European Weather Cloud (EWC) User Workshop
2025

Local insights, global impact: Optimizing Weather Resources from Climate Zones to Extreme Events in Europe

CoLAB +ATLANTIC

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on behalf of the CoLAB +ATLANTIC team

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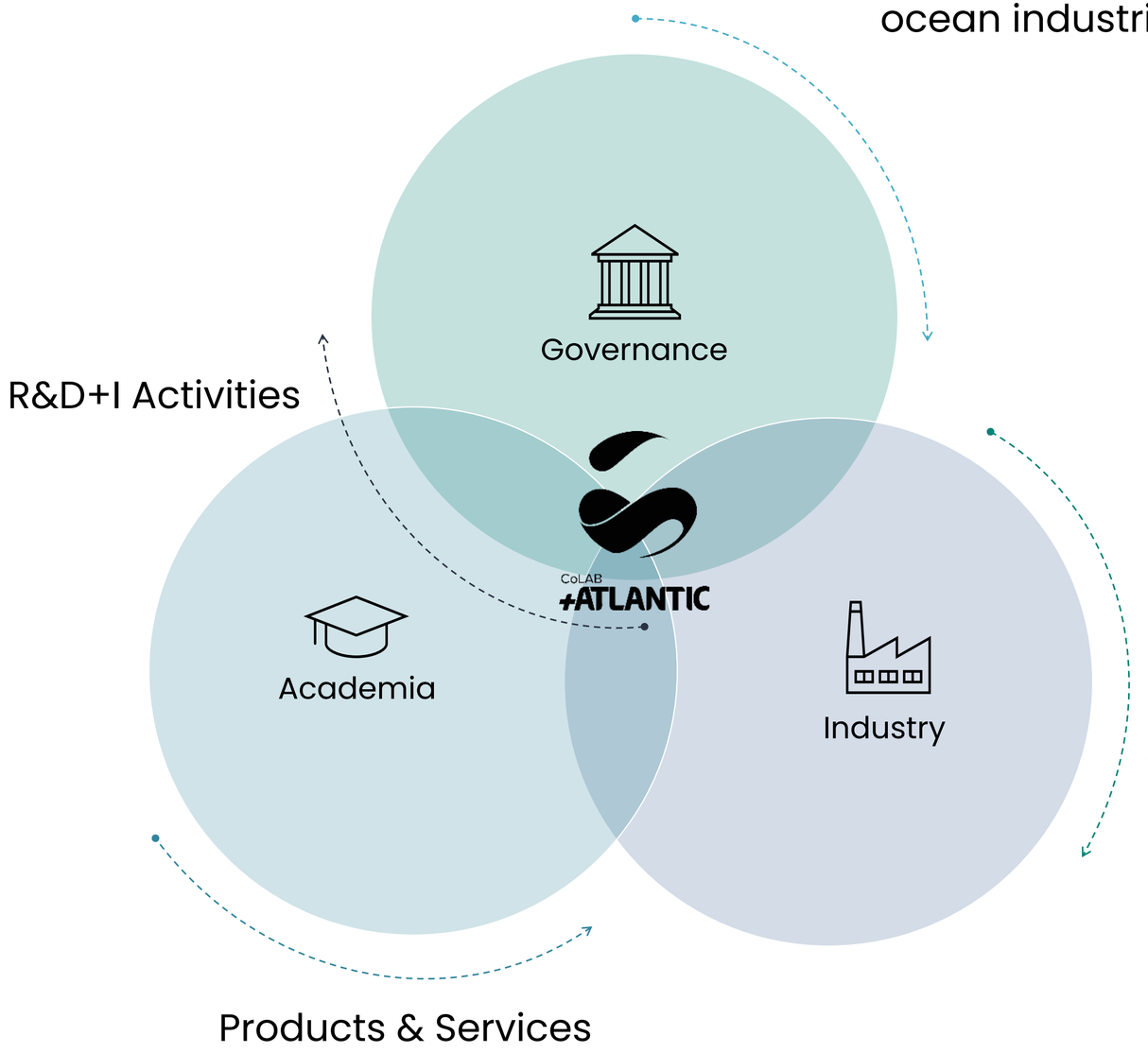
ABOUT

WHO IS +ATLANTIC?

Complementary R&D+I to bring innovative solutions to forefront ocean industries



Aquaculture & Fisheries

- Growth optimisation
- Biometric monitoring
- Environmental monitoring
- Feed optimisation

Blue Economy Consultancy

- Stakeholder engagement & user requirements
- Science communication
- Regulatory support
- Ocean literacy

Atlantic SENSE

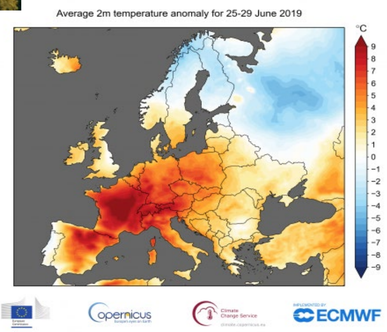
Geospatial Information for Climate Resilience and Environmental Monitoring

- Ocean and estuaries
- Coastal hazards
- Climate and land
- Data Visualisation

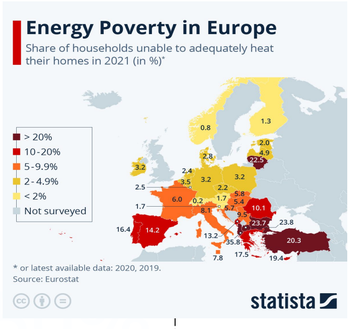
- **Local Climate Zones**
- **Temperature ML Model**

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.

Climate Change Prospects



Energy Poverty



Ageing Population

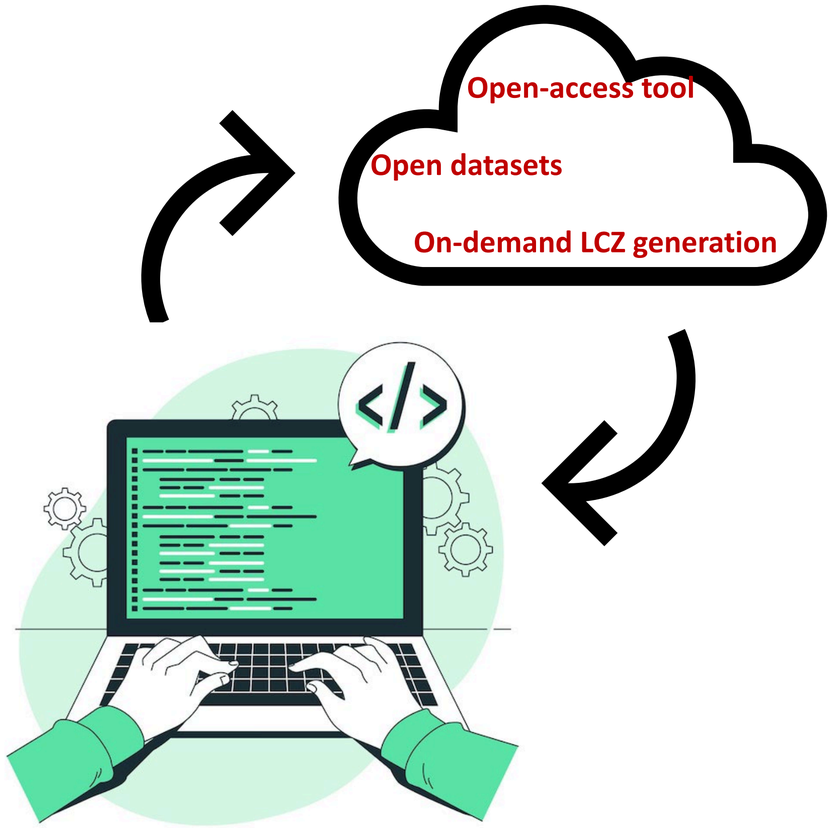
CLIM4cities wants to contribute towards cost-effective Integrated Urban Climate and Weather Component (for Local Digital Twins)

