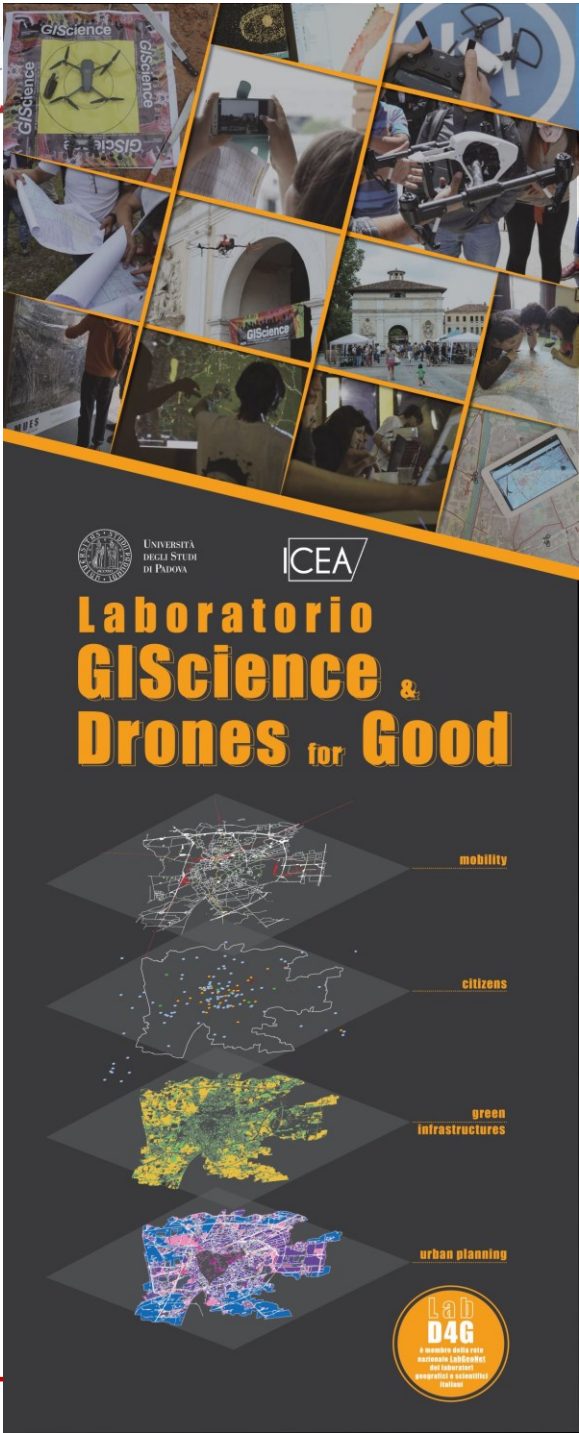
Proposte di tesi A.A 2023/2024

Gruppo di ricerca

Cambiamenti climatici territori diversità

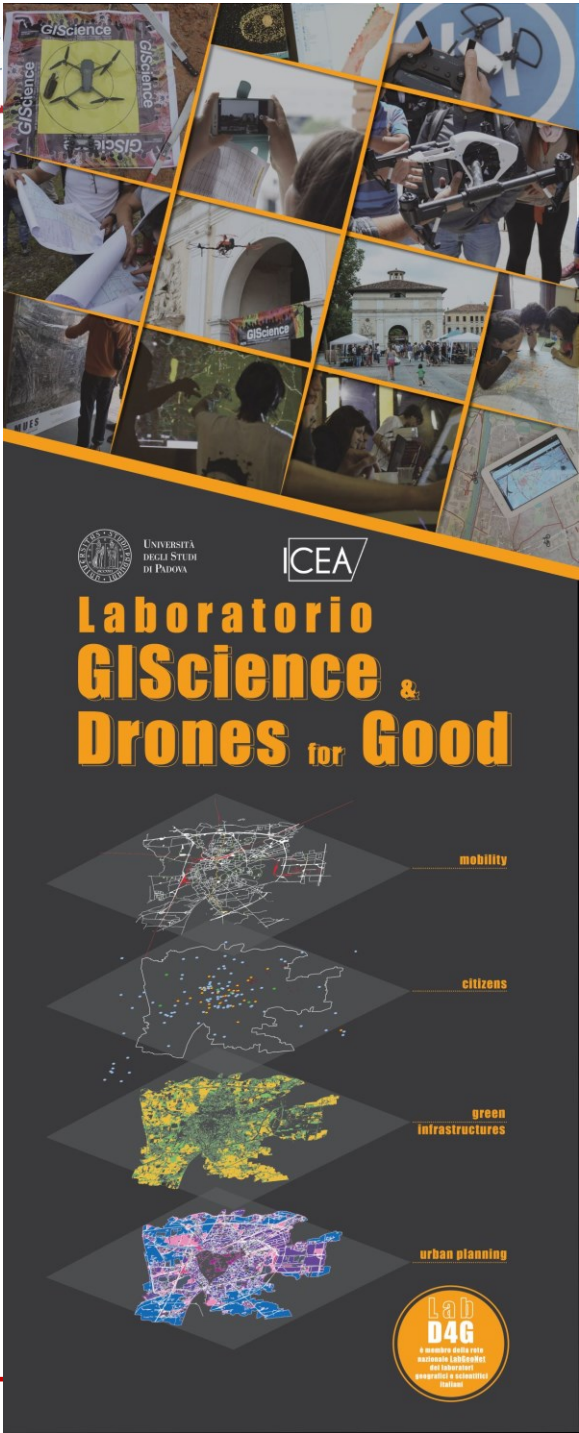
Laboratorio GIScience Drones for Good

Palazzetto Costruzioni Marittime
Via Ognissanti 39, Portello
Padova



Pre-requisiti

- Conoscenze di base (pratiche) uso di GIS (QGIS)
- Disponibilità e volontà di apprendimento di nuove metodologie e conoscenze
- Lettura testi in inglese (*literature review*)
- Capacità di *data mining* e *data production*
- *Data analysis*
- Approccio critico
- Spirito di iniziativa



Approcci, strumenti, metodologie: la GIScience

Remote sensing

Piattaforme satellitari (ESA, USGS, Planet)

Rilievi aerei tradizionali

Rilievi SAPR (ala fissa, rotore)

PIXEL

Citizen Science e PGIS

GIS partecipativo

Mappatura partecipativa

Volunteered Geography (VGI)

PEOPLE

Sostenibilità e resilienza climatica urbana

- Consumo di suolo (BAF) e scenari di compensazione (*LULC analysis*)
- Vuoti urbani ed aree abbandonate (rigenerazione urbana)
- Reti ecologiche, infrastrutture verdi e servizi ecosistemici
- Analisi ondate di calore (*Heat Waves*) e mappatura isole di calore urbano (*Urban Heat Islands*)
- Citizen science e monitoraggio microclima urbano diffuso: analisi dati da stazioni meteo fisse e *testing snifferbike*
- Mappatura e classificazione del verde urbano

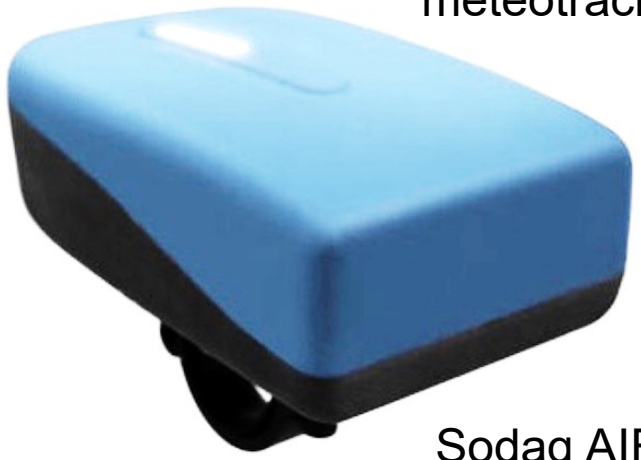
Climate Justice in the city

- *Volunteered Geographic Information* (VGI) and climate extremes in urban areas: mapping and assessing urban microclimates and heat islands by snifferbikes (Summer)
- VGI and air pollution: mapping air quality by using an open-source device (open-seneca) (Winter)
- Mapping Local Climate Zones for urban resilient development
- Mapping and assessing *Heat Waves* and *Urban Heat Islands*: study cases at local level
- Integrated heat-related climate risk analysis and mapping urban climate justice
- Climate change in Padova: meteo-climatic analyses from fixed weather stations

Mappatura isole di calore urbano e inquinanti atmosferici

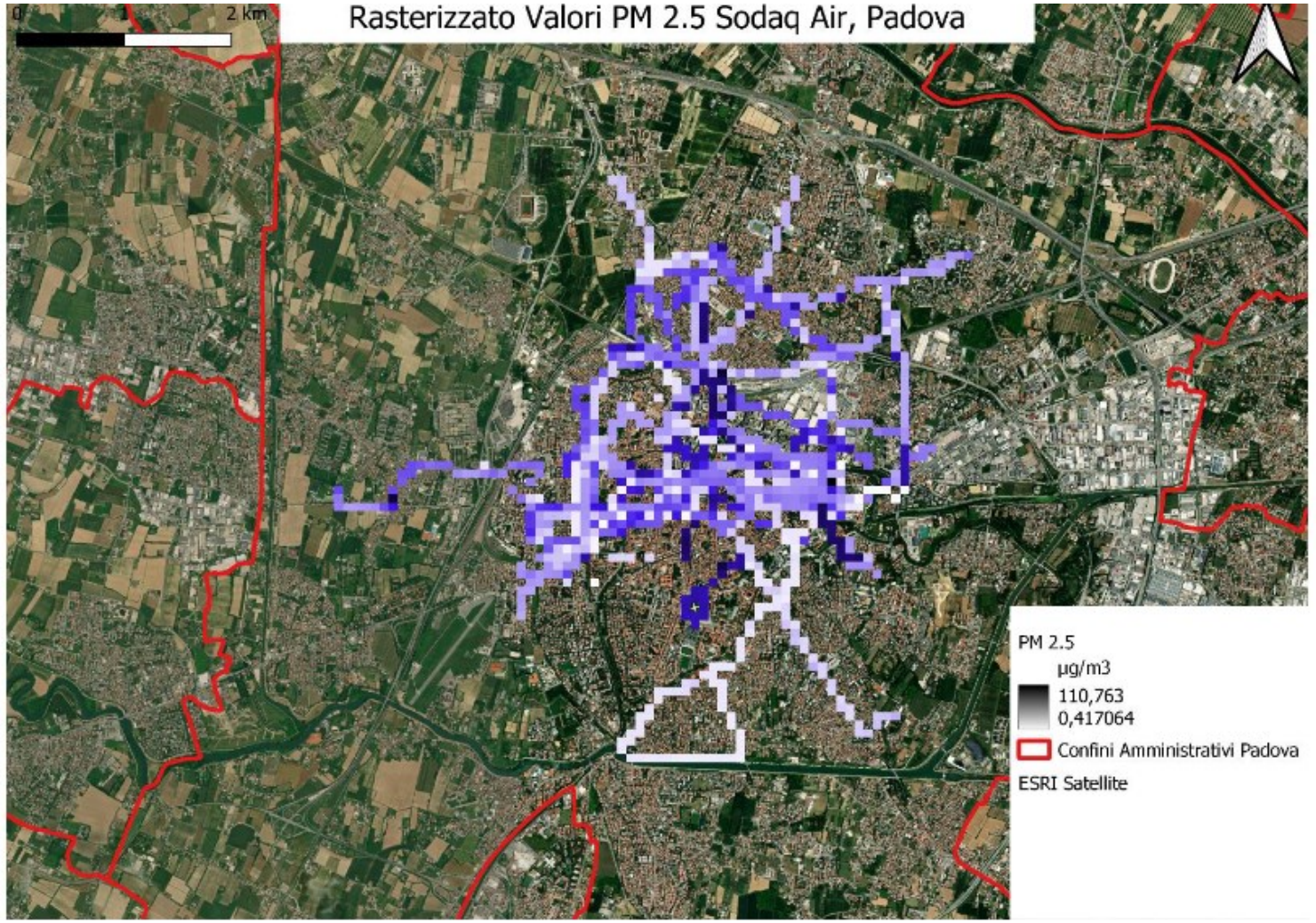
- Monitoraggio ambientale diffuso sul territorio urbano (T°, RH, P, Pm10, Pm 2.5, VOC)
- Dispositivi mobili per monitoraggio ambientale e qualità dell'aria (*snifferbike*)

meteotracker



Sodaq AIR

Mappatura isole di calore urbano e inquinanti atmosferici



Laureando Marco Carraro, 2023

International Symposium on Mobile Mapping Technology (MMT)

PADOVA, May 24-26

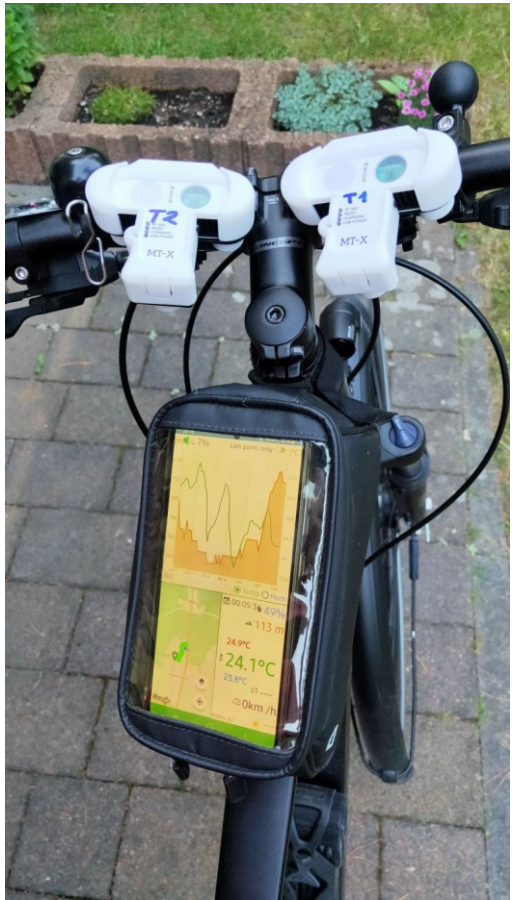
Volunteered Geographic Information (VGI) and climate extremes in urban areas: mapping and assessing urban microclimates and heat islands by snifferbikes

