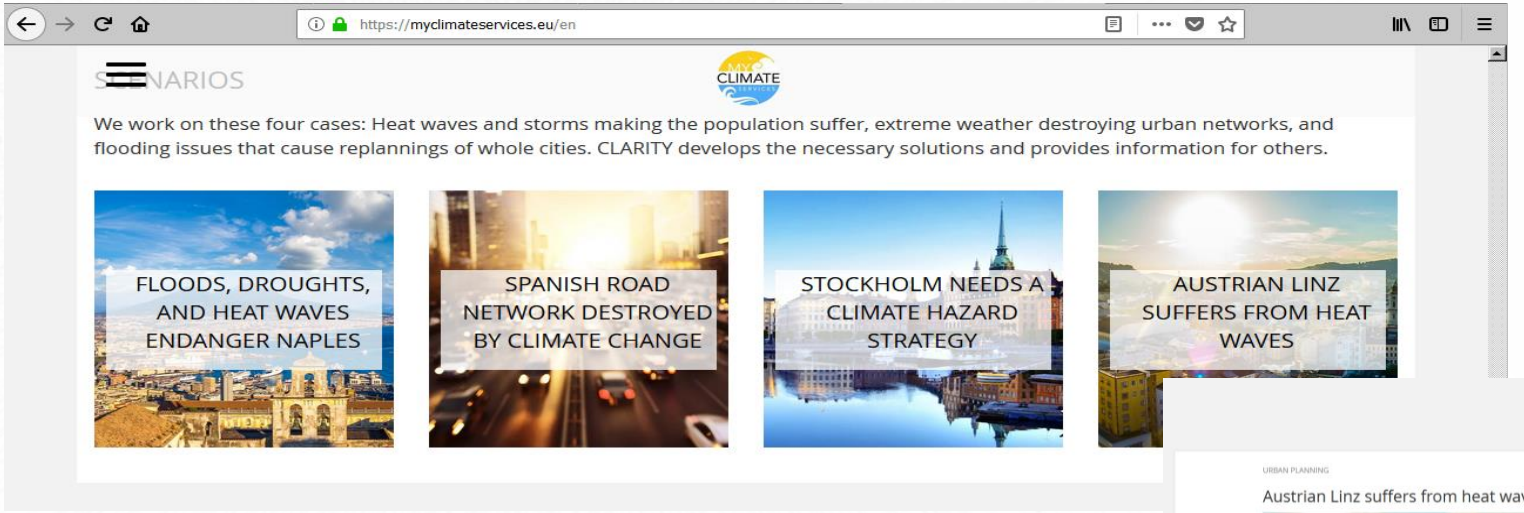
- **Screening** of potential hazards, exposed elements at risk, general adaptation options, ..
- Based on available **open** data (e.g. EURO-CORDEX, Urban Atlas)





Marketplace

- **Expert Services** and **Solutions** based on results of the screening
- Expert Studies in pilot sites (Naples, Linz, Sweden, Spain) showcase the benefit



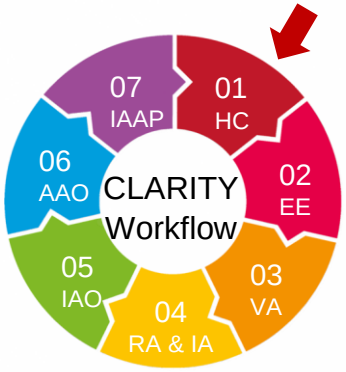
- Application of models and tools at higher spatial resolution
- Integration of **city-specific** (i.e. non-open) datasets

CLIMATE MODELLING AT EUROPEAN SCALE

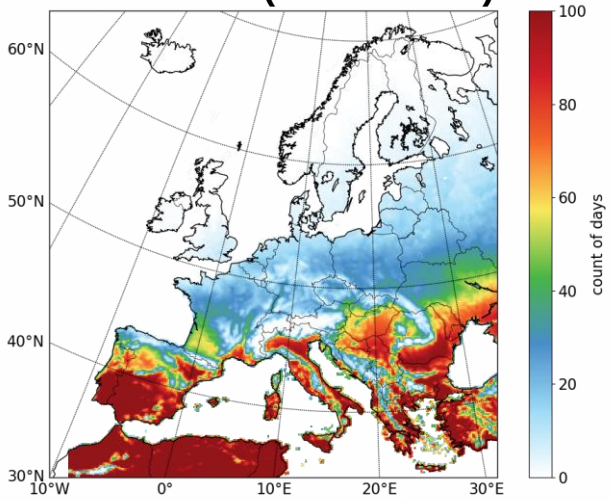
- Hazards are represented through a set of **climate indices** (ETCCDI, ECA&D)
- 16 GCM-RCM combinations from EURO-CORDEX simulations (0.11° resolution)
- Bias correction method quantile mapping applied to temperature and precipitation data using the E-OBS Dataset (still ongoing)
- Representative Concentration Pathways (RCPs): RCP2.6, RCP4.5, RCP8.5
- Periods: 1971 – 2000, 2011 – 2040, 2041 – 2070, 2071 – 2100
- Special focus on heat and flood-related hazards

https://euro-cordex.net/

SUMMER DAYS (Tmax ≥ 25°C)

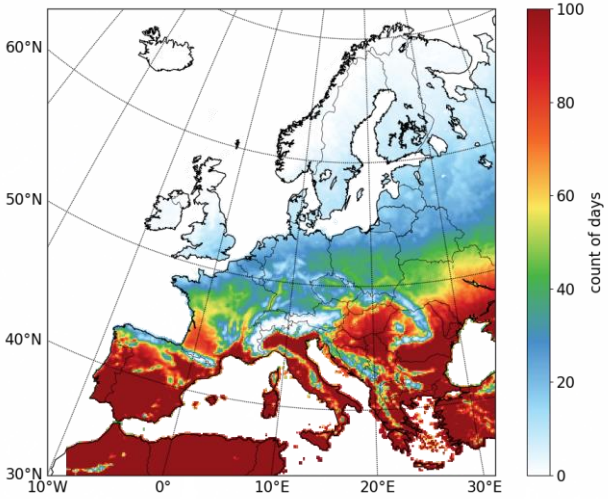


Baseline (1971 – 2000)

