Climatewalks

Hyperlocal environmental sensing

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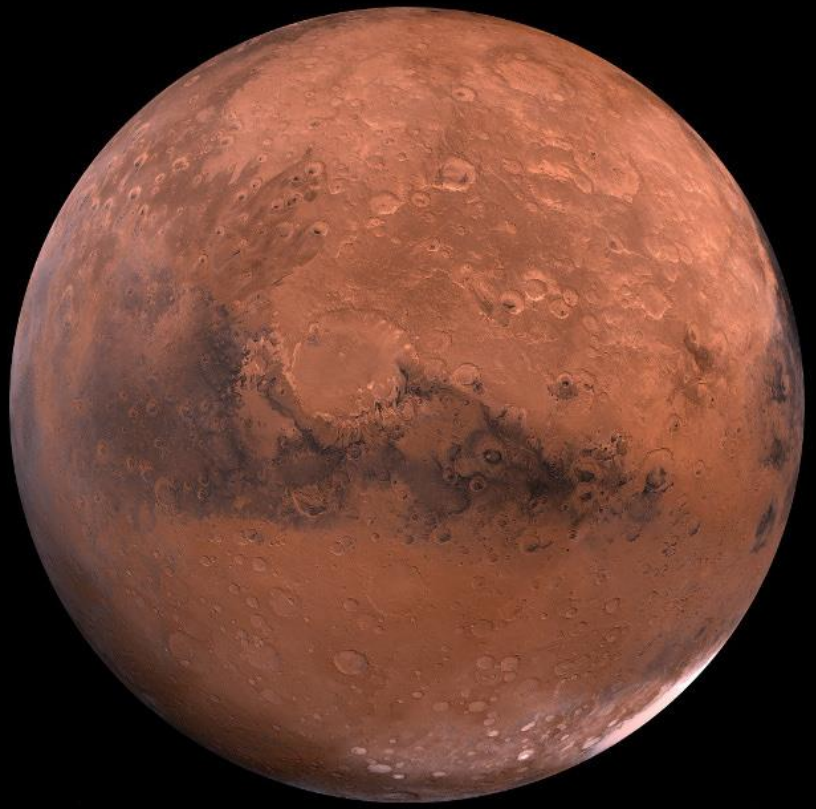
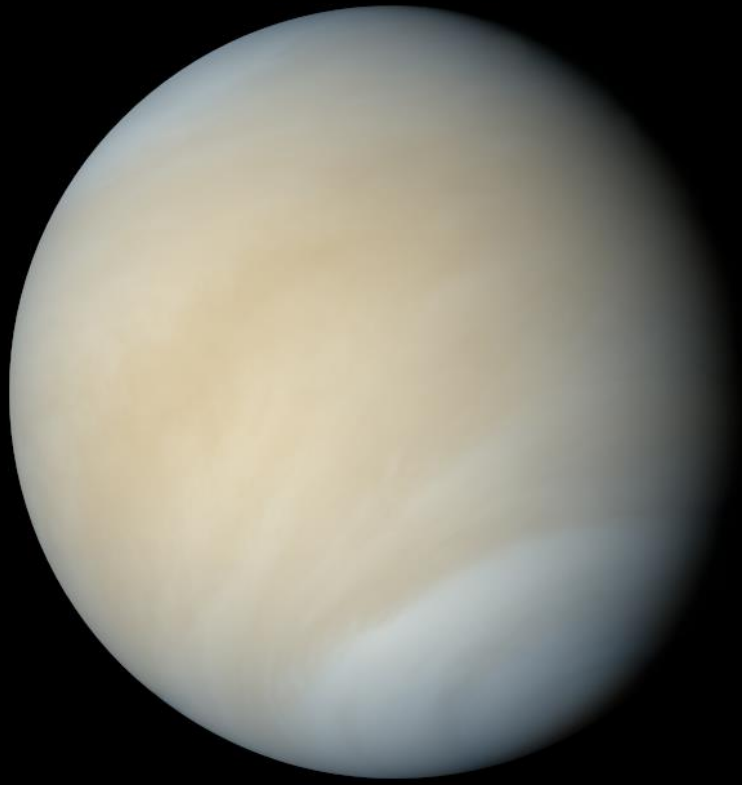
Politecnico di Torino
21 March 2025

Quelle: Jil Schroth, 2024

The Blue Marble, a photograph of the planet Earth made on December 7, 1972 by the crew of the Apollo 17 spacecraft.



-87 to -5 °C

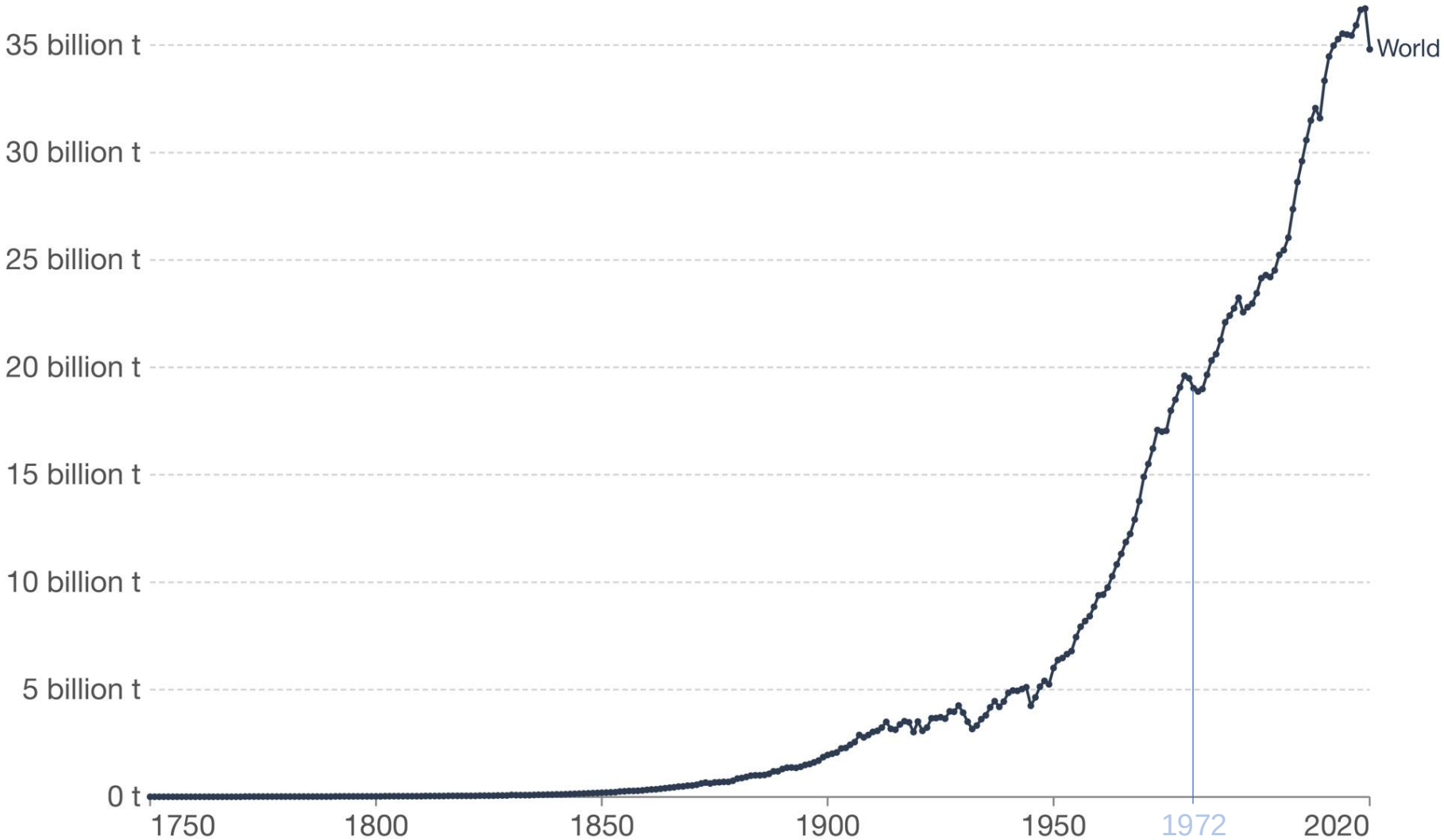


462 °C

https://solarsystem.nasa.gov/planets/

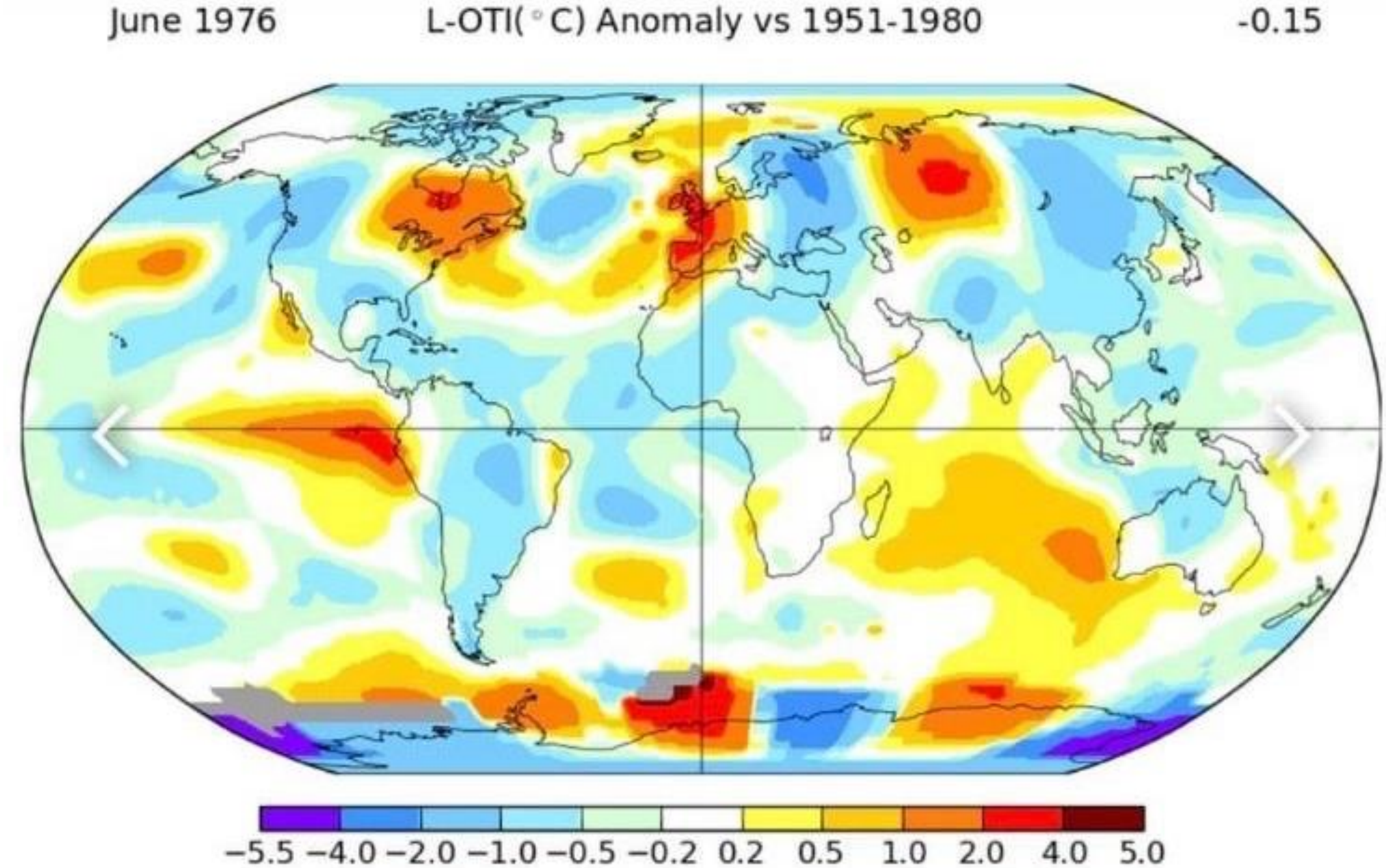
Annual CO_2 emissions

Carbon dioxide (CO_2) emissions from the burning of fossil fuels for energy and cement production. Land use change is not included.

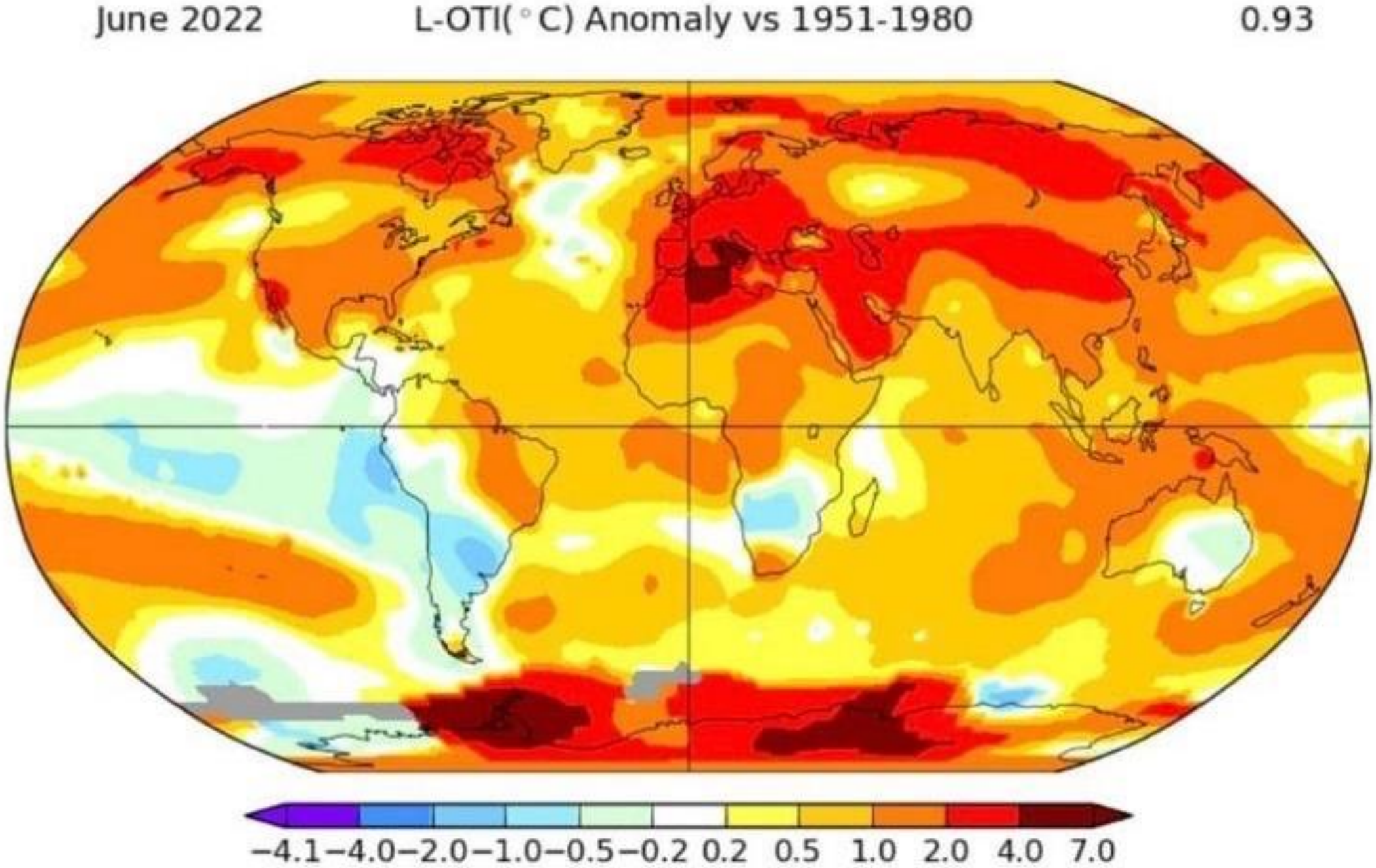


Source: Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY



Source: www.eea.europa.eu

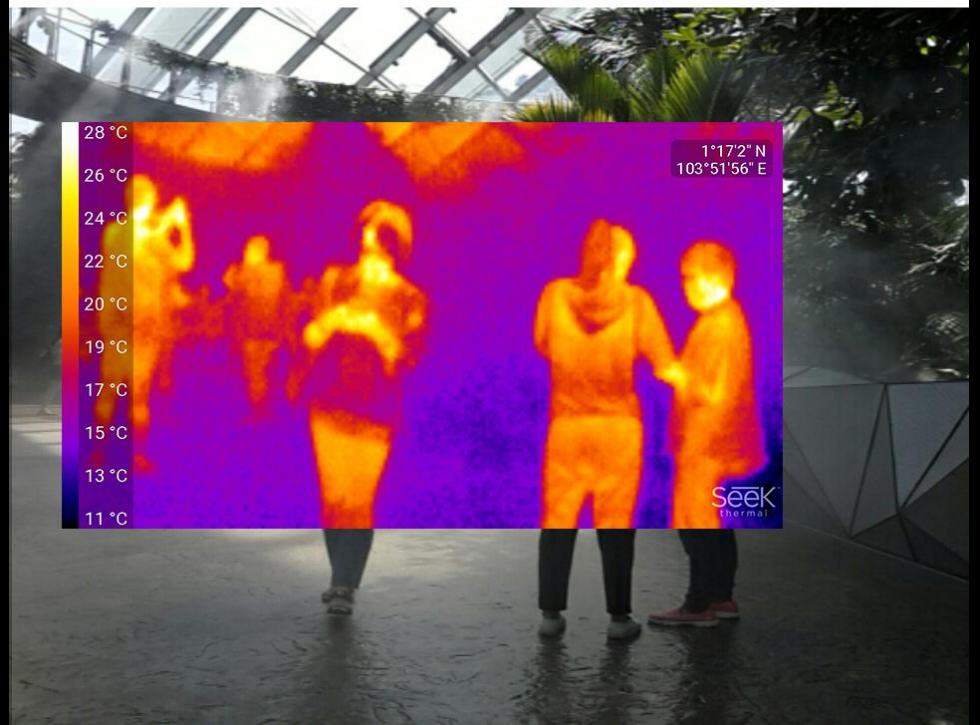


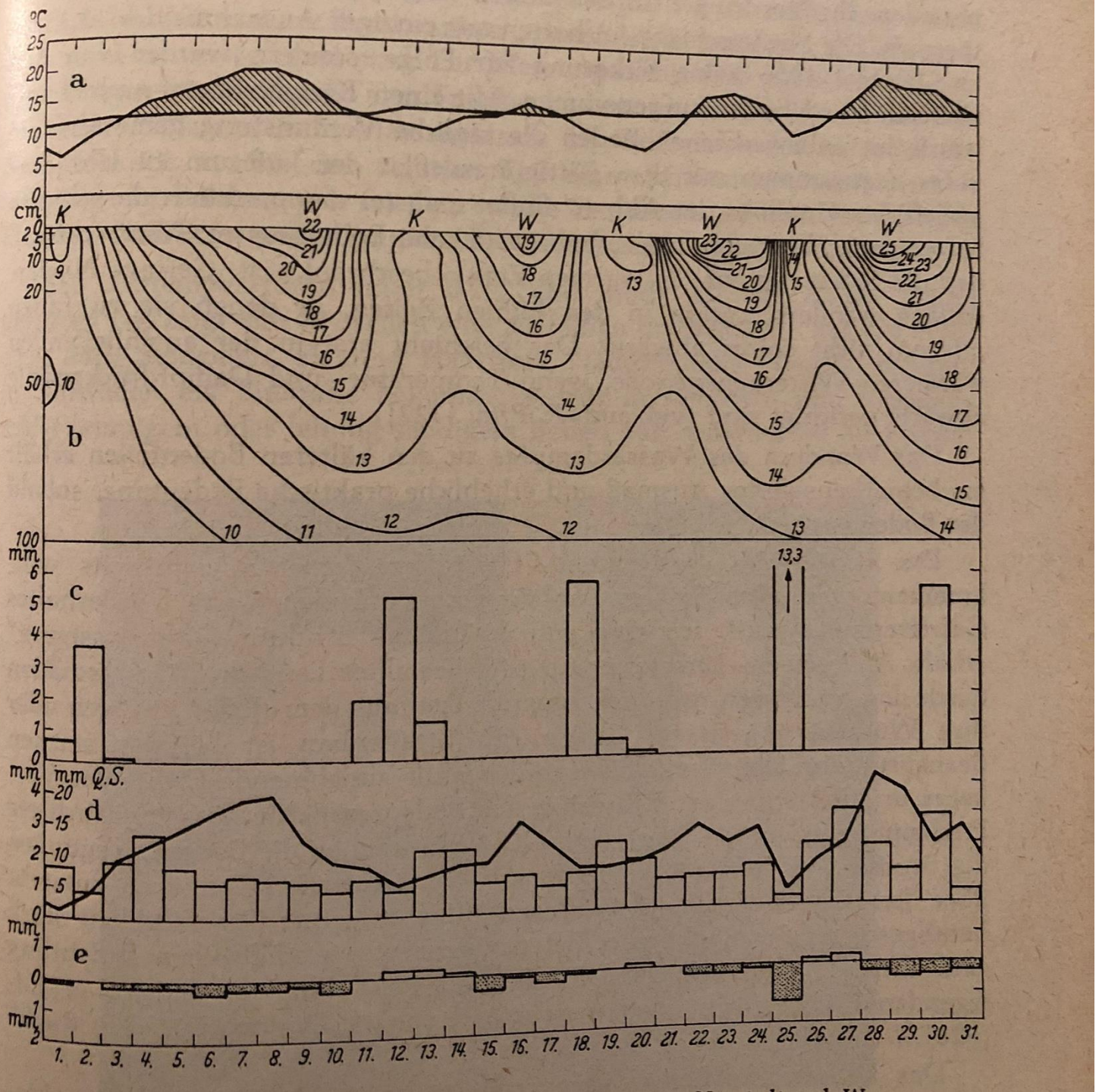
Source: www.eea.europa.eu


Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Beka Lemoine

Jason Larkin


28 °C
26 °C
24 °C
22 °C
20 °C
19 °C
17 °C
15 °C
13 °C
11 °C
1°17'2" N
103°51'56" E
SeeK
thermal

