

**E04UTEMP**

**Large scale exploitation of satellite data for the assessment of urban surface temperatures**

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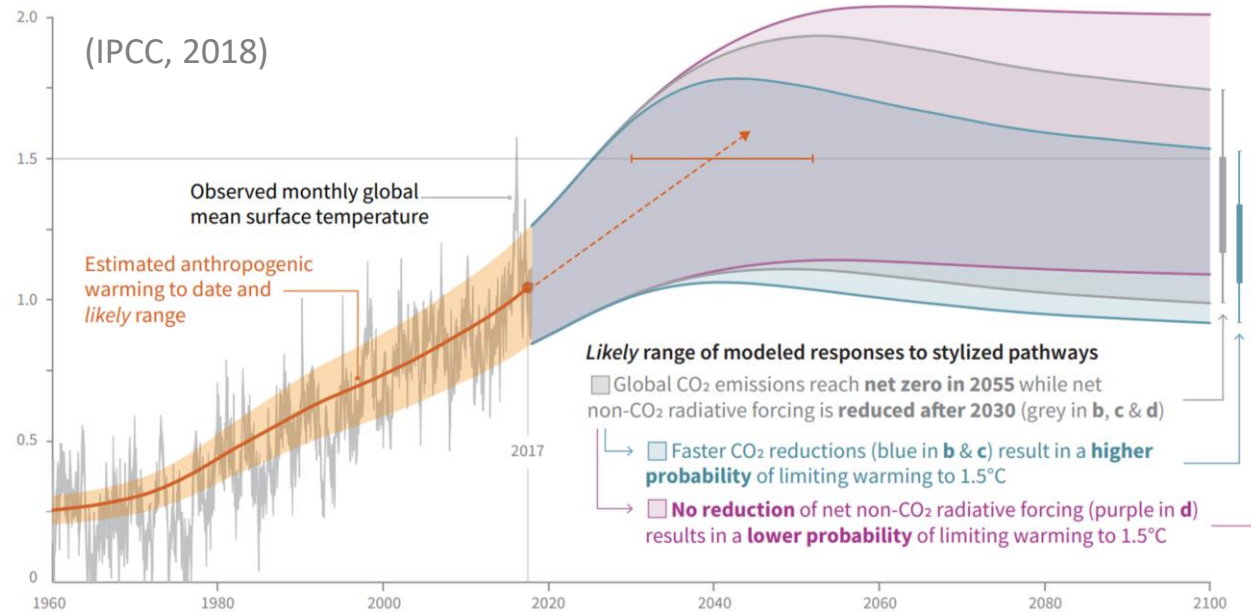
**ANTROPOSPHERE**



# Why E04UTEMP



- Global climate change exerts added stress on urban areas through increased numbers of **heat waves threatening people's wellbeing and in many cases human lives.**
- Temperature is one of the most important parameters in climate monitoring.



(DLR, 2016)



- **Earth Observation (EO) systems and the advances in satellite remote sensing technology increase the opportunities for monitoring the land surface temperature from space.**
- **But, the particular properties of the urban surface and the unique urban geometry in combination with the trade-off between temporal and spatial resolution makes urban surface temperature (UST) retrieval from the current satellite missions insufficient for urban climate studies.**
- **Upcoming satellite missions like the Copernicus High Spatio-Temporal Land Surface Temperature Monitoring Mission (LSTM) will increase the potential for UST monitoring.**
- **Therefore, new approaches are necessary to allow accurate UST mapping and monitoring from space.**

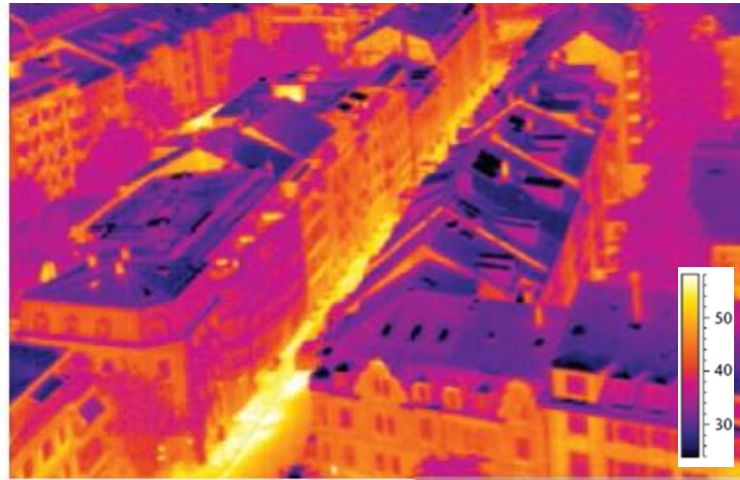


- Geometric, radiative and thermal properties govern the physical processes occurring in the urban canyons

