



Integrated Climate Adaptation Service Tools for Improving Resilience Measure Efficiency

<http://www.clarity-h2020.eu>



H2020-SC5-2016-TwoStage
Grant agreement no.: 730355

CLARITY Climate Services - Supporting Urban Climate Change Resilience and Adaptive Planning through Modelling of Possible Climate Adaptation Strategies

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CLARITY Project Overview



- Develop an integrated **Climate Services Information System (CSIS)** for resilience assessments, climate proofing of large scale infrastructure projects
- **Co-creation** with suppliers, purveyors and end-users of climate intelligence
- 4 Demonstration Cases
- Project start: June 2017
- Duration: 3 years



CLARITY Climate Services Vision



Clarity

“on-line”

“off-line”



Modules for climate resilient investments adapted from “Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient”, EC 2011.

ICT CS

tool-supported **(ultra)high-level** strategic pre-feasibility risk **screening** and general adaptation options



simple risk **screening report** and recommendations for Expert CS

Expert CS

professional scenario-driven risk assessment and adaptation strategy studies



detailed **standardized reports** + impact & adaptation scenario **data**

ICT CS

tool-supported indicator-based decision support and **multi-criteria analysis**

CLARITY Demonstration Cases

- Implement 4 demonstration cases for showcasing and validating CSIS in **different climatic, regional, infrastructure and hazard contexts**

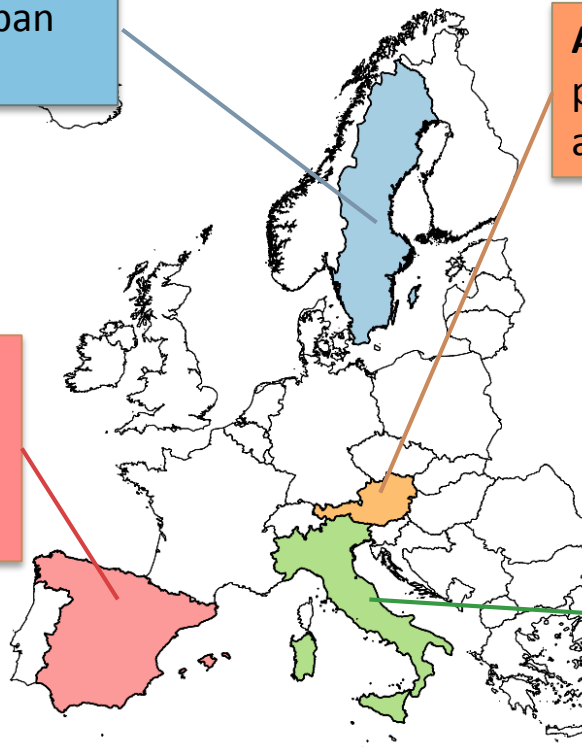
Sweden (Stockholm/Jönköping):

Fostering adaption of large-scale infrastructure in Sweden at urban and regional scale

Austria (Linz): Urban planning and climate adaptation

Spain: Construction, maintenance and design of Spanish Transport Infrastructure

Italy (Naples): Adaptation Scenarios for Multi-Scale Resilience-based Planning/Design



Demonstration Case Austria (Linz)



Location: Metropolitan area of Linz

Population:

772 000 (metropolitan area)

205 000 (city)

Elements at risk:

City residents, especially vulnerable persons (children, elderly, ill), city infrastructure



Main hazards:

Heat waves, urban heat islands

End Users/Stakeholders:

City of Linz

Demonstration Case Austria (Linz)

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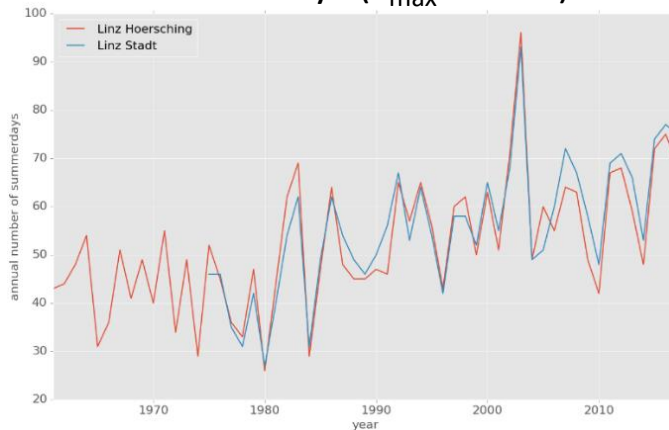
Heat waves, urban heat islands

End Users/Stakeholders:

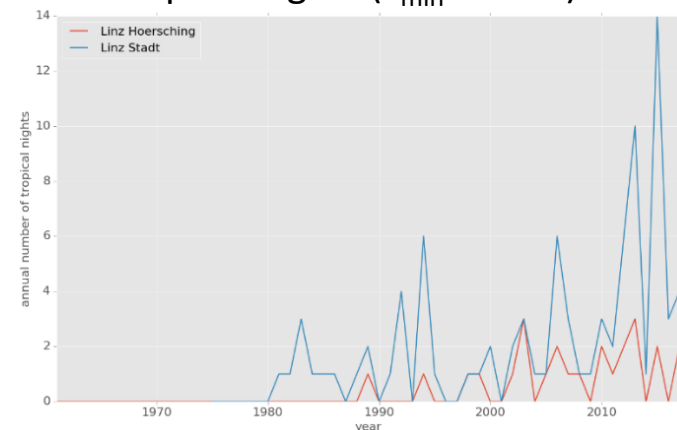
City of Linz

Increase in the number of ...