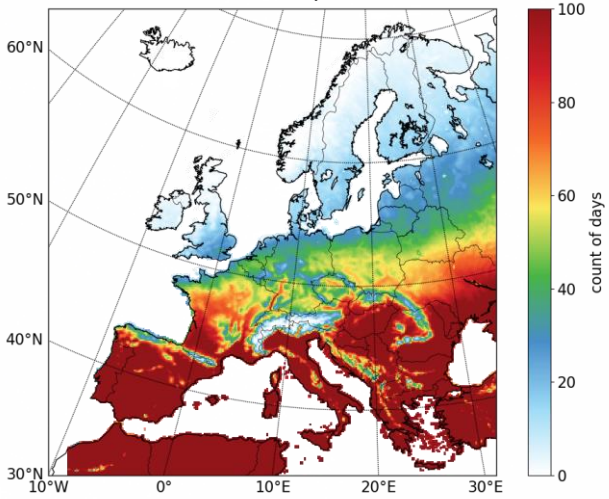


Ensemble mean of EURO-CORDEX simulations (near-surface maximum temperature)

2071 – 2100, **RCP4.5**



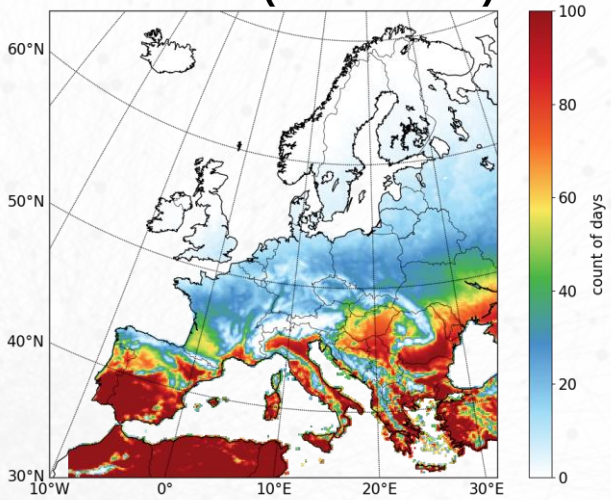
2071 – 2100, **RCP8.5**



Preliminary results!

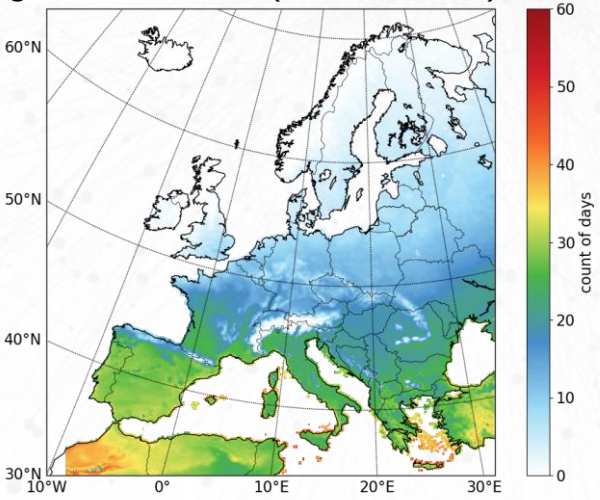
CHANGE IN SUMMER DAYS (Tmax ≥ 25°C)

Baseline (1971 – 2000)

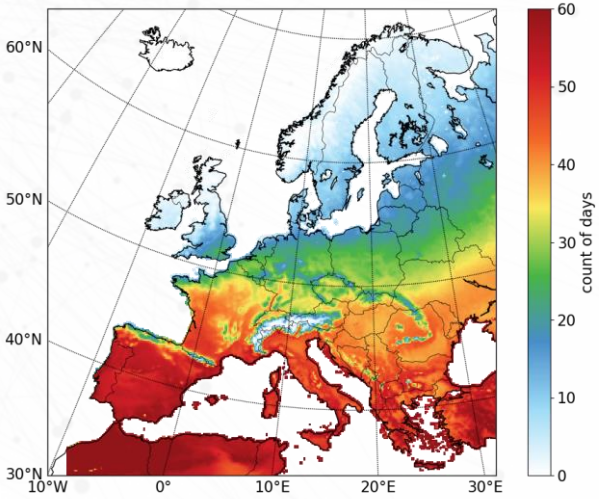


Ensemble mean of EURO-CORDEX simulations (near-surface maximum temperature)

Change wrt baseline (**2071 – 2100**), **RCP4.5**

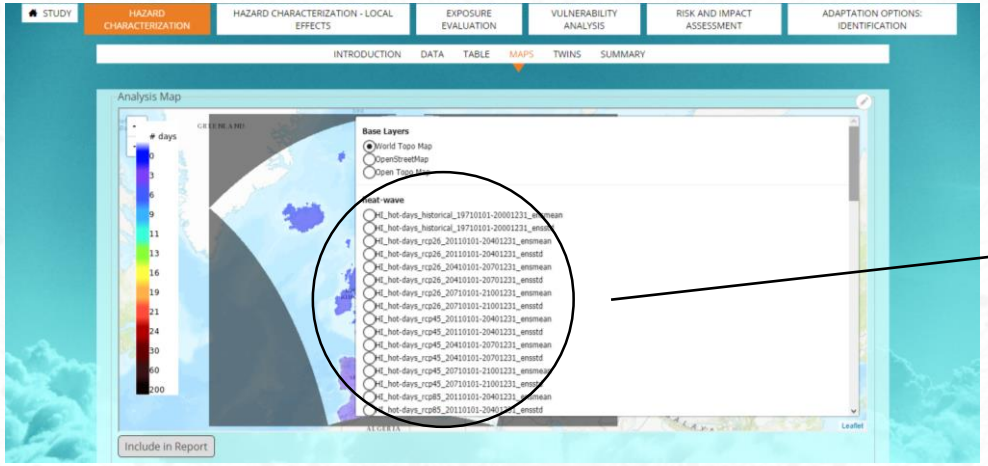


Change wrt baseline (**2071 – 2100**), **RCP8.5**



Preliminary results!