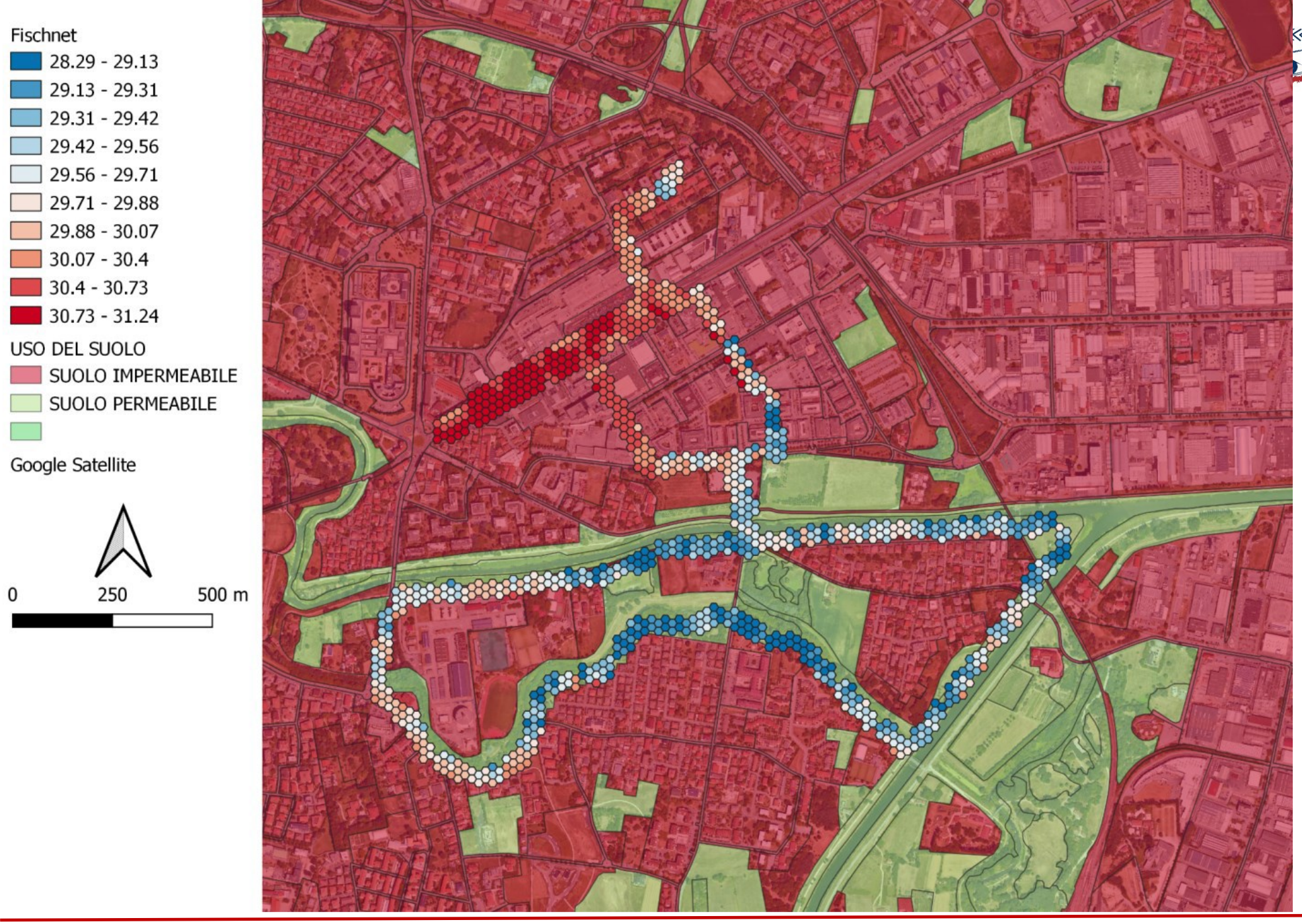
Climate Justice
Centre of Excellence

Lisa Rubert (IAT, 2023)

Mappando le isole di calore in bicicletta (29 luglio 2023)

MeteoTracker





Climate Justice
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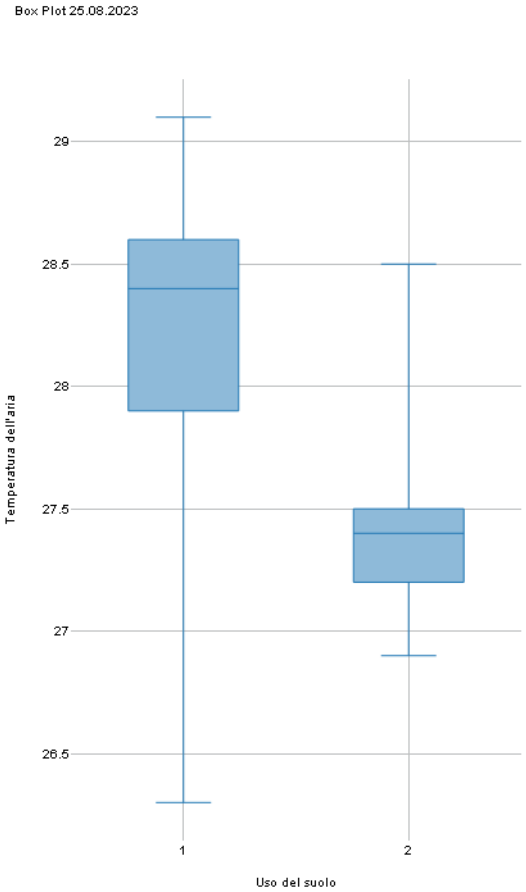
Lisa Rubert (IAT, 2023)



Mapping and assessing *Heat Waves* and *Urban Heat Islands*: study cases at local level

Università degli Studi di Padova

ICEA

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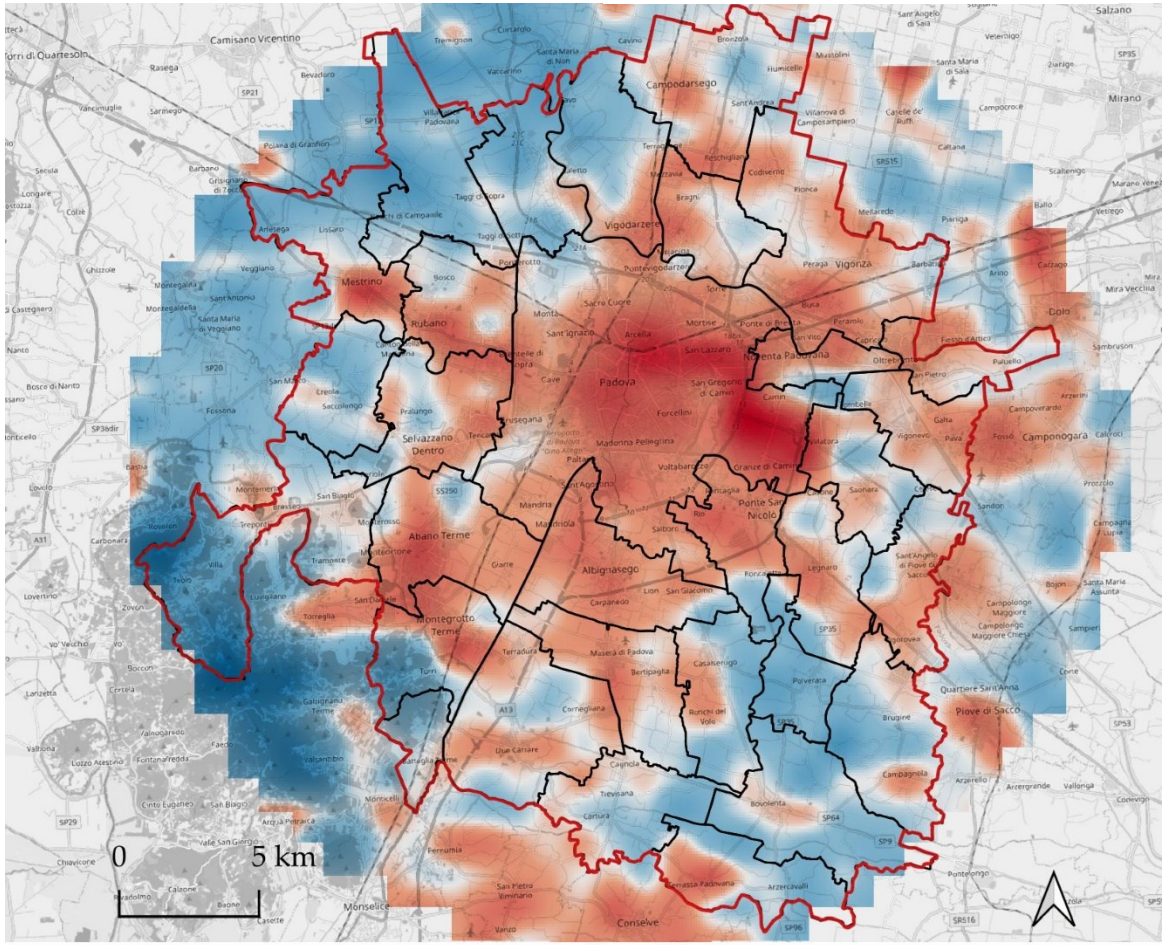
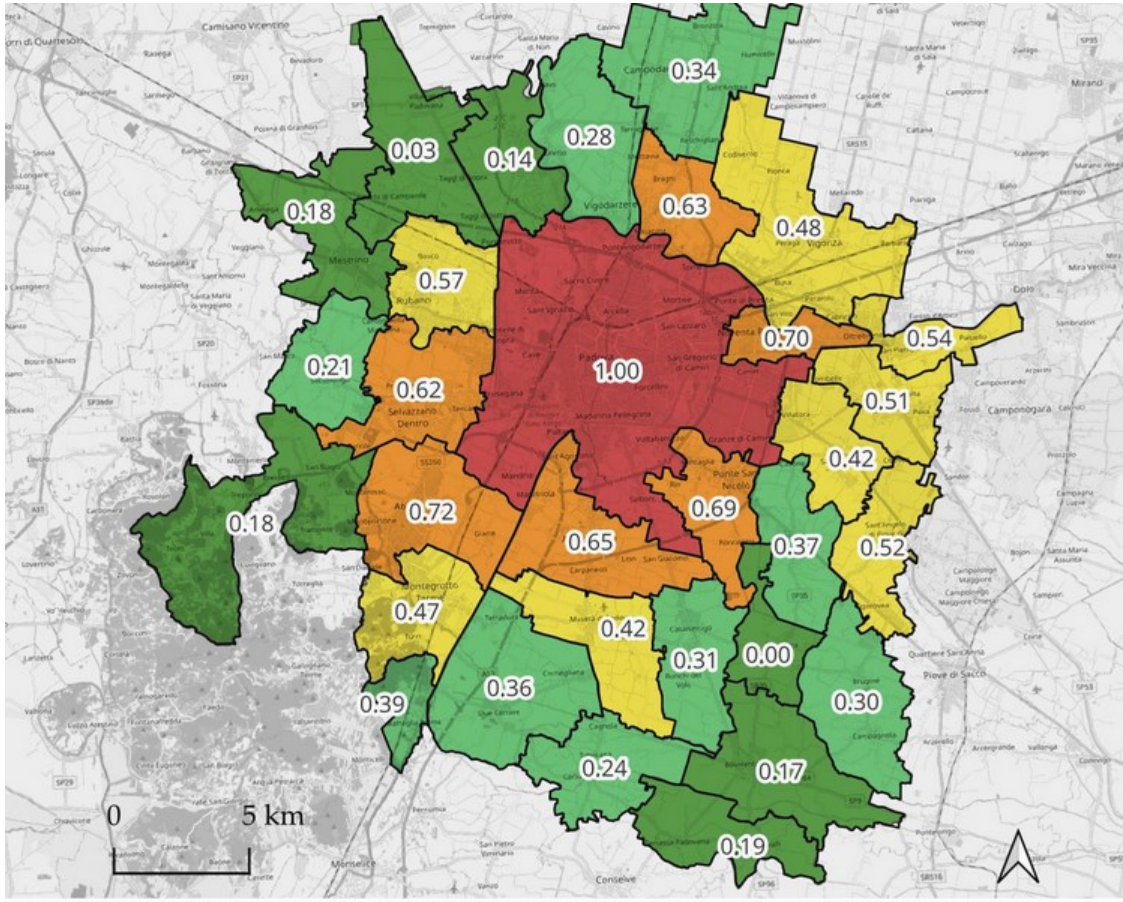
Climate Justice Centre of Excellence

isprs International Journal of Geo-Information

Climate Justice in the City: Mapping Heat-Related Risk for Climate Change Mitigation of the Urban and Peri-Urban Area of Padua (Italy

by Valeria Todeschi [1], Salvatore Eugenio Pappalardo [2,3,*], Carlo Zanetti [1], Francesca Peroni [4] and Massimo De Marchi [3]





International Journal of Geo-Information

Climate Justice in the City: Mapping Heat-Related Risk for Climate Change Mitigation of the Urban and Peri-Urban Area of Padua (Italy)