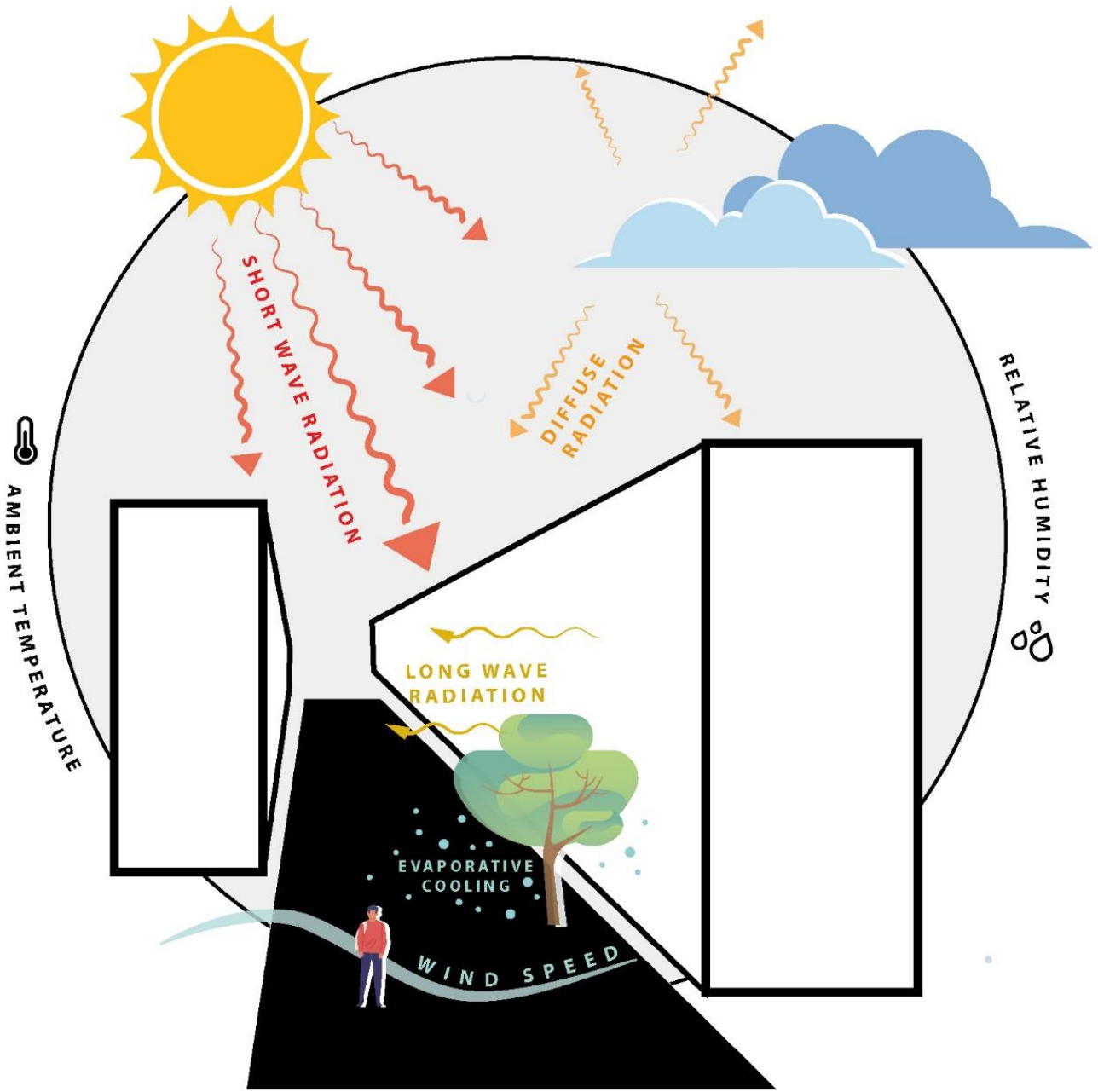


R. Geiger

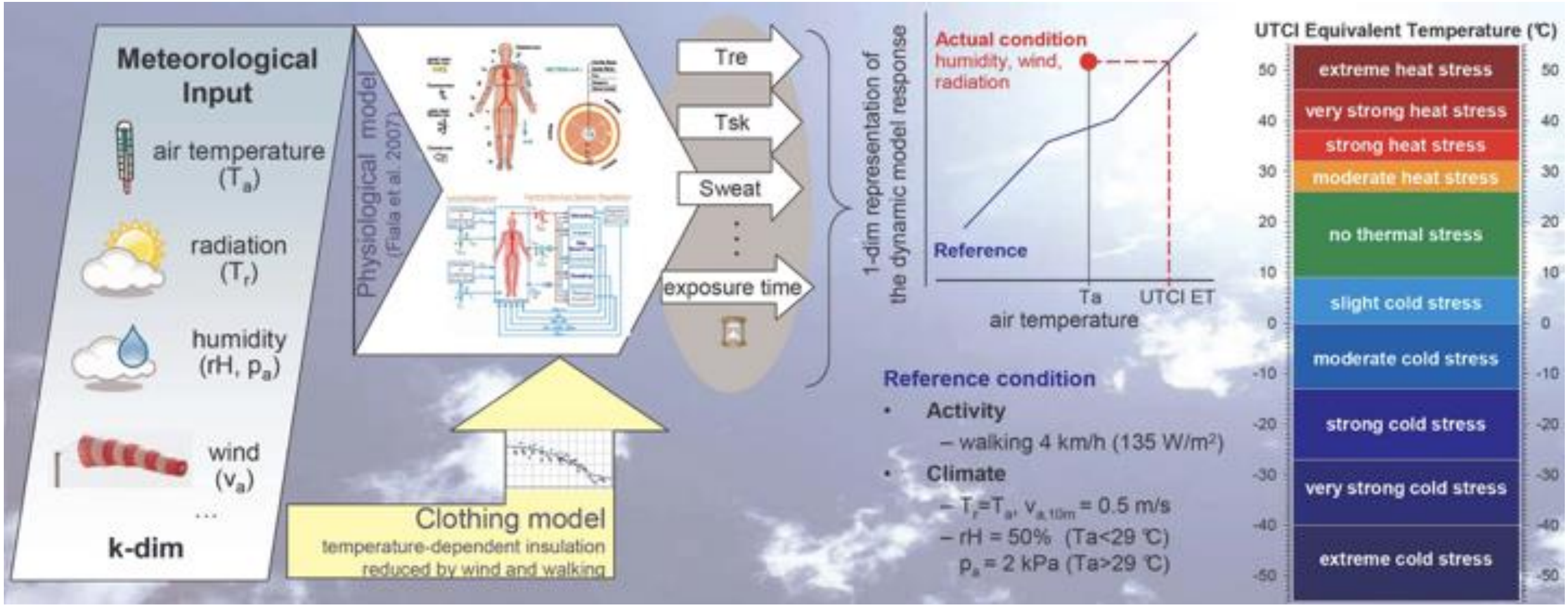
“Das Klima der bodennahen Schicht”

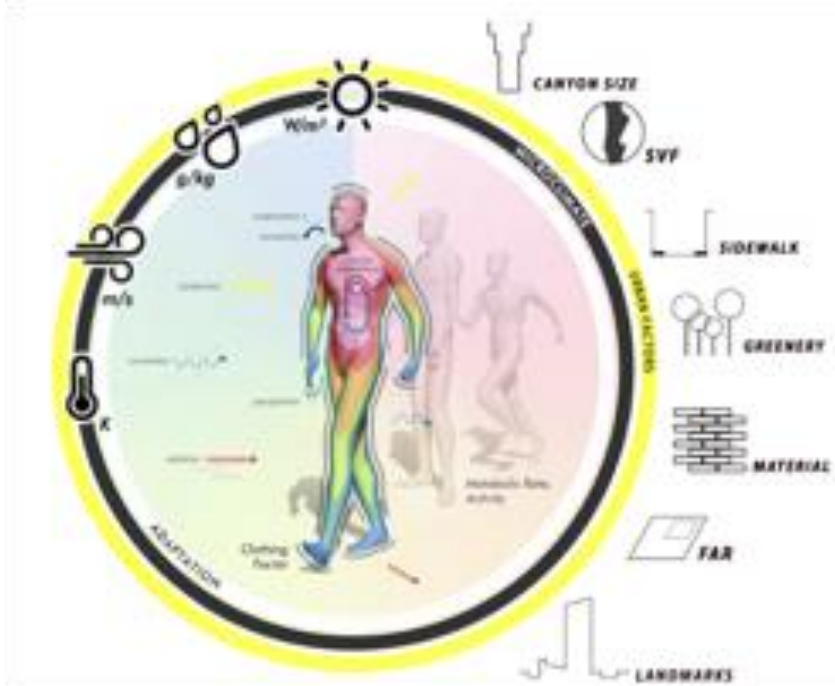
München 1927

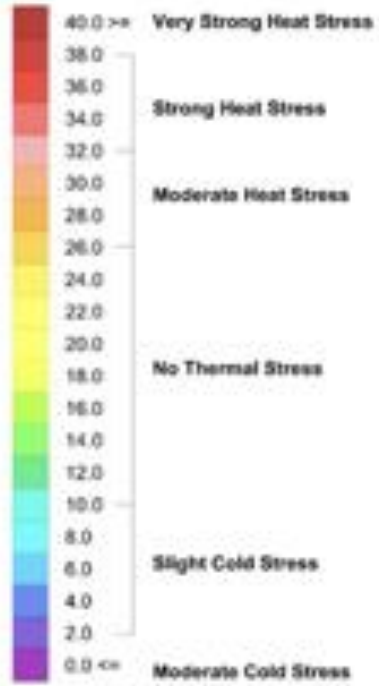
Einflussfaktoren



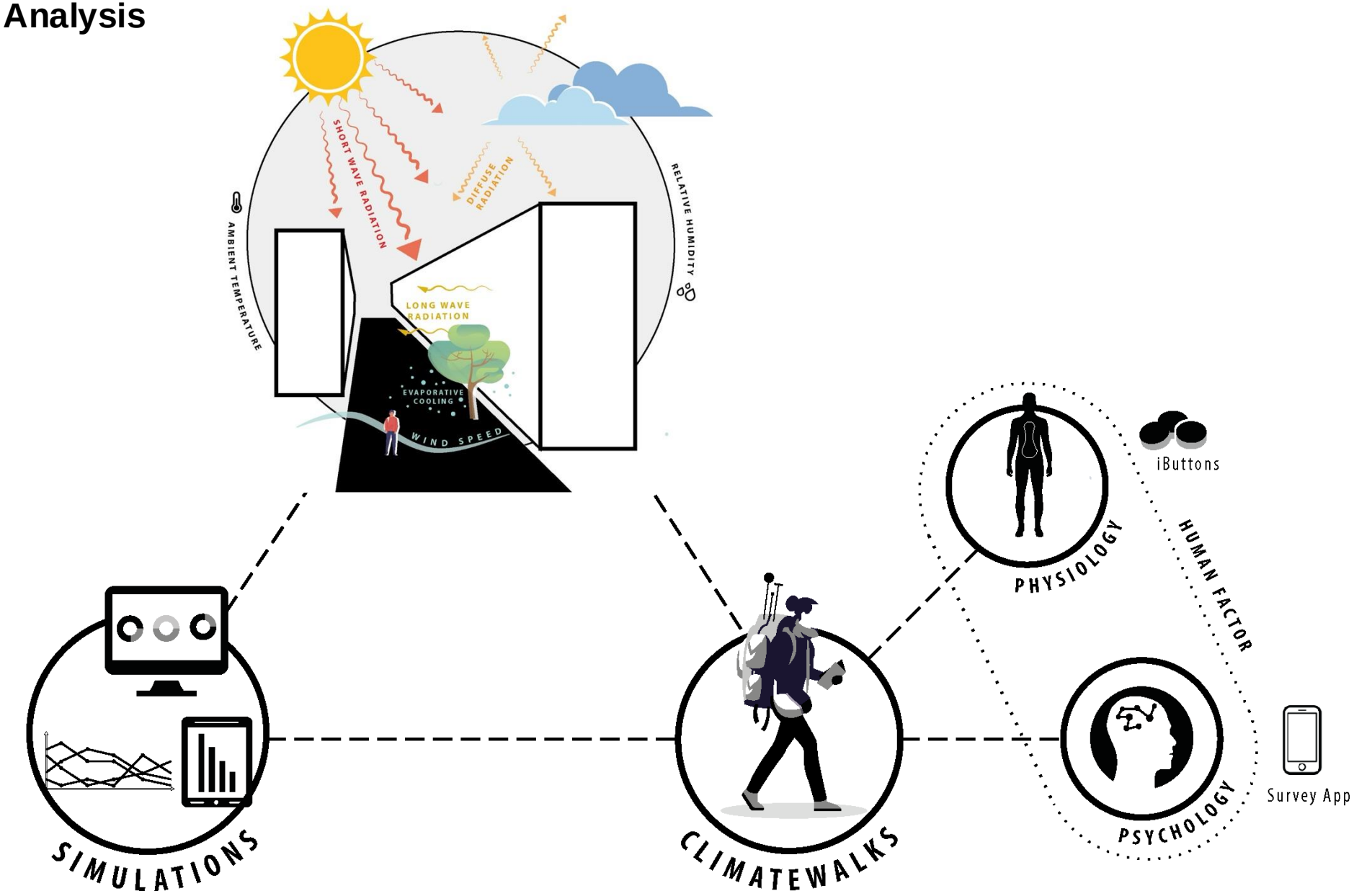
Universal Thermal Climate Index (UTCI)




CANYON SIZE
SVF
SIDEWALK
GREENERY
MATERIAL
FAR
LANDMARKS
W/m²
g/kg
m/s
K
ADAPTATION
SURROUNDINGS


40.0 >=
38.0
36.0
34.0
32.0
30.0
28.0
26.0
24.0
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0 <=
Very Strong Heat Stress
Strong Heat Stress
Moderate Heat Stress
No Thermal Stress
Slight Cold Stress
Moderate Cold Stress

Quantitative Analysis



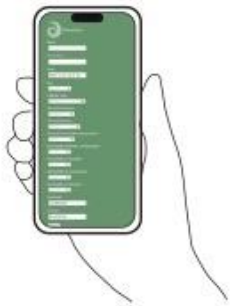
Climatewalks Device

Data-Driven
Records conditions along the route using a mobile weather station

Human-Centered
Surveys participants thermal comfort levels via web-based

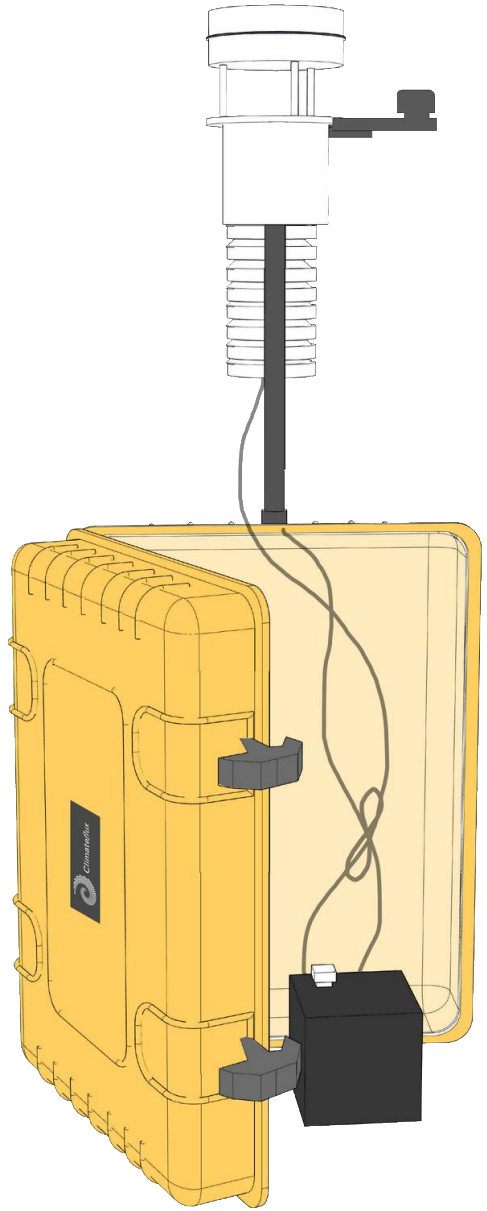
Dynamic
Accounts for cumulative effect of environmental stress

Integrated
Maps environmental and thermal comfort data in real-time



Sensor Specifications

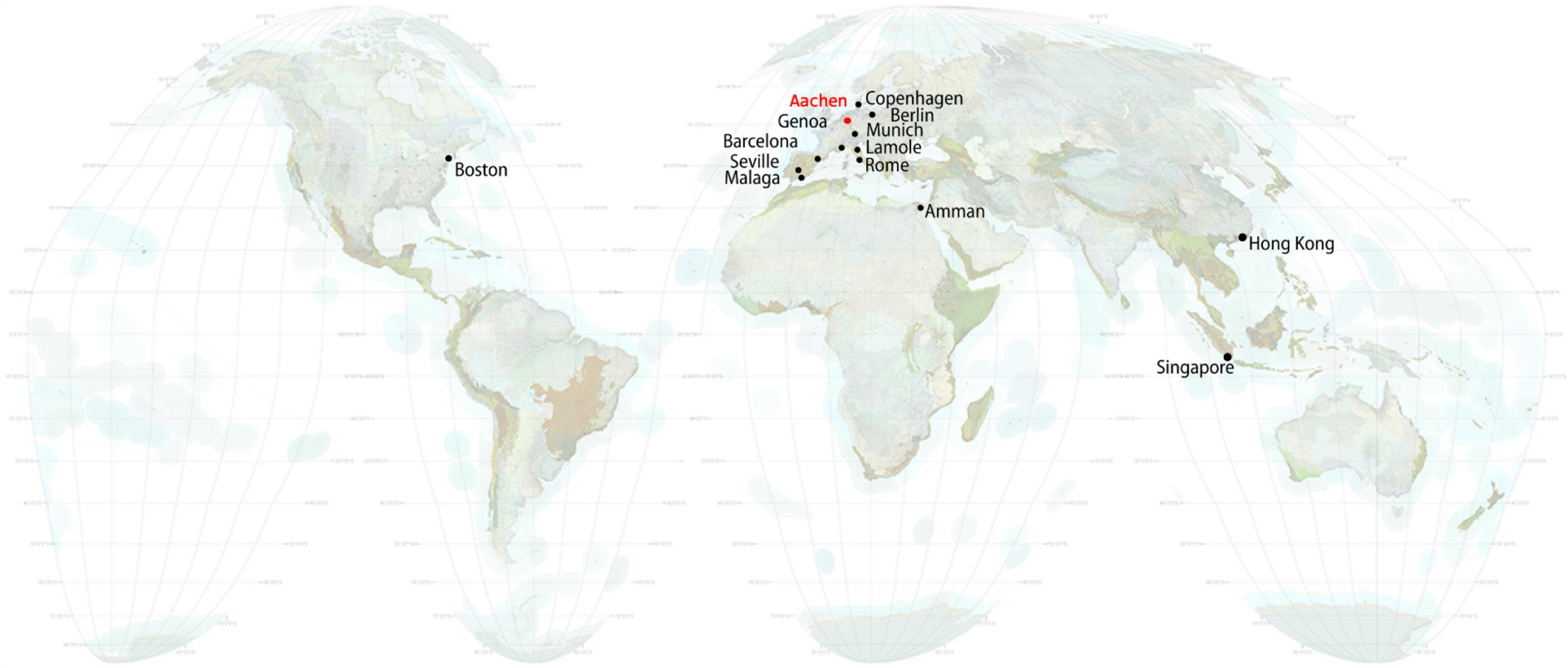
	Range	Resolution	Accuracy
Air Temperature	-50°C – 60°C	0.1°C	±0.1°C
Wind Speed	0 – 30 m/s	0.01 m/s	The greater of 0.3 m/s or 3% of measurement
Wind Direction	0° – 359°	1°	±5°
Wind Gust	0 – 30 m/s	0.01 m/s	The greater of 0.3 m/s or 3% of measurement
Tilt	-90° – 90°	0.1°	±1°
Humidity	0%RH to 100%RH	0.01%RH	±2%
GPS	-148dBm (Acquisition),	10Hz	3 meters
Pyranometer	0 - 2000 W m-2	0.01 W m-2	1 W m-2
Globe Thermometer	-50°C to +400°C	0.01°C	±0.7°C



Source: Climateflux

Device/Event to Method

Climatewalks Experiment



Source: Climateflux

nature medicine

Article

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Heat-related mortality in Europe during the summer of 2022

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Check for updates

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Over 70,000 excess deaths occurred in Europe during the summer of 2003. The resulting societal awareness led to the design and implementation of adaptation strategies to protect at-risk populations. We aimed to quantify heat-related mortality burden during the summer of 2022, the hottest season on record in Europe. We analyzed the Eurostat mortality database, which includes 45,184,044 counts of death from 823 contiguous regions in 35 European countries, representing the whole population of over 543 million people. We estimated 61,672 (95% confidence interval (CI) = 37,643–86,807) heat-related deaths in Europe between 30 May and 4 September 2022. Italy (18,010 deaths; 95% CI = 13,793–22,225), Spain (11,324; 95% CI = 7,908–14,880) and Germany (8,173; 95% CI = 5,374–11,018) had the highest summer heat-related mortality numbers, while Italy (295 deaths per million, 95% CI = 226–364), Greece (280, 95% CI = 201–355), Spain (237, 95% CI = 166–312) and Portugal (211, 95% CI = 162–255) had the highest heat-related mortality rates. Relative to population, we estimated 56% more heat-related deaths in women than men, with higher rates in men aged 0–64 (+41%) and 65–79 (+14%) years, and in women aged 80+ years (+27%). Our results call for a reevaluation and strengthening of existing heat surveillance platforms, prevention plans and long-term adaptation strategies.

Anthropogenic emissions of greenhouse gases have led to a detectable rise in global temperatures, which is associated with an increase in the frequency and intensity of heat waves and hot summers[1,2]. Globally, the last 8 years have been the warmest on record, and 2022 was the fifth warmest year[3]. In this context, Europe emerges as a major climatic hotspot[4,5], given that warming since preindustrial levels is almost 1 °C higher than the corresponding global increase, and higher than in any other continent[6]. Moreover, climate change projections for the continent indicate that temperatures, and their health impacts, will rise at an accelerated rate unless strong mitigation and adaptation actions are put in place[7,8].