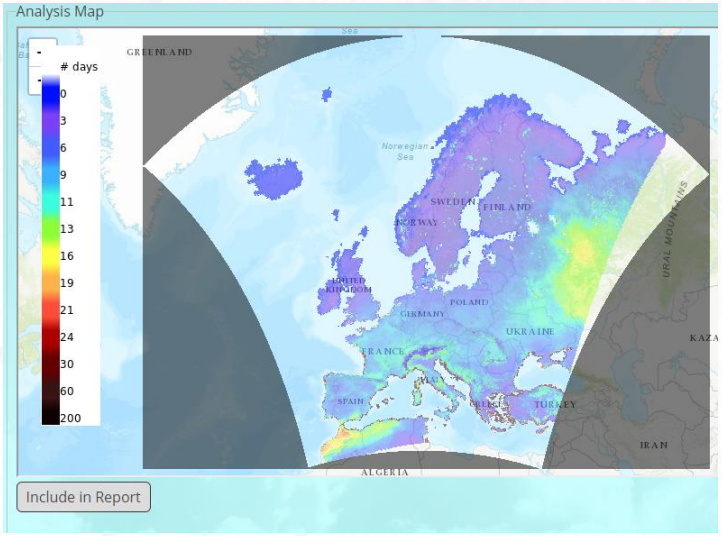
HAZARD CHARACTERISATION ON EUROPEAN SCALE - HEAT



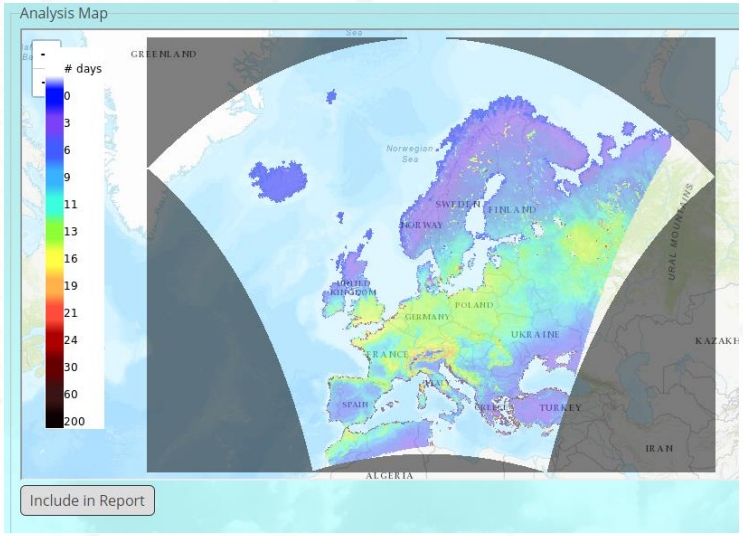
Visualisation of . . .

