



Climate Change

# European Health

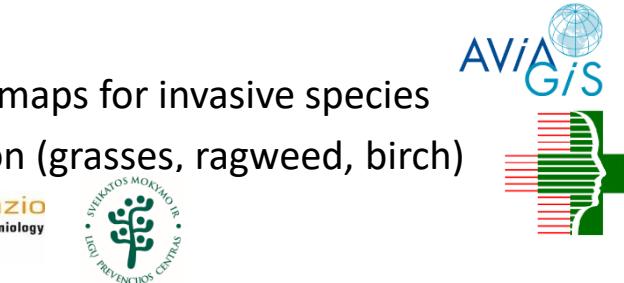
How C3S will deliver urban climate information for  
100 cities in Europe

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- Project leader: VITO 
- Aim: develop & demonstrate a European climate service for the health sector
- 3 topics:
  - Vector-borne disease: suitability/seasonality maps for invasive species
  - Allergenic pollen: season start, severity season (grasses, ragweed, birch)
  - Heat/cold: exposure, mortality 
- *Vector-borne disease & heat/cold have an important urban component*





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# Urban heat island phenomenon



Lack of vegetation, lack of evaporative cooling, shading



Building materials store solar heat and release it at night

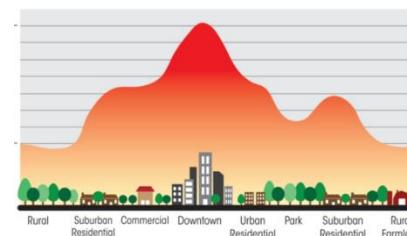
Anthropogenic heat released from heated or cooled buildings



Heat released by traffic



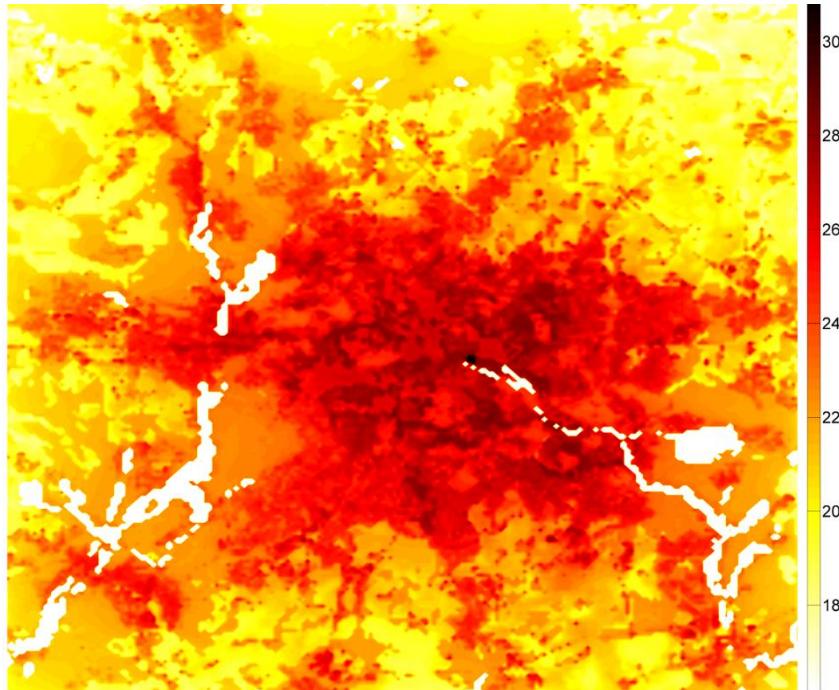
Tall buildings trap air in to the street canyons and reduce wind speed within the city





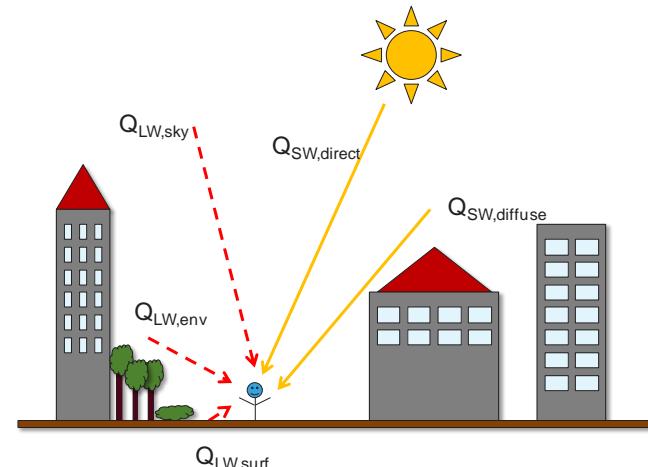
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## Urban heat island vs health