Visible

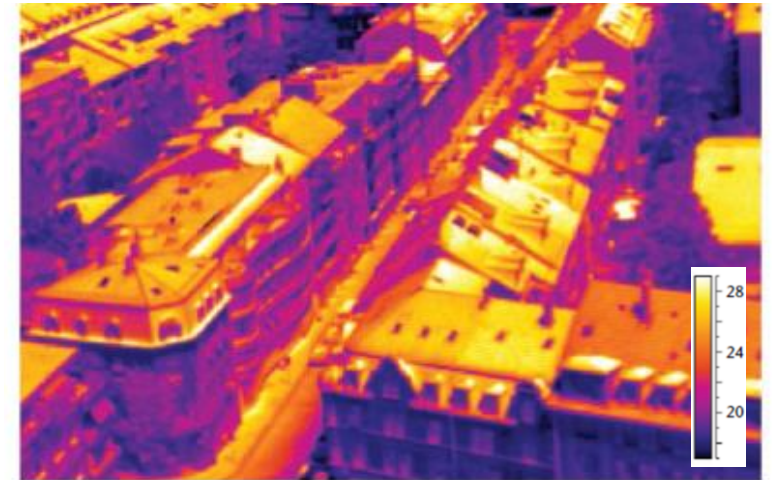


Daytime Brightness Temperature (°C)



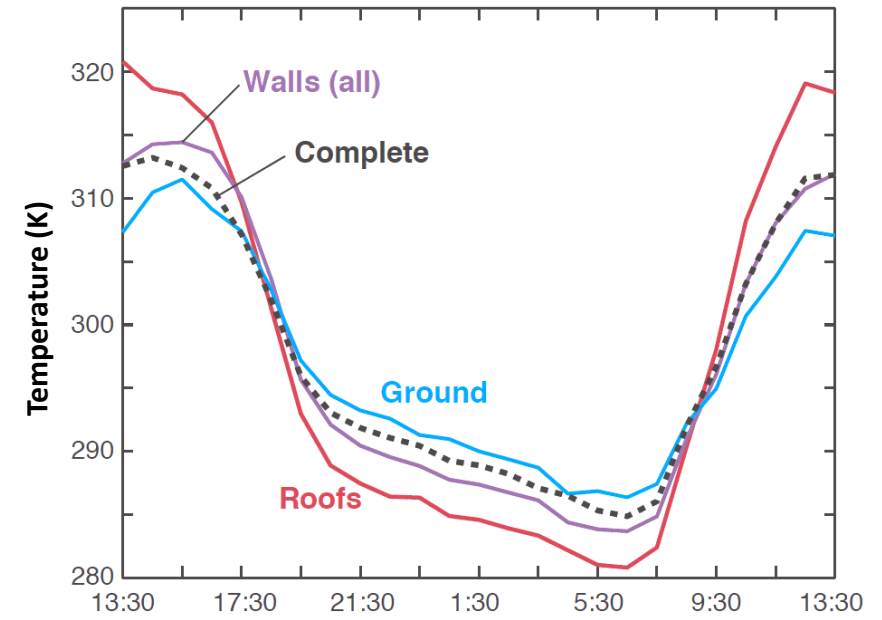
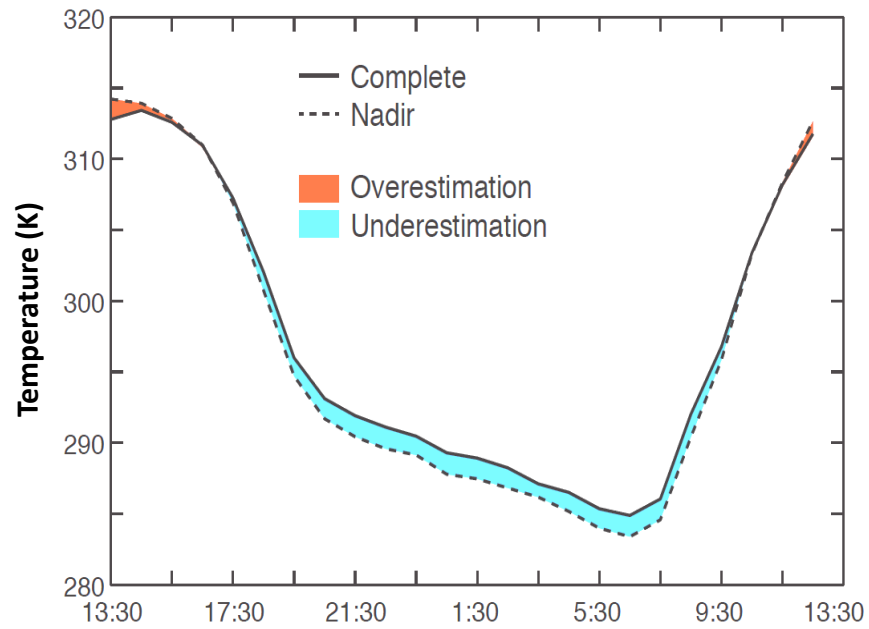
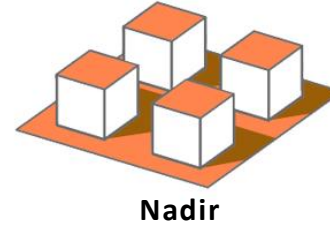
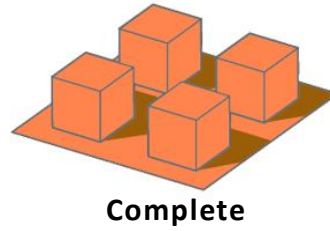
Basel, Switzerland, July 12, 2002, 14.30