Exposure to heat poses a major threat to high-risk populations in Europe and worldwide by substantially contributing to increased morbidity and mortality[9,10]. Heat waves are the extreme weather events with the highest impact in terms of attributable counts of death[11]. Heat-related mortality has been a major concern for the past two decades in Europe, especially after the 71,449 excess deaths registered during the months of June, July, August and September of 2003 (ref. 12). The resulting societal awareness of the short-term health effects of heat led to the design and implementation of heat prevention plans and other adaptation strategies to protect at-risk populations

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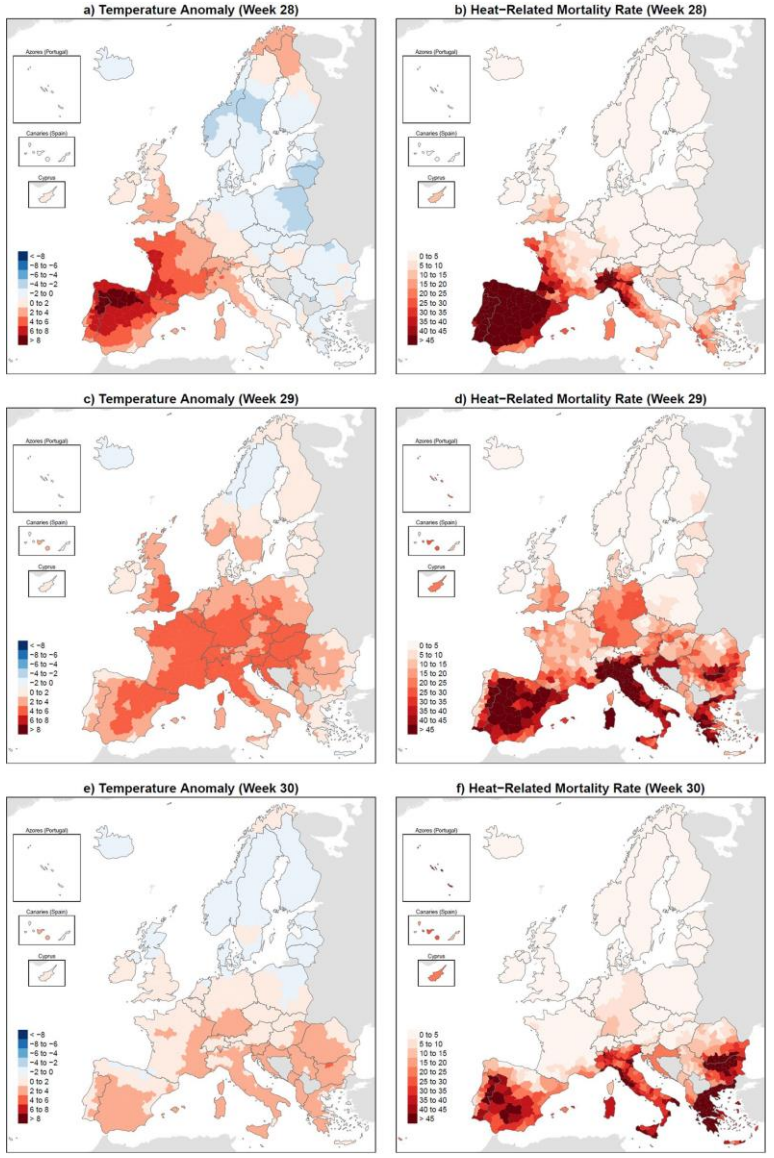


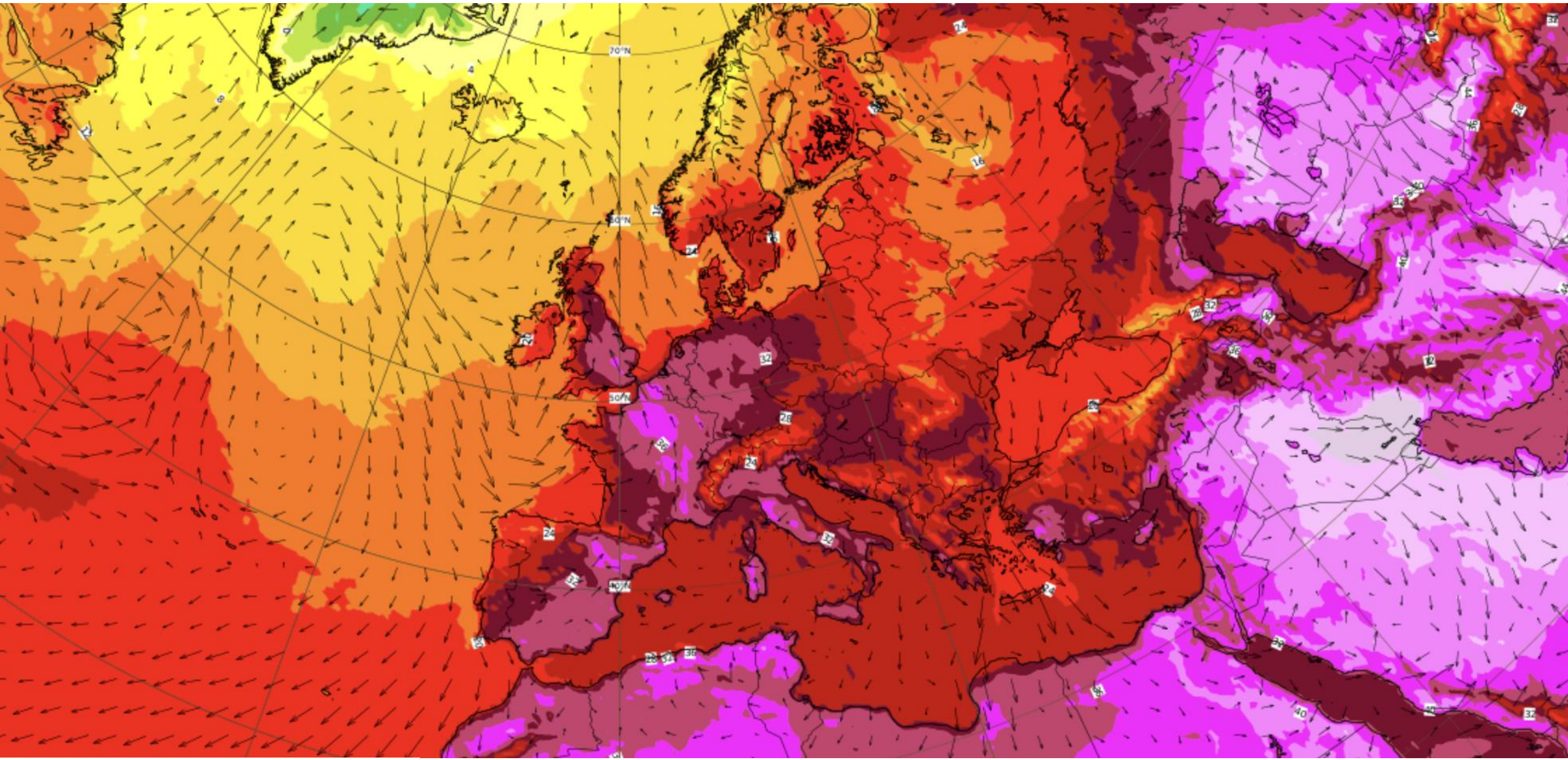
Extended Data Fig. 4 | Regional temperature anomaly and heat-related mortality rate during weeks 28, 29 and 30. Regional temperature anomaly (a,c,e; °C) and heat-related mortality rate (b,d,f; weekly deaths per million) during weeks 28 (July 11 – July 17; a,b), 29 (July 18 – July 24; c,d) and 30 (July 25 – July 31; e,f) of the year 2022.

Mikroklimatische Stadtspaziergänge
Climatewalks

RWTH Aachen University
Dr.-Ing. Daniele Santucci
Lehrstuhl für Gebäudetechnologie

mit Climateflux GmbH

19.07.2022



Source: https://www.ecmwf.int/

Source: Marlene Maier/Chair for Building Technology RWTH

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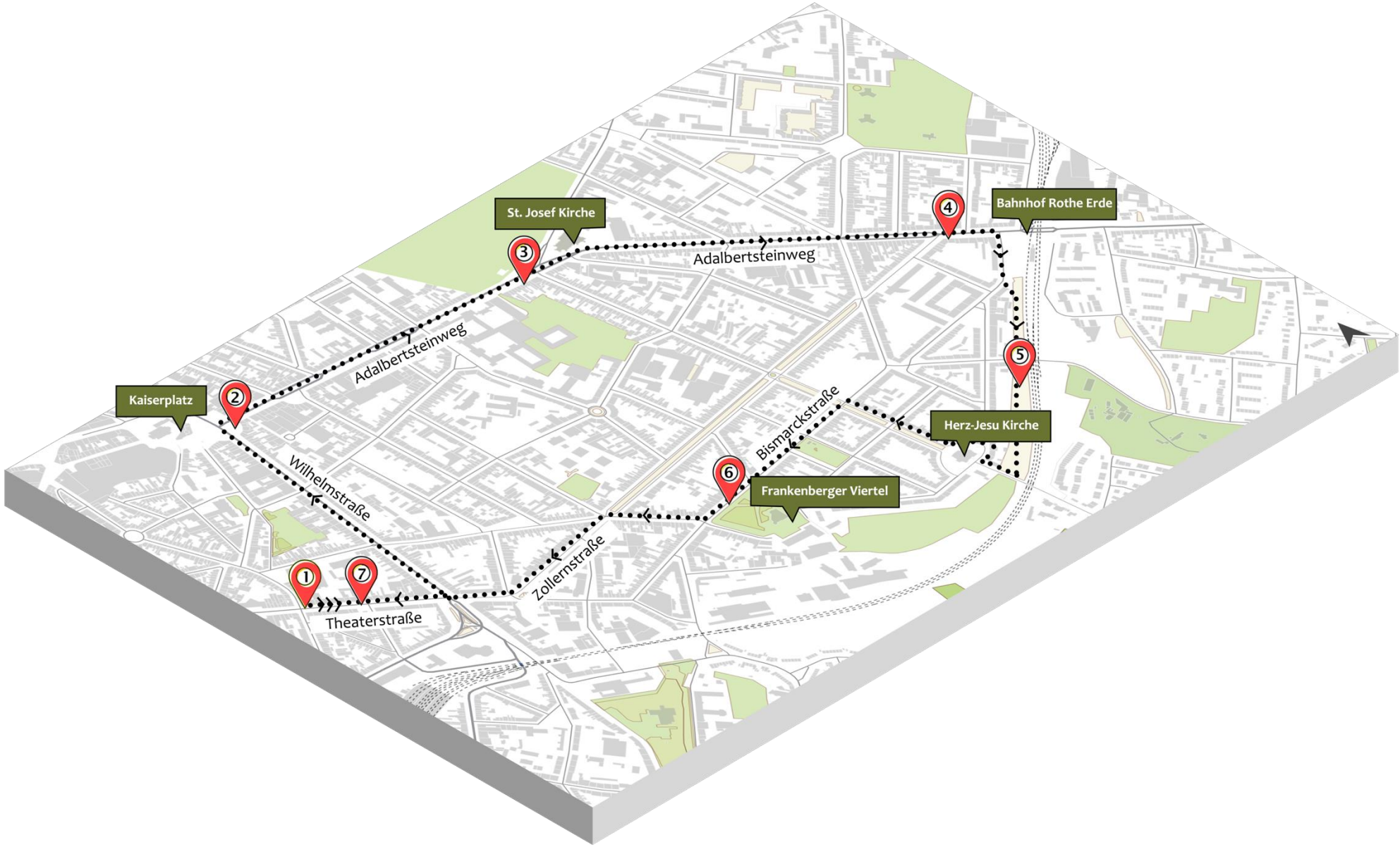

Source: Chair for Building Technology RWTH

19.07.2022

Source: Climateflux

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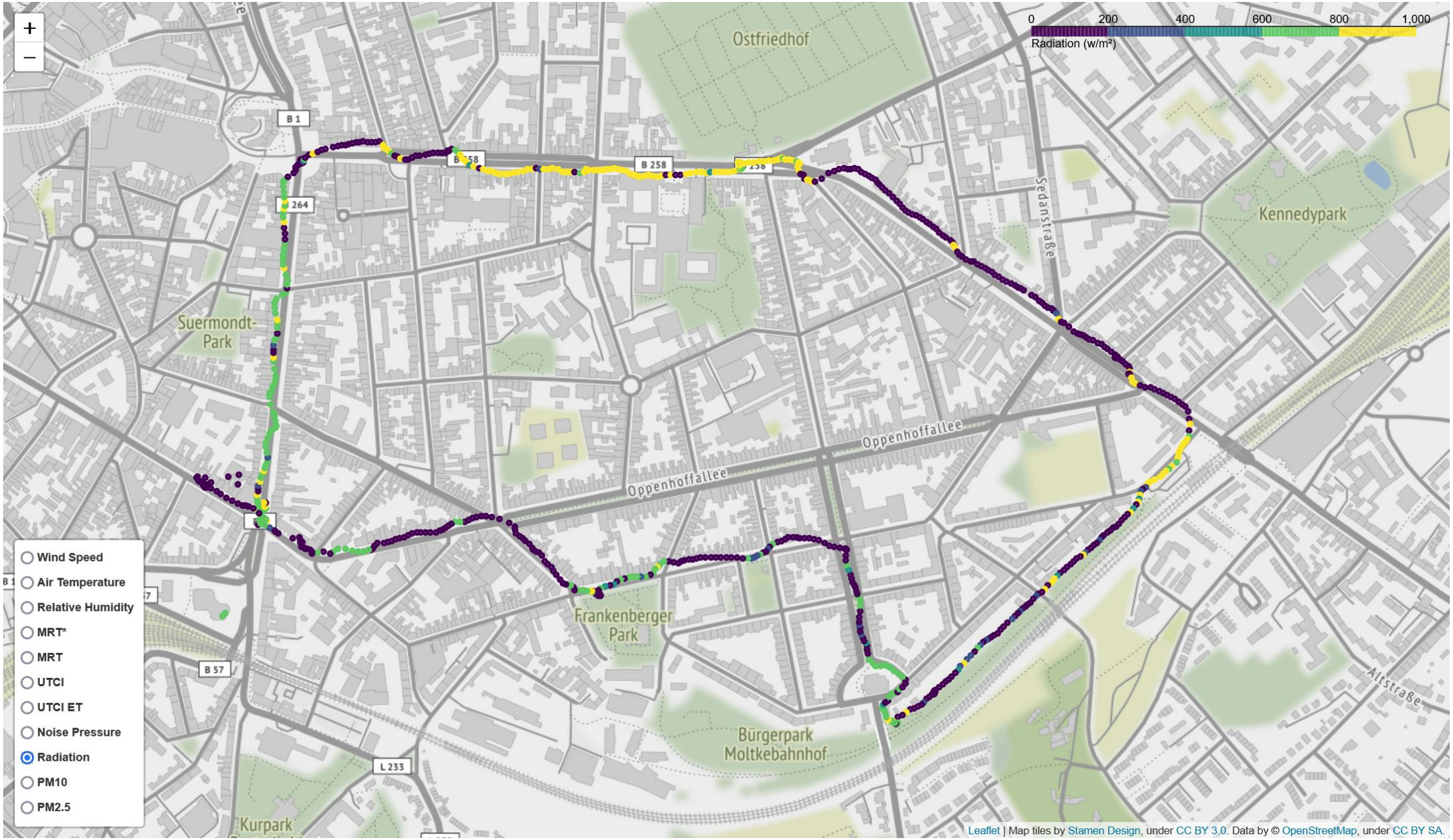
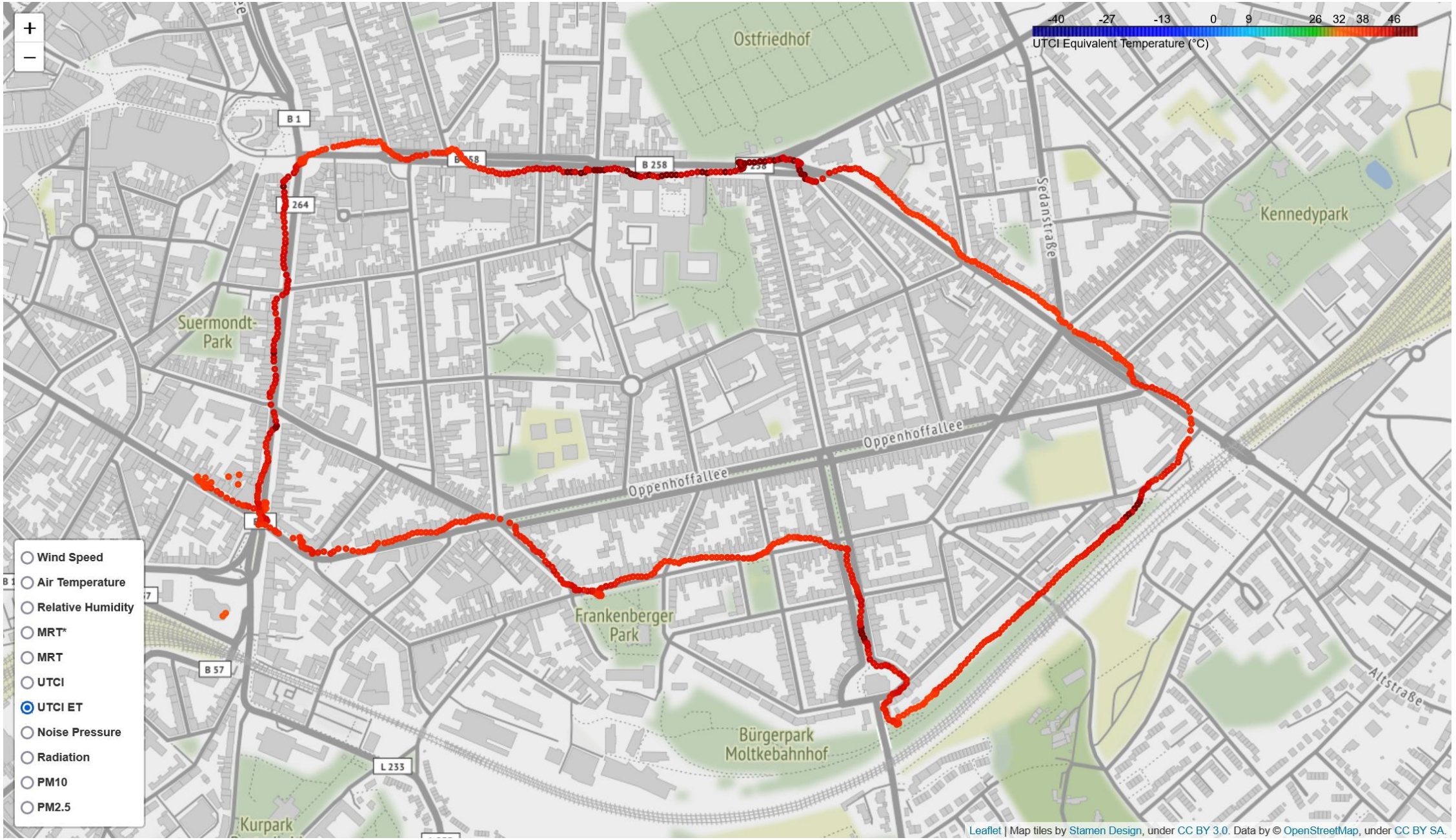
Source: Climateflux

