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Training event “Climate change and air quality: challenges and objectives for the atmospheric research.”

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(D.D. n. 130/2022 - CUP B53C22002150006) Funded by EU - Next Generation EU PNRR-Mission 4 “Education and Research” - Component 2: “From research to business” - Investment 3.1: “Fund for the realisation of an integrated system of research and innovation infrastructures”

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UNIVERSITÀ DEL SALENTO

DIPARTIMENTO DI SCIENZE E TECNOLOGIE BIOLOGICHE ED AMBIENTALI

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Study of extreme heat phenomena in the Puglia region and the dynamics of the Urban Heat Island Intensity in Lecce (Italy)

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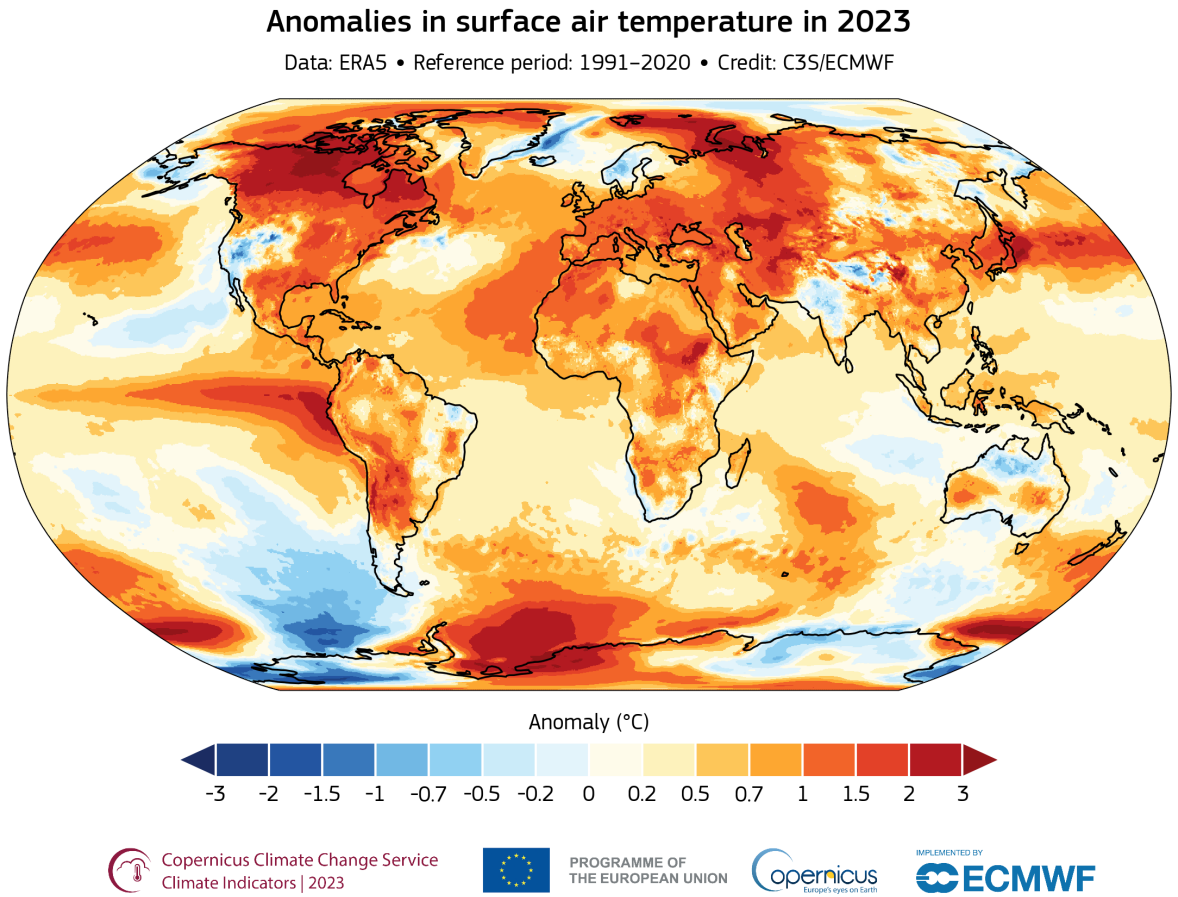
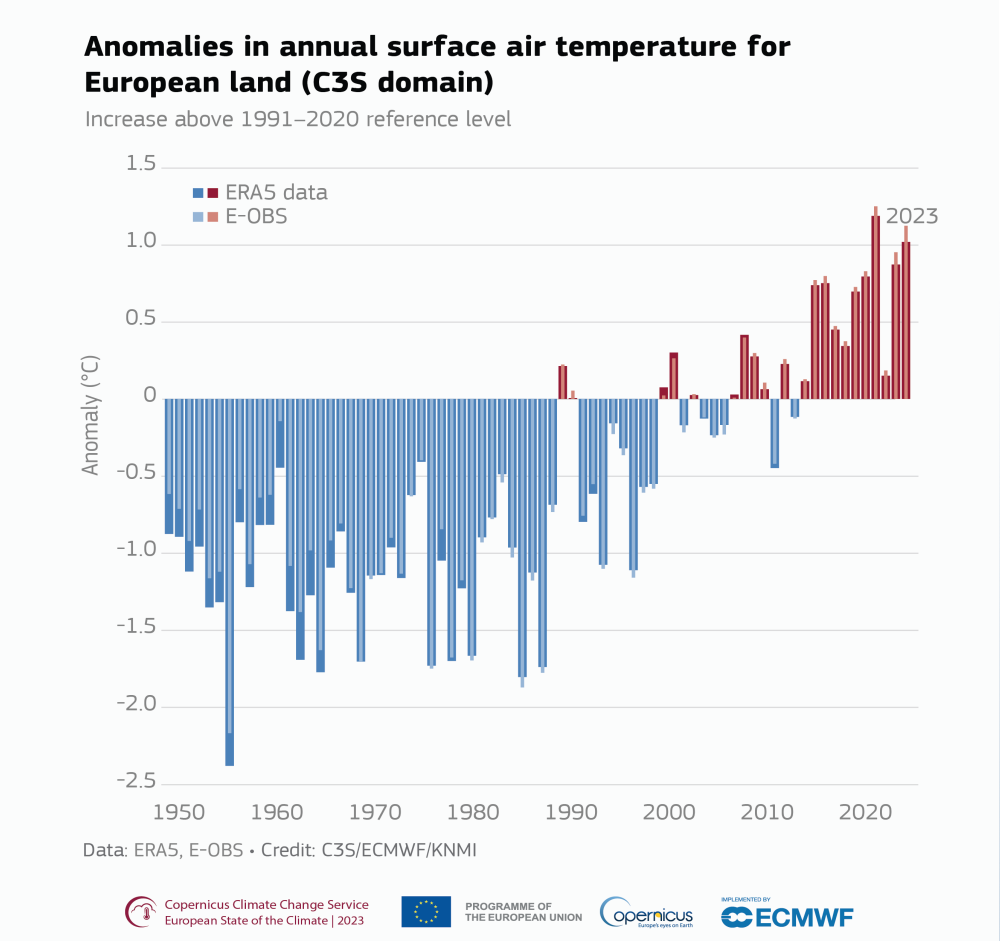
Climate change



