



# The impact of **urban greenery** on local **climate**

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# Impact of LCLUC on functioning of ecosystems

Extensive LCLUC in mid-east European countries:

- agriculture (abandonment, intensification, field size,...)

- **construction/building activities:**

- **town expansion:** road net; industrial parks; logistics, shopping, entertainment centers in the suburb

- **infrastructure in town centers** (roads, pavement; underground services) -> loss of greenery (trees)

**+ climate change**

Contribution to heating islands; impact on human health/wellbeing in inhabited parts of towns; economically demanding to keep good living conditions,...

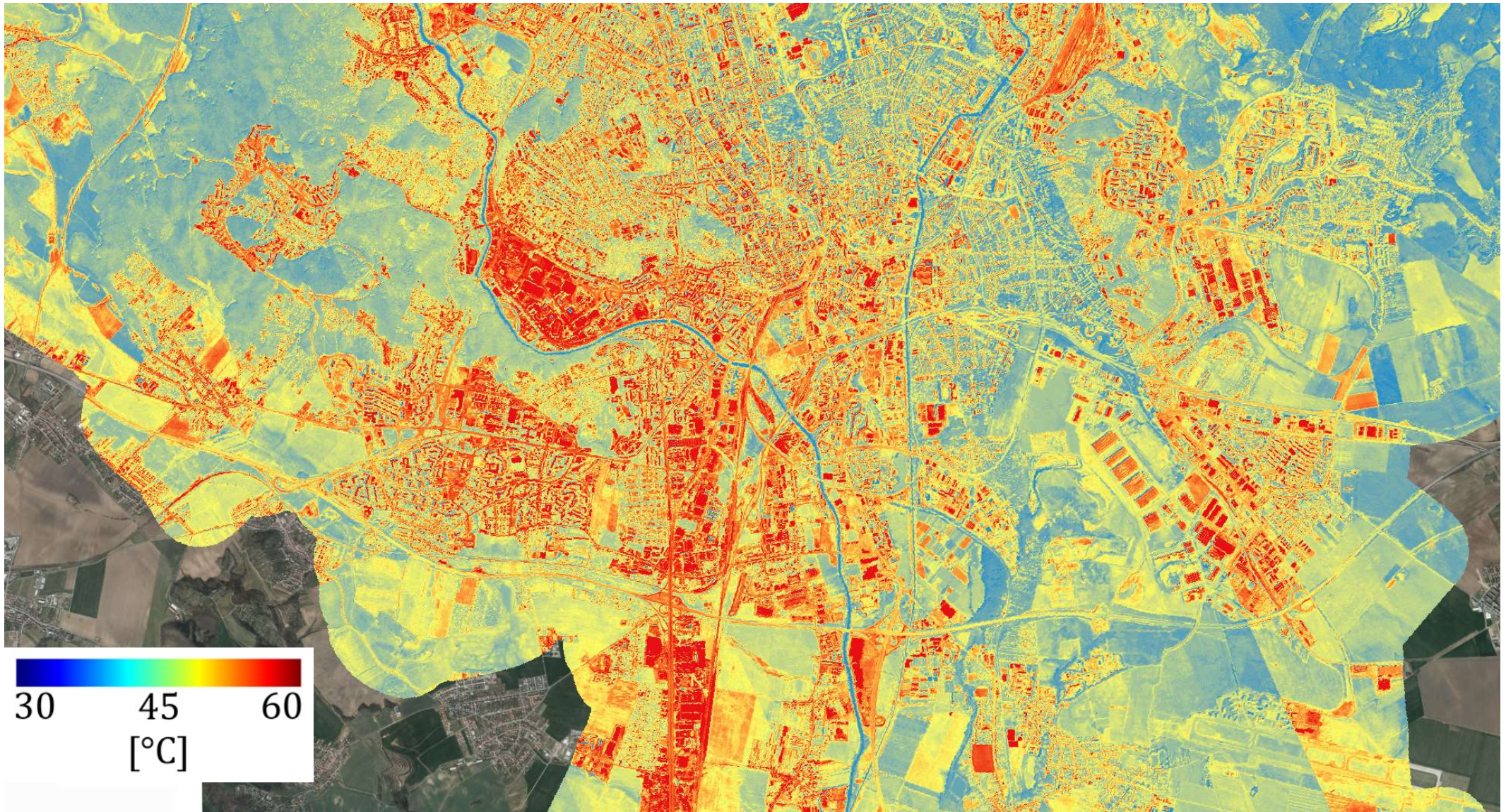
# Brno 1984 – Landsat 5



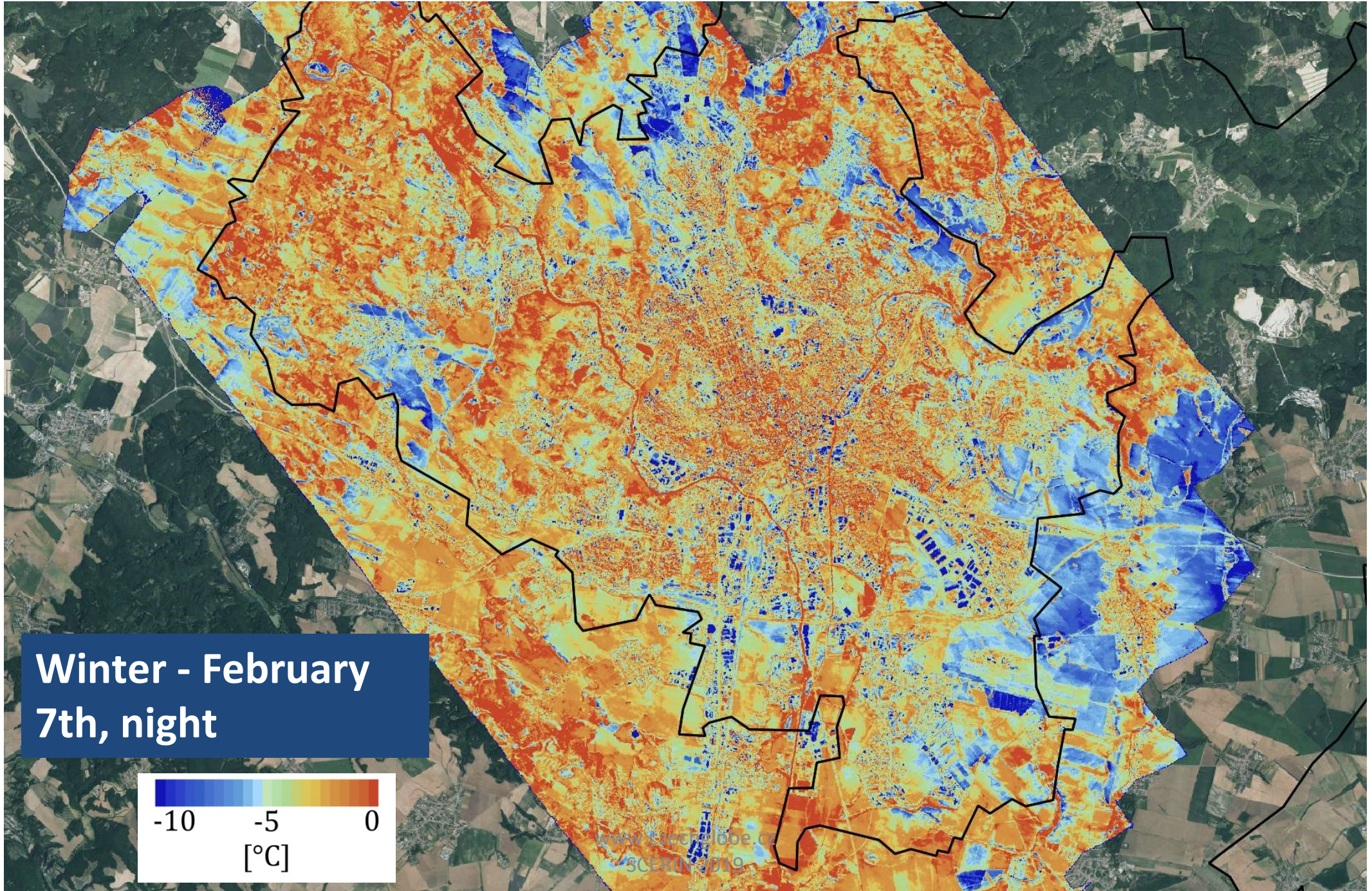
# Brno 2018 – Landsat 8



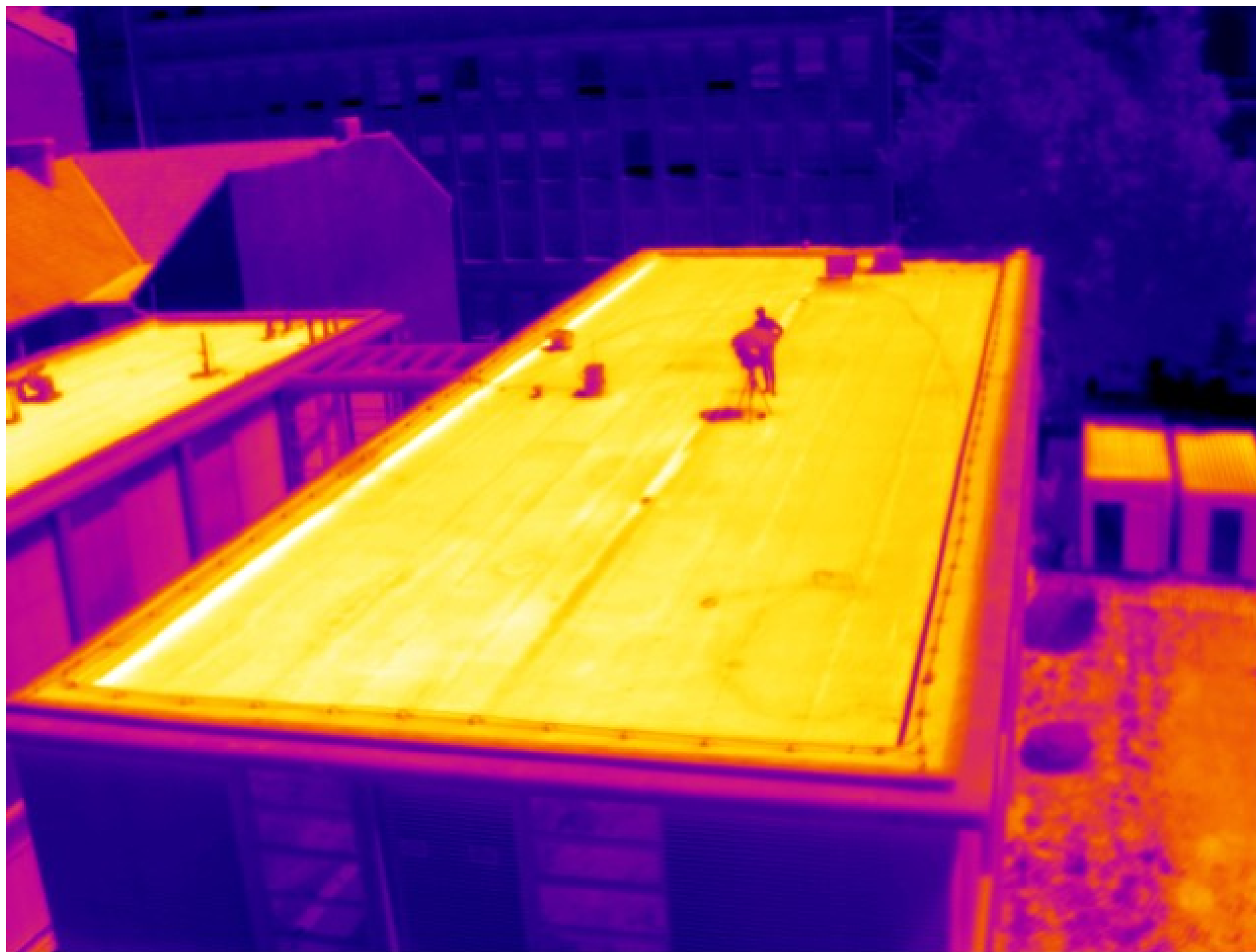
# Brno 2016 – surface temperature from TASI