Nighttime Brightness Temperature (°C)



(Oke et al., 2017)

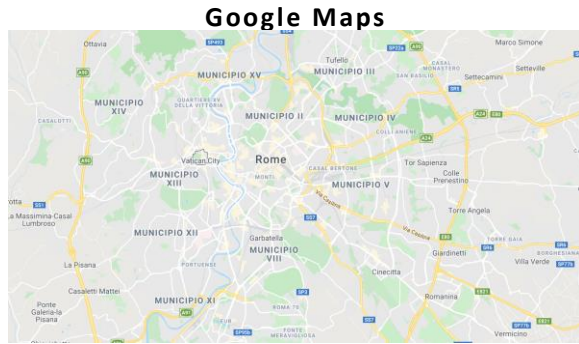
# The Challenge



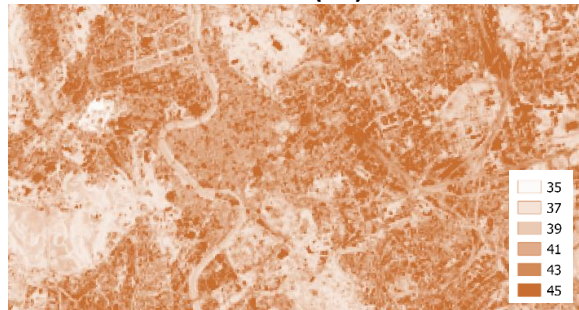
(Adderley et al., 2015)