- Global temperature increase of **more than 1°C** compared to the **1991-2020 average**.
- IPCC predicts **increase in intensity and frequency of extreme heat events.**
- **Heat Waves (HWs)**
- **Urban Heat Island (UHI)**

Climate change



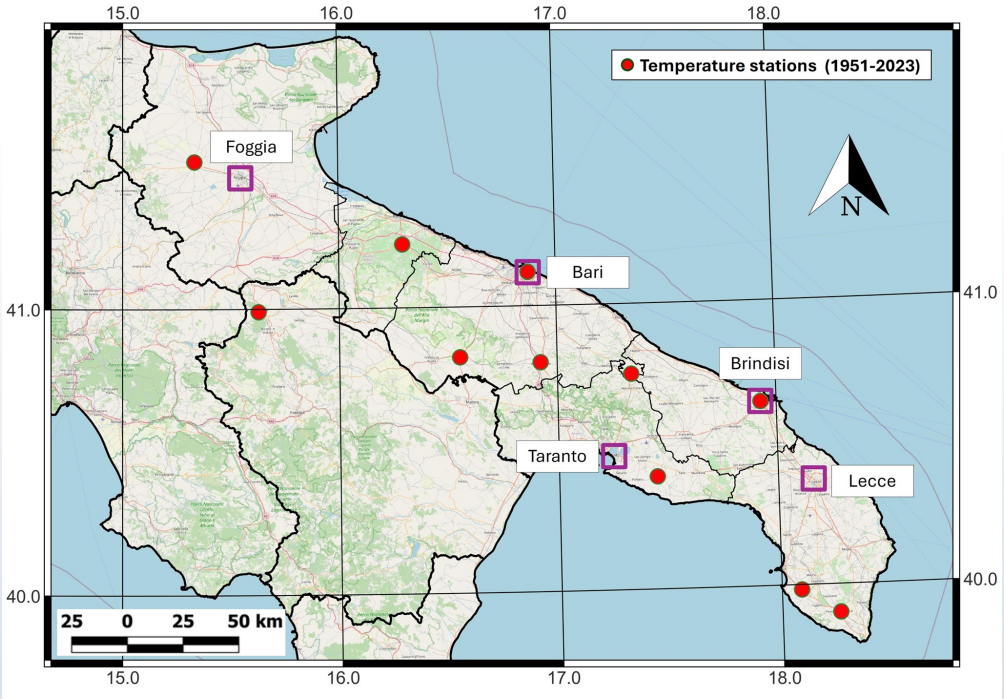
- Global temperature increase of **more than 1°C** compared to the **1991-2020 average**.
- IPCC predicts **increase in intensity and frequency of extreme heat events.**
- **Heat Waves** (**HWs**)
- **Urban Heat Island** (**UHI**)

Objectives

- Analysis of **historical temperature series** in the Puglia region.
- Study and identification of **extreme events** and **Heat Waves** (**HWs**).
- Analysis of the impact of HWs on the **Urban Heat Island Intensity** (**UHII**) in the city of Lecce.

Analysis of historical series of temperature

Methods



- The period considered for the analysis is **1951-2023.**
- **Thermal anomalies**
- **Extreme phenomena**

TN10p
- ***Cold Nights***
- Daily minimum temperature below the 10th percentile (reference period 1961-1990).

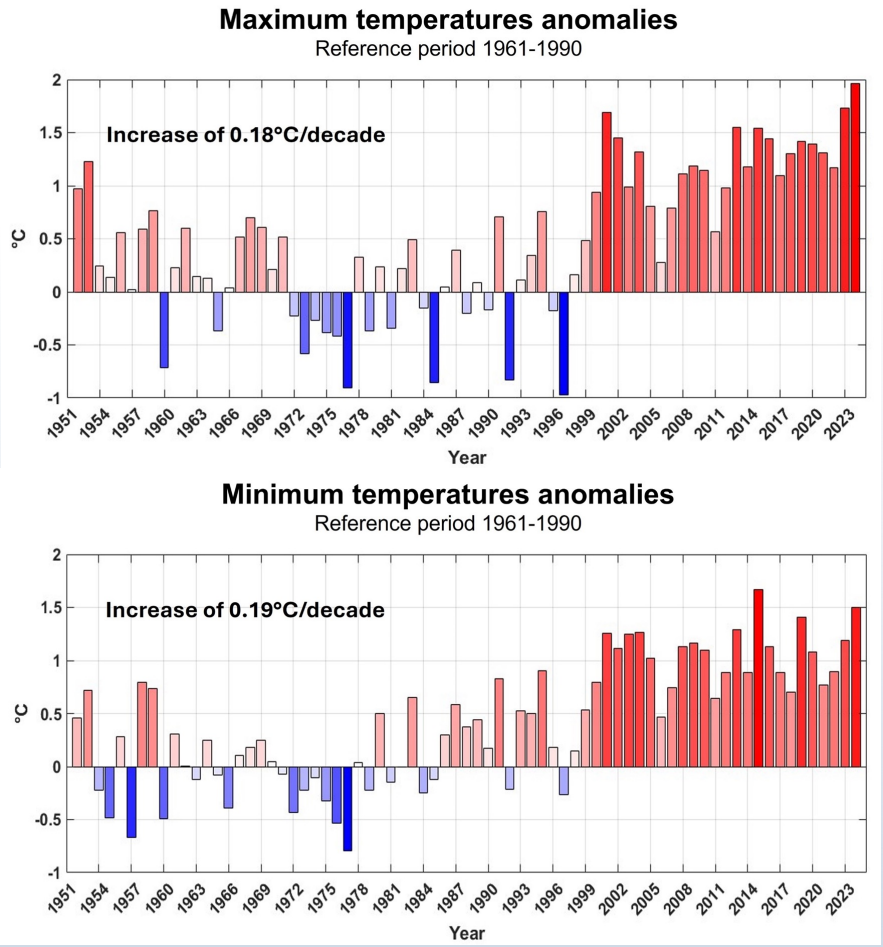
TN90p
- ***Warm Nights***
- Daily minimum temperature above the 90th percentile (reference period 1961-1990).

