powered by esa in partnership with ADB

esa

Global Development Assistance

Climate Adaptation and Finance

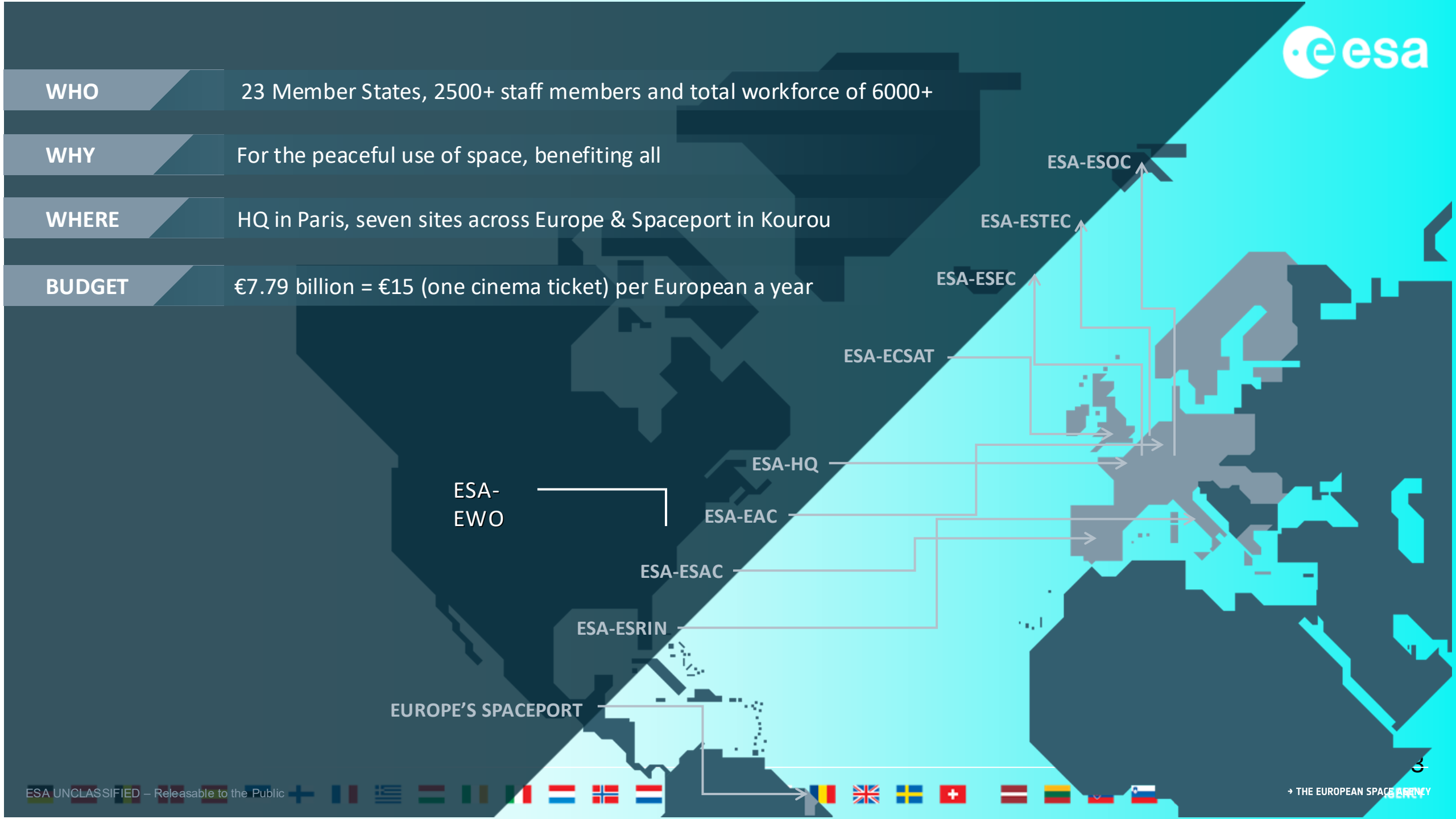
ESA

Urban Nature Network

Welcome and Introduction to ESA

Alex Chunet - ESA

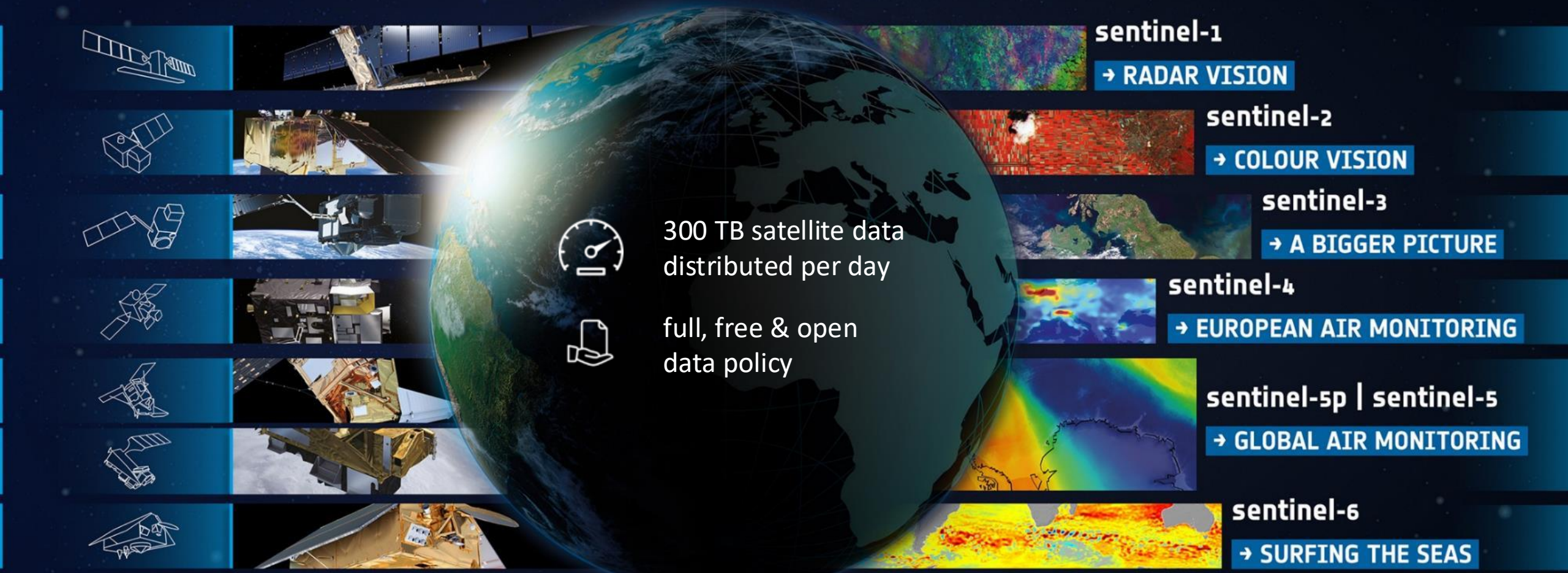
WHO	23 Member States, 2500+ staff members and total workforce of 6000+
WHY	For the peaceful use of space, benefiting all
WHERE	HQ in Paris, seven sites across Europe & Spaceport in Kourou
BUDGET	€7.79 billion = €15 (one cinema ticket) per European a year



Rich data of Copernicus at the fingertips of everyone

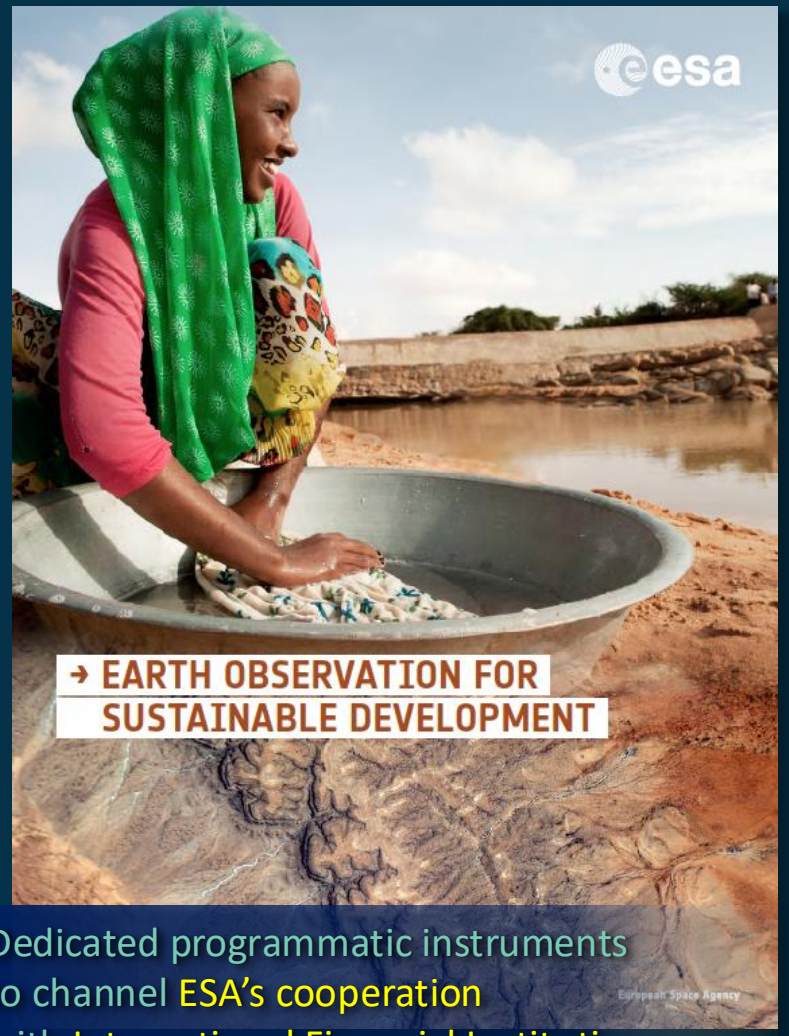
PROGRAMME OF THE EUROPEAN UNION

esa




esa
All global landmass is observed every 5 days at 10m resolution!
0 days 00 hours 00 minutes
Sentinel-2 constellation:
summer solstice

ESA EO programmes in support of Int. Development



Dedicated programmatic instruments
to channel ESA's cooperation
with International Financial Institutions

- **eoworld:** 2008-2015
  Small-scale demonstrations of EO services
  in support of IFI projects to **raise awareness**
- **EO4SD:** 2016-2024
  Consolidation of requirements and strategic engagement
  of development stakeholders to **build capacity** on EO services
- **GDA:** 2020-2027
  Mainstreaming of EO into development operations and financing,
  and **skills transfer** to IFI and client state stakeholders
- **GDA^{x}** within **Earth Action:** 2026 onwards

Water Resources
KO Feb'23

Clean Energy
KO Dec'22

Transport & Infrastructure
KO Jan'24

Agriculture
KO Sep'22

Forest Management
KO Sep'24

Marine Env. & Blue Economy
KO Jun'22

Public Health
KO Sep'24

Urban Sustainability
KO Feb'22

Fragility, Conflict & Security
KO Jan'22

Climate Resilience
KO Dec'21

Disaster Resilience
KO Sep'21

Climate Adaptation & Finance
KO Apr'25

GDA AID

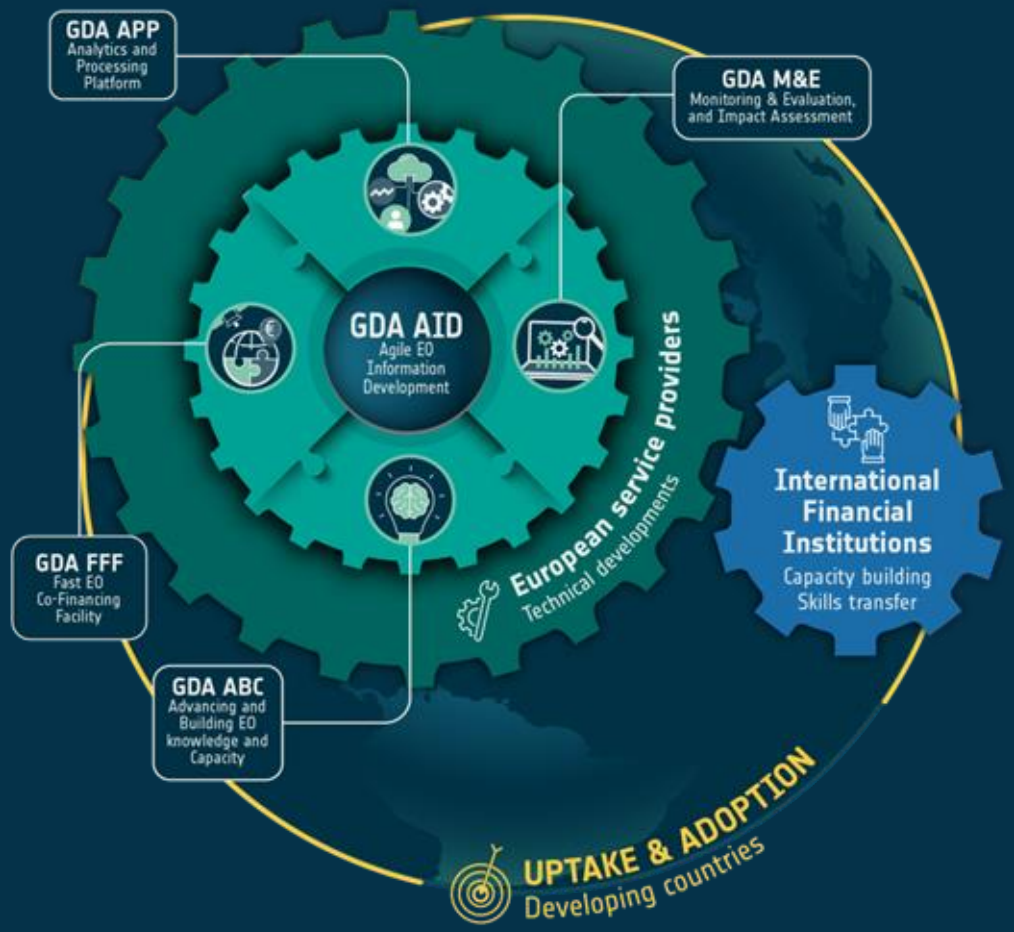
Agile EO Information Development

GDA Programme and Activity overview

#AcceleratingImpact

- ESA's Global Development Assistance (GDA) programme aims at supporting the integration of Earth Observation technologies in climate and development finance projects.

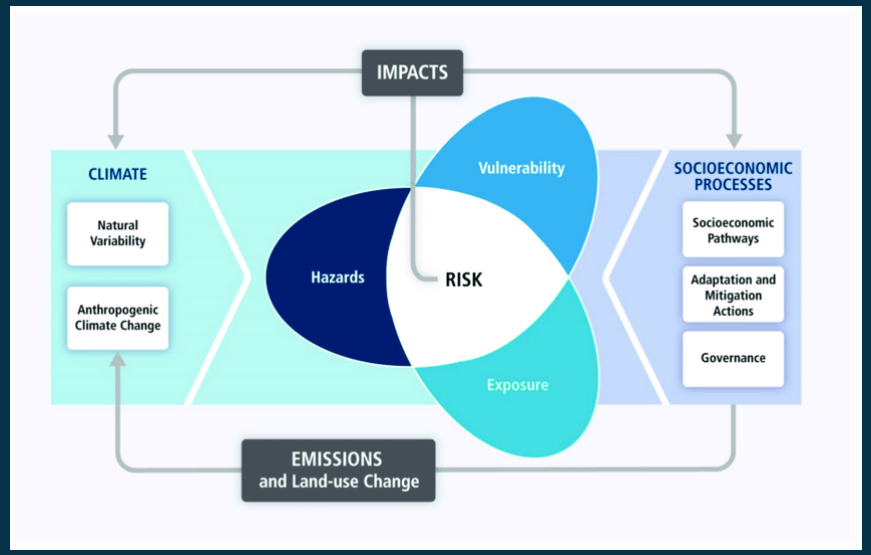
- The GDA AID Climate Adaptation & Finance collaborates with the climate funds and their implementing agencies on the integration of EO technologies both at strategic and project levels to tackle climate adaptation challenges.

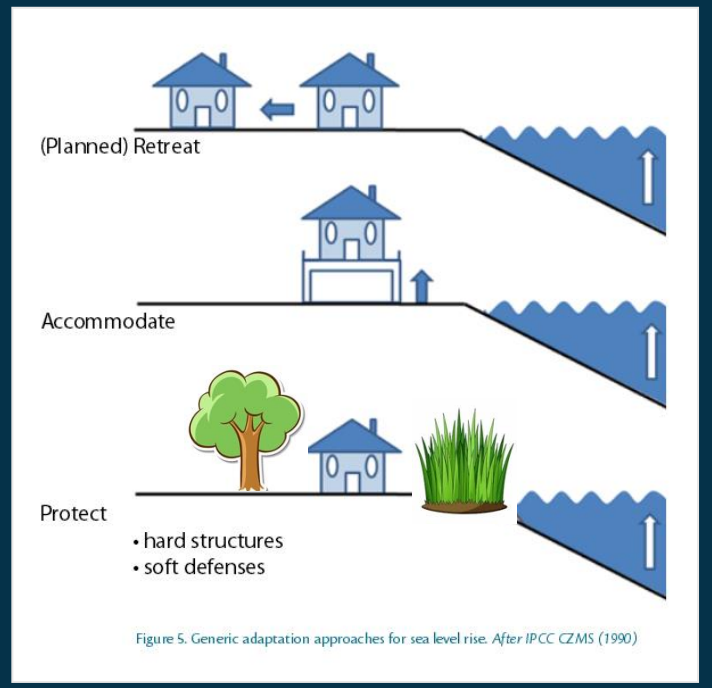


What sort of questions can EO help with?

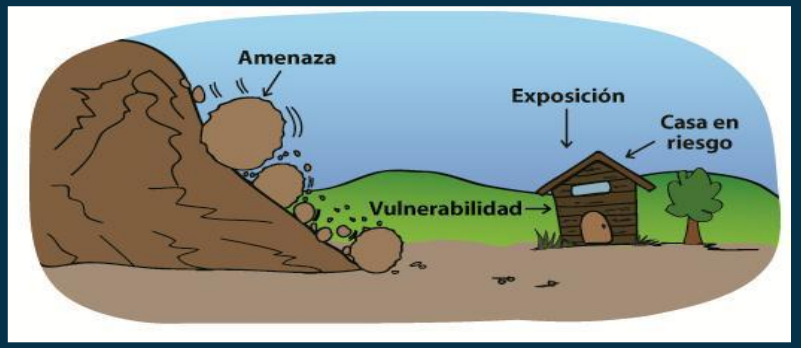
Efren Feliu Torres - Tecnalia

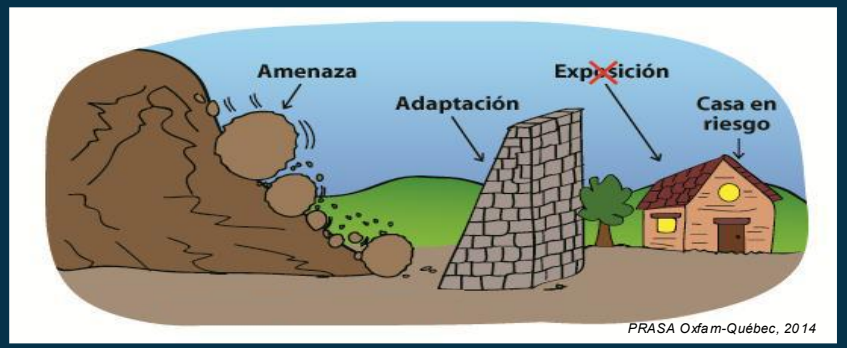
Climate Risks and Adaptation





Acute vs. chronic climate related risks
<u>Risks components</u> (IPCC):
hazard, exposure, vulnerability (sensitivity, adaptive capacity)





<u>Climate Change adaptation</u>
reduce EXPOSURE
reduce SENSITIVITY (vulnerability)
increase ADAPTIVE CAPACITY (vulnerability)

Earth Observation as input for climate risk analysis

Earth observation is a highly valuable resource for climate risk analysis.

Provide consistent, spatially detailed, and up-to-date **quantitative information that can support all risk components**.

Hazards

- flood-prone areas
- landslide-prone areas
- land surface temperatures
- coastal erosion and shoreline retreat caused by sea-level rise.
- drought conditions
- wildfire susceptibility

Exposure

- land use change
- urban expansion, informal settlements or rapidly growing urban areas
- location of critical infrastructure and facilities (hospitals, schools, power plants, and transport networks)
- industrial or commercial land use
- forest and agricultural areas

Earth Observation as input for climate risk analysis

Sensitivity

- building characteristics or infrastructure types
- roof materials and building heights
- infrastructure condition
- impervious surfaces
- vegetation loss
- ecosystems degradation

Adaptive Capacity

- green spaces, natural capital, and the presence of nature-based solutions
- urban green spaces, tree canopy cover, and cooling corridors
- wetlands, mangroves, and coastal vegetation
- water bodies and reservoirs condition
- implementation of nature-based solutions such as green roofs and permeable surfaces
- early warning systems through near-real-time monitoring of hazards and environmental conditions

Earth observation can deliver **objective**, **spatially explicit**, and **regularly updated** data that strengthen climate risk assessments and **support more informed urban adaptation and resilience planning**.