Efficient	Reliable	Meaningful
• Minutes to run daily or sub-daily, instead of hours • MB of data to be stored from each run, instead of GB	• Improved accuracy compared to the NWP • Sustained accuracy during temperature extremes	• Detailed enough to disclose contrasts between neighbourhoods • Broad coverage to support metropolitan adaptation plans and spatial planning

Local Climate Zones

Built types	Definition	Land cover types	Definition
1. Compact high-rise	Dense mix of tall buildings to tens of stories. Few or no trees. Land cover mostly paved. Concrete, steel, stone, and glass construction materials.	A. Dense trees	Heavily wooded landscape of deciduous and/or evergreen trees. Land cover mostly pervious (low plants). Zone function is natural forest, tree cultivation, or urban park.
2. Compact midrise	Dense mix of midrise buildings (3–9 stories). Few or no trees. Land cover mostly paved. Stone, brick, tile, and concrete construction materials.	B. Scattered trees	Lightly wooded landscape of deciduous and/or evergreen trees. Land cover mostly pervious (low plants). Zone function is natural forest, tree cultivation, or urban park.
3. Compact low-rise	Dense mix of low-rise buildings (1–3 stories). Few or no trees. Land cover mostly paved. Stone, brick, tile, and concrete construction materials.	C. Bush, scrub	Open arrangement of bushes, shrubs, and short, woody trees. Land cover mostly pervious (bare soil or sand). Zone function is natural scrubland or agriculture.
4. Open high-rise	Open arrangement of tall buildings to tens of stories. Abundance of pervious land cover (low plants, scattered trees). Concrete, steel, stone, and glass construction materials.	D. Low plants	Featureless landscape of grass or herbaceous plants/crops. Few or no trees. Zone function is natural grassland, agriculture, or urban park.
5. Open midrise	Open arrangement of midrise buildings (3–9 stories). Abundance of pervious land cover (low plants, scattered trees). Concrete, steel, stone, and glass construction materials.	E. Bare rock or paved	Featureless landscape of rock or paved cover. Few or no trees or plants. Zone function is natural desert (rock) or urban transportation.
6. Open low-rise	Open arrangement of low-rise buildings (1–3 stories). Abundance of pervious land cover (low plants, scattered trees). Wood, brick, stone, tile, and concrete construction materials.	F. Bare soil or sand	Featureless landscape of soil or sand cover. Few or no trees or plants. Zone function is natural desert or agriculture.
7. Lightweight low-rise	Dense mix of single-story buildings. Few or no trees. Land cover mostly hard-packed. Lightweight construction materials (e.g., wood, thatch, corrugated metal).	G. Water	Large, open water bodies such as seas and lakes, or small bodies such as rivers, reservoirs, and lagoons.
8. Large low-rise	Open arrangement of large low-rise buildings (1–3 stories). Few or no trees. Land cover mostly paved. Steel, concrete, metal, and stone construction materials.	**VARIABLE LAND COVER PROPERTIES**	Variable or ephemeral land cover properties that change significantly with synoptic weather patterns, agricultural practices, and/or seasonal cycles.
9. Sparsely built	Sparse arrangement of small or medium-sized buildings in a natural setting. Abundance of pervious land cover (low plants, scattered trees).	*b. bare trees*	Leafless deciduous trees (e.g., winter). Increased sky view factor. Reduced albedo.
		s. snow cover	Snow cover >10 cm in depth. Low admittance. High albedo.
10. Heavy industry	Low-rise and midrise industrial structures (towers, tanks, stacks). Few or no trees. Land cover mostly paved or hard-packed. Metal, steel, and concrete construction materials.	*d. dry ground*	Parched soil. Low admittance. Large Bowen ratio. Increased albedo.
		w. wet ground	Waterlogged soil. High admittance. Small Bowen ratio. Reduced albedo.

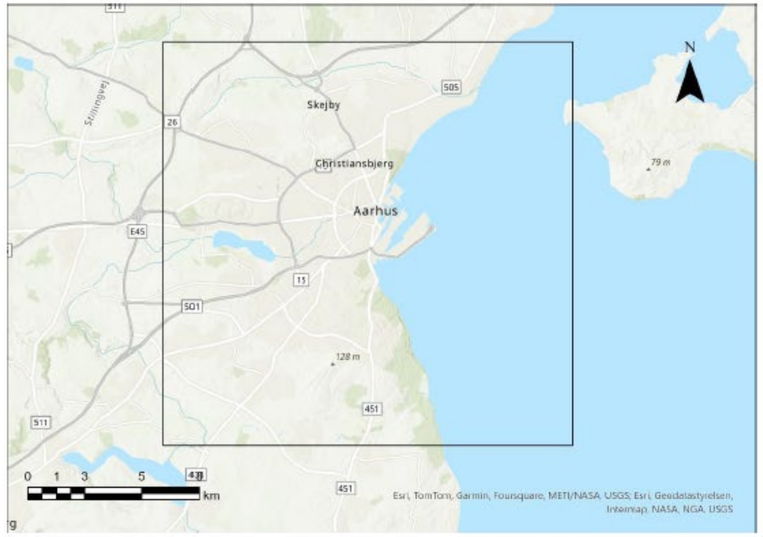
Source: Stewart & Oke, 2012



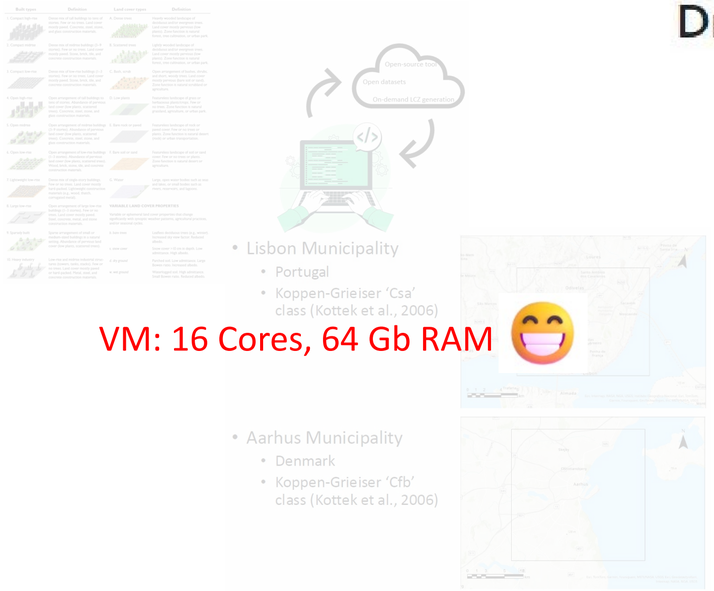
Local Climate Zones

- Lisbon Municipality
  - Portugal
  - Koppen-Grieiser ‘Csa’ class (Kottek et al., 2006)

- Aarhus Municipality
  - Denmark
  - Koppen-Grieiser ‘Cfb’ class (Kottek et al., 2006)