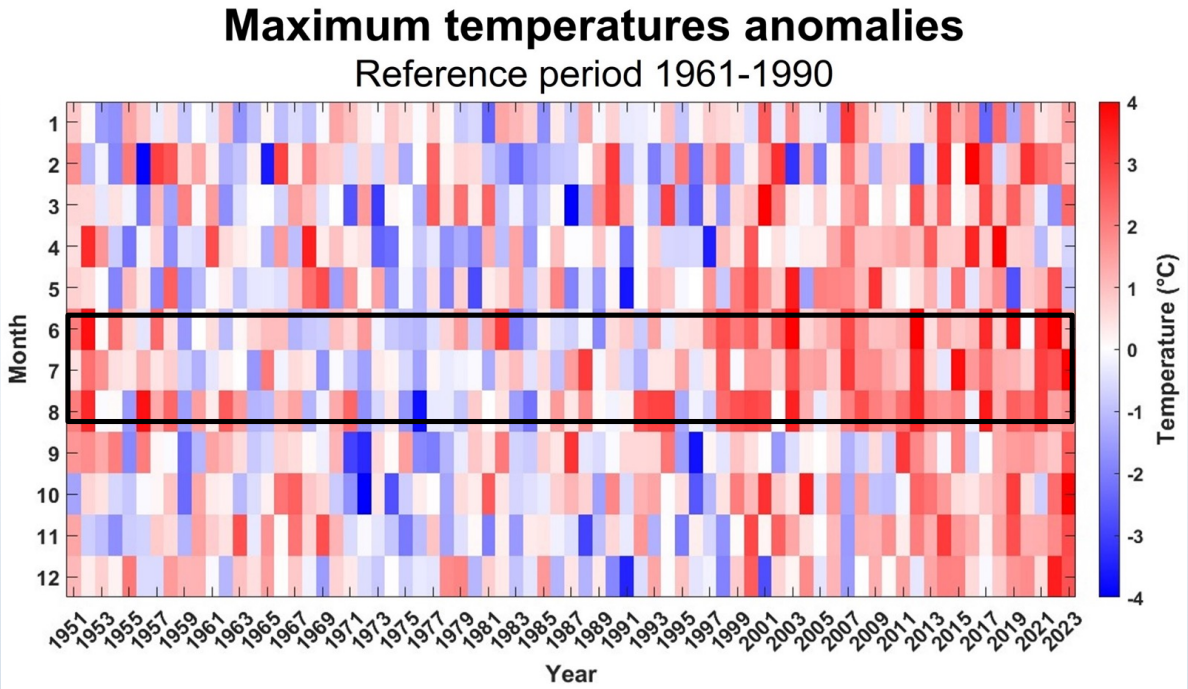
TX10p
- ***Cold days***
- Daily maximum temperature below the 10th percentile (reference period 1961-1990).

TX90p
- ***Warm days***
- Daily maximum temperature above the 90th percentile (reference period 1961-1990).

