

From **Data** to **Action**: using **DestinE** for **resilient** and **HEALTHIER CITIES**

Photo [Urtimud89](#) from Pexels

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in [@colabatlantic.com](#)





Why **AI for cities** makes **SENSE**?

AI for cities makes SENSE

BECAUSE we need to **quantify and avoid infrastructure losses** due to **mean and extreme sea-level rise!**



Vila Nova de Gaia, Portugal



Mira, Portugal



Cascais, Portugal

AI for cities makes SENSE

BECAUSE we need to **acknowledge, preserve and restore** the **ecosystem services provided by nature!**

LULC Classification



RF Classification Results

LULC	f1-score
Others	0.79
Salt marshes	0.76
Salines	0.59
Intertidal Flats	0.71
Water	0.83
Overall	0.76

CLMS Costal Zones LULC



RF LULC Classification



Carbon Stock Estimates

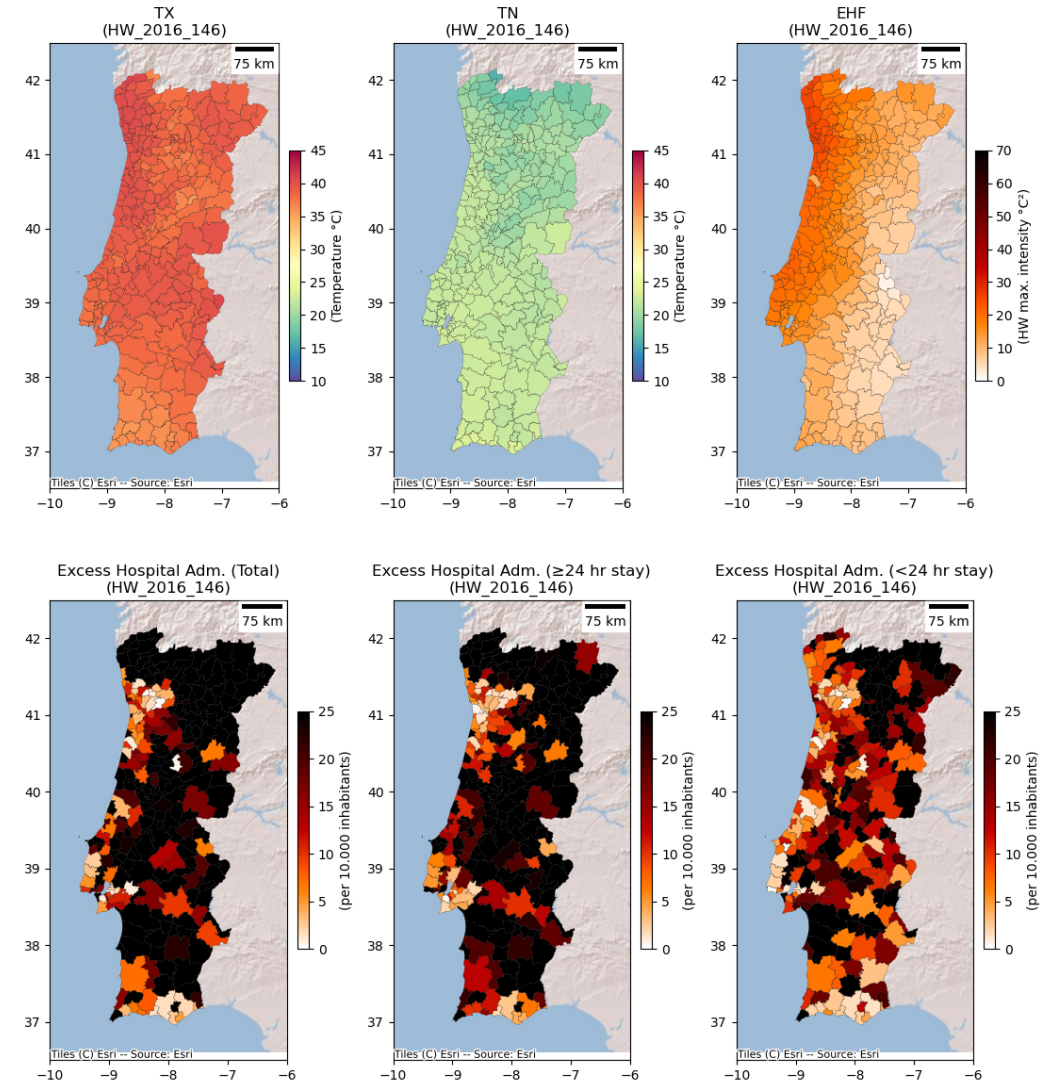
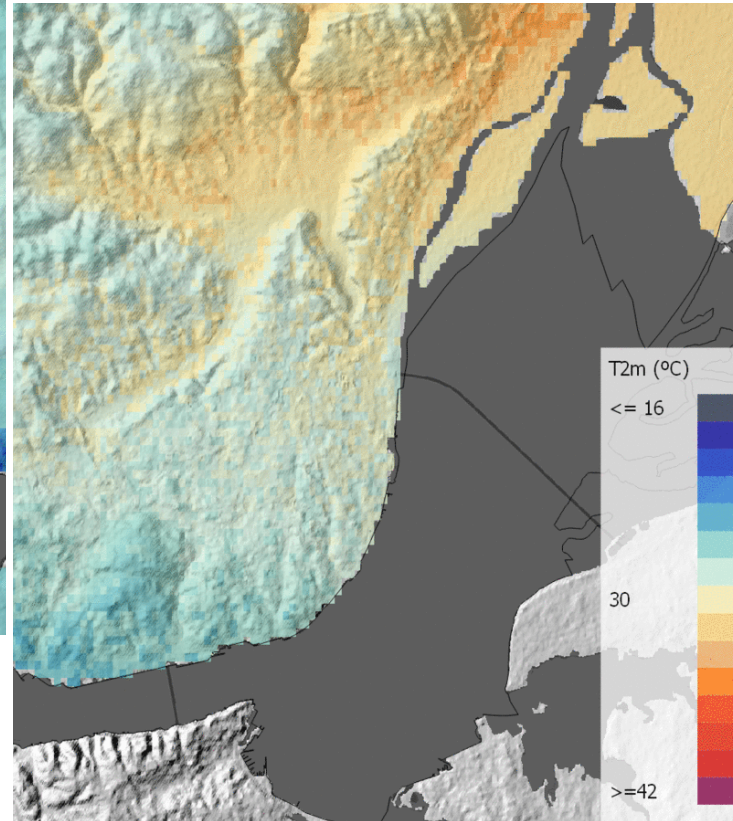
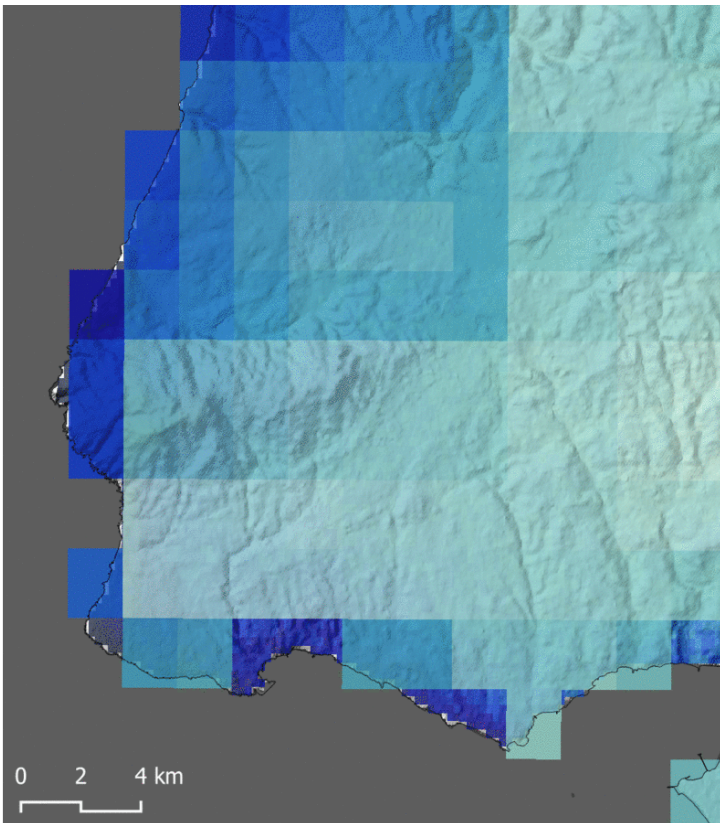


Highest correlation value = 0.70 (Max scenario)

Highest correlation value = 0.85 (Max scenario)

AI for cities makes SENSE

BECAUSE we need to better **predict and prevent excess deaths and hospital admissions** due to **extreme temperatures!**





How **AI for cities** makes **SENSE**?

WHAT?

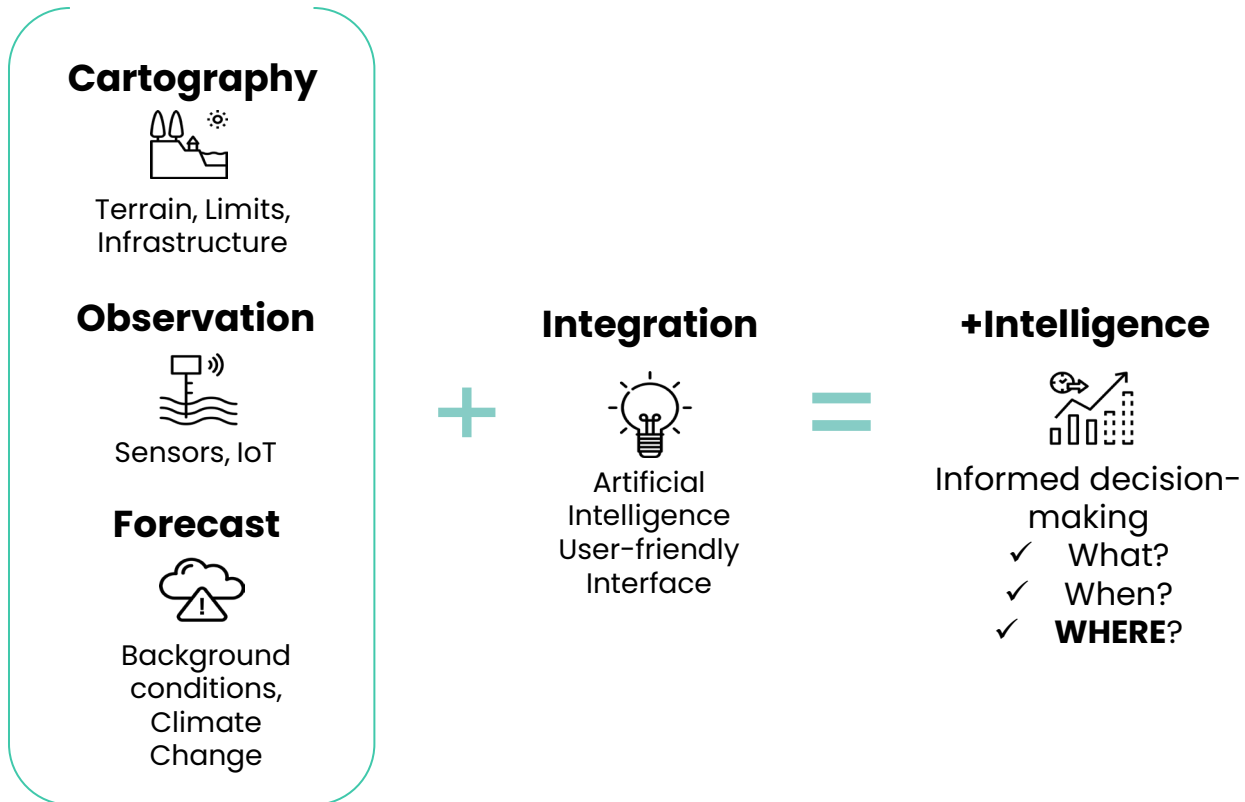
The Solution

Leverage OPEN DATA and DATA-DRIVEN METHODS to overcome the spatial scale DEFICIT, providing:

ADDED-VALUE FORECASTS

MORE PRECISE RISK ASSESSMENT INPUTS

SCENARIO-MAKING TOOLS



Global temperature change since 1850

Future choices up to 2100

WE
ARE
HERE

WHAT?

The Solution



TODAY

[weather forecasts: predicting impacts]

OUR CHOICES



YESTERDAY

[reanalysis: observing relationships, modelling effects]



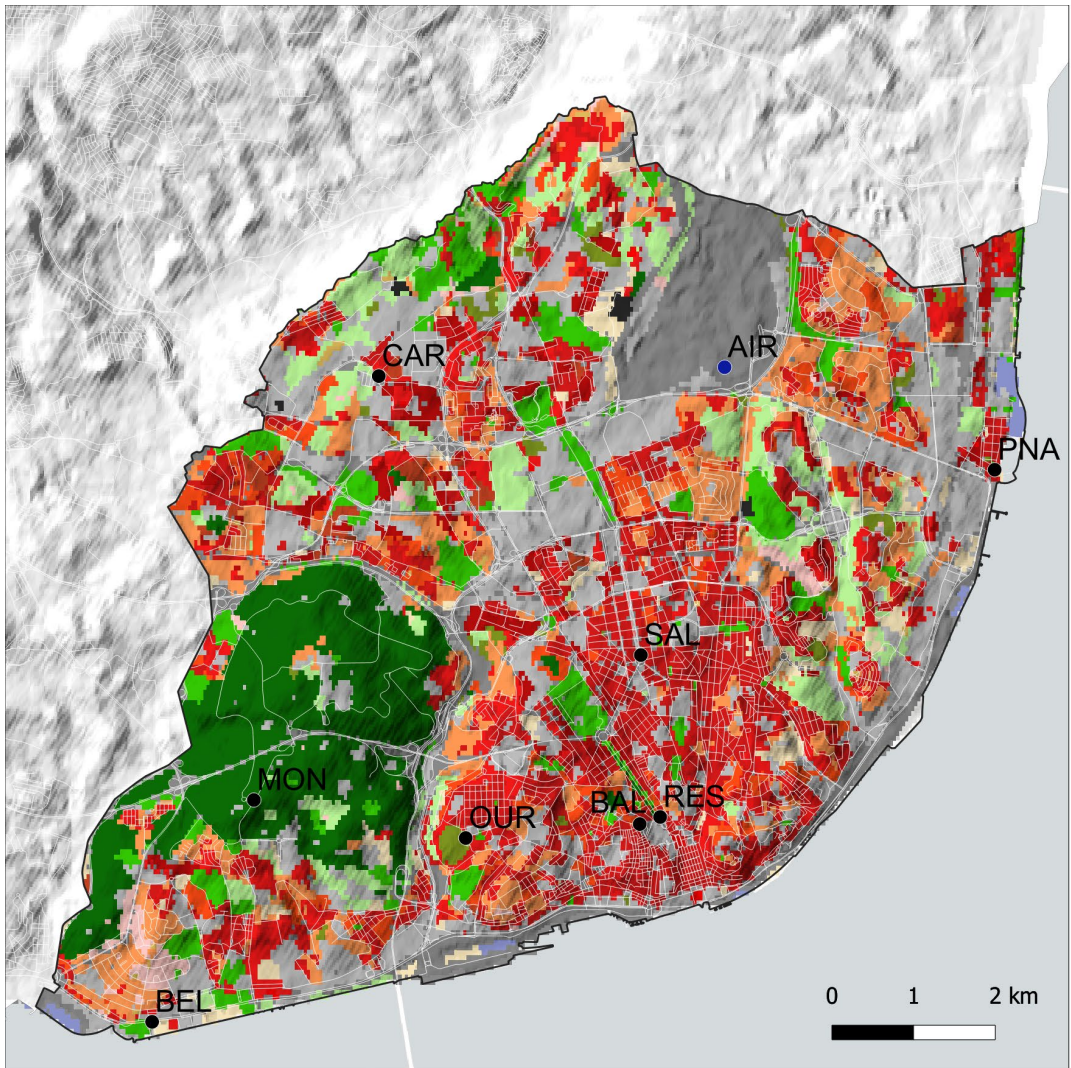
TOMORROW

[climate projections: assess alternative scenarios]



YESTERDAY

[reanalysis: observing
relationships, modelling effects]



City Limits

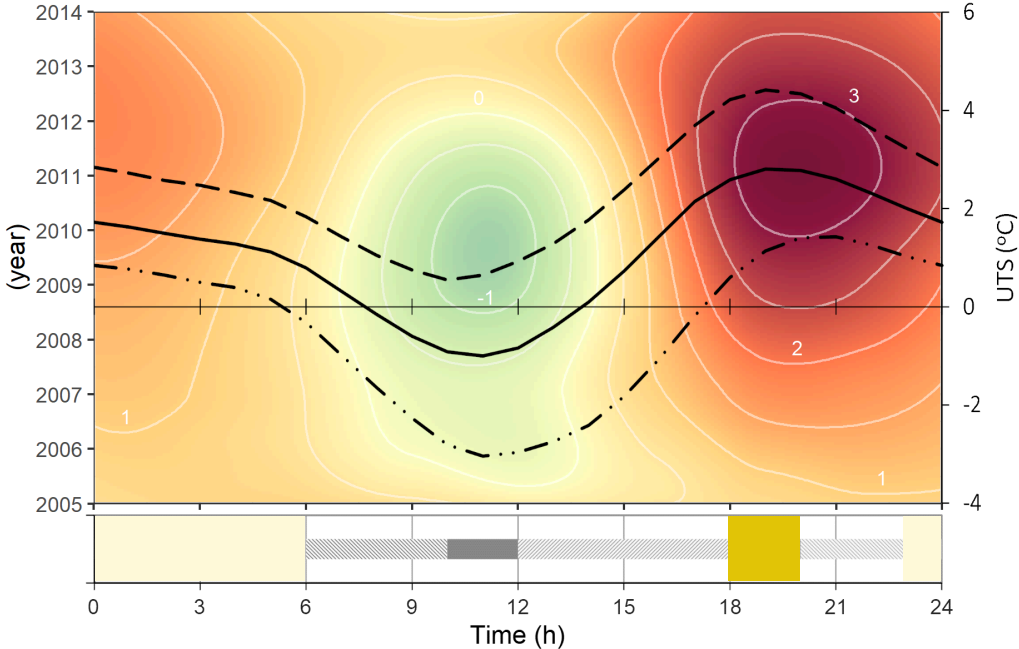
Ta Observation Sites

- IGOT's Network
- Airport

LCZ classes

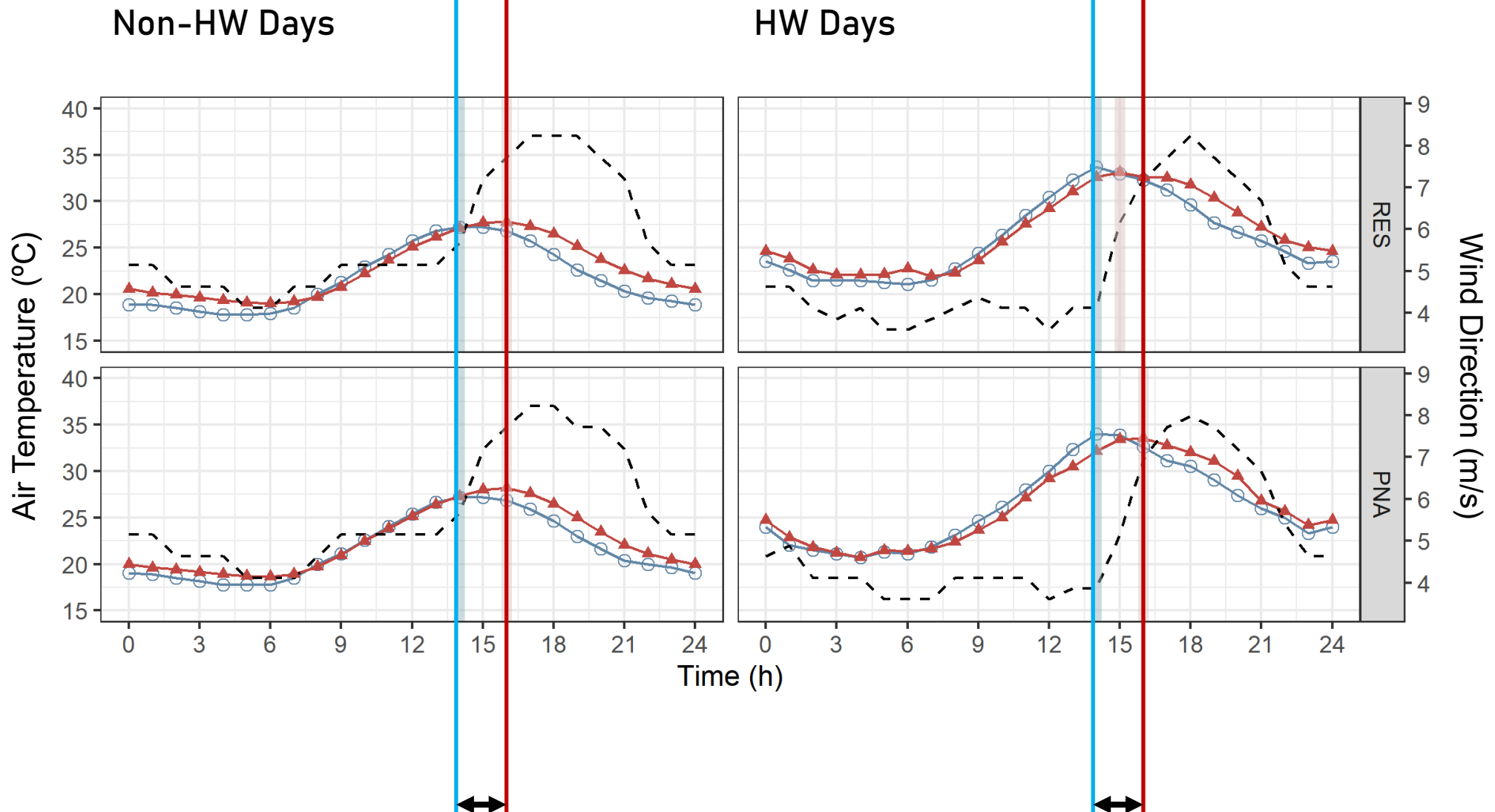
- 1 - Compact high-rise
- 2 - Compact midrise
- 3 - Compact low-rise
- 123 - Compact mixed-rise
- 4 - Open high-rise
- 5 - Open midrise
- 6 - Open low-rise
- 456 - Open mixed-rise
- 8 - Large low-rise
- 9 - Sparsely built
- 10 - Heavy industry
- A - Dense trees
- B - Scattered trees
- C - Bush, scrub
- D - Low plants
- E - Bare rock or paved
- F - Bare soil or sand
- G - Water