- Different indices
- Different RCP scenarios
- Ensemble statistics

Summer days: Standard deviation, 2071 – 2100, **RCP4.5**

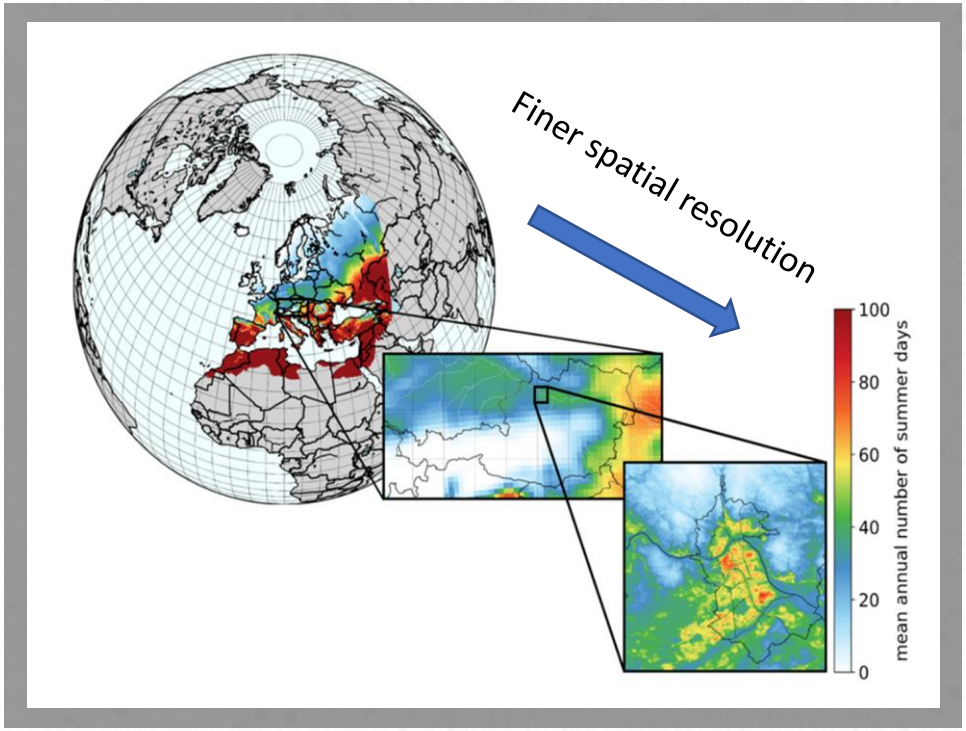


Summer days: Standard deviation, 2071 – 2100, **RCP8.5**

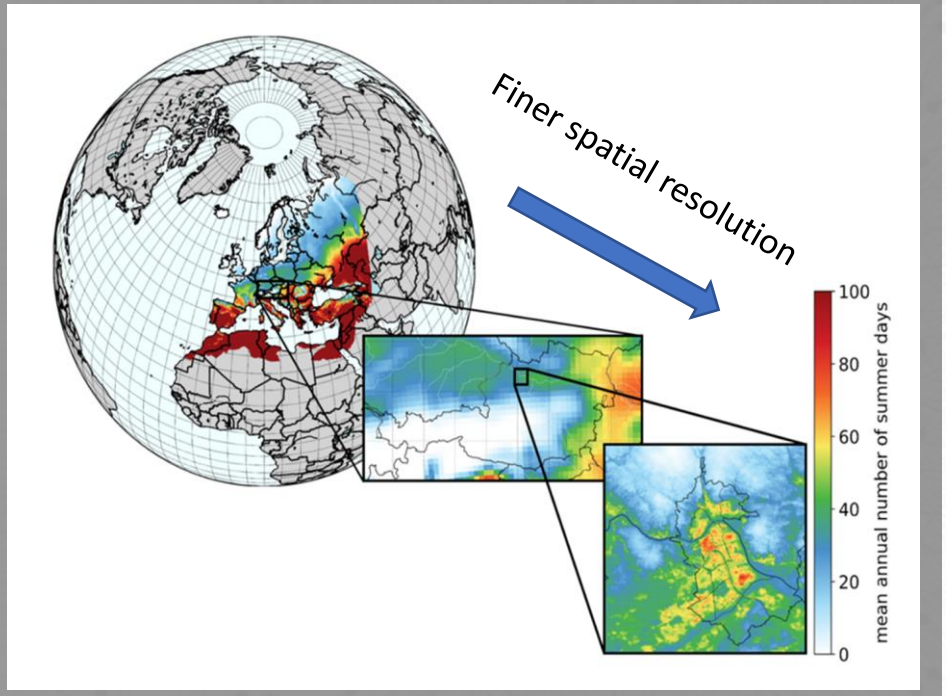


Preliminary results!

CLIMATE MODELLING AT LOCAL SCALE



CLIMATE MODELLING AT LOCAL SCALE



Applied models and tools on expert level:

- Regional climate models (e.g. COSMO-CLM)
- **Urban climate models (e.g. MUKLIMO_3)**
- Microclimate models (e.g. Grasshopper)

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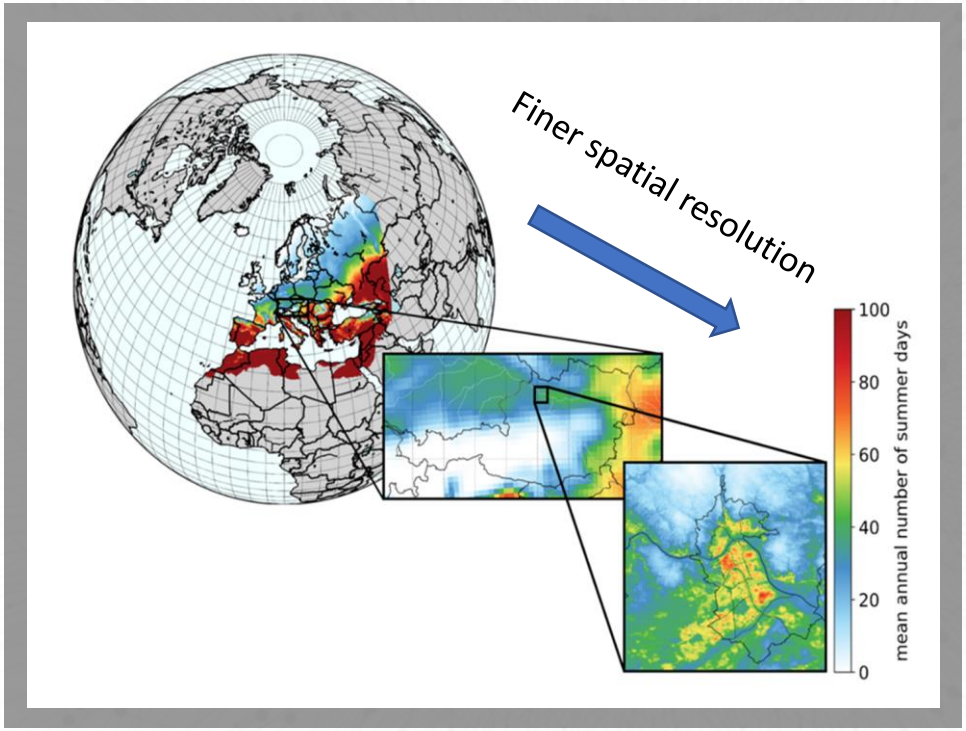

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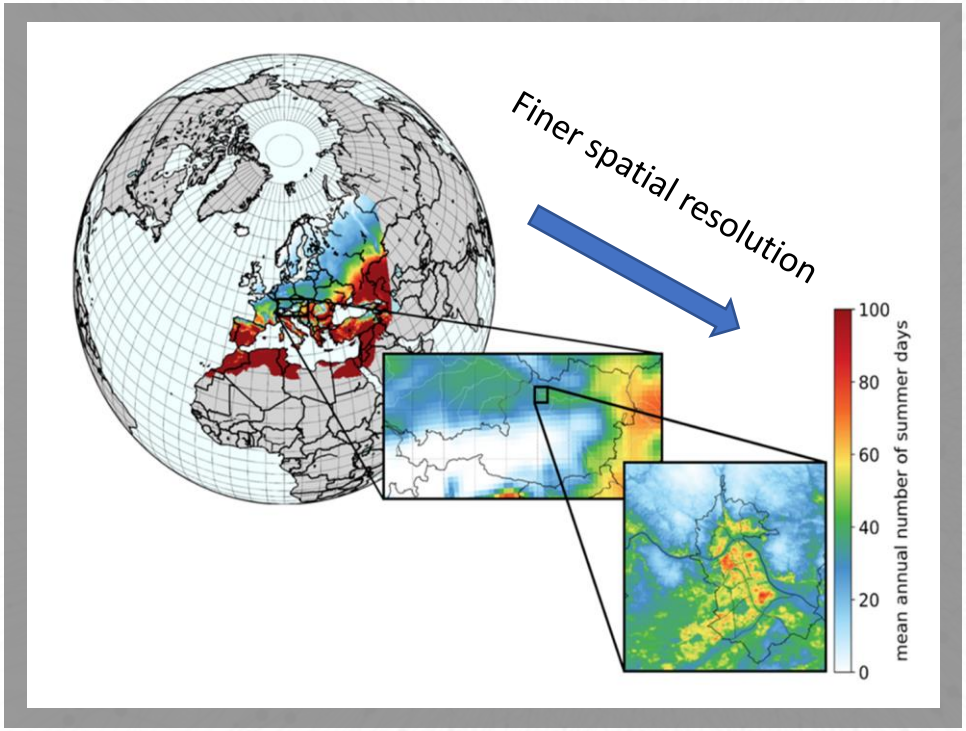
MUKLIMO_3 (*Sievers and Zdunkowski, 1986; Sievers, 1990; Sievers, 1995)*