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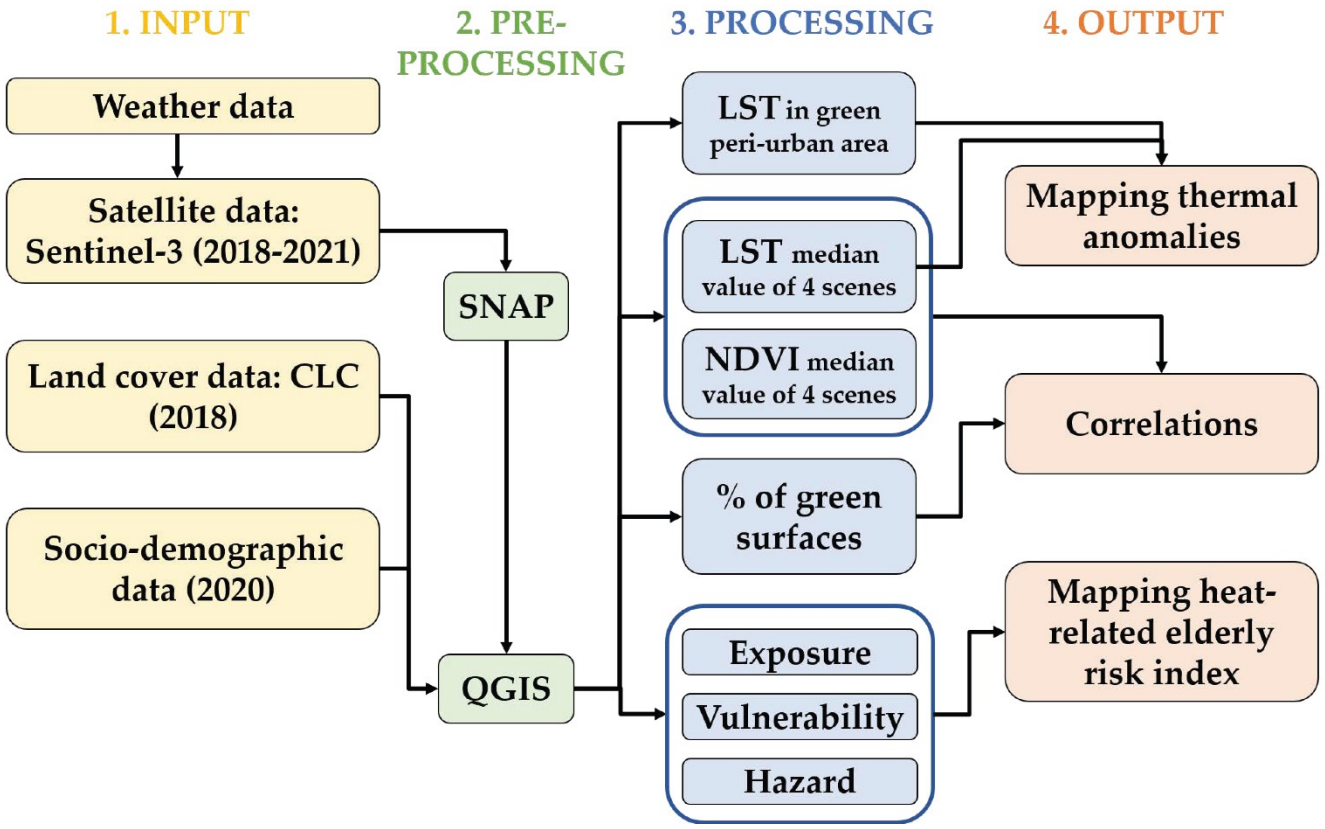
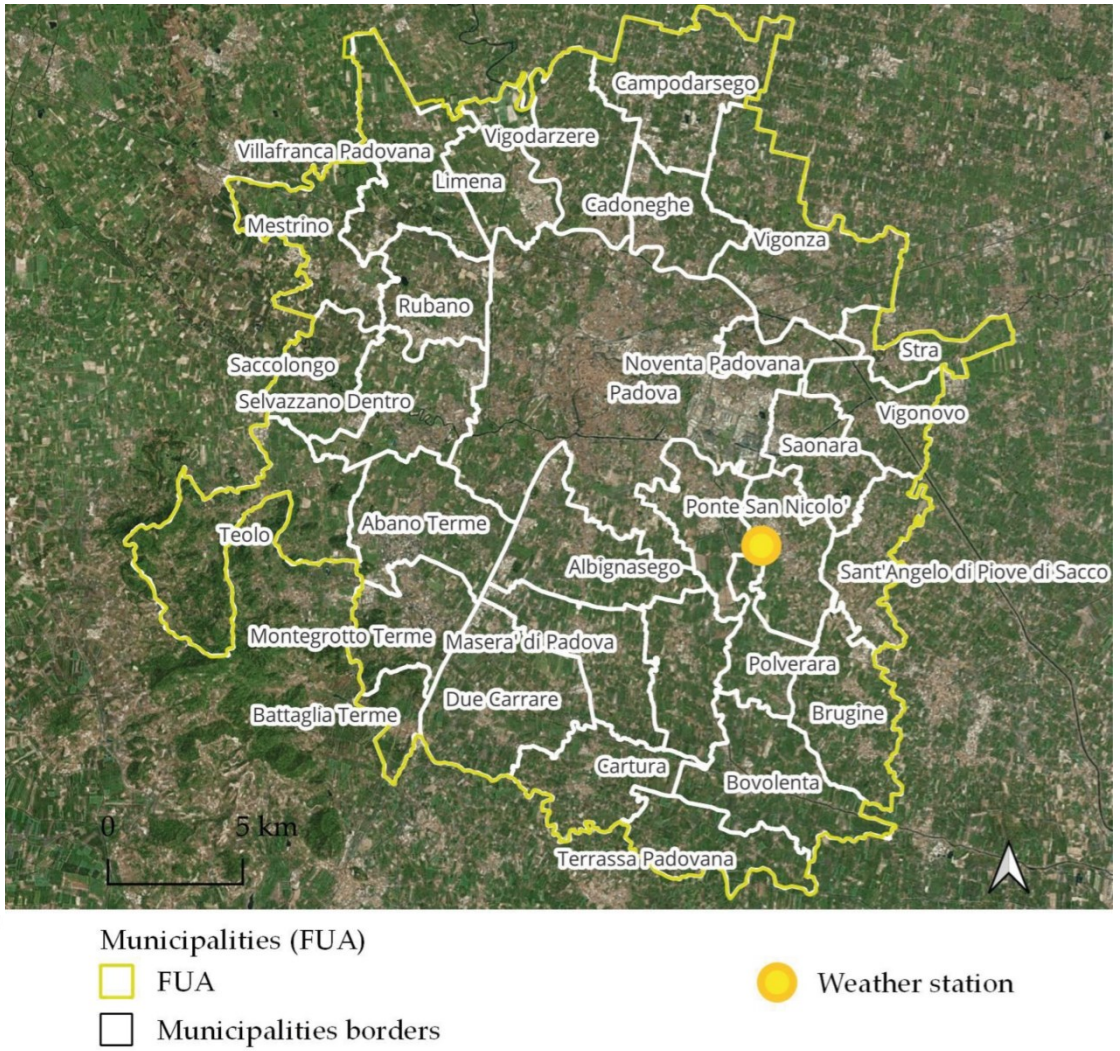
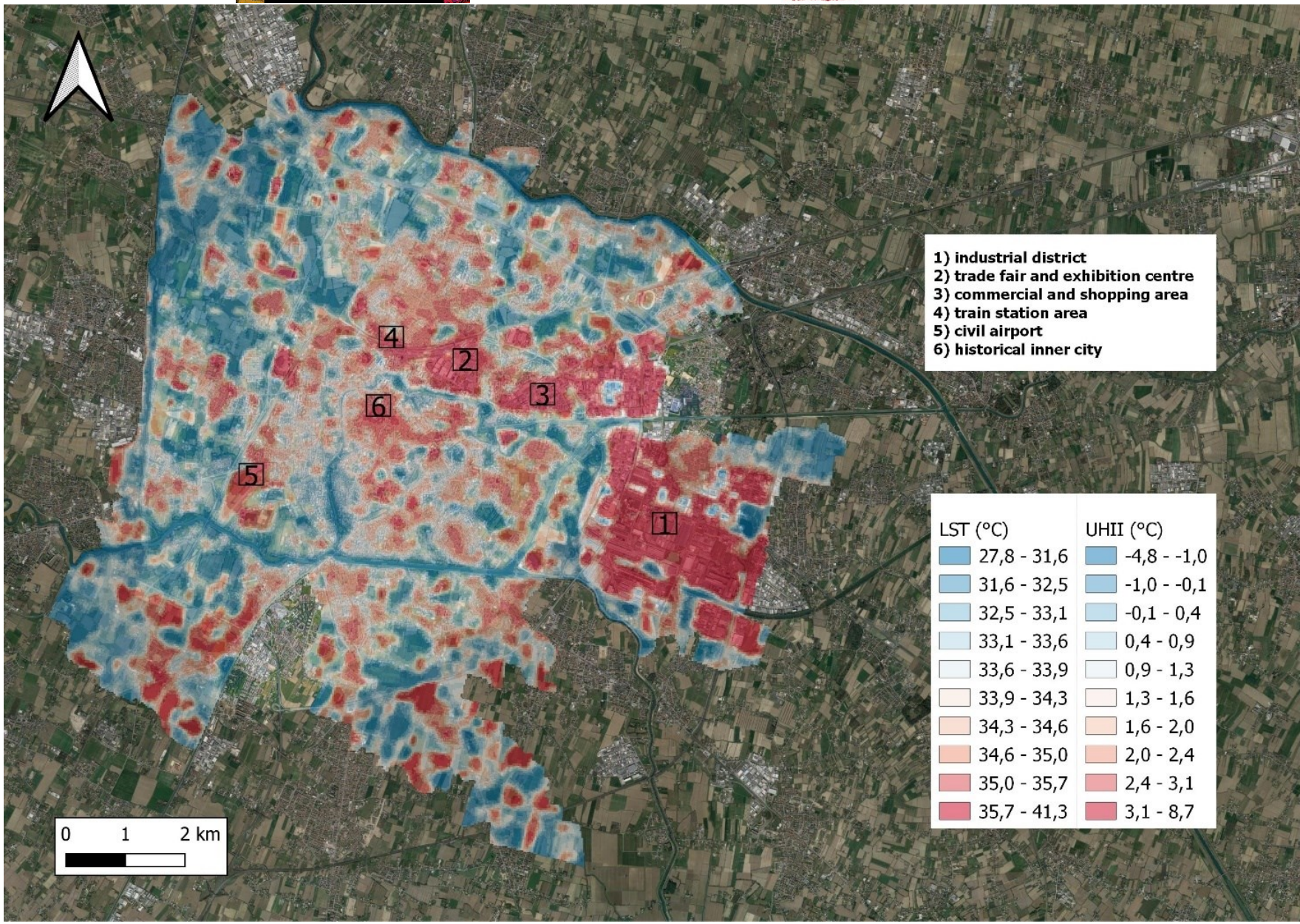




Mapping urban heat islands and heat-related risk during heat waves from a climate justice perspective: a case study in the municipality of Padua (Italy) for inclusive adaptation policies

(Pappalardo SE, Zanetti C, Todeschi, 2023, *in review*)