UTS (Tu-Tr) daily cycle per month, Summer (JJAS 2005-2014)
(‘N’ and ‘N var’ wind direction)



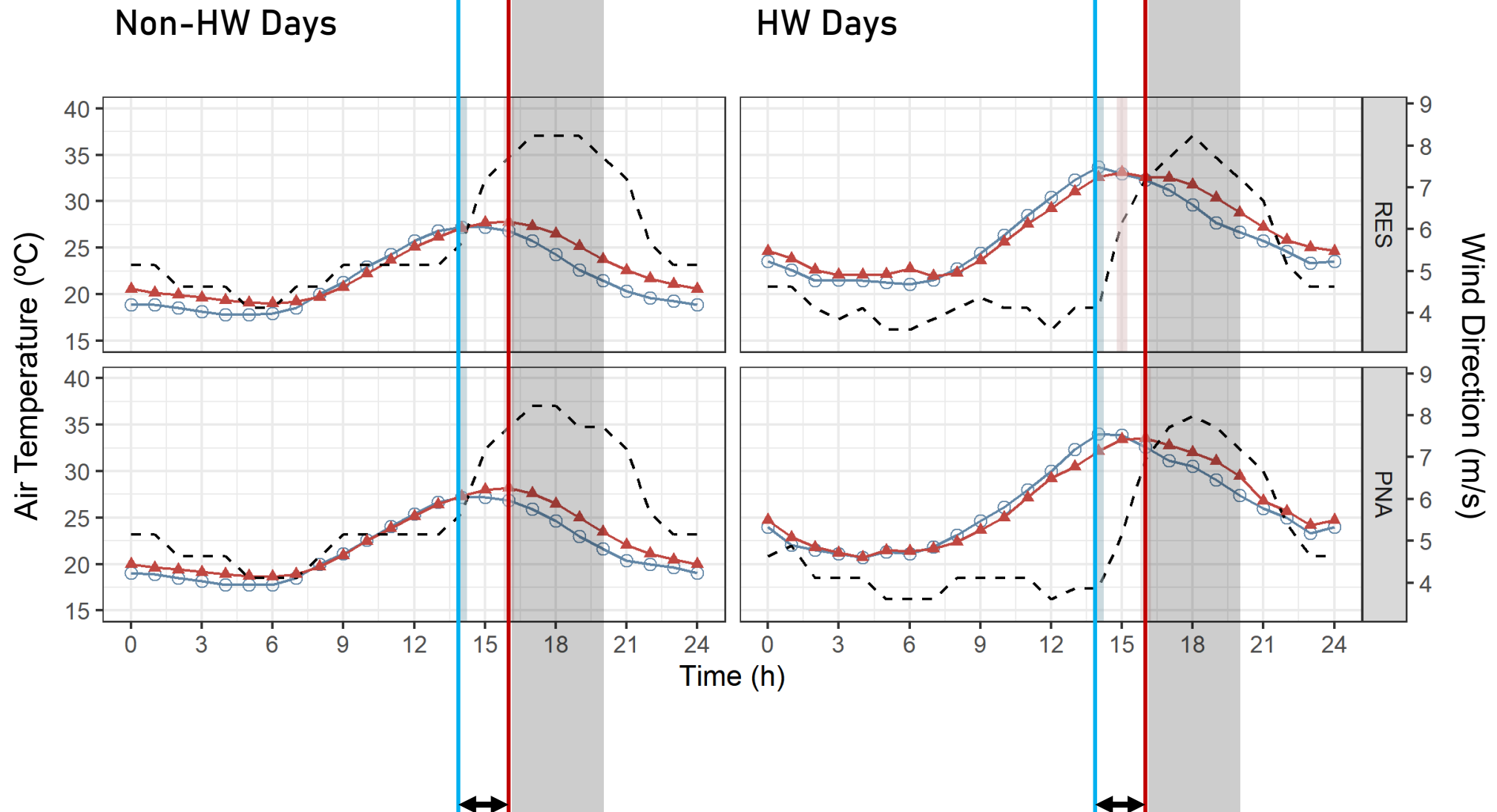
UTS daily cycle stages		UTS signal
1	1. Nocturnal stable UHI	Positive
2	2. Morning transition to UCI	Positive to negative transition
3	3. Diurnal Peak UCI	Negative
4	4. Afternoon transition to UHI	Negative to positive transition
5	5. Late Afternoon peak UHI	Positive
6	6. Evening stabilizing UHI	Positive

Sources:
<https://www.epa.gov/heatislands/learn-about-heat-islands>
Oliveira A, Lopes A, Correia E, Niza S, Soares A. Heatwaves and Summer Urban Heat Islands: A Daily Cycle Approach to Unveil the Urban Thermal Signal Changes in Lisbon, Portugal. Atmosphere. 2021; 12(3):292. <https://doi.org/10.3390/atmos12030292>

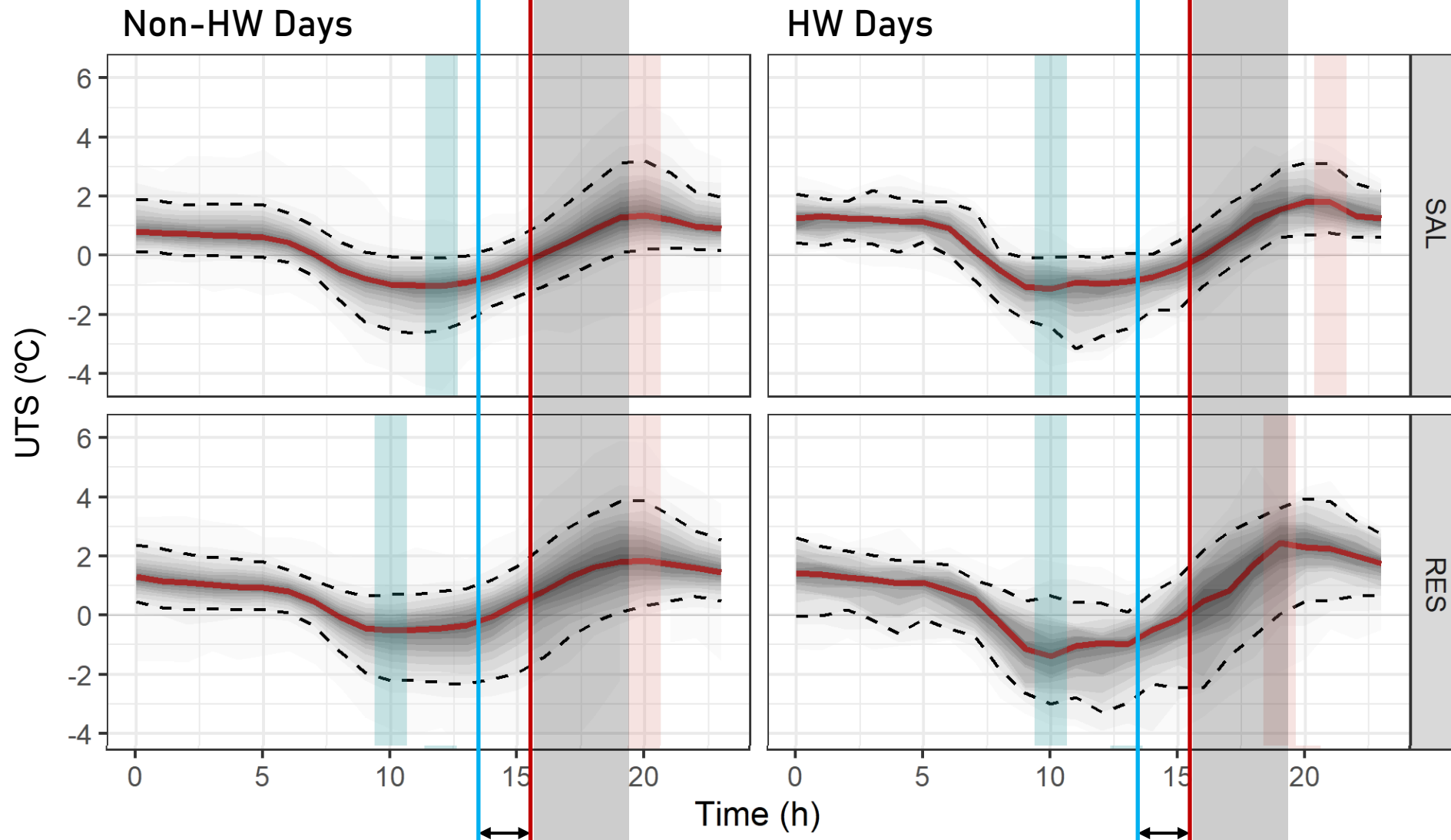


There is a ~2hour lag between the Rural and Urban Sites.