Summer days ($T_{\max} \geq 25^{\circ}\text{C}$)



Tropical nights ($T_{\min} \geq 20^{\circ}\text{C}$)



Picture source:

Stadtkommunikation Linz (Magistrat der Landeshauptstadt Linz, Österreich)

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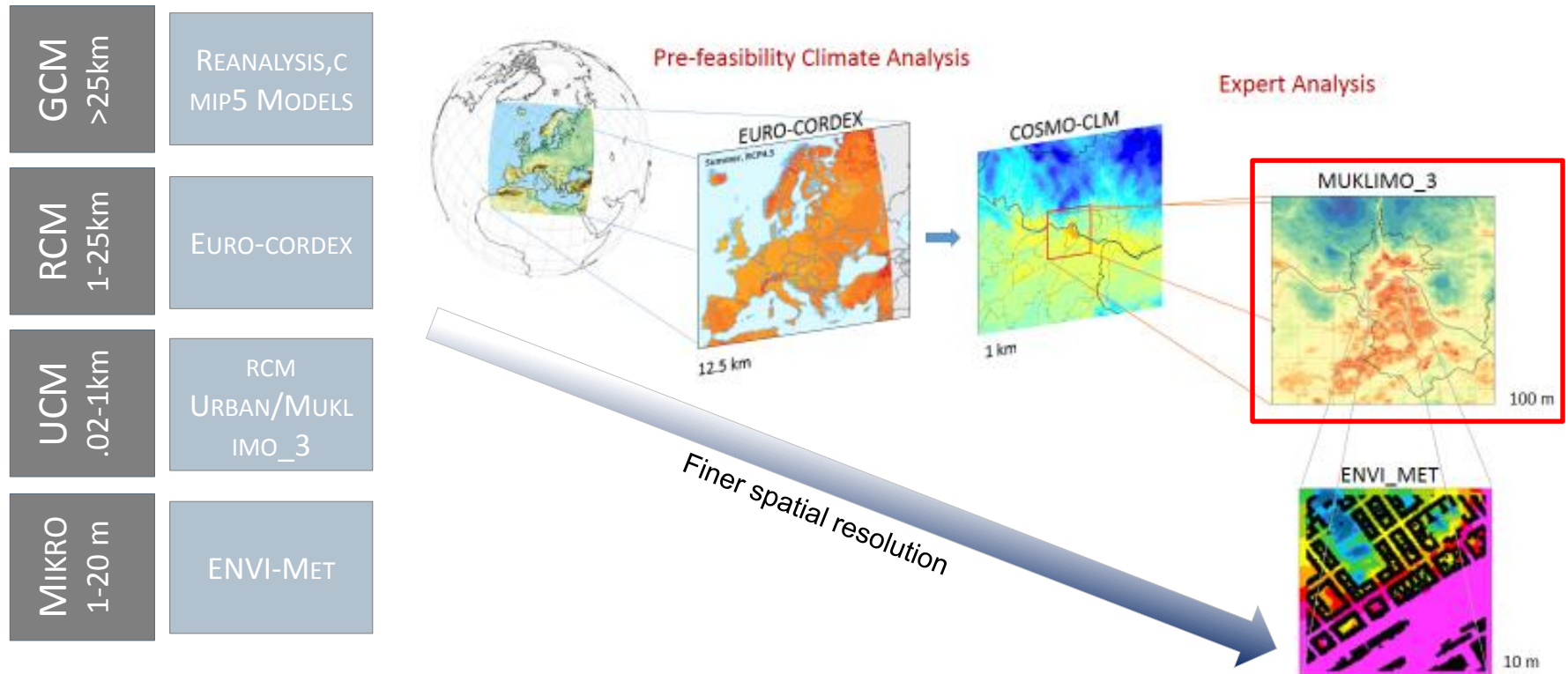
CLARITY Support according to end-user requirements:

- ➡ **Heat hazard** analysis on urban scale.
- ➡ Evaluating the effects of **adaptation measures (greening, unsealing, ...)** on urban heat load
- ➡ Evaluating the effects of **building characteristics** on **ventilation** within urban areas.