19.07.2022



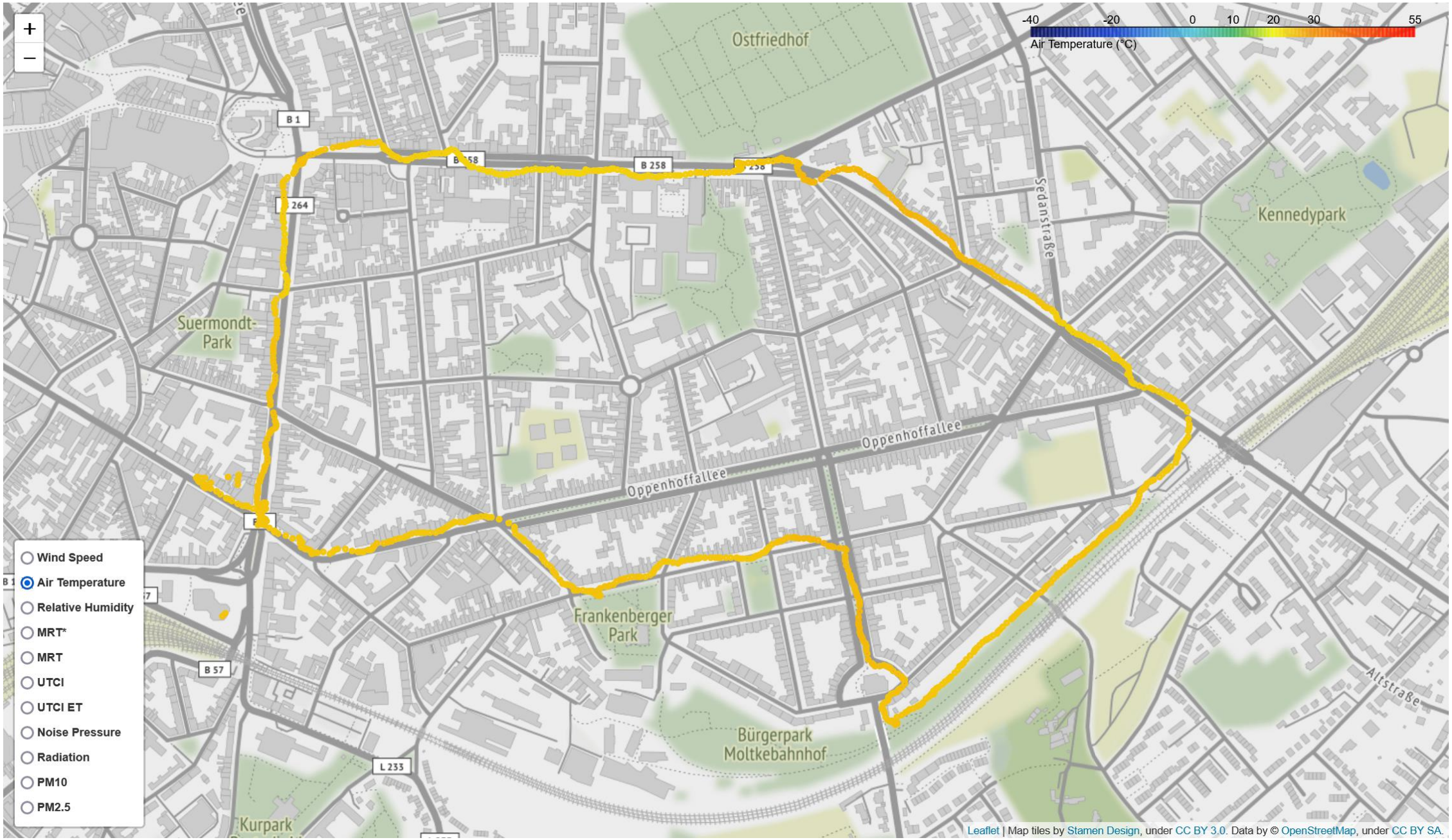
Source: Climateflux

19.07.2022



Source: Climateflux

31.08.2022



Source: Climateflux

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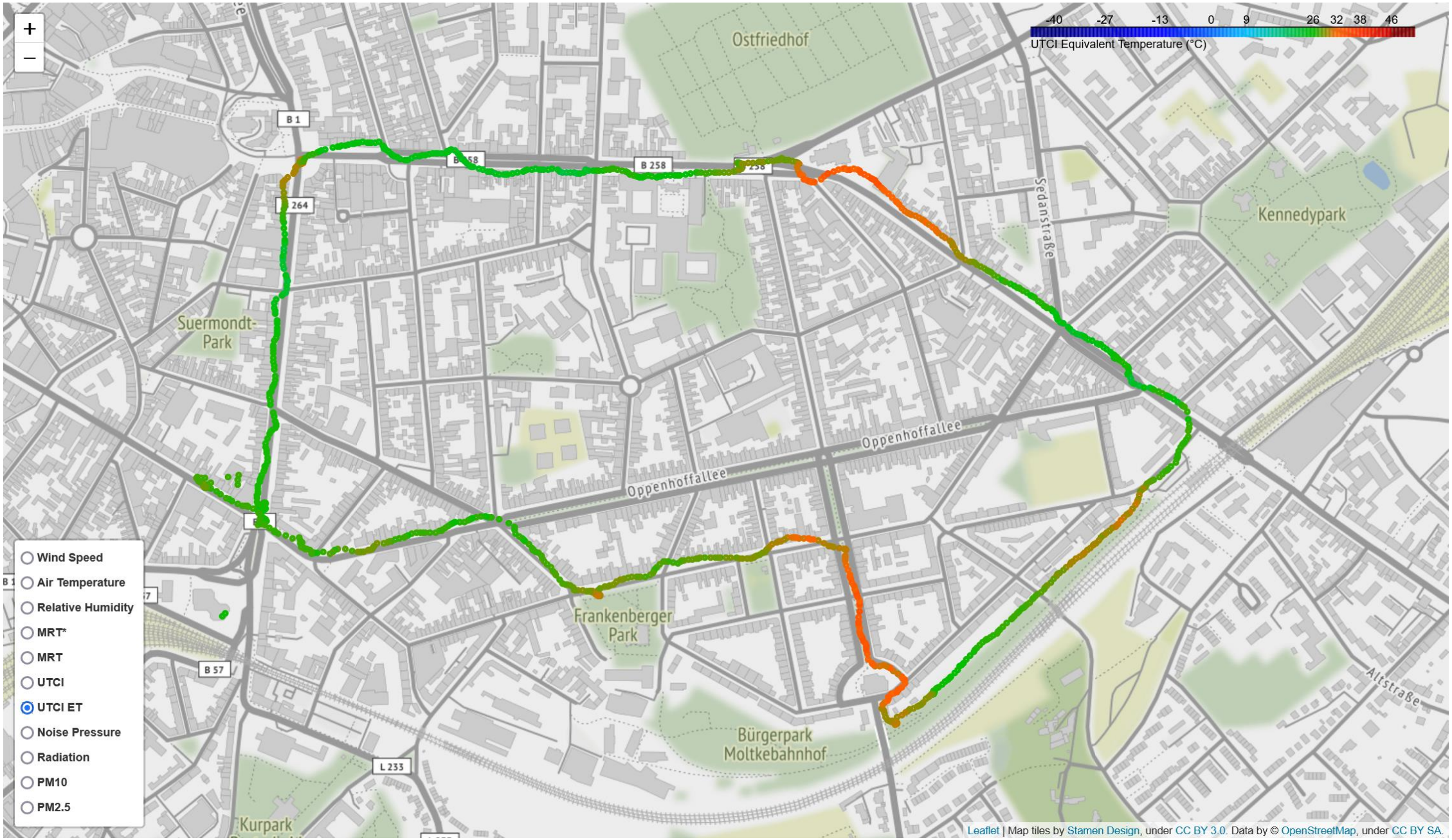
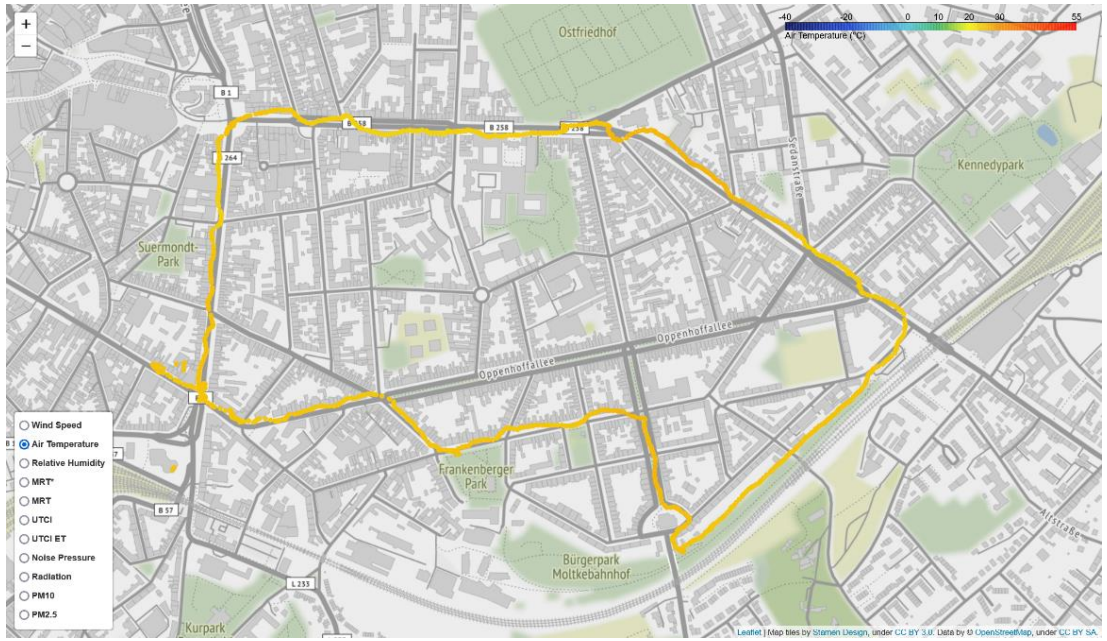
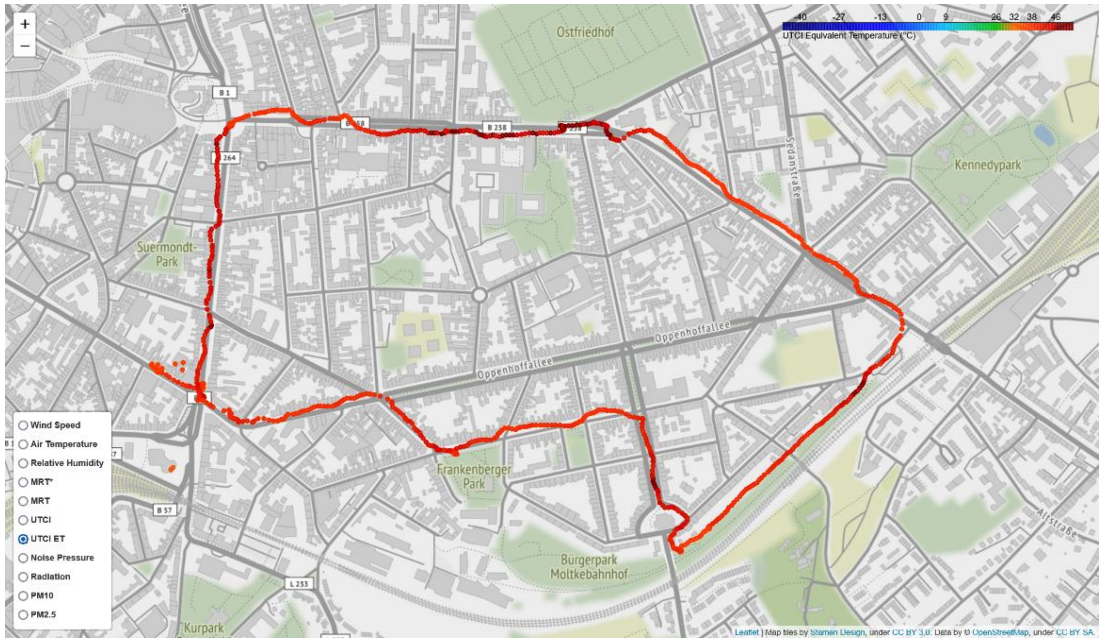


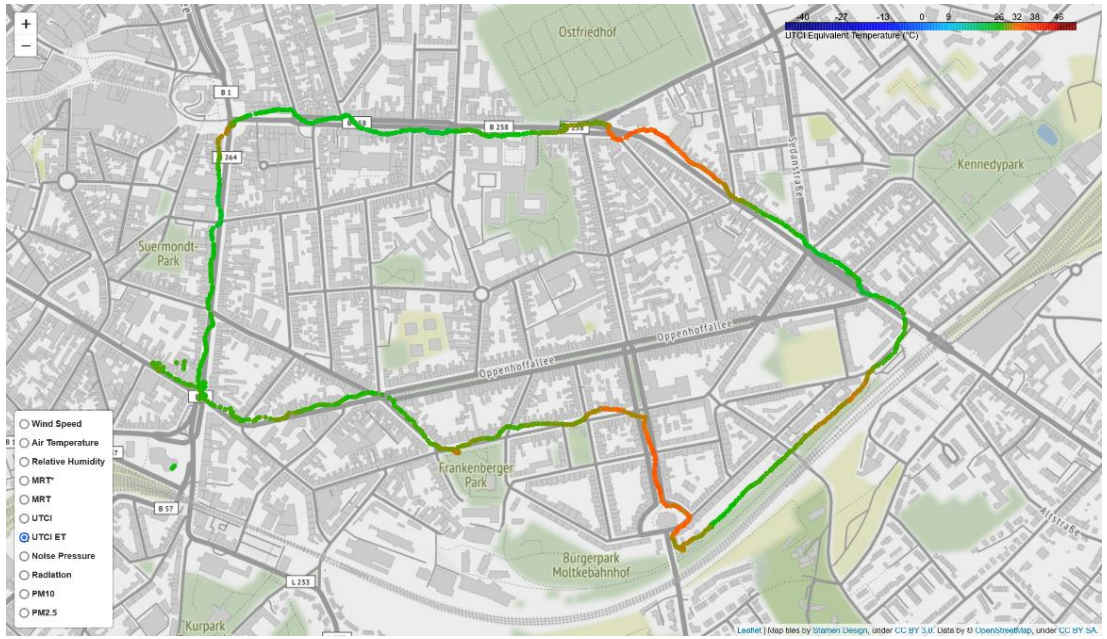
Source: Climateflux

19.07.2022

31.08.2022

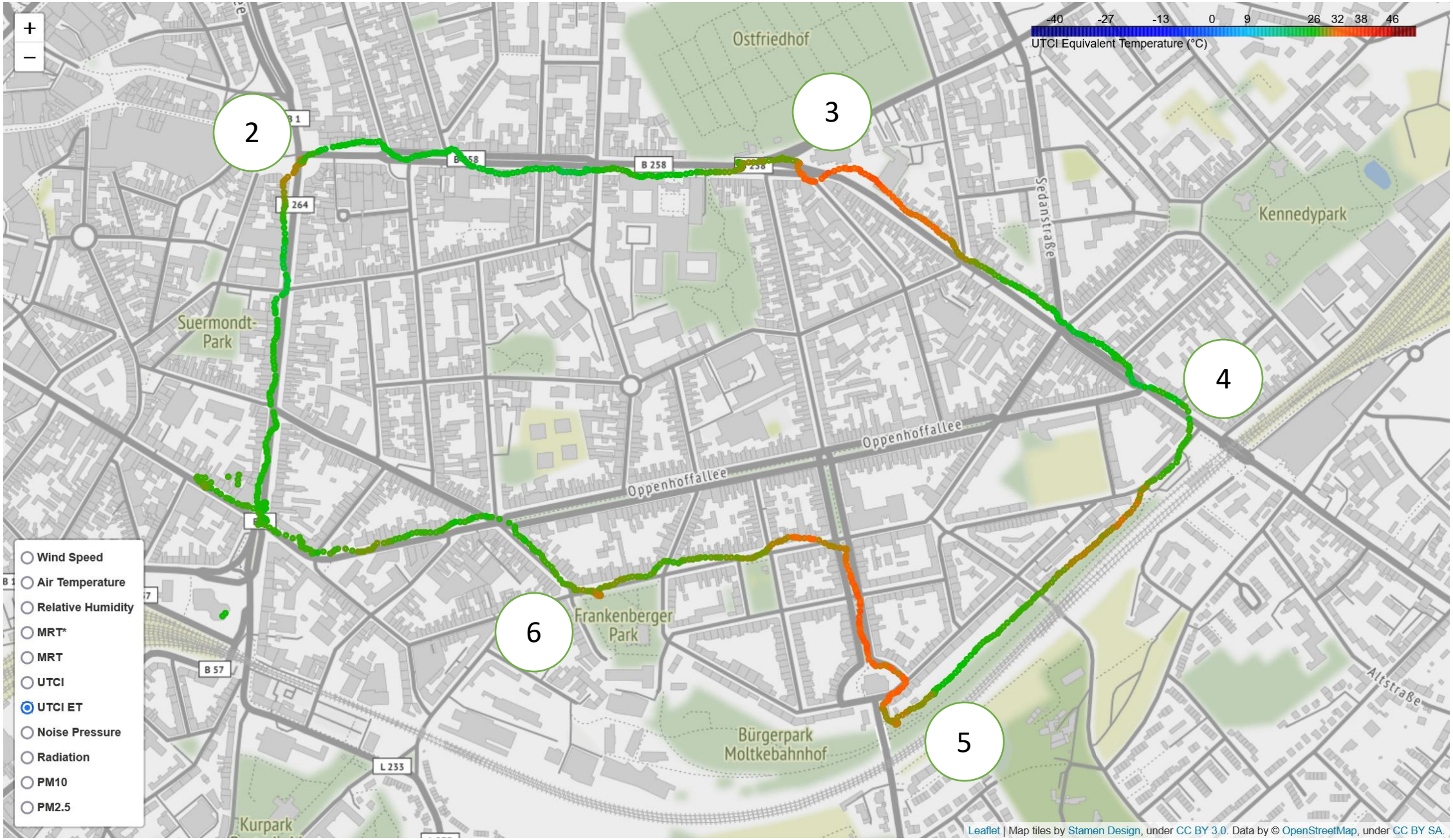


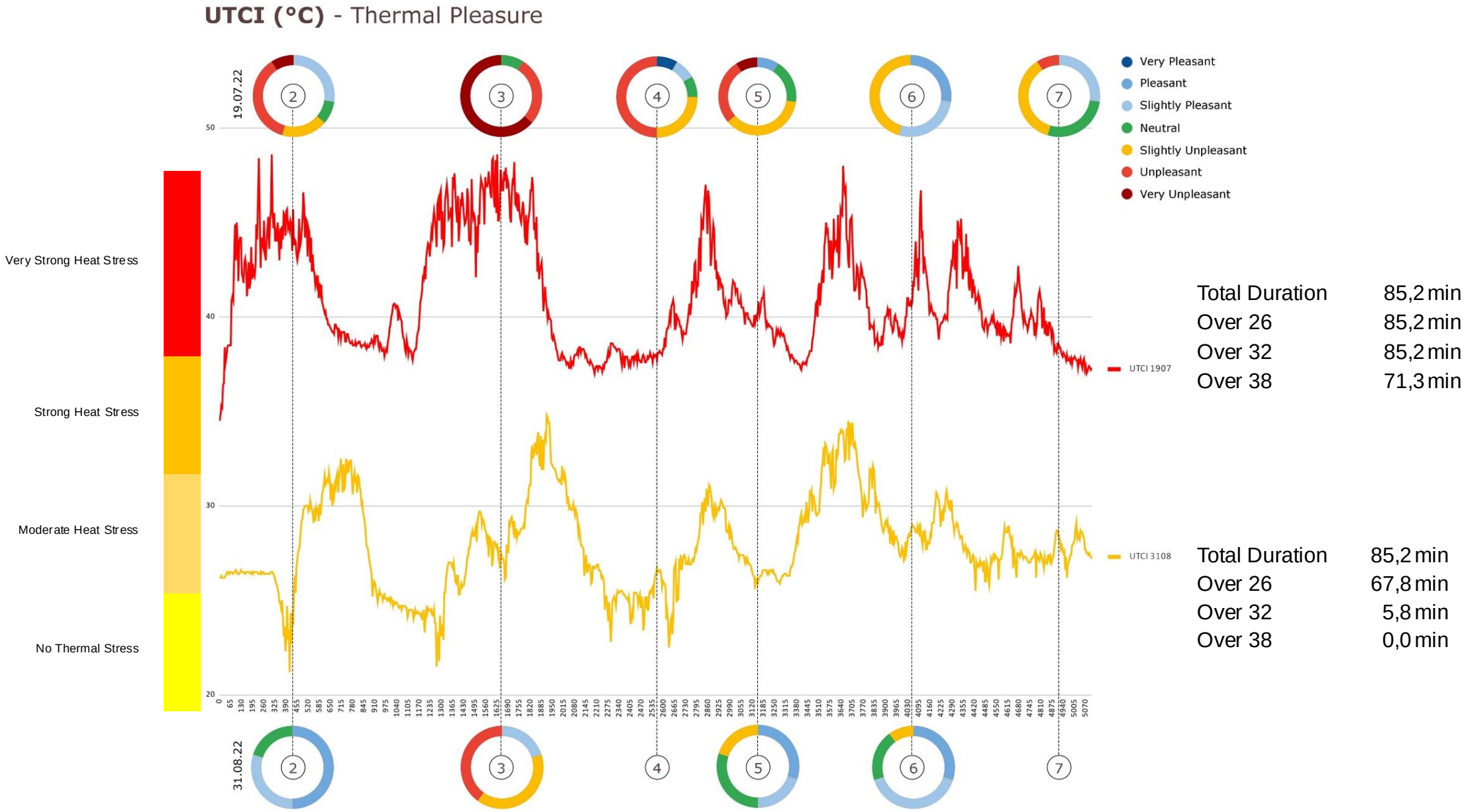




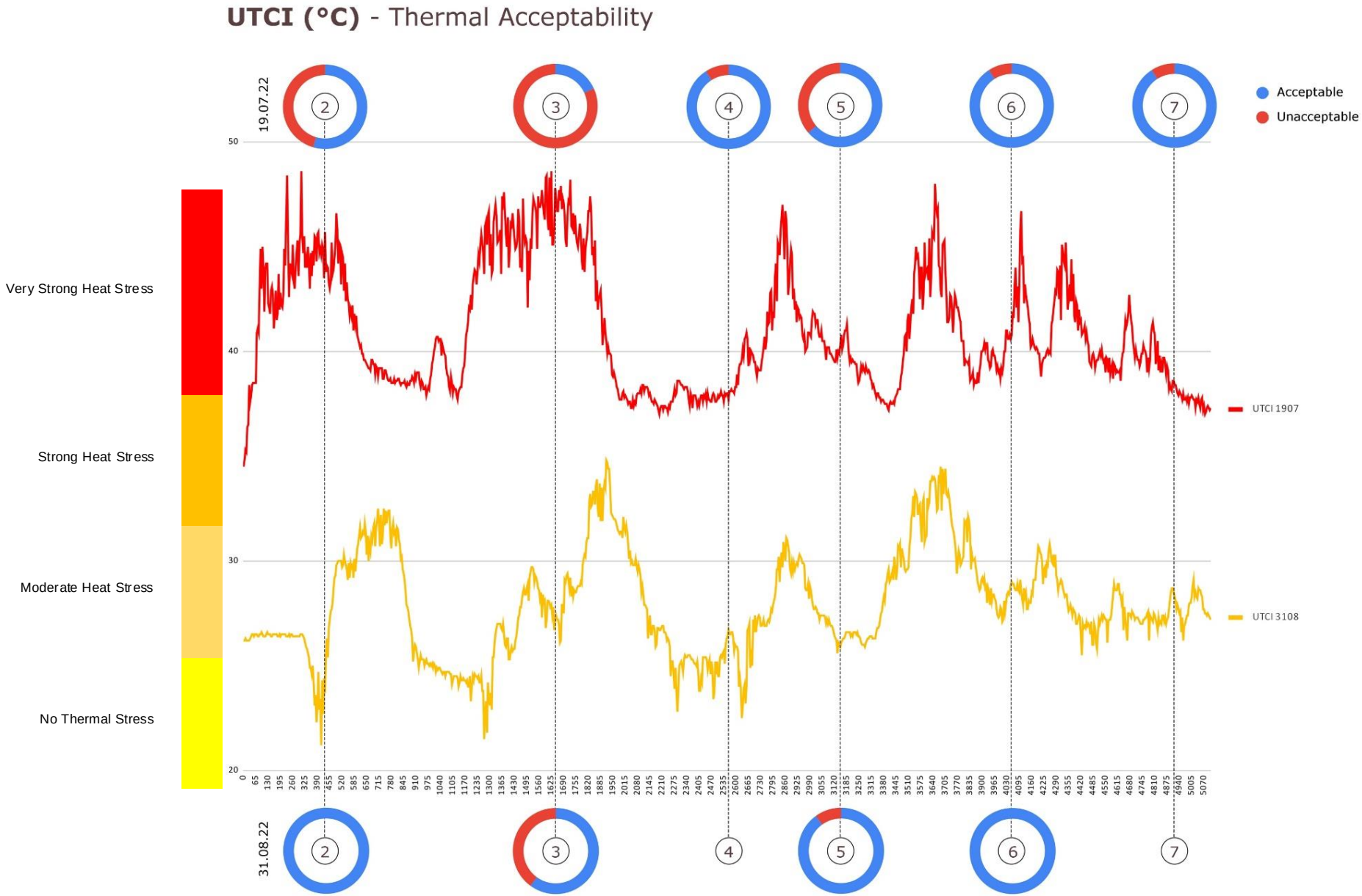
Source: Climateflux

31.08.2023

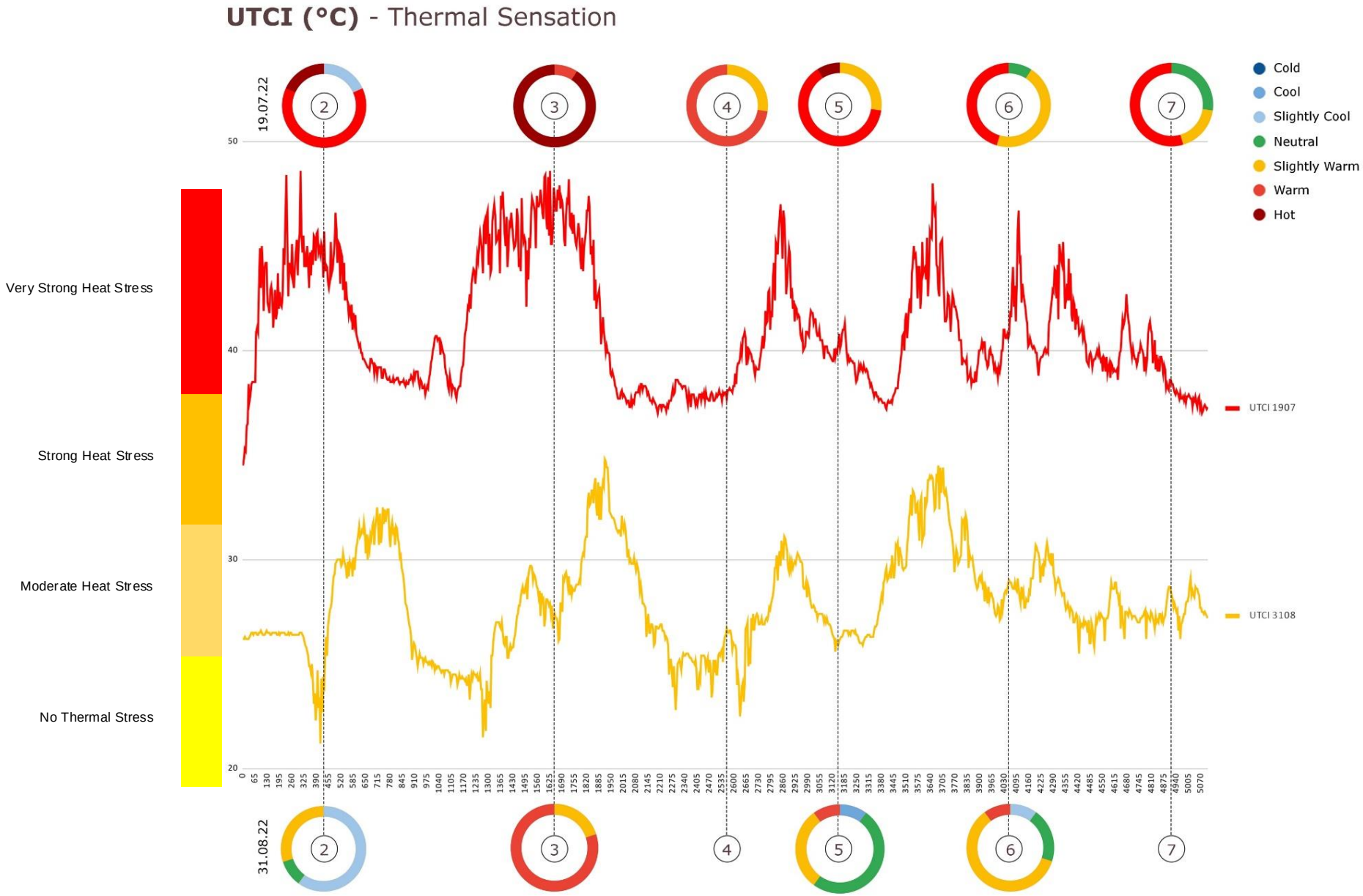

-40 -27 -13 0 9 26 32 38 46
UTCI Equivalent Temperature (°C)
2
3
4
5
6
Ostfriedhof
Kennedypark
Suermondt-Park
Frankenberger Park
Bürgerpark Moltkebahnhof
Kurpark
Oppenhoffallee
Oppenhoffallee
Sedanstraße
Altstraße
B 258
B 57
L 233
264
Wind Speed
Air Temperature
Relative Humidity
MRT*
MRT
UTCI
UTCI ET
Noise Pressure
Radiation
PM10
PM2.5
Leaflet | Map tiles by Stamen Design, under CC BY 3.0. Data by © OpenStreetMap, under CC BY SA.