- Lisbon Airport Ta (Tr): Median (Tr50p)
- ▲— IGOT's urban sites Ta (Tu): Median (Tu50p)
- - - Lisbon Airport regional wind speed (Ws50p)



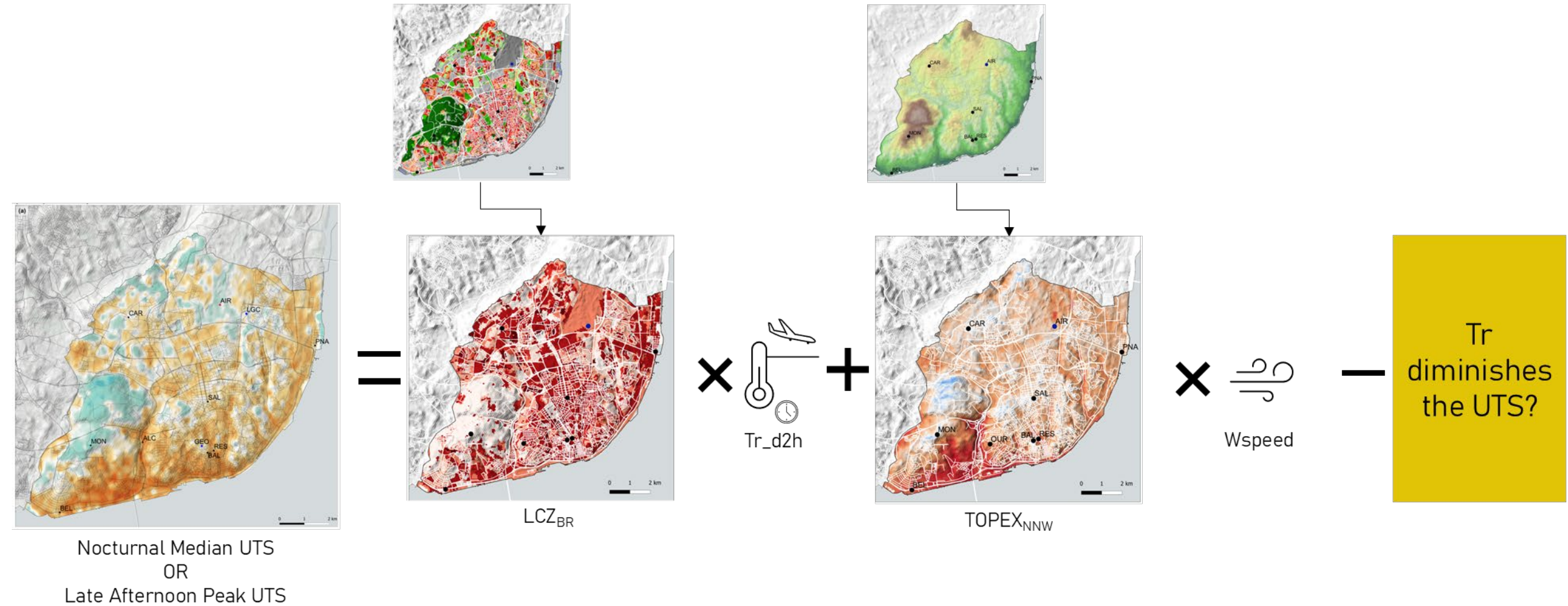
There is a late afternoon **Wind Speed Peak.**



Both contribute to the **UTS** Late Afternoon **Peak?**

UTS upper bound intensity, 90th percentile (UTS90p)
— UTS median intensity, 50th percentile (UTS50p)
UTS lower bound intensity, 10th percentile (UTS10p)

WHAT? The Solution



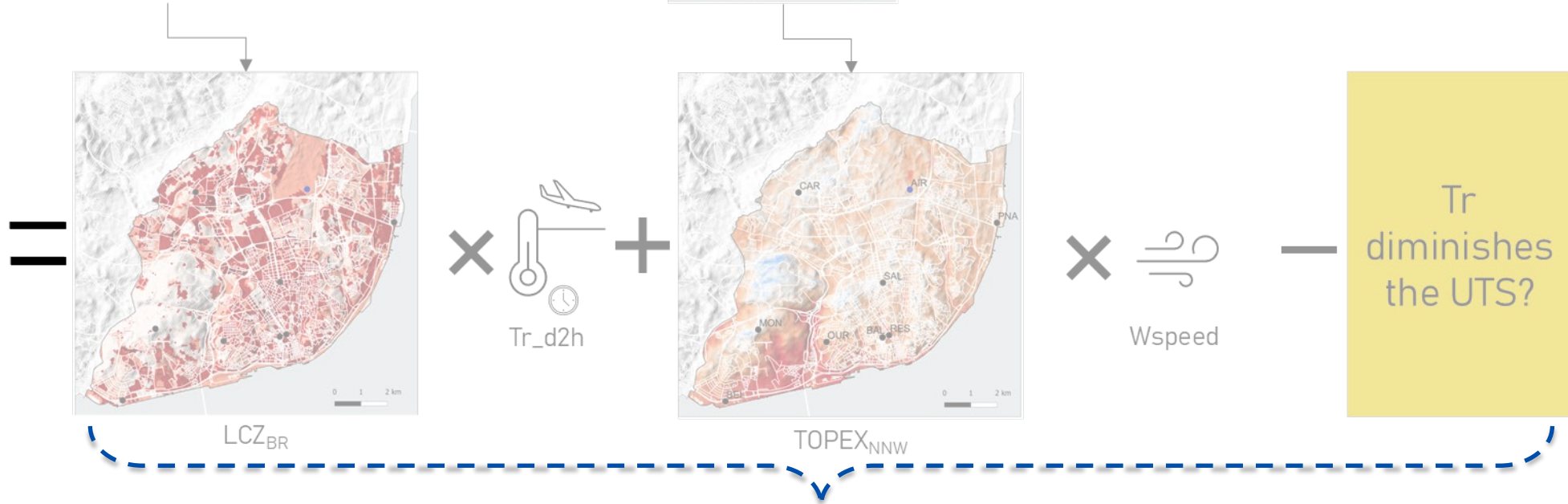
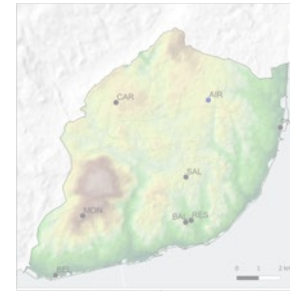
WHAT?

The Solution



TODAY

[weather forecasts:
predicting impacts]



TOMORROW

[climate projections:
assess alternative
scenarios]

Monotonic?



YESTERDAY

[reanalysis: observing
relationships, modelling effects]

Sources:

Oliveira A, et al. (2021). An urban climate-based empirical model to predict present and future patterns of the Urban Thermal Signal.

STOTEN. 790. <https://doi.org/10.1016/j.scitotenv.2021.147710>

WHAT?

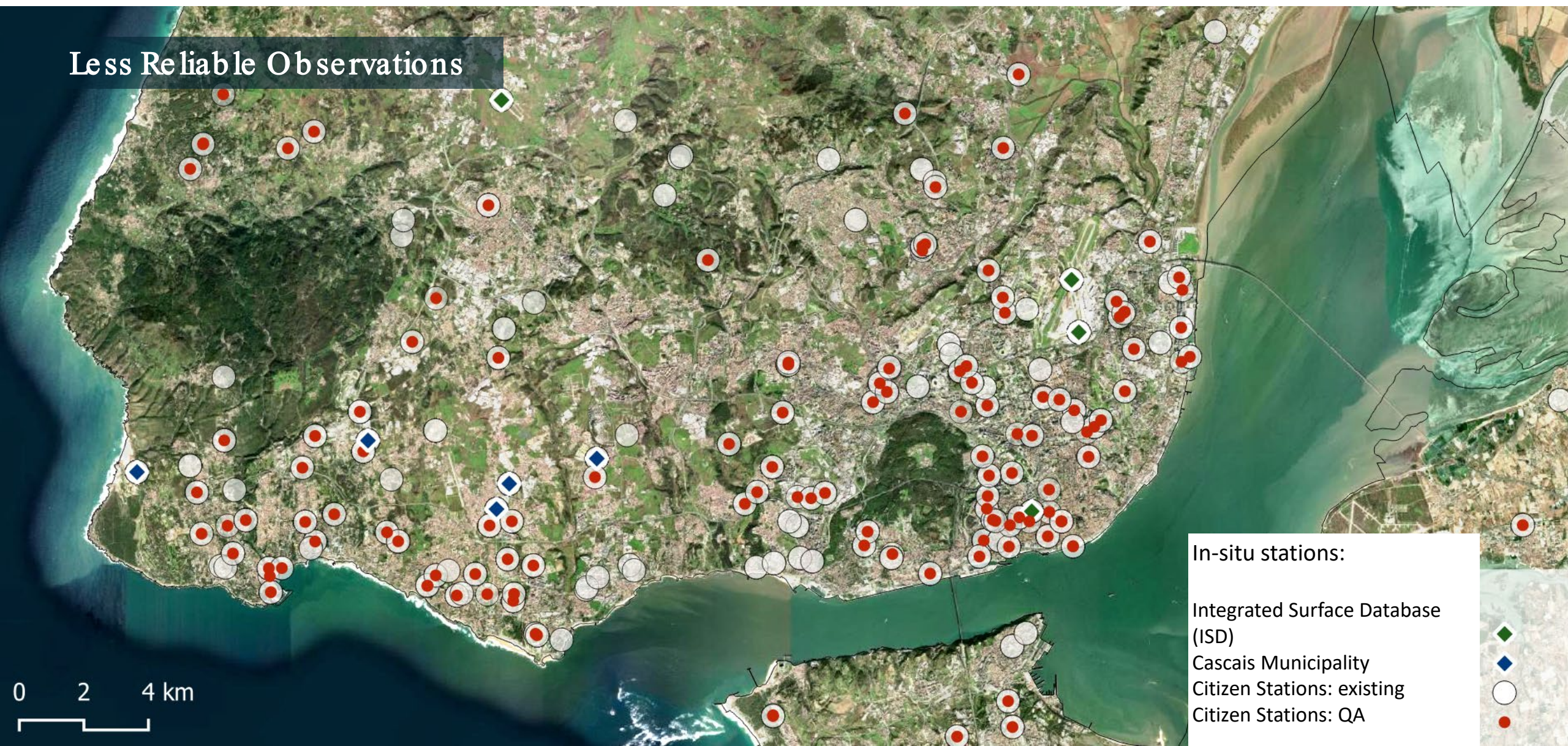
The Solution



WHAT?