Berlin, number of annual heat wave days for 2081-2100, RCP8.5 (EU-FP7 RAMSES/NACLIM)

- Urban heat island enhances exposure of humans to **heat stress** during heat waves
- Higher temperature minima enhance habitat suitability of certain **disease vectors** (mosquitos)





# Increased mortality in urban areas compared to rural locations

## Excess mortality during 2003 heat-wave



**Small town: +40%**

**Paris:**  
**+140%**

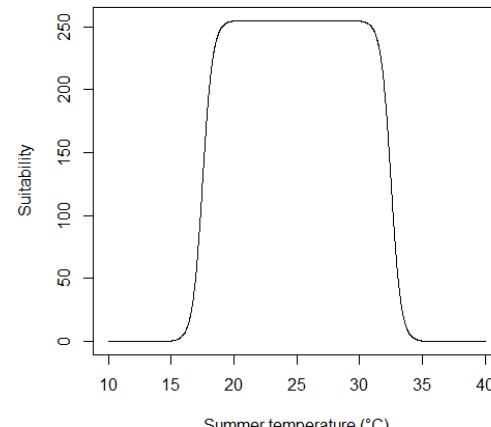
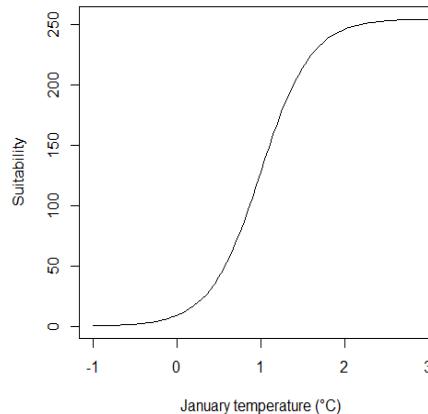
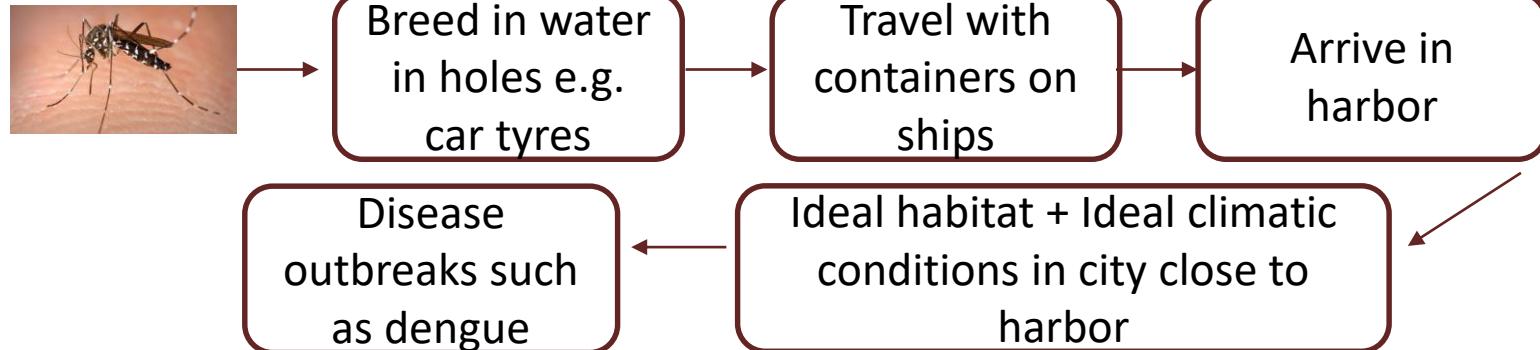
**Lyon:**  
**+80%**

Vandentorren S., et al., 2004. Am J Public Health, 94, p. 1518.