Local Climate Zones Web-based Tool



VM: 16 Cores, 64 Gb RAM 😁

Bruno Marques

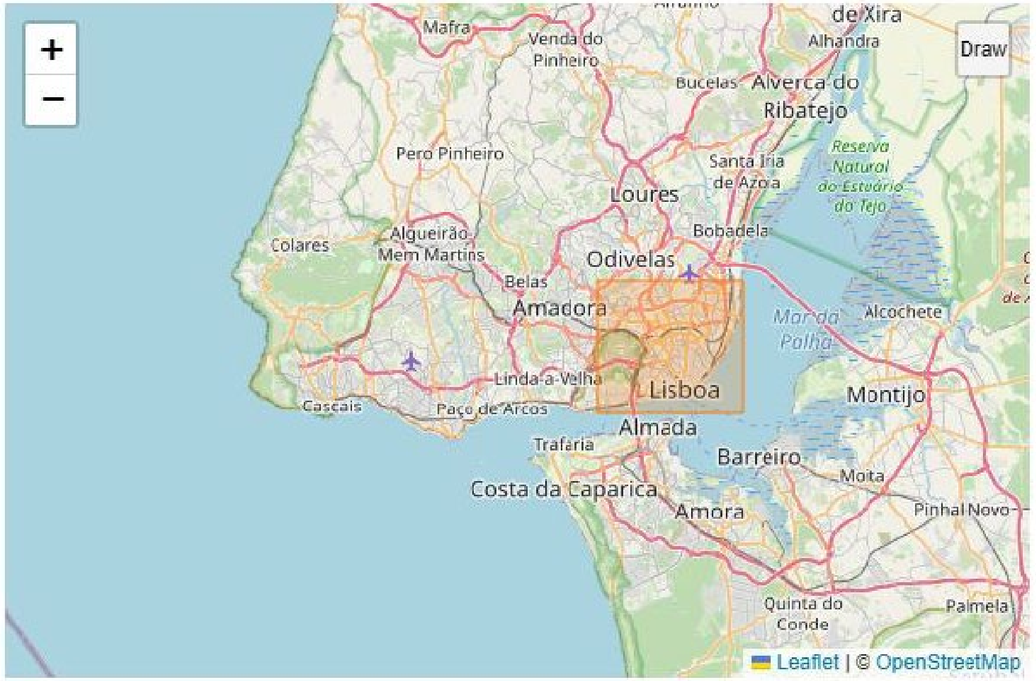
Master's theses: [RUN: Local Climate Zone Classification System Using Web GIS Approach]

bruno.marques@colabatlantic.com

Check generated LCZ classifications

LCZC Generator

Draw the area in which you want to generate Local Climate Zones



Email

☐ Include tree types (Deciduous or Coniferous)