# The Challenge



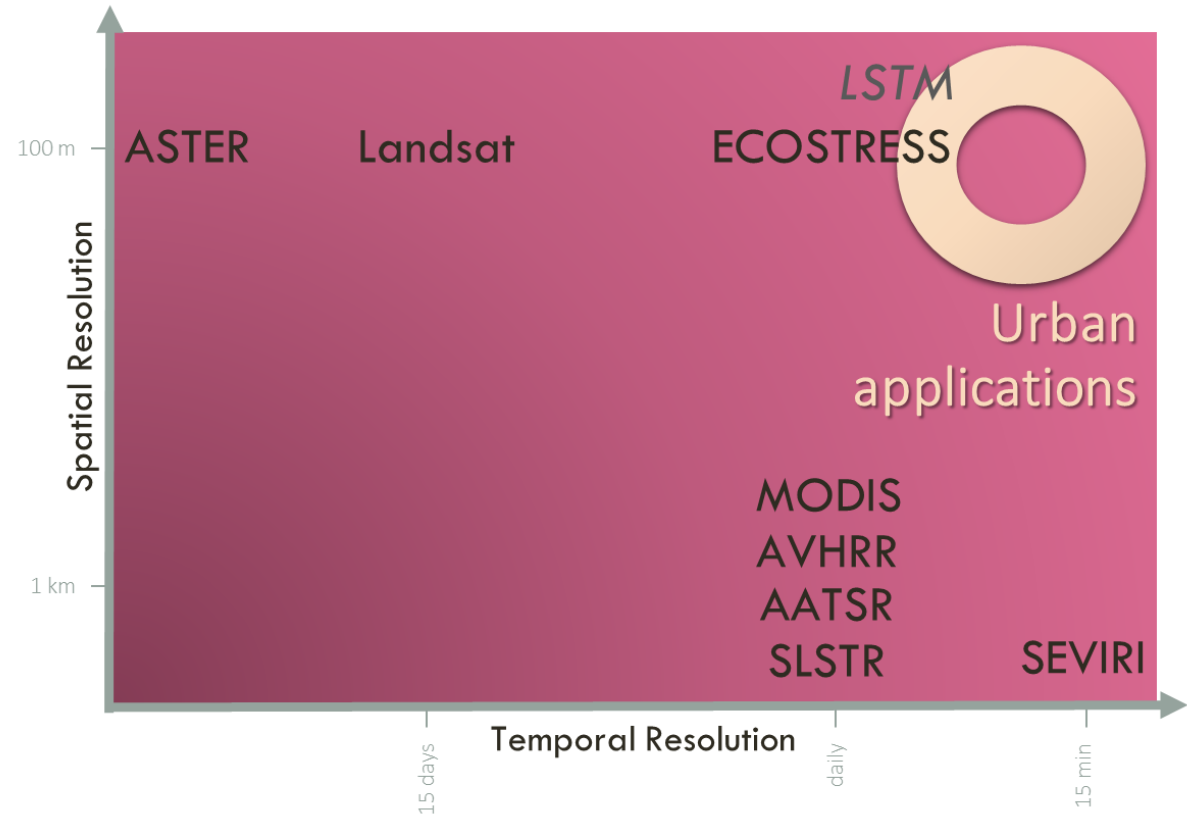
Landsat 8 LST (°C) – 100 m



Sentinel-3 LST (°C) - 1 km

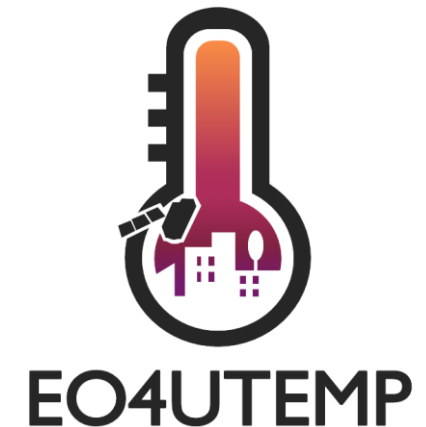


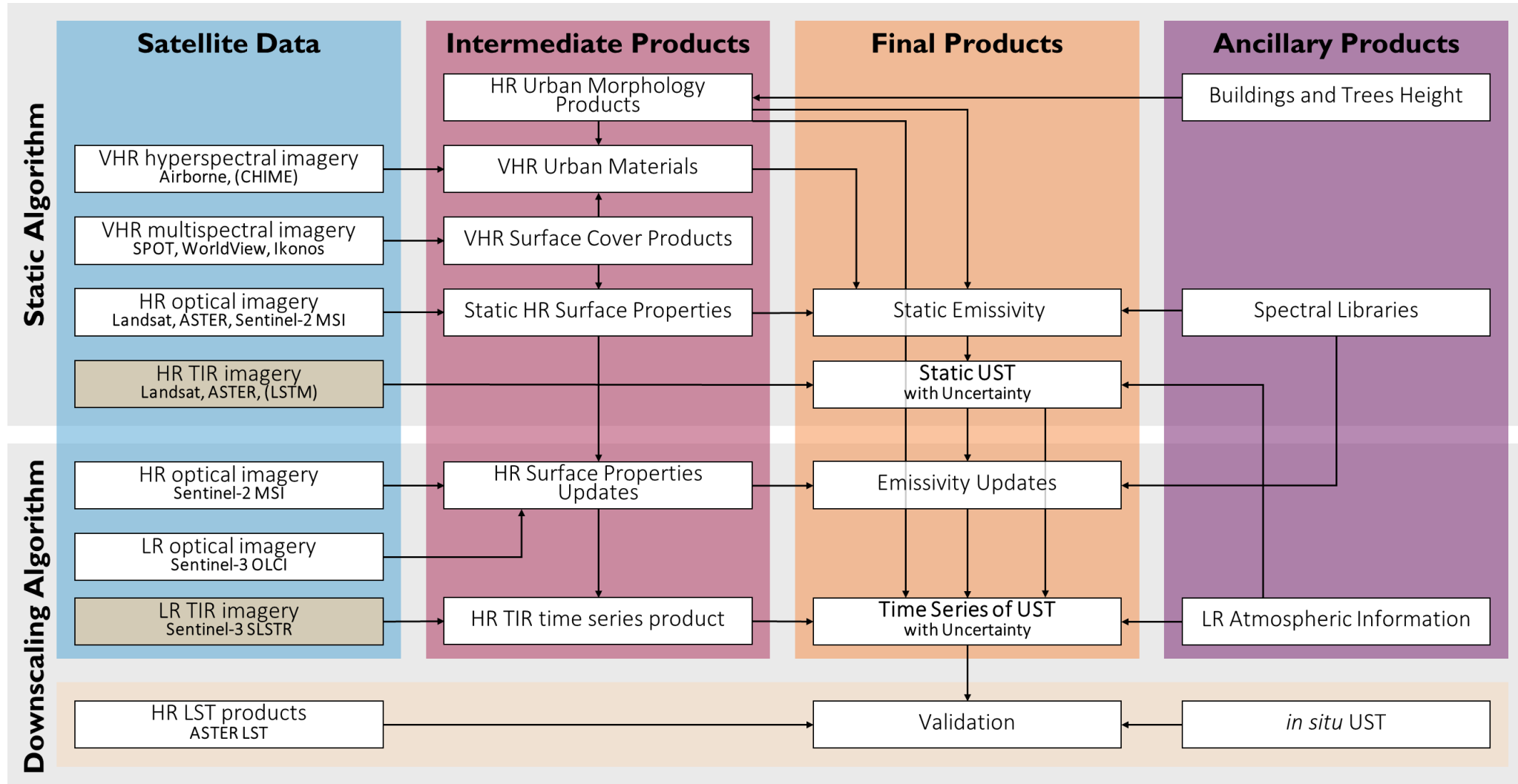
Rome, Italy, July 09, 2018



## EO4UTEMP is

- developing an **UST retrieval algorithm**, designed to **account for the particular properties of the urban surface and form**;
- exploiting **multi-temporal, multi-scale and multi-sensor satellite data** in order to conclude to a synergistic UST retrieval methodology;
- investigating the links in different spatial scales of UST;
- performing **uncertainty analysis** to quantify the impact of uncertainty from the different data sources, as well as the uncertainty of the final products;
- **validating the developed algorithms**, using UST estimations from independent satellite sources and from *in situ* measurements.









## London

- is a highly urbanized megacity,
- characterized by a variations in urban surface and form,
- with great availability of data
- including 3D city representation, building materials and hyperspectral campaigns
- and *in-situ* measured downward and upwelling longwave radiation of a wide urban surface (University of Reading)



