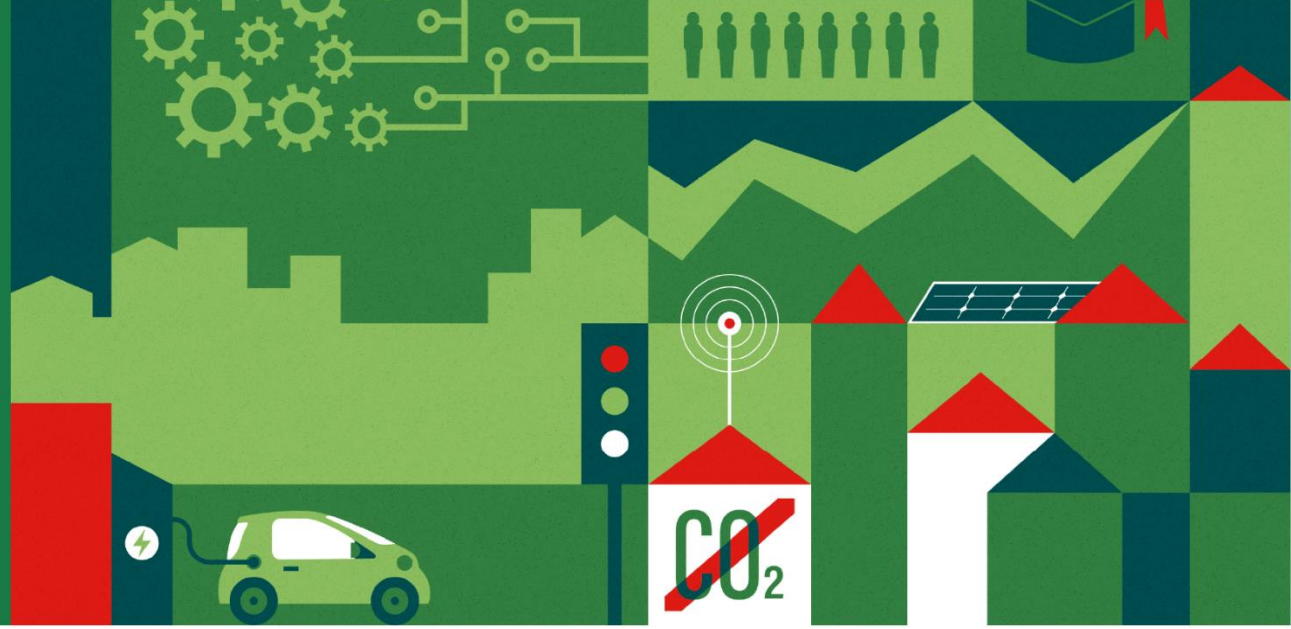
eurac research

5th international conference on

**Smart and Sustainable Planning for Cities and Regions 2025**

9-12 December, Bolzano/Bozen




Track n. 4 – Special Session 5

# Democratizing Science for Urban Climate Justice: the SCIFT experience in Bologna

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# “OFFICINA SCIFT”

Science, Climate activism, Imagination, Fostering knowledge, and Technology”

(Scienze, Climattivismo, Immaginazione, Formazione, Tecnologie)

Reclaim The Tech – May 5th-7th 2023

Inauguration of SCIFT - March 21st 2025

RECLAIM THE TECH

Sciences and technologies are not neutral!

# OUR PROJECTS

- AI, Algorithms;
- Alternative platforms
- Drones
- 3D Printing
- Noise pollution (Bologna airport)
- **<u>Urban Heat Islands</u>**

(*And more to come!*)

# Why Urban Heat Islands Matter

Cities today not only represent humanity's main habitat, but also one of the central hubs of the global ecological crisis (Spano et al., 2021). Housing more than half of the world's population on 3% of the earth's surface - a share that is constantly growing - urban areas are responsible for a significant share of climate-changing emissions, consumption of natural resources and waste production (UN-Habitat, 2020).

Cities are heating up. We believe that understanding and acting on heat islands should be a collective right and responsibility.

“

With this artwork, I send out love, healing and a cry to rise and change!