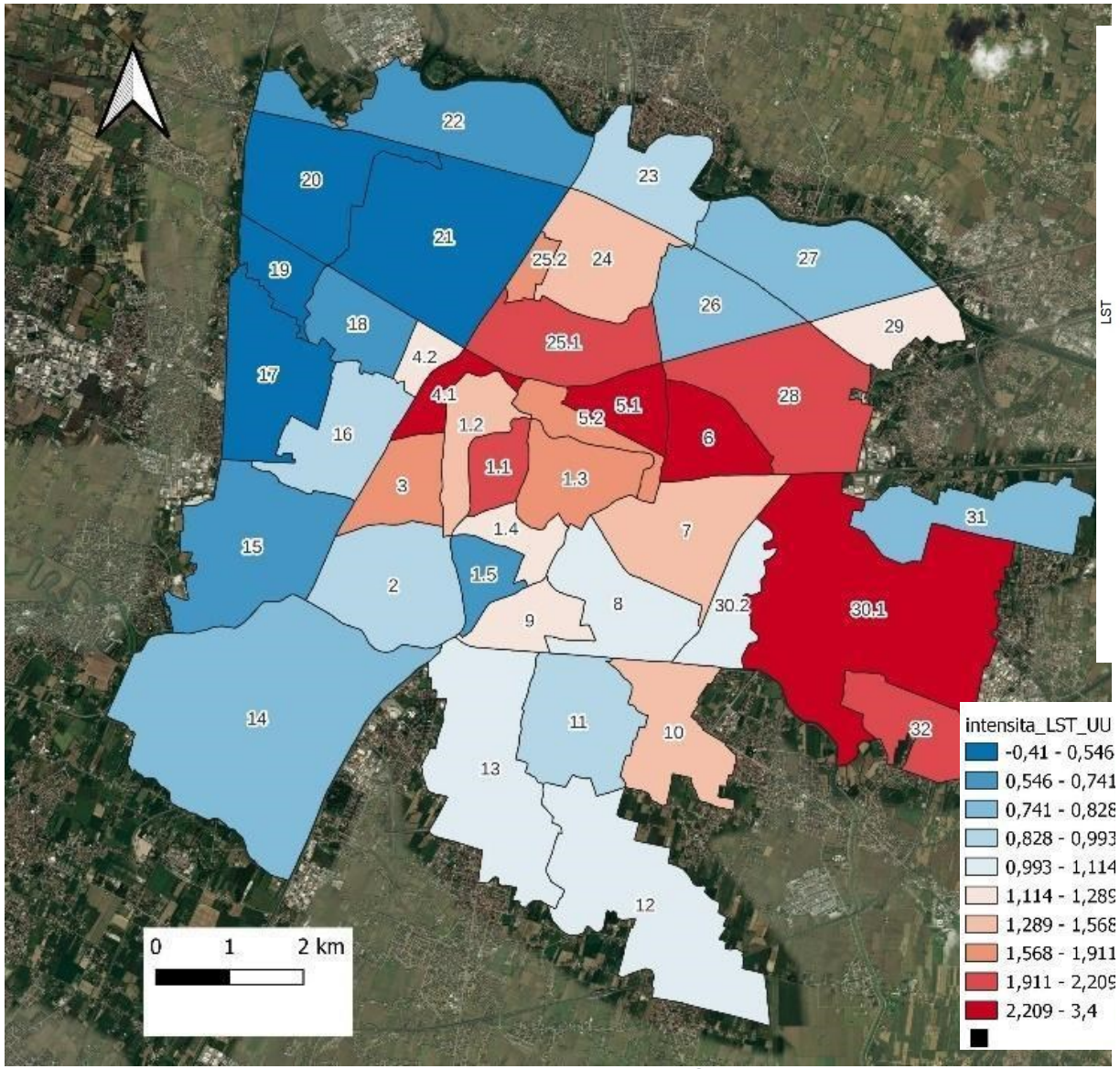


Figure 3. Mean UHI intensity for each UU

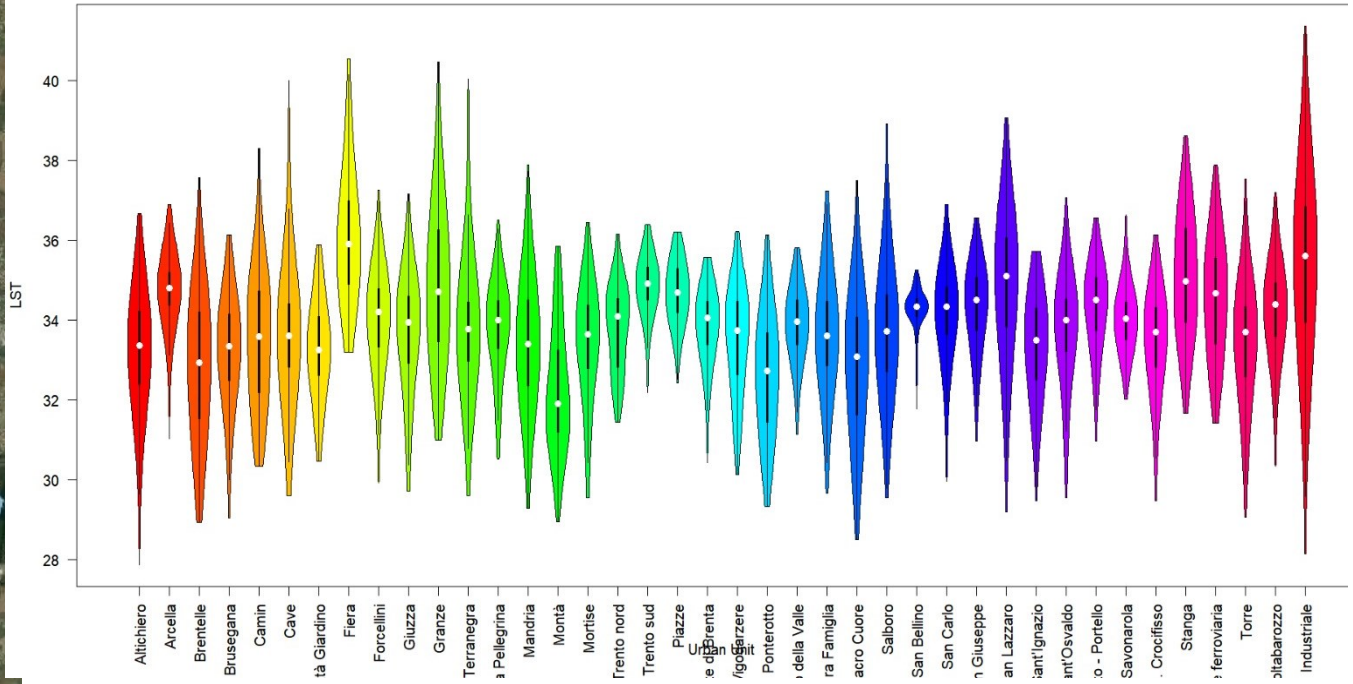
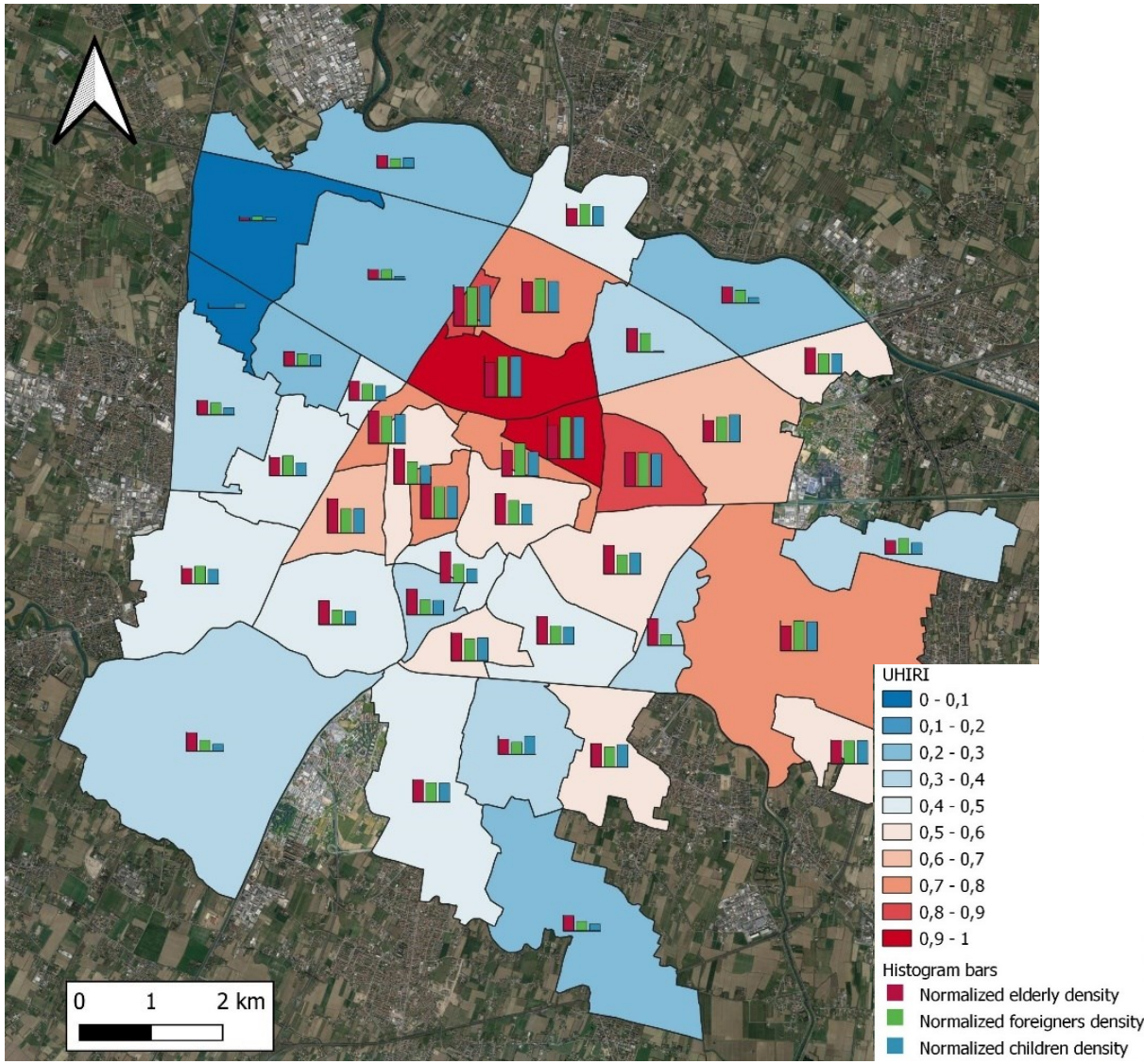


Figure 4. Violin plot of LST distribution in Padua's UUs

(Pappalardo SE, Zanetti C, Todeschi, 2023, *in review*)

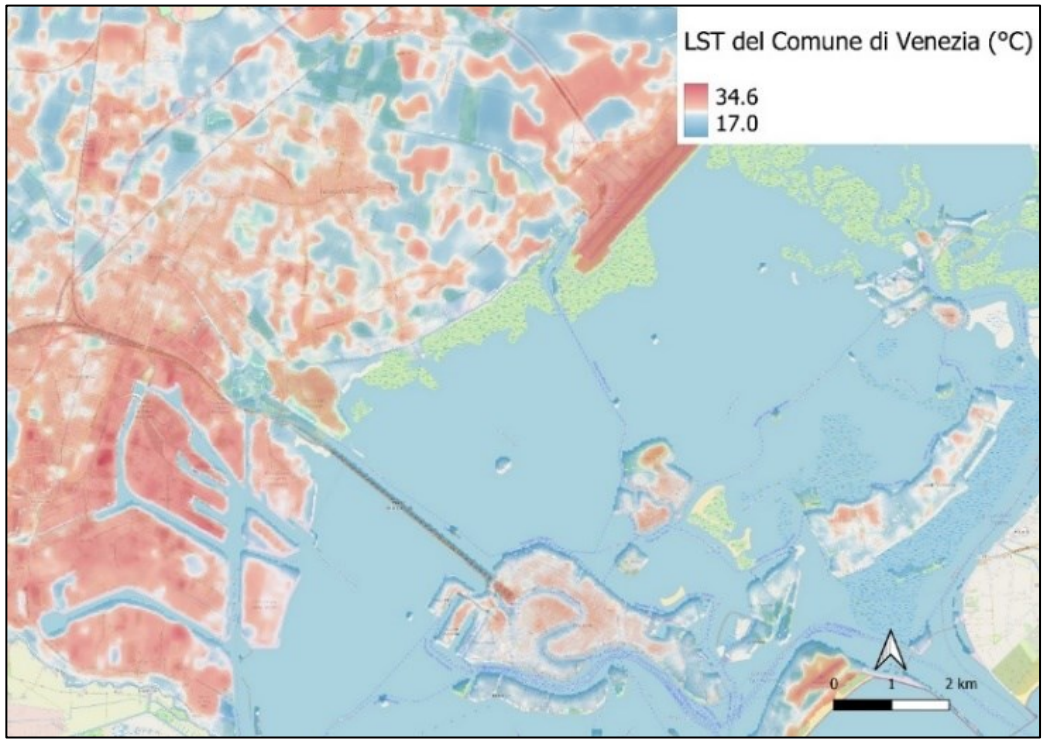
Climate Justice – Integrated heat-related Risk Analysis for vulnerable social groups

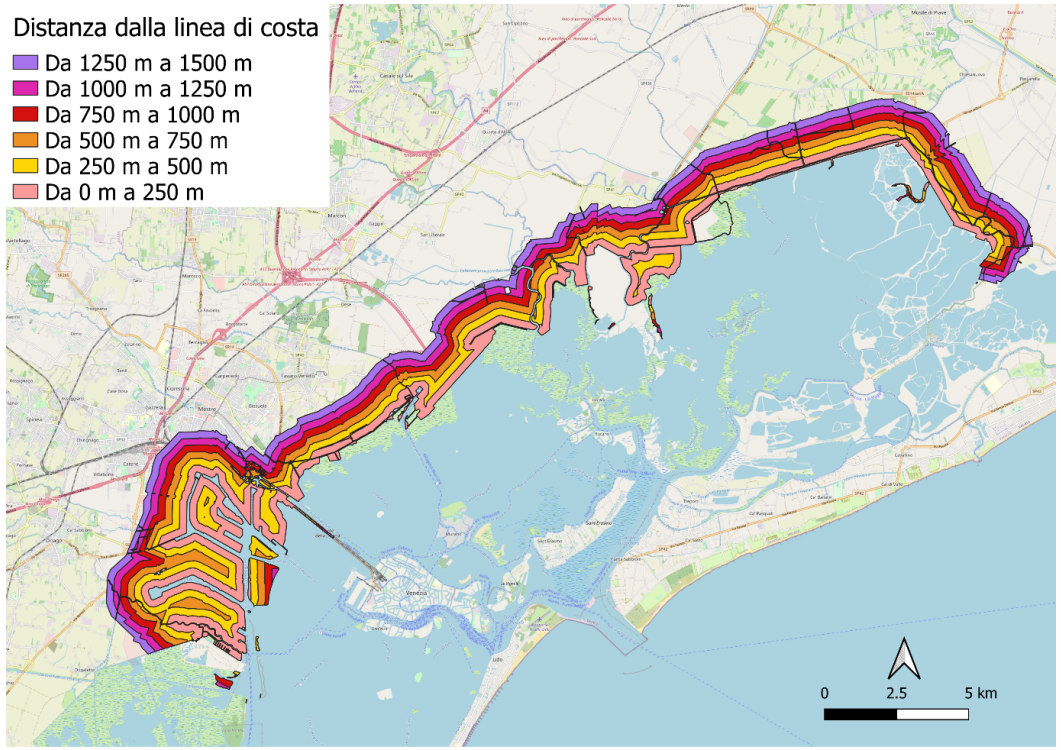
1. Heat-related Child Risk analysis (HCRI Index)
2. Heat-related Elderly Risk Index analysis (HERI)
3. Heat-related Alone Elderly Risk Index (HAERI)
4. Heat-related Foreigners Risk Index (HFRI)
5. Heat-related Low-Income Risk Index (HLIRI)
6. UHI Risk Index (UHIRI)