Earth Observation range of possibilities

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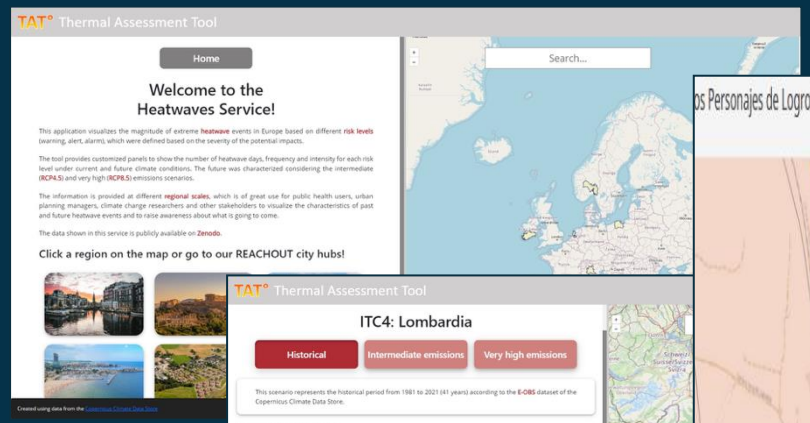
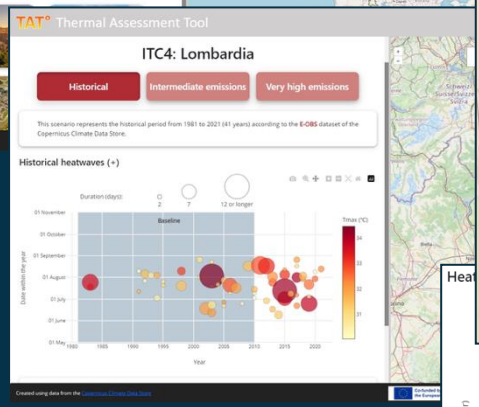
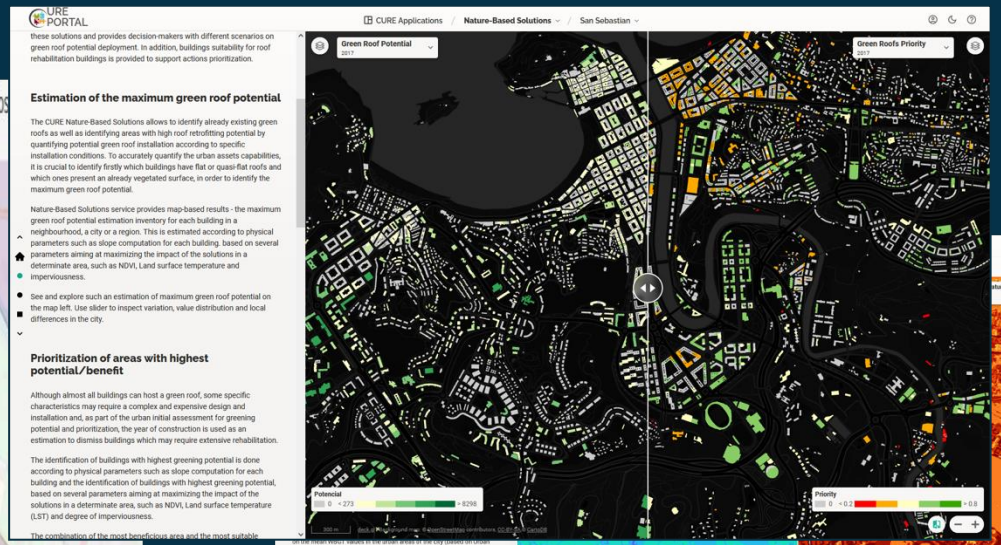
Single products (for risk analysis)

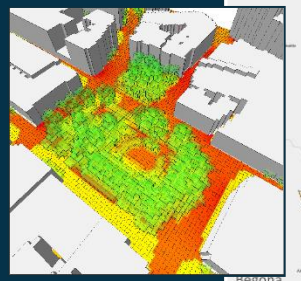
Combined sources (more complex analysis for adaptation)

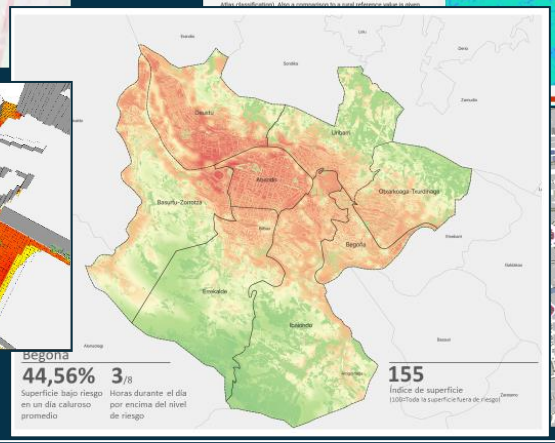


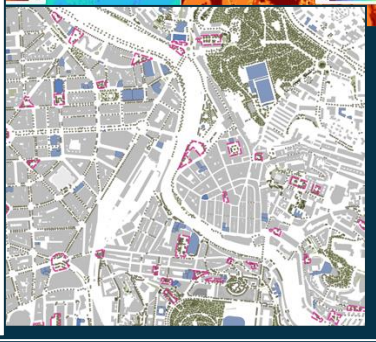


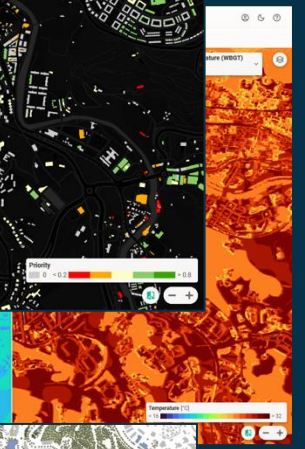
REACH OUT





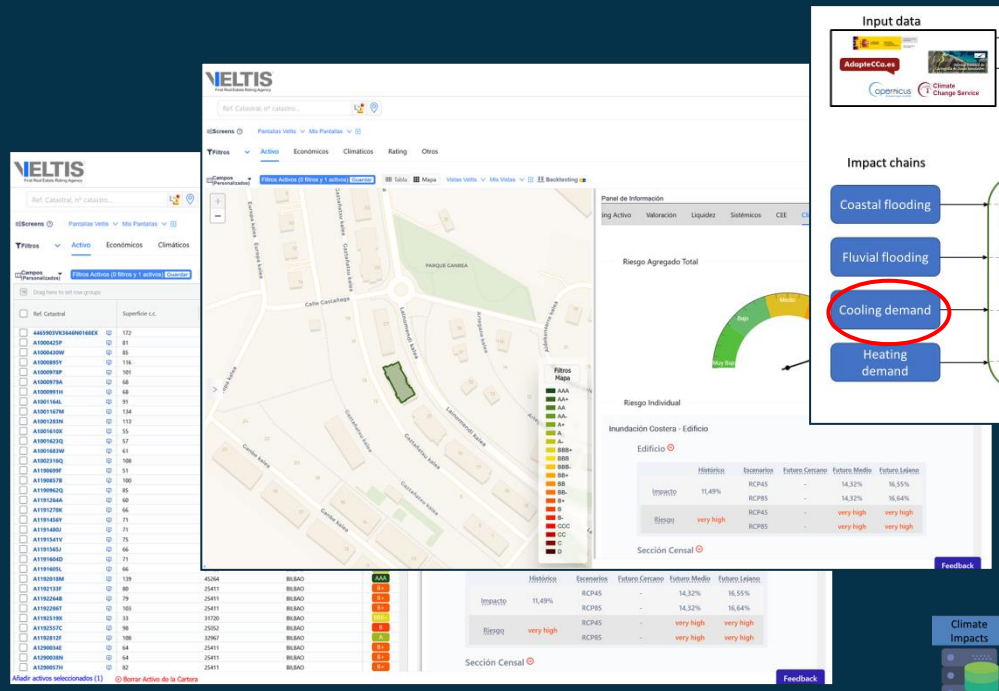


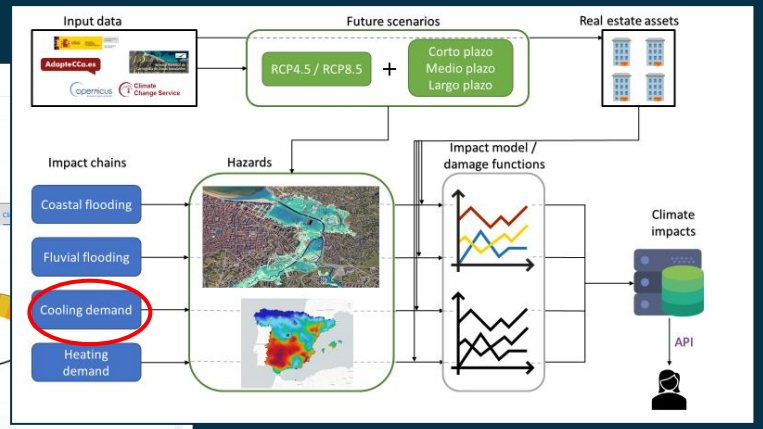


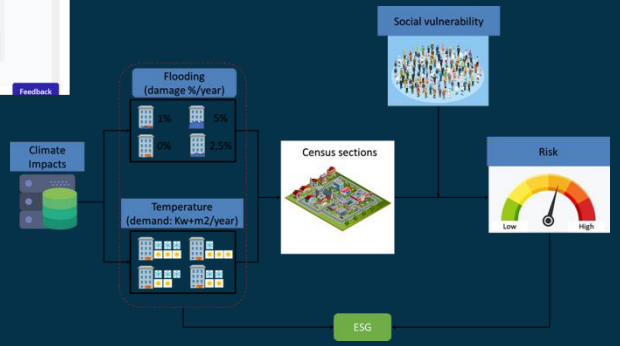


Scalability to territorial analysis

National products (ES)

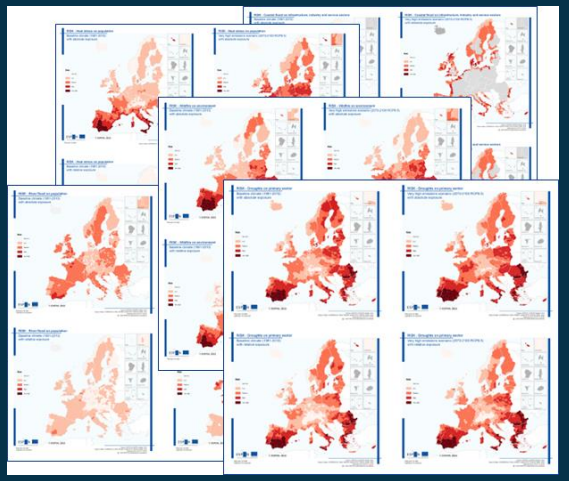


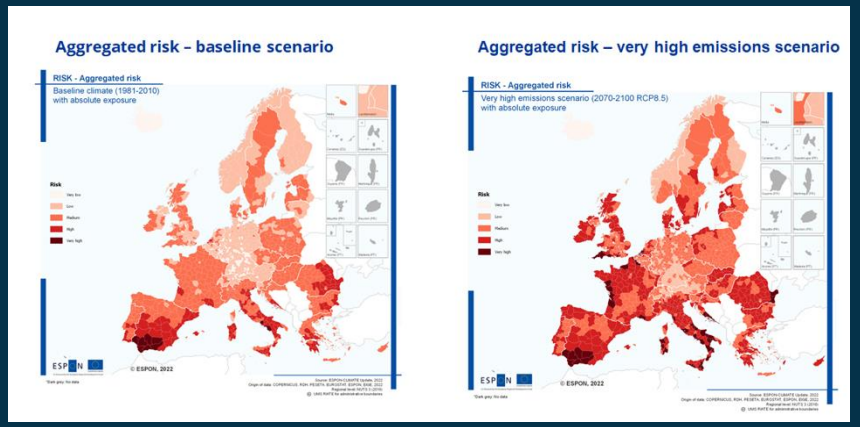




and potential regional scalability

ESPON Co-funded by the European Union





Considerations

- Potential of
  integration of earth observation with local/private data
  and **interoperability**

- Aim of developing **transferable-scalable workflows and applications,**
  for complex informed decision making (dynamic, scenarios, effectiveness, AI, etc.),
  with different resolution-qualities and complementary information

- At territorial scale
  allowing **benchmarking**
  while providing the required local analysis **granularity**

Case study 1: Modelling environmental benefits of new urban parks (Dakar, Senegal)

David Fletcher - UK Centre for Ecology & Hydrology

Dakar, Senegal

- Dakar Metropolitan area population approx. 4 million
- Dakar city proper population approx. 1.3 million

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- 47 administrative areas – communes

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- Review of urban green spaces

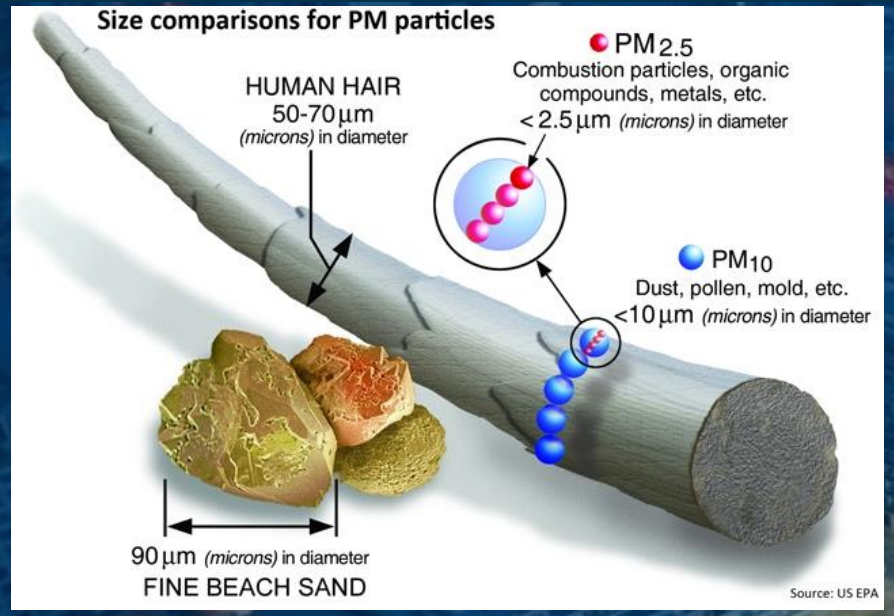
Dakar, Senegal

- Dakar Metropolitan area population approx. 4 million
- Dakar city proper population approx. 1.3 million
- 47 administrative areas – communes
- Review of urban green spaces
- Commitment to 55 new public green spaces across 13 communes
- Sizes range from ≈ 500 m^2 up to ≈ 26,000 m^2
- Desire to understand the health impacts of this additional green space

Understanding health impacts of adding green spaces

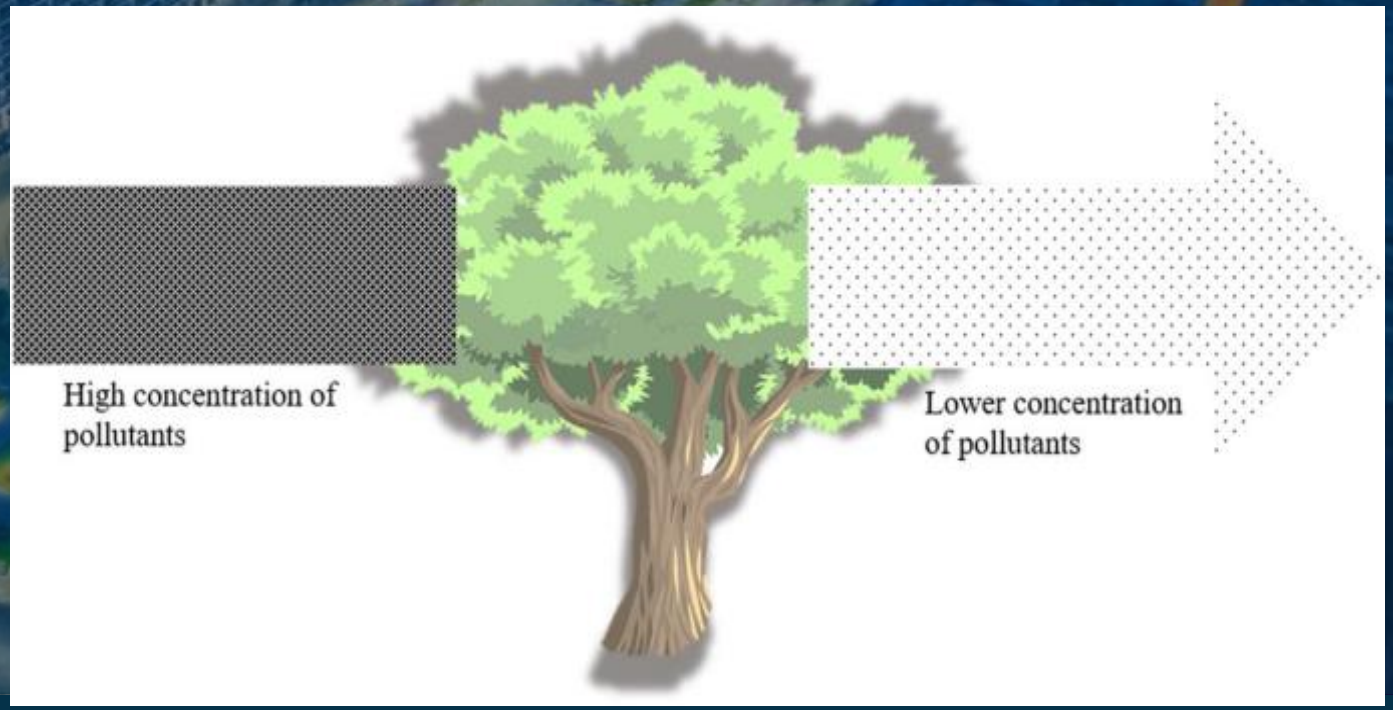
UKCEH
Our planet. Decoded.
esa

Green spaces and $PM_{2.5}$



$PM_{2.5}$ removal by vegetation:

- Vegetation structure acts like filter
- Removal largely by dry deposition
- Modest impact, but multifunctional

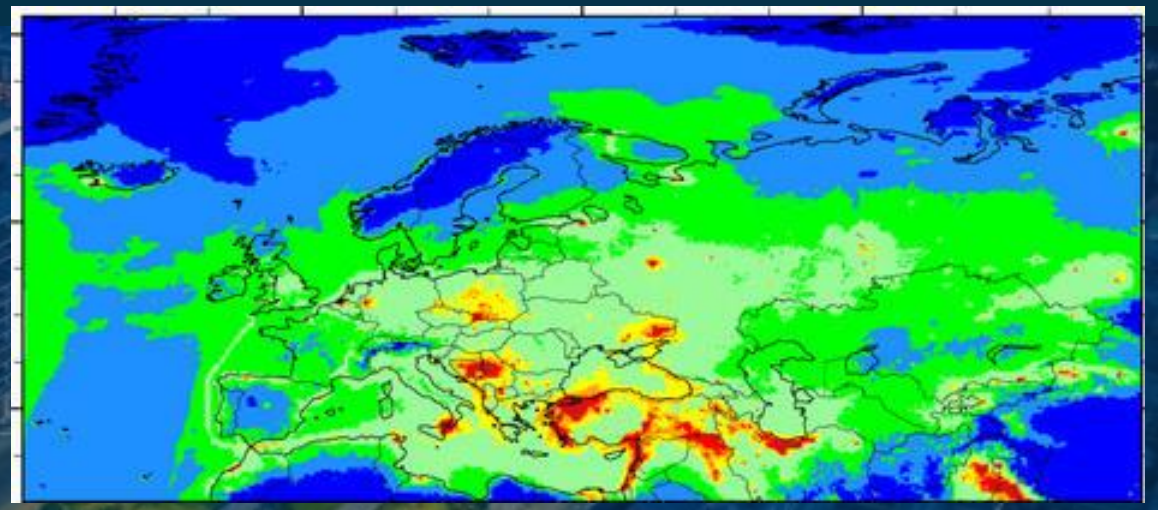


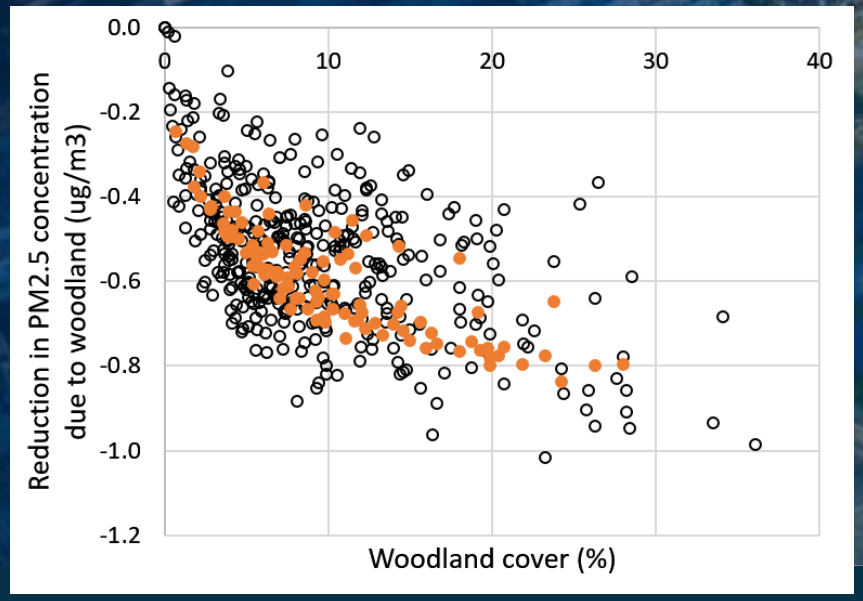
Demonstrated association between $PM_{2.5}$ and:

- Respiratory diseases
- Cardiovascular diseases
- Neurological disorders

Modelling $PM_{2.5}$ removal at a fine scale

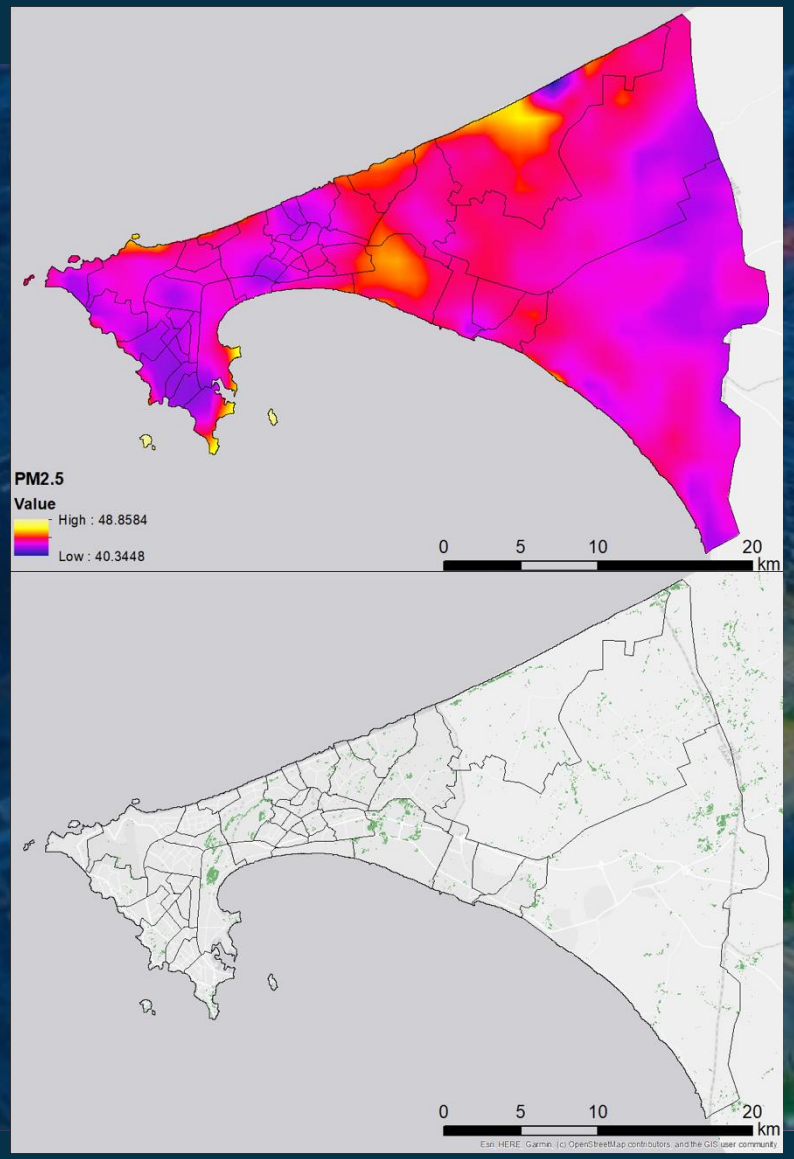
- UKCEH models concentrations and deposition of $PM_{2.5}$ and a wide range of other pollutants, using EMEP
- EMEP is complex and is typically applied at global, regional or national scales
- Minimum horizontal resolution >1 km