- **Main applications:** Simulation of urban heat island effects and modelling the effects of climate adaptation measures
- **Horizontal/vertical resolution**: 20–250 m / 10–100 m
- **Input data**: orography and land use (city administration, CORINE, Urban Atlas)
- **Output data and analysis**: air temperature, wind speed and direction, relative humidity and heat fluxes
- **Post-processing:** Calculation of climate indices with the cuboid method
  - Number of summer days
  - Number of hot days
  - Number of tropical nights

CLIMATE MODELLING AT LOCAL SCALE



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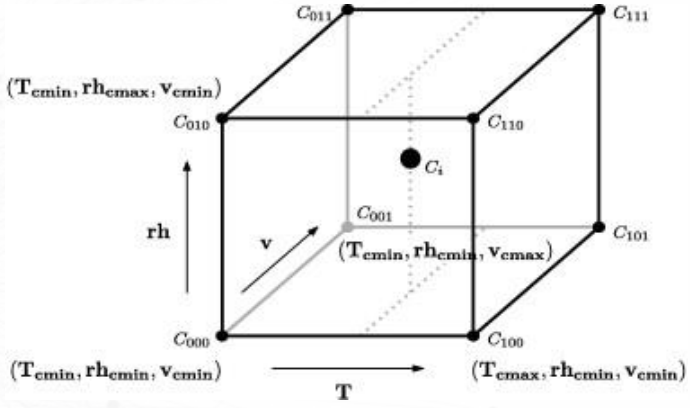
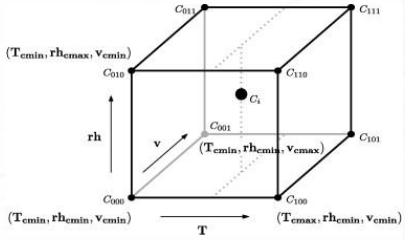
DYNAMICAL-STATISTICAL DOWNSCALING



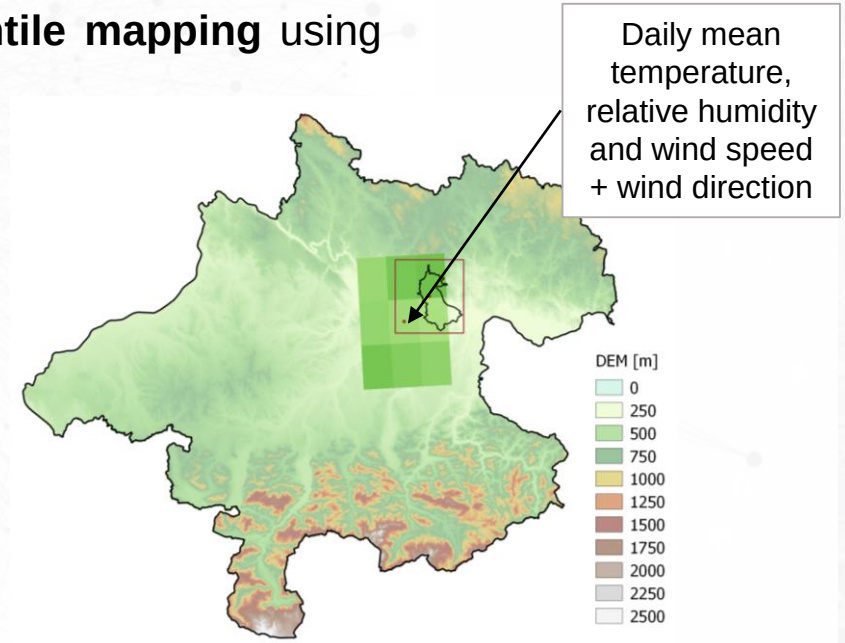
Cuboid method (Früh et al., 2011): Downscaling method combining idealized single-day urban climate simulations, carried out by **MUKLIMO_3**, with long-term climate information of monitoring stations or regional climate simulations (e.g. **EURO-CORDEX**) by means of trilinear interpolation

CLIMATE MODELLING AT LOCAL SCALE – BACKGROUND CLIMATE

- Ensemble (8 members) of **EURO-CORDEX** simulations extracted for a location representative for the city's rural environment
- 3 time periods, 2 scenarios (**RCP4.5, RCP8.5**)
- Bias-correction of temperature data via **quantile mapping** using monitoring data from a reference station