Author: Kiva Stimac

Sustainable Geosciences: People, Planet and Prosperity 1 (2025) 100006

Contents lists available at ScienceDirect

Sustainable Geosciences: People, Planet and Prosperity

ELSEVIER

journal homepage: www.elsevier.com/locate/susgeo

A global downstream approach to mapping surface urban heat islands using open data and collaborative technology

Chiara Richiardi [a,b,c,*], Letizia Caroscio [c,d,**], Edoardo Crescini [c,e,f], Massimo De Marchi [e,f], Giovanni Marco De Pieri [c], Christopher Ceresi [c], Federico Baldo [c,g], Matteo Francobaldi [c,h], Salvatore Eugenio Pappalardo [e,i]

# From data to action: how we automatize heat mapping

User's requirements:
- city's name
- local folder path

## 1. Data download

Landsat Thermal Band

OpenStreet Map (Land Cover, LC)

Digital Elevation Model (DEM)

## 2. Pre-processing

- Cloud masking (QA band)
- Offset & scaling
- Conversion to Celsius degrees
- Seasonal aggregation (mean)

Seasonal mean LST (°C)

Urban areas

Rural areas

## 3. Thermal anomaly

Final aggregation of each elevation band (100 m)

Altitudinal homogeneous analysis of thermal anomalies (difference between rural and urban LST)

## 4. SUHII

Normalization (Zargari et al. 2024)

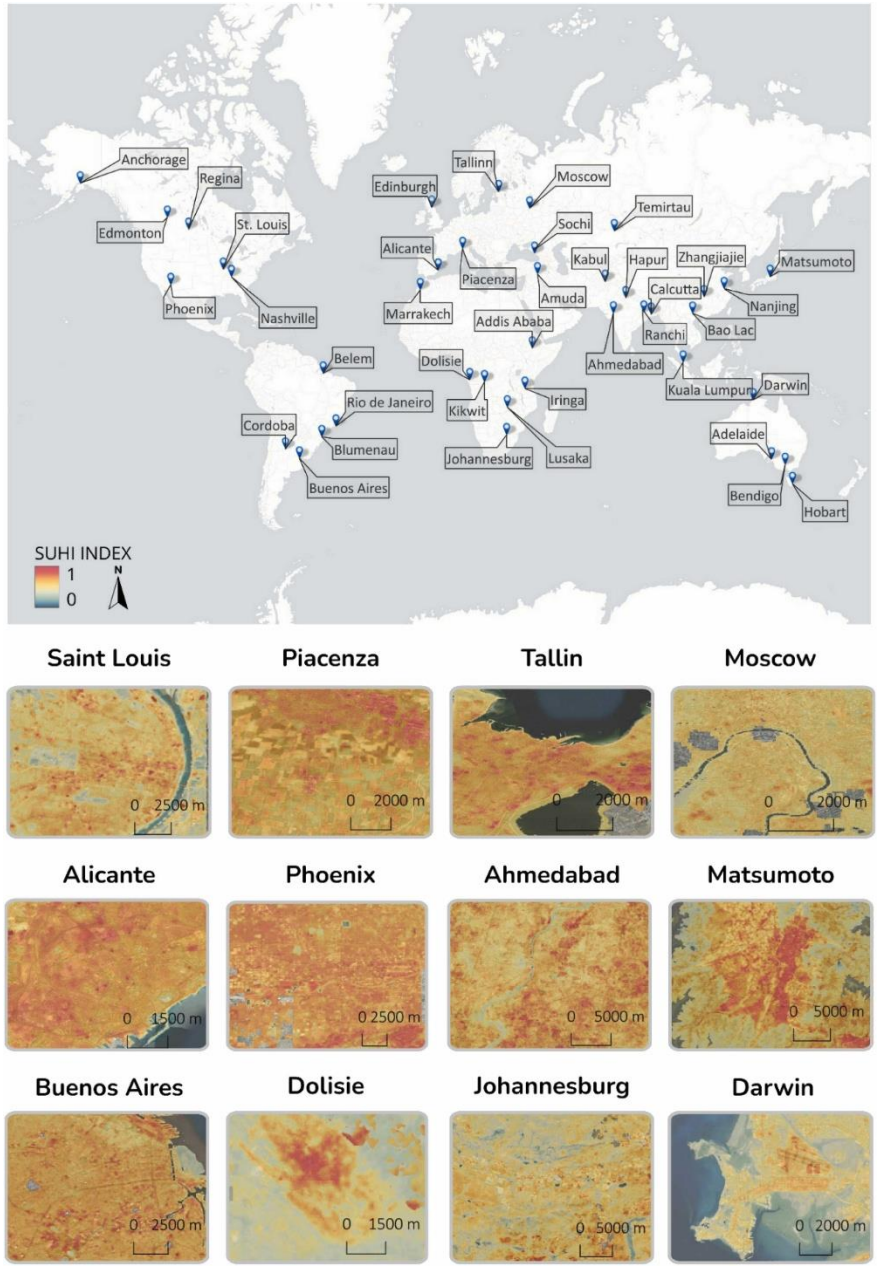
Surface Urban Heat Island Index (SUHII) map