Source: Chair for Building Technology RWTH



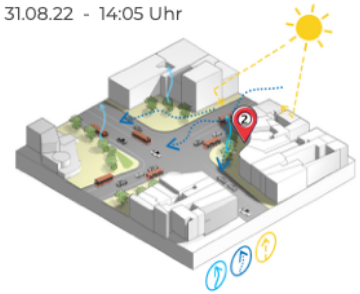
Source: Chair for Building Technology RWTH

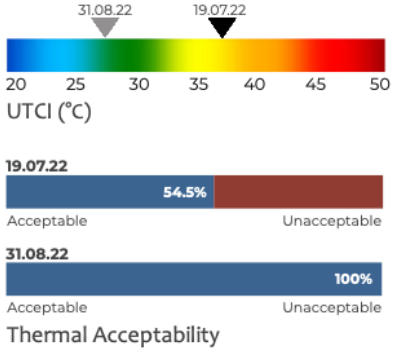


Source: Chair for Building Technology RWTH

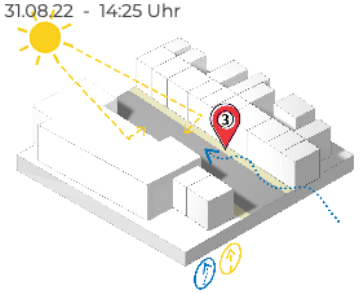
Comparative Results: 19.07.2022 and 31.08.2022

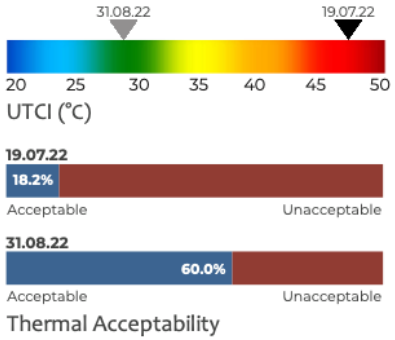
Point 2:
19.07.22 - 14:55 Uhr
31.08.22 - 14:05 Uhr



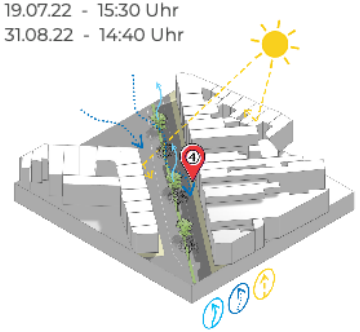


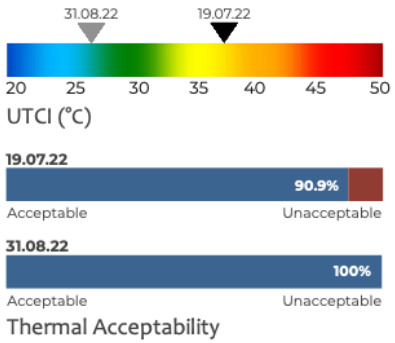
Point 3:
19.07.22 - 15:15 Uhr
31.08.22 - 14:25 Uhr



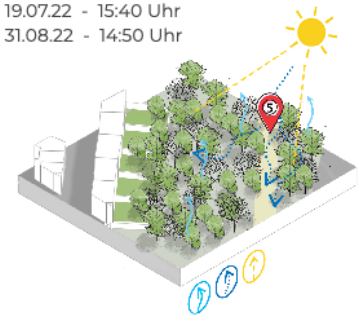


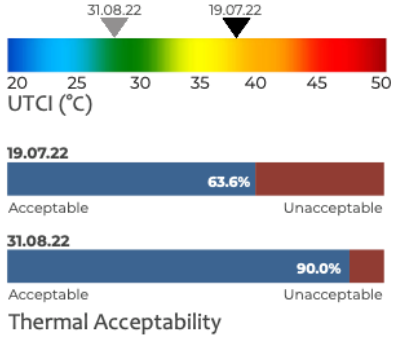
Point 4:
19.07.22 - 15:30 Uhr
31.08.22 - 14:40 Uhr



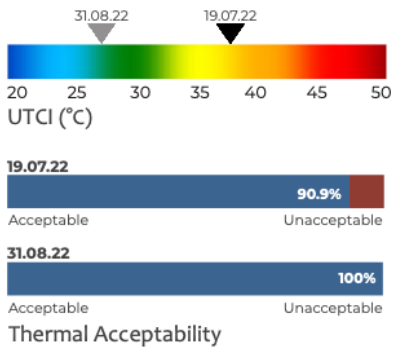


Point 5:
19.07.22 - 15:40 Uhr
31.08.22 - 14:50 Uhr

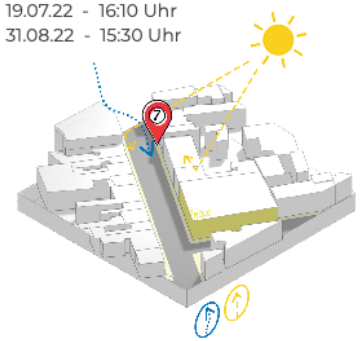


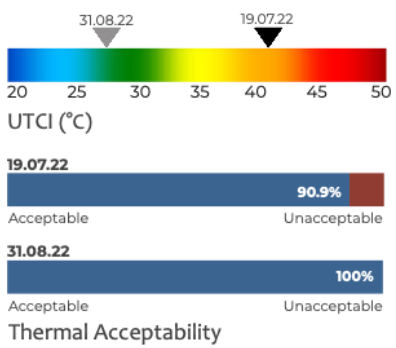


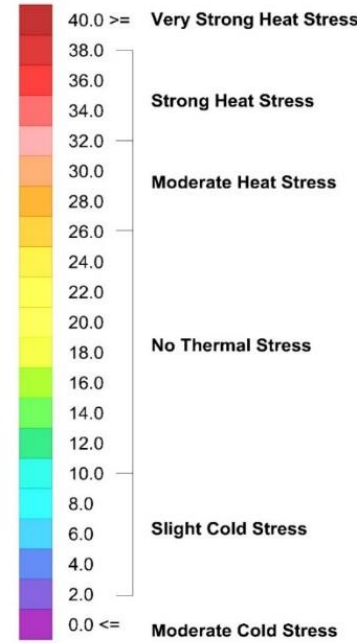
Point 6:
19.07.22 - 15:55 Uhr
31.08.22 - 15:05 Uhr



Point 7:
19.07.22 - 16:10 Uhr
31.08.22 - 15:30 Uhr



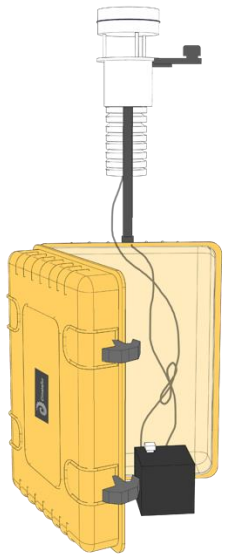


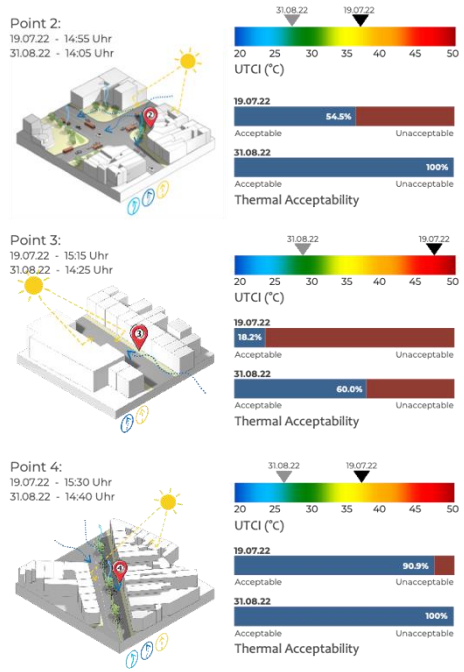


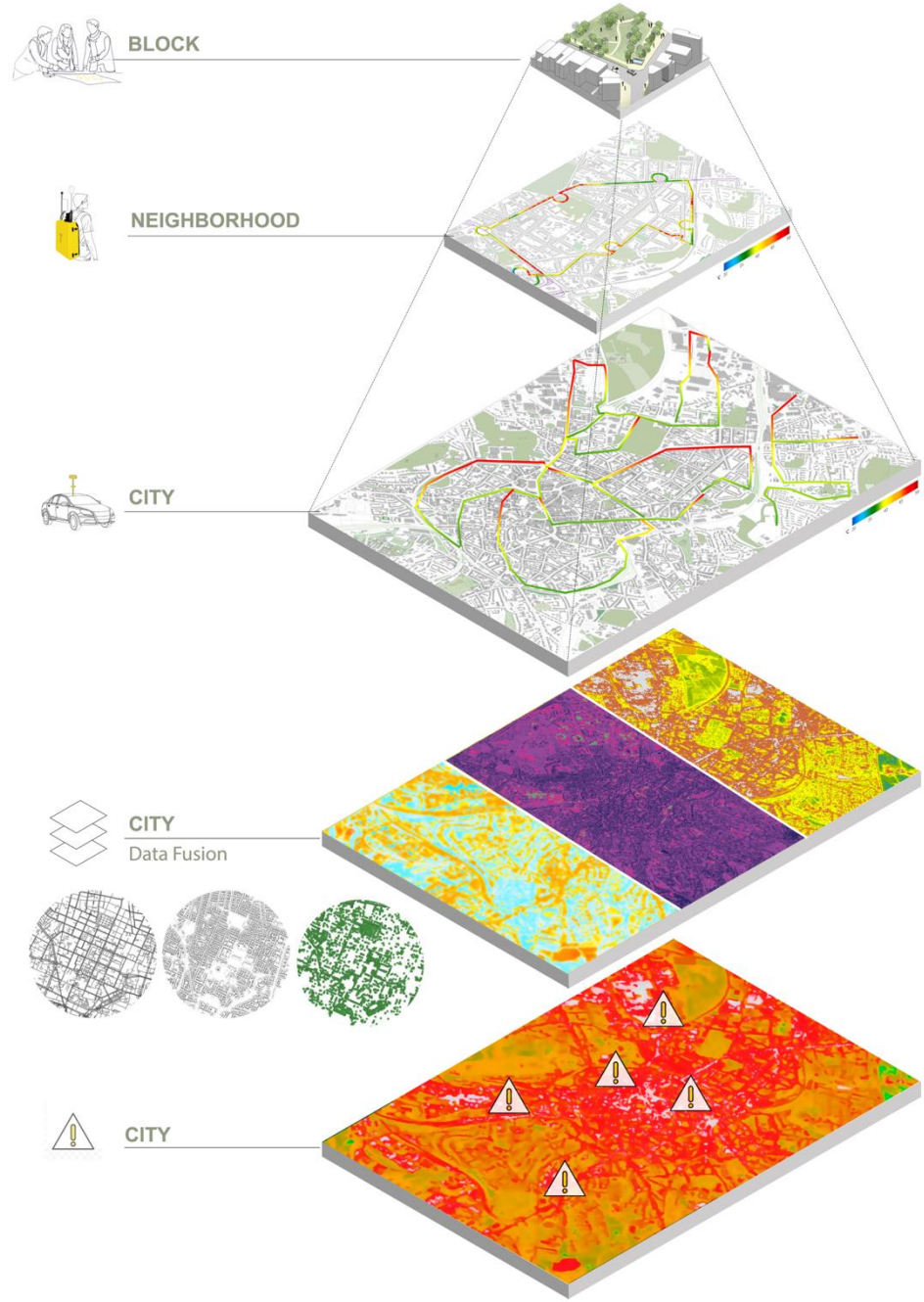
Source: Chair for Building Technology RWTH

Source: Marlene Maier/Chair for Building Technology RWTH

Source: Chair for Building Technology RWTH

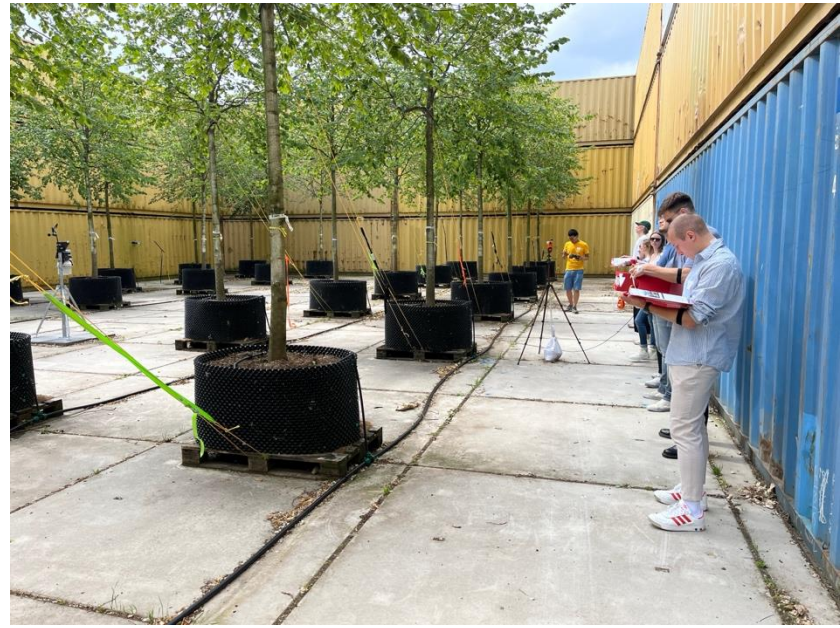



Point 2:
19.07.22 - 14:55 Uhr
31.08.22 - 14:05 Uhr
31.08.22
19.07.22
20 25 30 35 40 45 50
UTCI (°C)
19.07.22
54.5%
Acceptable
Unacceptable
31.08.22
100%
Acceptable
Unacceptable
Thermal Acceptability
Point 3:
19.07.22 - 15:15 Uhr
31.08.22 - 14:25 Uhr
31.08.22
19.07.22
20 25 30 35 40 45 50
UTCI (°C)
19.07.22
18.2%
Acceptable
Unacceptable
31.08.22
60.0%
Acceptable
Unacceptable
Thermal Acceptability
Point 4:
19.07.22 - 15:30 Uhr
31.08.22 - 14:40 Uhr
31.08.22
19.07.22
20 25 30 35 40 45 50
UTCI (°C)
19.07.22
90.9%
Acceptable
Unacceptable
31.08.22
100%
Acceptable
Unacceptable
Thermal Acceptability


BLOCK
NEIGHBORHOOD
CITY
CITY
Data Fusion
CITY

Summer sensory walk



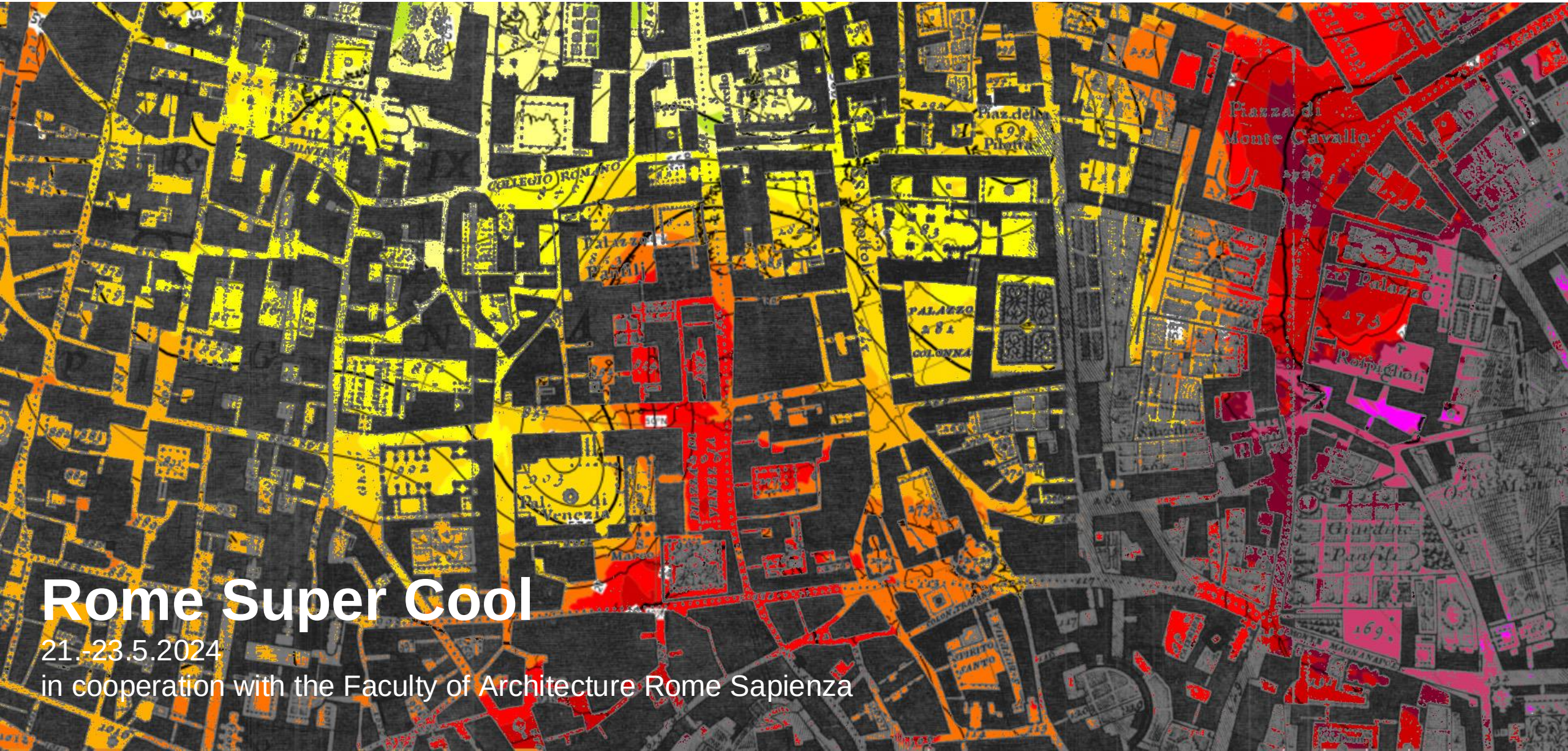



SAPIENZA
UNIVERSITÀ DI ROMA

Dipartimento di
Pianificazione, design, tecnologia
dell'architettura

RWTH AACHEN UNIVERSITY

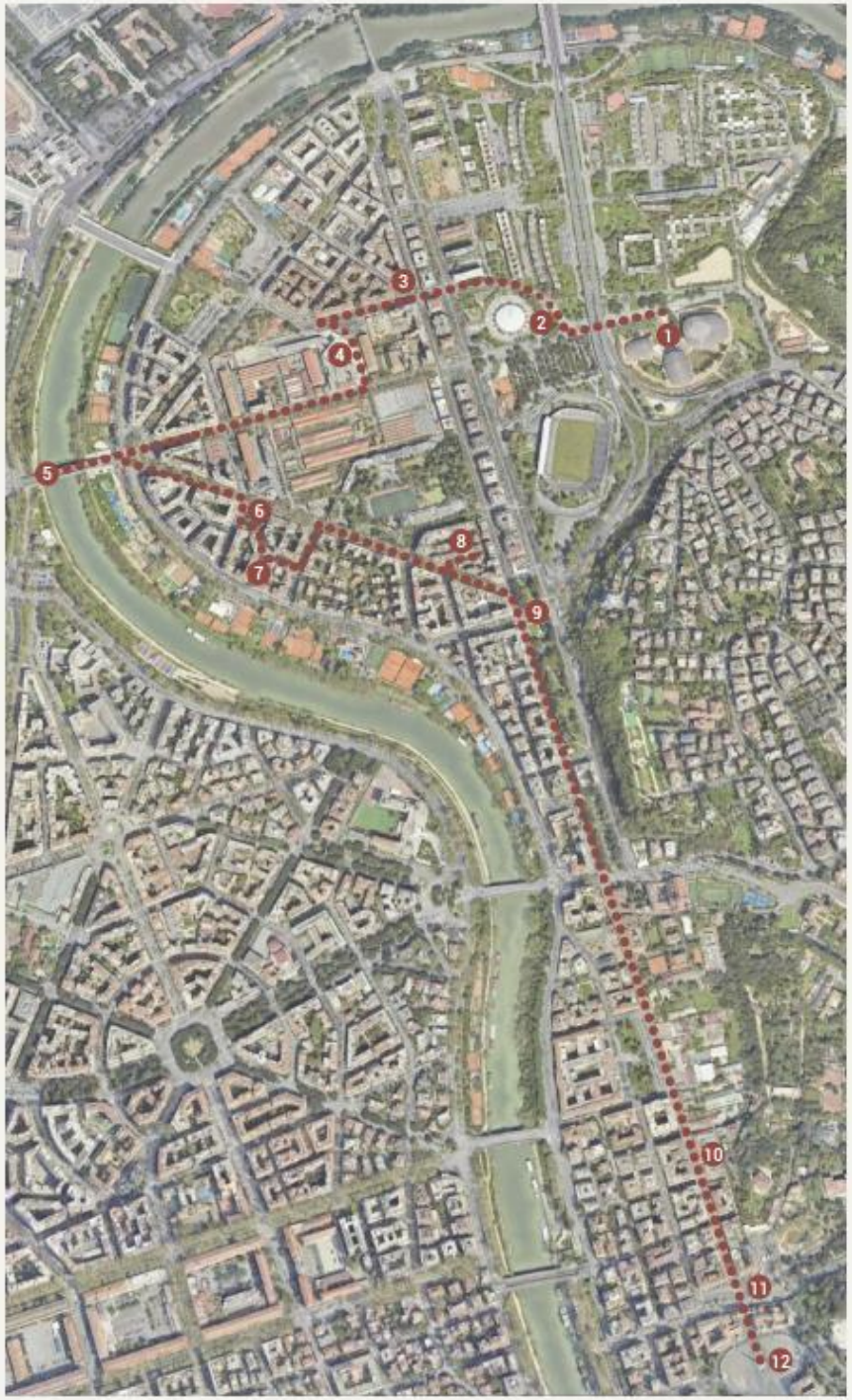
Lehrstuhl für
Gebäudetechnologie



Rome Super Cool

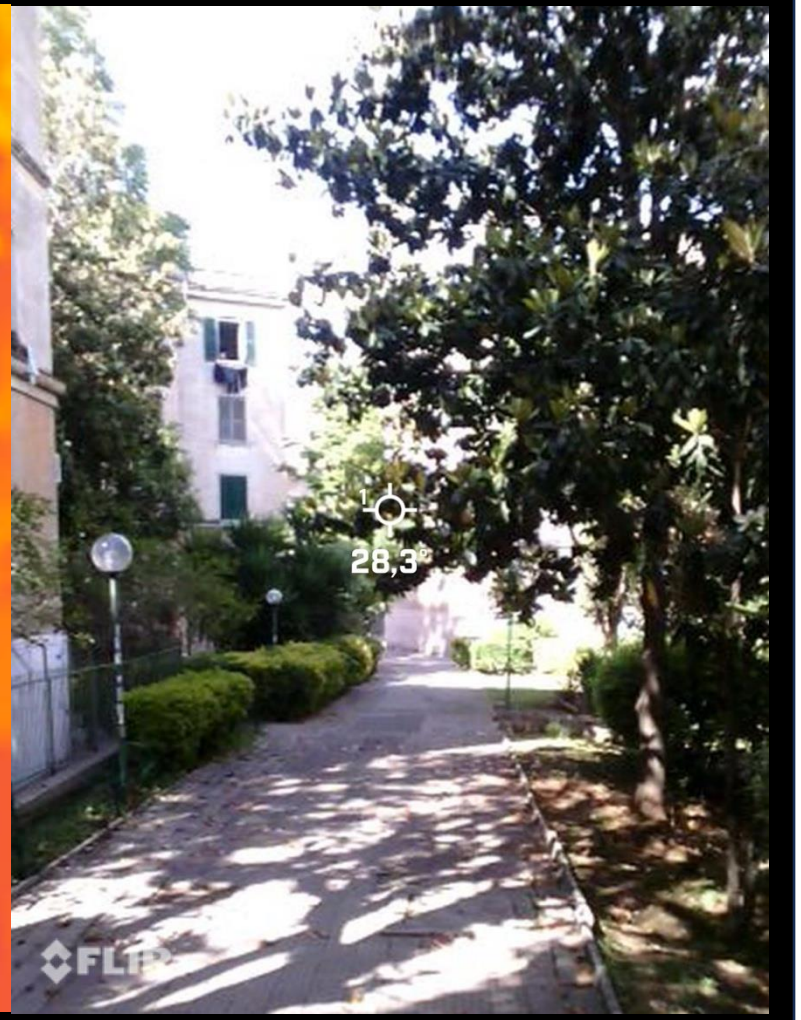
21.-23.5.2024

in cooperation with the Faculty of Architecture Rome Sapienza



1. Auditorium Parco della Musica
2. Palazzetto dello Sport
3. Piazza dei Carracci
4. MAXXI
5. Ponte della Musica
6. Piazza Piazza Melozzo da Forlì
7. Piazza Perin del Vaga
8. Piccola Londra
9. Piazzale Manila
10. Faculty of Architecture - Sapienza
11. Piazzale Flaminio
12. Piazza del Popolo