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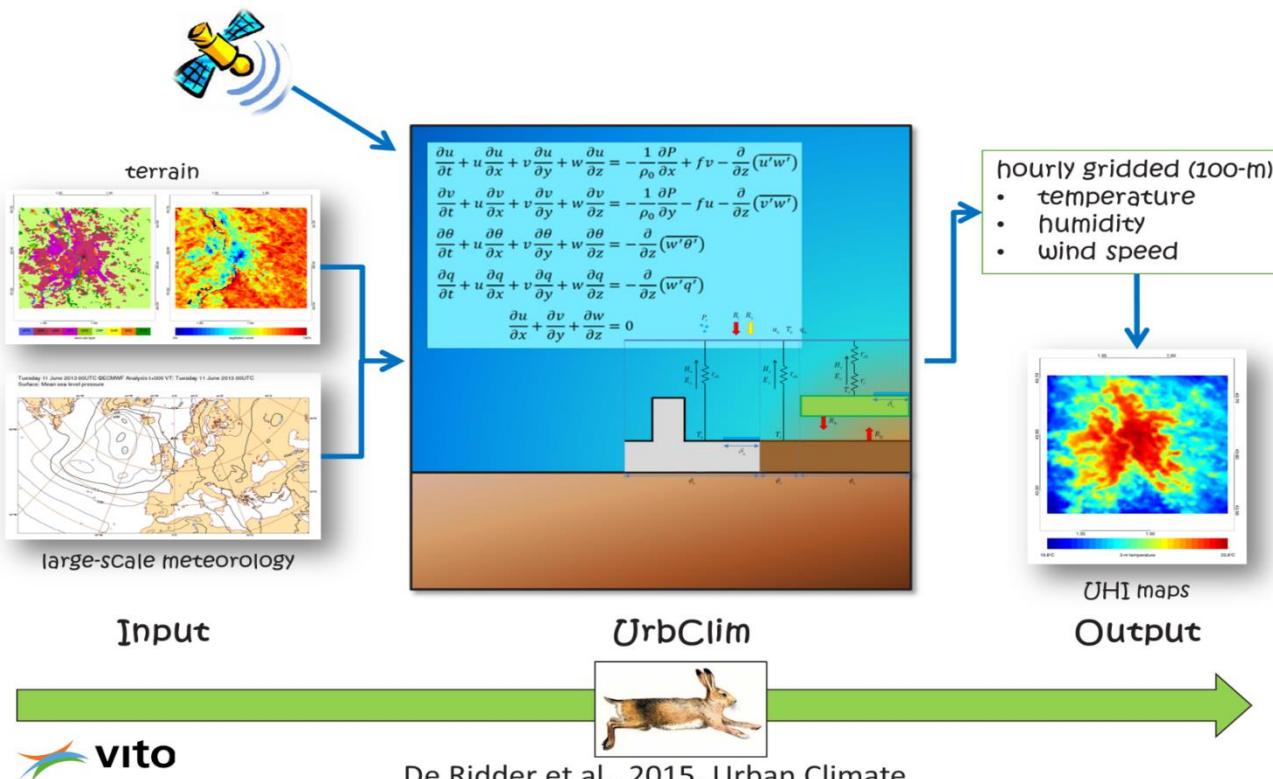
## Suitability for vector-borne diseases