Applied models and downscaling process

Expert Climate Services

Downscaling of climate information



MUKLIMO_3 model application

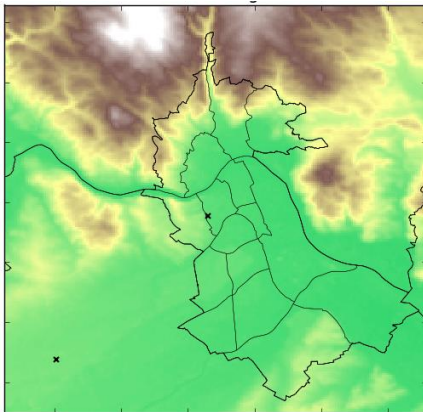


Mikroskaliges Urbanes KLimaMOdell

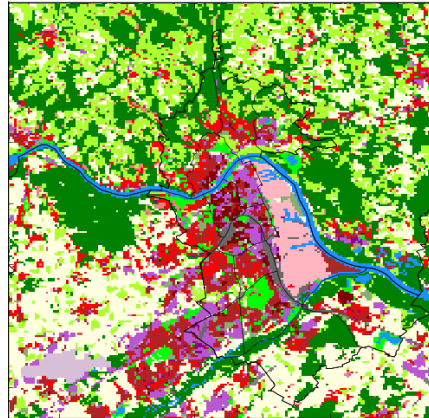
(Sievers and Zdunkowski, 1986; Sievers, 1990; Sievers, 1995)

- **Horizontal/vertical resolution:** 100m / 10–100 m
- **Input data:** high-resolution orography and land use data
- Calculation of climate indices with the **cuboid method**

EU-DEM

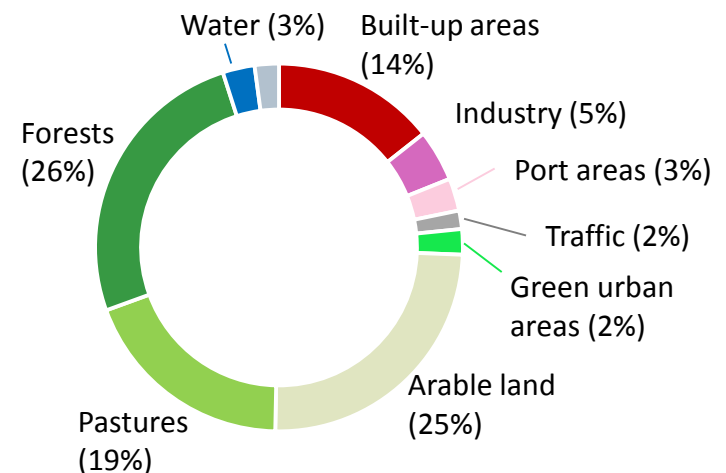


Urban Atlas 2012



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21 land use classes for Linz



MUKLIMO_3 model application

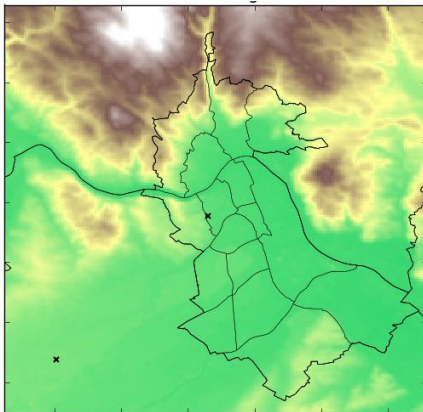


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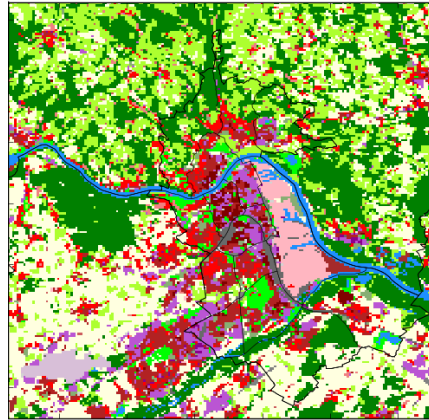
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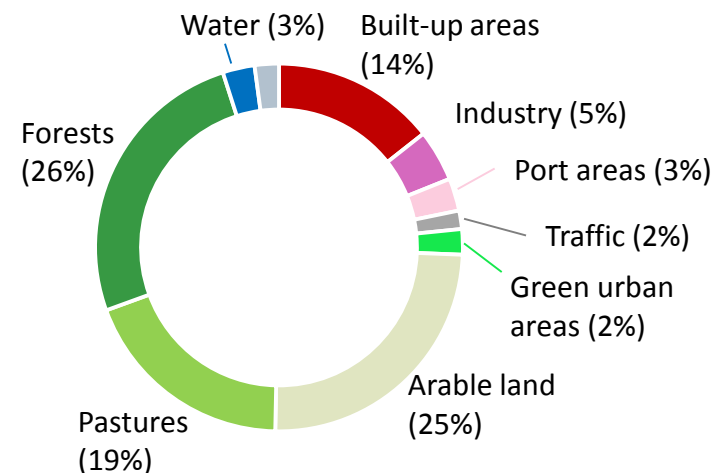
Urban Atlas 2012