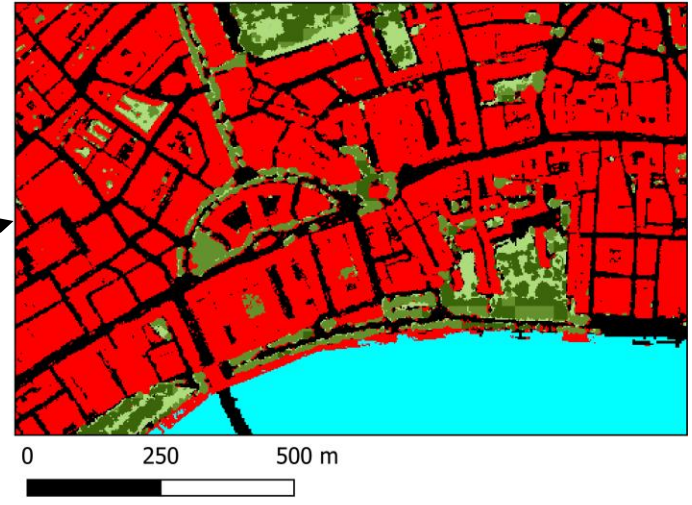
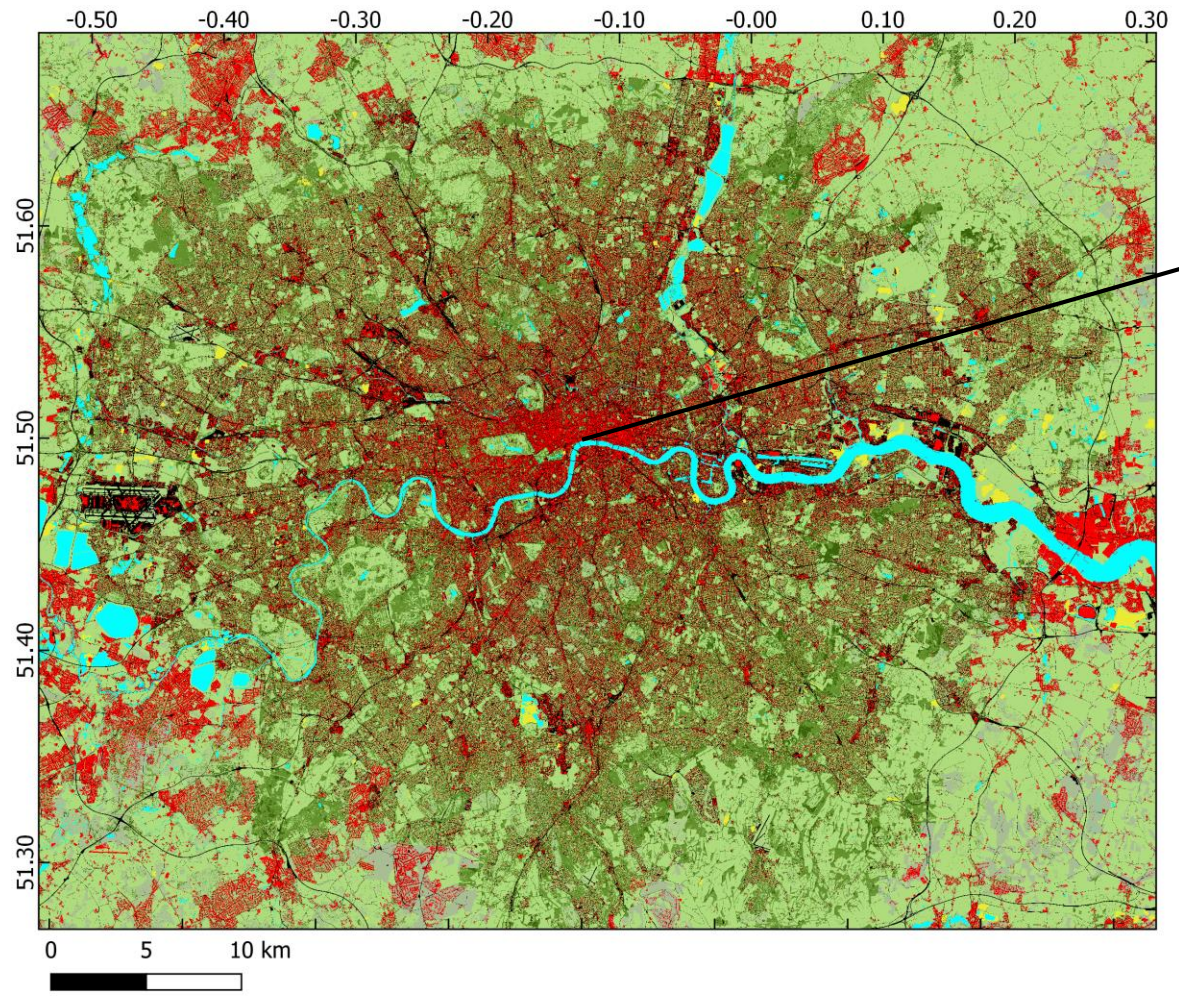
## Heraklion