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# VITO UrbClim model





# Integration of Copernicus land services

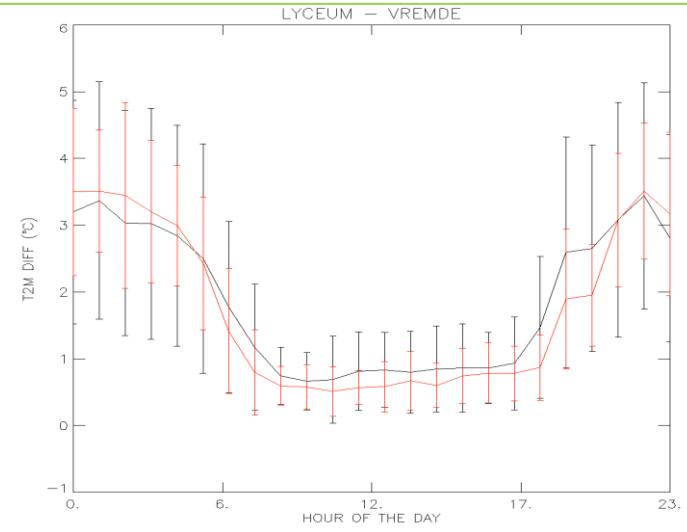
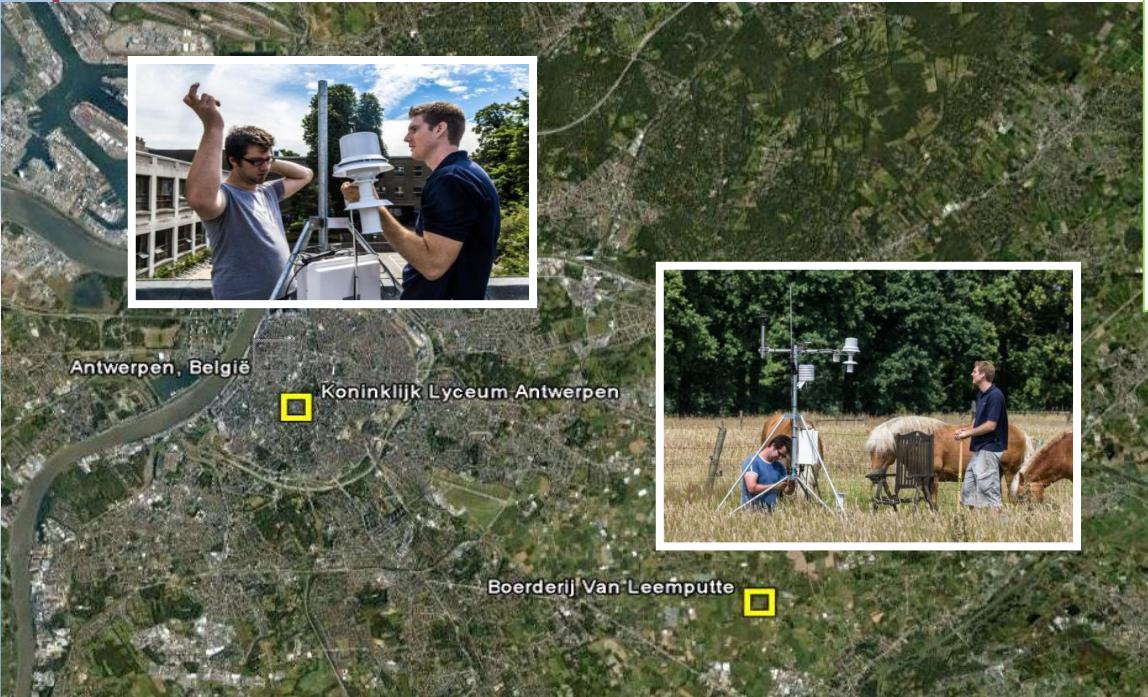
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Type	Source	Link
Land use	Copernicus (Corine land cover 2012)	<a href="https://land.copernicus.eu/pan-european/corine-land-cover">https://land.copernicus.eu/pan-european/corine-land-cover</a>
Soil sealing	Copernicus (Imperviousness 2012)	<a href="https://land.copernicus.eu/pan-european/high-resolution-layers/imperviousness">https://land.copernicus.eu/pan-european/high-resolution-layers/imperviousness</a>
Vegetation index (NDVI)	Copernicus (Proba V 2014 - 2017)	<a href="https://land.copernicus.eu/global/products/ndvi">https://land.copernicus.eu/global/products/ndvi</a>