Parameterization of buildings and vegetation: 26 physical parameters for each land use class



21 land use classes for Linz



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MUKLIMO_3 model application



Clarity

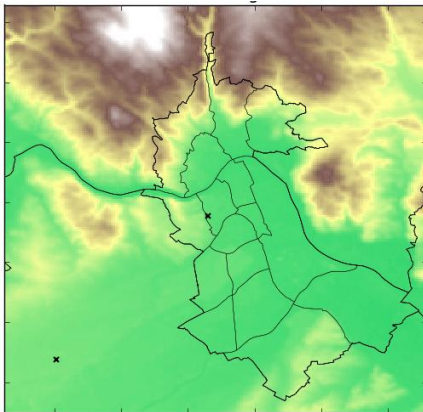


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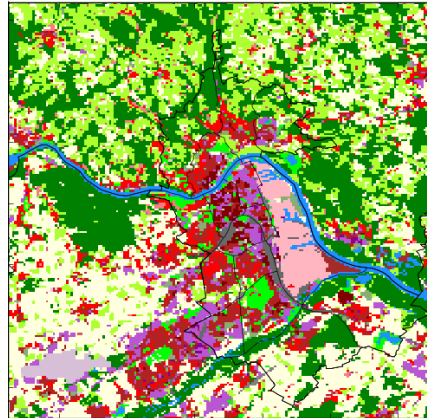
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Urban Atlas 2012

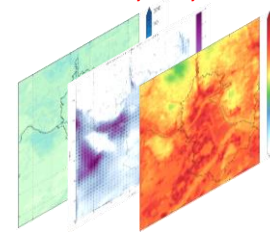


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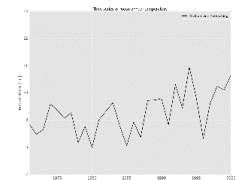
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Cuboid Method (Früh et al. 2010)

Muklimo model output:
fields of T , rh , v



Monitoring data,
RCM data



Dynamical simulations with
MUKLIMO_3
idealized diurnal cycle
for cuboid points (T_c , rh_c , v_c)

Climate analysis
background climate
(observations, RCM)

MUKLIMO_3 fields
hourly \bar{T} , rh , v
daily T_{min} , T_{max}
for cuboid points (T_c , rh_c , v_c)

time series of
daily mean T_p , rh_p ,
 v_i

cuboid method

tri-linear
interpolation

interpolated fields
 $T_{i,max}$, $T_{i,min}$

count threshold
exceedance

climate
indices

Number of
summer days,
hot days,
tropical nights

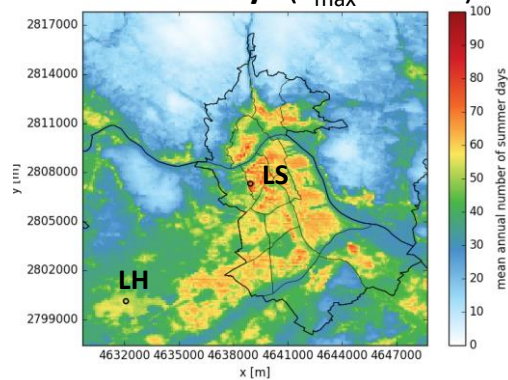
Results: Climate Indices



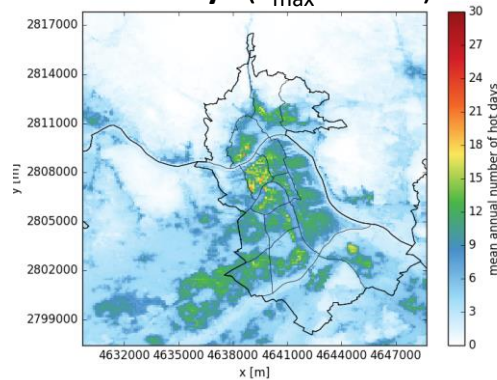
Clarity

1971-2000

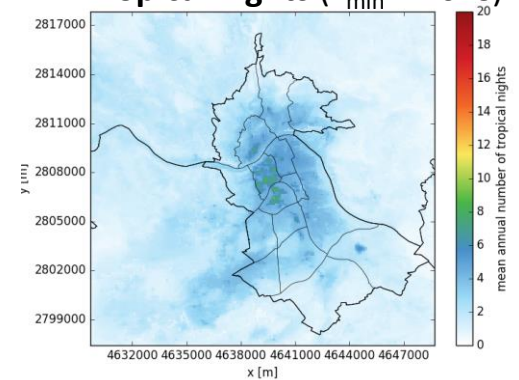
Summer days ($T_{\max} \geq 25^{\circ}\text{C}$)