1. Via Giulio Ruocco
2. Piazza Benedetto Brin
3. Piazza Pantero Pantera
4. Piazza Bartolomeo Romano
5. Csoa La Strada
6. Piazza Damiano Sauli
7. Piazza Giovanni da Triora
8. Fontana della Carlotta
9. Piazza Geremia Bonomelli
10. Piazza Michele da Carbonara
11. Via Luigi Lasagna
12. Via Rocco da Cesinale
13. Piazza Nicola Longobardi
14. Ex casa di Alberto Sordi
15. Murale Sten e Lex
16. Via Caffaro
17. Piazza Augusto Albini
18. Piazza Pantero Pantera

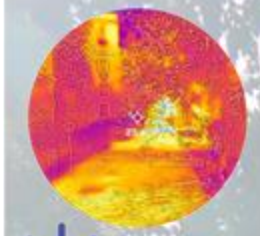


ROME SUPER COOL

GARBATELLA

SPOT N° 6

Via Roberto de Nobili / Via Rocco da Cesinale



Wind:
High (large streets expose wind channels)

Exposure:
West

Shade:
High (shading provided by trees and buildings)

Material Albedo Vertical Surfaces:
House walls 20%

Green elements – Trees:
Yes (high trees >12 m)

Noise
Low (footpath)

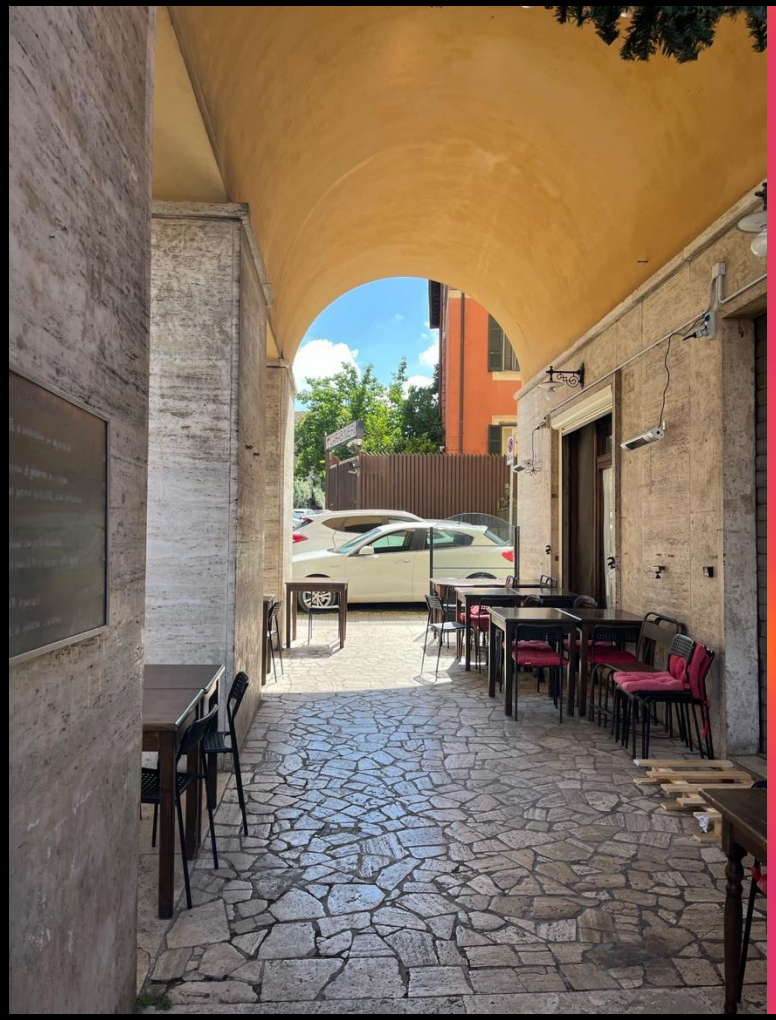
Green elements – Bushes:
Yes (framing the footpath)

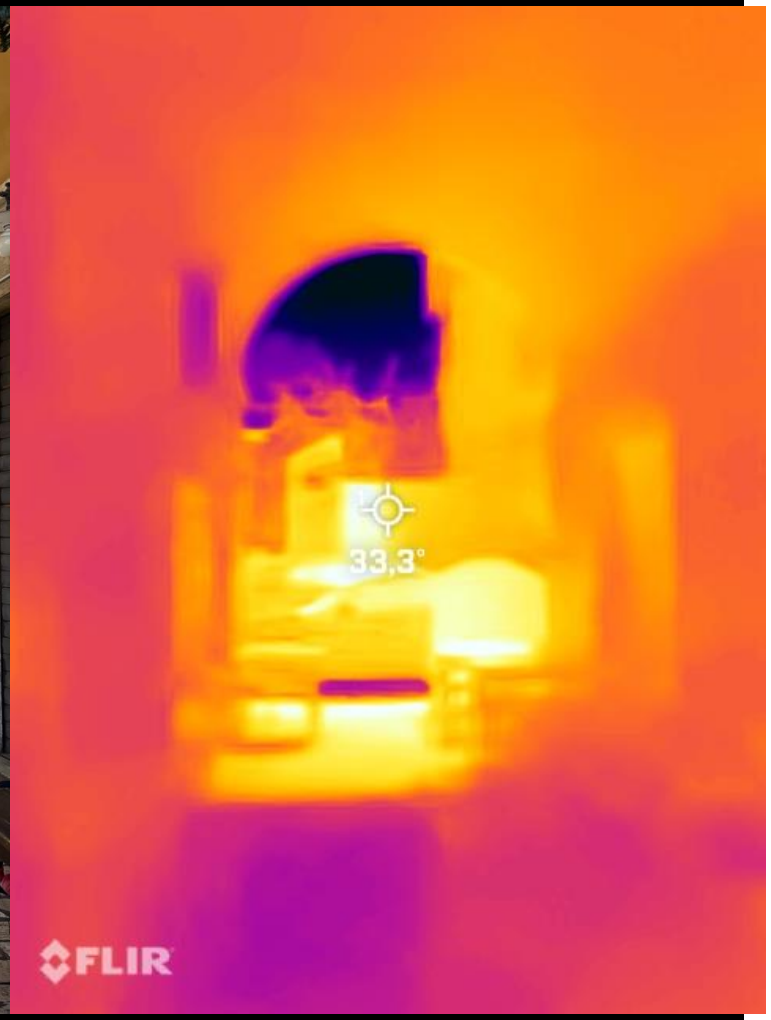
Quality of stay:
High (no traffic)

Material Albedo Horizontal Surfaces:
Grass 25%
Stone path 20%

Green elements – Grass:
Yes (medium/sized areas near the buildings)

Permeability:
Medium (stone path mixed with grass)



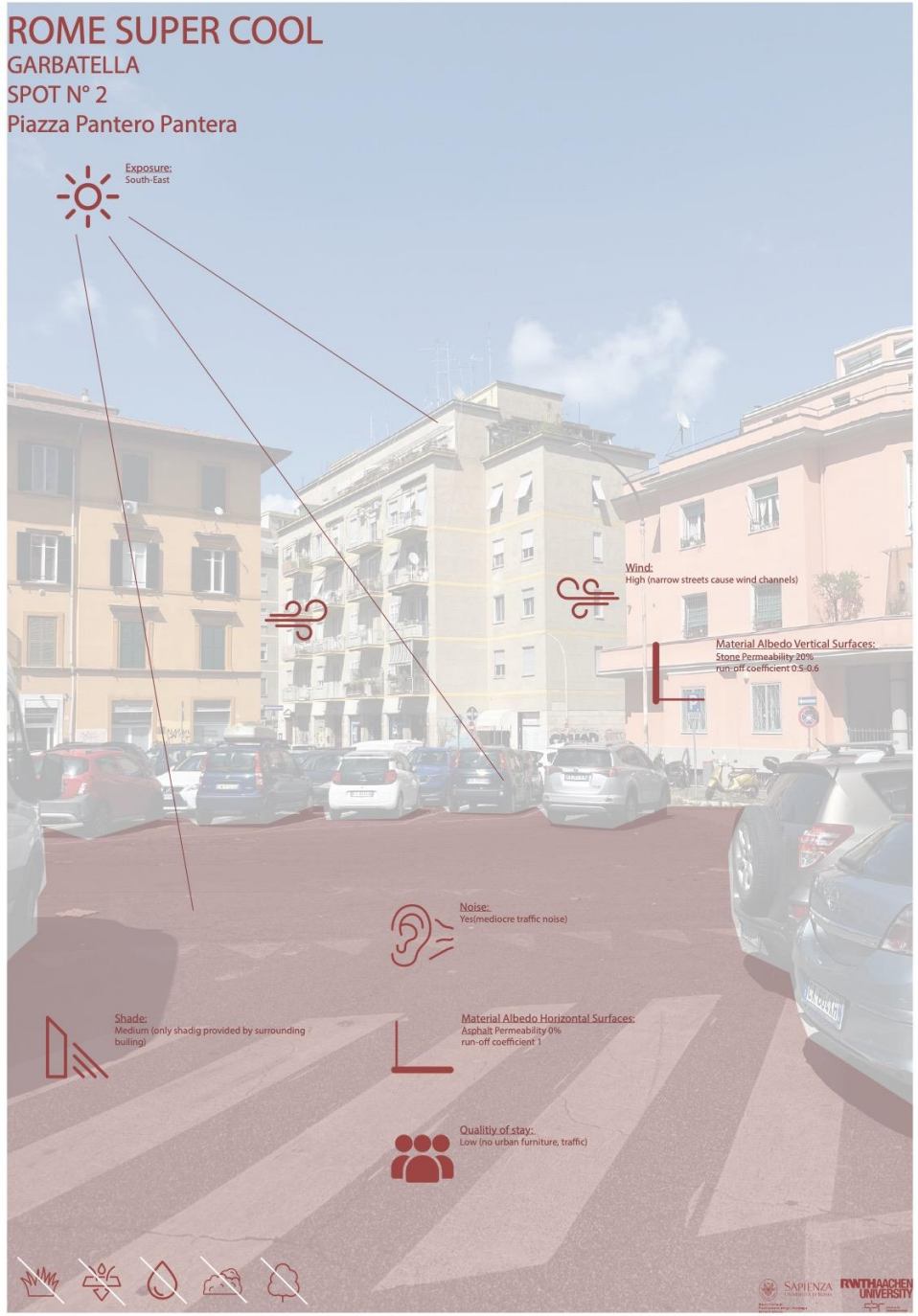


ROME SUPER COOL

GARBATELLA

SPOT N° 2

Piazza Pantero Pantera




FLIR
20.2°C
1
34.6°C
37.2°C


FLIR
-14.5°C
1
12.0°C
54.3°C


ROME SUPER COOL
FLAMINIO
SPOT N° 1
Piazza del Popolo
Exposure:
High / No Shelter
Wind:
medium (wide open space)
Material Albedo Vertical Surfaces:
Stone Permeability 20%
run-off coefficient 0,2-0,4
Waterfountain -
Material Albedo Horizontal Surfaces:
Noise:

THE HUMAN LIMIT

THE INEQUALITY OF HEAT

Scroll to continue ↓

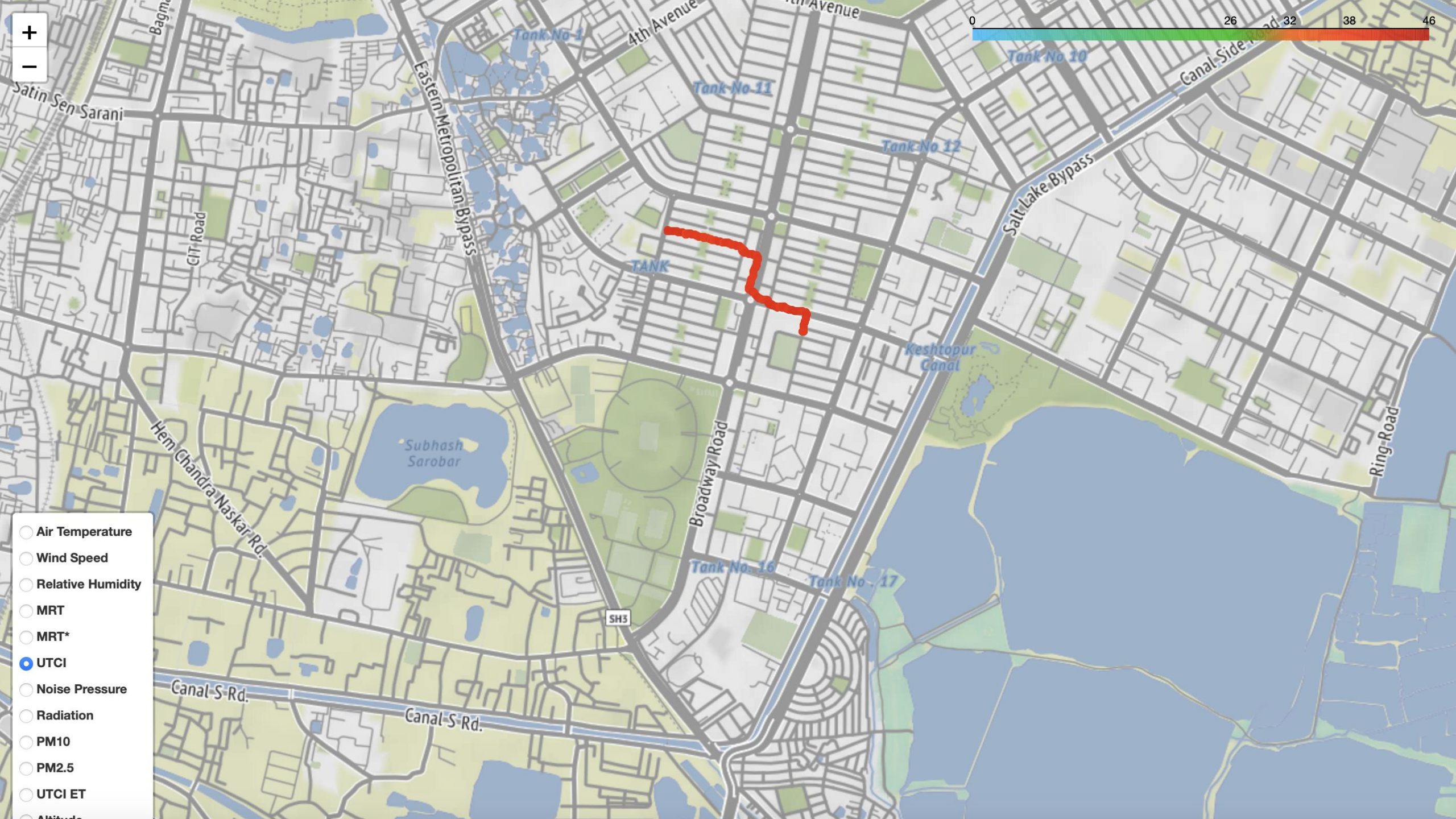
https://www.washingtonpost.com/climate-environment/interactive/2023/india-deadly-extreme-heat-poverty/

THE HUMAN LIMIT

THE INEQUALITY OF HEAT

Scroll to continue

https://www.washingtonpost.com/climate-environment/interactive/2023/india-deadly-extreme-heat-poverty/


0
26
32
38
46
Satin Sen Sarani
Eastern Metropolitan Bypass
Tank No 1
4th Avenue
Tank No 11
Tank No 10
Canal Side Road
Tank No 12
Salt Lake Bypass
CIT Road
TANK
Keshtopur Canal
Ring Road
Subhash Sarobar
Hem Chandra Naskar Rd.
Broadway Road
Tank No. 16
Tank No . 17
SH3
Canal S Rd.
Canal S Rd.
Air Temperature
Wind Speed
Relative Humidity
MRT
MRT*
UTCI
Noise Pressure
Radiation
PM10
PM2.5
UTCI ET

Hitze in der Stadt

Eine sozial-räumlich differenzierte Analyse zur Bewertung der thermischen Belastung von Stadtnutzer*innen in Berlin

Funding: BBSR Zukunft Bau
in cooperation with:
BTU Cottbus,
Berliner Institut für Sozialforschung

Duration: 12 Months
Start: May 2024

ZUKUNFT BAU
FORSCHUNGSFÖRDERUNG

Bundesministerium
für Wohnen, Stadtentwicklung
und Bauwesen

Bundesinstitut
für Bau-, Stadt- und
Raumforschung
im Bundesamt für Bauwesen
und Raumordnung

Quelle: Jil Schroth, 2024

Projektbeteiligte

Forschungsleitung:
Brandenburgische Technische Universität Cottbus-Senftenberg
Platz der Deutschen Einheit 1, 03046 Cottbus
Fachgebiet Entwerfen und Energieeffizientes Bauen
Koordination: Prof. Dr.-Ing. Susan Draeger
Projektleitung: Jil Schroth, M.Sc. jil.schroth@b-tu.de

Brandenburgische Technische Universität Cottbus - Senftenberg

Projektpartner:
Climateflux GmbH
Lindwurmstraße 11
80337 München
Dr.-Ing. Daniele Santucci daniele@climateflux.com

Climate*flux*

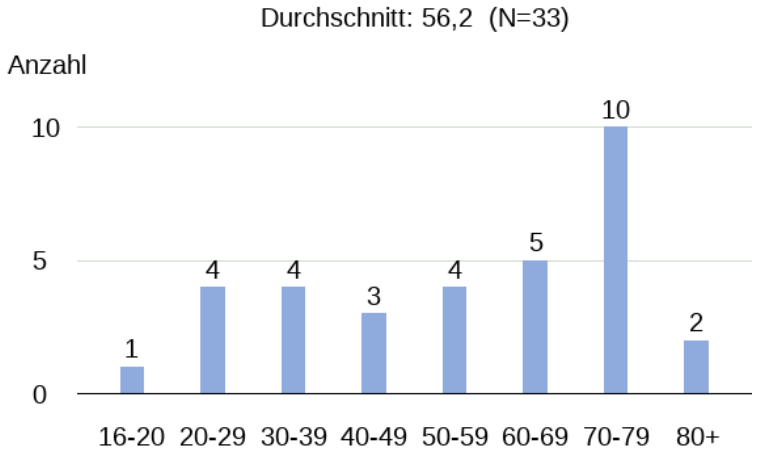
Institut für Sozialforschung Berlin GmbH
Brandenburgische Str. 16
10707 Berlin
Dr. Eva Schulze
Dipl. Soz. Janika Gabriel j.gabriel@bis-berlin.de

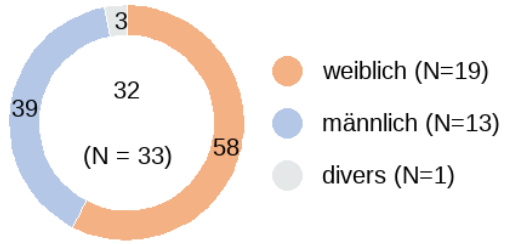
Berliner Institut für Sozialforschung GmbH

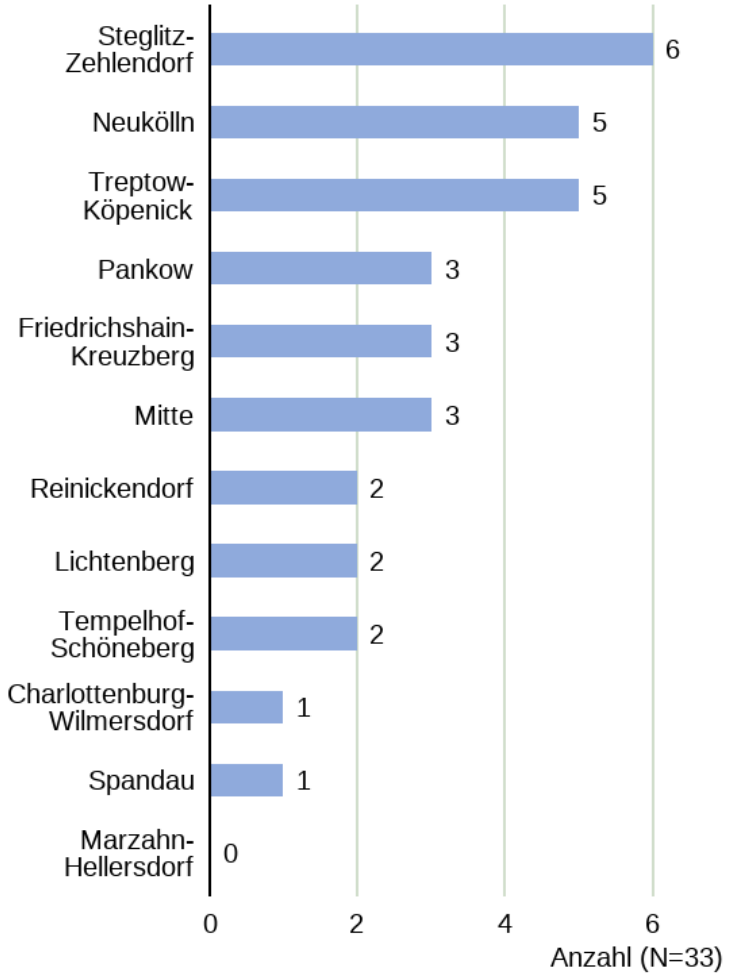
Krausnickstraße, Berlin (Quelle: Jil Schroth, 2024)

Monbijou Park, Berlin (Quelle: Jil Schroth, 2024)

Sample


Durchschnitt: 56,2 (N=33)
Anzahl
10
5
0
1
4
4
3
4
5
10
2
16-20
20-29
30-39
40-49
50-59
60-69
70-79
80+

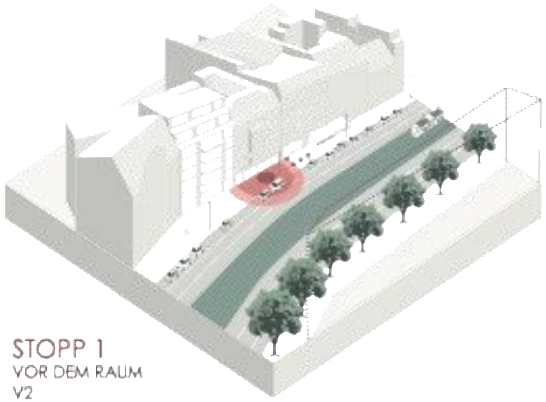

3
32
(N = 33)
39
58
weiblich (N=19)
männlich (N=13)
divers (N=1)


Steglitz-Zehlendorf
6
Neukölln
5
Treptow-Köpenick
5
Pankow
3
Friedrichshain-Kreuzberg
3
Mitte
3
Reinickendorf
2
Lichtenberg
2
Tempelhof-Schöneberg
2
Charlottenburg-Wilmersdorf
1
Spandau
1
Marzahn-Hellersdorf
0
0
2
4
6
Anzahl (N=33)