The Solution

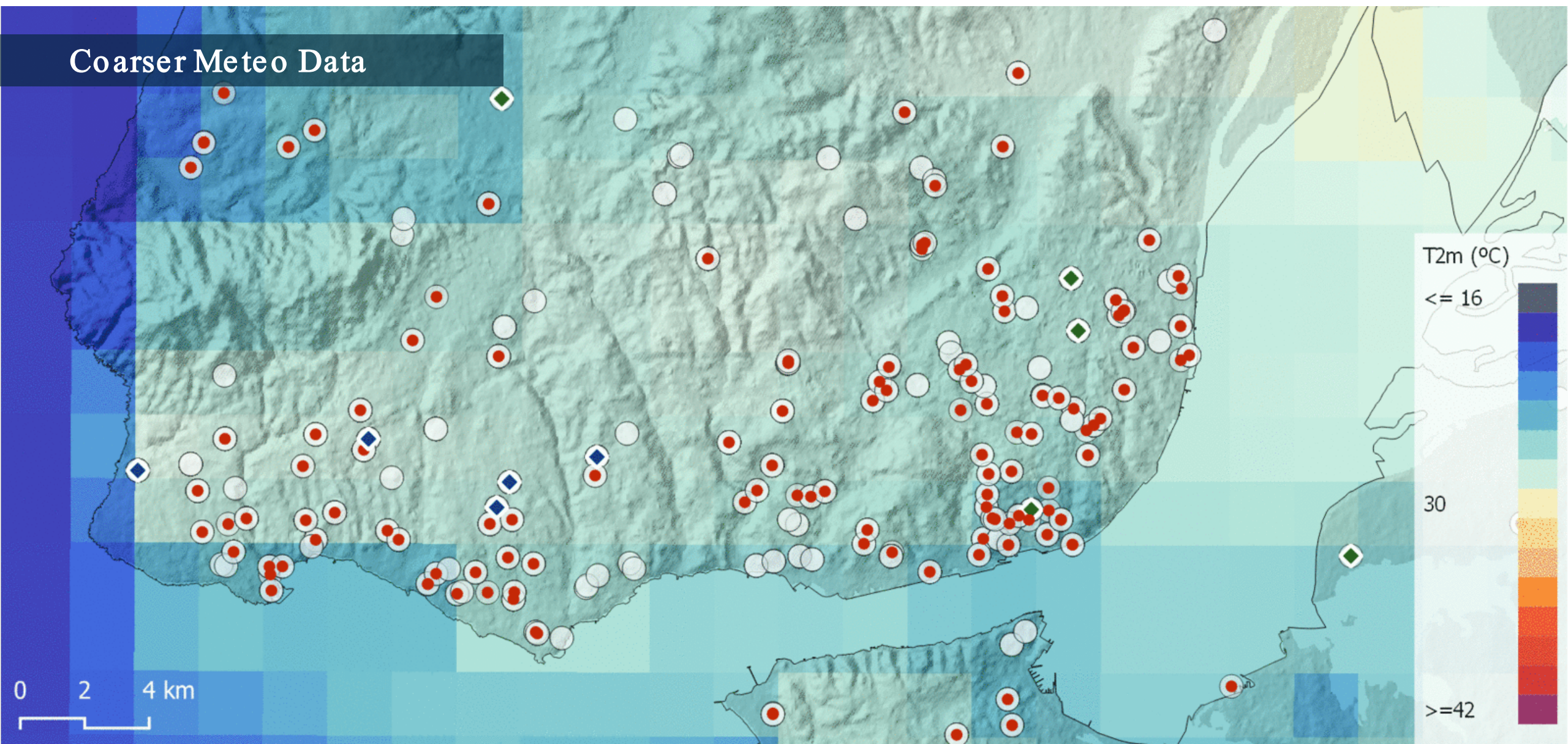
Less Reliable Observations



WHAT?

The Solution

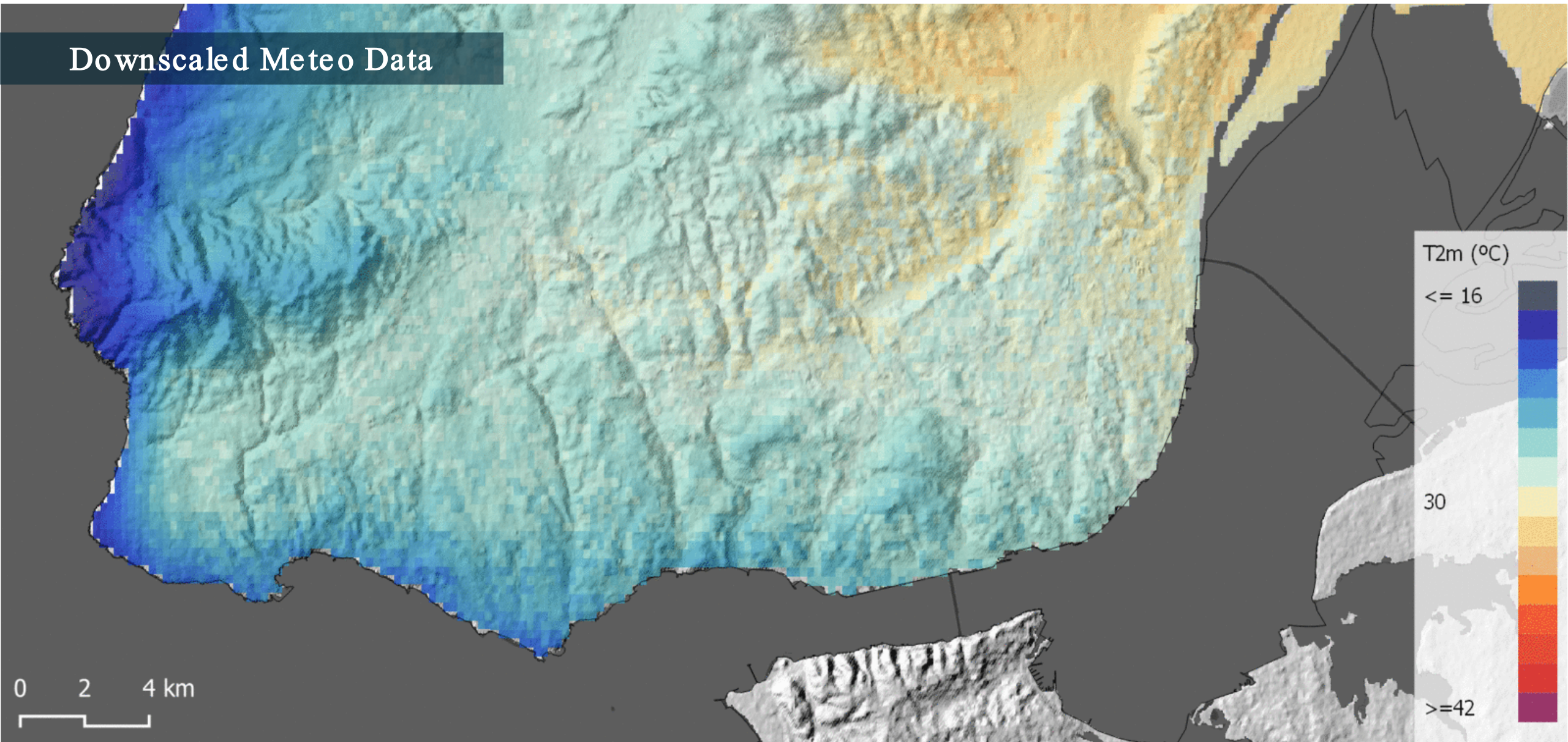
Coarser Meteo Data



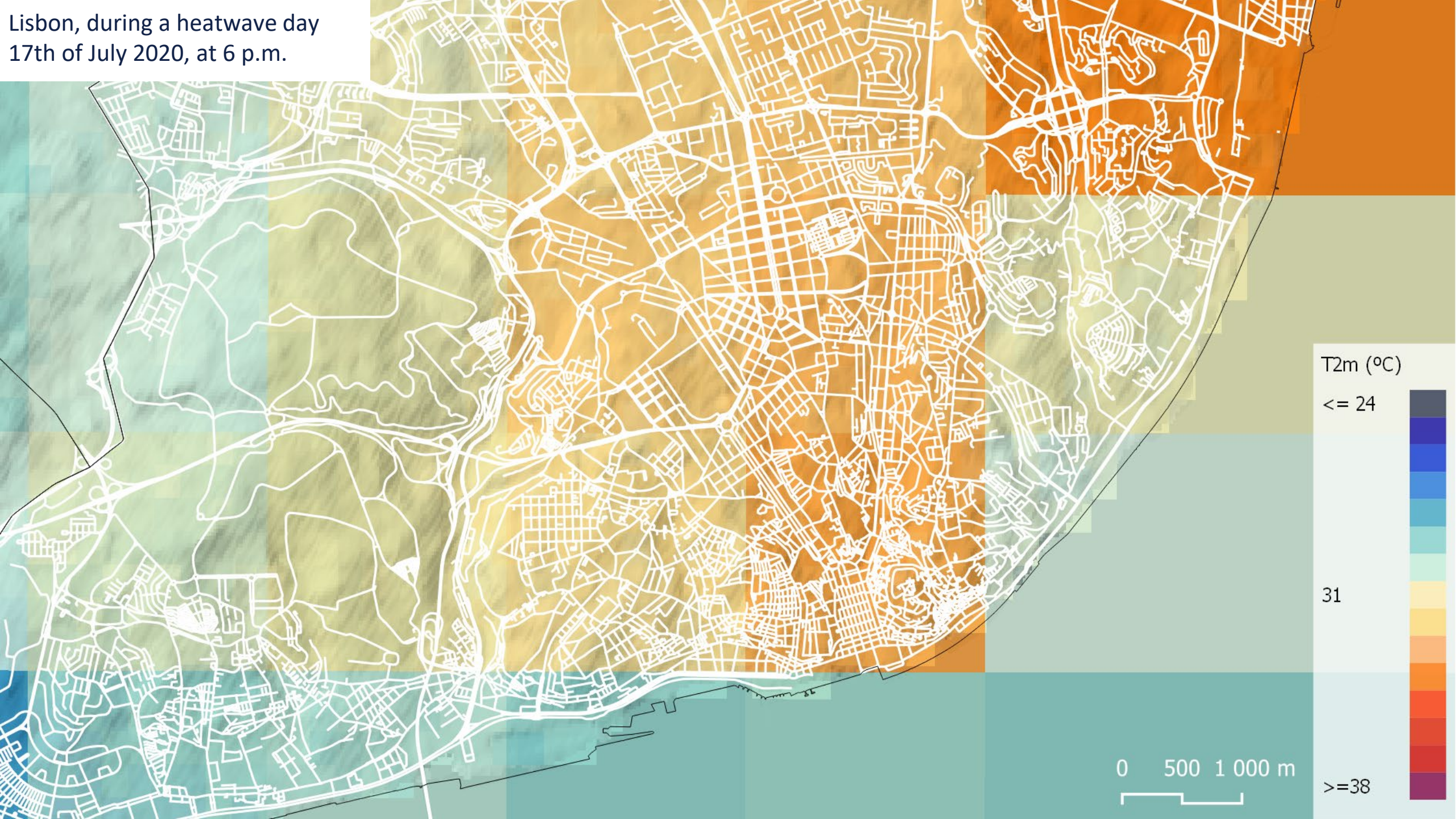
WHAT?