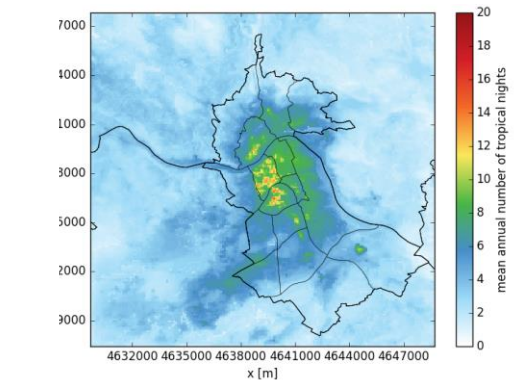
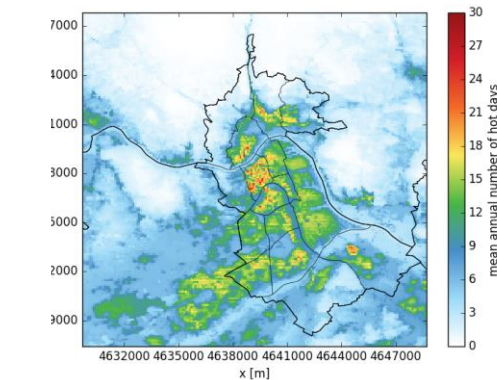
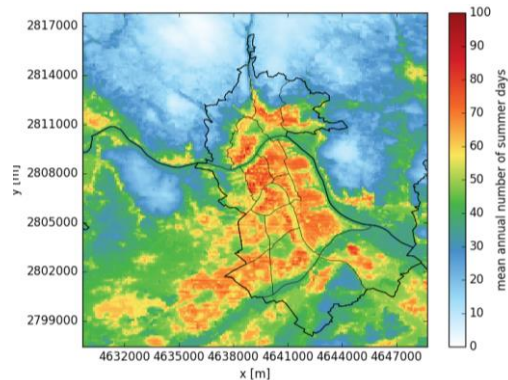
Hot days ($T_{\max} \geq 30^{\circ}\text{C}$)



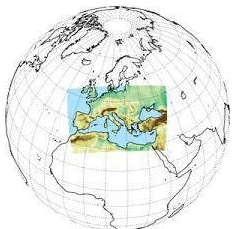
Tropical nights ($T_{\min} \geq 20^{\circ}\text{C}$)



1981-2010

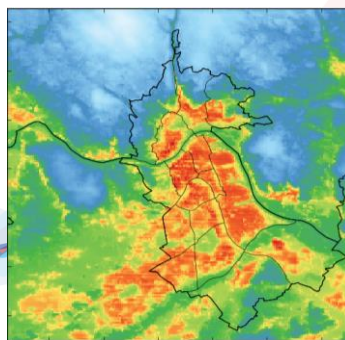
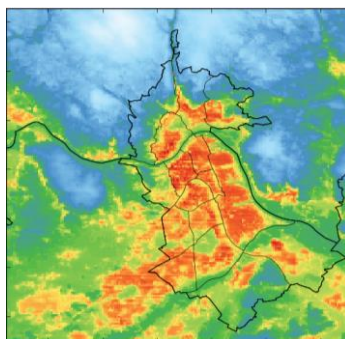
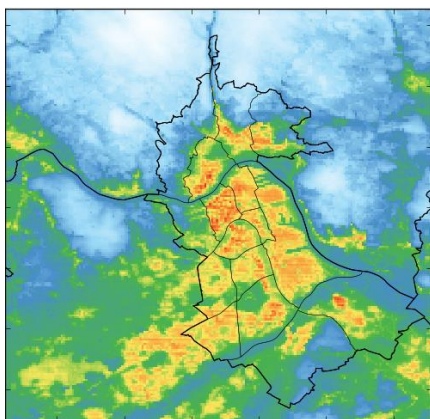
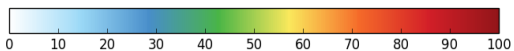


Future climate projections (Linz)



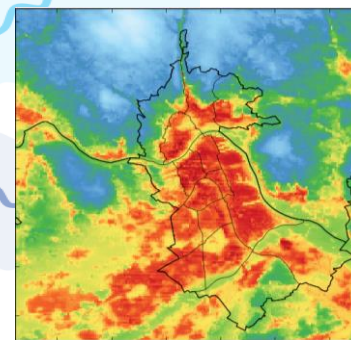
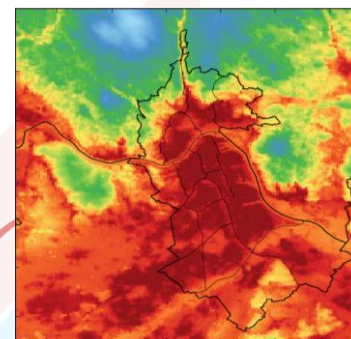
Input for cuboid method: **EURO-CORDEX simulations**, RCP4.5 and RCP8.5 scenarios, 6 members

Mean annual number of summer days ($T_{\max} \geq 25^{\circ}\text{C}$), model ensemble average