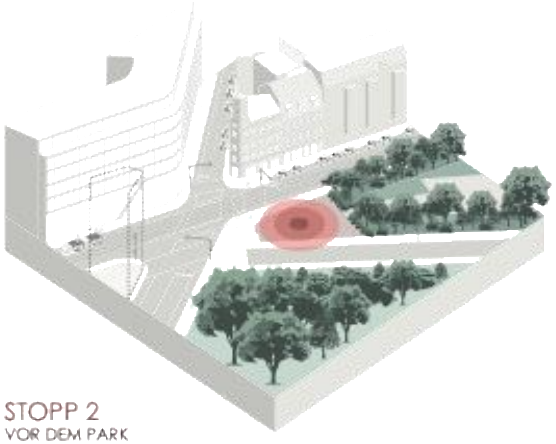
Route

LOR 01011302 Oranienburger Straße

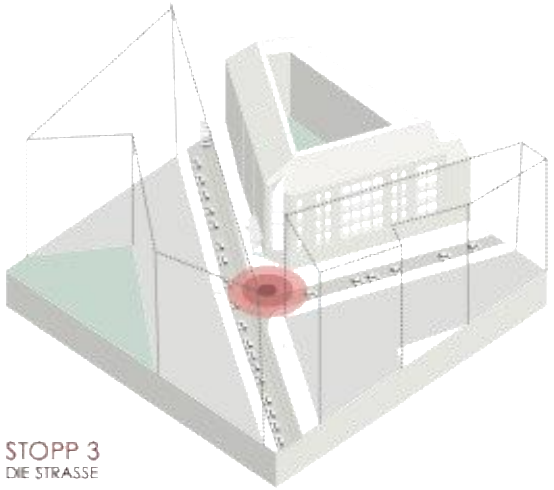
Stops



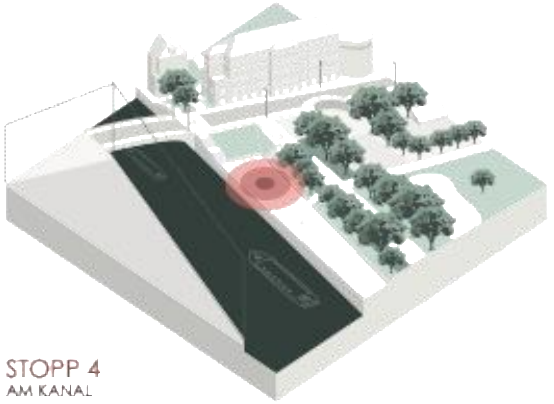
STOPP 1
VOR DEM RAUM
V2



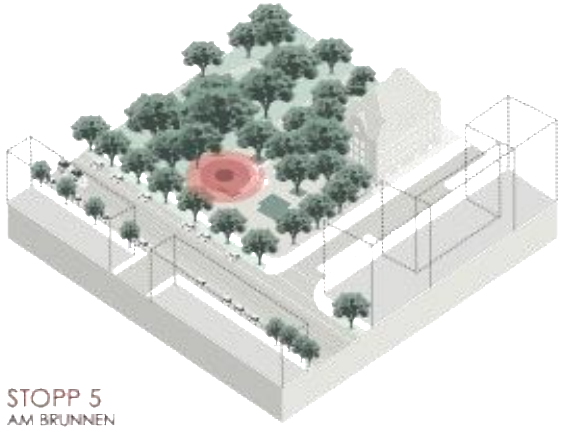
STOPP 2
VOR DEM PARK
V2



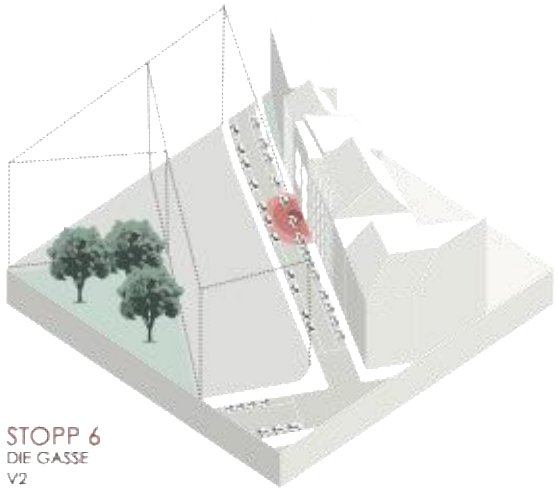
STOPP 3
DIE STRASSE



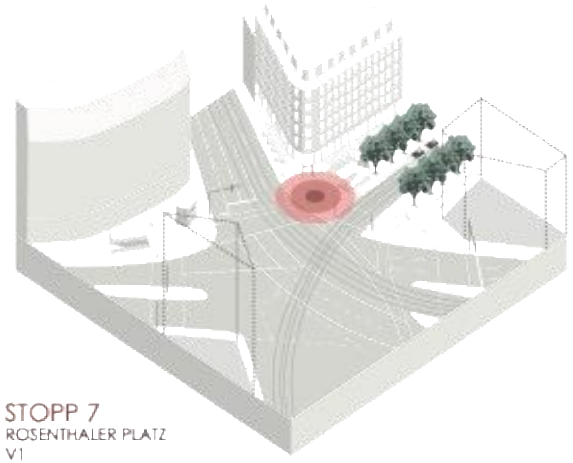
STOPP 4
AM KANAL



STOPP 5
AM BRUNNEN
V2

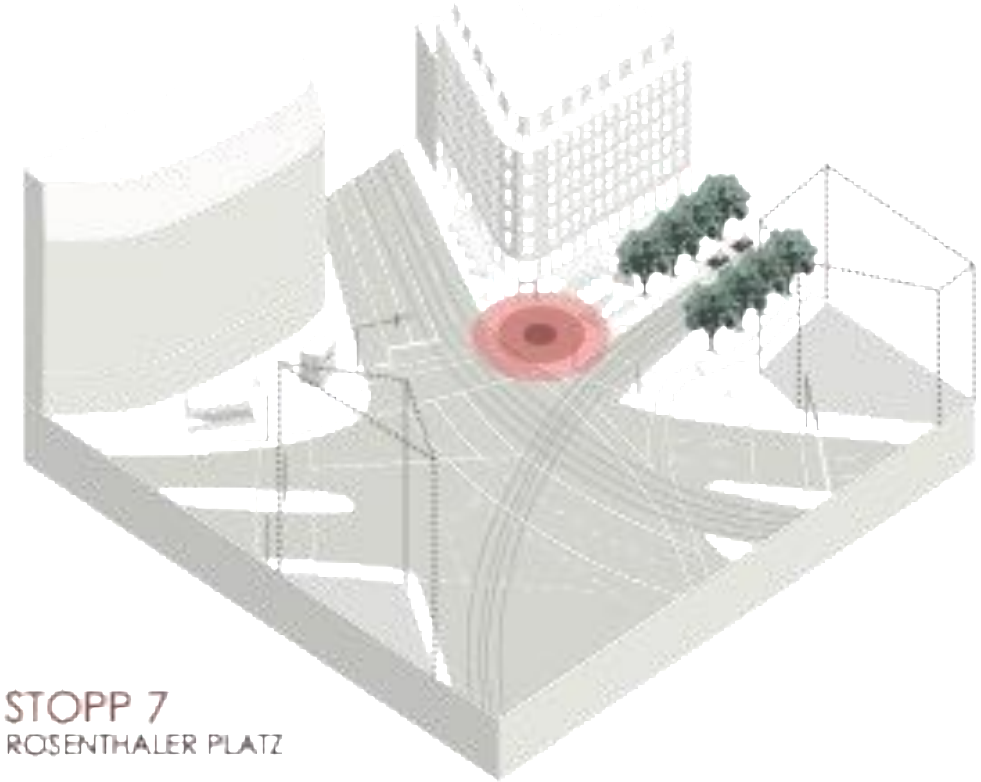


STOPP 6
DIE GASSE
V2



STOPP 7
ROSENTHALER PLATZ
V1

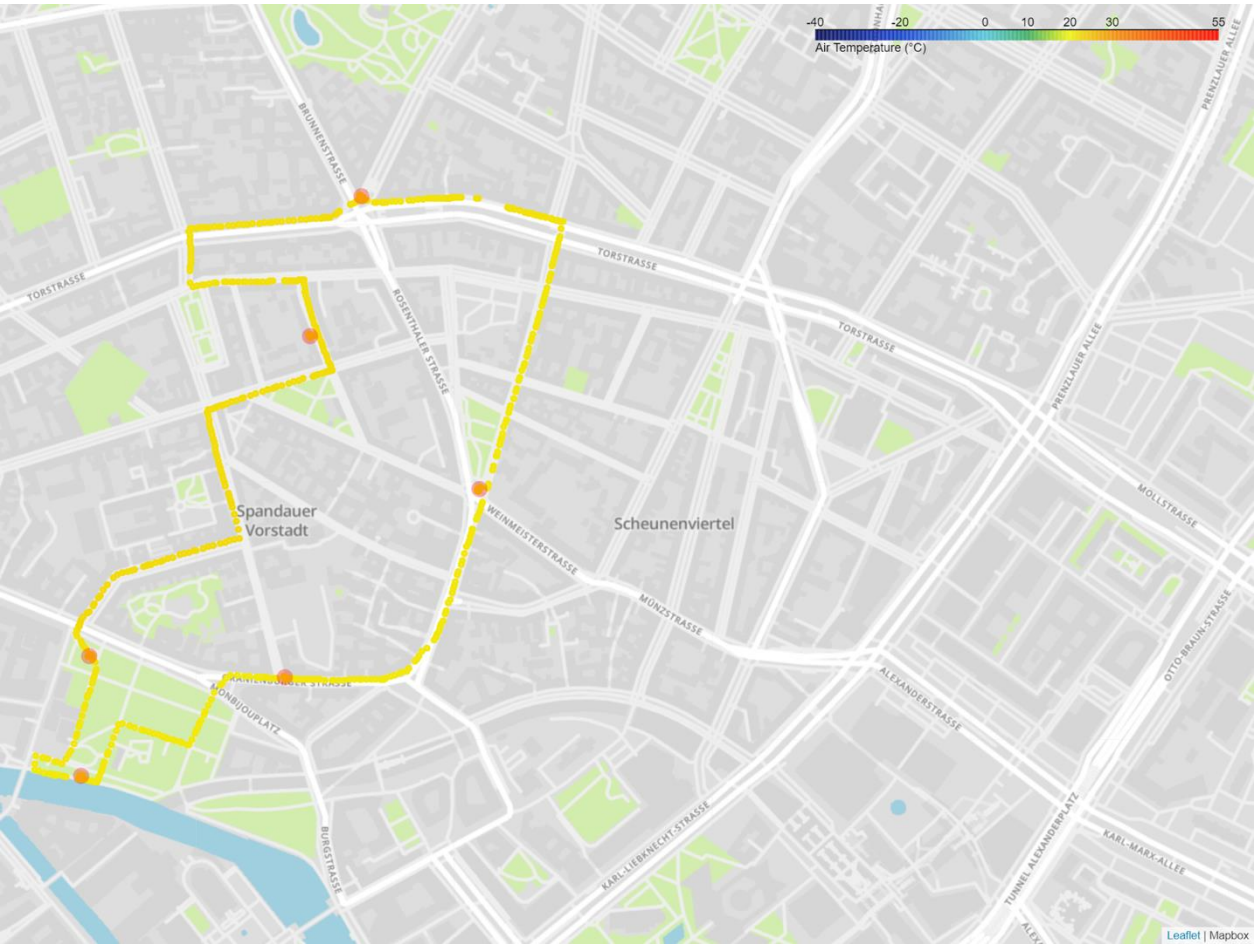
Rosenthaler Platz, Berlin (Quelle: Jil Schroth, 2024)



