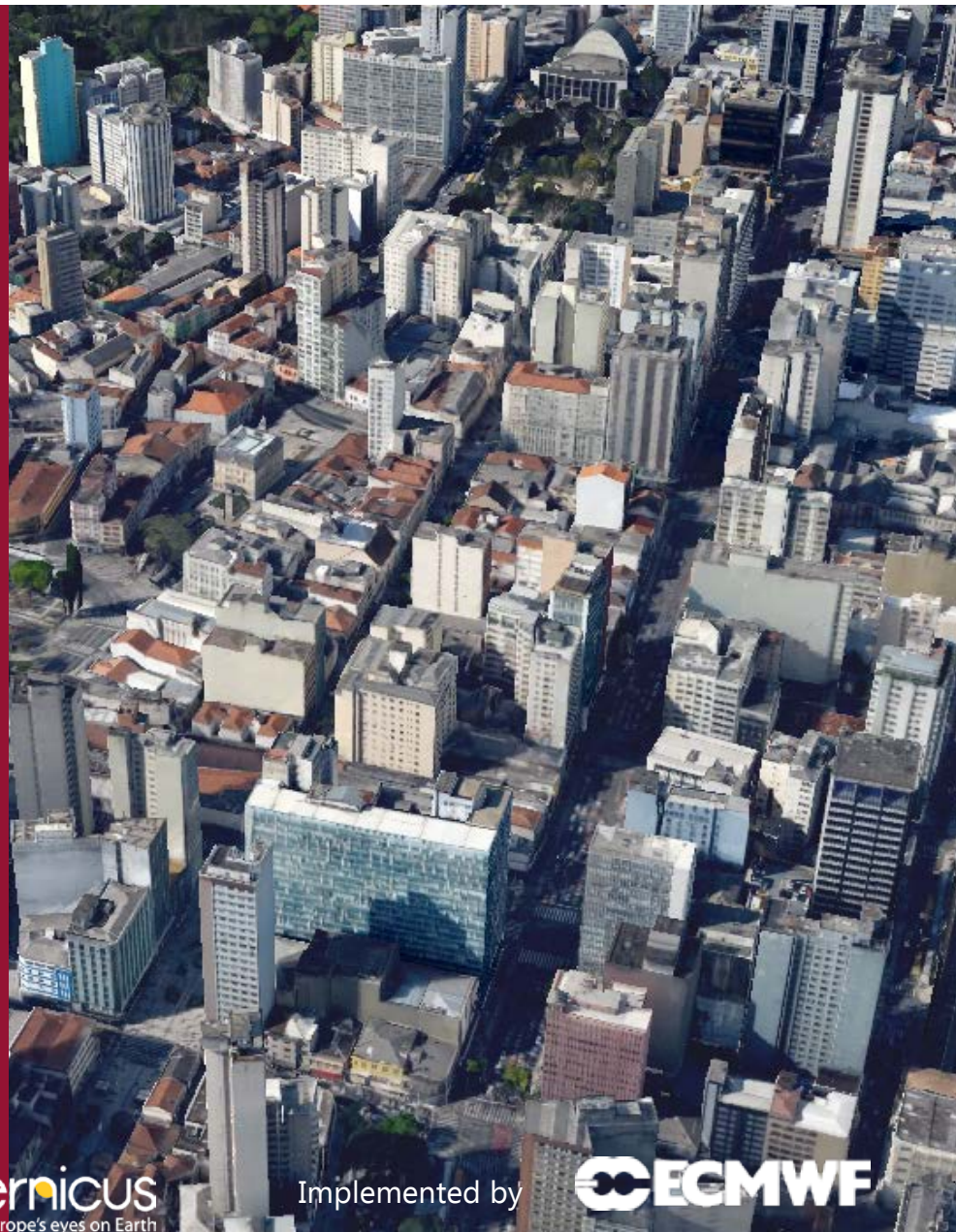
Data management
for building a
European Climate service – the Urban SIS project.