RCP 8.5

RCP 4.5

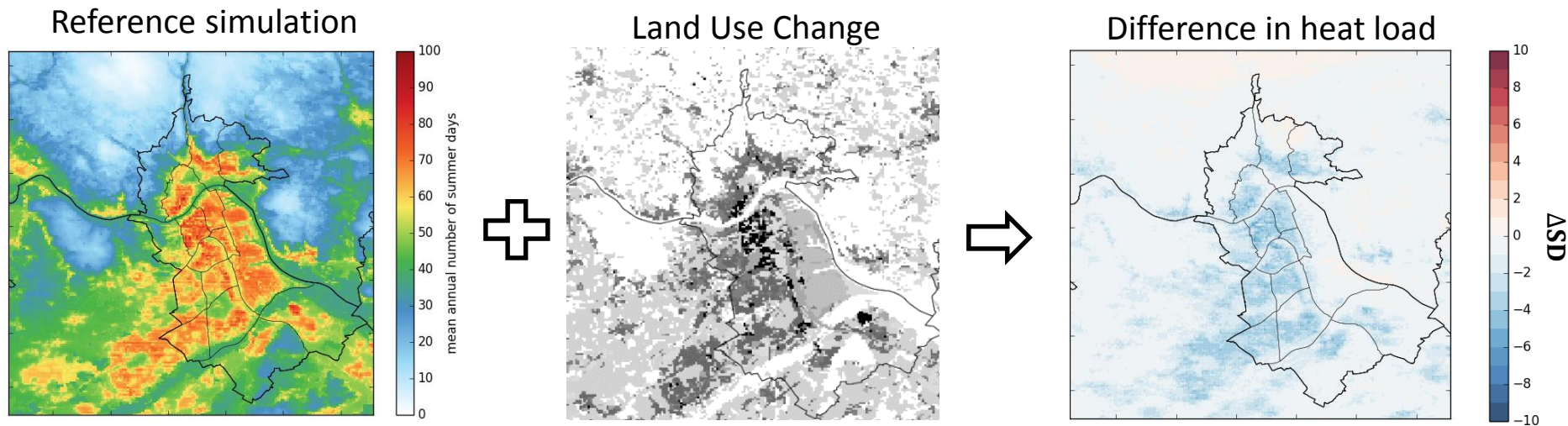


1971-2000

2021-2050

2071-2100

Modelling of Adaptation Strategies



Experiments

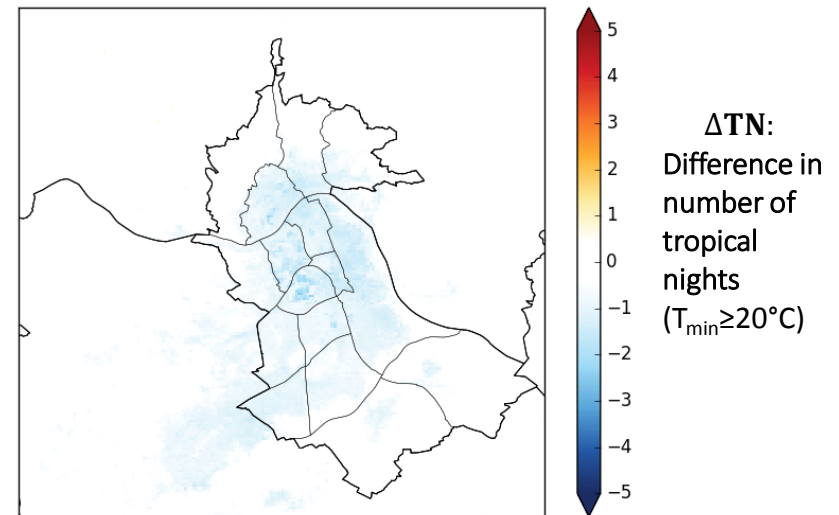
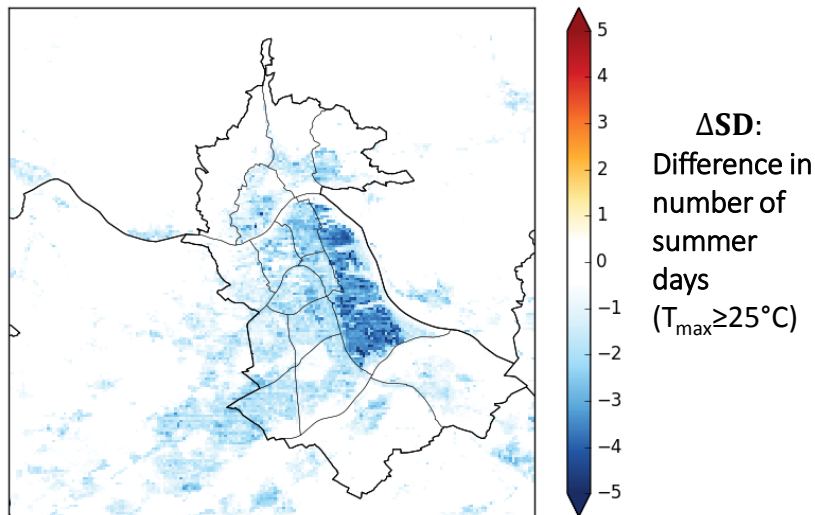
Modification of ...