The Solution

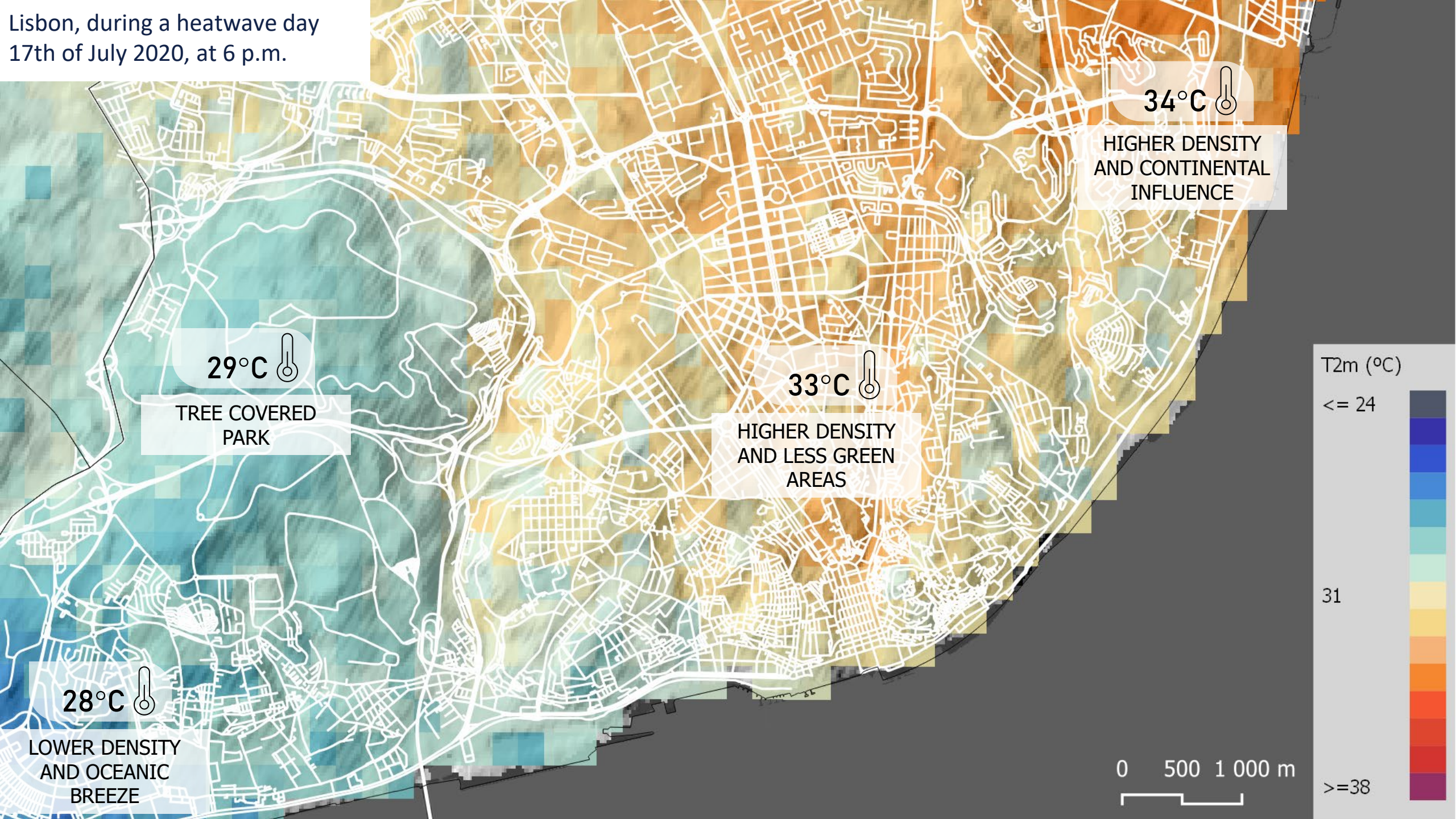
Downscaled Meteo Data



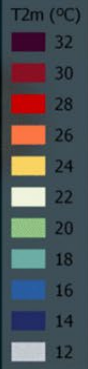
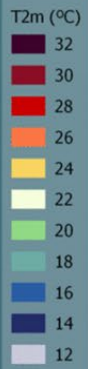
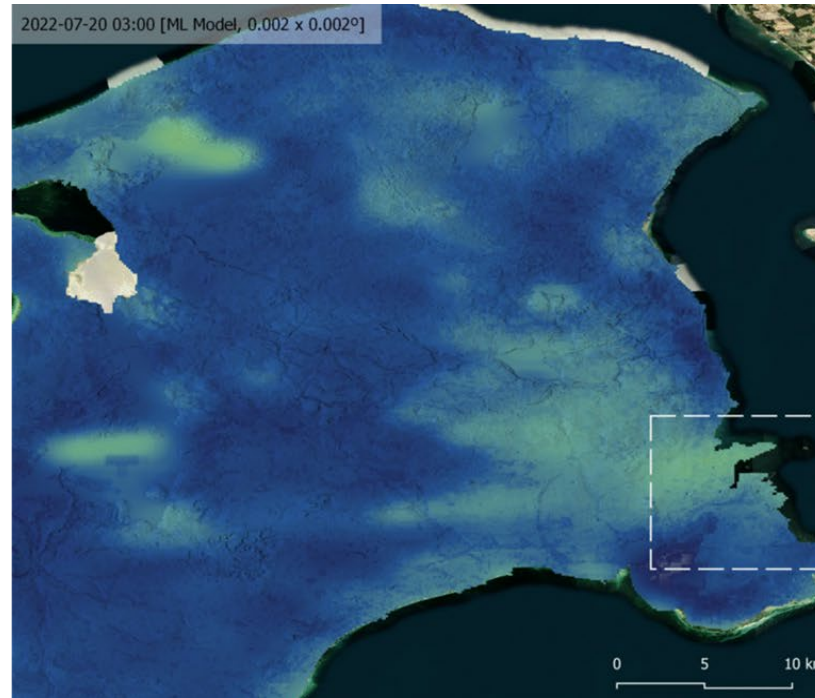
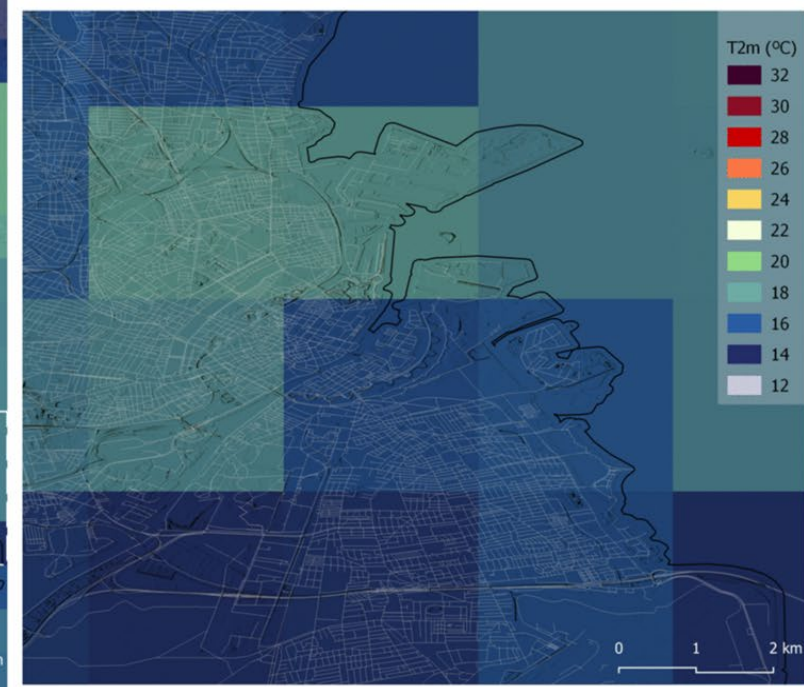
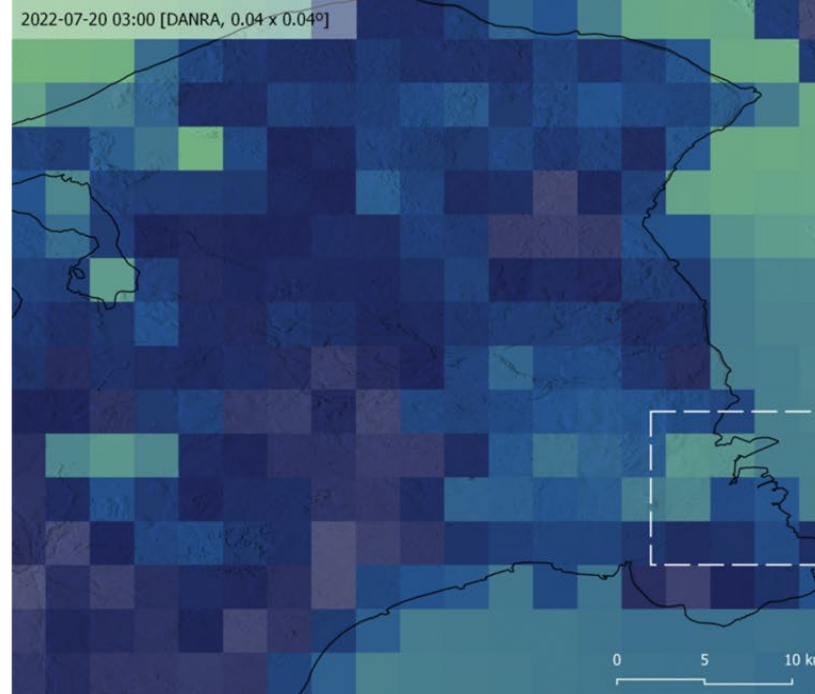
Lisbon, during a heatwave day
17th of July 2020, at 6 p.m.



Lisbon, during a heatwave day
17th of July 2020, at 6 p.m.



WHAT? The Solution



Implementation of the air temperature ML model in Denmark: (a) available citizen-owned stations, (b) DANRA reanalysis with 4km resolution, (c) downscaled forecasts to 200m grid. These results are now under fine-tuning and validation, in the scope of ESA CLIM4cities.