Thermal anomalies

Results



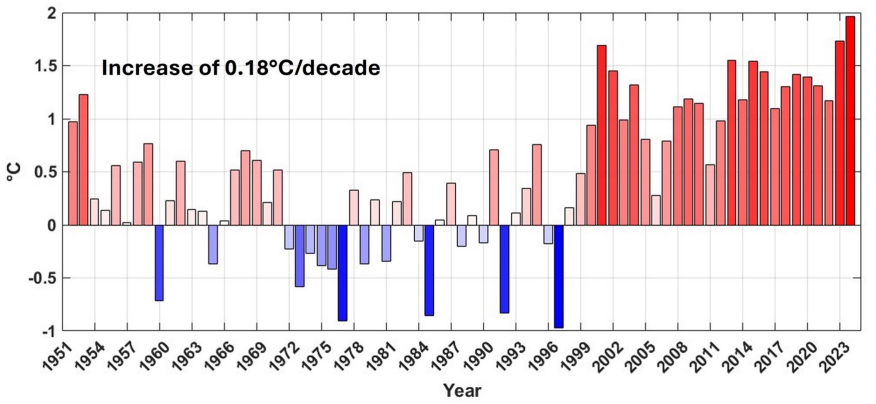


Extreme phenomena

Results

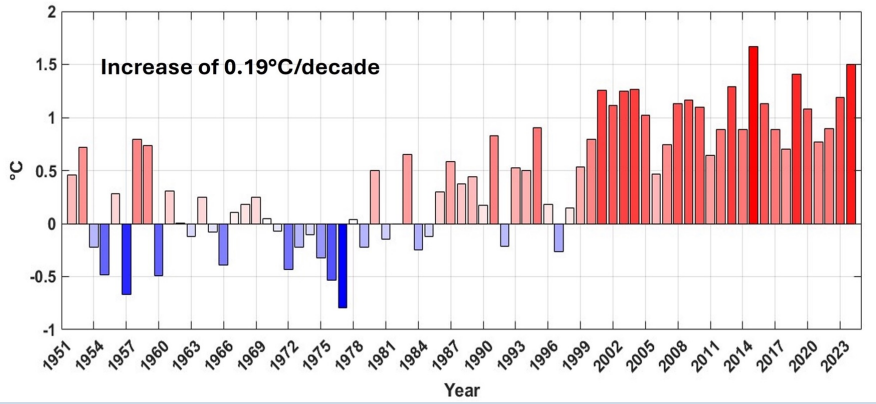
Maximum temperatures anomalies

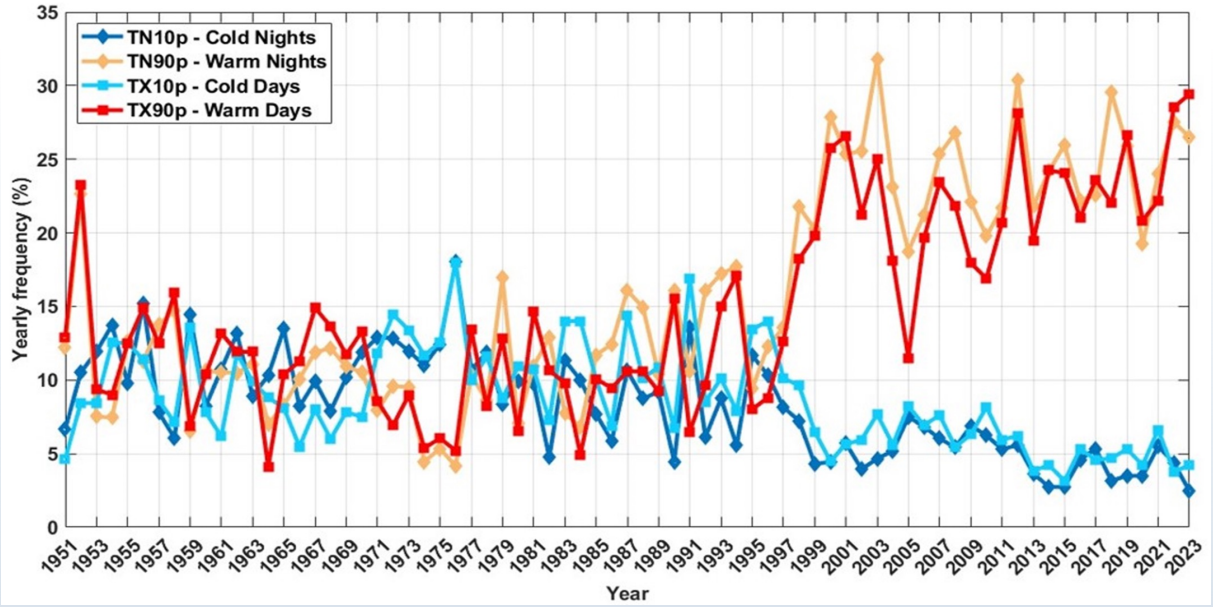
Reference period 1961-1990



Minimum temperatures anomalies