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

Modelling of Adaptation Strategies

Reduction of soil sealing: -50%

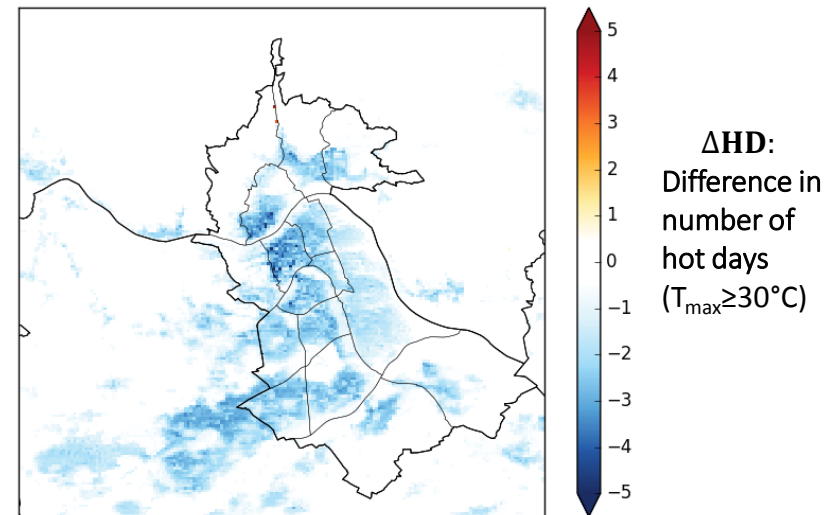
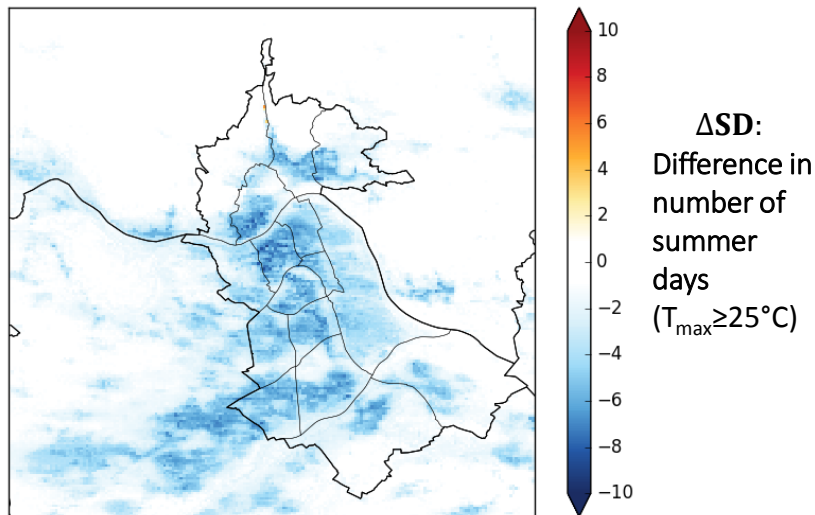
- impervious parts between buildings



Modelling of Adaptation Strategies

Roof albedo: 0.7

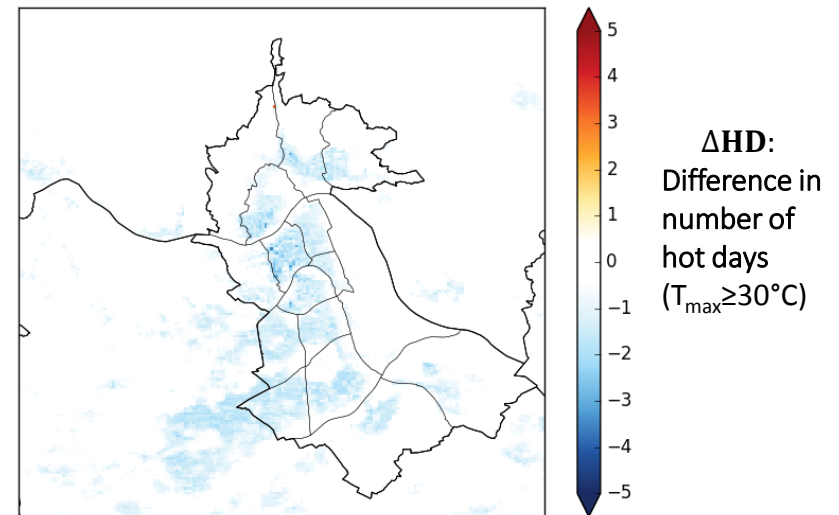
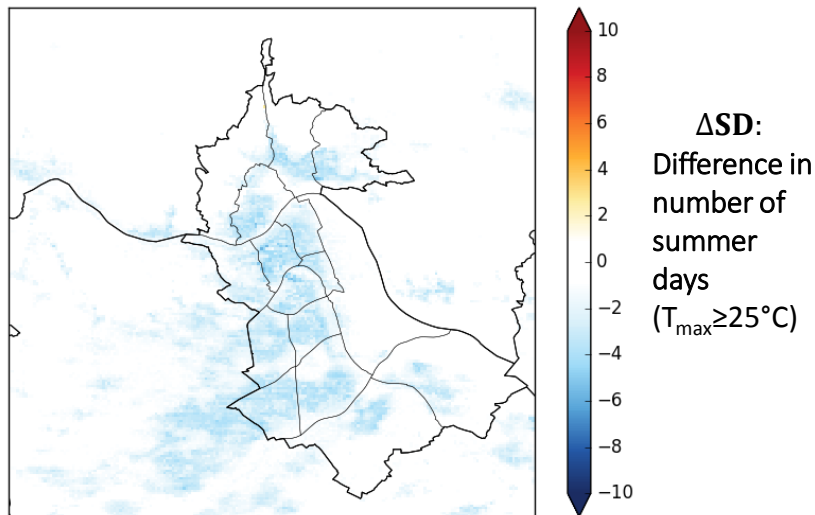
- all built-up areas