CLIM4
CITIES



DMI

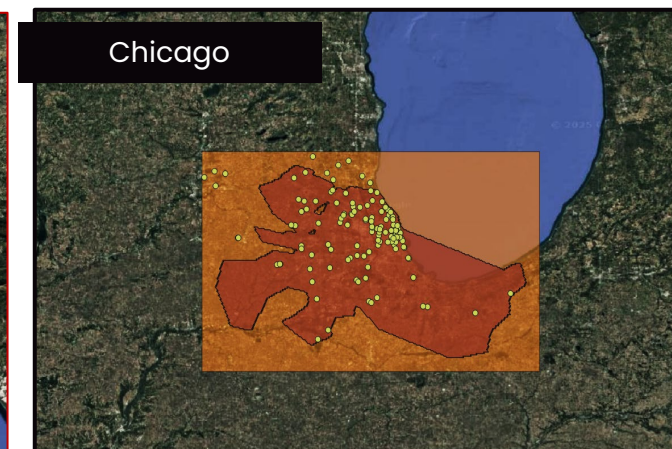
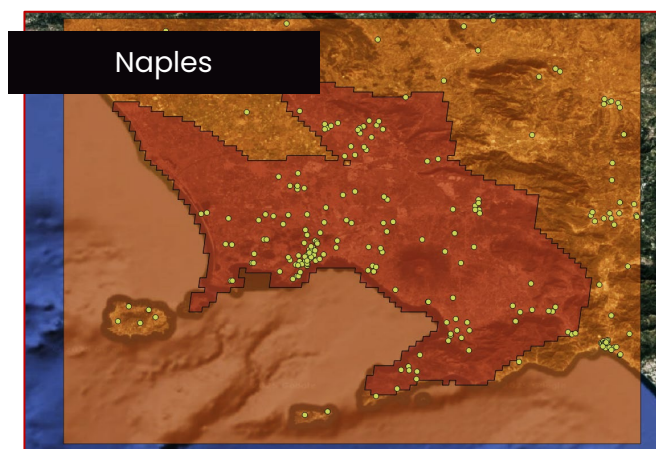
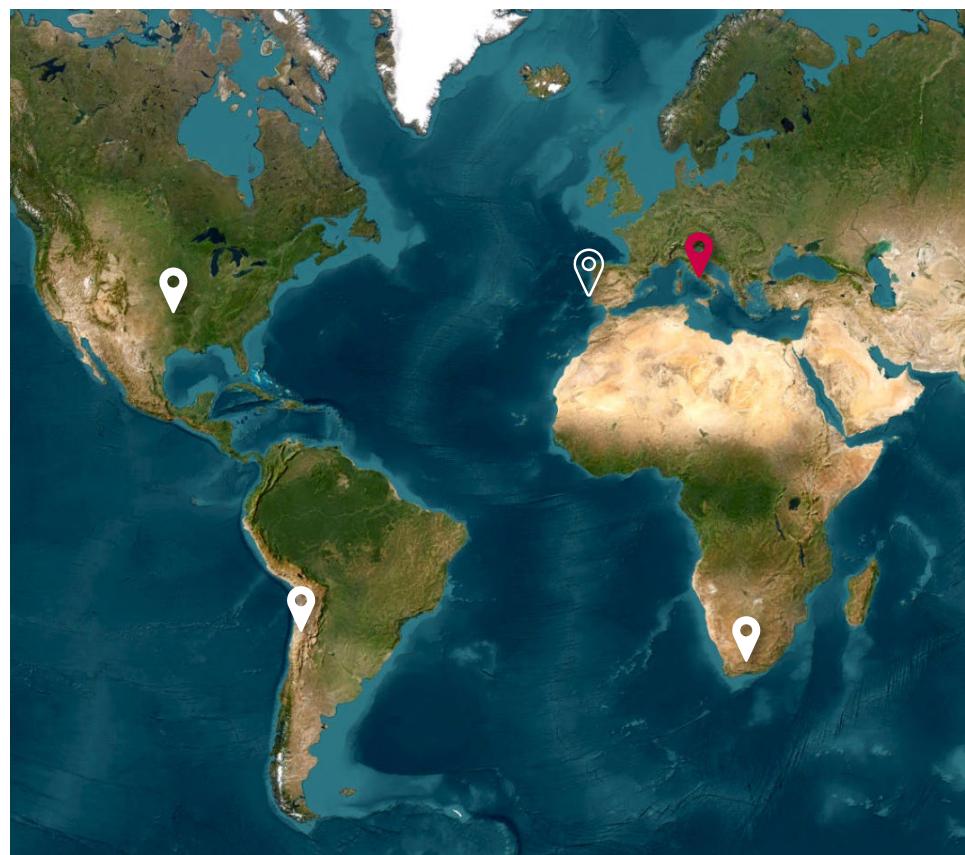


CoLAB
+ATLANTIC

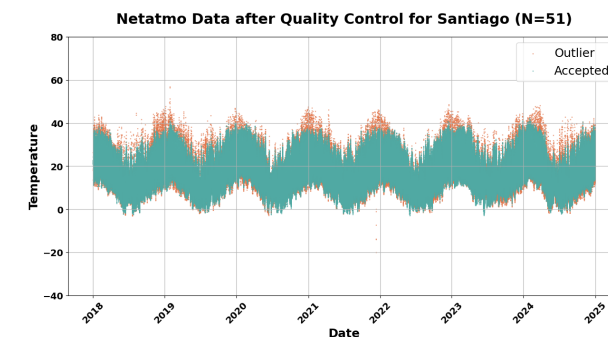
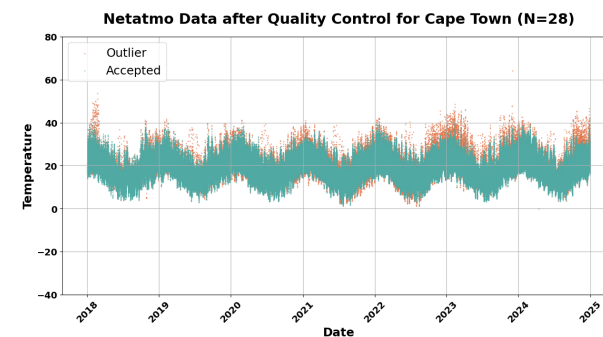
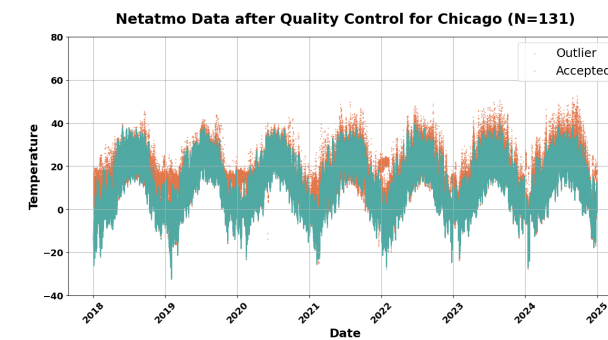
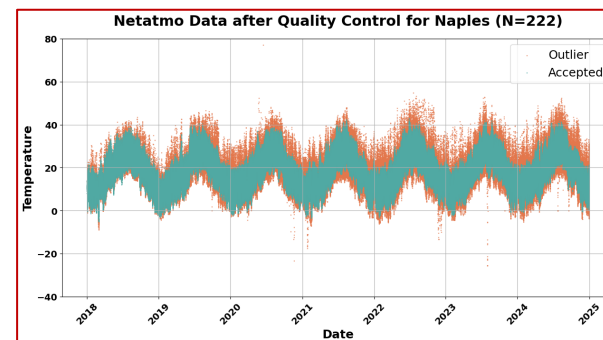
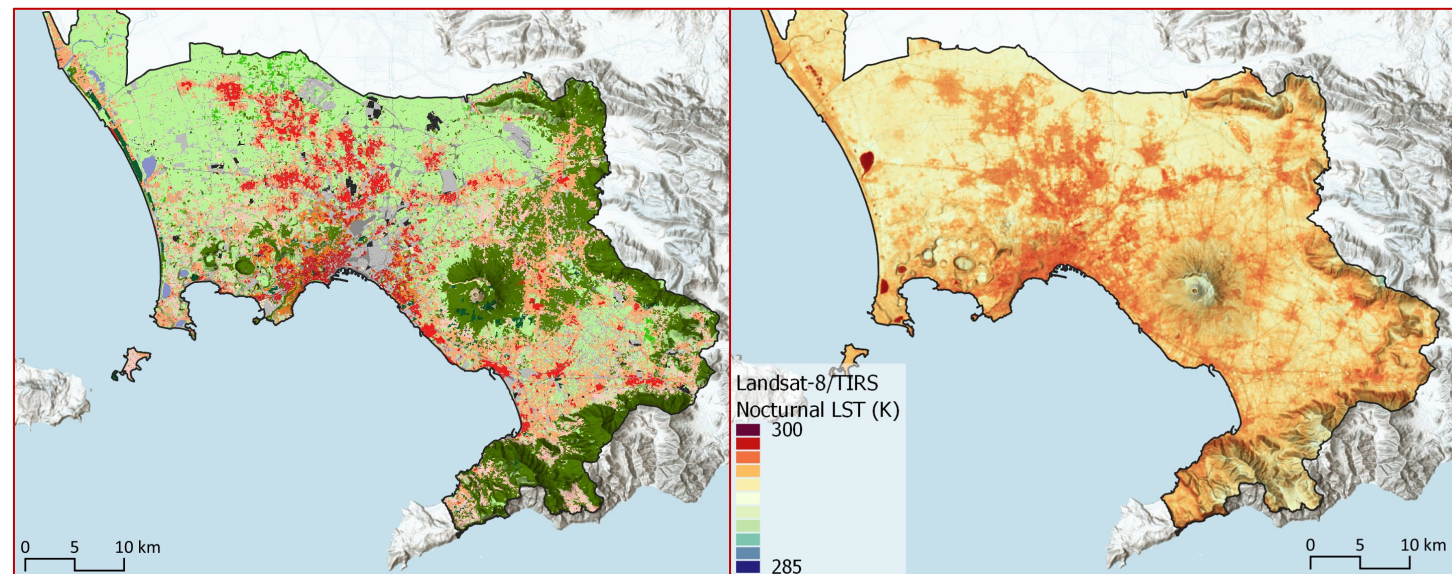
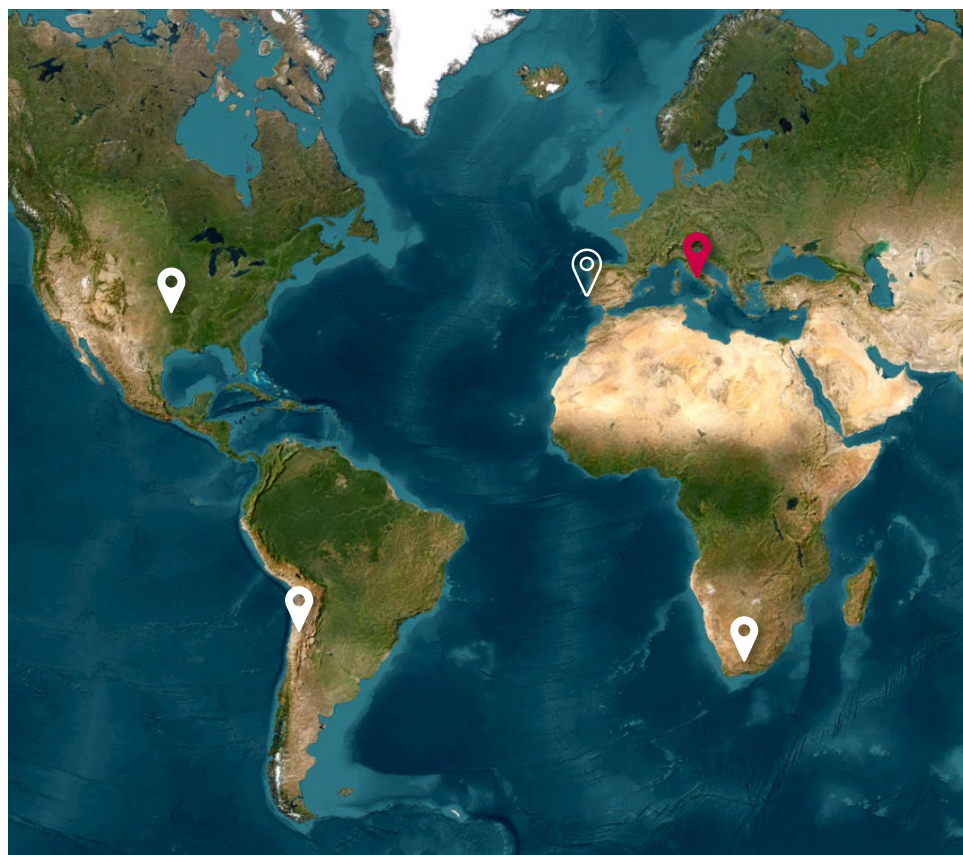