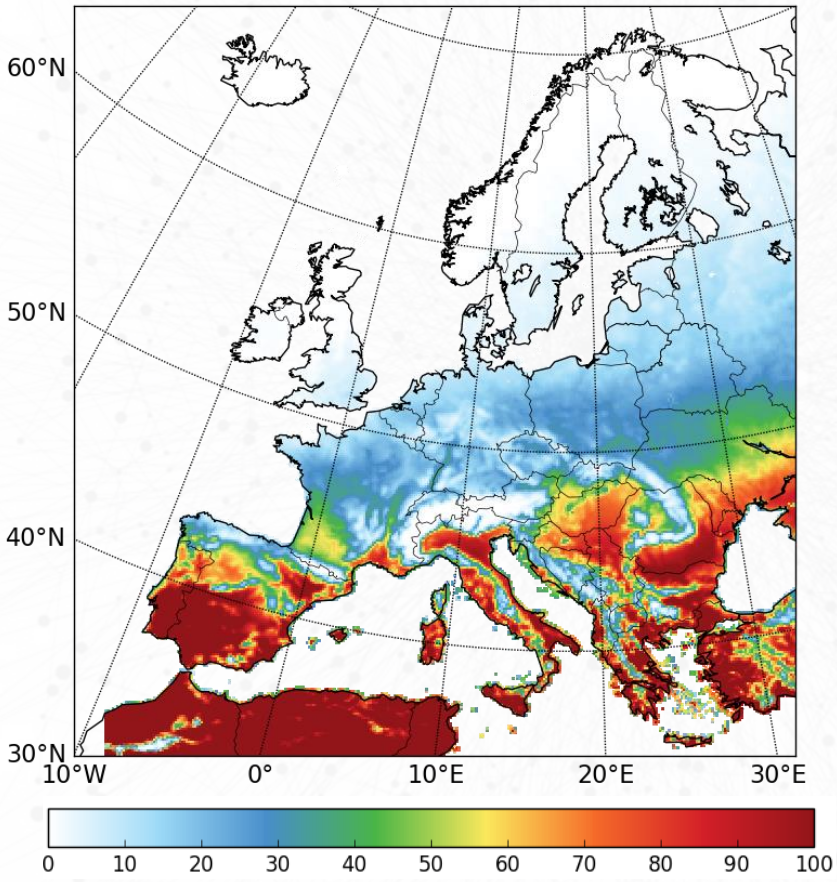
Institute	Driving GCM	RCM
DMI	ICHEC-EC-EARTH	HIRHAM5
	NCC-NorESM1-M	HIRHAM5
KNMI	ICHEC-EC-EARTH	RACMO22E
SMHI	CNRM-CERFACS-CNRM-CM5	RCA4
	ICHEC-EC-EARTH	RCA4
	IPSL-IPSL-CM5A-MR	RCA4
	MOHC-HadGEM2-ES	RCA4
	MPI-M-MPI-ESM-LR	RCA4



Linz, Upper Austria

SUMMER DAYS (Tmax ≥ 25°C): BASELINE (1971 – 2000)

Δx = 12.5 km



Mean annual number of summer days (T_{max} ≥ 25°C), model ensemble average

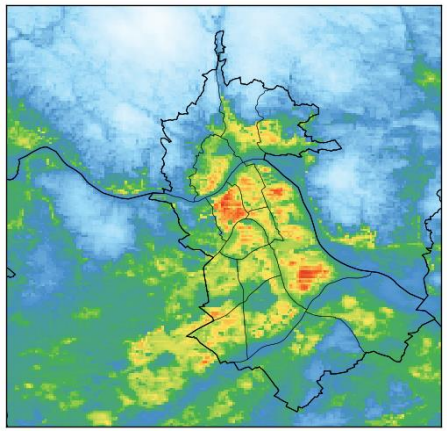
Preliminary results!

Expert Studies

Downscaling

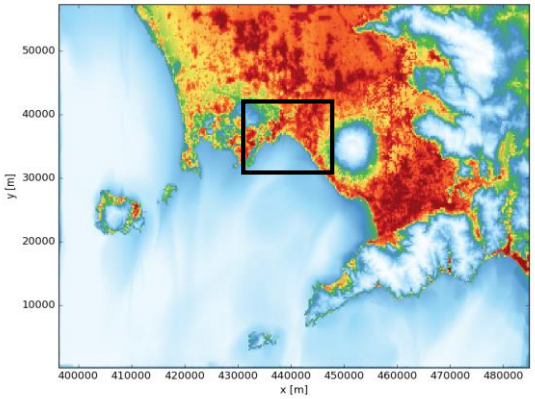
Downscaling

Linz, Austria



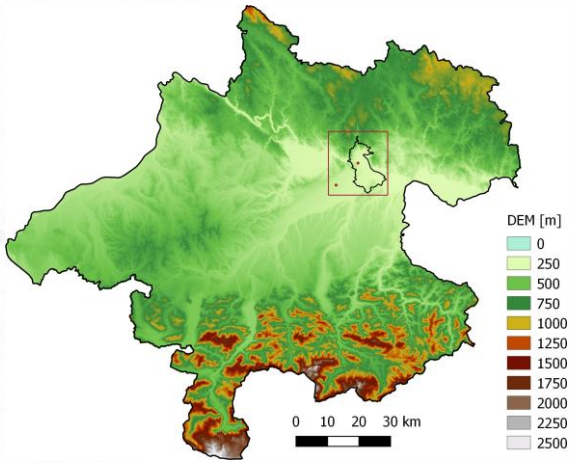
Δx = 100 m

Campania Region, Italy



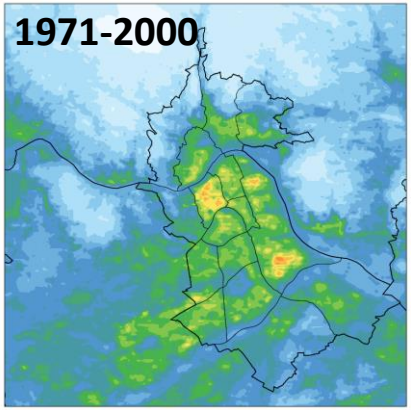
Δx = 250 m

EXPERT STUDY (Linz)