Modelling of Adaptation Strategies

Green roofs: 50%

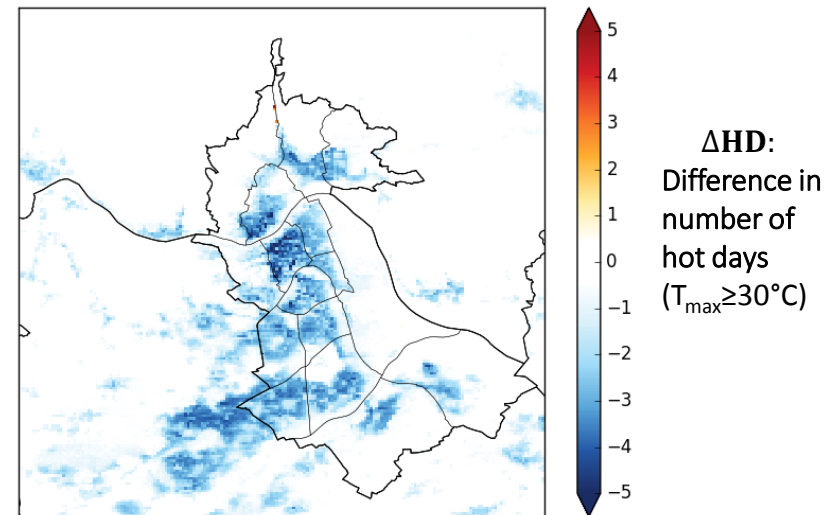
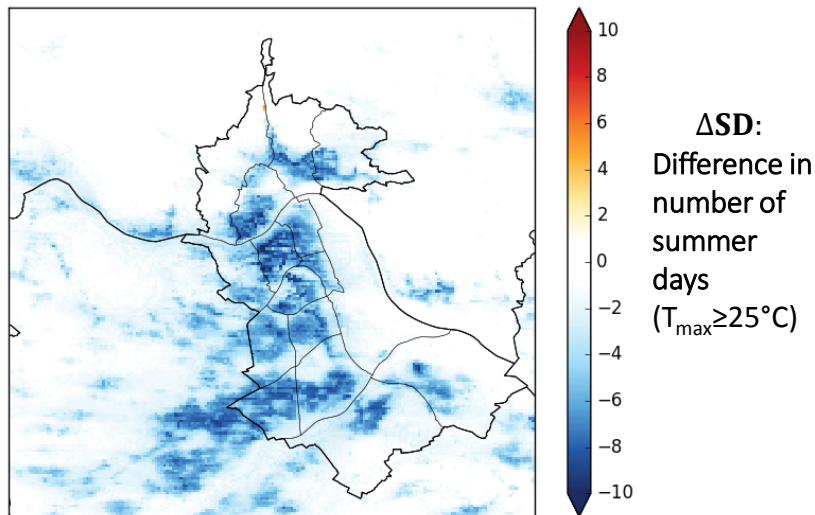
- all residential/industrial built-up areas



Modelling of Adaptation Strategies

Green roofs: 100%

- all residential/industrial built-up areas



Summary and Conclusion



- **CLARITY H2020 project** aims to develop a Climate Services Information System (CSIS) to integrate resilience into urban infrastructure.
- Preliminary high-resolution (100m) simulations have been carried out with the urban climate model MUKLIMO_3, showing past and future heat load in the city of Linz, as part of the Austrian Demonstration Case → useful for heat hazard analysis and identification of hot-spot areas
- Extreme adaptation scenarios (e.g. unsealing, roof greening) show moderate to strong cooling effects
- **Improvement of MUKLIMO_3 modelling results expected through an integration of high-quality input data from the city administration**



Thank you for your attention!

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Please visit our website for more detailed information:
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