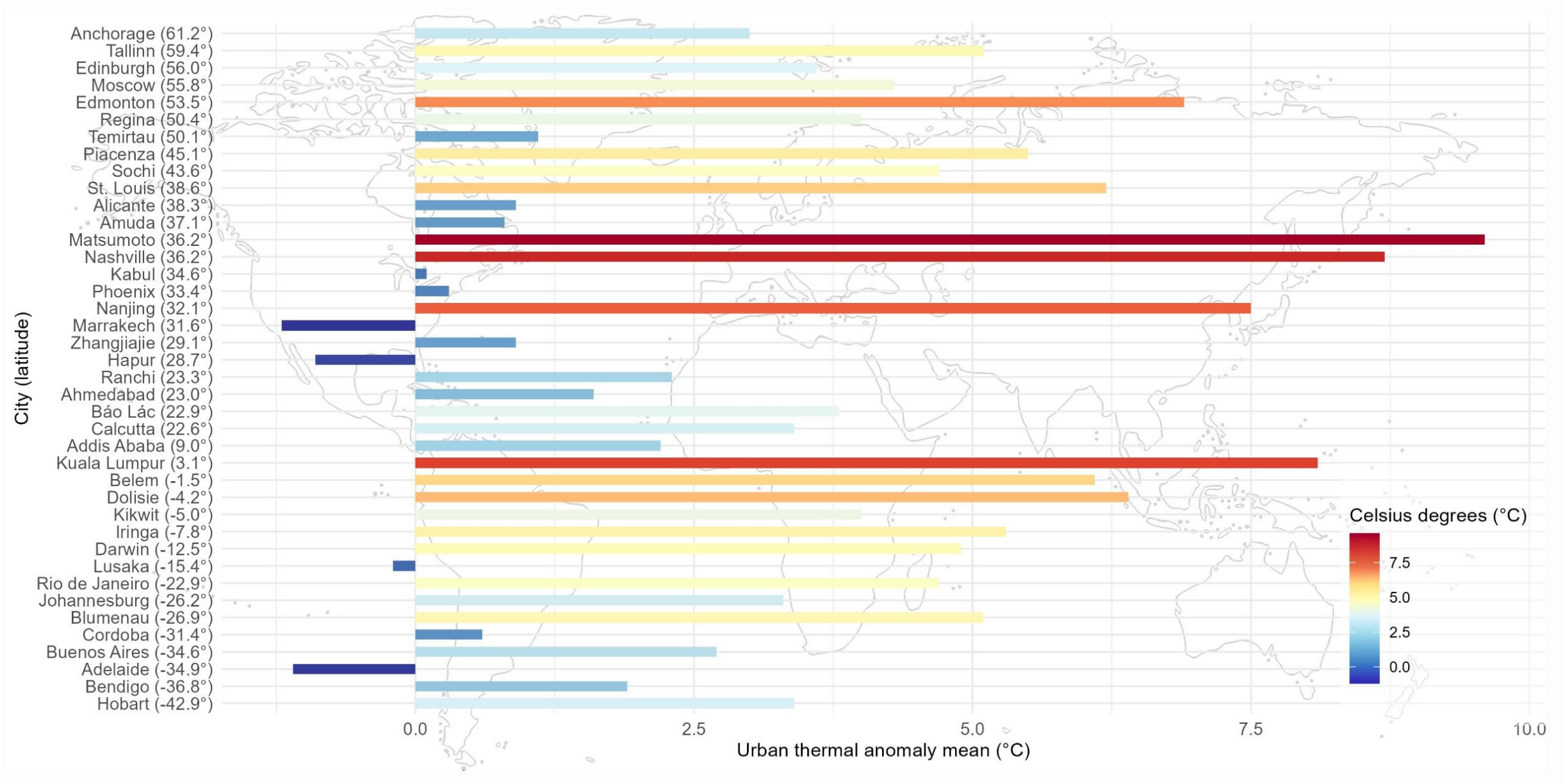
## 5. Distance to Green Infrastructures (> 300 m)

3-30-300 rule (Browning et al., 2024)