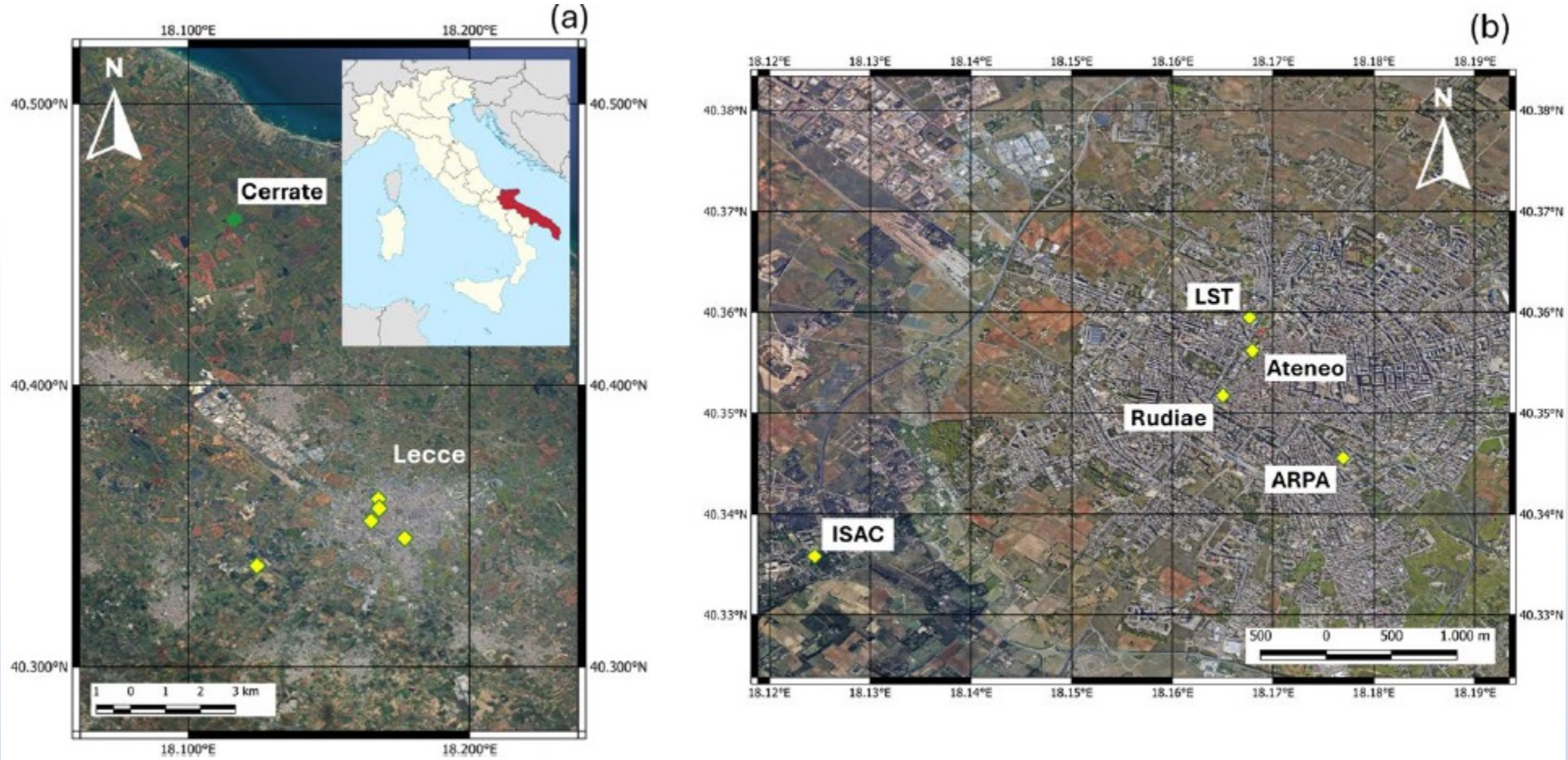
Reference period 1961-1990





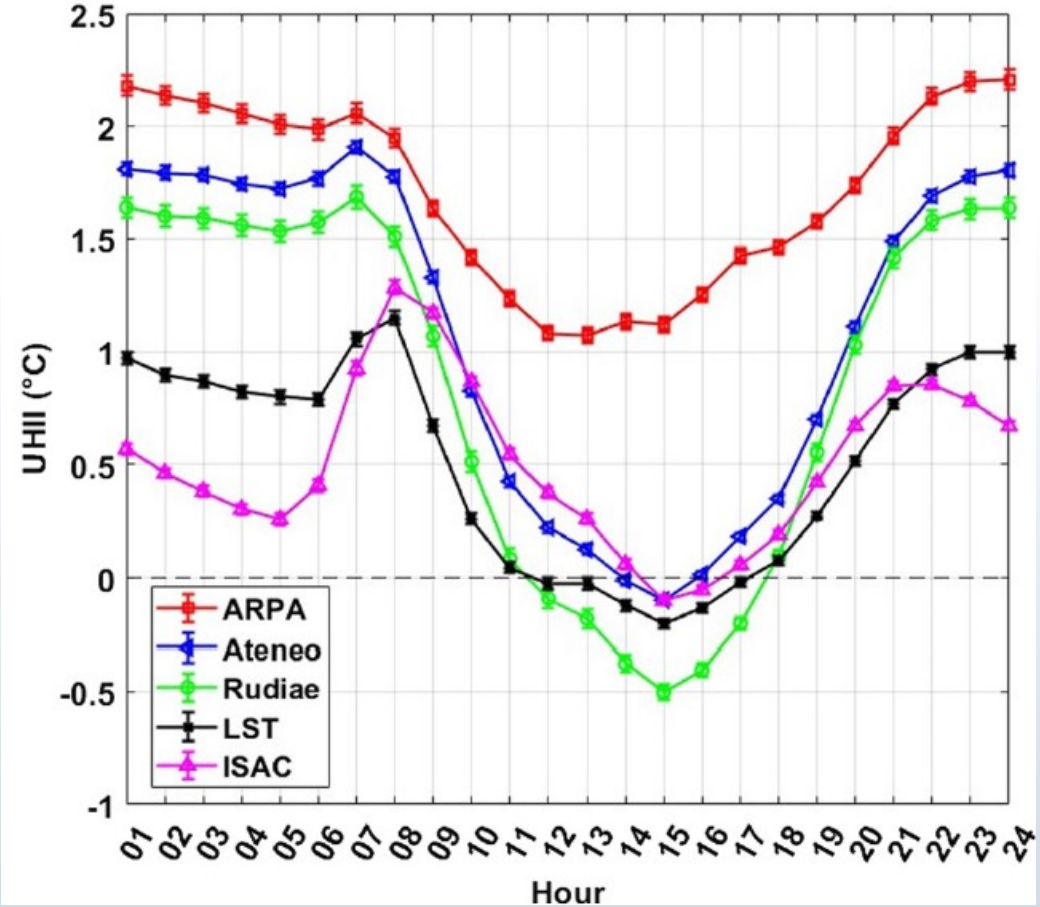
Impact of Heat Waves on UHII in Lecce

Methods



Impact of Heat Waves on UHII in Lecce

Results



- The **daily mean trend** from 2020-2023 shows a **consistent trend with the natural cycle of UHII** for all stations.
- UHII for **urban stations** varies **between 1.5°C and 2°C** during the **night**.
- For **Rudiae** station the **Urban Cool Island** (-0.50°C) occurs in the central hours.