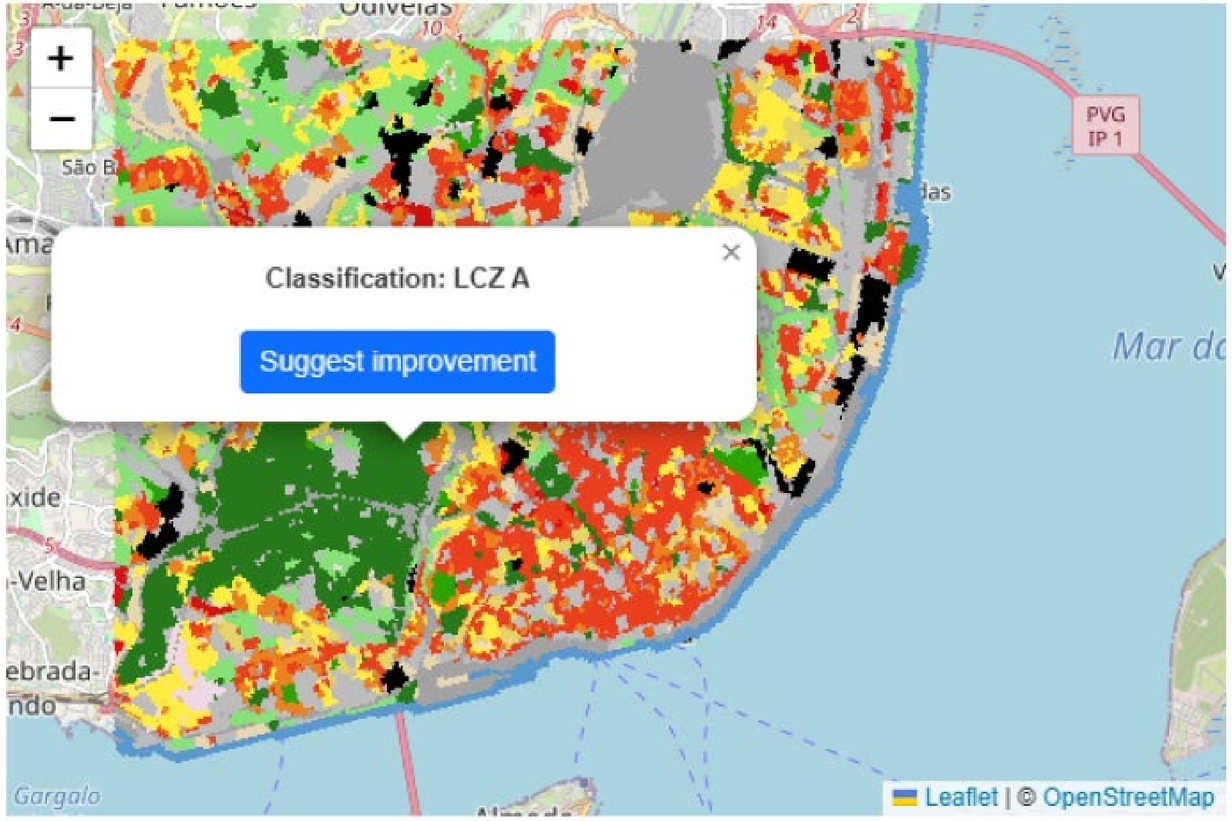
☐ I accept the Privacy Policy

Generate LCZ

Local Climate Zones Web-based Tool

LCZC Generator - Viewer

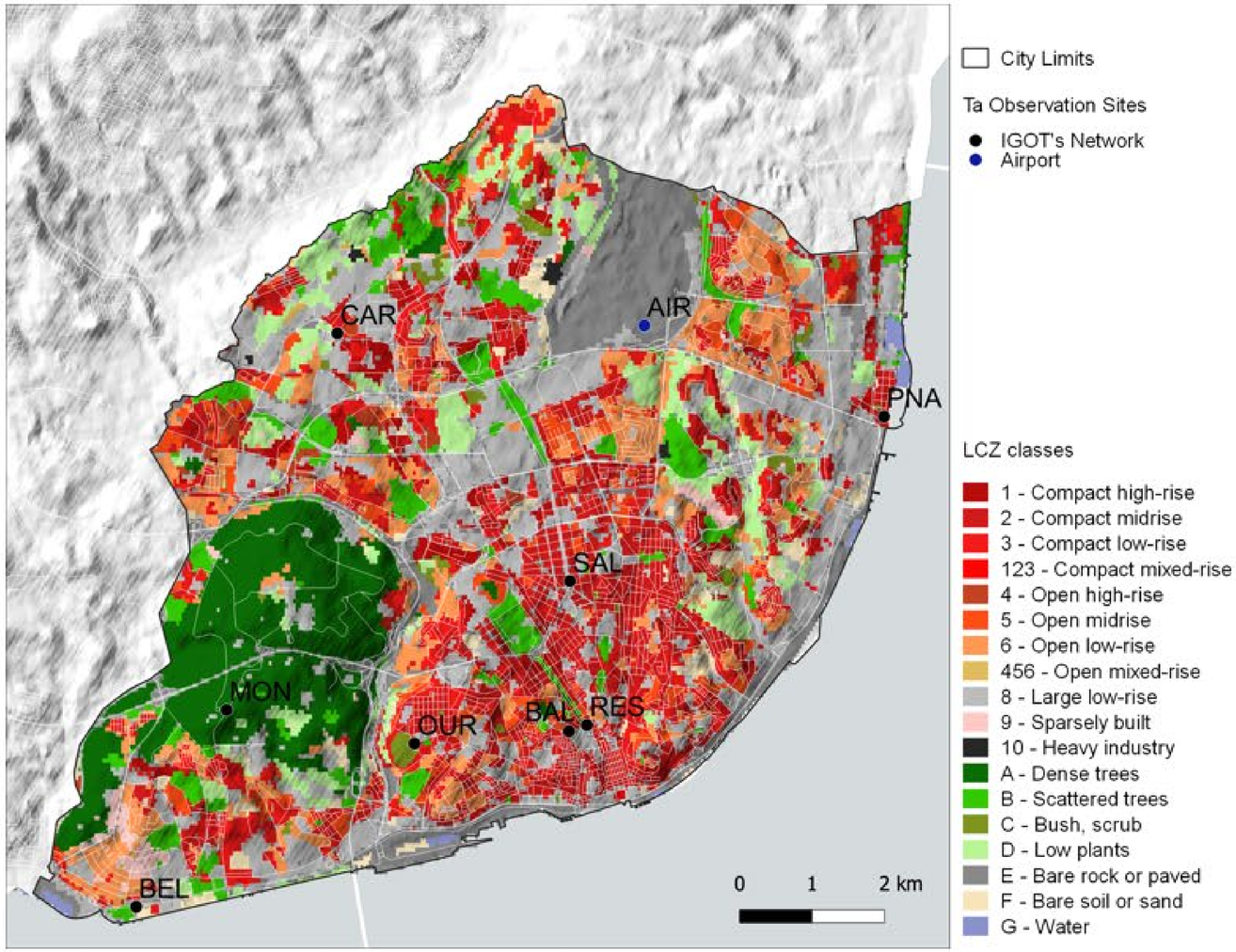
Download dataset

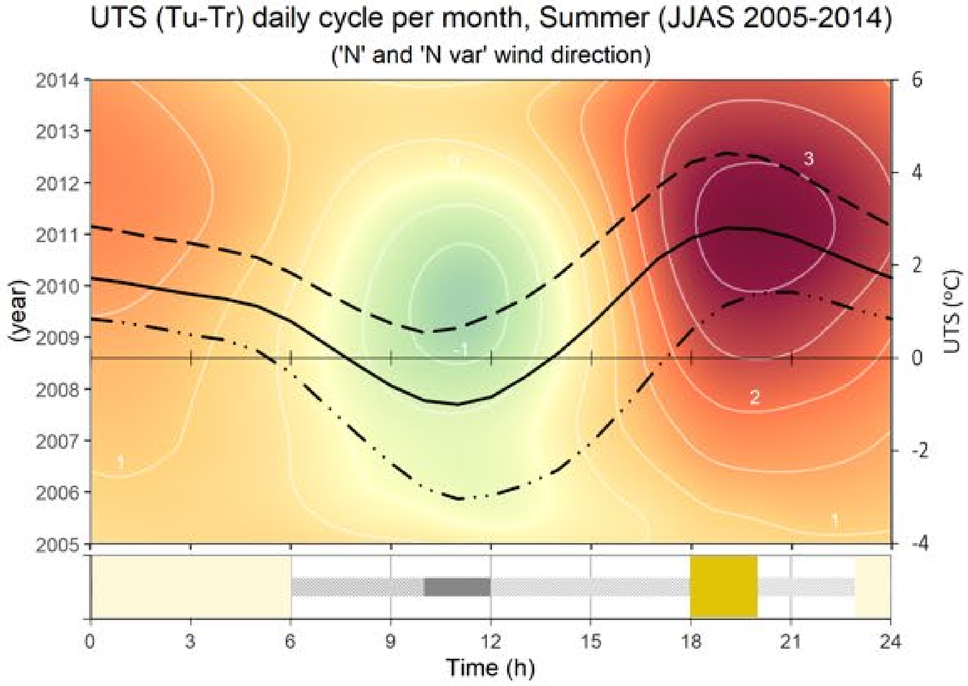


- LCZ 1: Compact high-rise
- LCZ 123: Compact mix-rise
- LCZ 2: Compact midrise
- LCZ 3: Compact low-rise
- LCZ 4: Open high-rise
- LCZ 456: Open mix-rise
- LCZ 5: Open midrise
- LCZ 6: Open low-rise
- LCZ 8: Large low-rise
- LCZ 9: Sparsely build
- LCZ 10: Heavy industry
- LCZ A: Dense trees
- LCZ B: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

LCZC Generator

Temperature ML Model



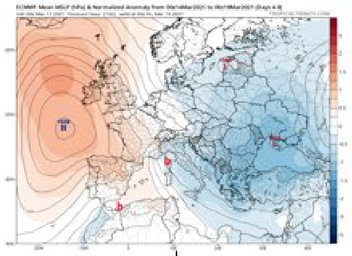


	UTS daily cycle stages	UTS signal
1	1. Nocturnal stable UHI	Positive
2	2. Morning transition to UCI	Positive to negative transition
3	3. Diurnal Peak UCI	Negative
4	4. Afternoon transition to UHI	Negative to positive transition
5	5. Late Afternoon peak UHI	Positive
6	6. Evening stabilizing UHI	Positive

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

Temperature ML Model

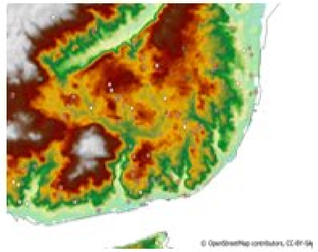
=



BACKGROUND CONDITIONS:

AROME T2m
MSLP
RH
Wind U/V

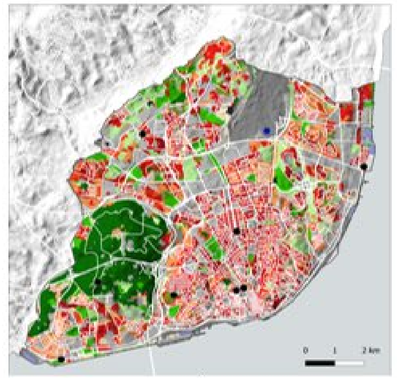
+



LANDSCAPE EFFECTS:

Elevation
TOPEX (per wind U/V)
Lat/Lon
Coast/river distance

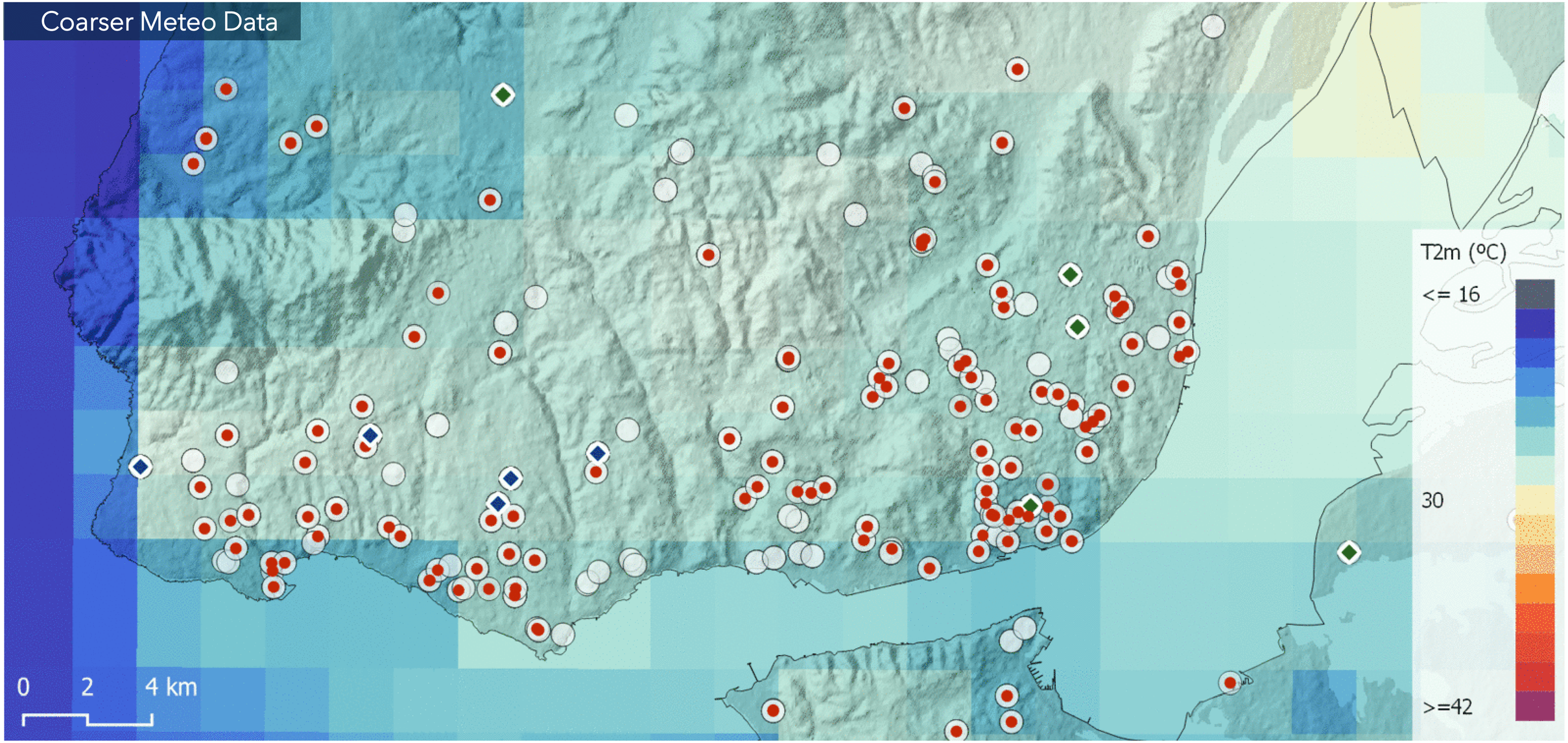
+



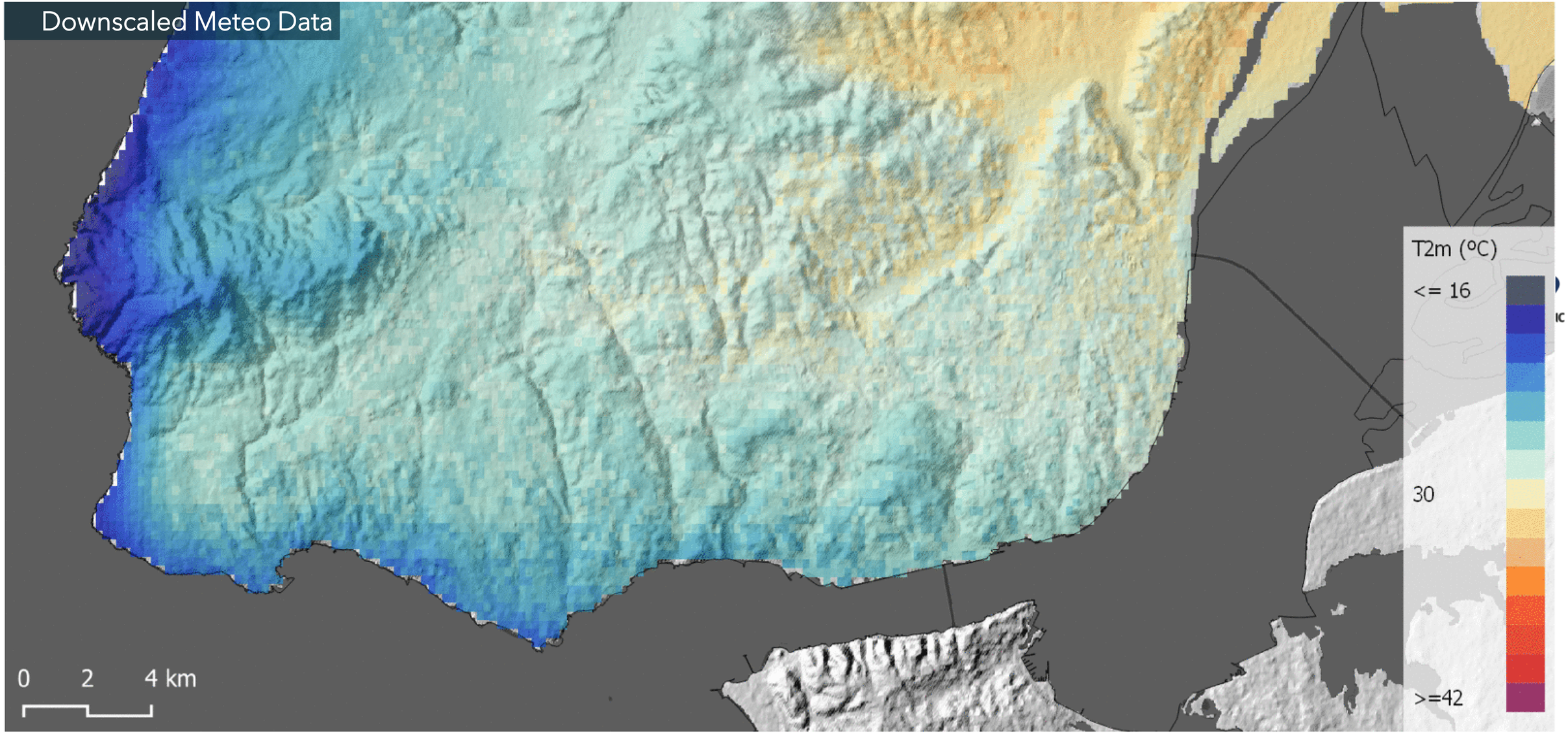
URBAN EFFECTS:

Bowen Ratio (QH/QE)
Imperviousness
Tree-cover percentage

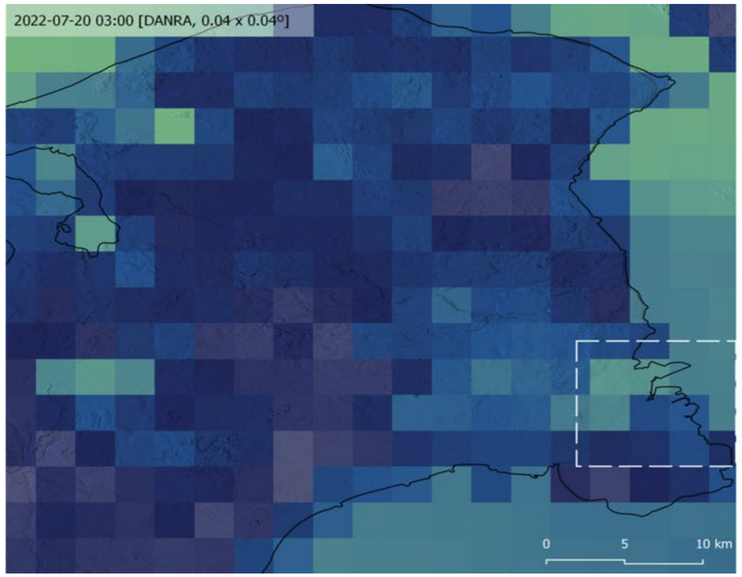
Temperature ML Model

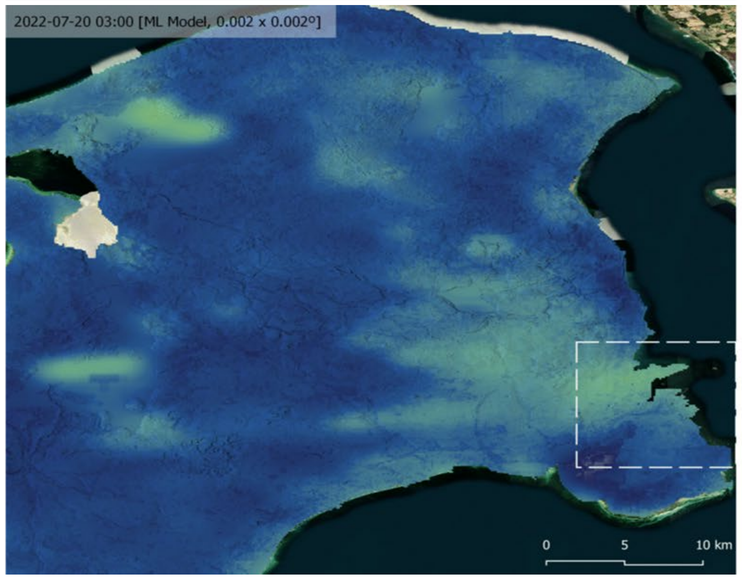


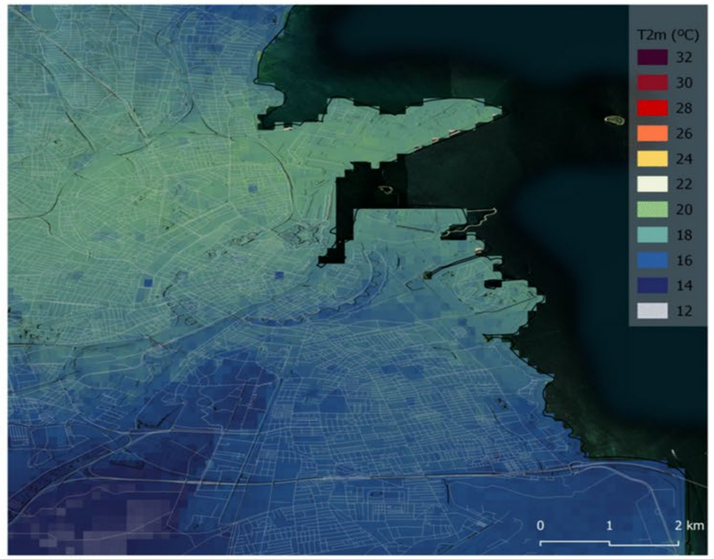
Temperature ML Model



Temperature ML Model

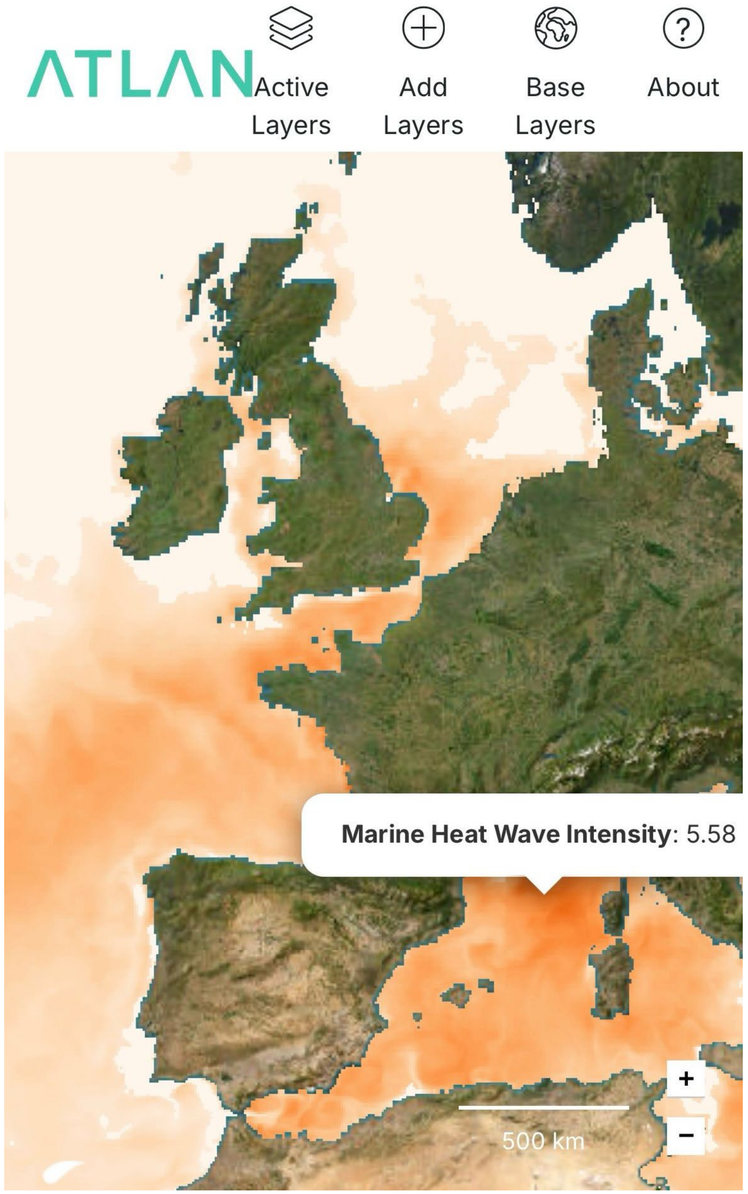




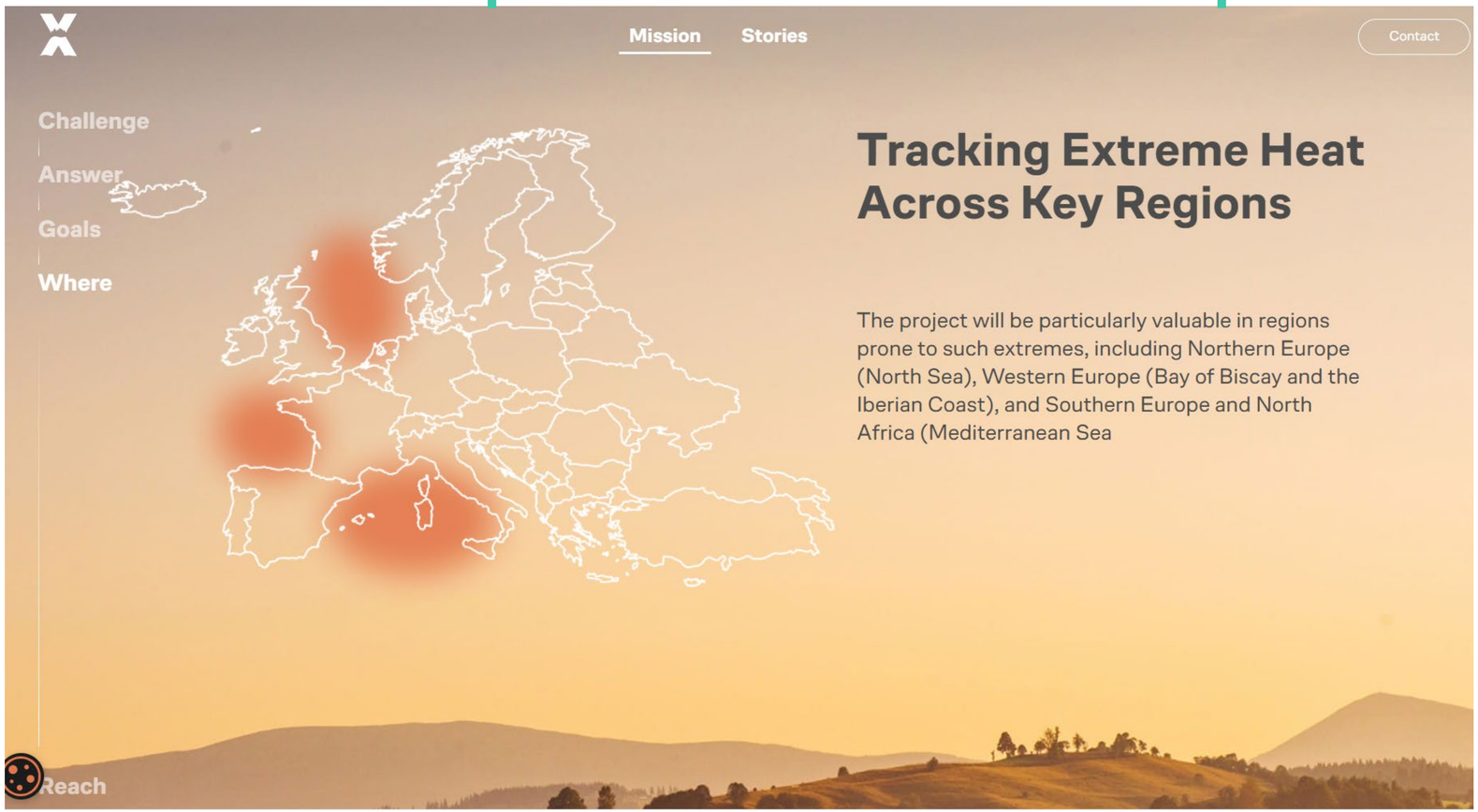


Implementation of the air temperature ML model in Denmark: (a) available citizen-owned stations, (b) DANRA reanalysis with 4km resolution, (c) downscaled forecasts to 200m grid. These results are now under fine-tuning and validation, in the scope of ESA CLIM4cities.