Lena Strömbäck, SMHI
Head of unit air quality research
WP7 Data portal leader

Linköping February 8th



European Commission

Copernicus
Europe's eyes on Earth

Implemented by ECMWF

Six Copernicus services

Services monitoring Earth systems

Land Monitoring

Marine Monitoring

Atmosphere Monitoring

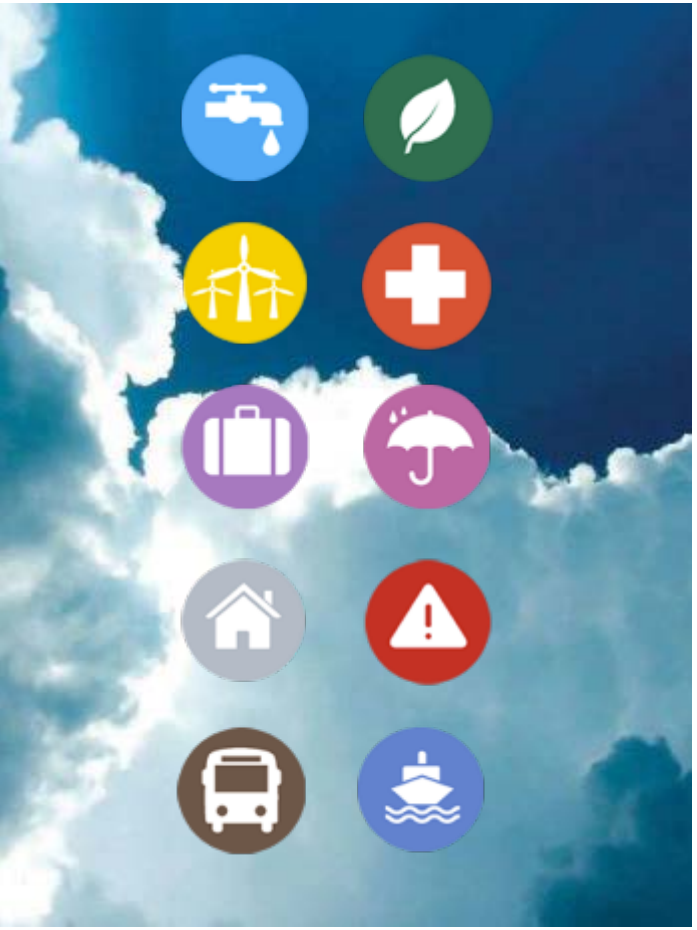
Horizontal services

Emergency Management

Security

Climate Change

Vision Copernicus Climate Change Service C3S



Authoritative source of climate information for Europe

Focus: Global and Europe

User driven, Free and Open data

Operational Service based on science
(Not a scientific programme).

- How is climate changing?
  - Earth observations
  - Reanalyses
- Will climate change continue/accelerate?
  - Predictions
  - Projections
- What are the societal impacts?
  - Climate indicators
  - Sectoral information

European Commission | Copernicus Europe's eyes on Earth | ECMWF |

Seven proof of concept SIS contracts have been awarded:

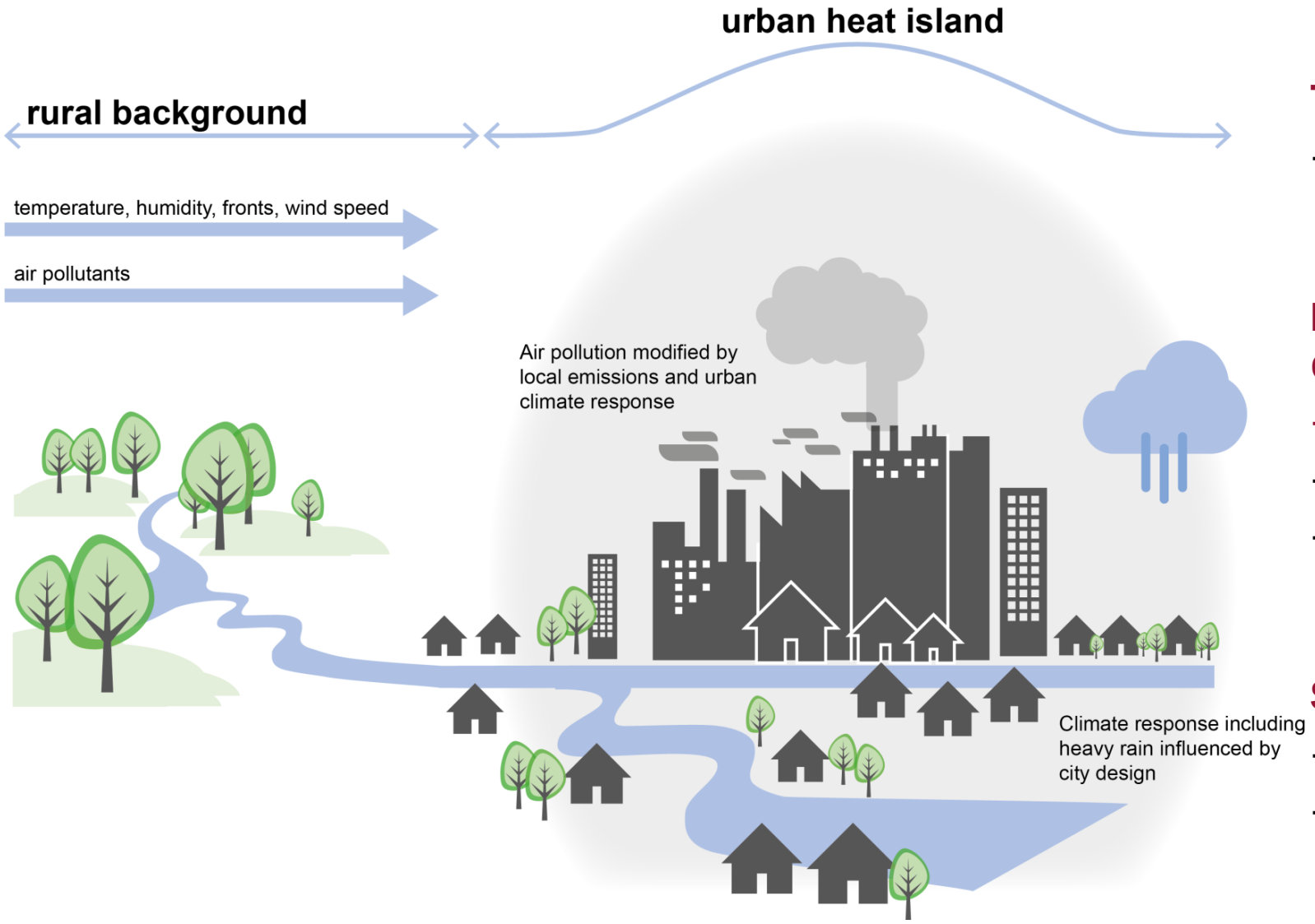
- SIS water management:
  - SWICCA (Service for Water Indicators in Climate Change adaptation) – **lead SMHI (Sweden)**
  - EDgE (End-to-End demonstrator for improved decision making in the water sector in Europe) – **Lead CEH (UK)**
- SIS energy:
  - CLIM4ENERGY (Climate for Energy) – **Lead CEA (France)**
  - ECEM (European Climatic Energy Mixes) – **Lead UEA (UK)**
- SIS others:
  - AgriCLASS (Agriculture Climate Advisory Services) – **Lead Telespazio – Vega (UK)**
  - WISC (Windstorm Information Service) – **Lead CGI (UK)**
  - URBAN SIS (touching health, infrastructure, water) – **Lead SMHI (Sweden)**