- UKCEH has developed a meta-model, which is a generalised version of the more complex model
- Requires only tree canopy cover data and ambient $PM_{2.5}$ concentration data
- Can be used at much smaller scales, using high resolution input data
- Applicable to urban environments

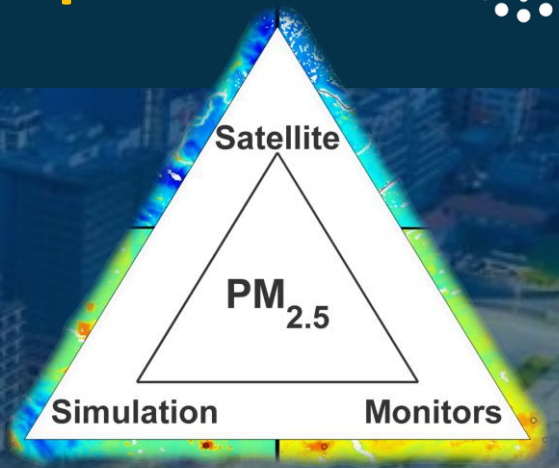
Modelling $PM_{2.5}$ removal at a fine scale – input data



1 km

Annual mean

µg m^{-3}



https://sites.wustl.edu/acag/surface-pm2-5

10 m

classification

trees

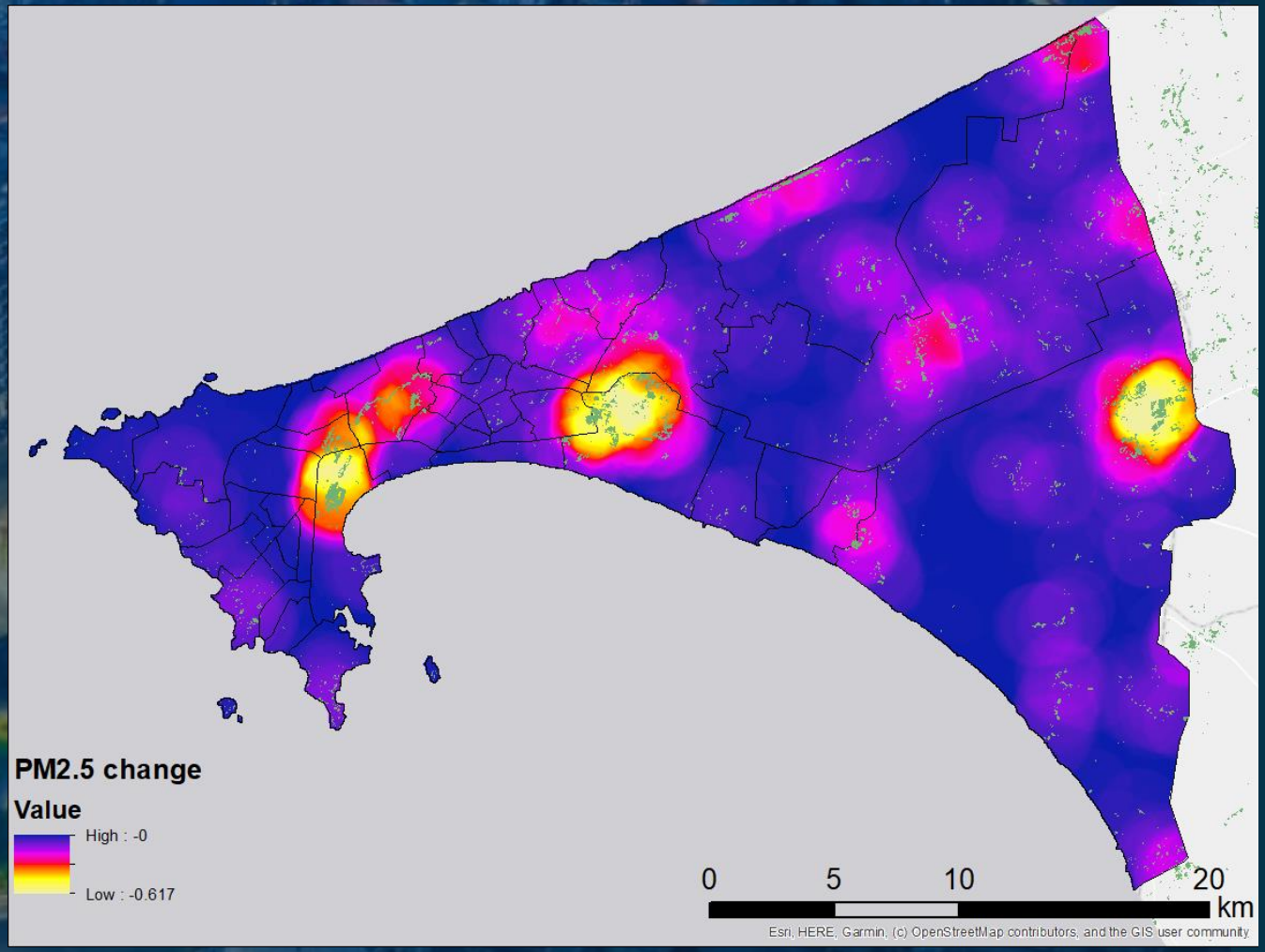
https://esa-worldcover.org/en

Modelling $PM_{2.5}$ removal at a fine scale – outputs

UKCEH Our planet. Decoded.

esa

- 2 Key factors:
  - Proportion of tree cover
  - Ambient concentration



Modelling $PM_{2.5}$ removal at a fine scale – outputs

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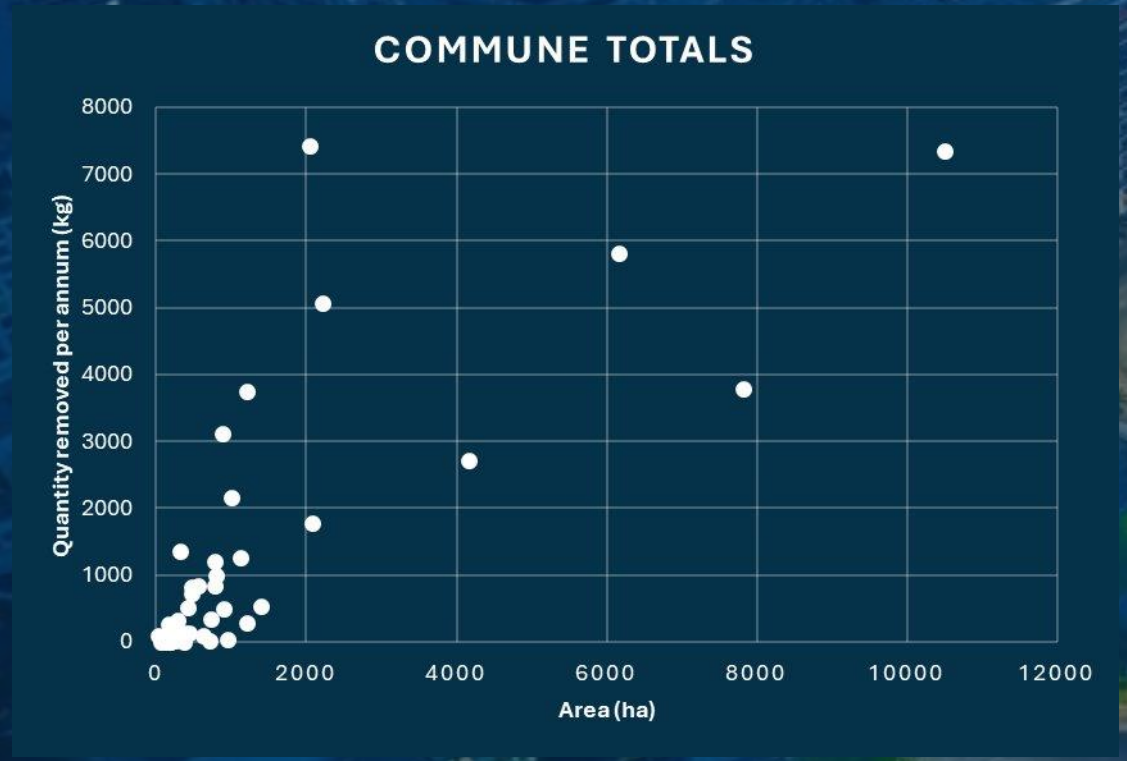
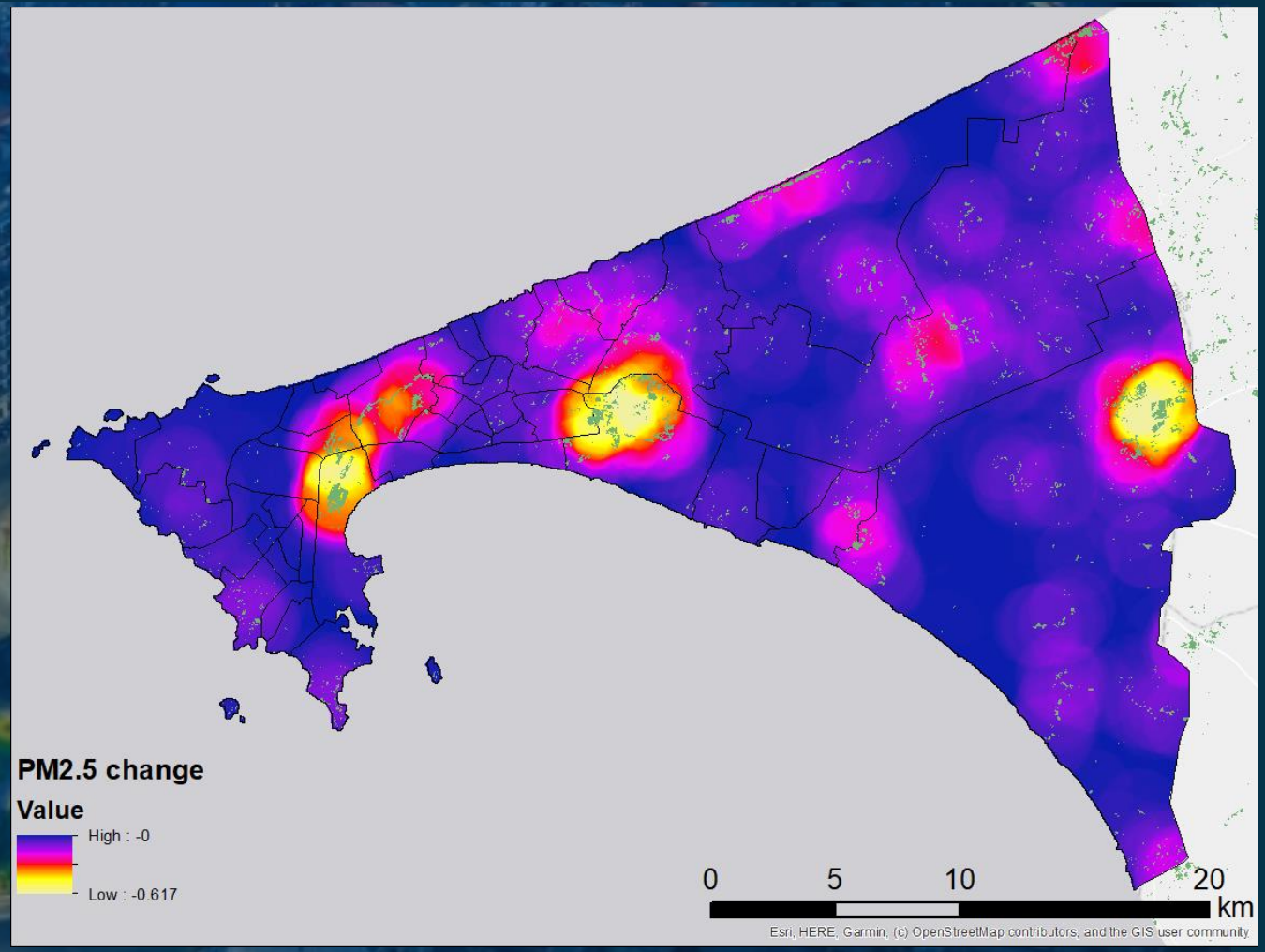
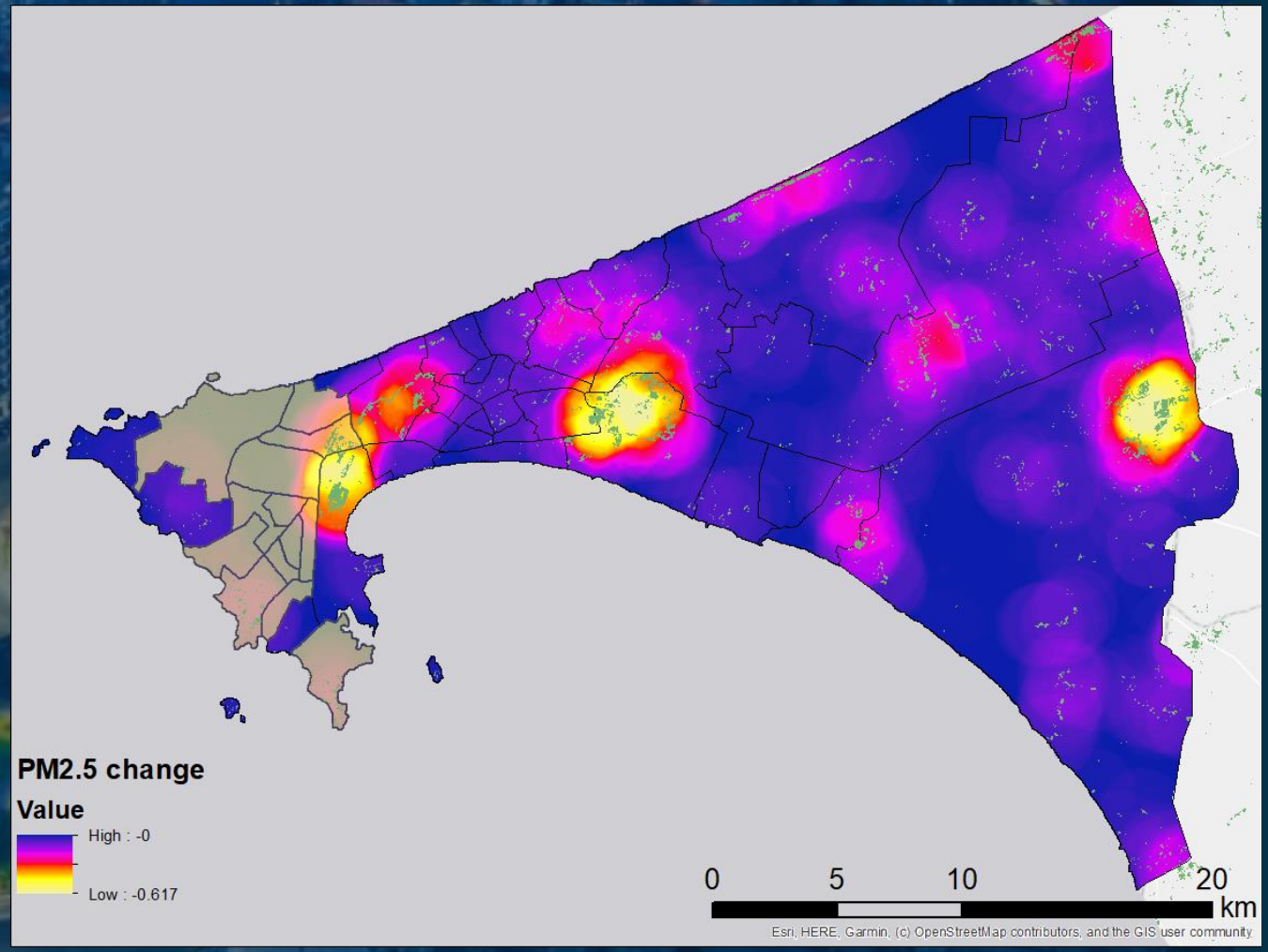




Next steps

- Digitising new green spaces
- Construct updated canopy cover scenario
- Run $PM_{2.5}$ removal model
- Estimate exposures, for each scenario (using population/demographics data)
- Work with LSHTM & APHRC to estimate health impacts
- Run some hypothetical scenarios, to inform regreening policy targets (e.g. 10%, 20% canopy cover, per commune)
- Maybe the returns are non-linear

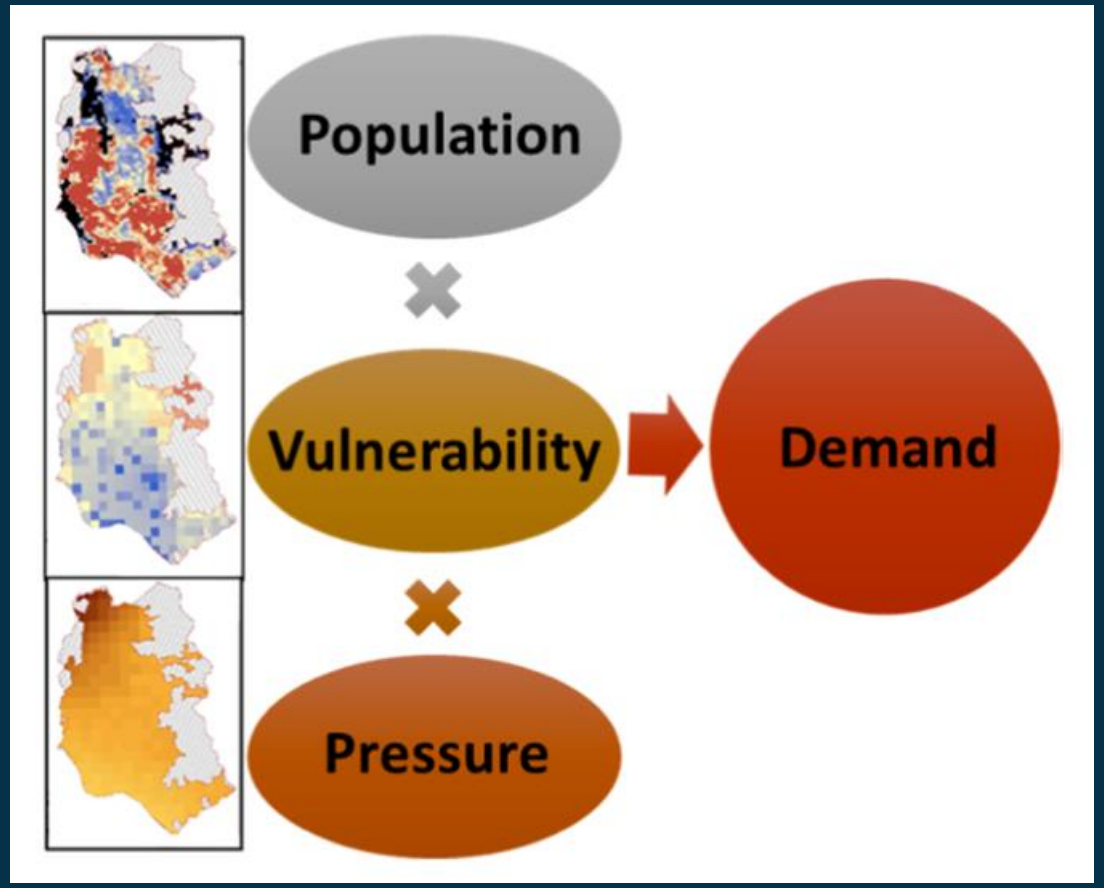


Case study 2: A vulnerability assessment of green space benefits (Medellín, Colombia)

Prof. Laurence Jones - UK Centre for Ecology & Hydrology

Medellín – Background to the study

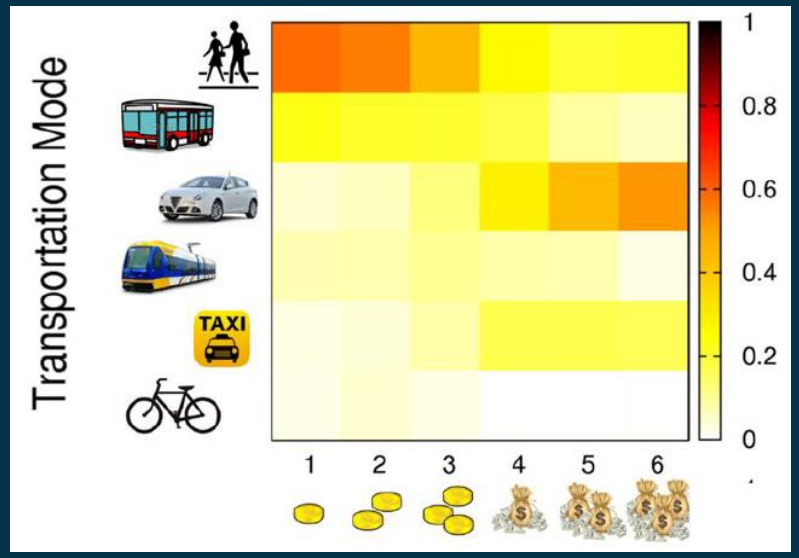
- A vulnerability-exposure based assessment of greenspace provision, which can inform spatial planning
- Aimed to demonstrate the importance of 'location'
- Multi-national partnership, but not commissioned by a specific end-user
- Cities were:
  - Medellín, Colombia
  - Dhaka City, Bangladesh
  - Kigali, Rwanda
  - Zomba, Malawi
  - Leicester, UK