Marine heatwaves and their impacts



XHEAT Disentangling the teleconnections leading to compound eXtreme HEAT in Europe

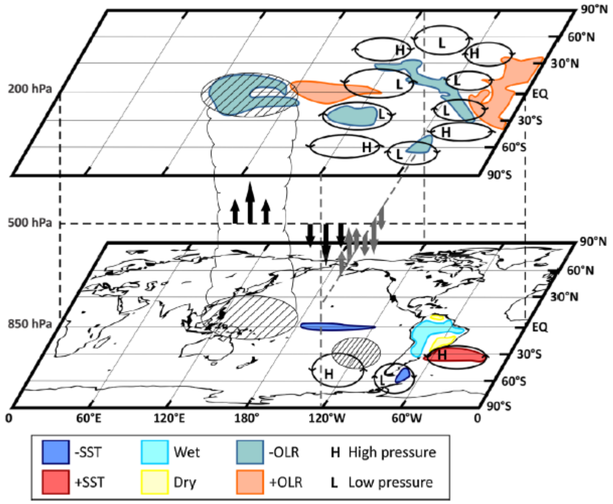


XHEAT Norwegian Meteorological Institute CNR ISMAR CoLAB +ATLANTIC esa

XHEAT 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.

Marine heat waves and their impacts

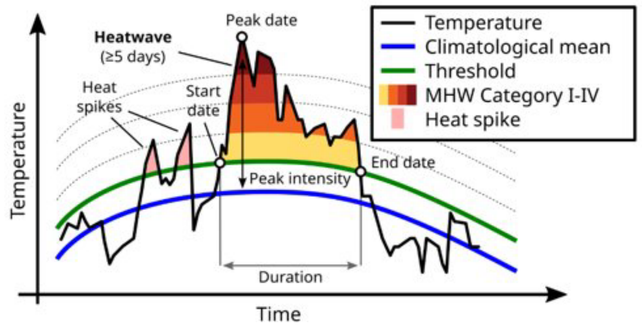
Teleconnection



Source: Coelho et. al., 2014

- Spearman Rank Correlation
- Granger Causality
- Atmosphere Circulation

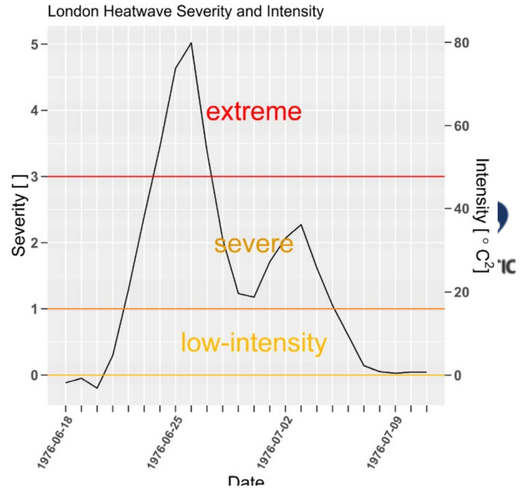
Marine Heat Waves



Hobday, 2016

- Prolonged discrete anomalously warm water events (> 5 days)
- Sea Surface Temperature exceeding the 90th percentile of the climatology