(Pappalardo SE, Zanetti C, Todeschi, 2023, *in review*)

Maria Teodoro (2023) Mappatura delle isole di calore urbano durante eventi estremi a supporto dei piani di adattamento: il caso studio del Comune di Venezia





Mappatura·delle·isole·di·calore·urbano·durante·eventi·estremi·a·supporto·dei·piani·di·adattamento:·il·caso·studio·del·comune·di·Venezia¶

Mapping·urban·heat·islands·during·extreme·events·for·adaptation·policies:·a·case·study·of·the·municipality·of·Venice¶

MARIA·TEODORO·*,·CARLO·ZANETTI**,·SALVATORE·EUGENIO·PAPPALARDO***,·MASSIMO·DE·MARCHI****¶

Bollettino della Associazione Italiana di Cartografia

Bulletin of the Italian Cartographic Association

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Frontiers in Earth Science

ORIGINAL RESEARCH article

Front. Earth Sci.
Sec. Interdisciplinary Climate Studies
Volume 12 - 2024 | doi: 10.3389/feart.2024.1375827

This article is part of the Research Topic
Climate and Environmental Changes in Circum-Mediterranean Regions
View all Articles >

Mapping urban heatwaves and islands: the reverse effect of Salento's "white cities"

Provisionally Accepted


Stefano De Razza[1]
Carlo Zanetti[2, 3*]

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[1] Laboratory GIScience and Drones for Good, Department of Civil, Environmental and Architectural Engineering (ICEA), University of Padua, 35100 Padua, Italy, Department of Civil, Architectural and Environmental Engineering, School of Engineering, University of Padua, Italy
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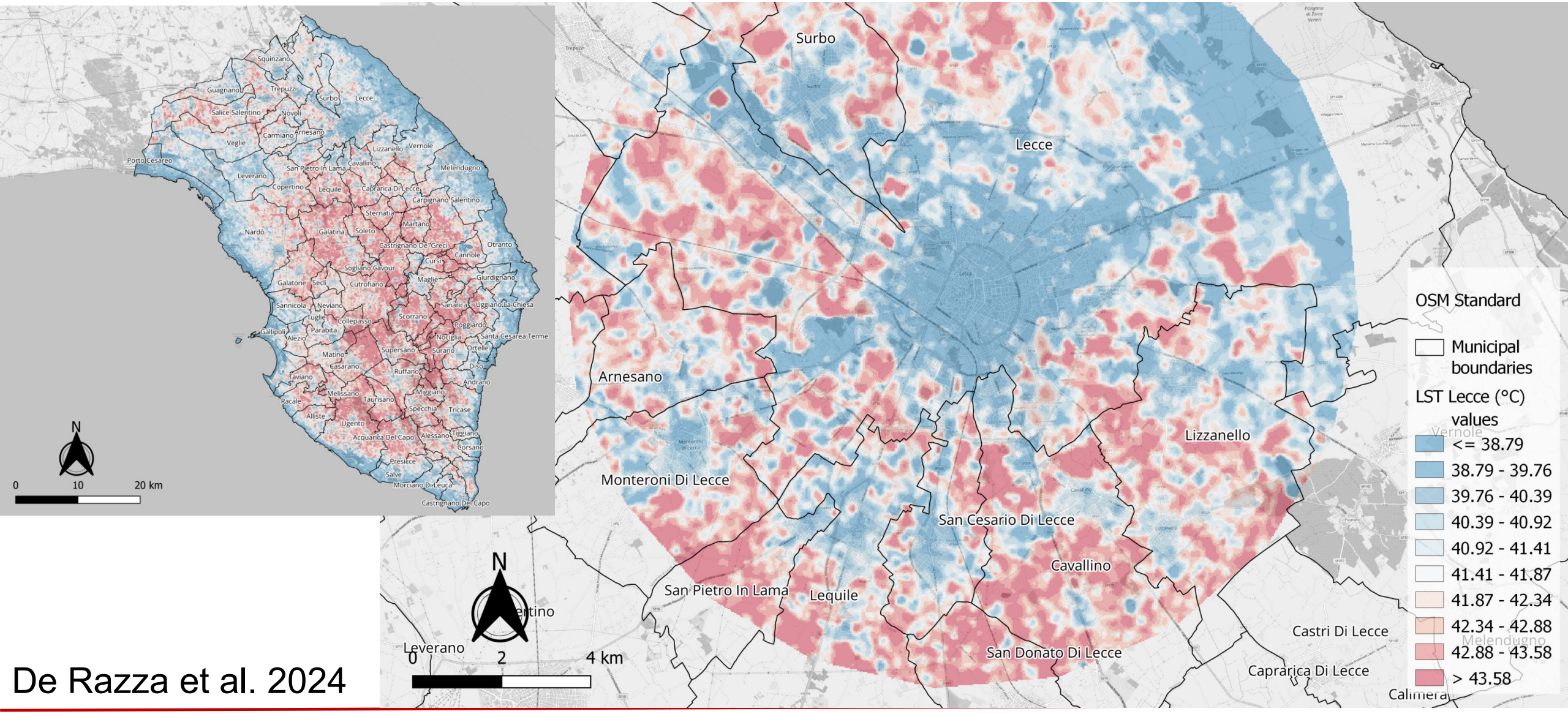
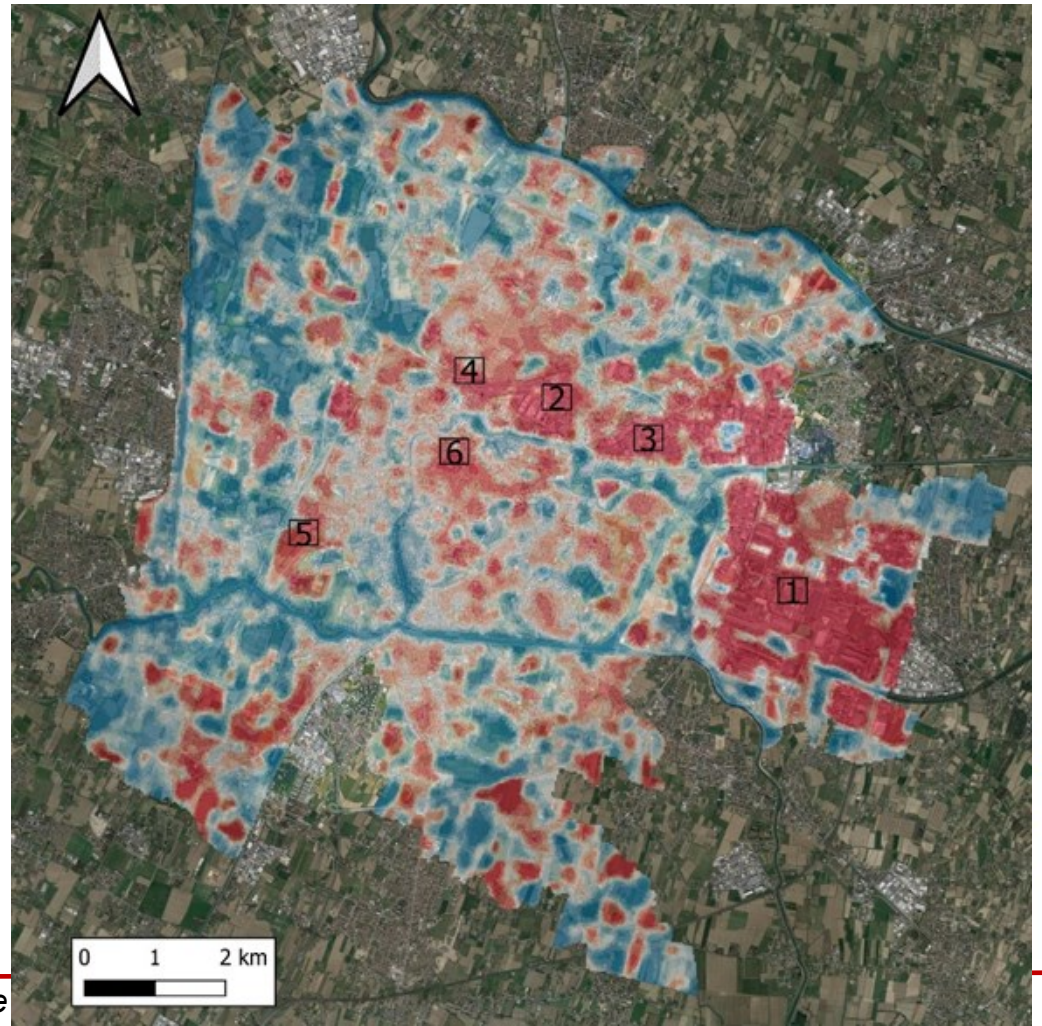
Mapping urban heatwaves and islands: the reverse effect of Salento's "white cities"

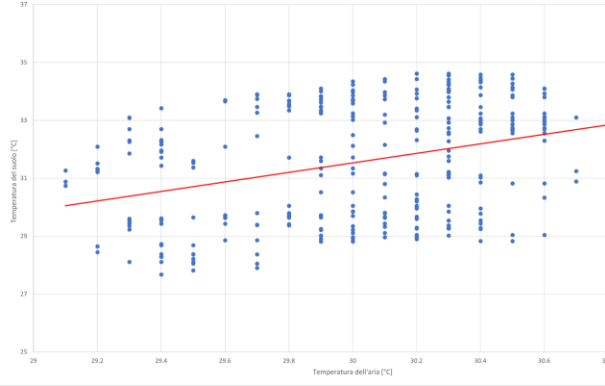


De Razza et al. 2024

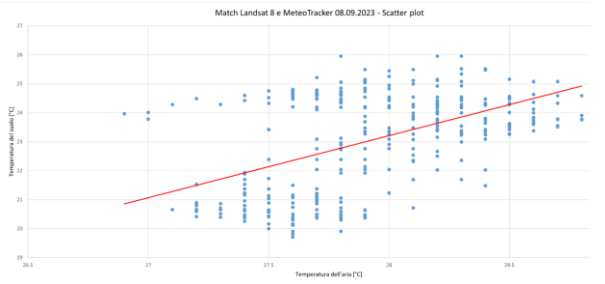
Mappatura isole di calore urbano dall'alto e dal basso: LST e temperatura dell'aria

Landsat 8 e 9





Lisa Rubert (IAT, 2023)



Bridging the Gap: Matching Data from Low-Cost Mobile Sensors and Satellite for Urban Heat Island Research. A case study in Padua, Italy.

********** (for review, names must be rendered anonymous)

********** (for review, affiliations must be rendered anonymous)

Rubert L., Zanetti C., De Marchi M., Pappalardo SE

Keywords: Urban Heat Island, Land Surface Temperature, Heat Waves, Climate Adaptation, Extreme Heat, Landsat, Low-Cost Device.

Abstract

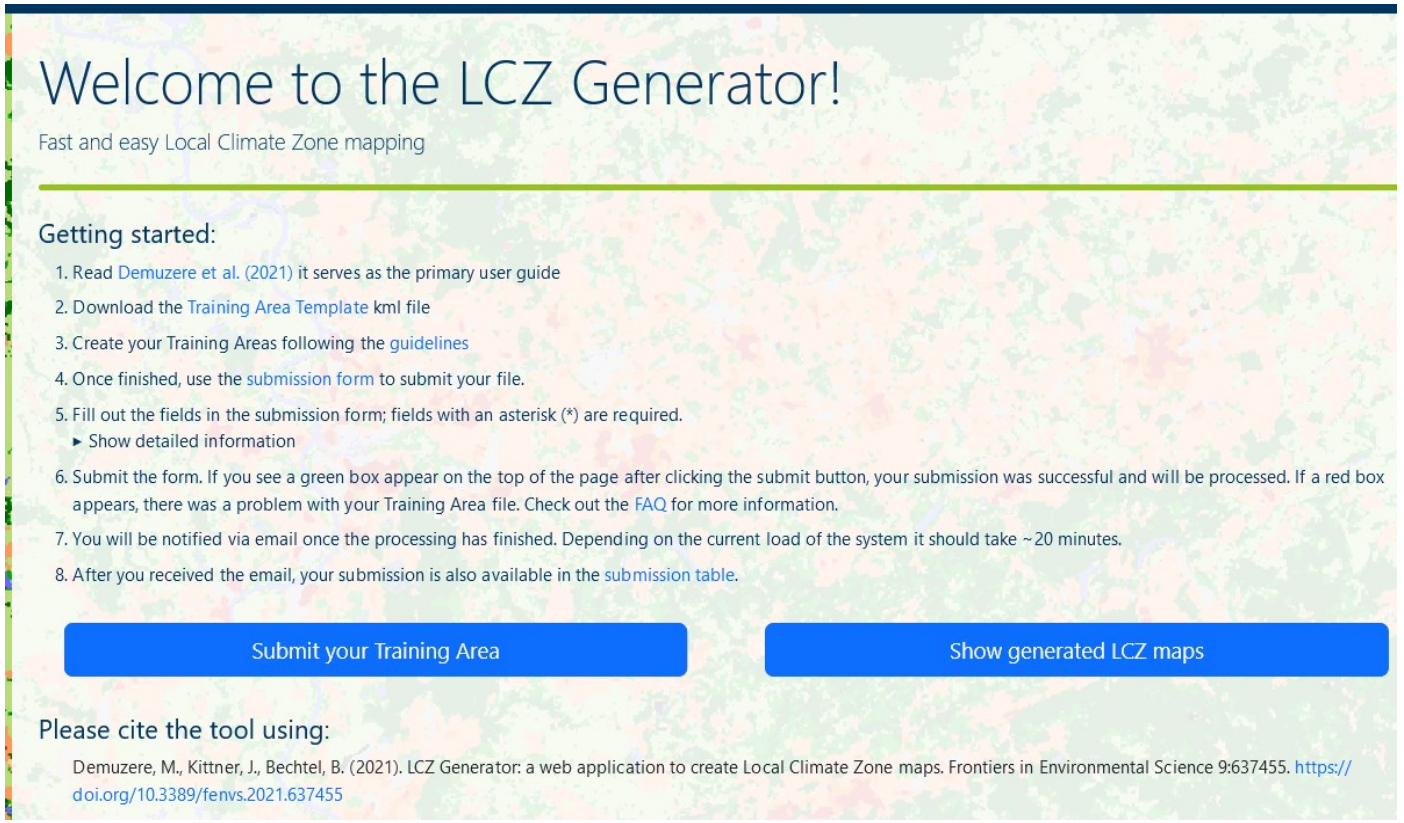
In recent decades, the phenomenon of urban heat islands has intensified due to the increased frequency, magnitude, and duration of extreme weather and climate events. The study of urban microclimates plays a crucial role in implementing actions to reduce thermal stress caused by urban heat islands. Typically, urban heat islands are identified through thermal satellite images (e.g. Sentinel, Landsat). However, these tools are inadequate for detecting heat islands at an appropriate spatial and temporal scale. Furthermore, satellite images do not measure air temperature but rather the land surface temperature, which is not directly usable to estimate thermal stress on the population. To address this issue, we explored, during Summer 2023 in Padua, the feasibility of using a low-cost sensor (MeteoTracker©) to map urban heat islands, to assess spatial relationships with impermeable surfaces, and to investigate potential correlations with land surface temperature. Over an overall mobile mapping of 540 km, on average, air temperature is 1°C higher in impermeable areas compared to permeable ones. Confirming this, a 0.1 increase in NDVI corresponds to a temperature decrease of 0.23°C in the afternoon and 0.3°C in the night. Moreover, a positive relationship was found between LST and air temperature: an increase of approximately 2°C in LST for every 1°C increase in air temperature. This study lays the foundation for further research on urban heat islands, integrating satellite and ground data for the development of high-resolution adaptation actions.