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# Extensively validated



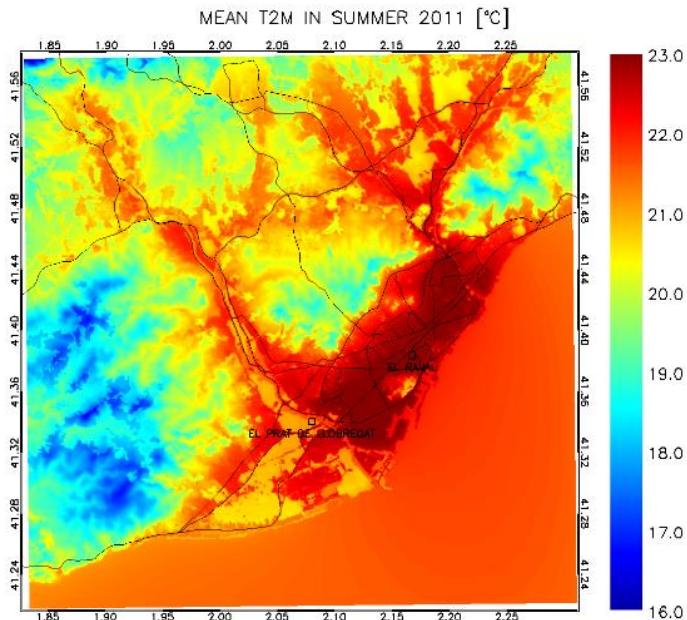
*Validations for  
Antwerp, Ghent,  
Brussels, Almada,  
Barcelona, London,  
Berlin, Athens,  
Skopje, ...*



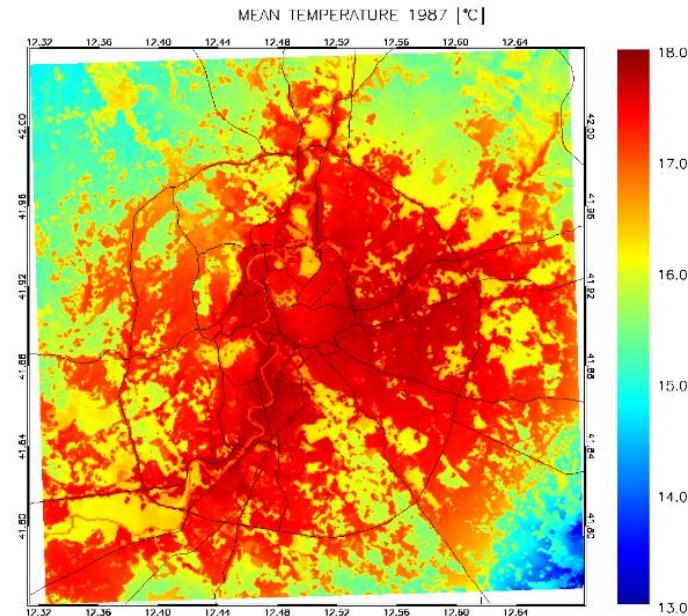
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# Urban climate examples