Excess Heat Factor

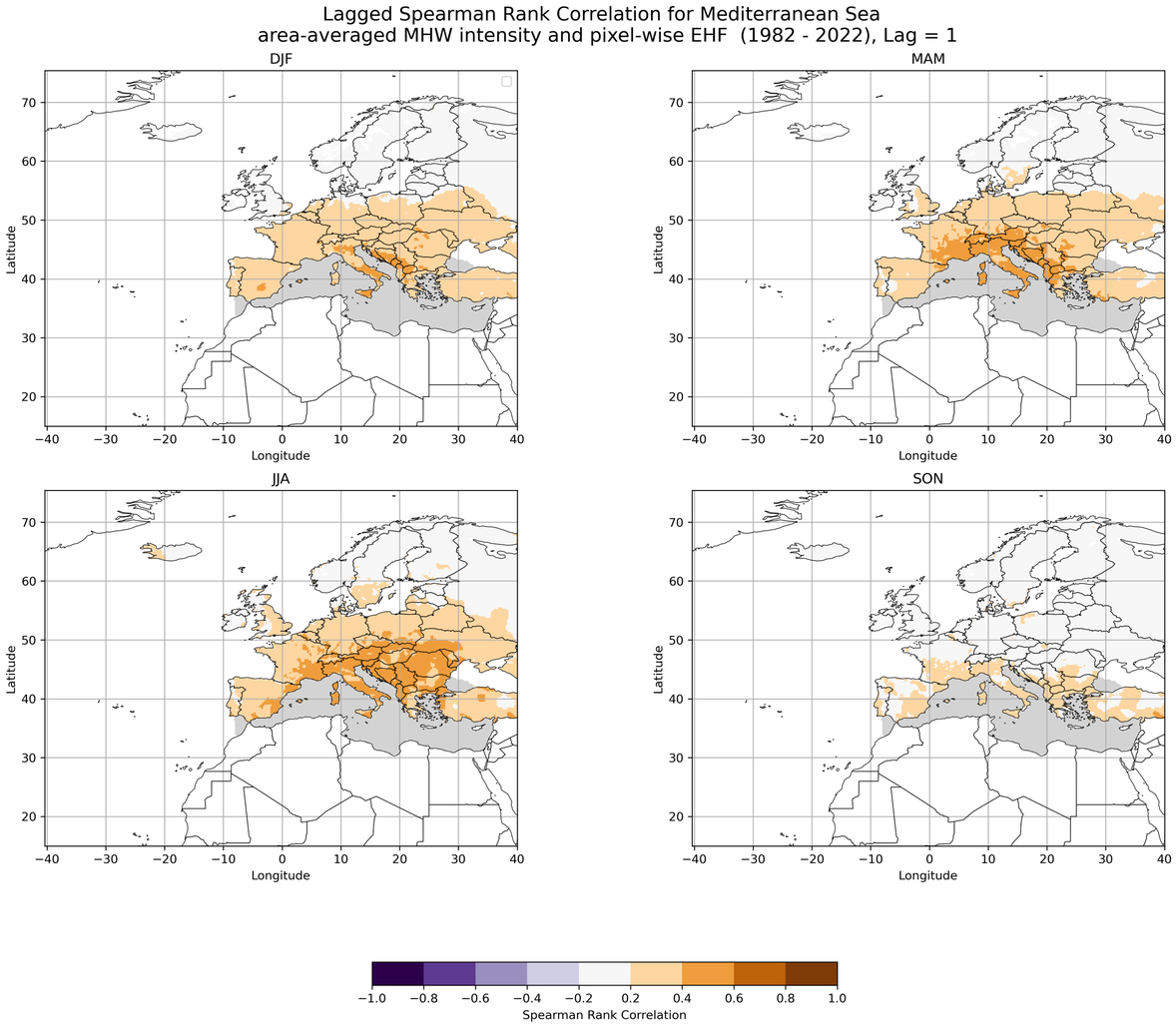


Naim et. al., 2018

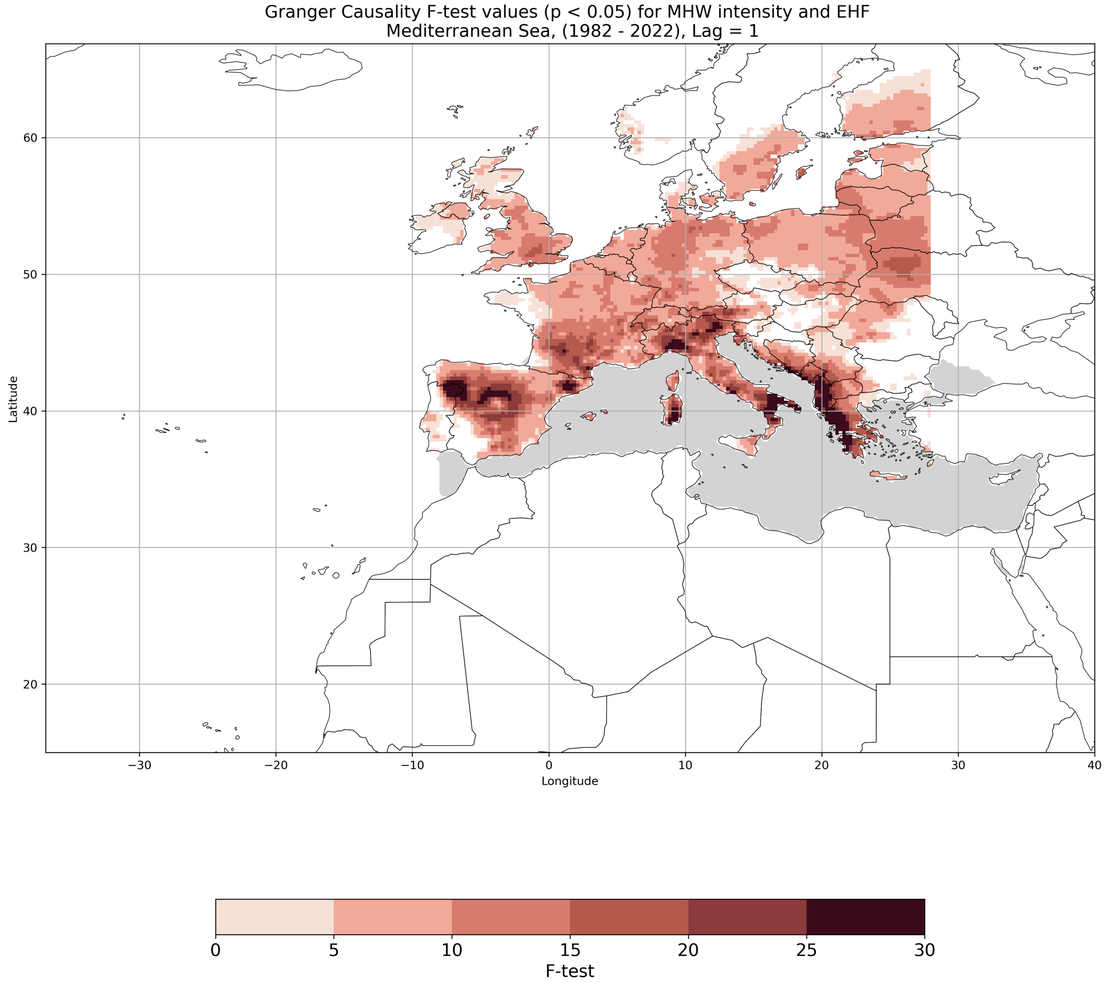
- anomalously warm consecutive days
- 2-m temperatures warmer than the 90th percentile of the climatology

Marine Heat Waves and Excess Heat Factor - Mediterranean Sea

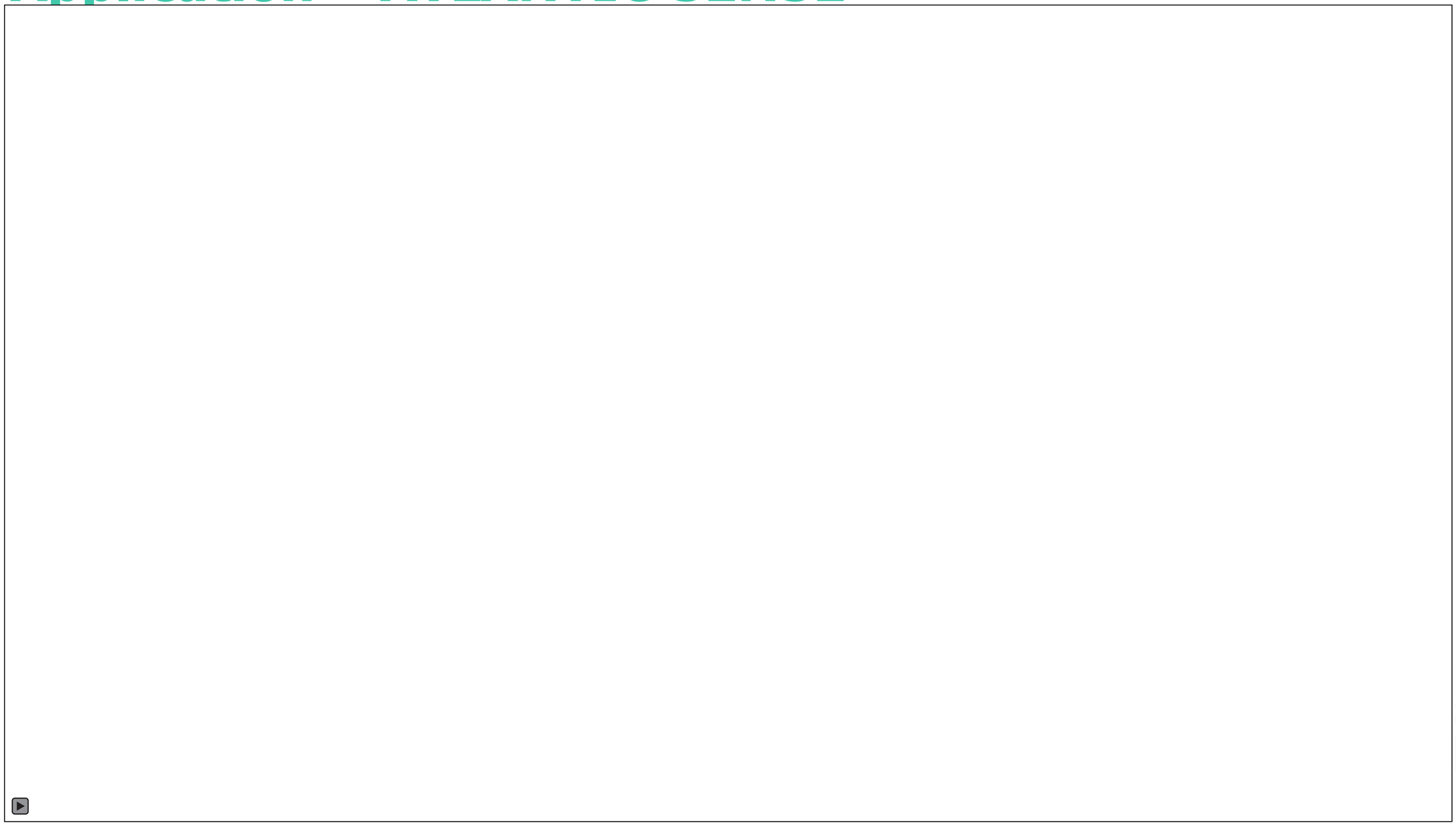
Lagged Spearman Rank Correlation



Granger Causality



Application – ATLANTIC SENSE



THANK YOU!

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André Brito

André Oliveira

Andreia Silva

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Bruno Marques

Caio Fonteles

Catarina Cecilio

Cintia Bonanad

Élio Pereira

Fabíola Silva

Francisco Campuzano

Inês Girão

Inês de Sousa Magusteiro

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PRR Plano de Recuperação e Resiliência

REPÚBLICA PORTUGUESA

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MI MISSÃO INTERFACE

ANI AGÊNCIA NACIONAL DE INOVAÇÃO