CLIM4cities is under a programme of, and funded by, the European Space Agency. Views expressed do not reflect the official opinion of the European Space Agency.

WHAT?
The Solution



WHAT? The Solution



WHAT?

The Solution



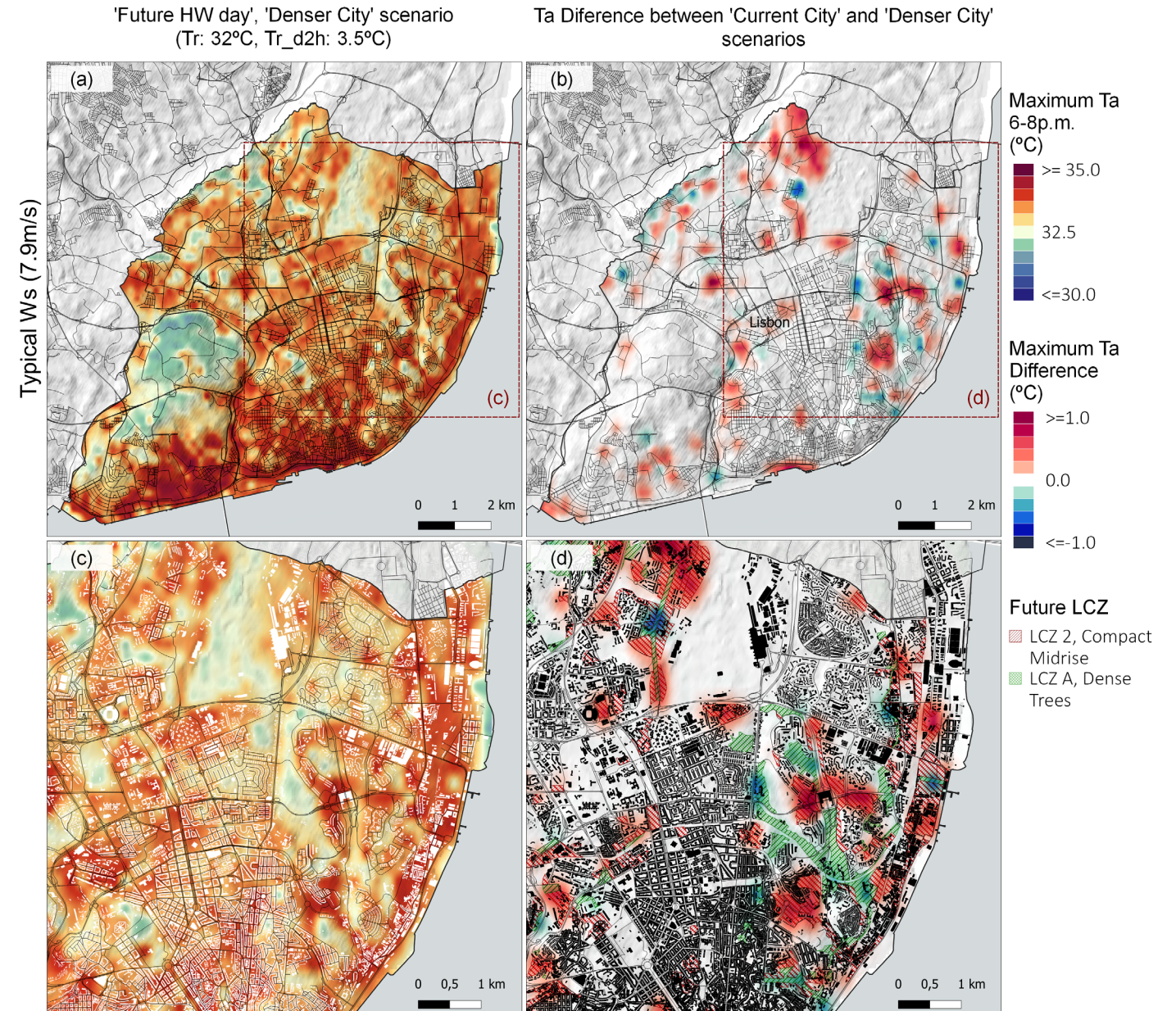
How much cooler/warmer a neighbourhood is, compared to the long-term average climate?



How extreme is the heat (cold) in a given neighbourhood, compared to the local temperature range?

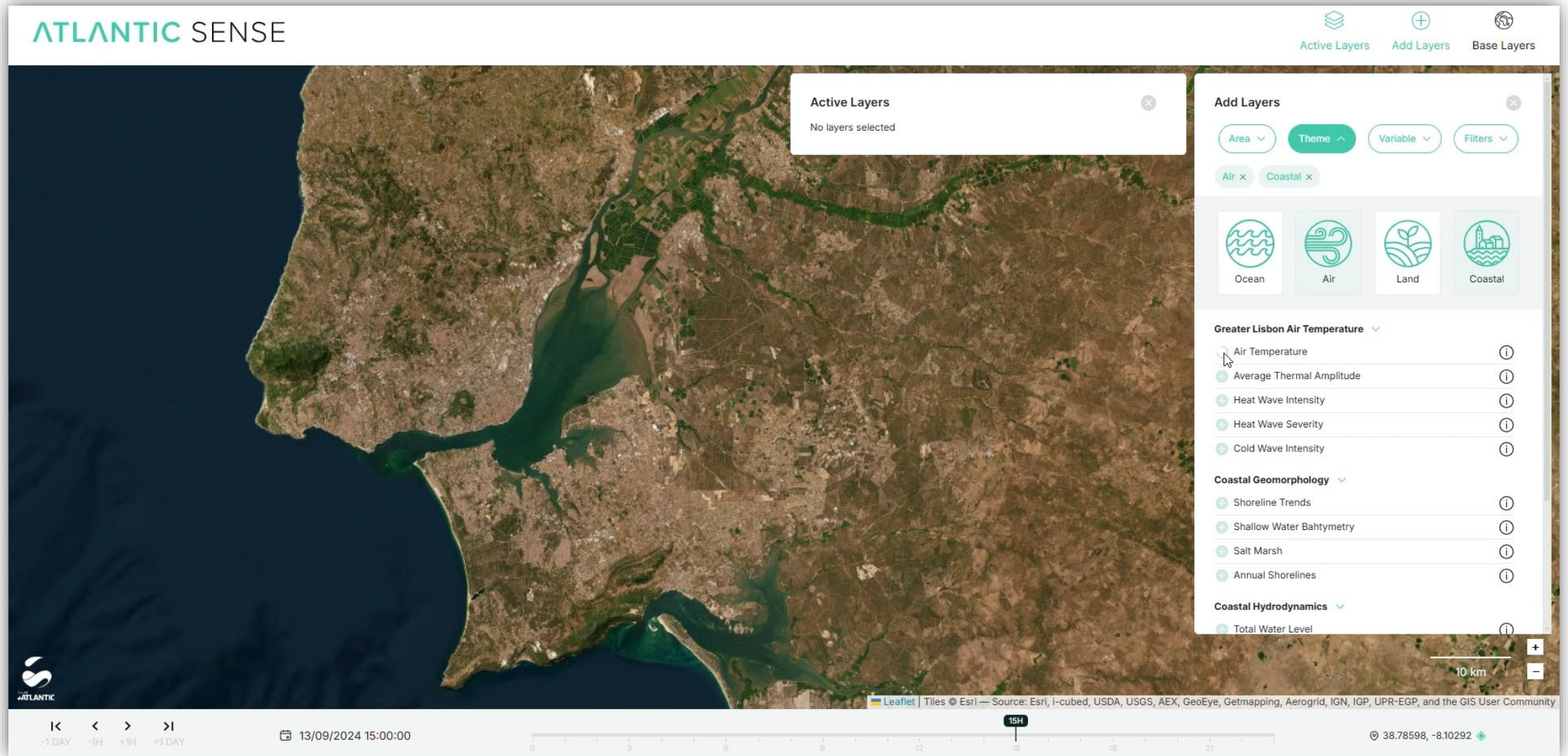


Which are the cooling (heating) acclimatization needs, in each neighbourhood?



AI for cities makes SENSE

BECAUSE we need to **comprehend interactions** in order to prevent the impact of **multi-hazard risks!**





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