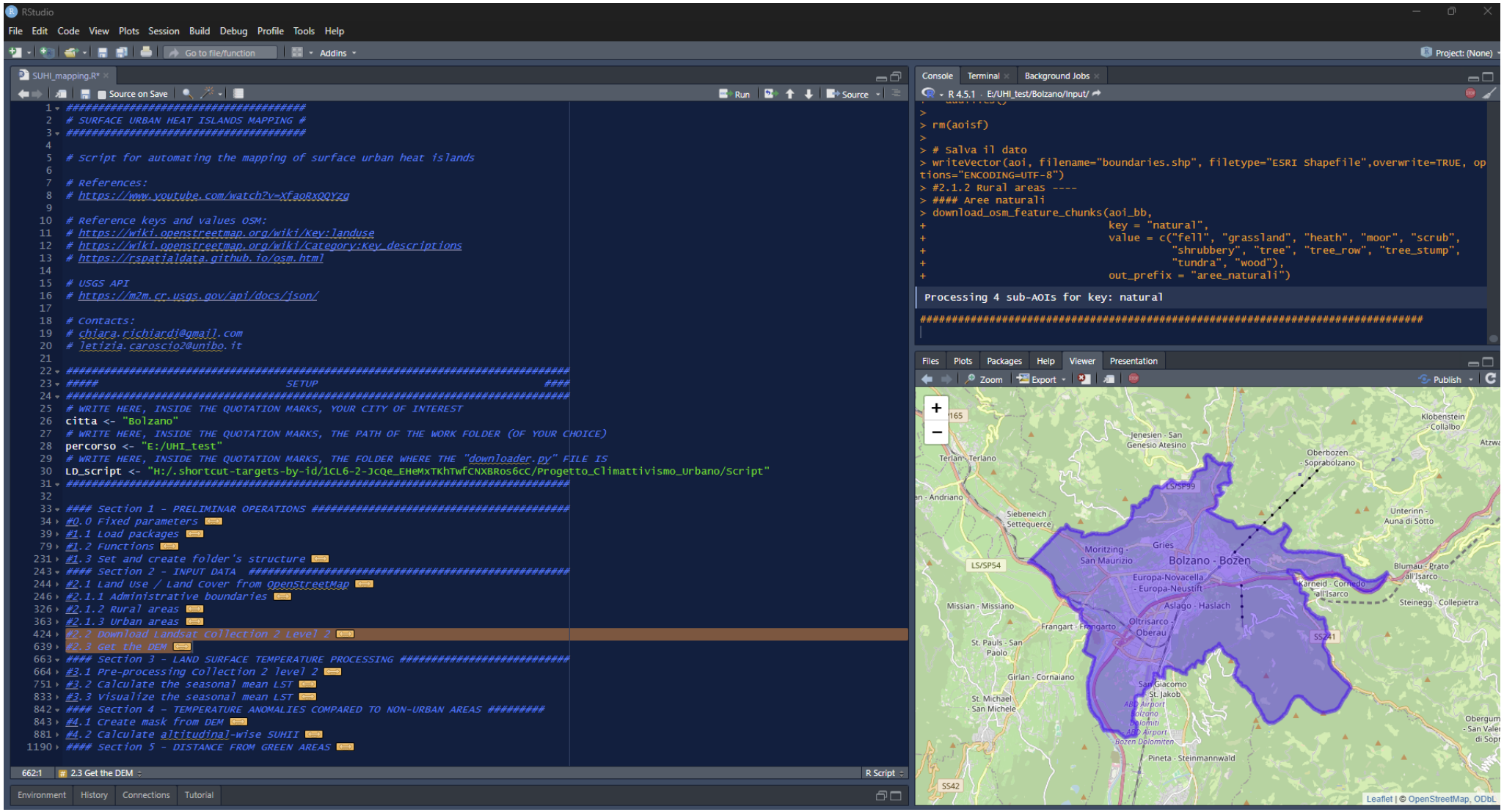
https://github.com/Officina-SCIFT/SUHII_mapping

The code does the scientific integration of data.
You get clear actionable maps.