## Barcelona



## Roma



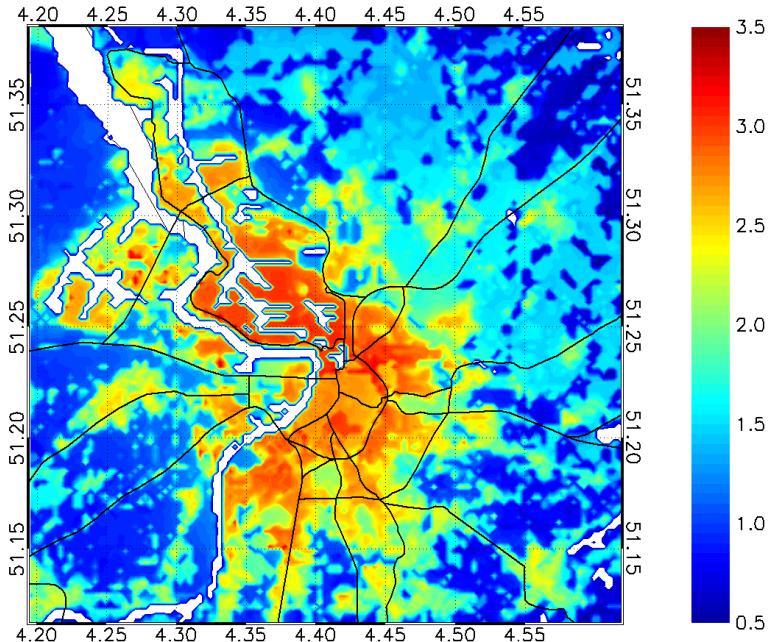


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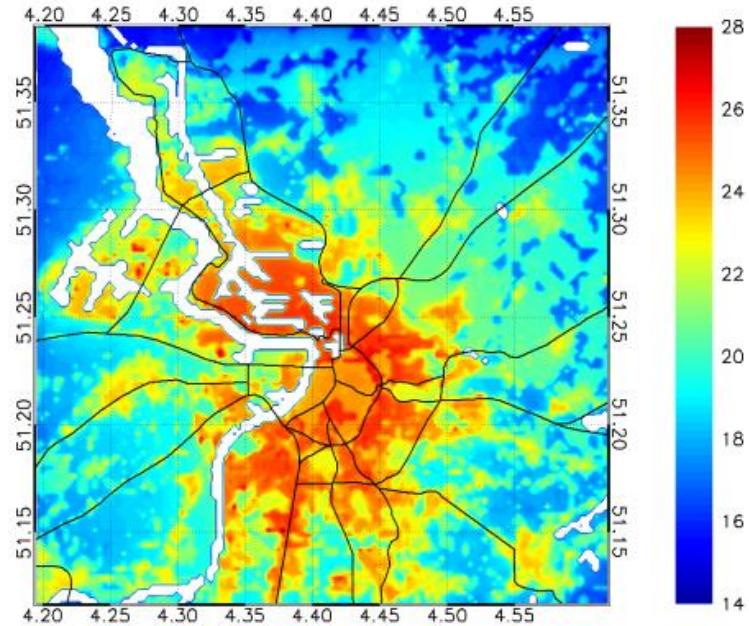
# Urban health: average heat wave days

## Antwerp

1986-2005



2081-2100 (RCP8.5)

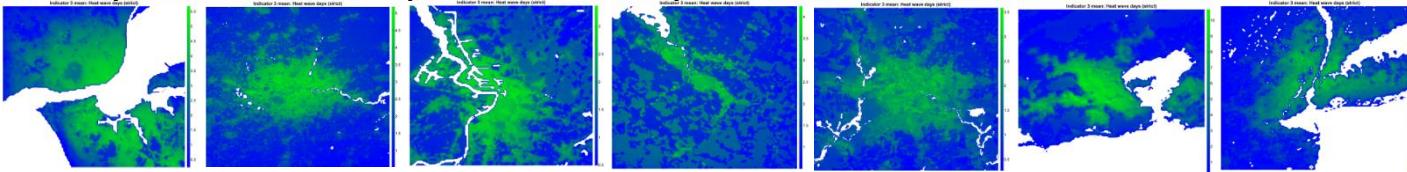




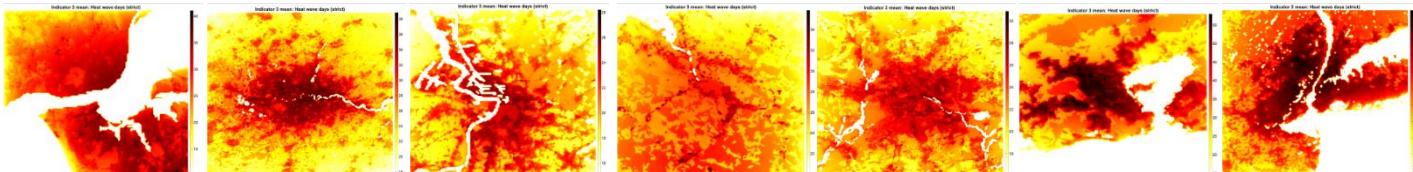
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## Not only in Antwerp . . .