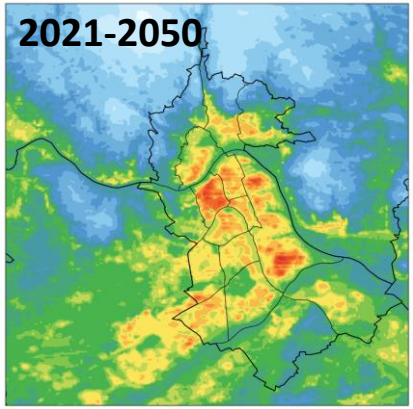


Mean annual number of summer days for historical and future periods

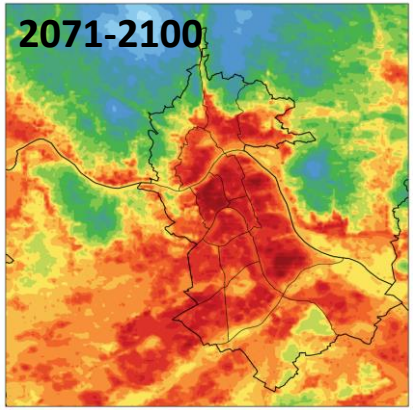
min: 2.0 **max**: 81.1 **avg**: 30.4 SD



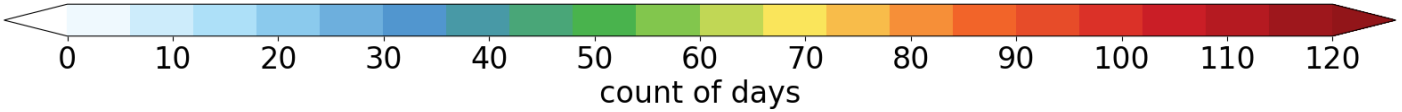
min: 4.4 **max**: 99.1 **avg**: 42.7 SD



min: 14.2 **max**: 132.9 **avg**: 71.1 SD

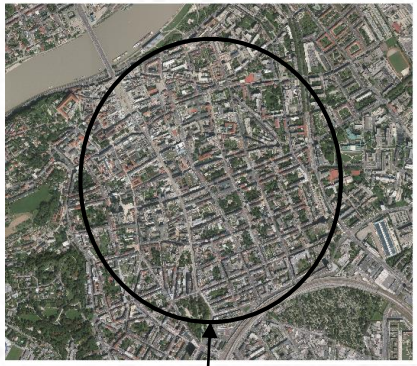


RCP8.5

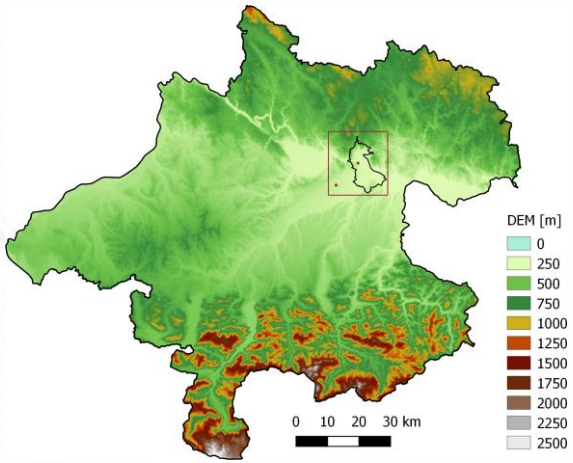


EXPERT STUDY (Linz)

„Hot-spot“ areas



Source: Land Oberösterreich - data.ooe.gv.at



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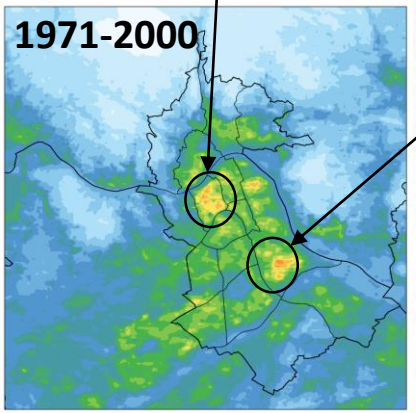

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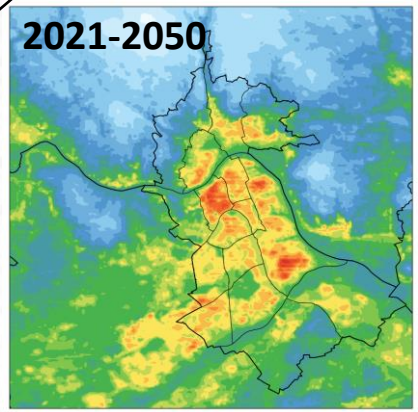

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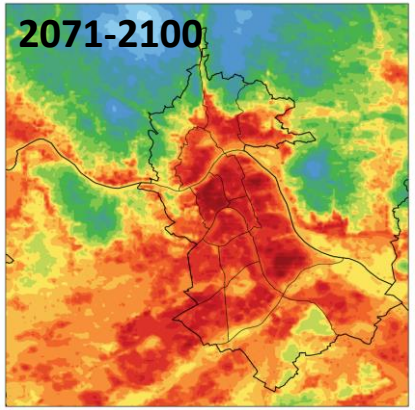

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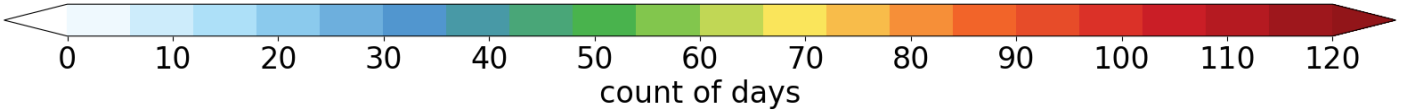
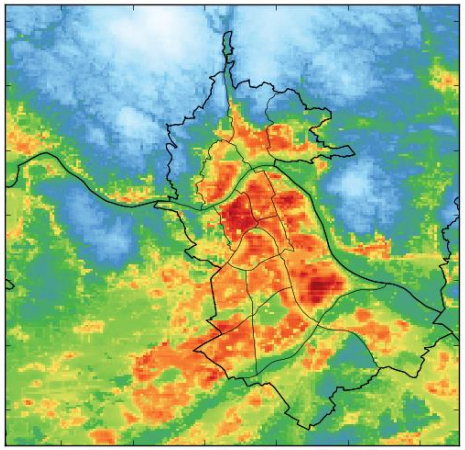
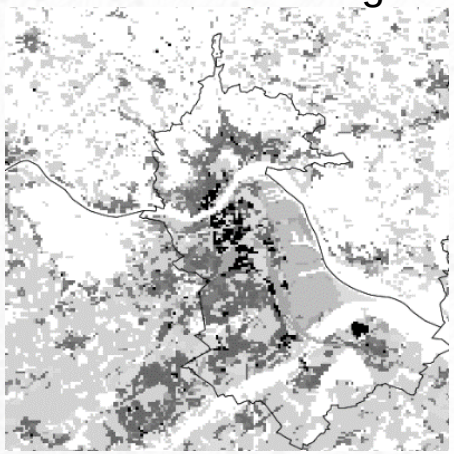