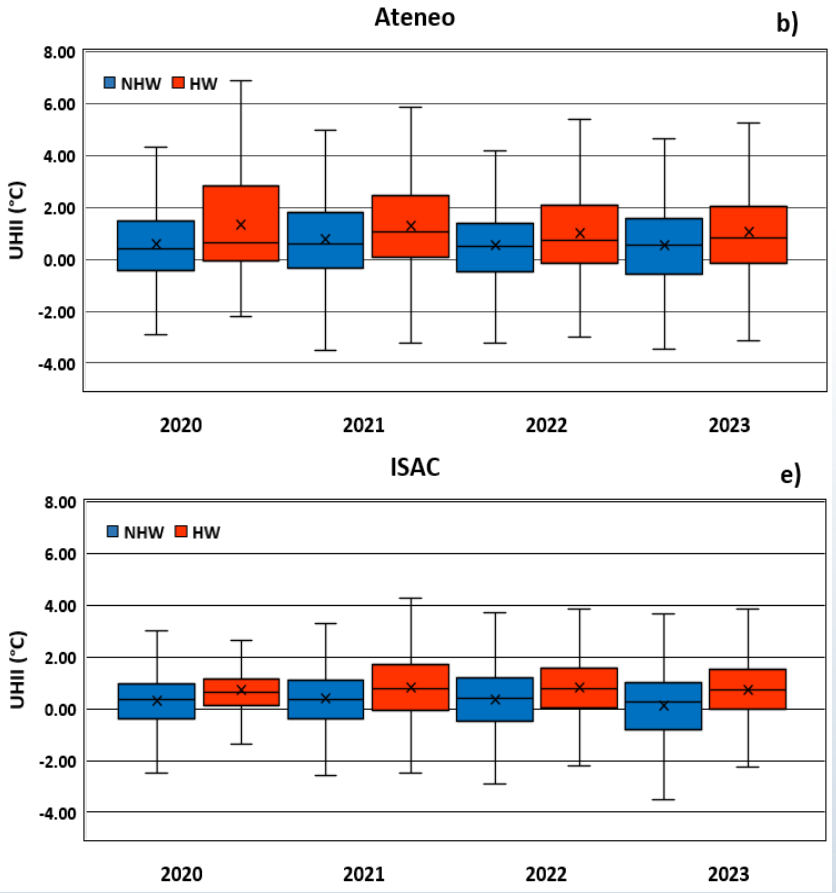
Impact of Heat Waves on UHII in Lecce

Results

Heat Wave: six consecutive days with the maximum temperature above the 90th percentile of the maximum LST temperatures for the reference period 1991-2020.

Year	N°	Start	Stop	HWD n°day	HWA °C
2020	1	26/06	03/07	7	33.36
	2	29/07	04/08	7	33.43
2021	1	21/06	26/06	6	37.22
	2	25/07	05/08	12	36.60
	3	07/08	17/08	11	34.15
2022	1	21/06	07/07	17	34.56
	2	21/07	31/07	11	34.44
	3	02/08	09/08	8	33.35
2023	1	11/07	26/07	16	37.62
	2	28/07	04/08	8	33.96
	3	21/08	28/08	8	34.47

HWD: heatwave duration (number of days)
HWA: averaged temperature ()



- **Significant differences in average UHII** between HWs and NHWs periods as confirmed by Student's T-test.
- Ateneo **average ΔUHII** of **0.60°C**.
- ISAC **average ΔUHII** of **0.48°C**.
- More **urbanized areas** are **more affected by warming** during HWs.

Future goals

1) **Study on mortality and related impact of extreme heat:** monthly and seasonal analysis of deaths/number of inhabitants in the municipalities of Puglia, also in relation to maximum daily temperatures and their anomalies.

2) **Microclimate simulation of areas of the city of Lecce**: use of ENVI-met to study the impact of climate change on the urban microclimate (outdoor thermal comfort) and mitigation measures (e.g. Cool roof, urban greenery).

References

- Pappaccogli, G., Giangrande, F., Esposito, A. et al. Dynamics of urban heat island intensity in Lecce, Italy: seasonal, diurnal and heat wave influence. Bull. of Atmos. Sci.& Technol. 5, 8 (2024). https://doi.org/10.1007/s42865-024-00072-z

- *Title*: Assessing Thermal Discomfort and Vulnerability to Heat Waves in the Municipalities of Puglia, Italy; *Authors*: Giangrande F., Pappaccogli G., Esposito A., Lionello P., Buccolieri R. (Medclivar-SISC 2024 conference).

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THANKS FOR YOUR ATTENTION!

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