Urban SIS

Urban Sectoral Information System

C3S 441 Lot3 Proof of concept project 2016-2017

- Swedish Meteorological and Hydrological Institute (SE)
- University of Reading (UK)
- University of Umeå (SE)
- ARPA Emilia-Romagna (IT)
- University of Bologna (IT)
- WSP (SE)
- Veryday (SE)



Target:

- major European cities

Pilot demonstrations:

- Bologna
- Stockholm
- Amsterdam-Rotterdam

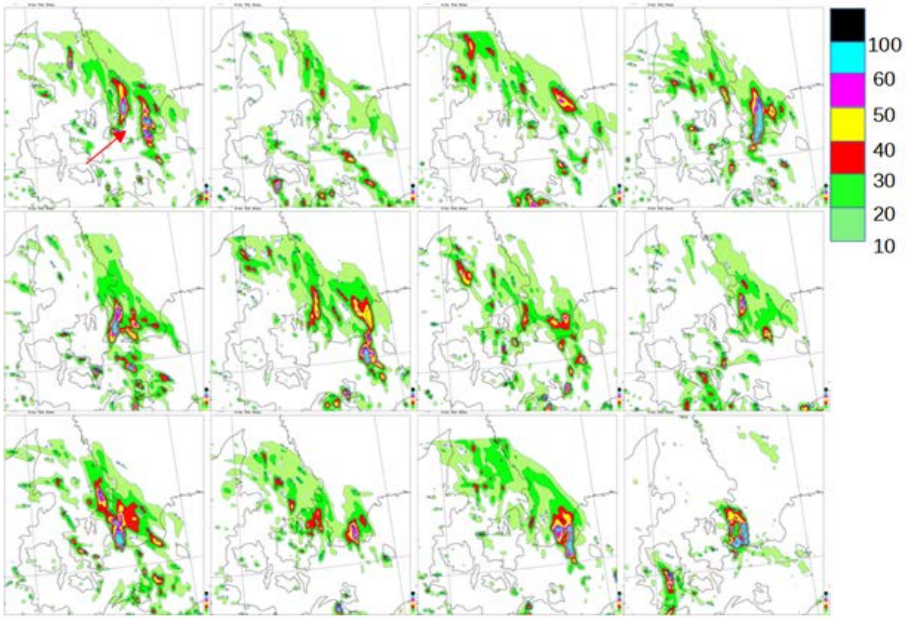
Sectors:

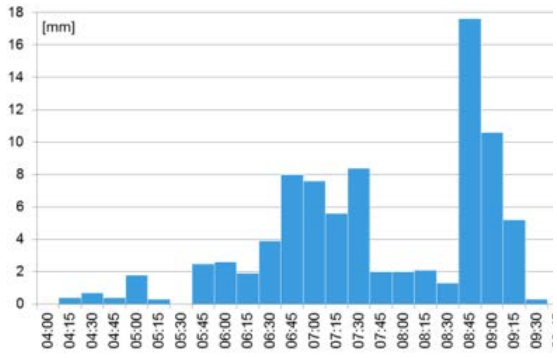
- Infrastructure
- Health

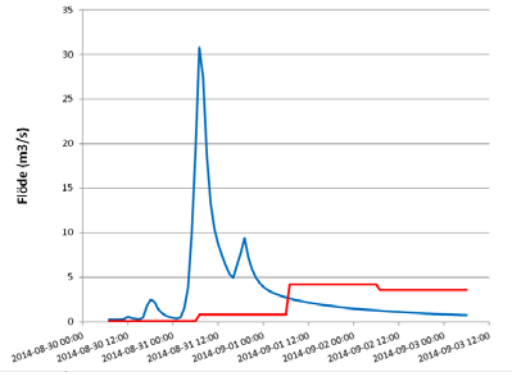
Malmö august 31st 2014

- ★ Extreme rain event
- ★ Highest amounts ever measured

This kind of events is expected to be more common in the future

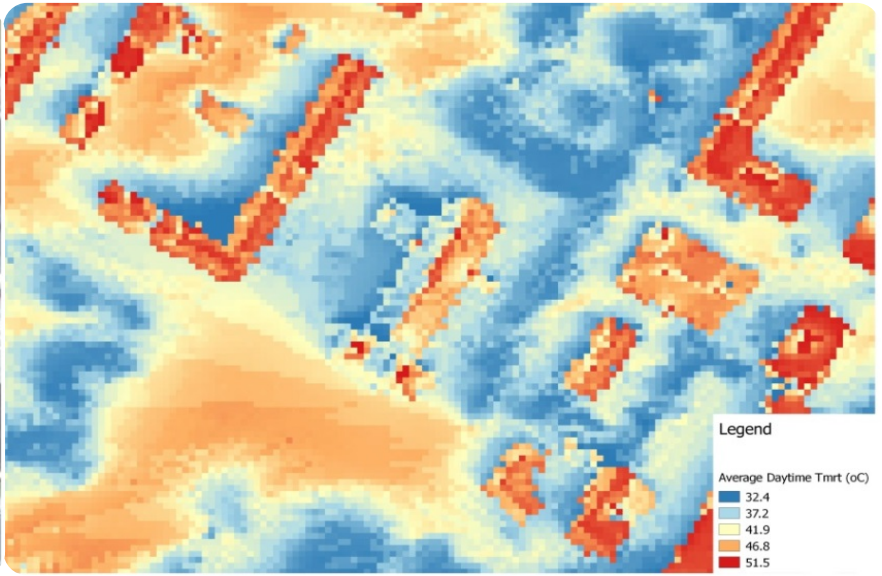






Temperature, comfort and health

City centre of Eskilstuna, Sweden

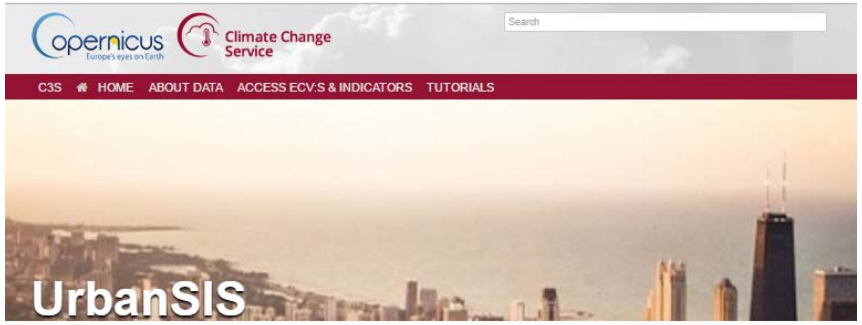


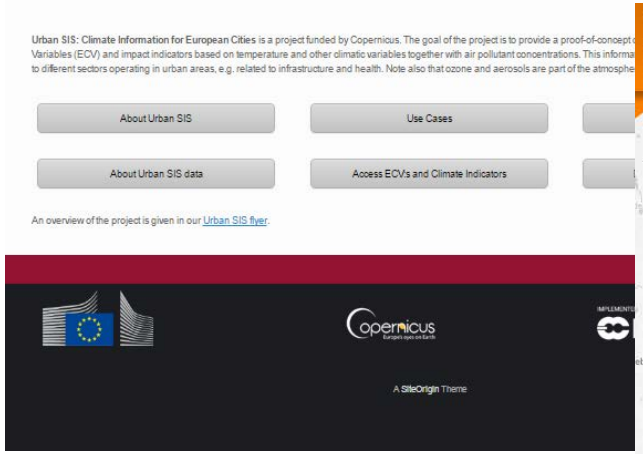
Solweig radiation model

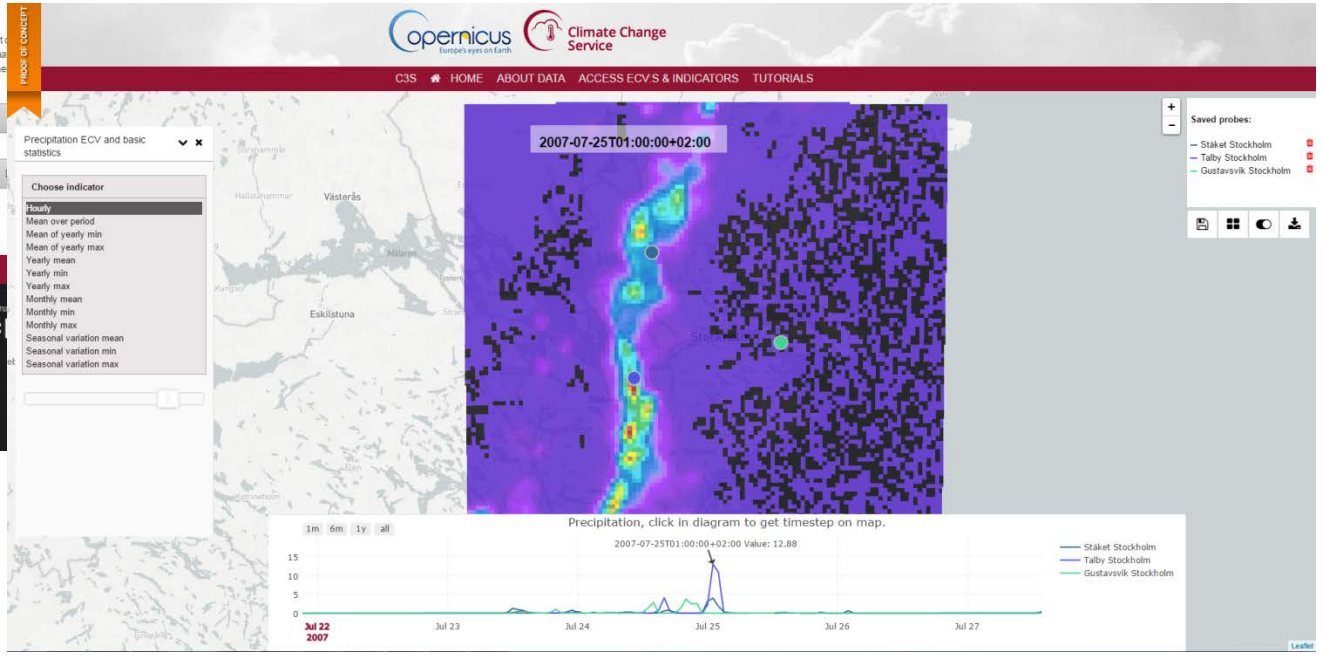
	Essential Climate Variables	Impact Indicators
Model areas	3 pilot cities, the architecture should be able to handle all major cities in Europe.	
Identified variables	Around 23	Around 45 indicators identified
Domain size	Defined for each city; typical size 110x110 km^2	
Spatial resolution	1x1 km^2	
Coordinate system	Selected for each city	
Time frame	Three periods of interest identified where a 5 year time frame will be selected; Historical (Early 2000's); Present; and Future (around 2050)	
Time resolution	Hourly time series. (For precipitation quarterly)	Varied from one value per period to time aggregated time series.
Estimated size per variable	~50 GB	Ranging from 1 MB for single value indicators to the size of ECVs for time series.
Estimated size per city	~1 TB	Ranging 50 MB to around 1 TB dependent of type and number of Impact Indicators.

Health	Air quality	Air pollutant concentration
		Air pollution exposure
		Annual deaths due to NO_2 and $PM_{2.5}$ long-term exposure
		Annual deaths due to ozone short-term exposure
	Heat stress	Hot days
		Heat wave duration
		Annual heat related deaths
	Discomfort	Thom Discomfort Index
		Universal Thermal Climate Index
		Frequency of tropical nights
Energy	Energy consumption	Heating and cooling degree days
	Solar energy	Solar insolation
Infrastructure	Flooding	Local runoff ECV and basic statistics
		Surface runoff ECV and basic statistics
		Discharge ECV and basic statistics
		Short duration extreme precipitation
	Soil	Soil temperature
	Green infrastructure	Growing season length
		Drought periods
	Transport infrastructure	Frost days
		Ice days
		Zero-crossings
Non-sector specific	Temperature	Daily maximum, minimum and average air temperature
		Temperature ECV and basic statistics
	Precipitation	Precipitation ECV and basic statistics
	Snow cover	Snow cover indicators