Anchorage (61.2°)
Tallinn (59.4°)
Edinburgh (56.0°)
Moscow (55.8°)
Edmonton (53.5°)
Regina (50.4°)
Temirtau (50.1°)
Piacenza (45.1°)
Sochi (43.6°)
St. Louis (38.6°)
Alicante (38.3°)
Amuda (37.1°)
Matsumoto (36.2°)
Nashville (36.2°)
Kabul (34.6°)
Phoenix (33.4°)
Nanjing (32.1°)
Marrakech (31.6°)
Zhangjiajie (29.1°)
Hapur (28.7°)
Ranchi (23.3°)
Ahmedabad (23.0°)
Báo Lác (22.9°)
Calcutta (22.6°)
Addis Ababa (9.0°)
Kuala Lumpur (3.1°)
Belem (-1.5°)
Dolisie (-4.2°)
Kikwit (-5.0°)
Iringa (-7.8°)
Darwin (-12.5°)
Lusaka (-15.4°)
Rio de Janeiro (-22.9°)
Johannesburg (-26.2°)
Blumenau (-26.9°)
Cordoba (-31.4°)
Buenos Aires (-34.6°)
Adelaide (-34.9°)
Bendigo (-36.8°)
Hobart (-42.9°)
City (latitude)
0.0
2.5
5.0
7.5
10.0
Urban thermal anomaly mean (°C)
Celsius degrees (°C)
7.5
5.0
2.5
0.0

# Let’s use it…


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
SUHI_mapping.R*
# SURFACE URBAN HEAT ISLANDS MAPPING #
# Script for automating the mapping of surface urban heat islands
# References:
# https://www.youtube.com/watch?v=XfaoRxQQYzg
# Reference keys and values OSM:
# https://wiki.openstreetmap.org/wiki/Key:landuse
# https://wiki.openstreetmap.org/wiki/Category:Key_descriptions
# https://rspatialdata.github.io/osm.html
# USGS API
# https://m2m.cr.usgs.gov/api/docs/json/
# Contacts:
# chiara.richiardi@gmail.com
# letizia.caroscio2@unibo.it
citta <- "Bolzano"
# WRITE HERE, INSIDE THE QUOTATION MARKS, THE PATH OF THE WORK FOLDER (OF YOUR CHOICE)
percorso <- "E:/UHI_test"
# WRITE HERE, INSIDE THE QUOTATION MARKS, THE FOLDER WHERE THE "downloader.py" FILE IS
LD_script <- "H:/.shortcut-targets-by-id/1CL6-2-JcQe_EHeMxTKhTwfCNXBRos6cC/Progetto_Climattivismo_Urbano/Script"
#### Section 1 - PRELIMINAR OPERATIONS
#0.0 Fixed parameters
#1.1 Load packages
#1.2 Functions
#1.3 Set and create folder's structure
#### Section 2 - INPUT DATA
#2.1 Land Use / Land Cover from OpenStreetMap
#2.1.1 Administrative boundaries
#2.1.2 Rural areas
#2.1.3 Urban areas
#2.2 Download Landsat Collection 2 Level 2
#2.3 Get the DEM
#### Section 3 - LAND SURFACE TEMPERATURE PROCESSING
#3.1 Pre-processing Collection 2 level 2
#3.2 Calculate the seasonal mean LST
#3.3 Visualize the seasonal mean LST
#### Section 4 - TEMPERATURE ANOMALIES COMPARED TO NON-URBAN AREAS
#4.1 Create mask from DEM
#4.2 Calculate altitudinal-wise SUHI
#### Section 5 - DISTANCE FROM GREEN AREAS
Console Terminal Background Jobs
R 4.5.1 · E:/UHI_test/Bolzano/Input/
> rm(aoisf)
> # Salva il dato
> writeVector(aoi, filename="boundaries.shp", filetype="ESRI Shapefile",overwrite=TRUE, options="ENCODING=UTF-8")
> #2.1.2 Rural areas ----
> #### Aree naturali
> download_osm_feature_chunks(aoi_bb,
+ key = "natural",
+ value = c("fell", "grassland", "heath", "moor", "scrub",
+ "shrubbery", "tree", "tree_row", "tree_stump",
+ "tundra", "wood"),
+ out_prefix = "aree_naturali")
Processing 4 sub-AOIs for key: natural
Files Plots Packages Help Viewer Presentation
Zoom Export Publish
Bolzano - Bozen
Leaflet | © OpenStreetMap, ODbL

# LET'S FEDERATE!

Let's connect ideas and expertise to rethink technology for social and climate justice.

# THANK YOU!

# Contacts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https://municipiozero.it/la-scienza-che-parte-dal-basso-officina-scift-presenta-un-algoritmoglobale-e-open-per-leggere-le-citta-e-le-isole-di-calore-urbane/

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Presentation Number **156**