Mapping Local Climate Zones for urban resilient development

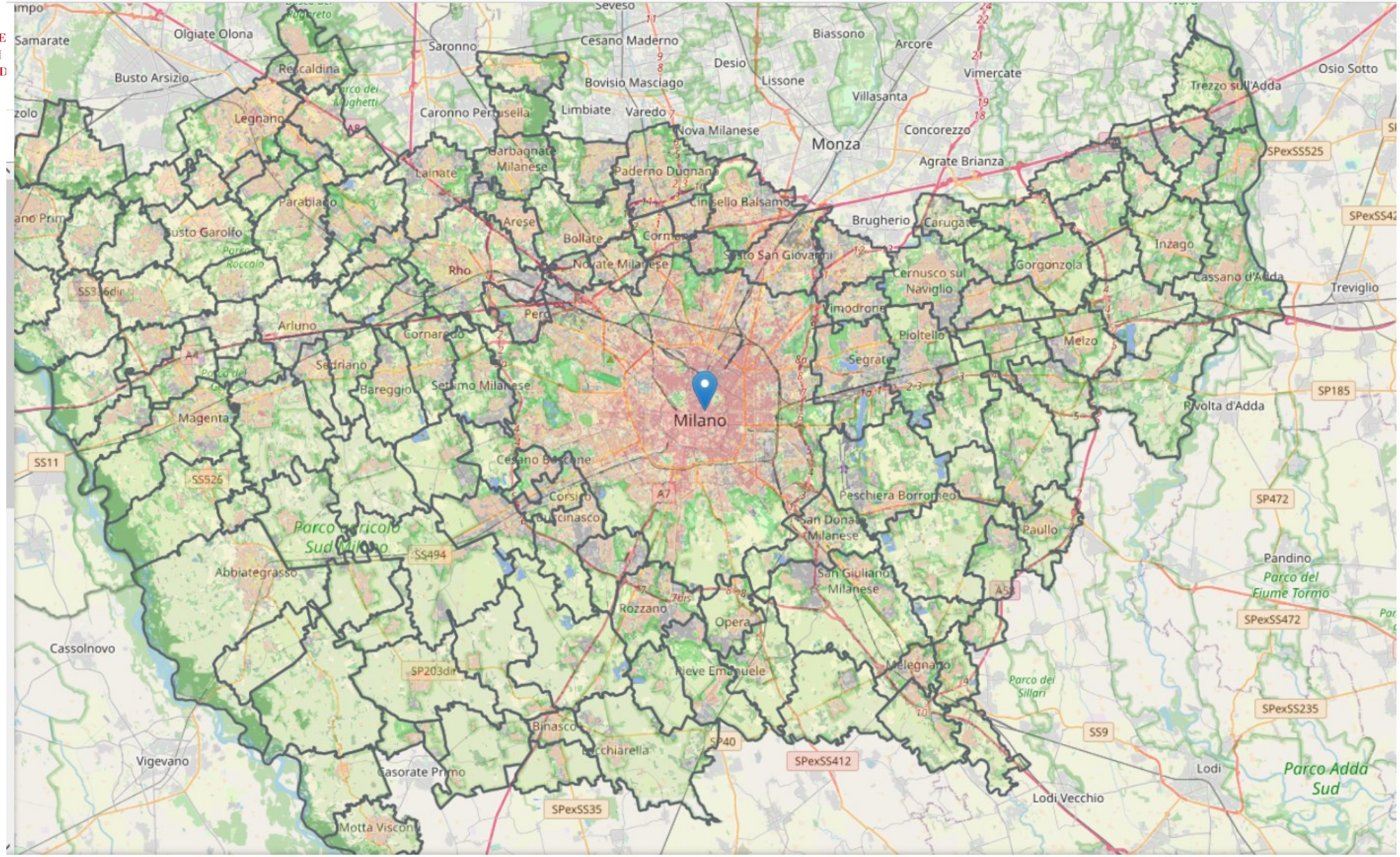
Mapping Local Climate Zones for urban resilient development

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.

Stewart and Oke, 2012



https://lcz-generator.rub.de/



https://decimetro.cittametropolitana.mi.it/maps/385/embed#/

A global map of Local Climate Zones

https://lcz-generator.rub.de/global-lcz-map

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Demuzere, M., Bechtel, B., Middel, A., Mills, G. (2019), Mapping Europe into local climate zones

Demuzere, M., Kittner, J., Bechtel, B. (2021), LCZ Generator: A Web Application to Create Local Climate Zone Maps

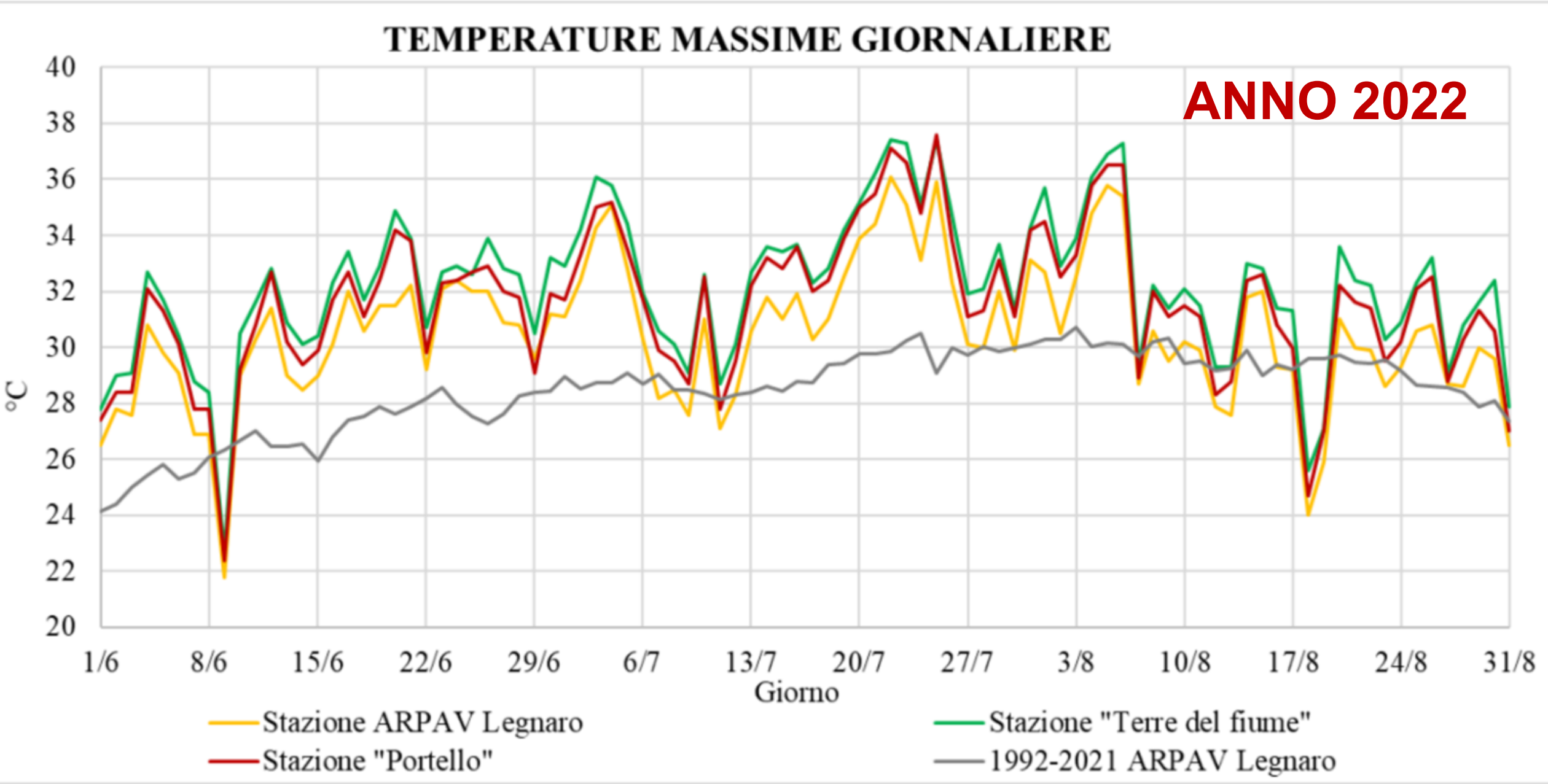
Taubenböck H., Debraya H., Qiub C., Schmitt M., Wang Y, Zhu X. X., (2020), Seven city types representing morphologic configurations of cities across the globe

Mapping and assessing spatial variability of urban microclimates in Padua

Focus on:

- Climate extremes and Urban Heat Islands: hotdays, tropical nights, heat-index
- Spatial variability of precipitation in Padua: a microclimate analysis

Andrea Santaterra (2023), Ondate di calore, notti tropicali e hot days a Padova: analisi meteo-climatica di eventi estremi e scenari di adattamento