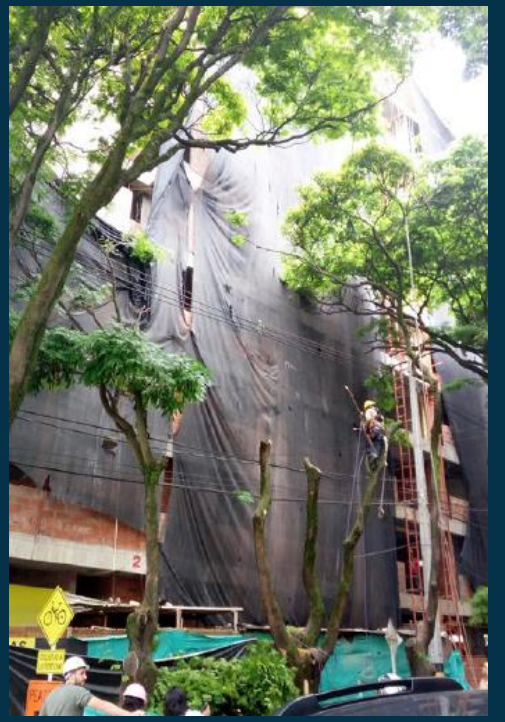


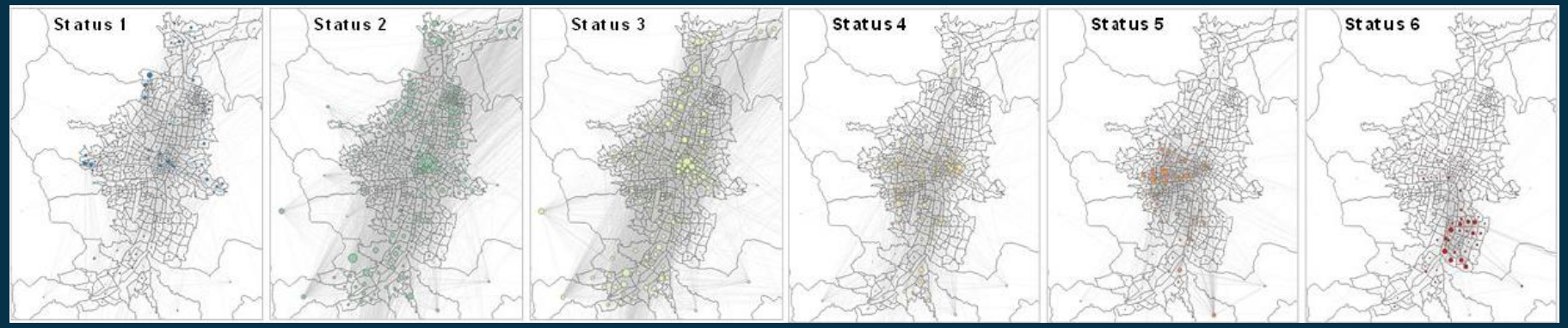
Fletcher et al. (2020) Demand mapping for urban green infrastructure.
https://doi.org/10.1016/j.scitotenv.2021.147238

Medellín – Challenges

- 2nd largest city in Colombia, population: 2.4 million
- Most Innovative City of the Year, 2013
- Air Quality intersecting with social issues, annual mean PM2.5 20 µg/m3
- ~12,000 deaths/year to air pollution (Colombia)
- Transport is a major source of emissions
- Social stratification around mobility







Medellín – Approach: Data and models used

Datasets used

Data type	City	Data
Land Surface Temperature	All cities	**LandSat-8 satellite observations** downloaded from USGS hub
$PM_{2.5}$	All cities	van Donkelaar, et al.. 2018. Global Annual PM2.5 Grids from MODIS, MISR and SeaWiFS Aerosol Optical Depth (AOD) with GWR, 1998-2016. Palisades NY: NASA Socioeconomic Data and Applications Center (SEDAC).
Land Cover	All cities	**Sentinel-2a All multi-spectral bands, including True Colour Image,** downloaded via Copernicus Open Access Hub
River networks	All cities	Open Street Map. Extract of all rivers and water
Road Networks	All cities	Open Street Map. Extract of all highways
Population density	Medellin	WorldPop. 2017. Colombia 100m Population, V2. University of Southampton.
Poverty indicator	Medellin	Mean monthly income figures, by Medellin district

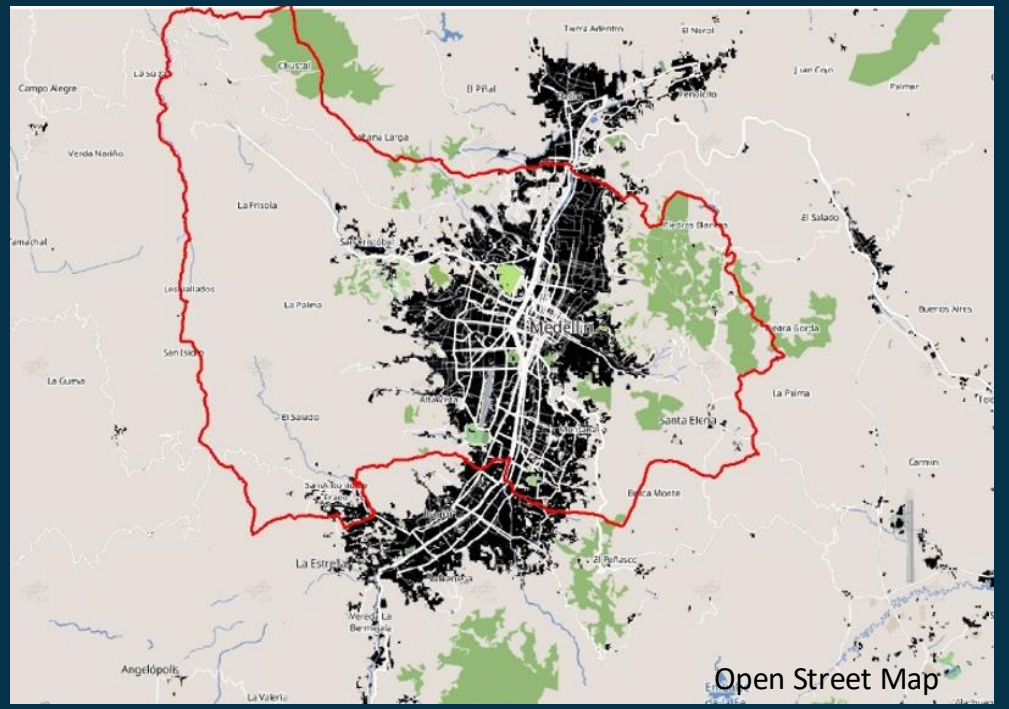
Models used

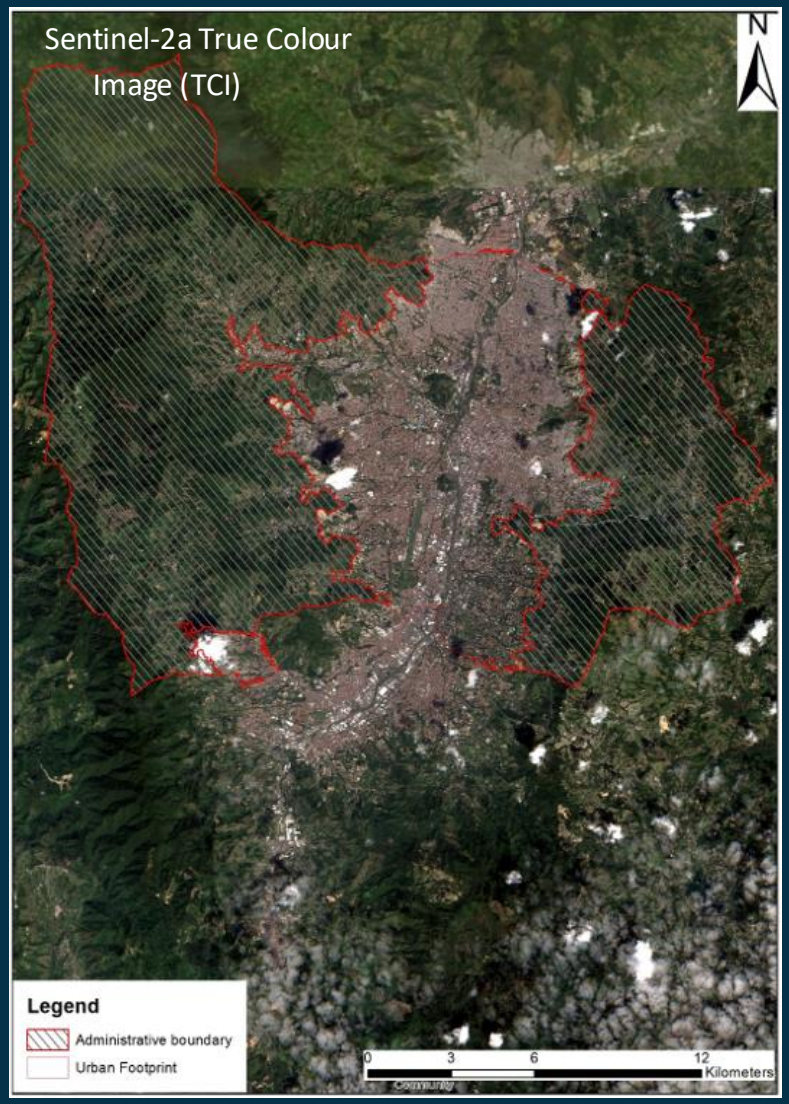
- Air pollution removal by trees[1]
- Aggregate cooling at city level by green and blue infrastructure[1,2]
- Accessible greenspace[1]

[1] Fletcher et al. (2020) Demand mapping for urban green infrastructure. https://doi.org/10.1016/j.scitotenv.2021.147238

[2] Jones et al. (2025) Economic value of hot-day cooling provided by urban GI. https://doi.org/10.1016/j.ufug.2024.128212

Medellín – Approach



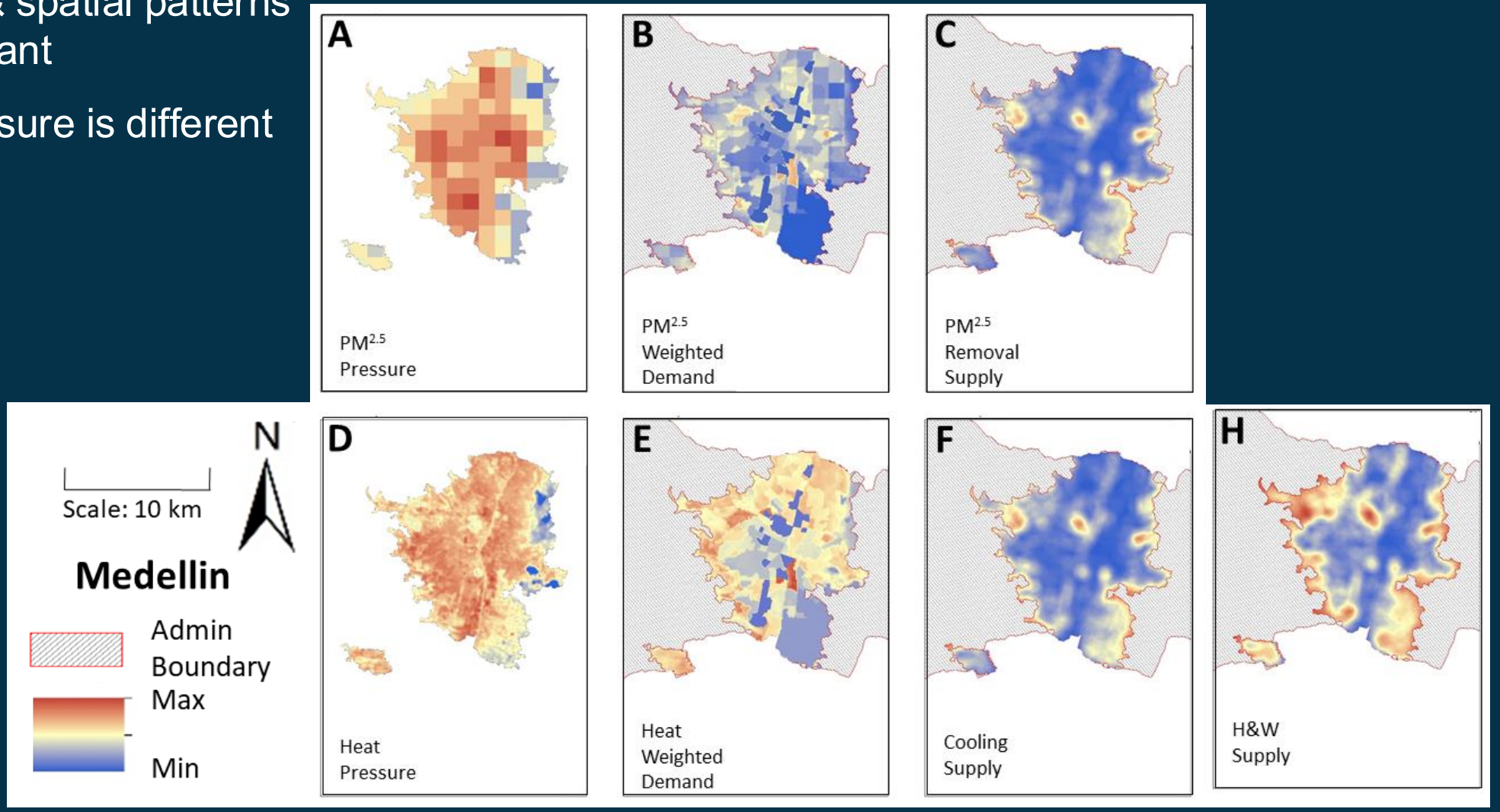


Considerations

- Who is impacted ?
- What do we mean by urban ?
  - administrative boundaries
  - morphology
  - census data

Medellín – Findings

- Location & spatial patterns are important
- Each pressure is different

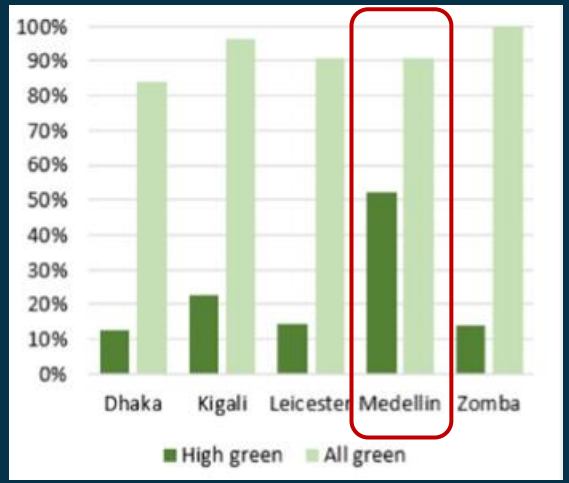


Medellín – Findings

- High urban tree cover already, but overall green or blue space is relatively low
- Good accessibility of green space to local residents
- High levels of air pollution removal and cooling by existing urban trees

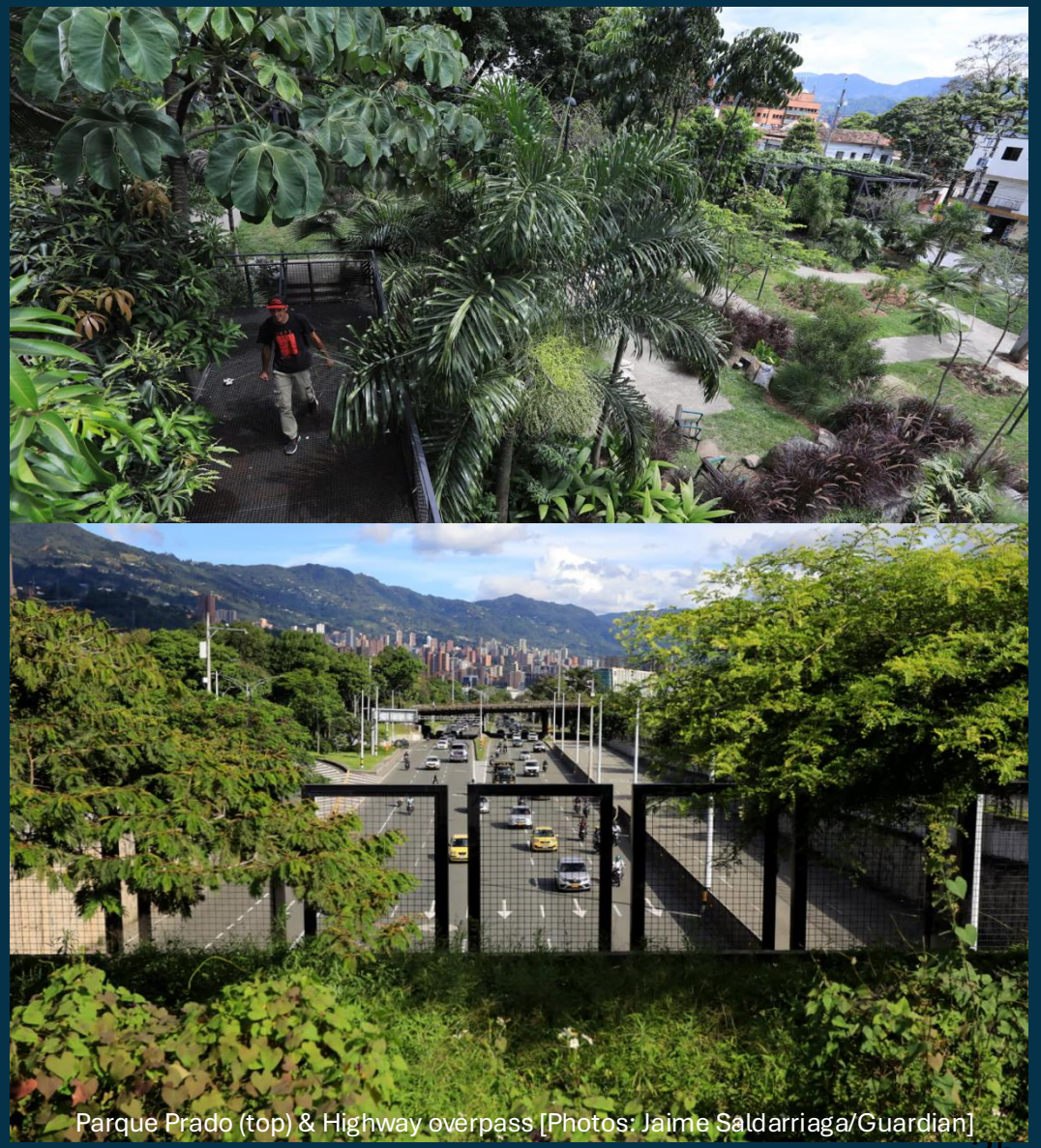
City	High green	Low green	Blue space	Combined blue/green space
Dhaka	3.1%	32.9%	4.52%	40.6%
Kigali	2.5%	47.7%	0.13%	50.3%
Leicester	3.5%	33.6%	0.52%	37.6%
Medellin	13.1%	21.7%	0.06%	34.9%
Zomba	2.4%	45.2%	0.03%	47.7%

City	$PM_{2.5}$ removed by woodland (kg/yr)	Estimated change in $PM_{2.5}$ due to trees ($\mu g/m^3$)	Aggregate cooling effect (°C)
Dhaka	48,402	−4.12	−0.63
Kigali	11,368	−1.49	−0.6
Leicester	3265	−0.83	−0.44
Medellin	13,164	−0.73	−0.98
Zomba	488	−0.62	−0.65



Medellín – Key learning points

- Each part of a city is unique because spatial pressures are different, tailoring solutions to context…
- Bringing in population / demographics helps better understand the challenges and the solutions
- Using models can quantify the benefits of existing or new greenspace
- Helps prioritise where to plan green infrastructure



Parque Prado (top) & Highway overpass [Photos: Jaime Saldarriaga/Guardian]

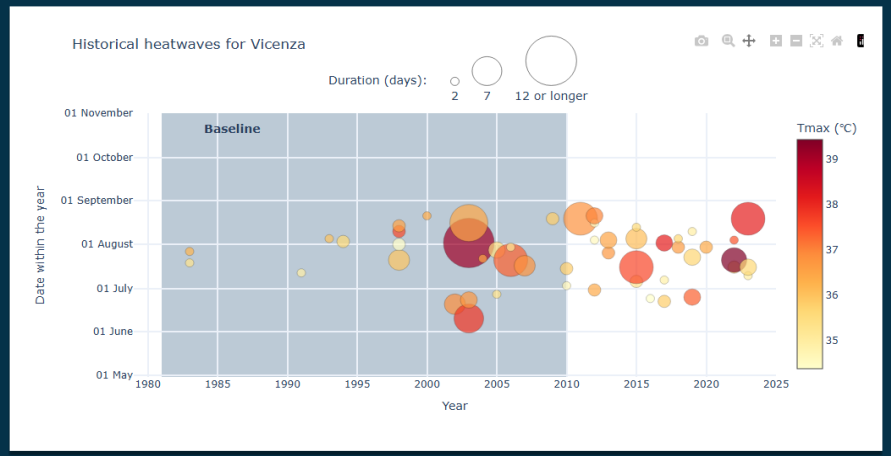
Case study 3: Identifying heat hotspots using land surface temperature and social vulnerability data (Logroño, Spain)

Nieves Peña - Tecnalia

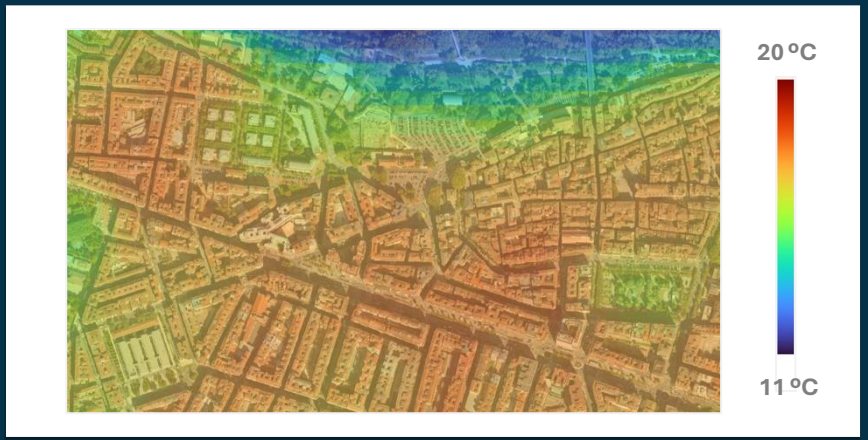
Climate services co-developed with Logroño, Athens and Milan