EXPERT STUDY (Linz)

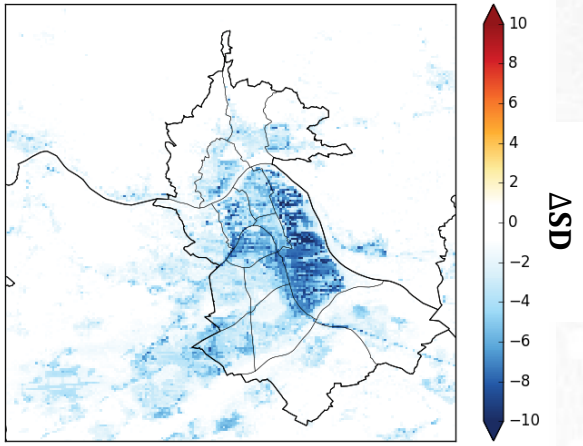
Reference simulation



Land Use Change



Difference in heat load



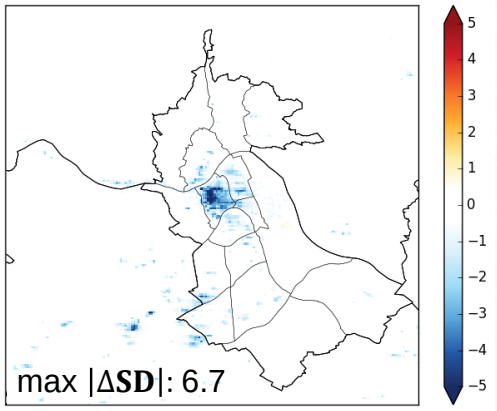
Experiments

Modification of …

- fraction of impervious surface (sealing)
- albedo (walls, roof)
- green roofs
- tree cover, vegetation cover

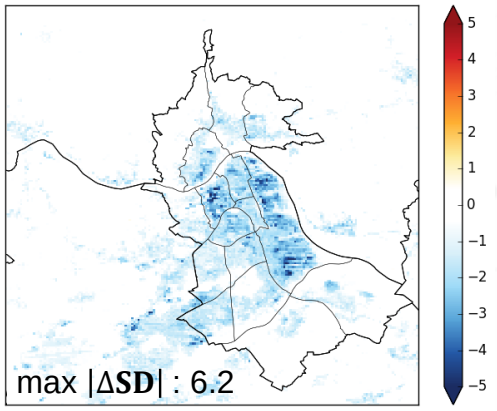
EXPERT STUDY (Linz)

Exp: 50% green roofs



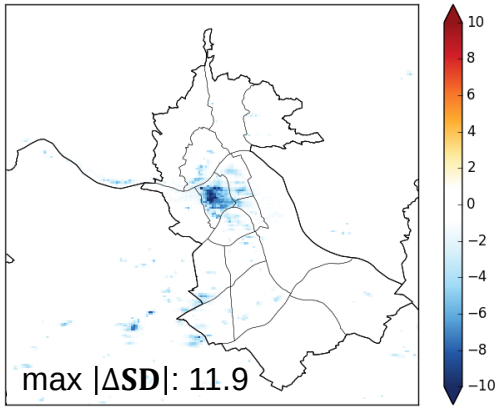
ΔSD: Difference in number of summer days ($T_{max} \geq 25°C$)

Exp: Reduction in total soil sealing by 30%



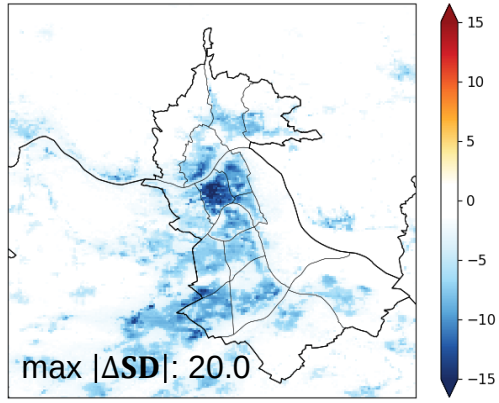
ΔSD: Difference in number of summer days ($T_{max} \geq 25°C$)

Exp: 50% green roofs and increased roof albedo (a_{roof} = 0.7)



ΔSD: Difference in number of summer days ($T_{max} \geq 25°C$)

Exp: Combination of measures (a_{roof} = 0.5, a_{wall} = 0.5, a_{street} = 0.4, 50% green roofs)



ΔSD: Difference in number of summer days ($T_{max} \geq 25°C$)

- Within the **CLARITY** project, **hazard characterisation** is provided via the CSIS screening tool using an ensemble of **EURO-CORDEX** simulations at 12.5 km resolution
- By applying **high-resolution models**, it is possible to obtain this information at much higher spatial scales (e.g. 100 m spatial resolution) within the framework of CLARITY **Expert Services**.
- This detailed climate information might be especially useful for many urban planning and climate adaptation applications

More information about the CLARITY Project and the Marketplace:

http://clarity-h2020.eu/

https://myclimateservices.eu/en