TEMPERATURE MASSIME GIORNALIERE
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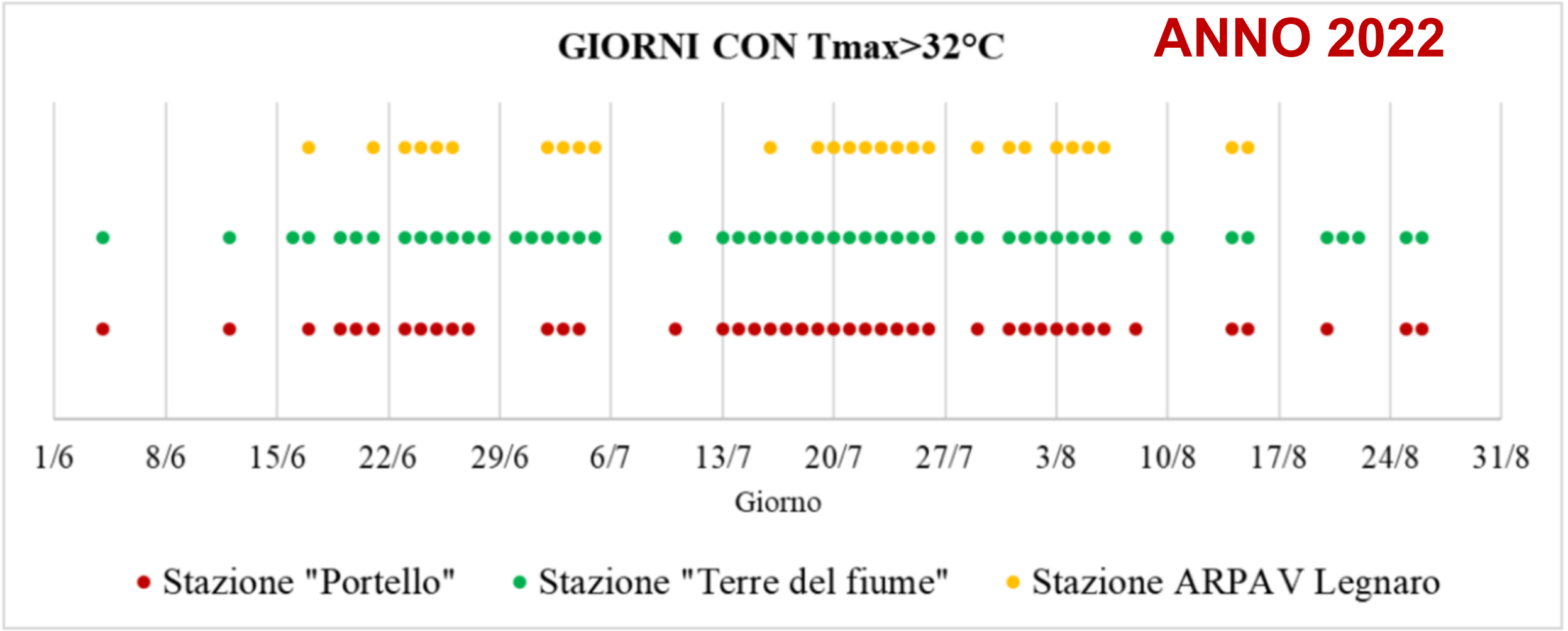
Stazione "Terre del fiume"
Stazione "Portello"
1992-2021 ARPAV Legnaro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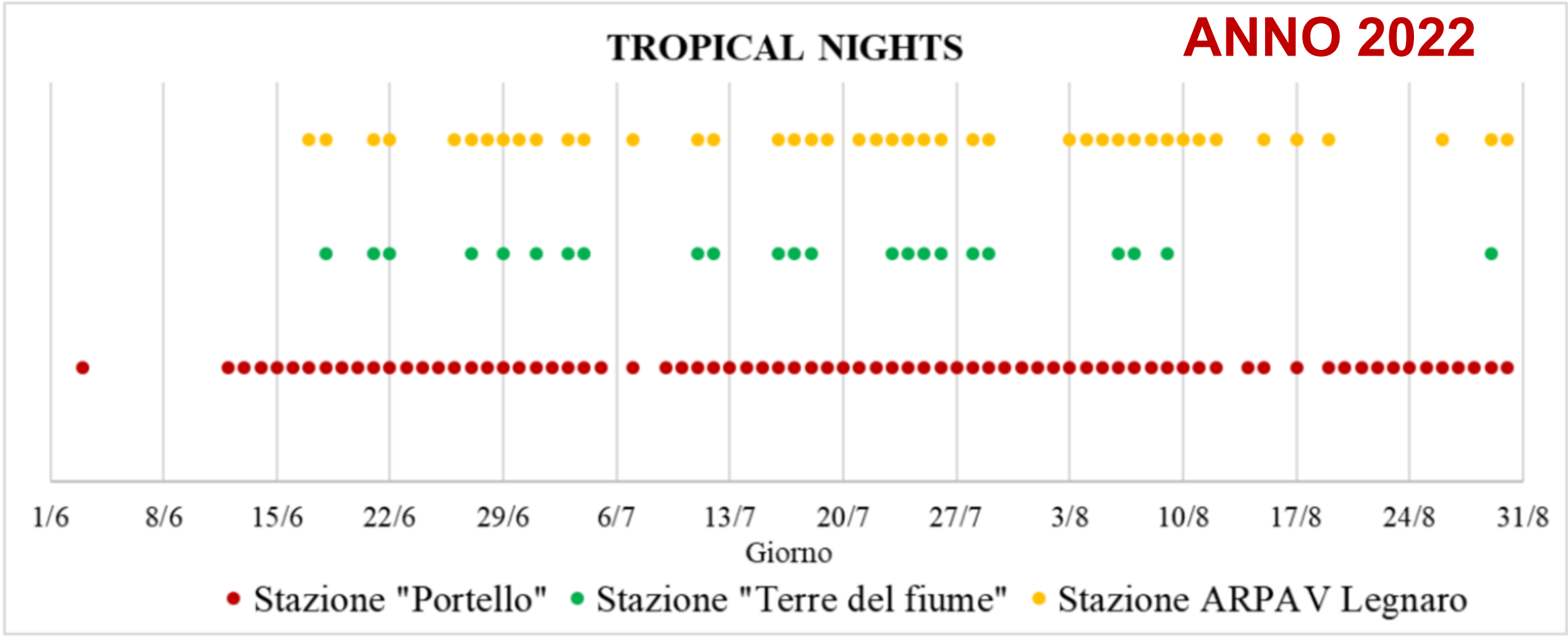
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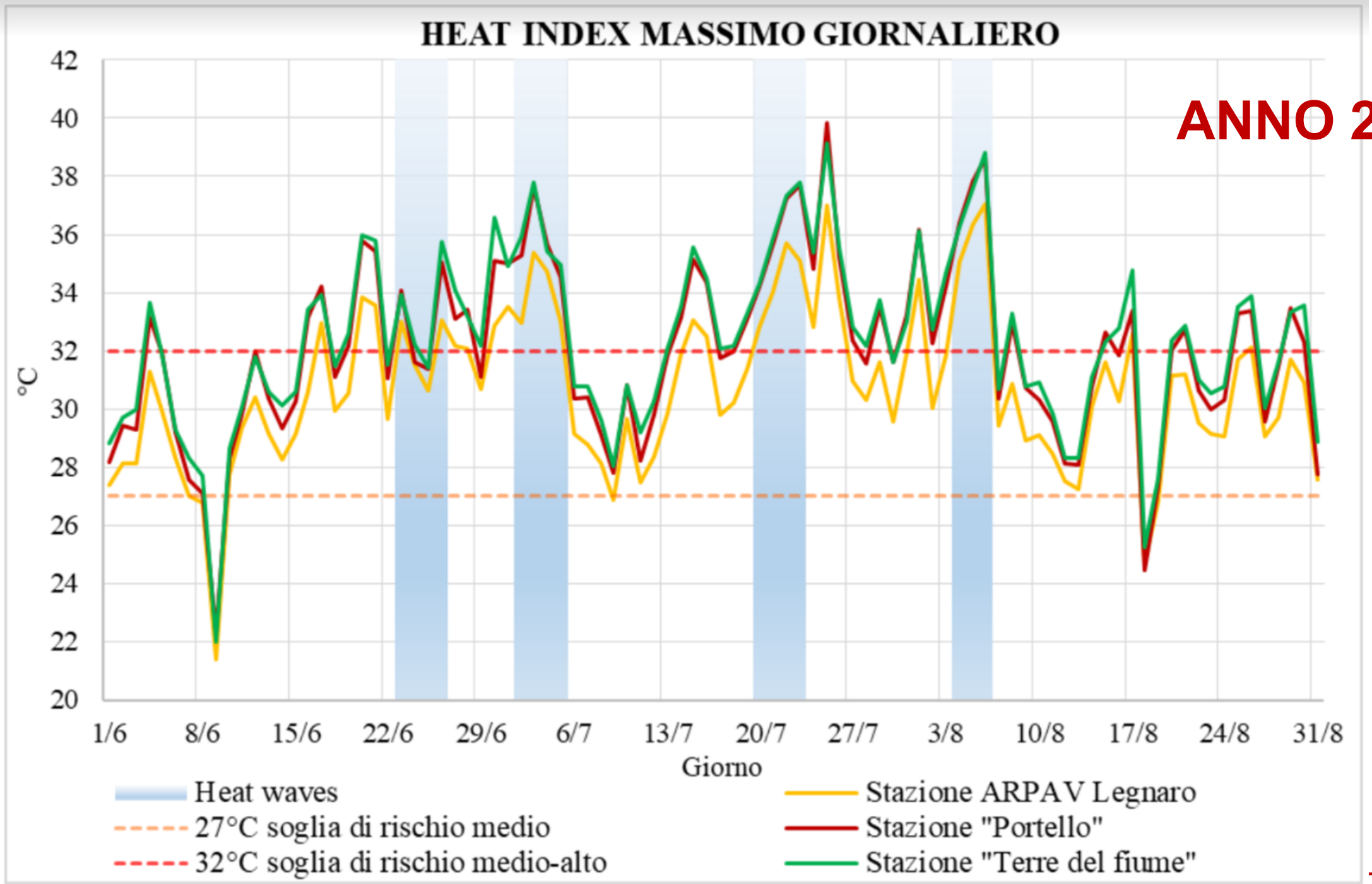
Giorno
Stazione "Portello"
Stazione "Terre del fiume"
Stazione ARPAV Legnaro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31/8
Giorno
Heat waves
27°C soglia di rischio medio
32°C soglia di rischio medio-alto
Stazione ARPAV Legnaro
Stazione "Portello"
Stazione "Terre del fiume"

Drafting the manuscript…

Mapping the urban heat island in Padova city: perspective and trends in the new millennium

Andrea Santaterra[1], Carlo Zanetti[1], Salvatore E. Pappalardo[1], Alessandro Ceppi[2]*

[1]University of Padova

[2]Department of Civil and Environmental Engineering (D.I.C.A.), Politecnico di Milano, Italy

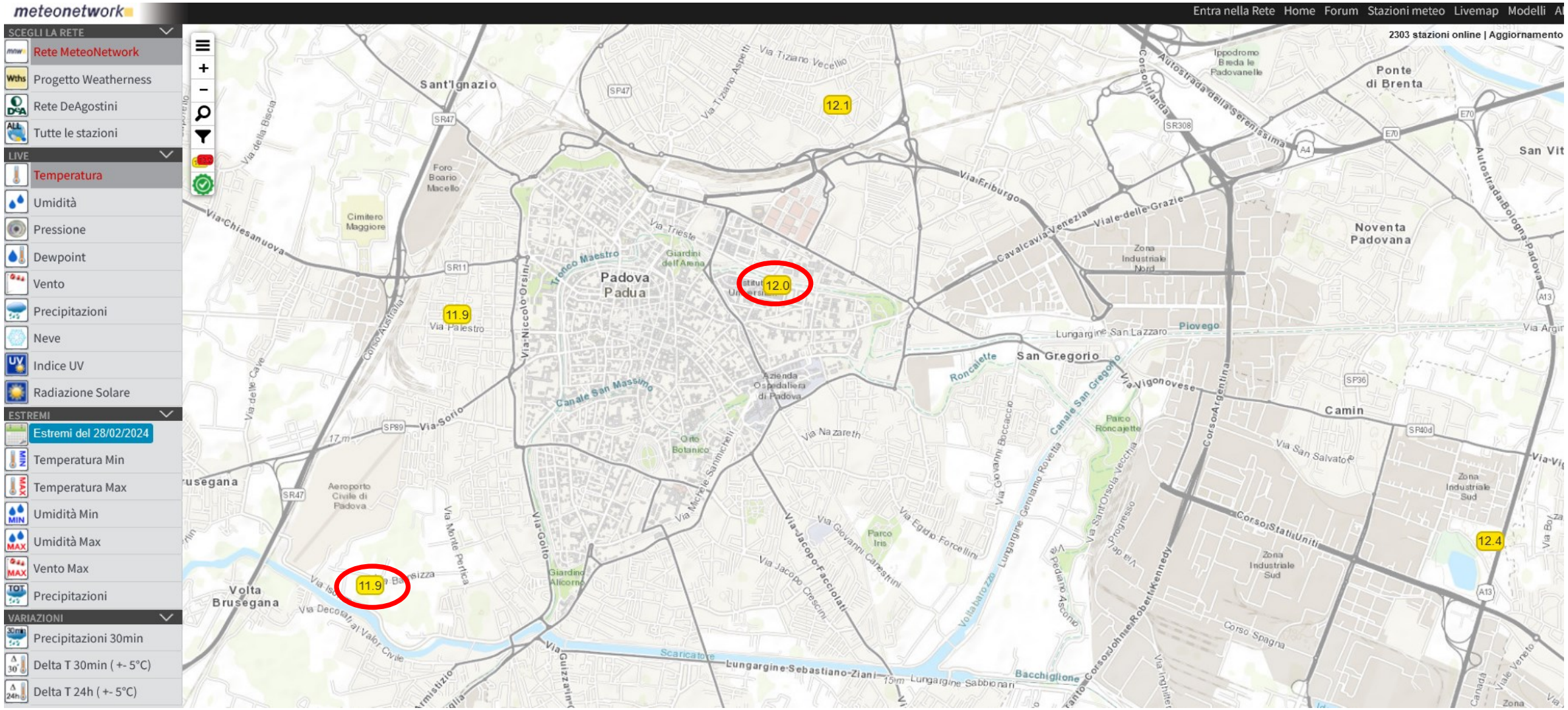
*Correspondence to: A. Ceppi (alessandro.ceppi@polimi.it)

Abstract

UHI…

Keywords: UHI, ERA5 dataset, urban climate, hot days, tropical nights

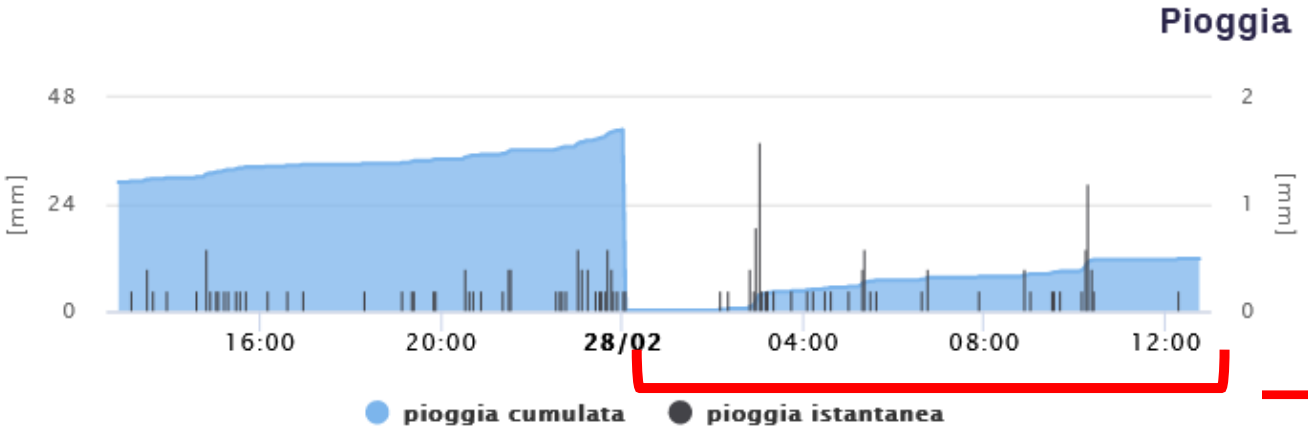
Variabilità spaziale dinamica meteorologica – Comune di Padova