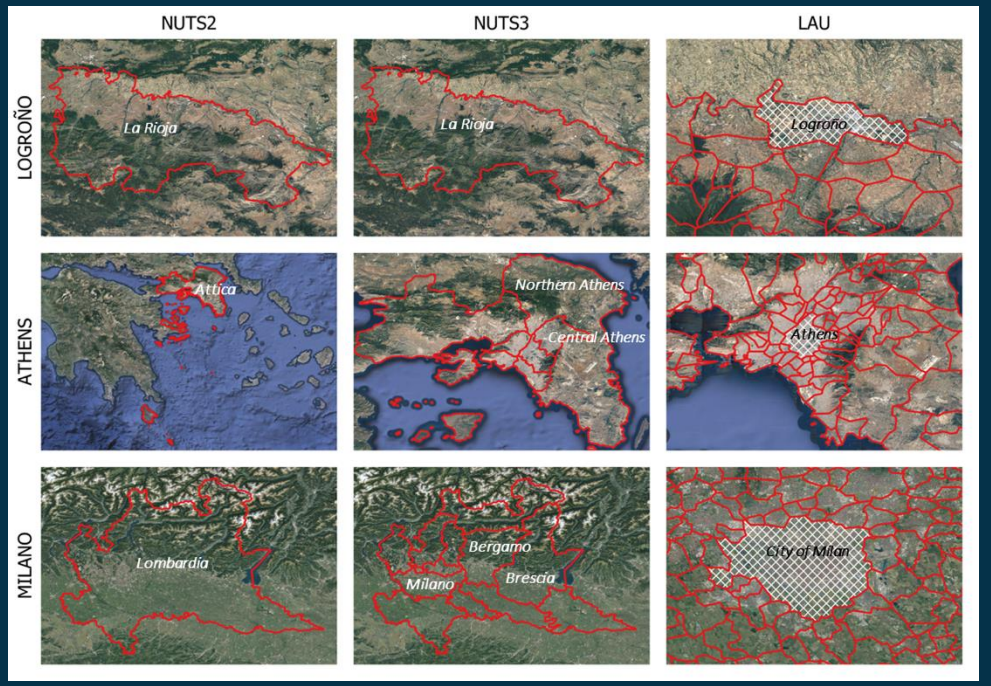
Thermal Assessment Tool| MIP4ADAPT Database

HeatWave Service



UrbanLST Service





Different spatial levels considered

Implemented in Lombardy, La Rioja, Pomerania, Oslo and Viken, Southern Ireland, and Attica, and their respective municipalities: Amsterdam, Athens, Cork, Milan, Gdynia, Logroño, and Lillestrøm

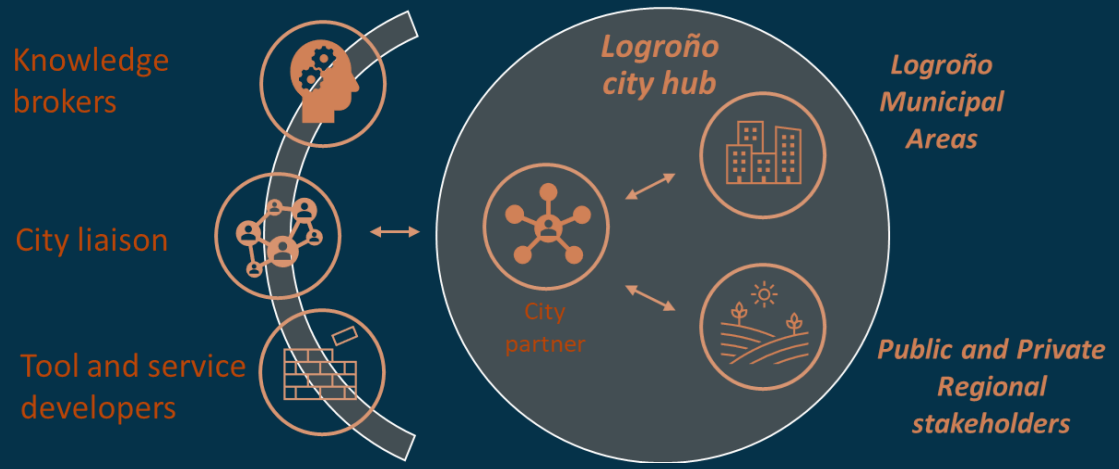
REACH OUT
shaping climate resilient cities

Logroño Context

Logroño is a medium-sized city with about **80 km²** and over **150,000 inhabitants** located in northern Spain in the autonomous region of La Rioja.

Over the last 15 years, Logroño has experienced **more frequent, intense and prolonged heatwaves leading to serious heat-health related impacts**.

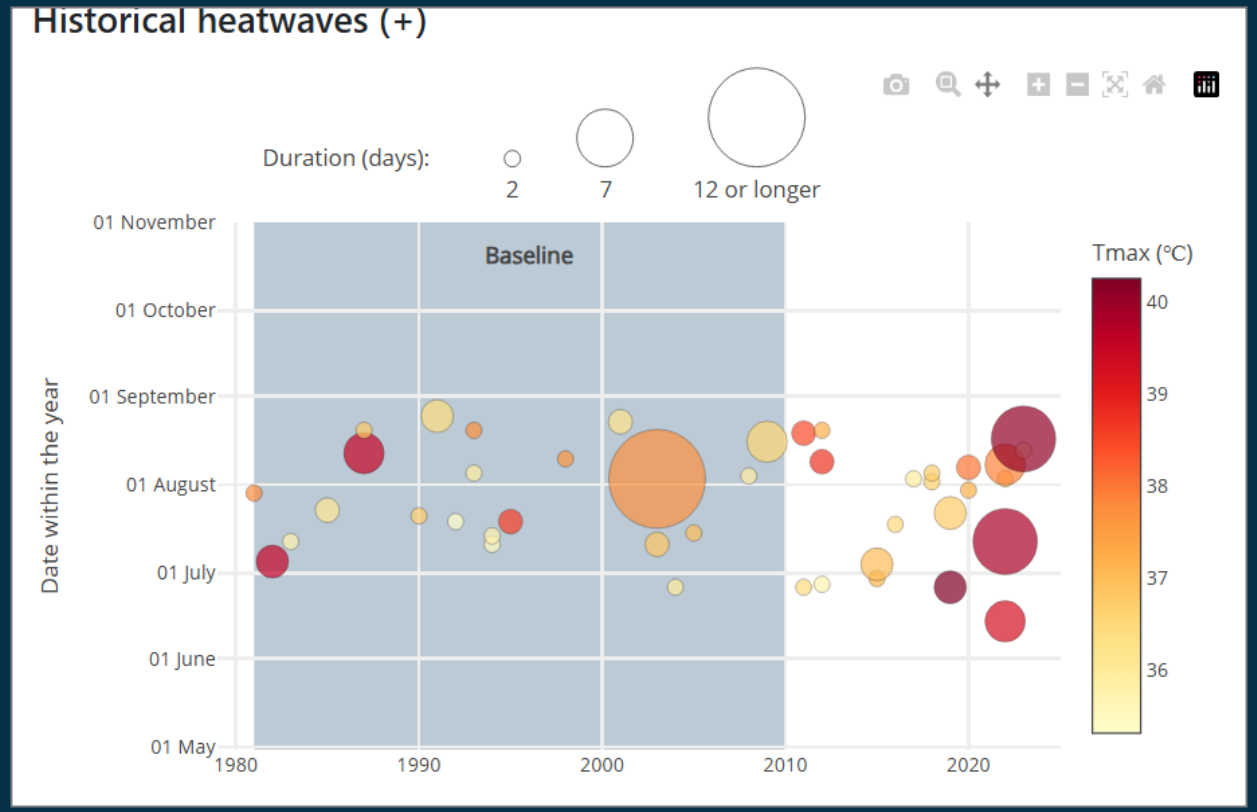
Climate service co-developed though several workshops with Logroño

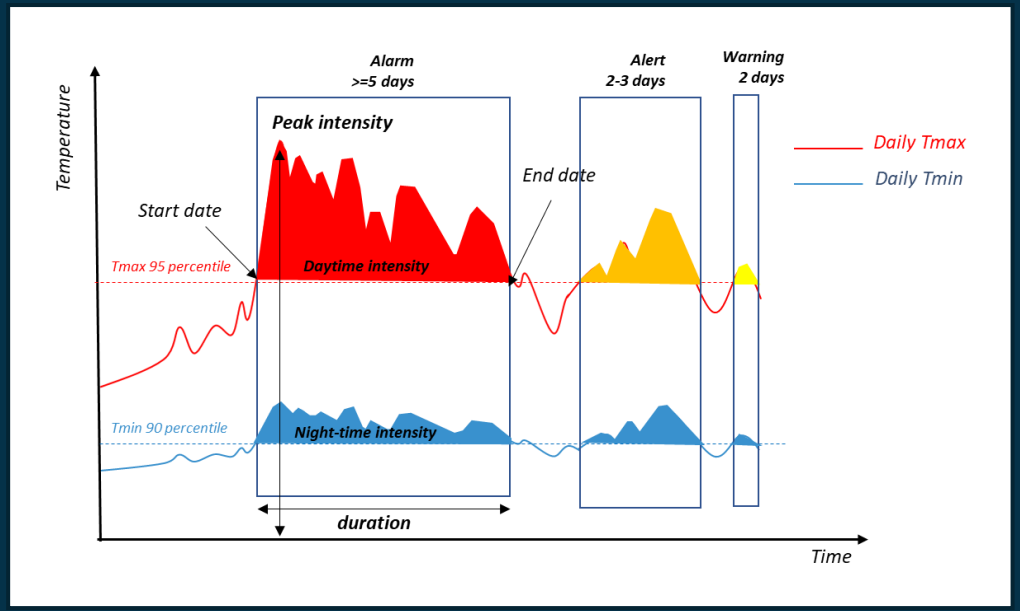


REACH OUT
shaping climate resilient cities

Heatwave Service

It supports the visualisation of how **extreme heatwave events** evolve across different risk levels (warning, alert, alarm) which are determined by the severity of potential impacts.





Heatwave characterization considering maximum temperature (tmax) and minimum temperature (tmin) evolution.

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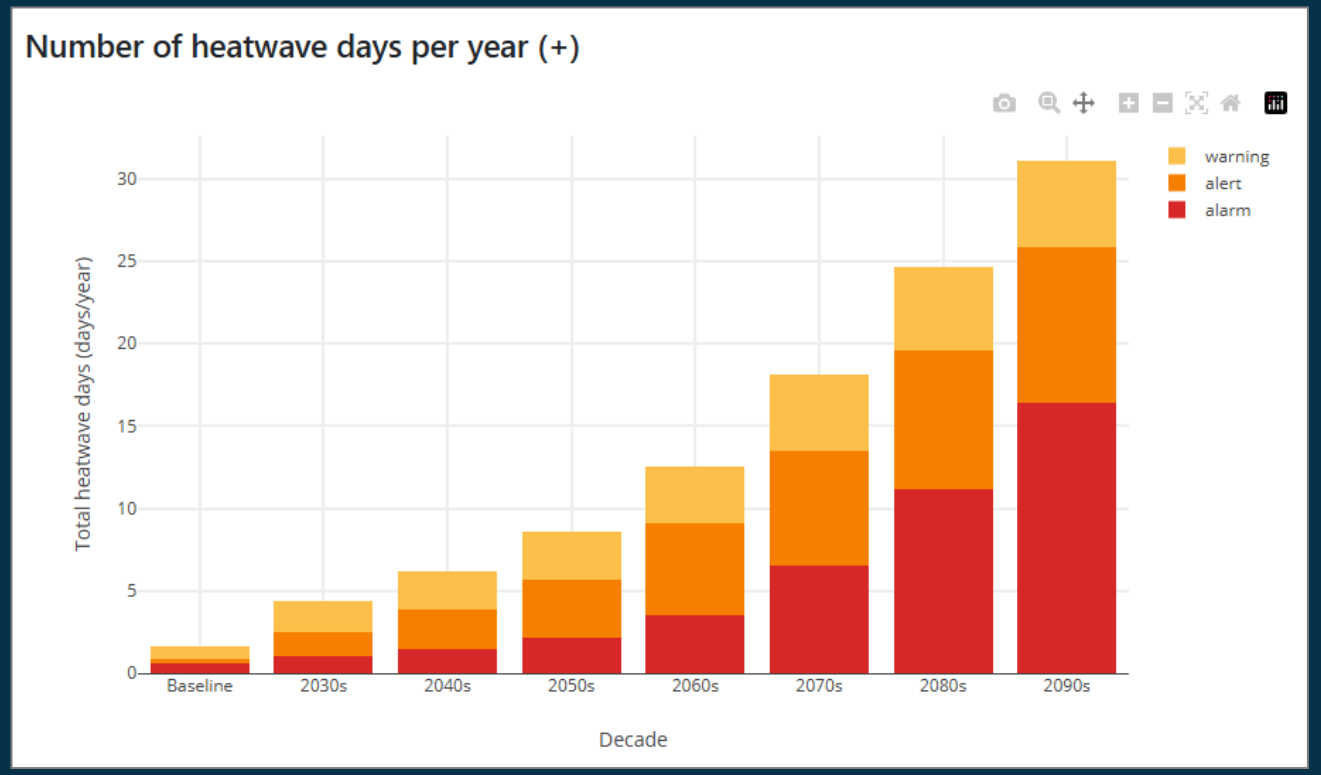

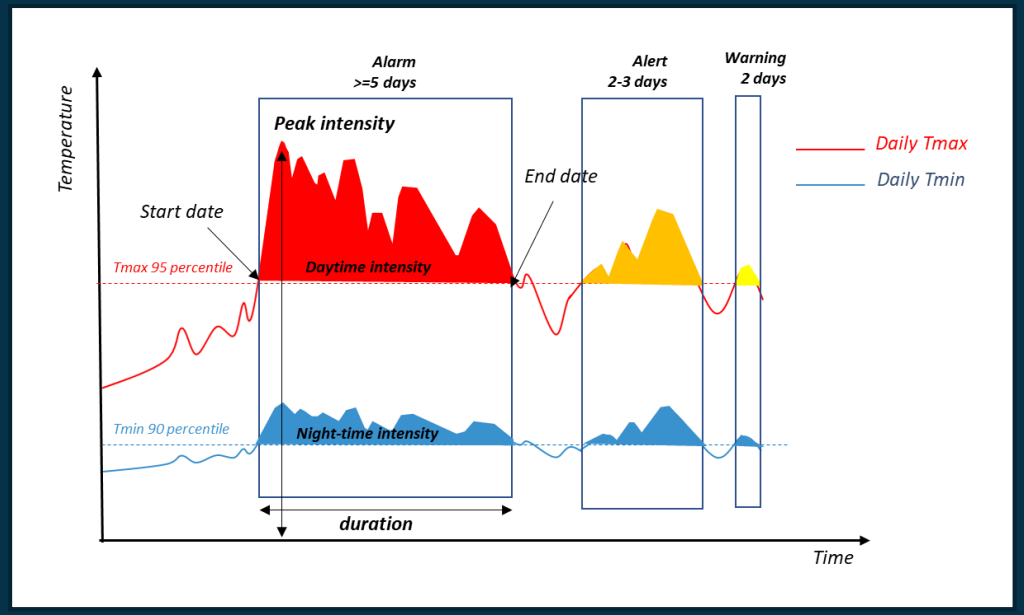

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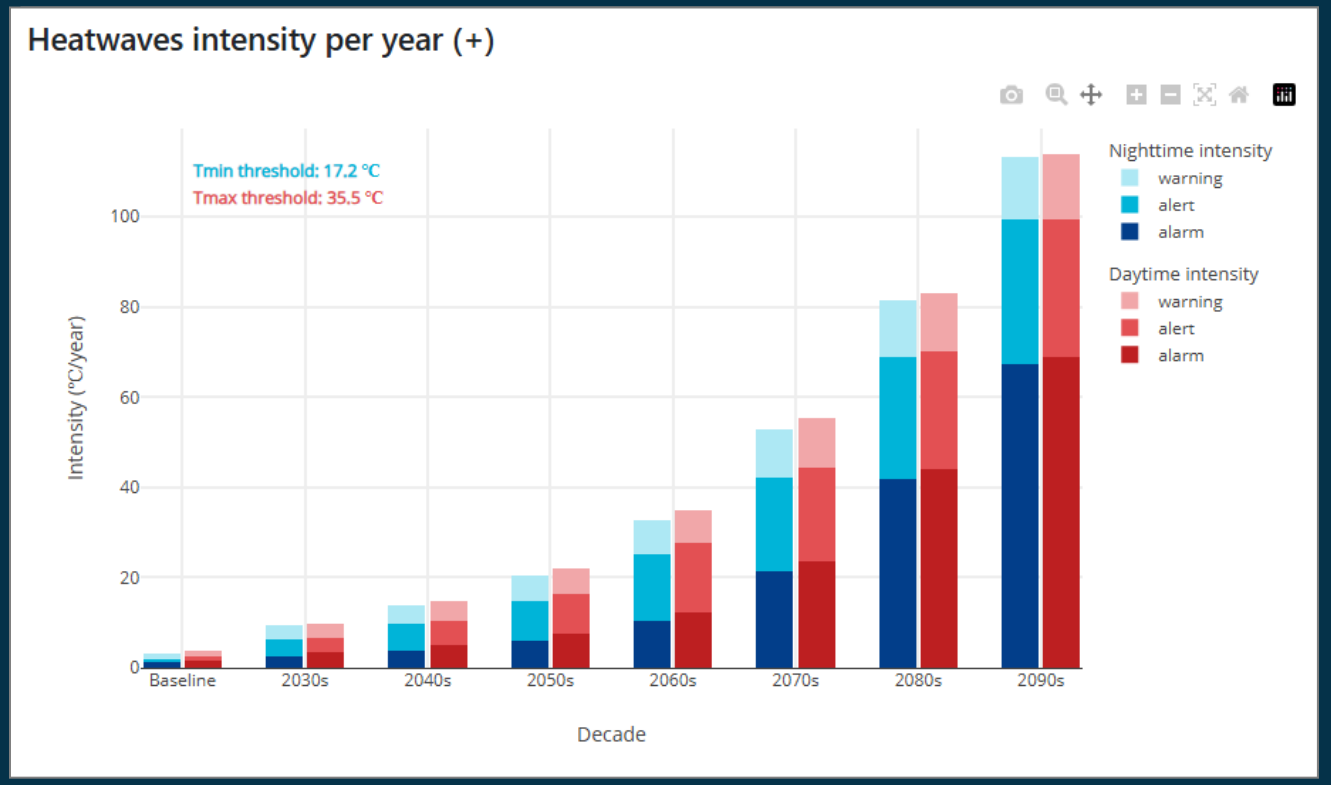

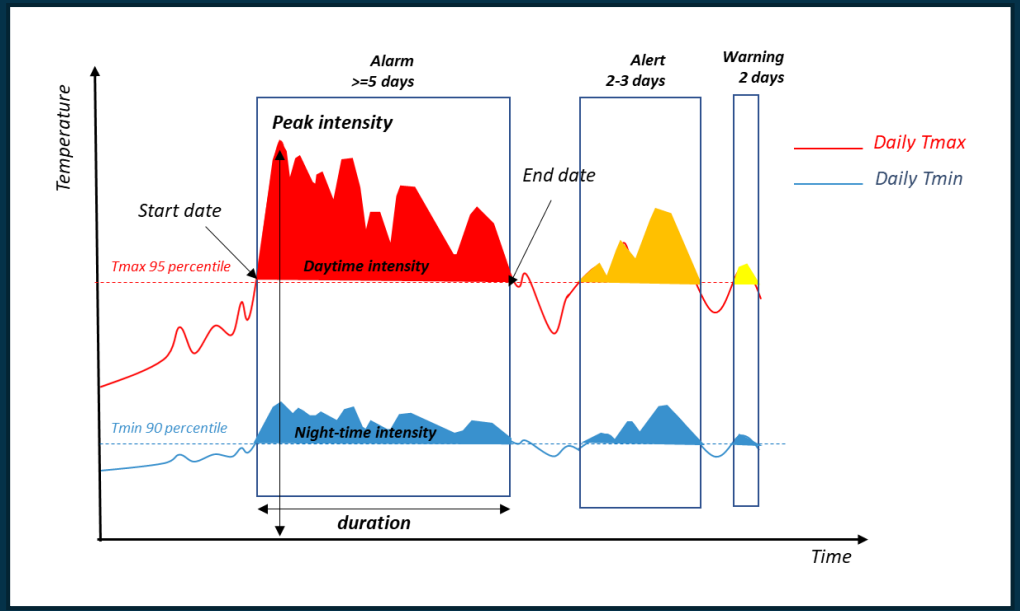

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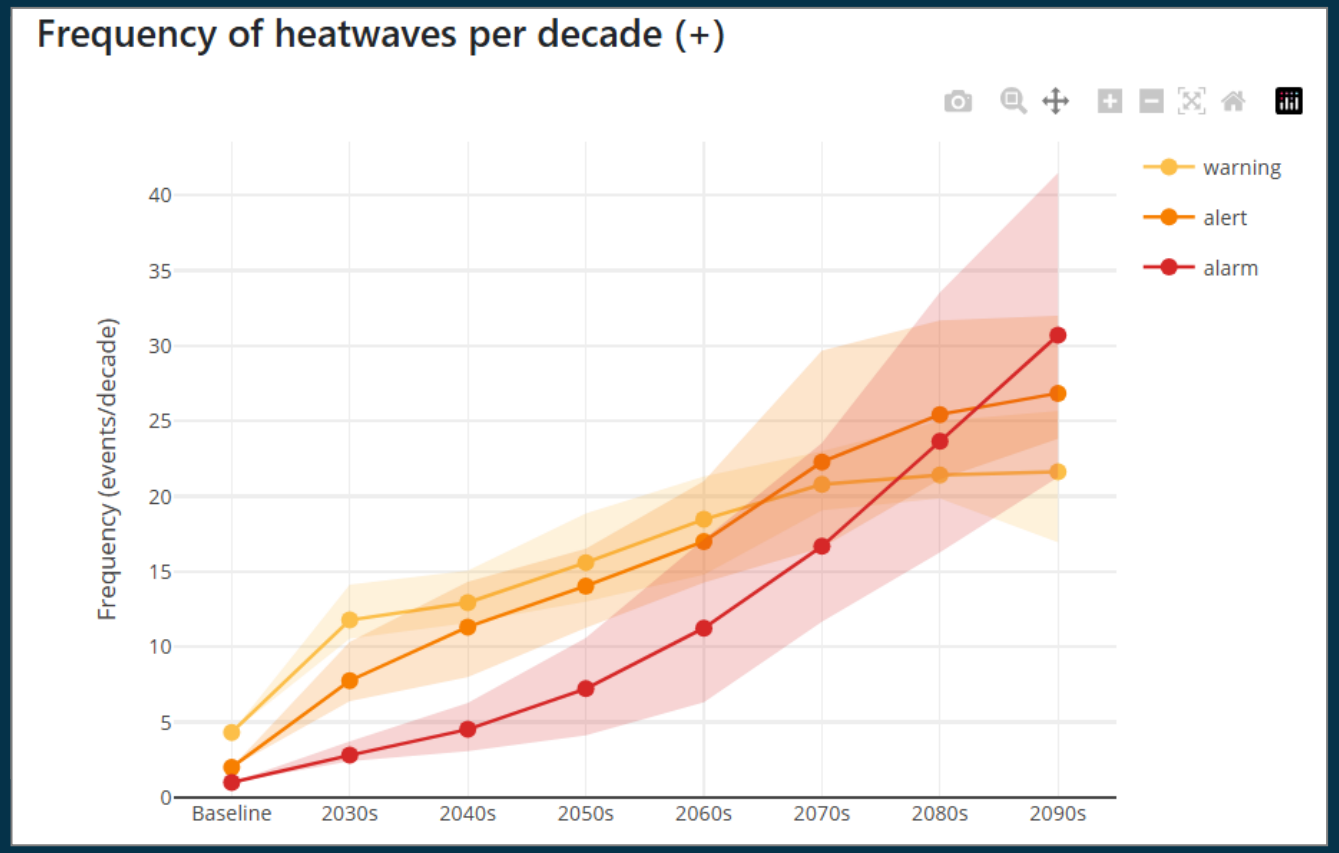