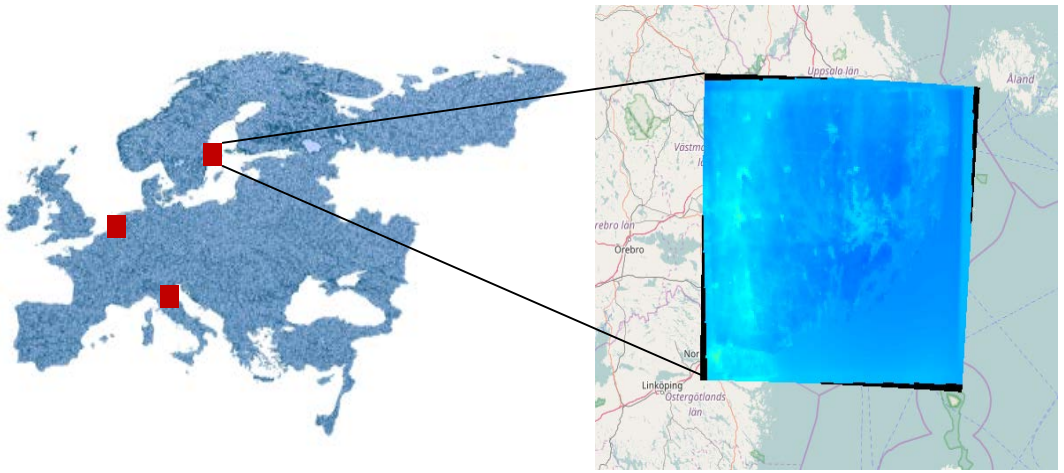
urbansis.climate.copernicus.eu

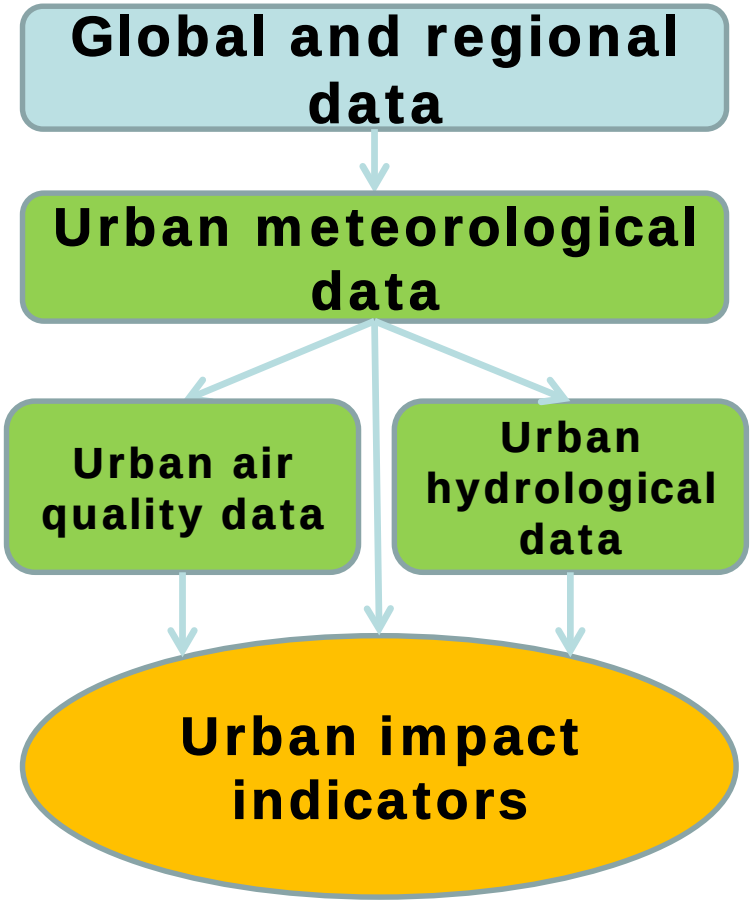




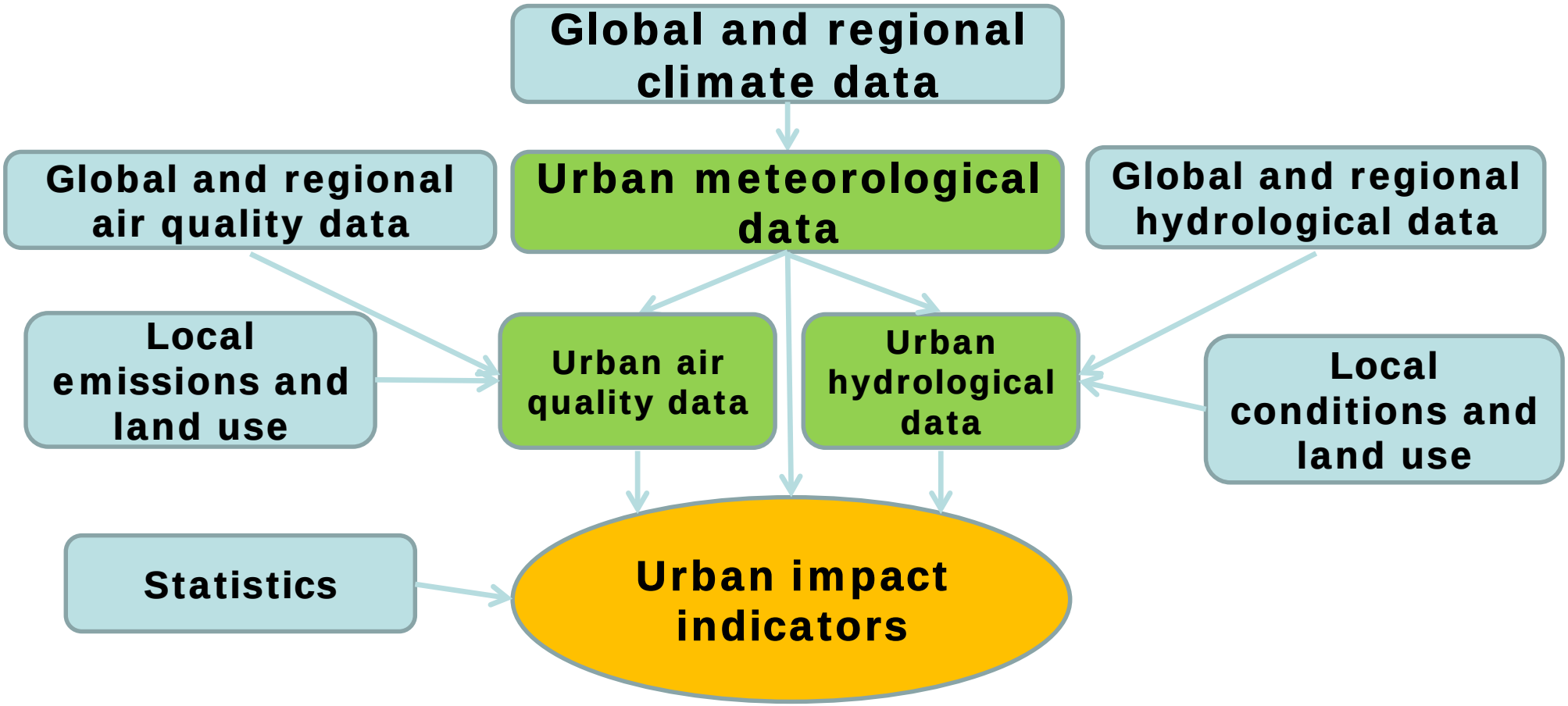


Downscaling climate information to the urban scale

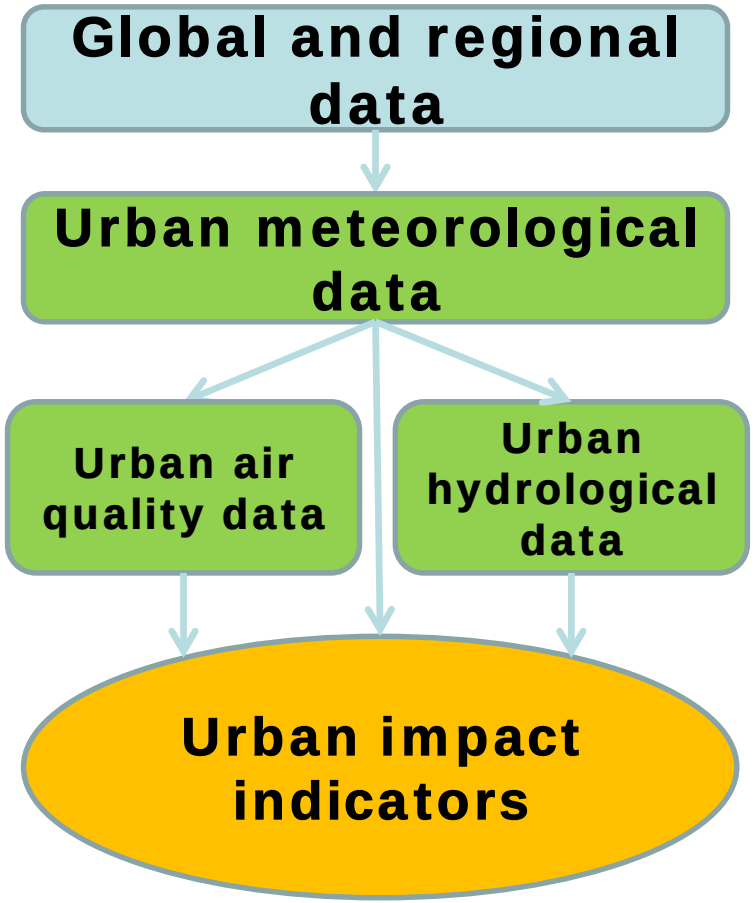




But the picture is far more complicated



Production of data – processing times



Global data – produced before this project.

★ Processing time up to months

Urban meteorological data:

★ 4-6 nodes on NSC, 1week/year

Urban air quality data:

★ 4-6 nodes on NSC, 1 day/year

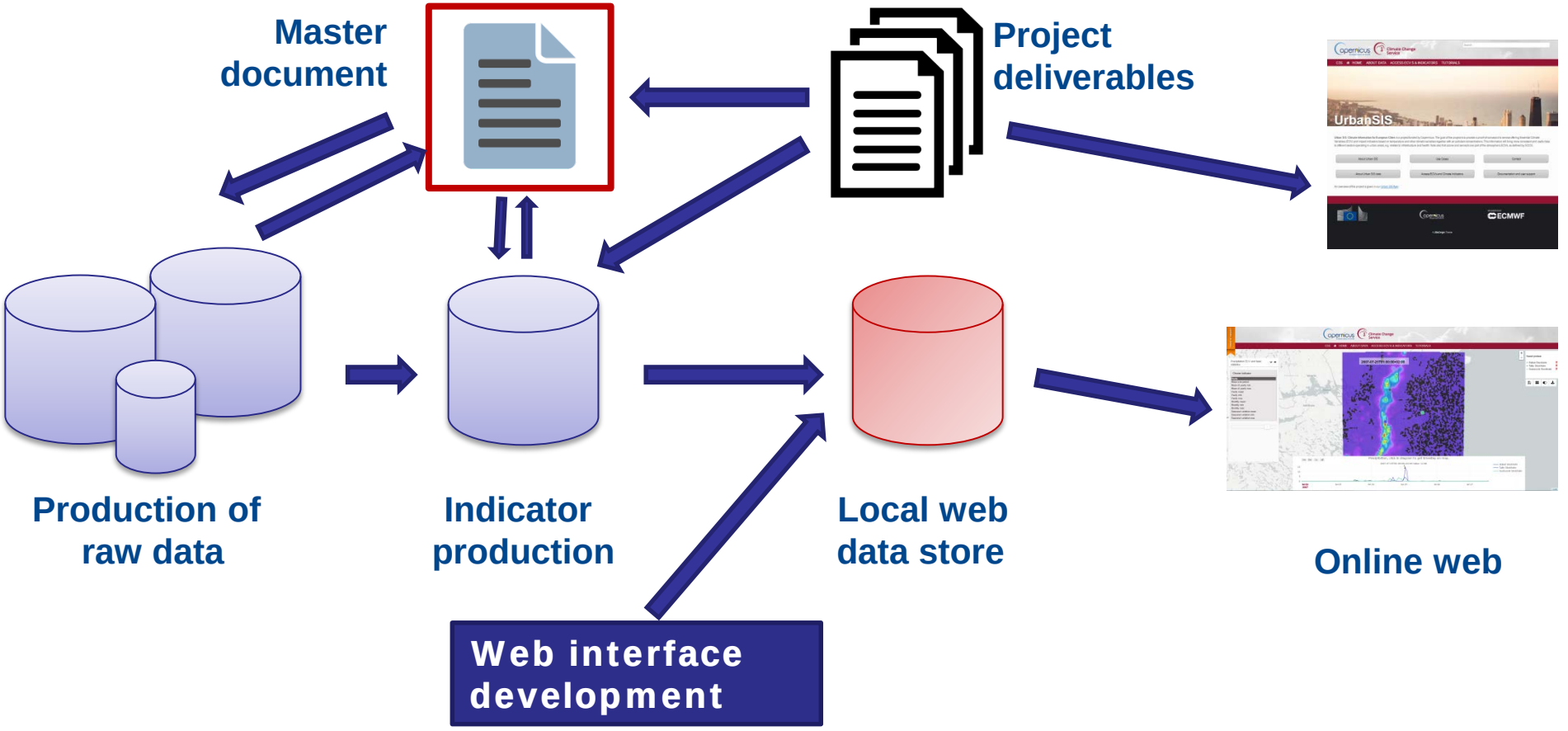
Urban hydrological data:

★ NSC or PC, hours

Urban impact indicators:

★ NSC or PC, minutes to hours

Data management during the production



Meta-data and provenance

Most important identification in the netCDF files

- ★ Identifier
- ★ Model version
- ★ Forcing data
- ★ Other improtant imput

Provenance recorded by linking identifiers and descriptions.

Heat wave duration

Sector	Heat stress and human discomfort
Description	Heat waves are characterized as periods of sustained, extreme heat, although there is no universal definition of a heat wave. For this application, a heat wave is defined according to Meehl and Tebaldi (2004) based on daily maximum air temperature (T_{max}) and two percentile thresholds (T1 and T2) from the distribution of daily T_{max} during the reference scenario period.
End User	General public, health authorities, urban planners
Calculation method	A heat wave is defined as a period of consecutive days that satisfy the following conditions: i) Daily T_{max} is above T_1 for at least three days, ii) the average T_{max} is above T_1 over the entire period, and iii) the daily T_{max} must be above T_2 every day of the period (the total heat wave period must be greater than or equal to 3 days). Here, T_1=97.5th percentile and T_2=81st percentile, following Meehl and Tebaldi (2004).

ID	Title	Period	Statistical processing	Unit	Threshold	Comment
heatwaveduration	Hot period duration	yearly	Maximum number of consecutive days when: i) Daily T_{max} is above T_1 for at least three days, ii) the average T_{max} is above T_1 over the entire period, and iii) the daily T_{max} must be above T_2 every day of the period (the total heat wave period may be longer than three days).	days	T1 = 97.5th percentile T2 = 81st percentile	Not available yet

Provenance	Theese indicators are based on output from the Harmonie meteorological modell.
Calculation caveats	Spatial representation: Other caveats: O3, O4 Could be compared to: Could be used with:
Motivation	Both duration and frequency of heat waves may increase in Europe (Perkins et al. 2011). The provided indicator can give planners a hint of changes to expect in their city. The selected method (Meehl and Tebaldi 2004) provides information about heat wave duration.
Experience user	Many methods to define a heatwave (Souch and Grimmond 2004, Perkins 2015).
References	Meehl GA, C Tebaldi 2004: More intense, more frequent, and longer lasting heat waves in the 21st century. Science 305.5686, 994-997.

User oriented description on the web pages

Urban SIS

Thank you for your attention!

lena.stromback@smhi.se

lars.gidhagen@smhi.se

urbansis.climate.copernicus.eu