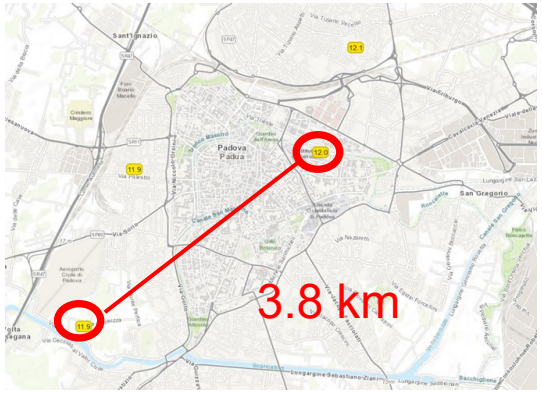


https://www.meteonetwork.it/rete/livemap/

Variabilità spaziale dinamica meteorologica – Comune di Padova

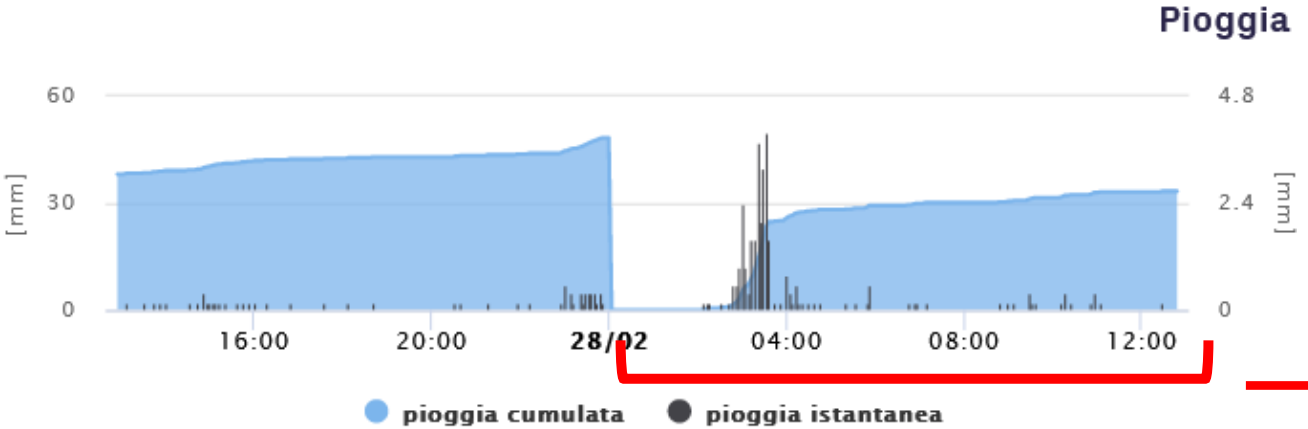
EVENTO DI PRECIPITAZIONE DALLE 00:00 del 28/02/2024





→ 00:00-13:00 cumulata 11.8 mm

Stazione Portello ICEA (Via Marzolo)



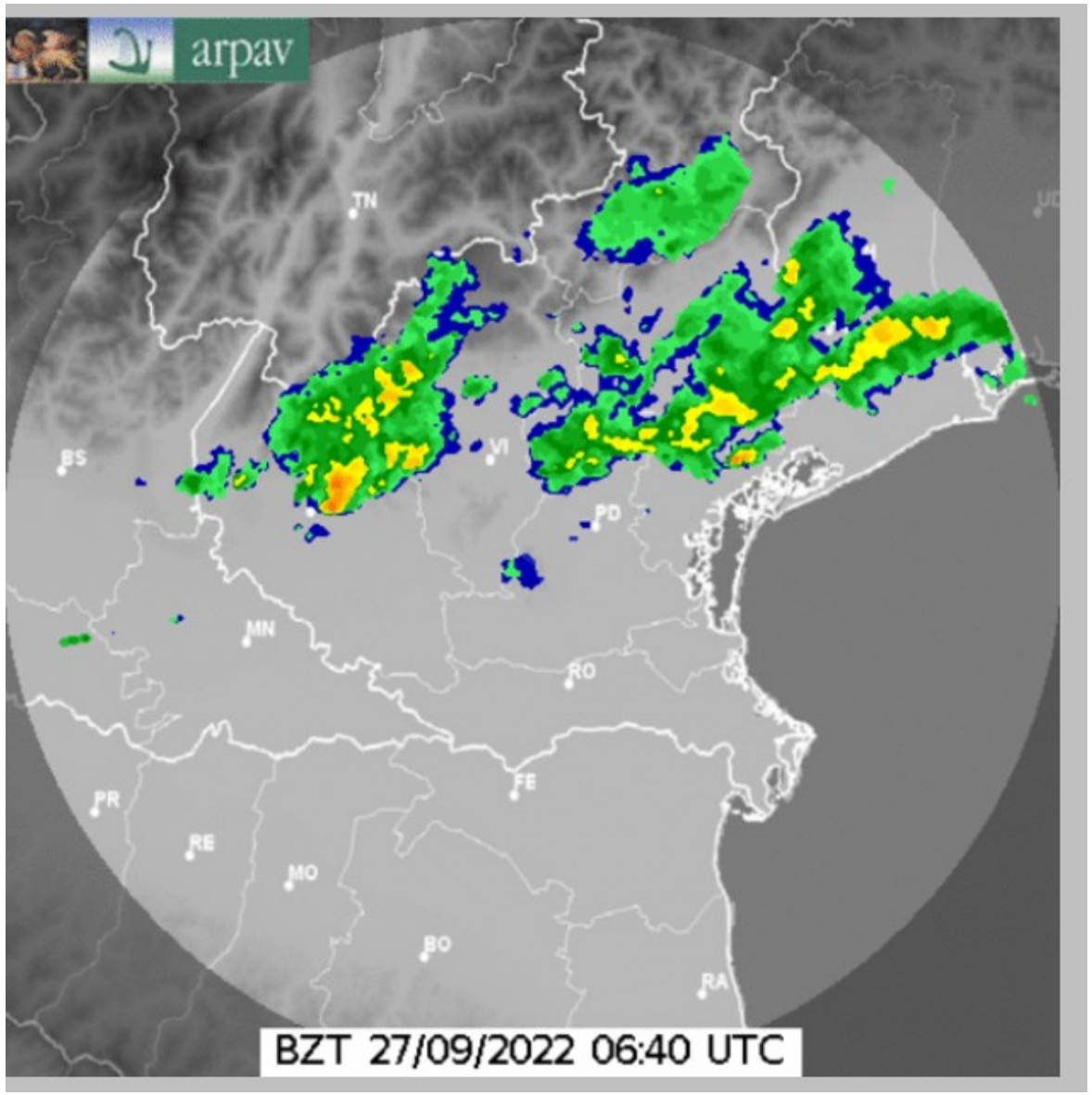
Stazione Basso Isonzo - Arakè

Differenza tra le due stazioni? 21,6 mm

Su 1.000 m^2, quanta acqua è caduta?

E su 1 ha?

→ 00:00-13:00 cumulata 33.4 mm


arpav
TN
BS
VI
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MN
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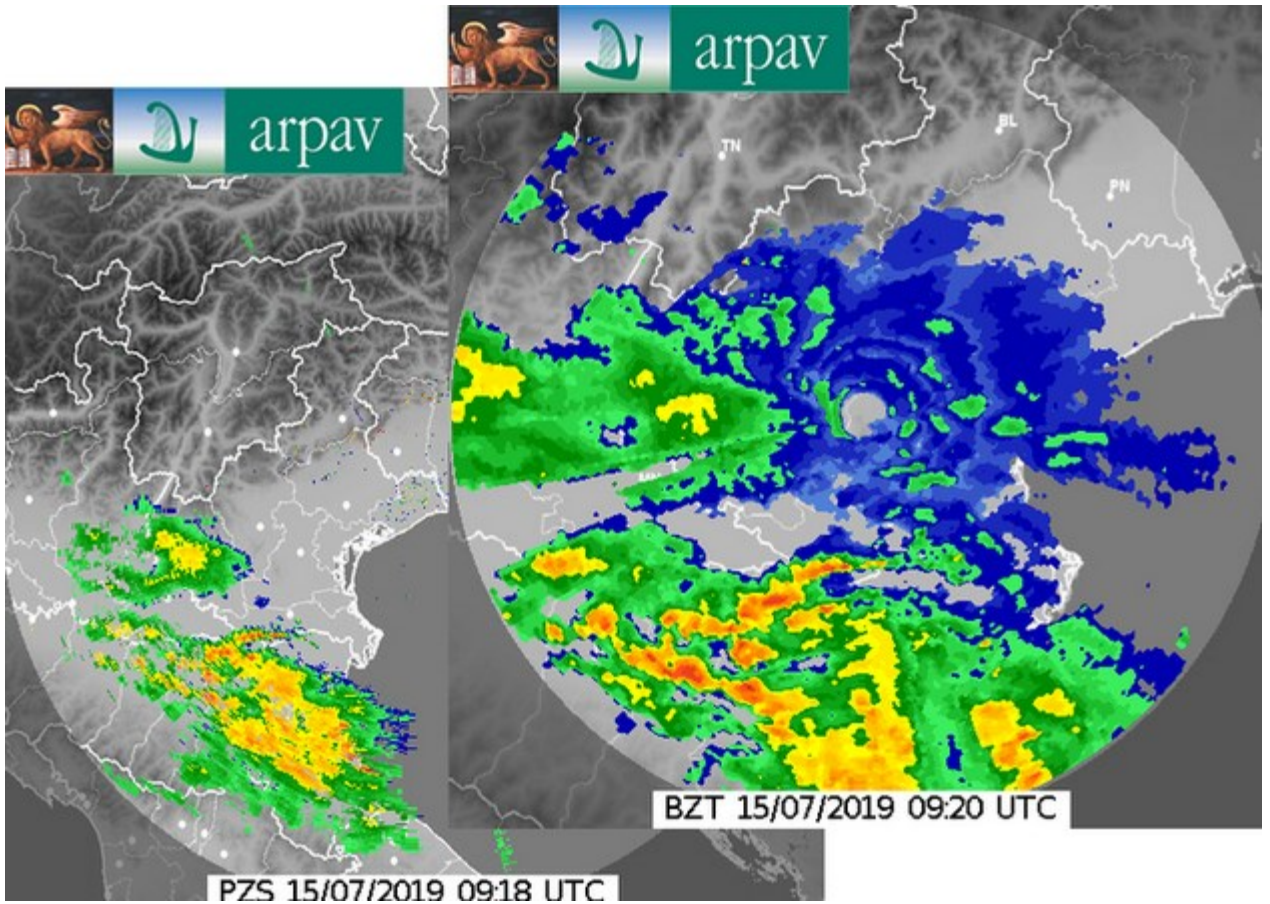
RE
MO
BO
RA
BZT 27/09/2022 06:40 UTC


arpav
arpav
TN
BL
PN
BZT 15/07/2019 09:20 UTC
PZS 15/07/2019 09:18 UTC

Tesi 2021-2023

- Martin Ikenna Nnabuife (2022), *Impronta carbonica per l'edificazione dell'ex foro boario e scenari di riqualificazione in area di verde urbano*
- Maria Lucia Roggero (2022), *Multitemporal and spatial analysis of the vitivinicultural sector on the Valpolicella production area: impact and future perspective of sustainability*
- Andrea Santaterra (2023), *Ondate di calore, notti tropicali e hot days a Padova: analisi meteo-climatica di eventi estremi e scenari di adattamento*
- Enrico Bosco, *Costellazioni di satelliti e spacecraft per il turismo spaziale: impatti dei gas climalteranti e scenari emissivi*
- Stefano De Razza (2023), *Impatti dei cambiamenti climatici sui territori urbani del Salento: mappatura e analisi dell'intensità delle isole di calore urbano*
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- Maddalena Crepaldi (2023) *Cambiamenti climatici: impatti sulle Alpi italiane e sul turismo invernale*
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- Chiara Antonacci (2023) *Impatto ambientale del settore dell'aviazione: analisi delle emissioni e strategie per una transizione sostenibile*
- Alice Andreanelli (2023) *Impatto dei cambiamenti climatici sugli ecosistemi corallini: cause ed effetti del coral bleaching*

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- David Ziviani (2023) *Impatto dei cambiamenti climatici sulla risorsa idrica nel Nord Italia: stato dell'arte e scenari futuri*
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- Lisa Rubert (2023) *Isole di calore a Padova nell'estate 2023: mappatura "dal basso" e valutazione del fenomeno mediante l'utilizzo di MeteoTracker*

Laureandi 2024

- Ambrosi Giacomo (2024) *Conflitto russo-ucraino: analisi dell'impatto climatico e ambientale con un focus sulle emissioni di gas climalteranti*
- Calista Francesco (2024) *Verso uno sviluppo urbano climate-resilient: infrastrutture verdi e blu per la mitigazione delle ondate ed isole di calore*
- Mattia Maritato (2024) *Valutazione del traffico di veicoli urbani e delle emissioni di gas a effetto serra: il caso del Comune di Padova*
- Niccolò Zaghetto (2024) *Droni "autocostruiti" open-source: progettazione, assemblaggio e calibrazione di un prototipo di SAPR per rilievi ambientali*
- Alessandro Cenzi (2024) *Rifugiati ambientali e giustizia climatica: panoramica ambientale, politica e geografica con casi studio*
- Alessio Zanette (2024) *Mappatura degli impianti fotovoltaici in Zona Industriale di Padova: stato attuale e prospettive future*