**1986-2005:** under present conditions, cities experience twice as many heat wave days than nearby rural areas



**2081-2100 (RCP8.5):** number of heat wave days is projected to increase by a factor of ten, to nearly 30 per year



Lisbon

London

Antwerp

Bilbao

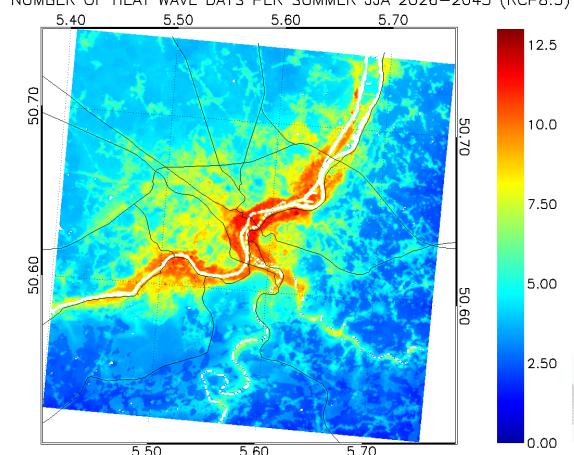
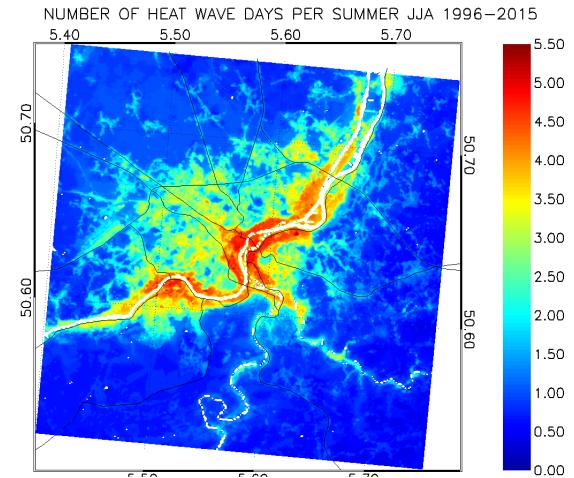
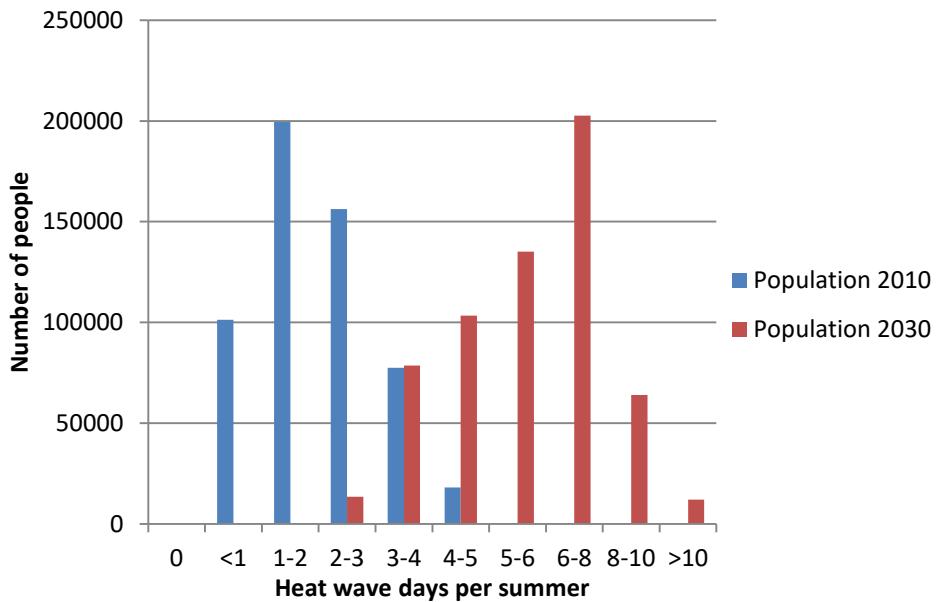
Berlin

Rio de Janeiro New York



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# Population growth and climate change





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# C3S Urban climate data for 100 cities



- Forced by large-scale climatology from C3S CDS (ERA5, 2008-2017)
- 100 m spatial resolution, hourly values
- Parameters:
  - 2 m temperature
  - 2 m specific humidity
  - 2 m relative humidity
  - Land surface temperature
  - Wind speed
- Available from CDS catalogue (spring 2019)