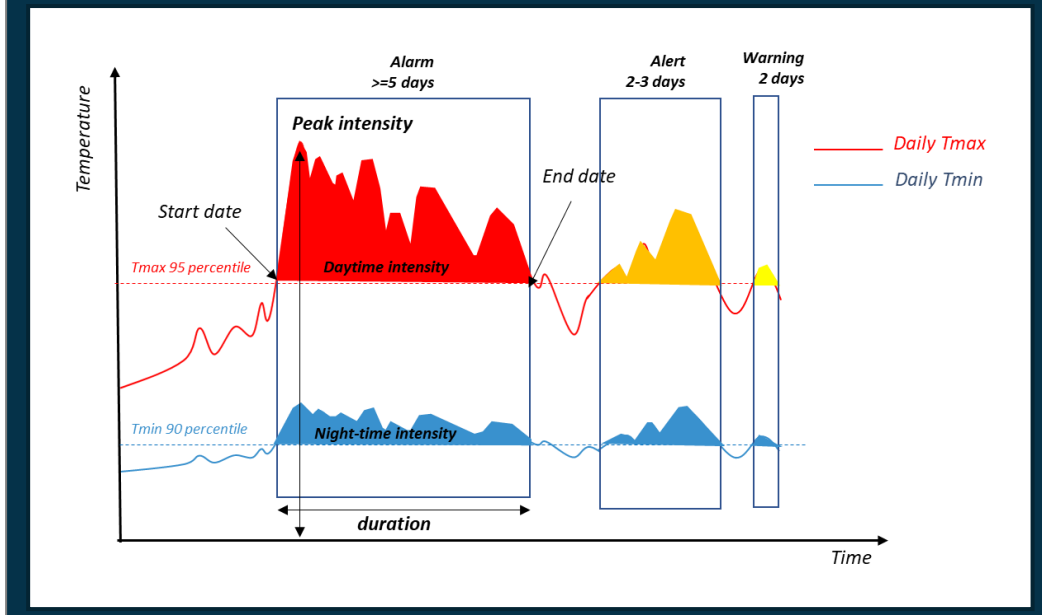

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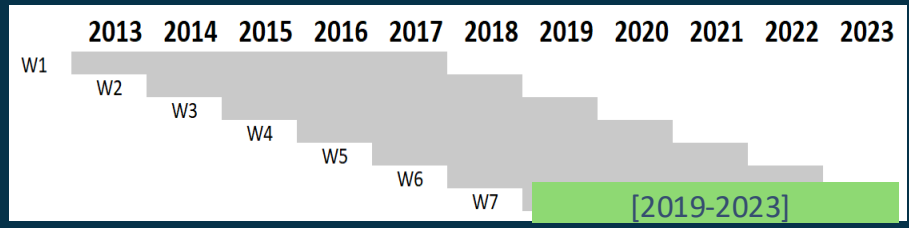
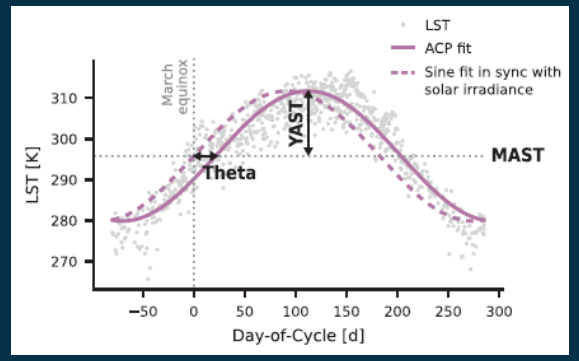
UrbanLST Service

This service allows to spatially highlight areas with **higher surface temperatures** during those heatwaves' events.

Images are downloaded from **Landsat 8 satellite** and processed to characterise not only the current (2019-2023) thermal behaviour of the city as well as its evolution considering the last seven 5-year windows.



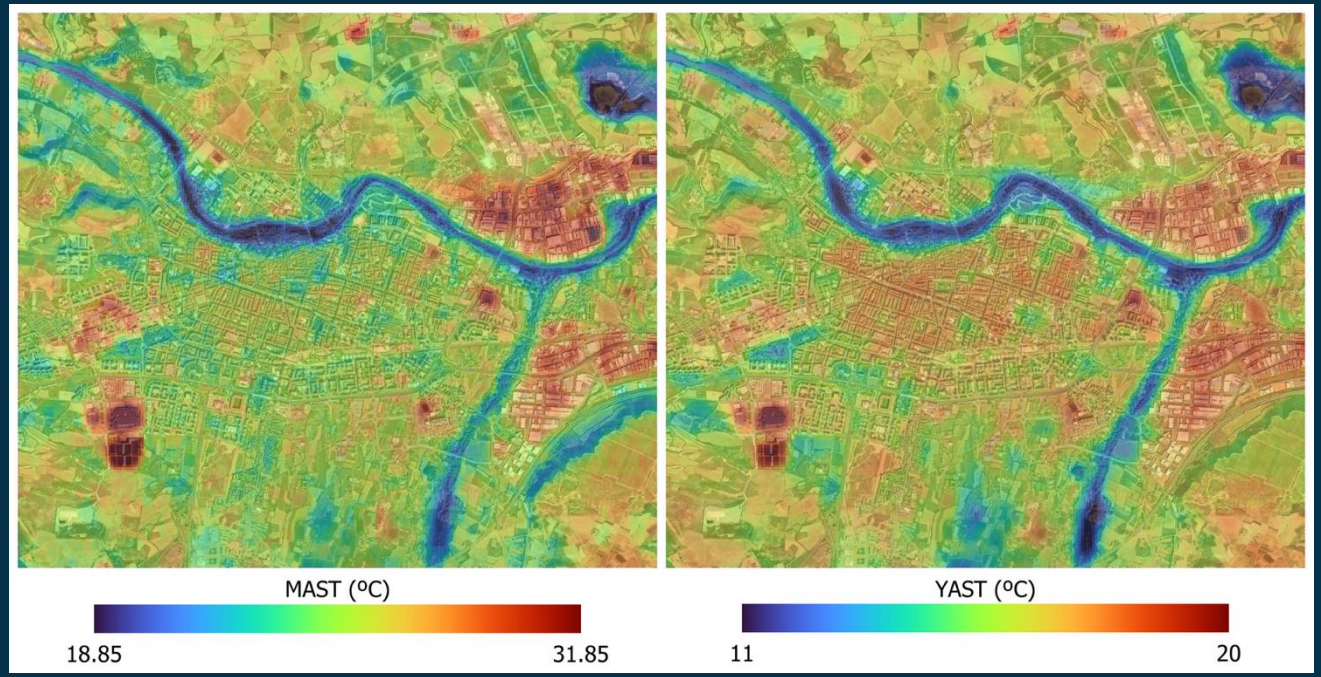
Annual cycle parameters (ACP) to deal with anisotropy



Bechtel, B. (2012). Robustness of Annual Cycle Parameters to Characterize the Urban Thermal Landscapes. *IEEE Geoscience and Remote Sensing Letters, 9*(5), 876-880. https://doi.org/10.1109/LGRS.2012.2185034

Mean Annual LST

Yearly Amplitude of LST



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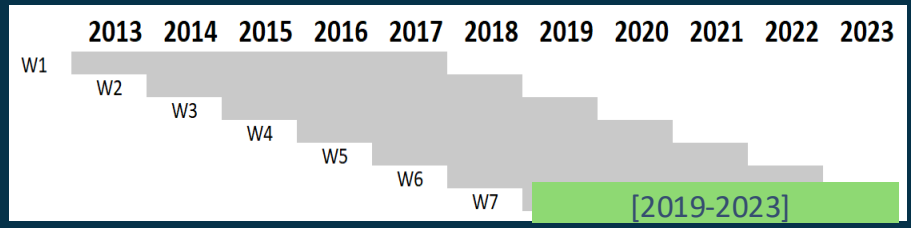

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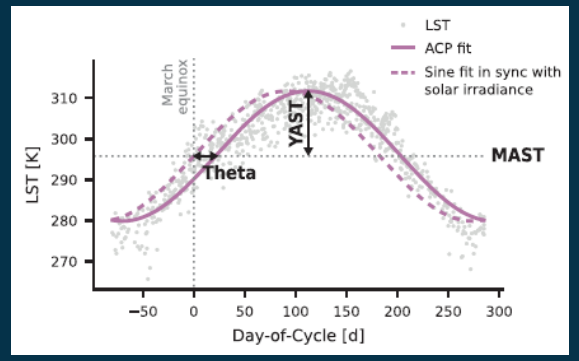

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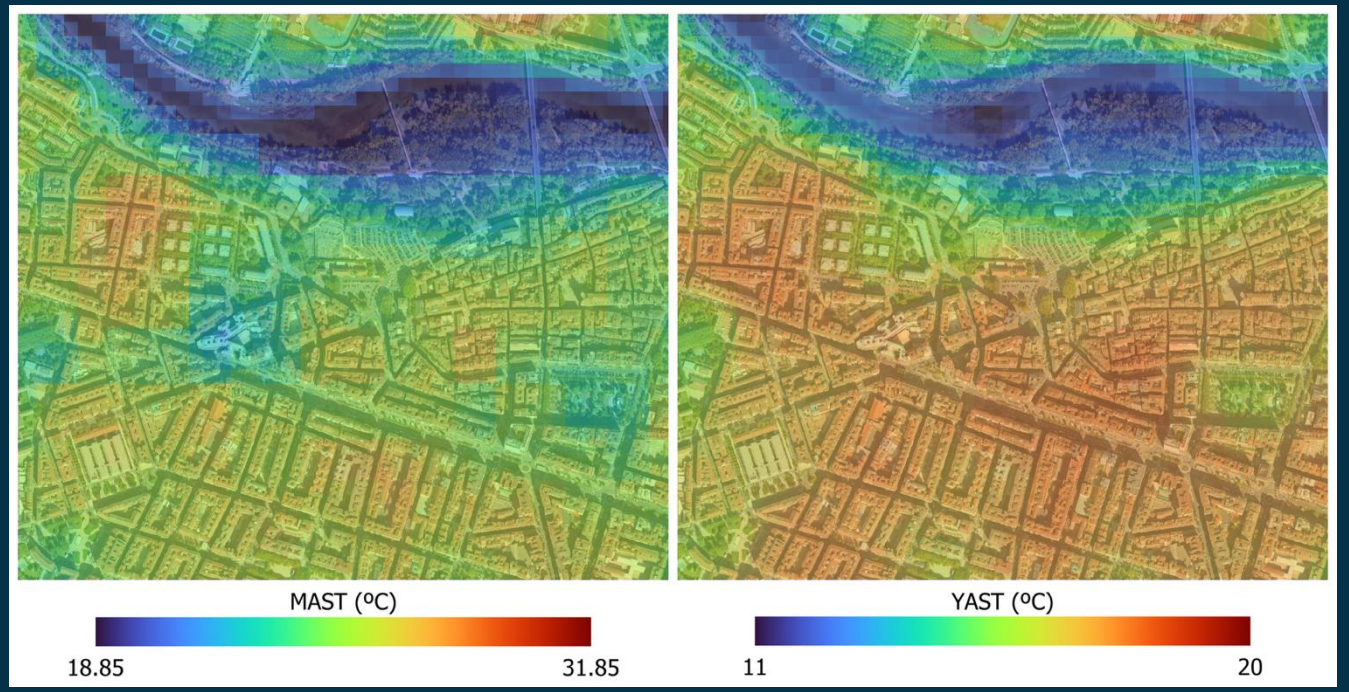
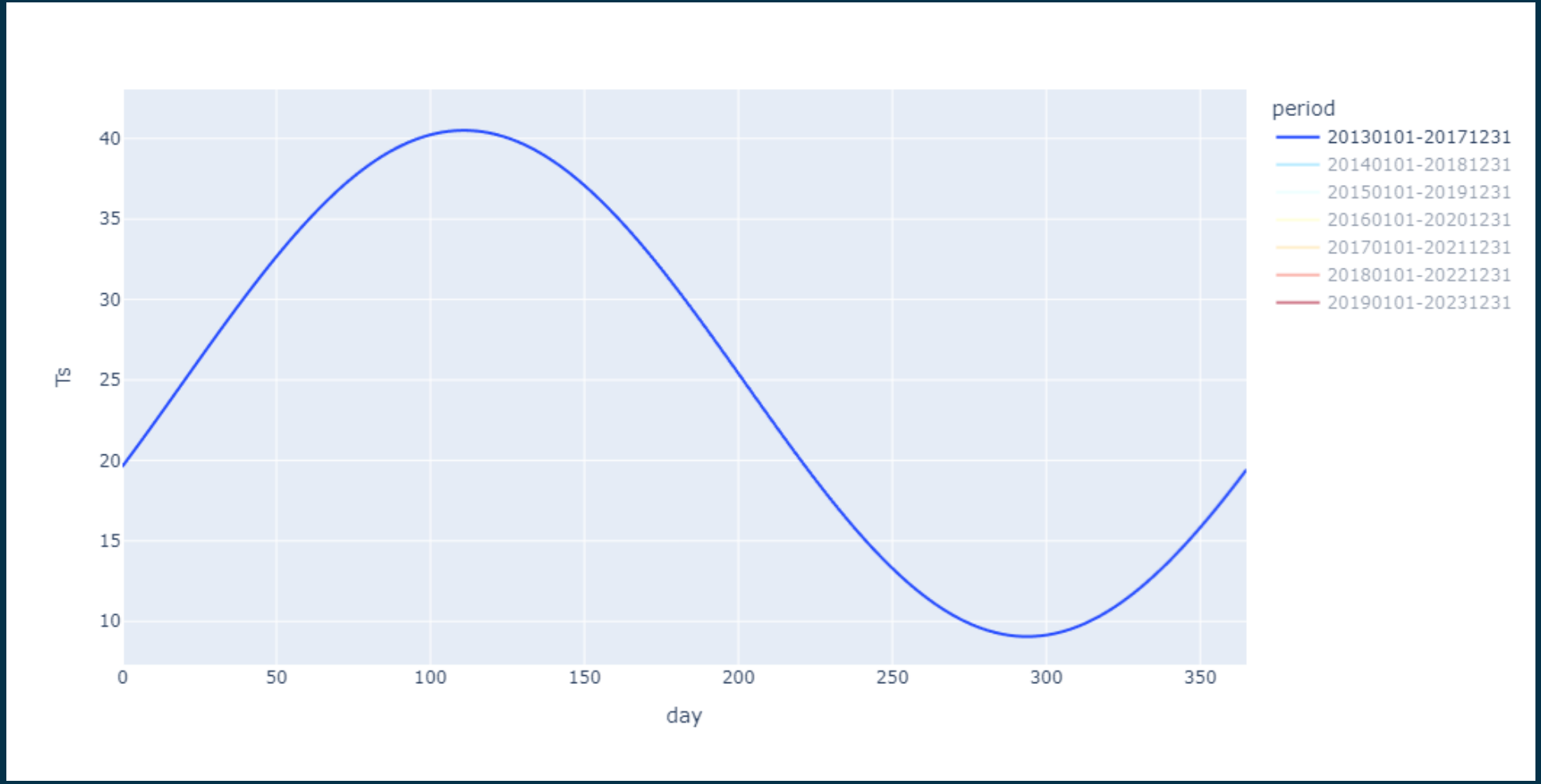


Evolution of the land surface temperature in Logroño

Is the urban area getting warmer?



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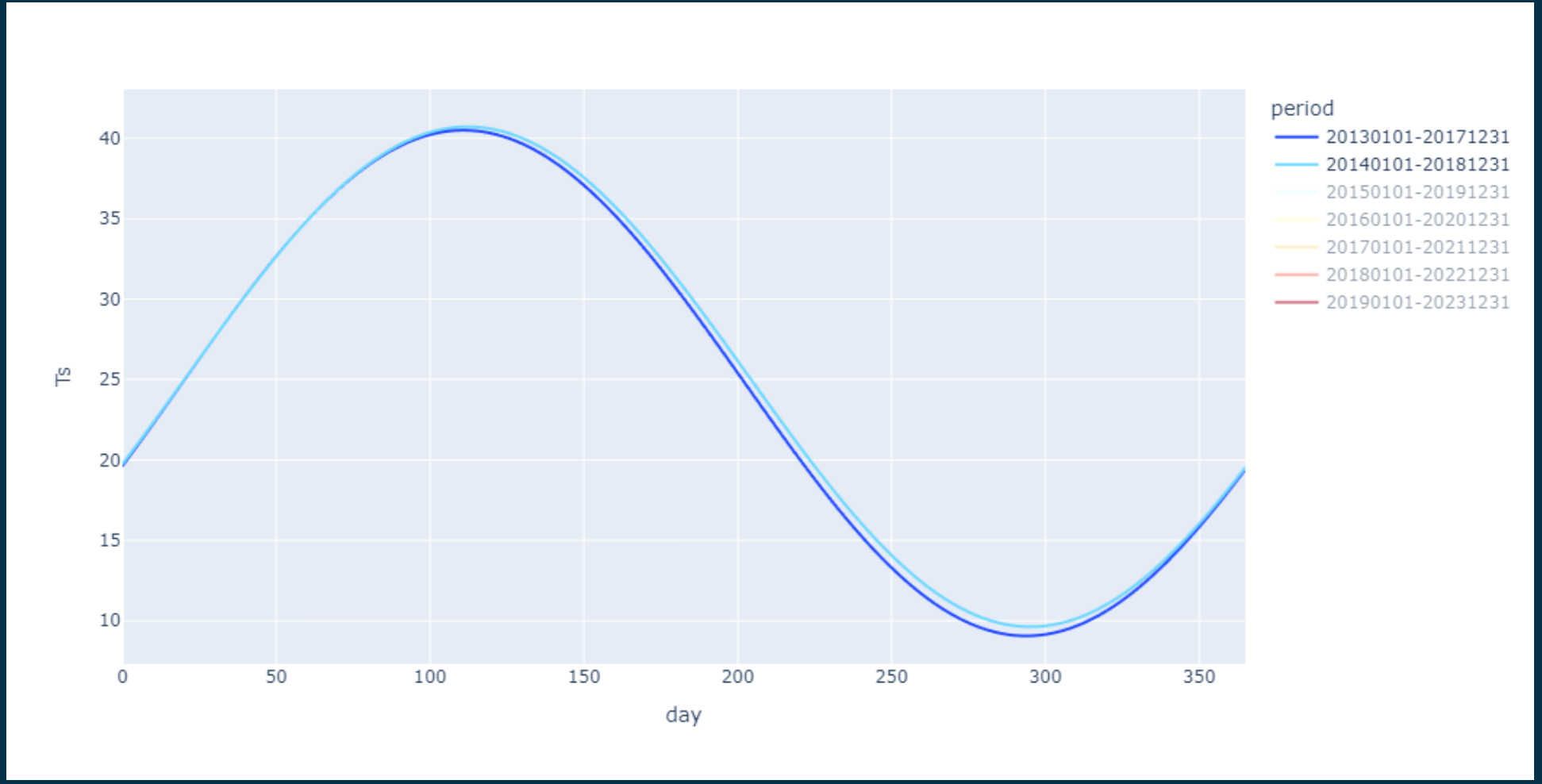

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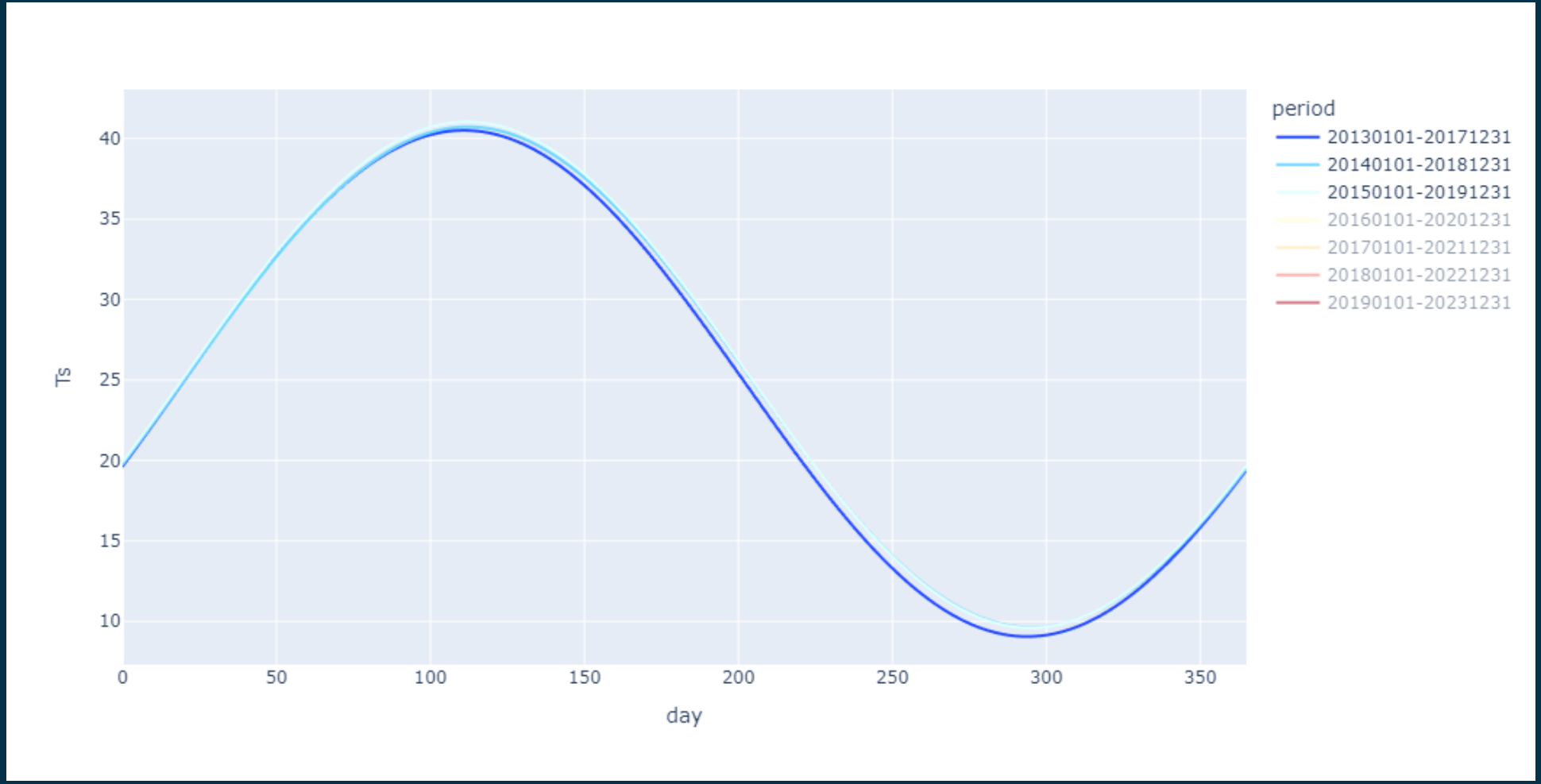