- is a small urban area,
- with great availability of data,
- including 3D city representation, building materials and hyperspectral campaigns
- and *in-situ* measured downward and upwelling longwave radiation of a wide urban surface (University of Reading)





## VHR Surface Cover Product from SPOT and Worldview 2 Imagery



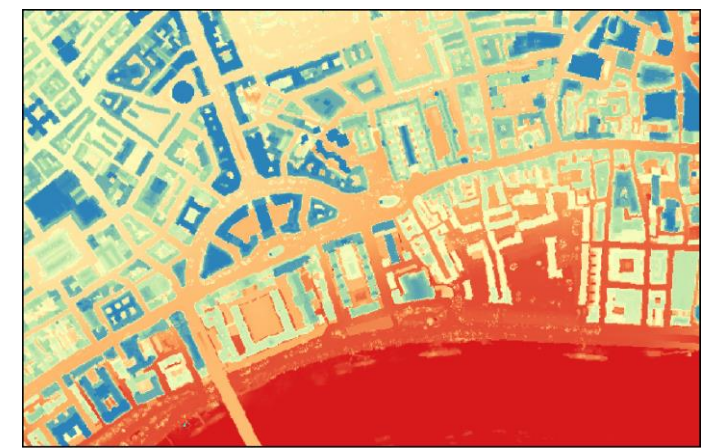
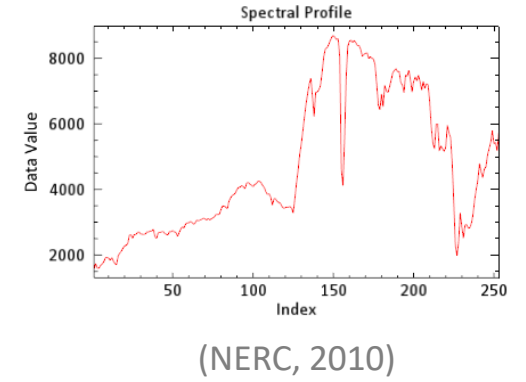
-  Buildings
-  Paved surfaces
-  Low vegetation (<2m)
-  High vegetation (<2m)
-  Bare Soil
-  Water



## Urban Materials and Morphology



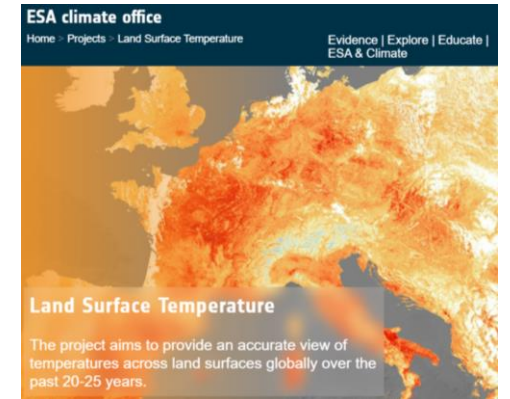
- Buildings
- Paved surfaces
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- Bare Soil
- Water



- Digital Surface Model (m)
- 0
  - 5
  - 10
  - 15
  - 20

- Land Surface Temperature project, ESA Climate Change Initiative

<https://climate.esa.int/en/projects/land-surface-temperature/>



- UK Urban Heat Island project, University of Leicester

<https://www.the-iea.org/uhi/>



- ERC-grant urbisphere project, FORTH

<http://urbisphere.eu/>








- **E04UTEMP will demonstrate new technologies and tools to the EO community and allow the urban climate research community to count on EO data for their analysis.**
- **The exploitation of Copernicus data for operational high spatio-temporal resolution UST will encourage further scientific activities and future applications, thus stimulating the wide exploitation of the Sentinel data in both scientific and operational services for cities.**
- **The ultimate goal is to assist the urban planners to take actions for sustainable and resilient cities to climate change.**



A grid of six vertical panels, each showing a different scene: clouds, a forest, a waterfall, layered rock, ocean waves, and a crowd. The panels are arranged in a 2x3 grid. A semi-transparent grey horizontal bar is overlaid across the middle of the grid, containing the text 'Thank you for your attention' and the email address 'mitraka@iacm.forth.gr'.

**Thank you for your attention**

[mitraka@iacm.forth.gr](mailto:mitraka@iacm.forth.gr)

A view of the Earth's horizon from space, showing the blue and white atmosphere against the black background of space.

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