# List of 100 cities

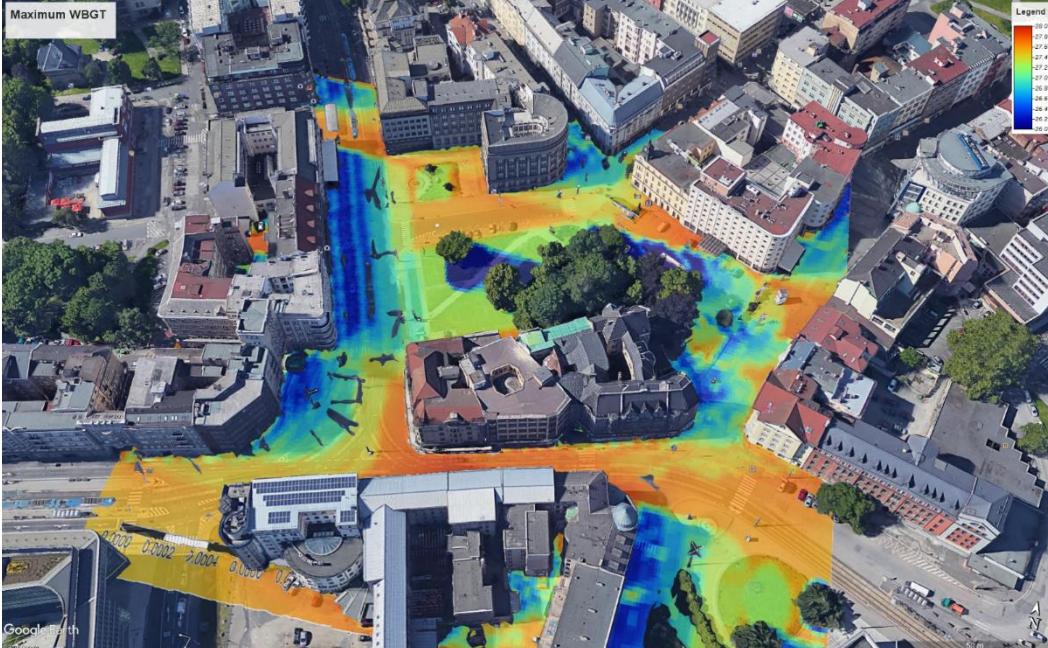
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Amsterdam	Dubrovnik	London	Pecs	Toulouse
Antwerp	Düsseldorf	Luxembourg	Porto	Turin
Athens	Edinburgh	Lyon	Poznan	Utrecht
Barcelona	Frankfurt am Main	Madrid	Prague	Valencia
Bari	Geneva	Malaga	Reykjavik	Vienna
Basel	Genoa	Manchester	Riga	Vilnius
Belgrado	Ghent	Marseille	Rome	Warsaw
Berlin	Glasgow	Milan	Rotterdam	Wroclaw
Bilbao	Göteborg	Miskolc	Sarajevo	Zagreb
Birmingham	Györ	Montpellier	Sevilla	Zürich
Bologna	Hamburg	Munich	Skopje	Florence
Bordeaux	Hannover	Murcia	Sofia	Alicante
Bratislava	Helsinki	Naples	Split	Podgorica
Brussels	Istanbul	Newcastle	Stockholm	Liège
Bucharest	Leeds	Nice	Strasbourg	Charleroi
Budapest	Leipzig	Novi Sad	Stuttgart	Padova
Cologne	Lille	Oslo	Szeged	Thessaloniki
Copenhagen	Lisbon	Palermo	Tallinn	(Kiev) Klaipeda
		Palma De		
Debrecen	Ljubljana	Mallorca	Tartu	Gdansk
Dublin	Lodz	Paris	Tirana	Cluj-Napoca



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# Human comfort (WBGT, UTCI, MRT, ...)





The screenshot shows the European Health Service website. At the top, there is a navigation bar with links: 'WHAT WE DO ▶ SECTORAL IMPACTS ▶ SECTORAL SPECIFIC CHALLENGES ▶ EUROPEAN HEALTH SERVICE'. Below the navigation is a large, bold title 'European health service'. Underneath the title is a horizontal menu with links: 'ABOUT' (highlighted), 'DATA AND TOOLS', 'HOW IT WORKS', and 'PROJECT PARTNERS'. Below the menu are social media icons for Twitter, Facebook, and Google+.

## About

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The European Health Service, as a part of C3S, provides users with tailor-made climate information for the health domain. This information consists of climate-health indicators concerning:

- heat and cold stress
- vector-borne diseases
- and allergenic pollen

Health will, in all likelihood, be strongly impacted by climate change. For example, the mortality associated with heat waves is expected to increase considerably, and city dwellers are particularly in danger, as the urban heat-island effect exacerbates thermal stress. Conversely, the impact of cold spells is expected to decrease. Climate change is also expected to affect the incidence, outbreak frequency, and distribution of many infectious diseases, mainly because of an altered distribution of infectious disease vectors. Similarly, it is expected that the geographic distribution of allergenic pollen in Europe, as well as the start/end and intensity of the pollen season, will be altered.