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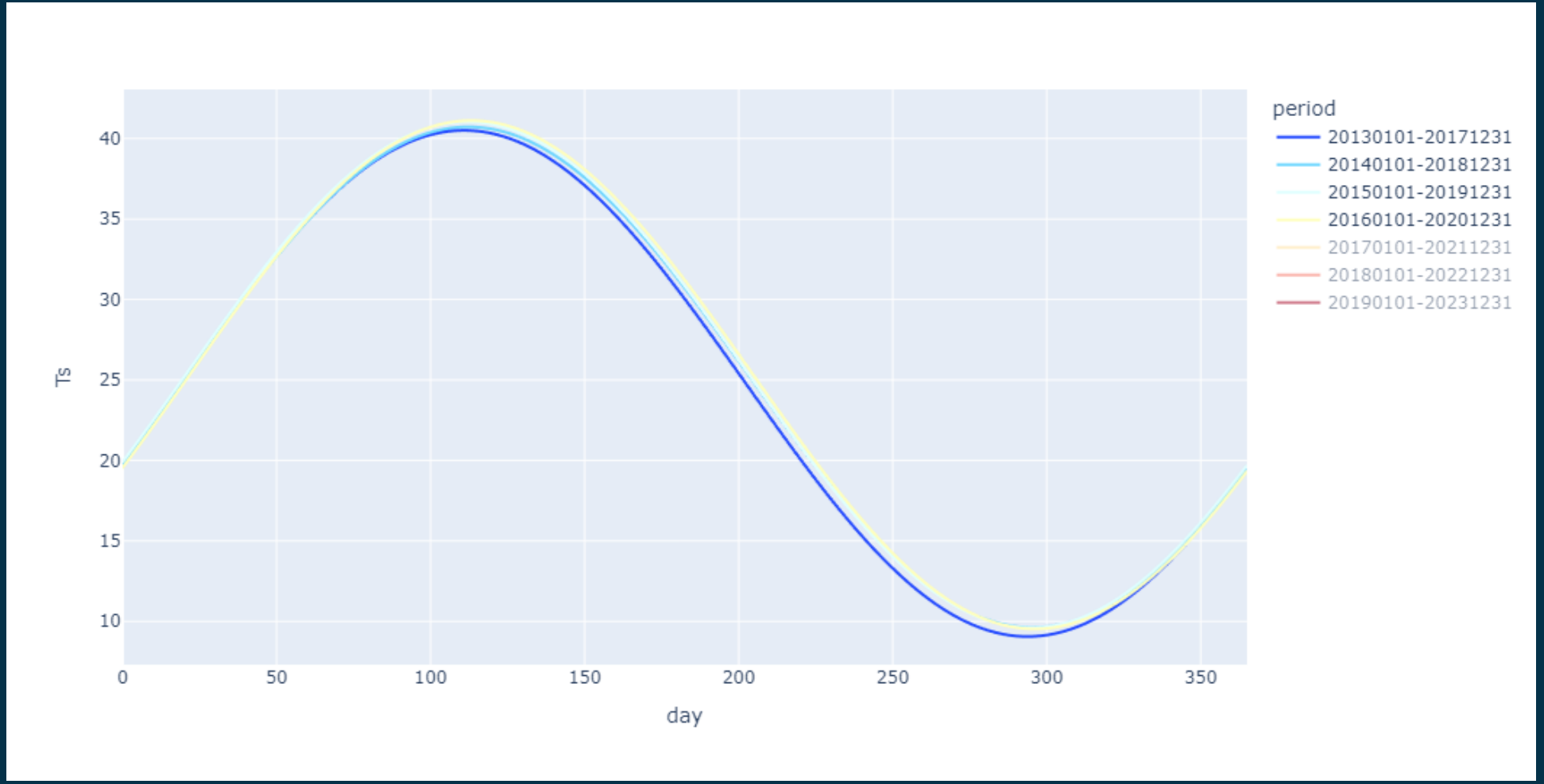

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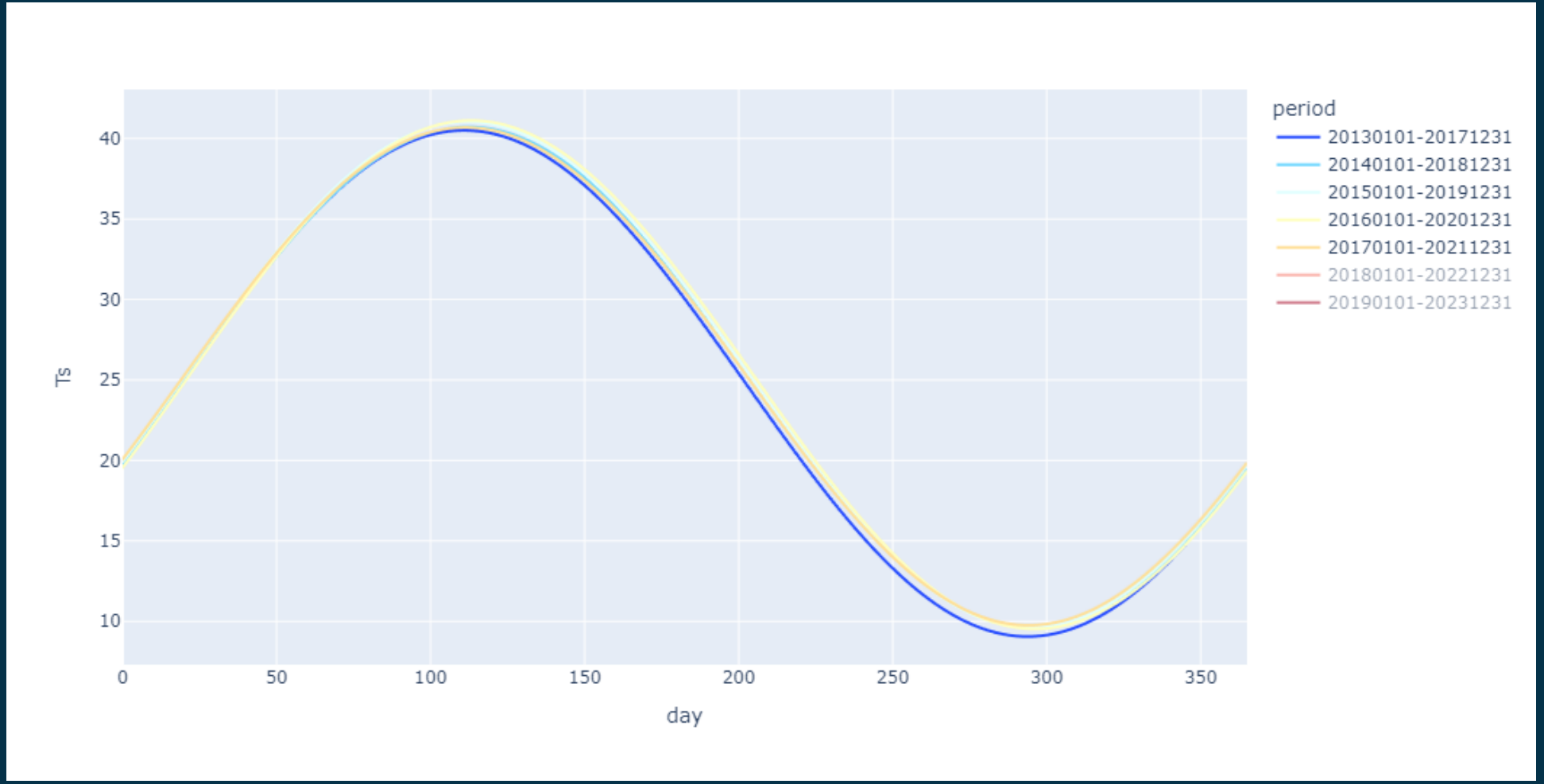

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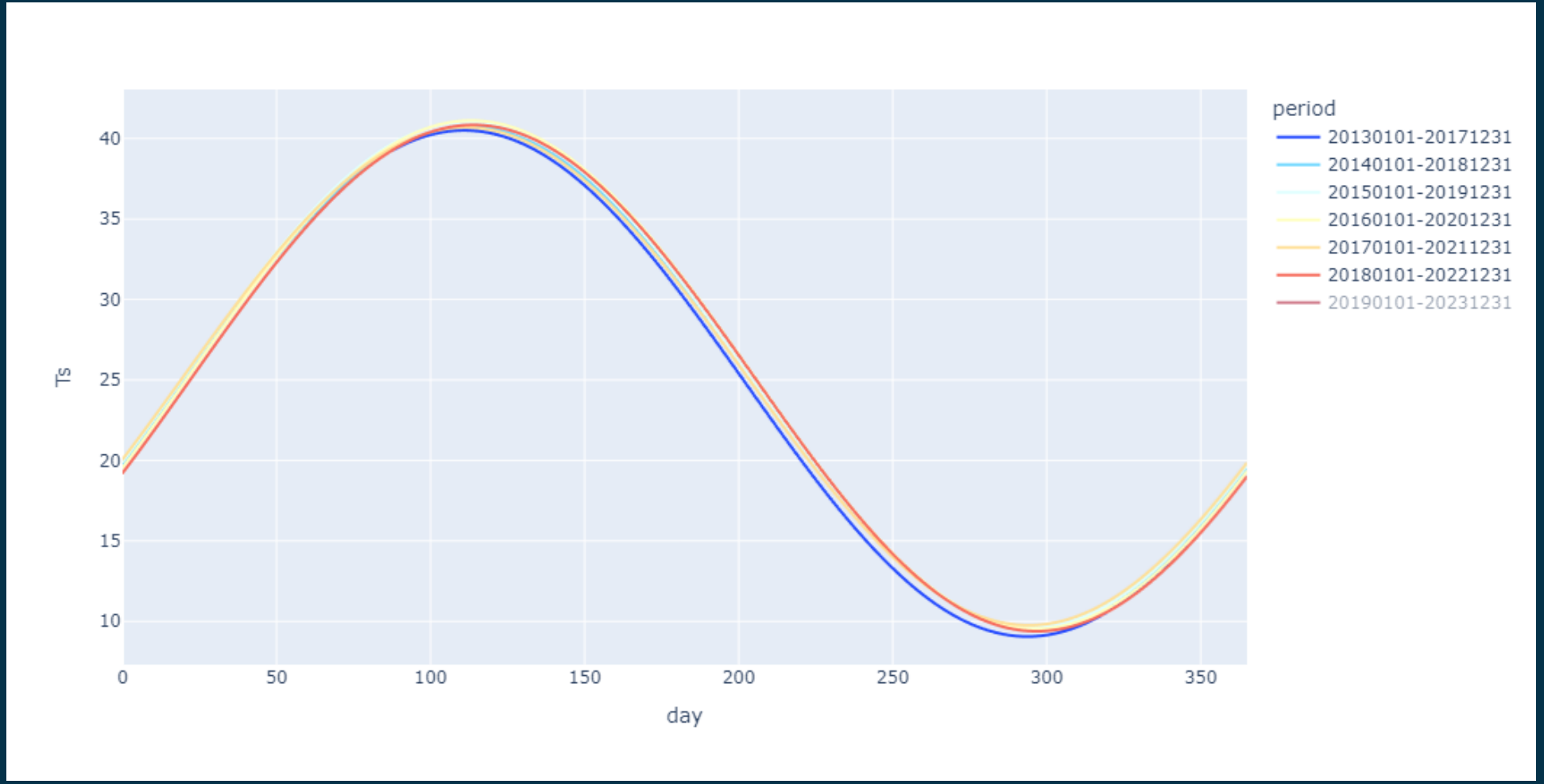

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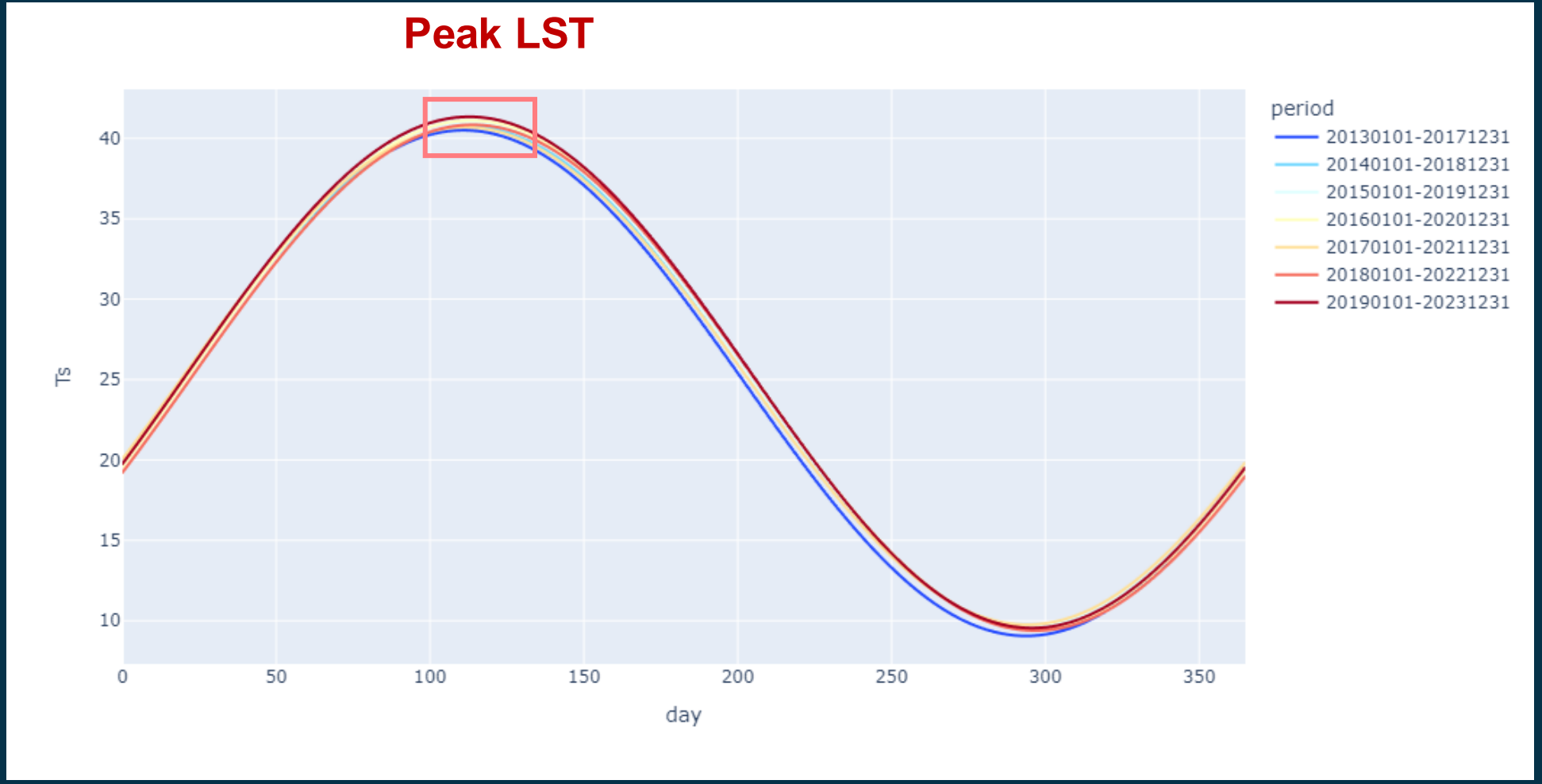
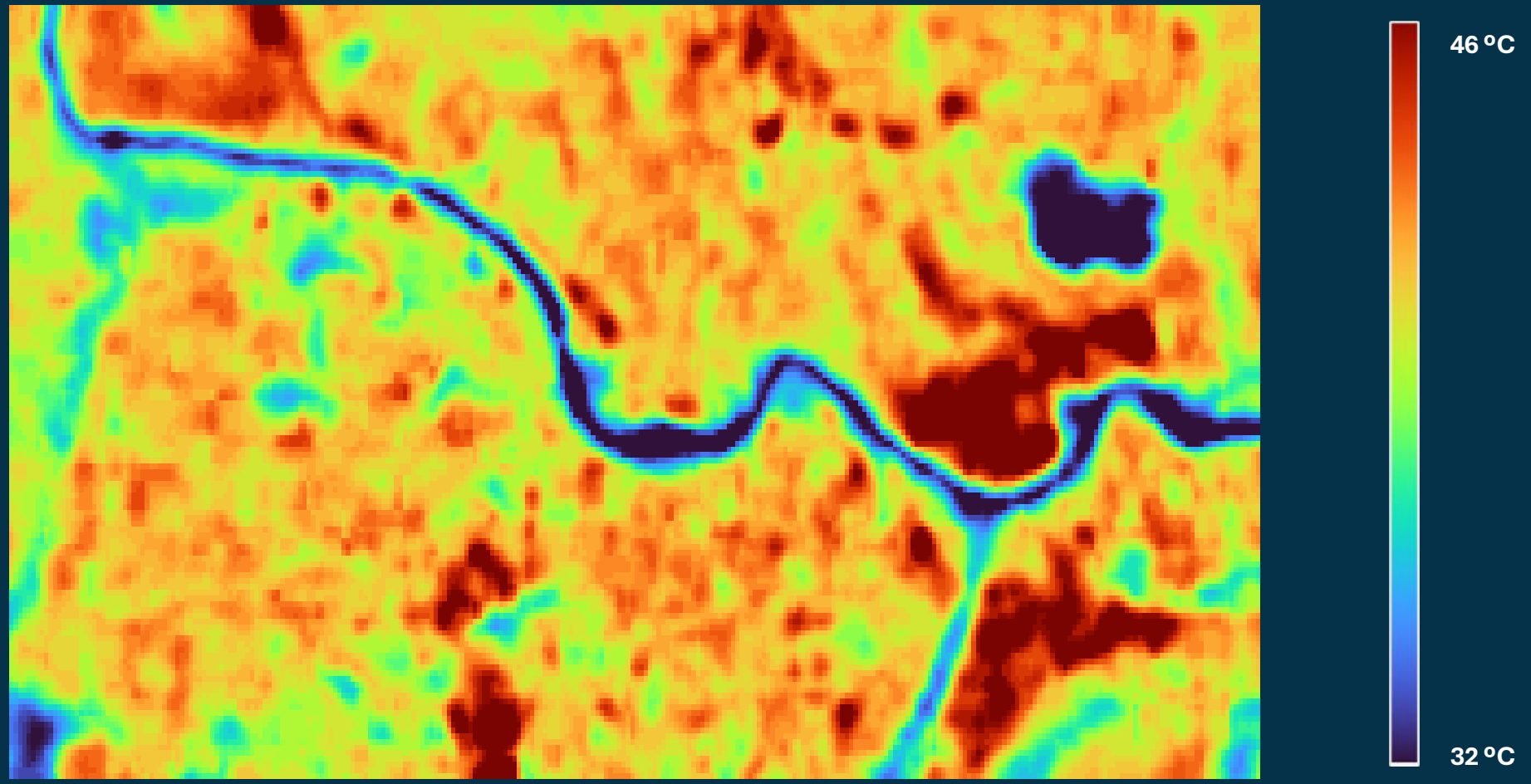


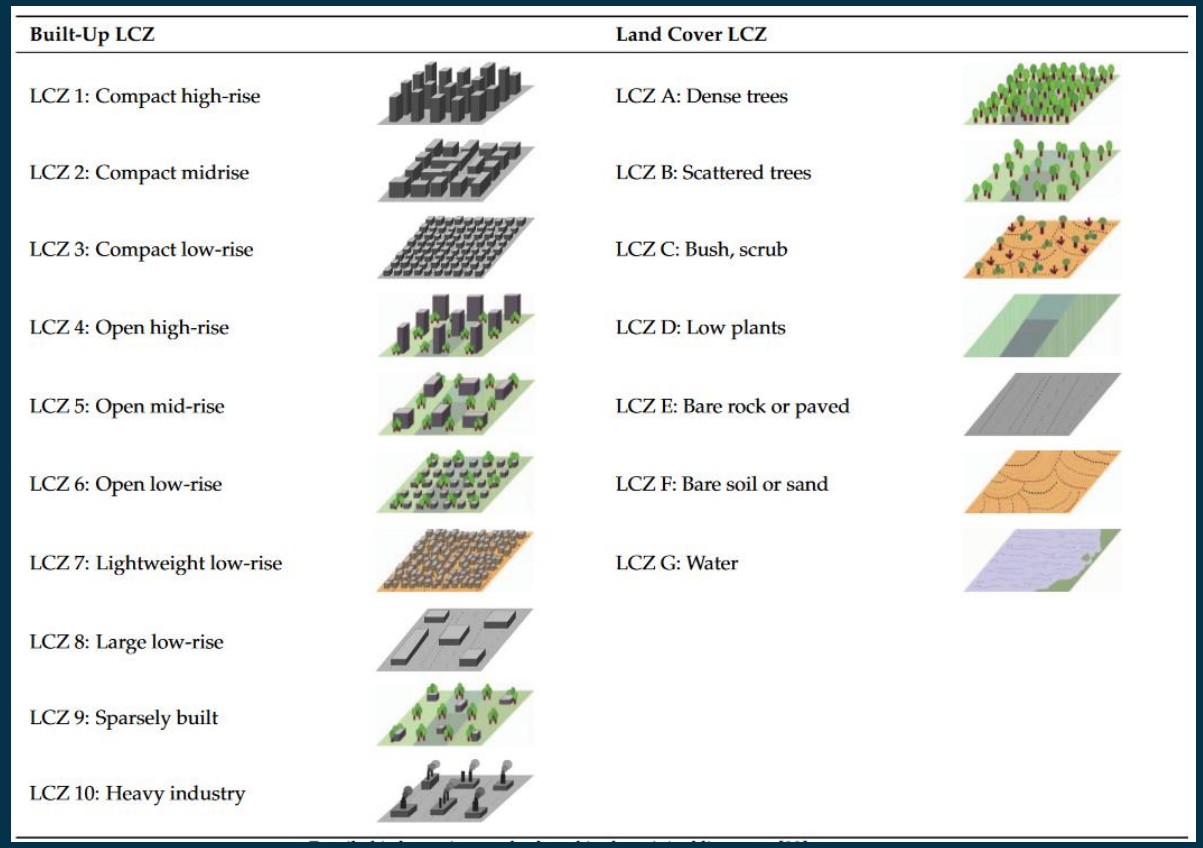
Peak Land surface temperature evolution



Understand land surface temperature impact factors based on local climate zones

The local climate zone (LCZ) and land surface temperature (LST) have gained considerable attention as urbanization continues to increase.