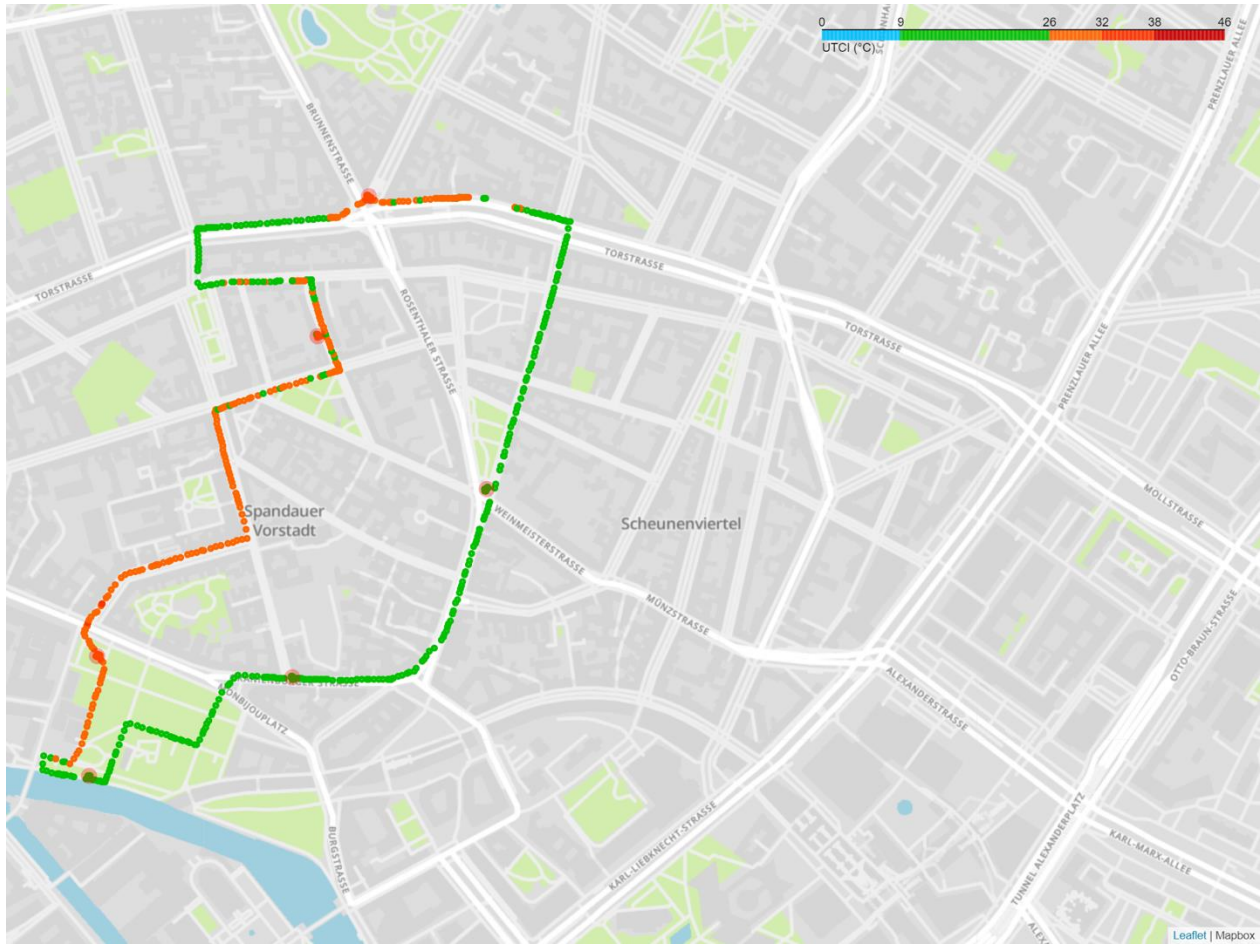
STOPP 7
ROSENTHALER PLATZ

17. Juli 2024 8:00 Uhr

T Luft



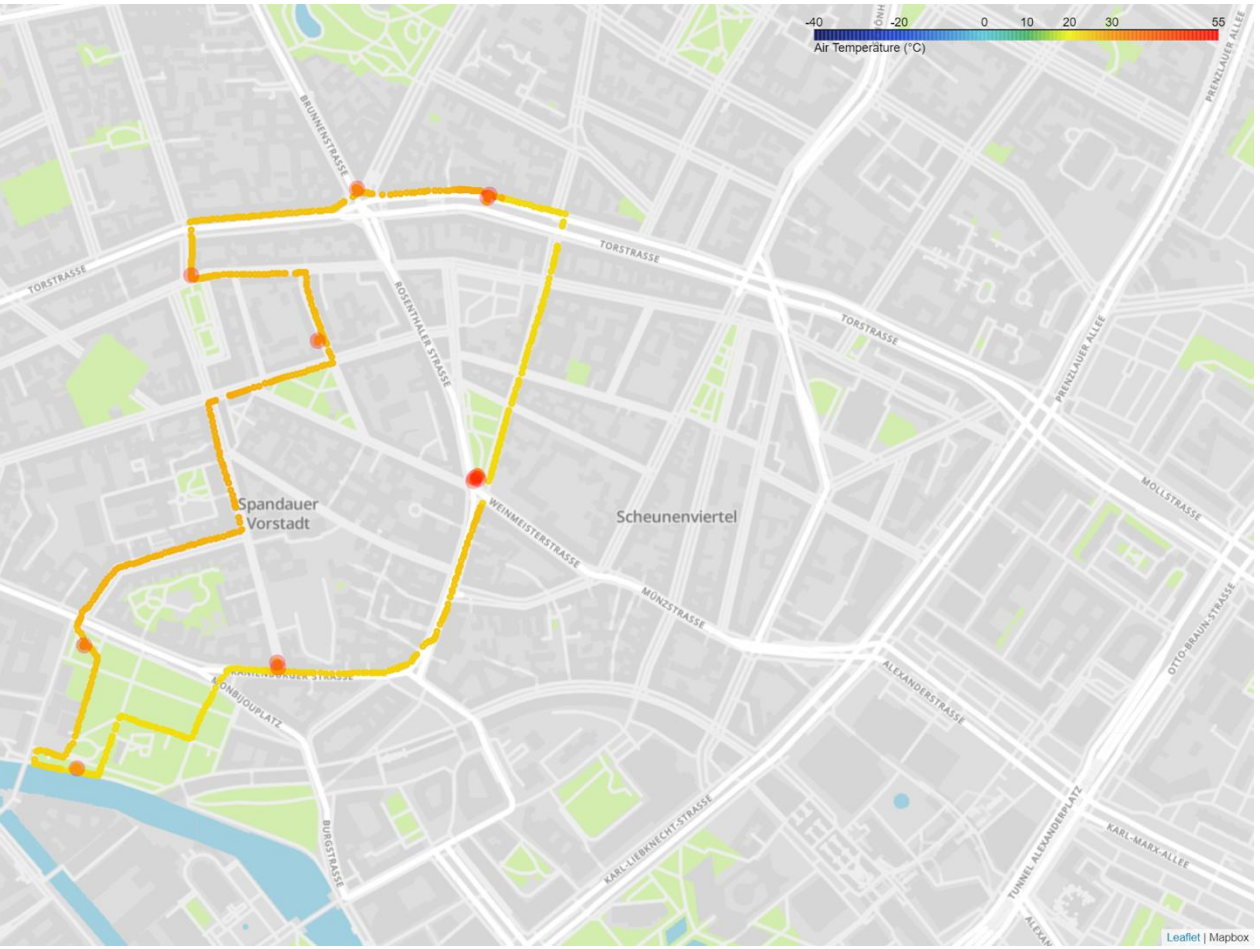
UTCI



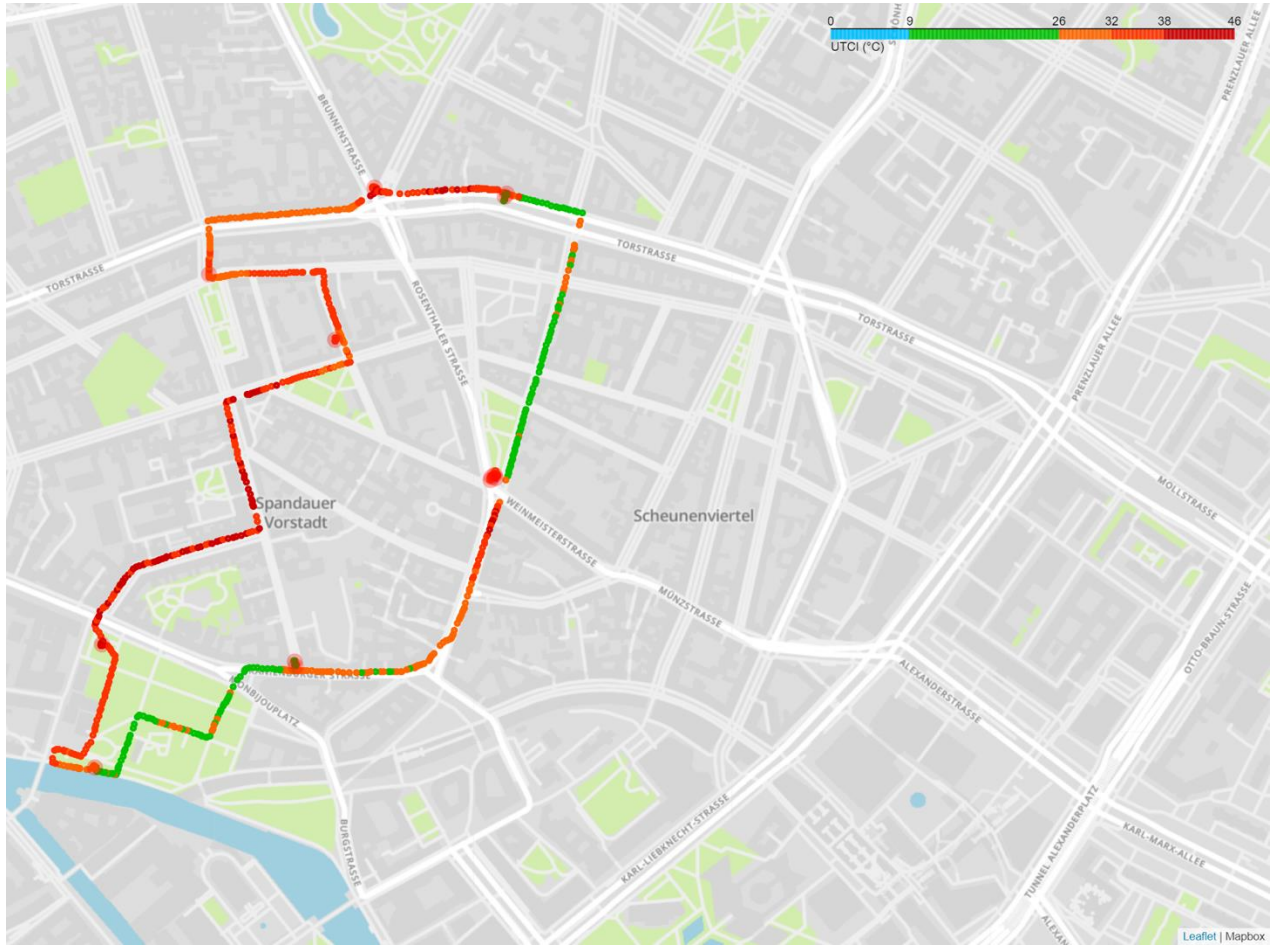
Source: Climateflux

17. Juli 2024 11:00 Uhr

T Luft



UTCI



Source: Climateflux

13. August 2024 11:00 Uhr

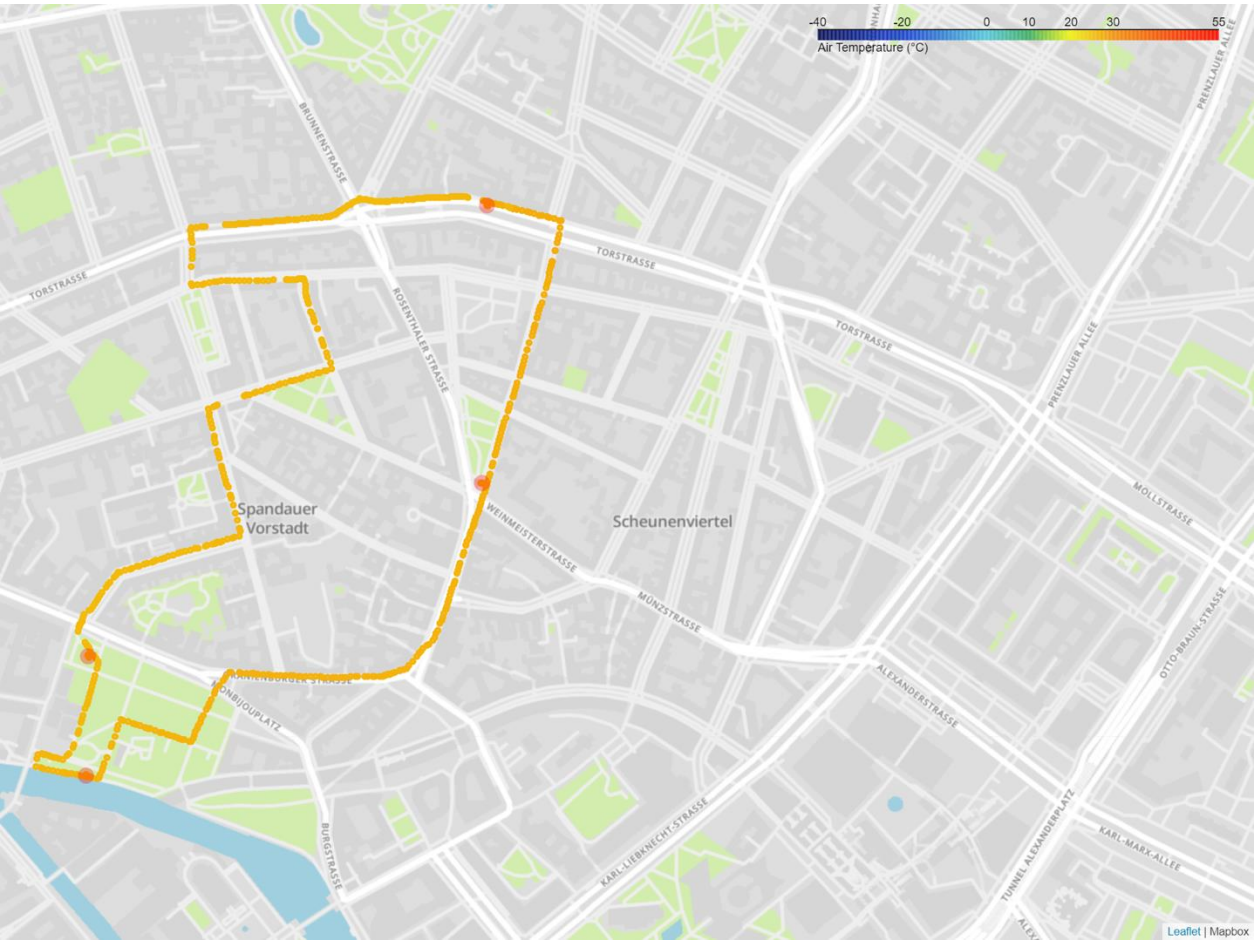
T_{Luft}

UTCI

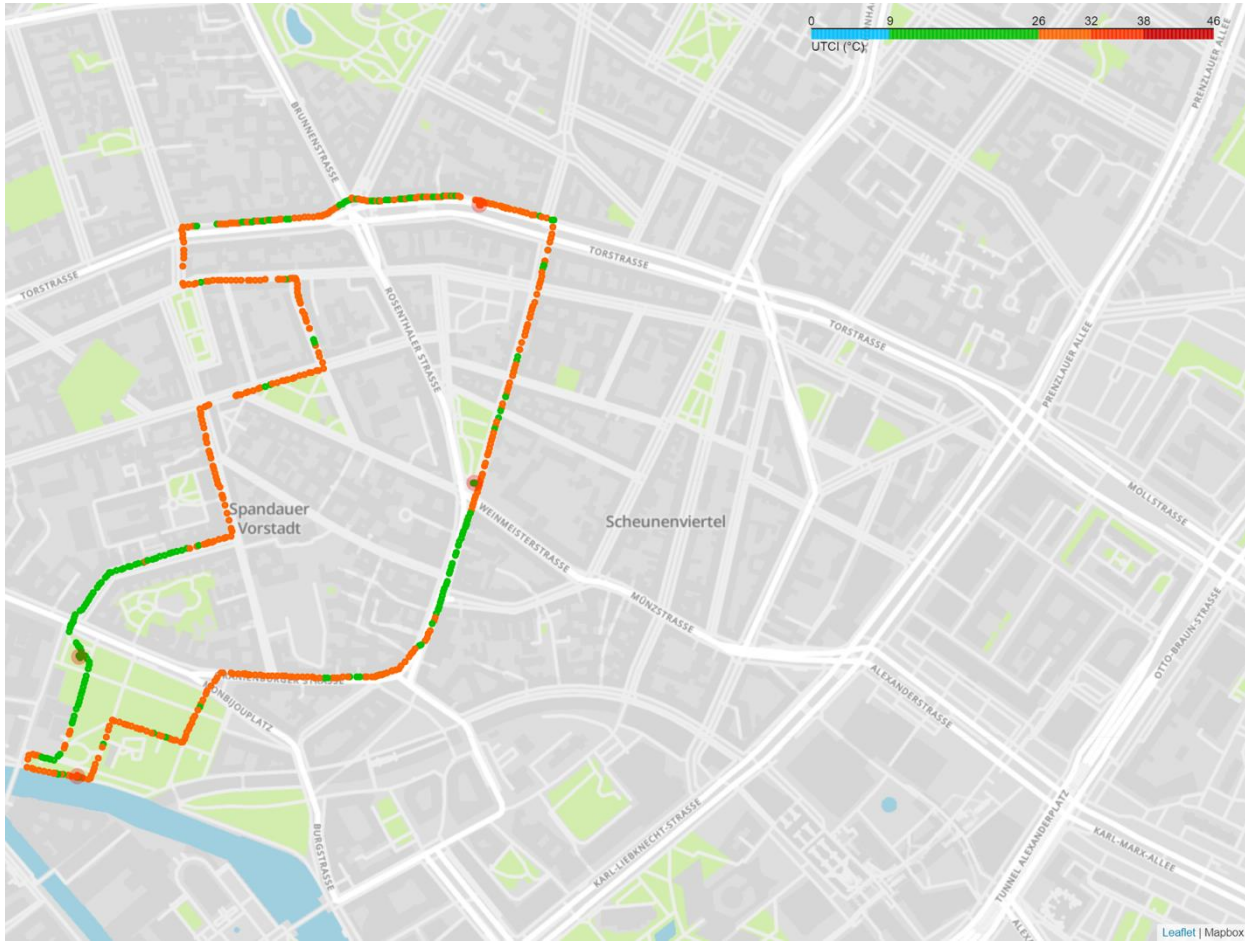
Source: Climateflux

13. August 2024 22:00 Uhr

T Luft



UTCI



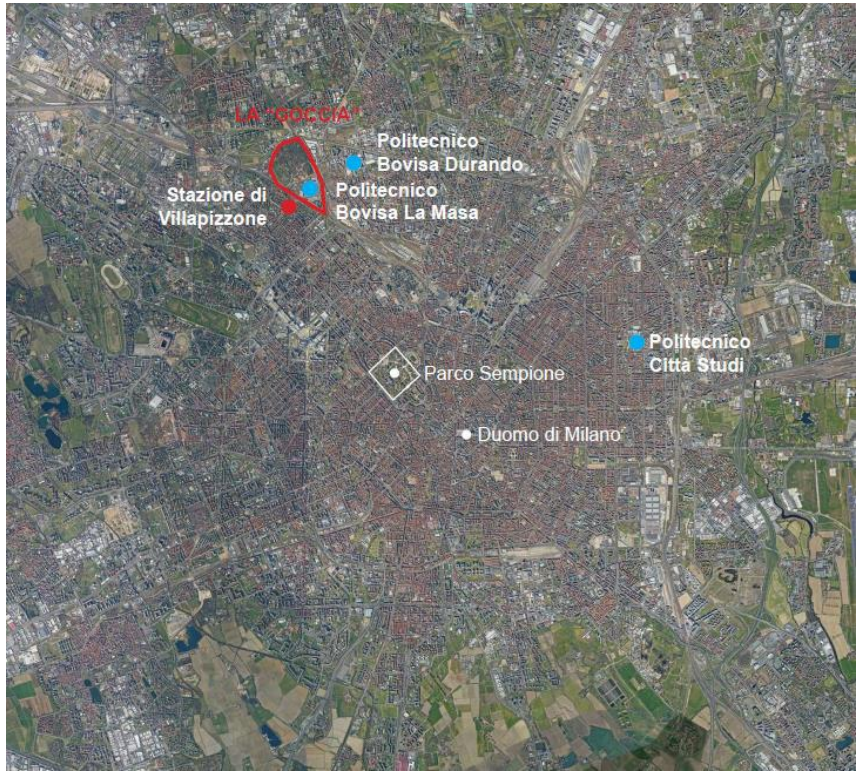
Source: Climateflux

European Urban Initiative

GOCCIA
Green Opportunities to Clean-up Contaminants through an Interspecies Alliance

Partners

Spontaneous Urban Forest



Project Abstract

GOCCIA involves a study of the plant-microorganism system of contaminant degradation processes whose results will be used to design new nature-based solutions for phytoremediation. Unlike other phytoremediation projects, it starts from an existing spontaneous ecosystem, and takes an interspecies approach to the monitoring of biodiversity and environmental ecosystem services in order to develop an innovative forest management and governance model. Expected results are:

- Accessibility to a new large green area for Milan citizens;
- Validation of a highly innovative reclamation process;
- Involvement of citizens in scientific processes;
- Consolidation of a quintuple-helix governance model, which includes the environment as a stakeholder; and
- Development of interspecies design thinking



COOLSTREET

in collaboration with TUM
Chair of Cartography and Visual Analytics

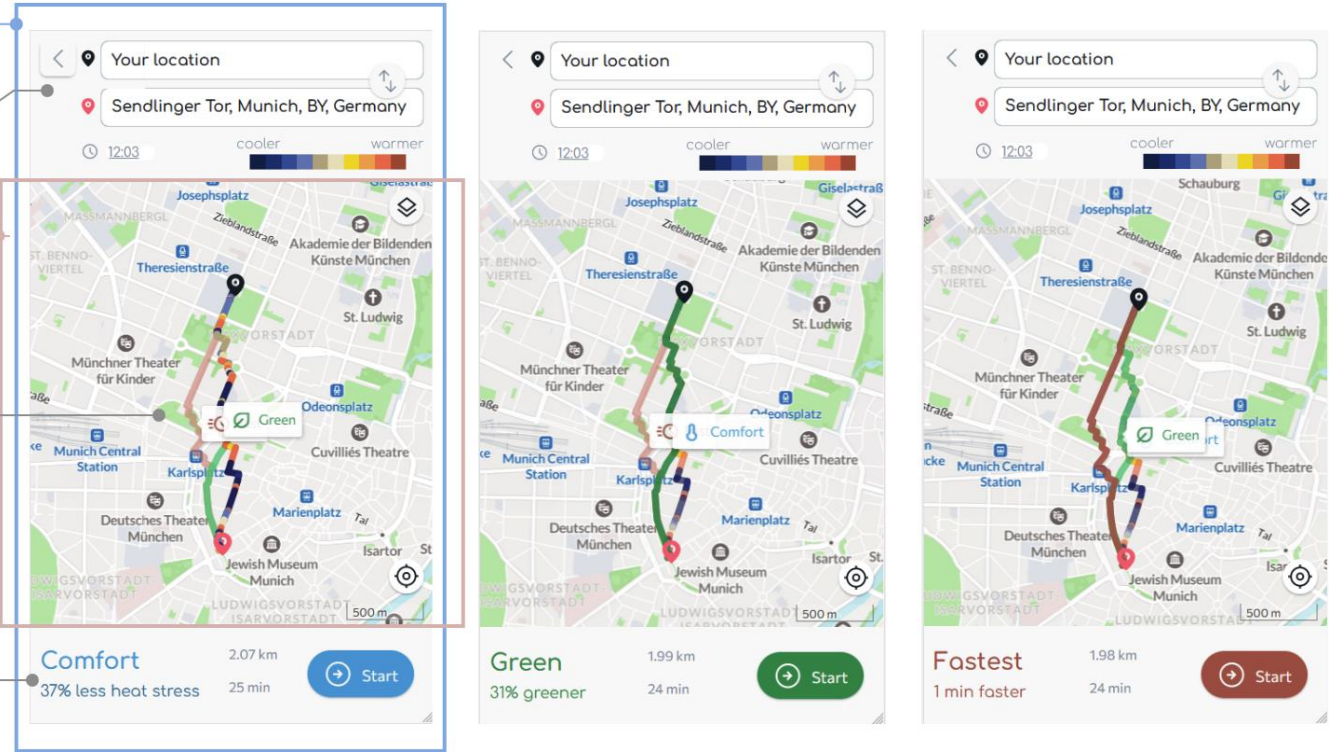
Funded by Bavarian Ministry of Economic Affairs, Regional Development and Energy

bayern innovativ
Innovation leben.

We provide

Components

App
- Map
  - AddressForm x2
  - MapContainer
    - Route
  - RouteInfo



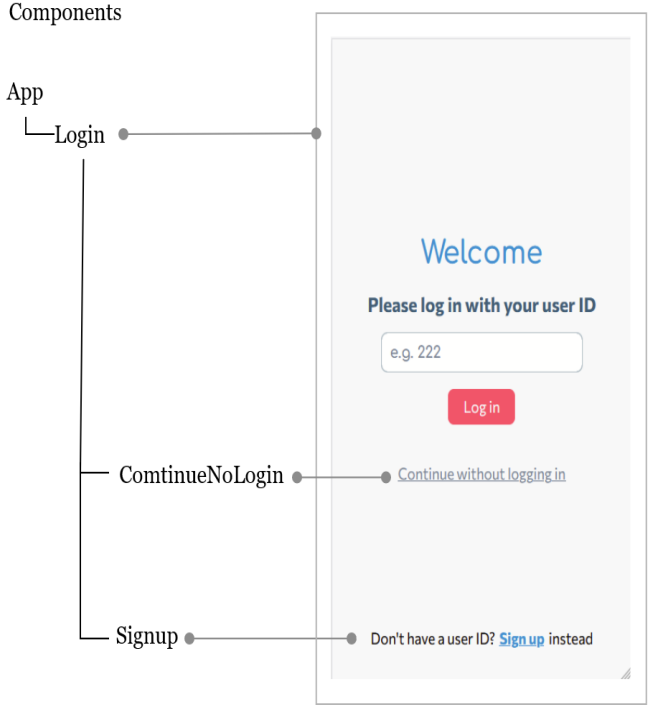
- ✓ Greenest route
- ✓ Comfortable route
- ✓ Fastest route

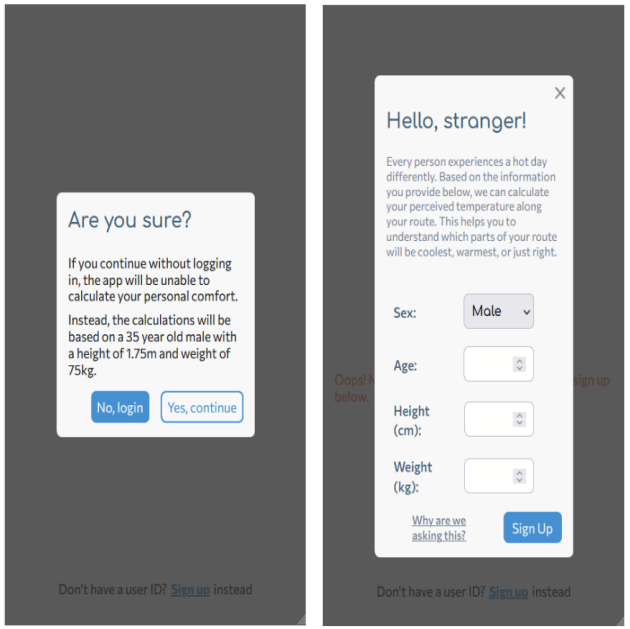
AI- driven mapping to provide real-time, personalized, and health-focused routes for pedestrians and cyclists

Interfaces

Login Page

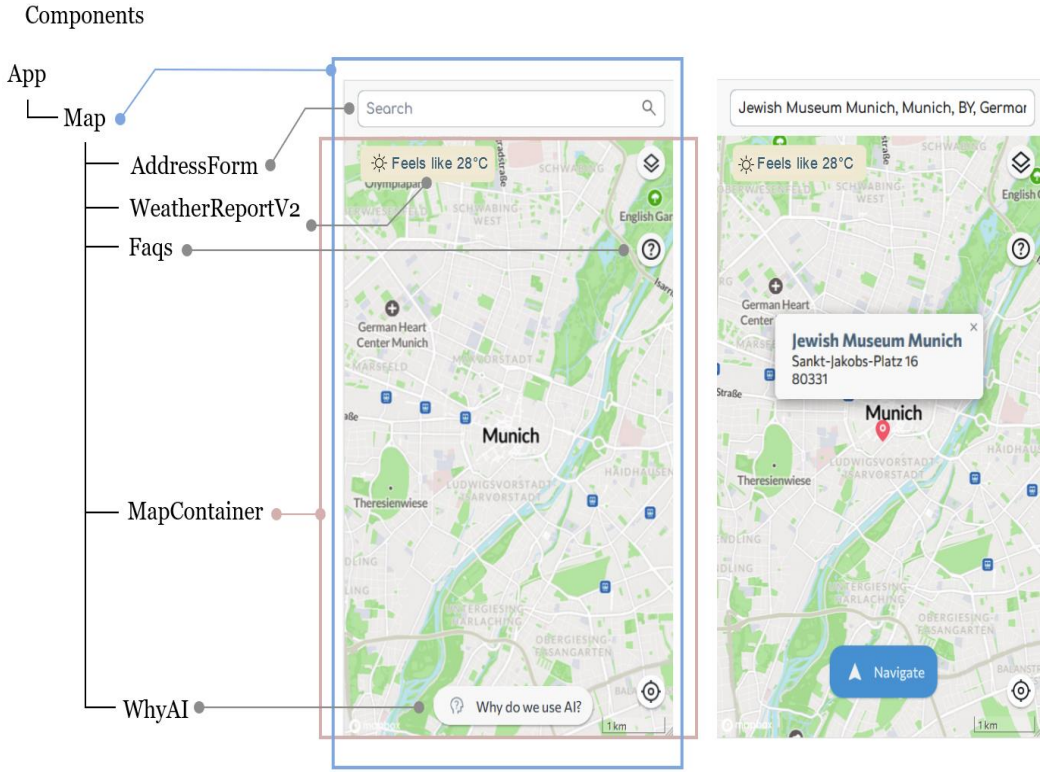
Components



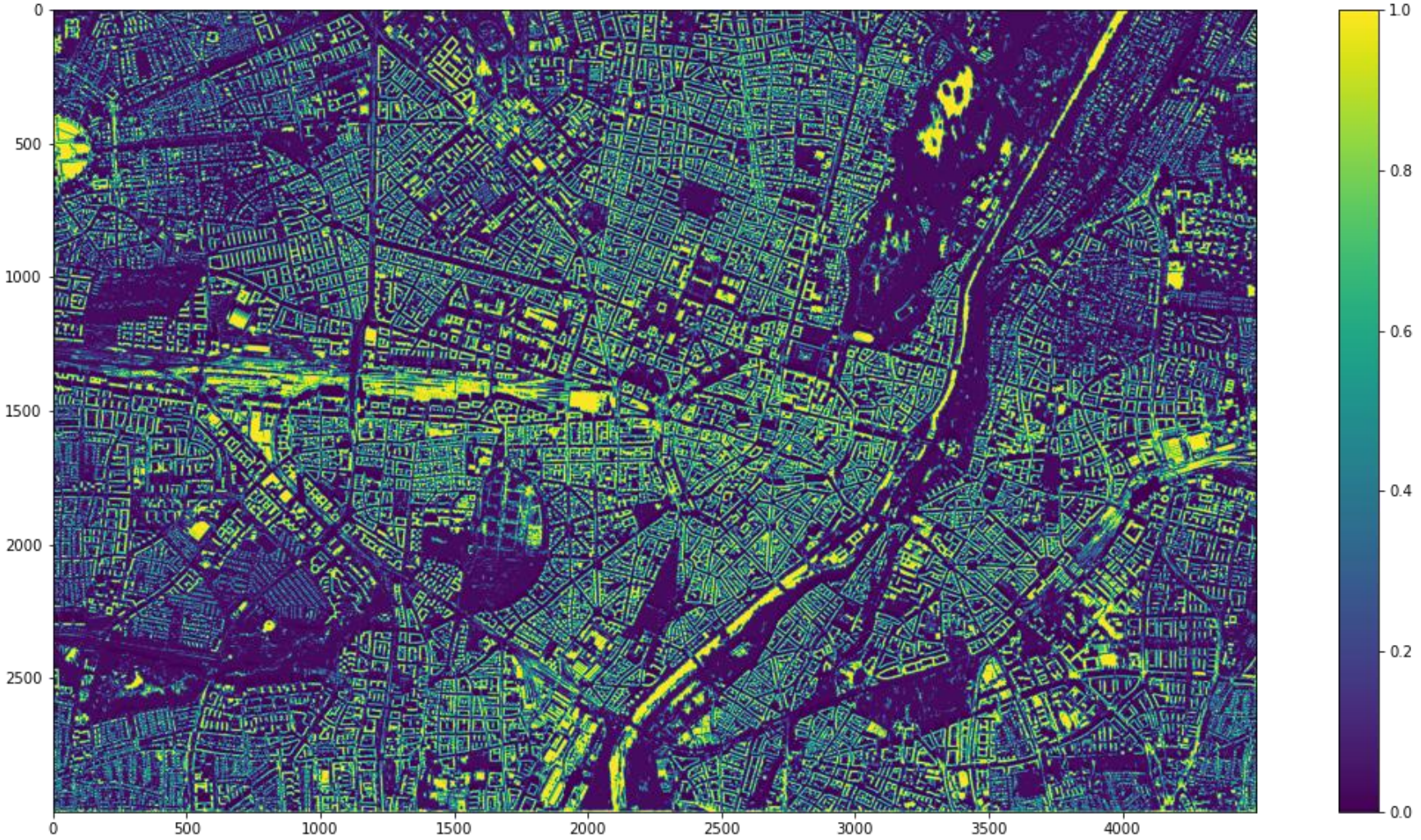


Map Landing Page

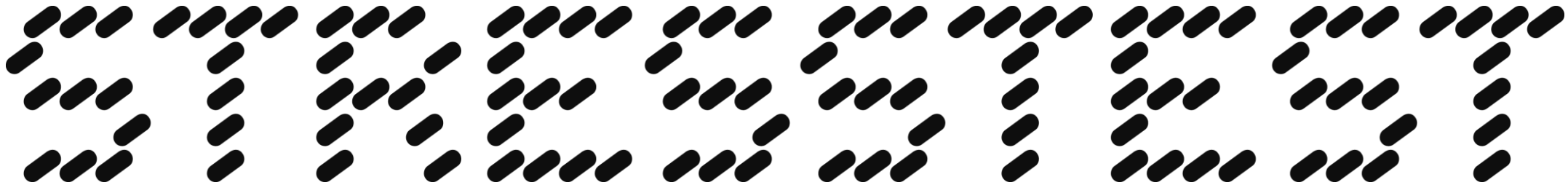
Components



Innovation



- AI model trained with radiation
- Weather API to utilize current weather
- Cloud cover and seasonal tree canopy variation



19. Architekturbiennale Venedig
10. Mai – 23. November 2025
Deutscher Pavillon

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Q&A

Grazie

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