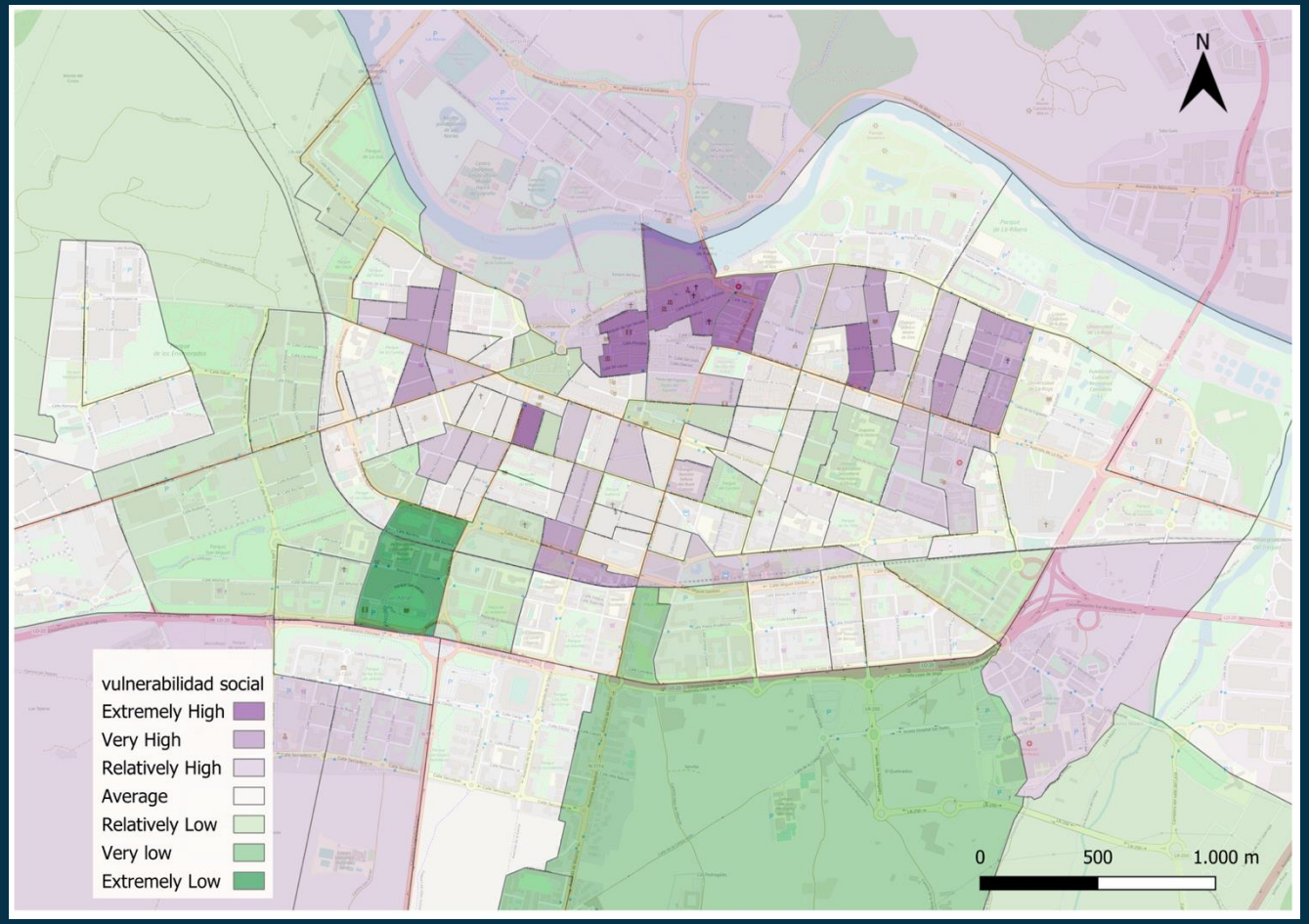
However, **the study of LSTs lacks a regional complexity perspective**. In order to explore the law of urban thermal environment, impact factors of LSTs are identified using GIS spatial analysis and statistical analysis methods in conjunction with parameter models that reflect urban spatial morphologies on the LCZ scale.



Su, R., Yang, C., Xu, Z., Luo, T., Yang, L., Liu, L., & Wang, C. (2024). Comparing Characteristics of the Urban Thermal Environment Based on the Local Climate Zone in Three Chinese Metropolises. *ISPRS International Journal of Geo-Information*, *13*(2), Article 2. https://doi.org/10.3390/ijgi13020061 / ID Stewart and TR Oke 2012

Mapping social vulnerability

Social vulnerability is defined as *"the propensity or predisposition of a population to be adversely affected by climate hazards.*

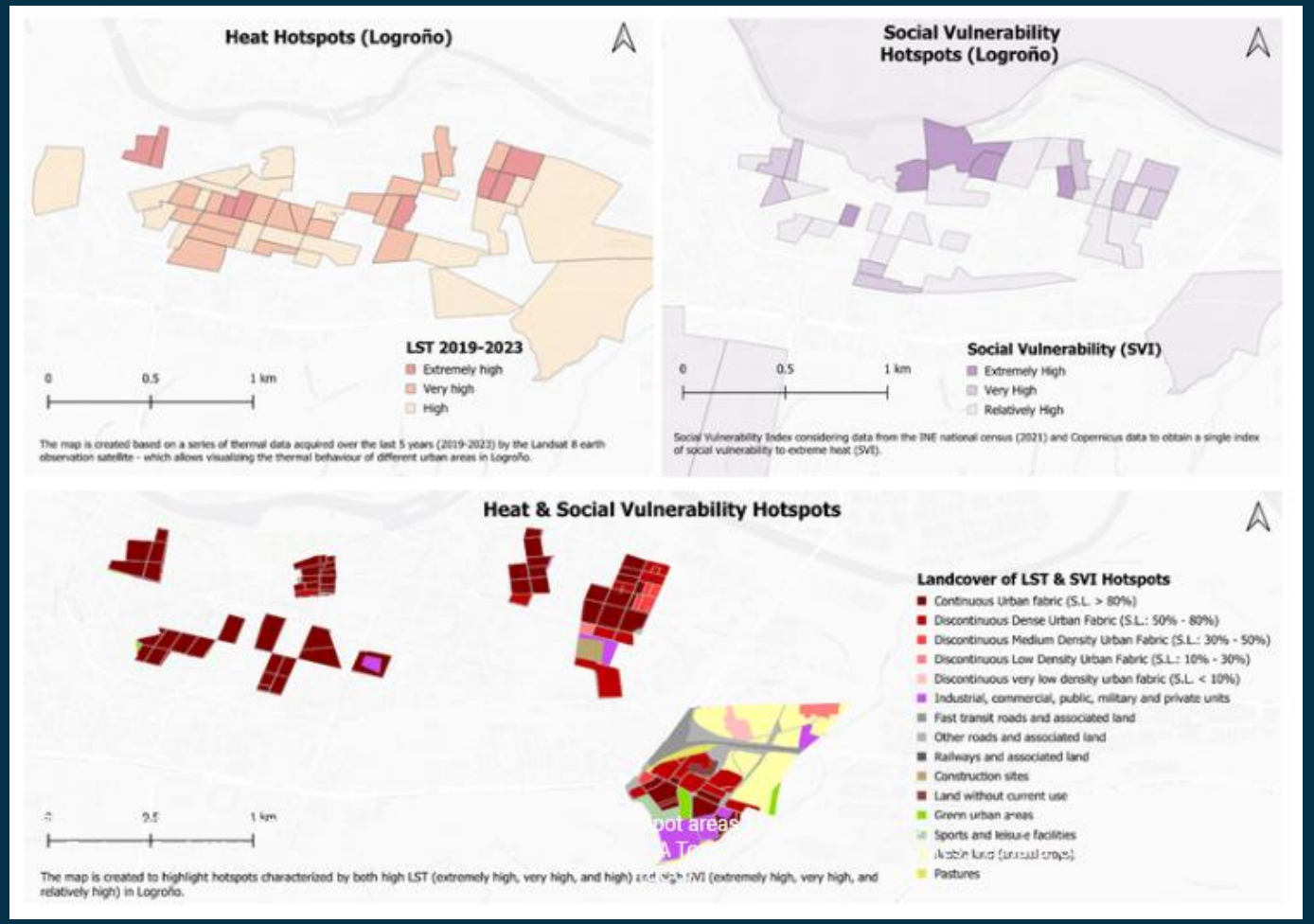


The social vulnerability maps allow spatial identification of the most vulnerable areas, enabling tailored interventions to enhance resilient strategies.

Integration of heat & vulnerability assessments

The Logroño City Council activates a **strategic heat plan** to combat heat waves with a preventive protocol and investments to create 'climate islands' starting in 2025 .

- Increasing urban canopy through new tree planting
- Sun protection for recreational spaces in the city
- Water misting in pedestrian areas
- Water infrastructure such as fountains, water features, water sheets, and water curtains
- Creation of new parks



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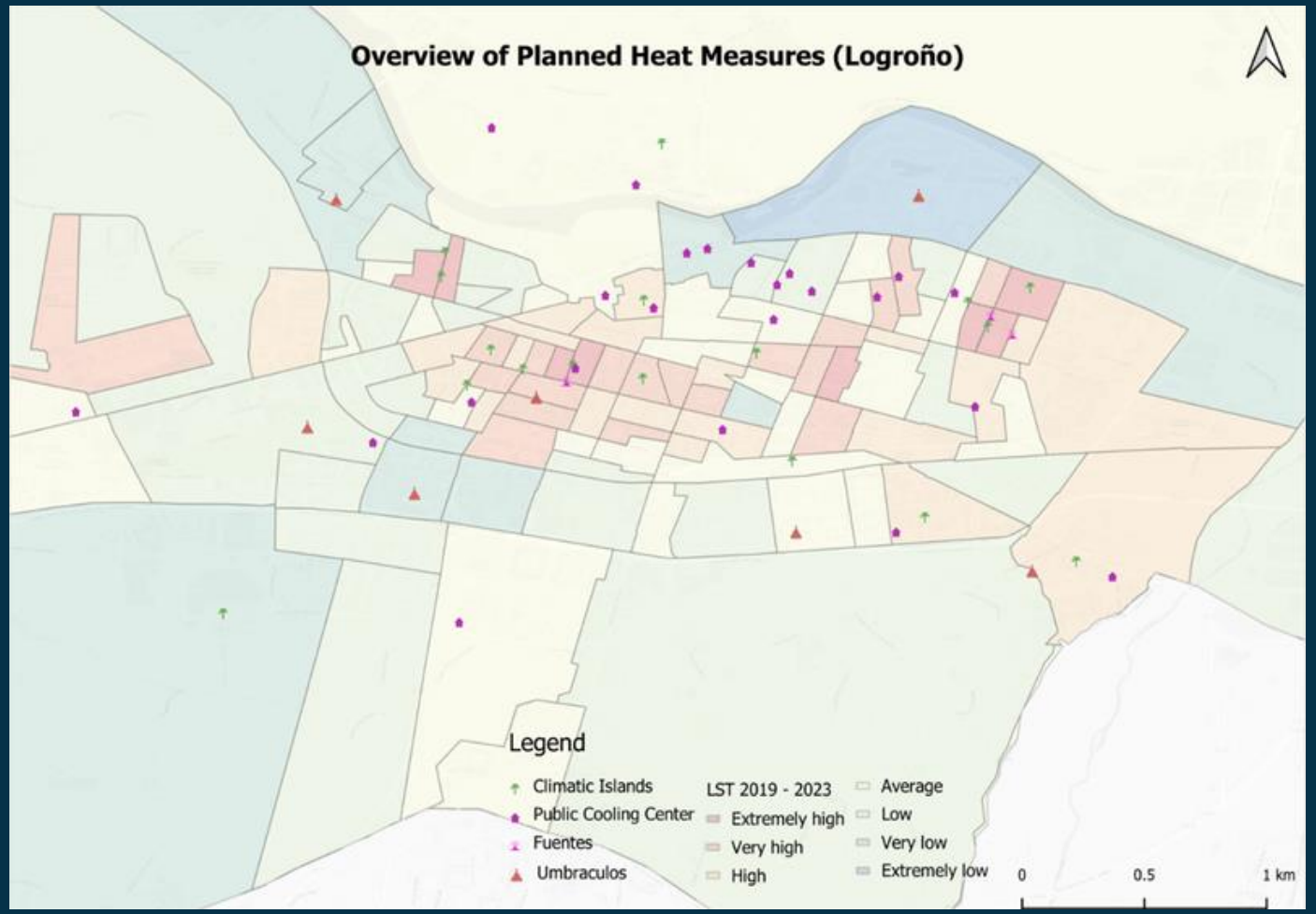
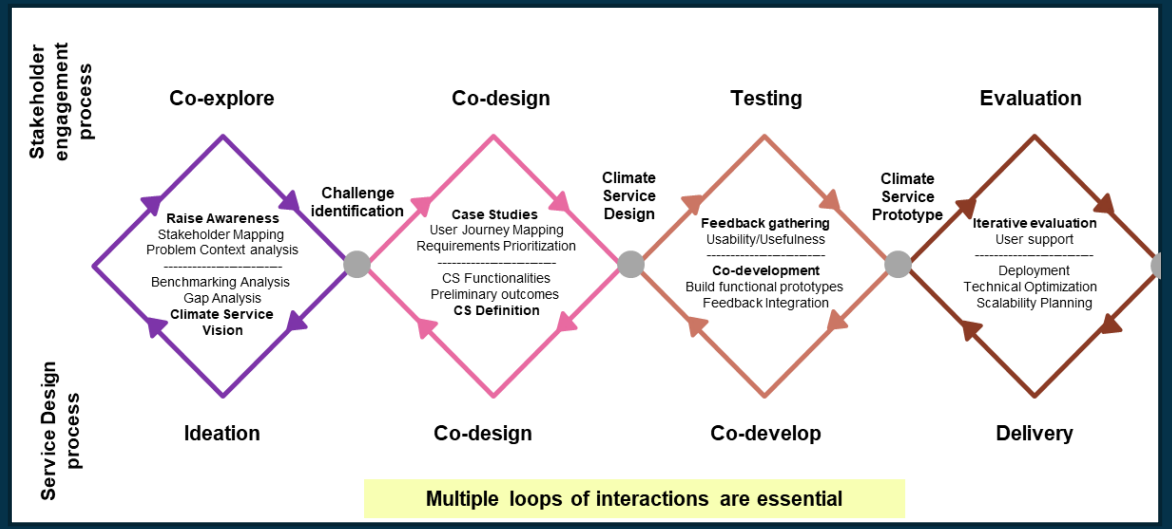


Key Learnings

1. The **co-creation processs** and a structured knowledge brokerage play a crucial role in transforming climate information into **actionable resilience strategies**.
2. It is also crucial the **combination with other data sources**
3. Evidence based decision making



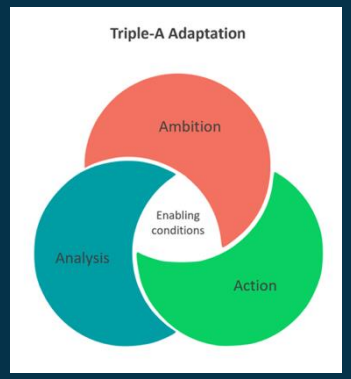
Trust

Diversity of knowledge

Iterative dialogue

Key Learnings

1. **Earth observation potential** – in different stages of the adaptation cycle

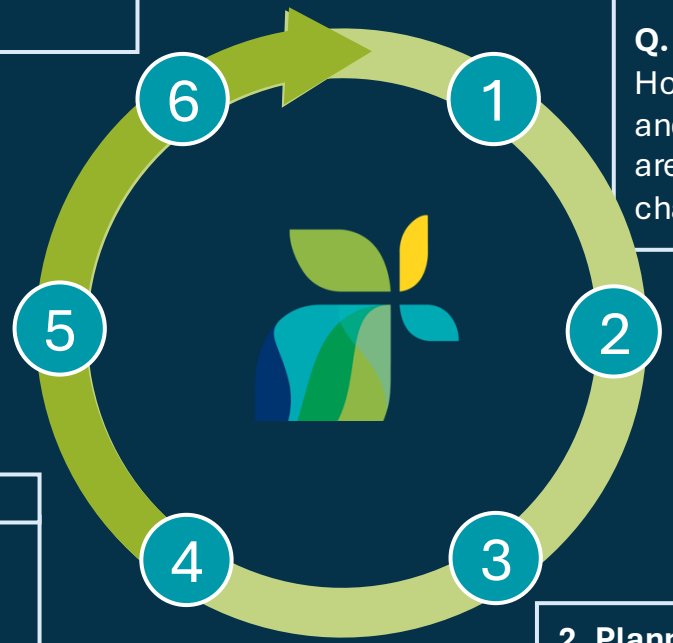


4. Monitoring and evaluation

Q. What **effects** have these adaptation **responses** had? How can be **measured these effects**?

2. Impacts and risk assessment

Q. What Impacts are happening? How are **hazards**, **vulnerbility** and **exposure** changing? What are the main risks? How will this change in the future?



3. Implementation

Q. What **responses** have been already taken? Where ?

2. Planning

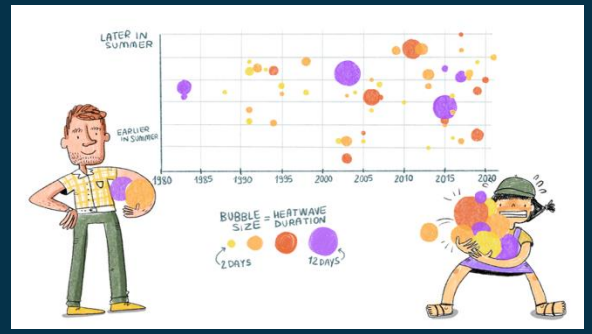
Q. What responses should be implemented?
Where are the **areas that should be prioritize**d?
When should these responses be planned?

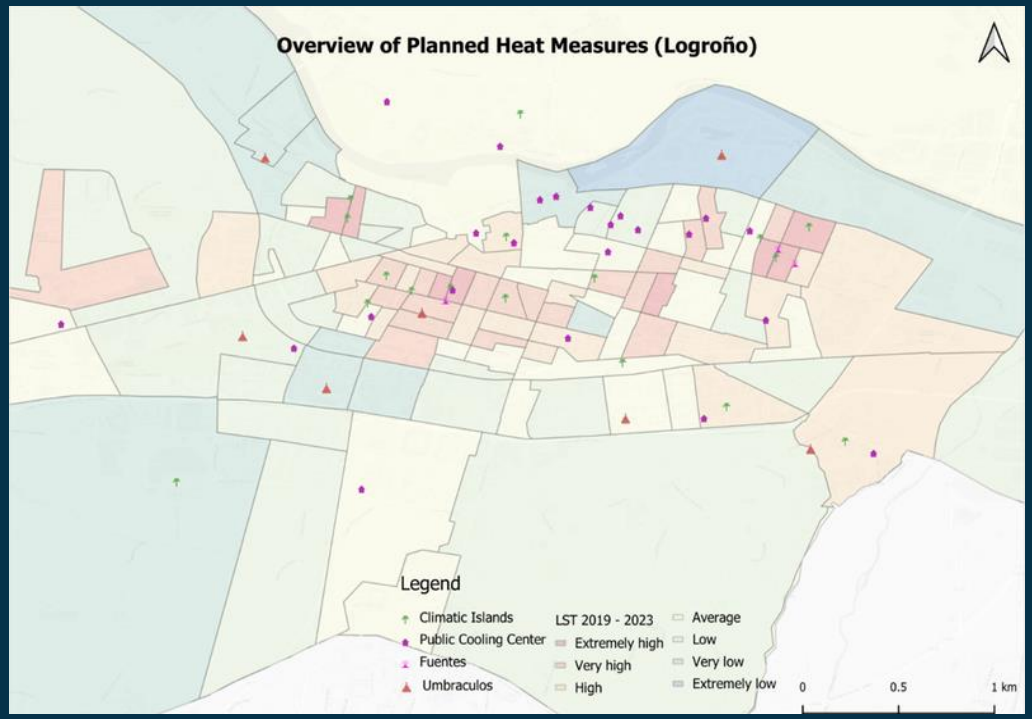
Learn More

The Logroño Strategic Heat Plan to combat heat waves with a preventive protocol and investments to create 'climate islands' starting in 2025

Building Climate Resilience in Logroño| Adaptation Stories | EU Mission on Adaptation to Climate Change Portal Climate-ADAPT

Logroño Climate Story:
Javier y María
Milano Climate Story:
Ambrogio & Gaia





Q&A

Nicki McGoh - Caribou

Next steps

Nicki McGoh - Caribou

Next steps

- Second webinar in March (details TBD) to discuss specific EO tools that are available for urban sustainability projects
  - This will be more interactive and a chance for us to hear from you about the types of challenges you face and what data you would like to have from EO data
  - More details will be shared in due course.