# What we learned from the UrbanAdapt project

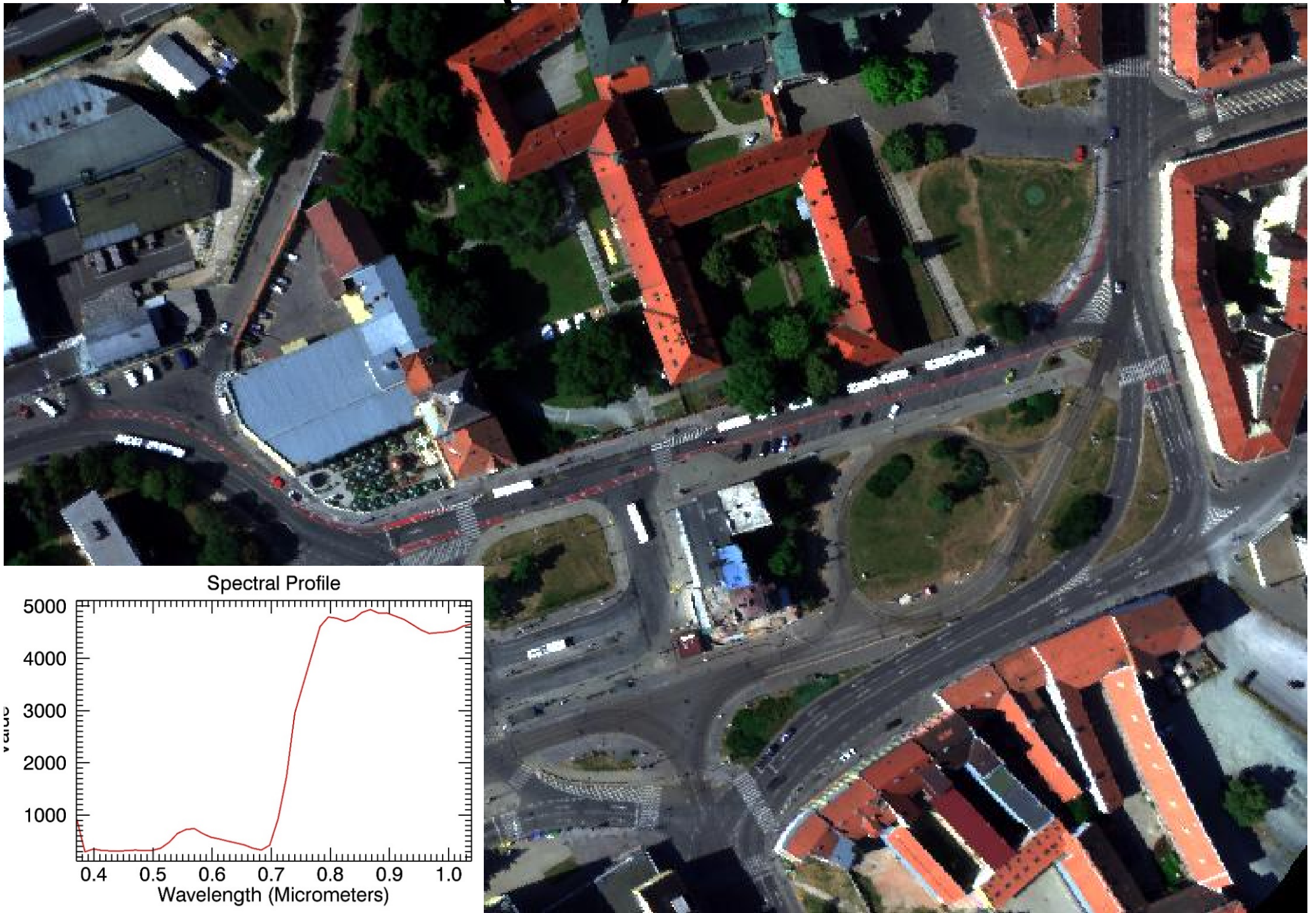




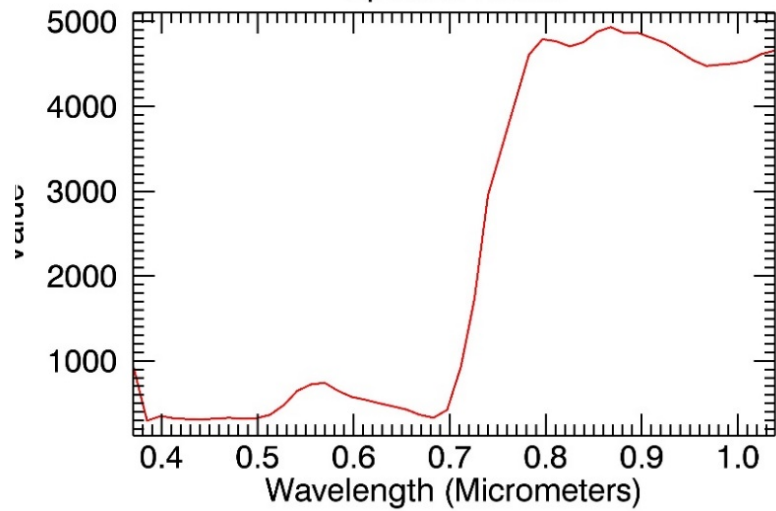




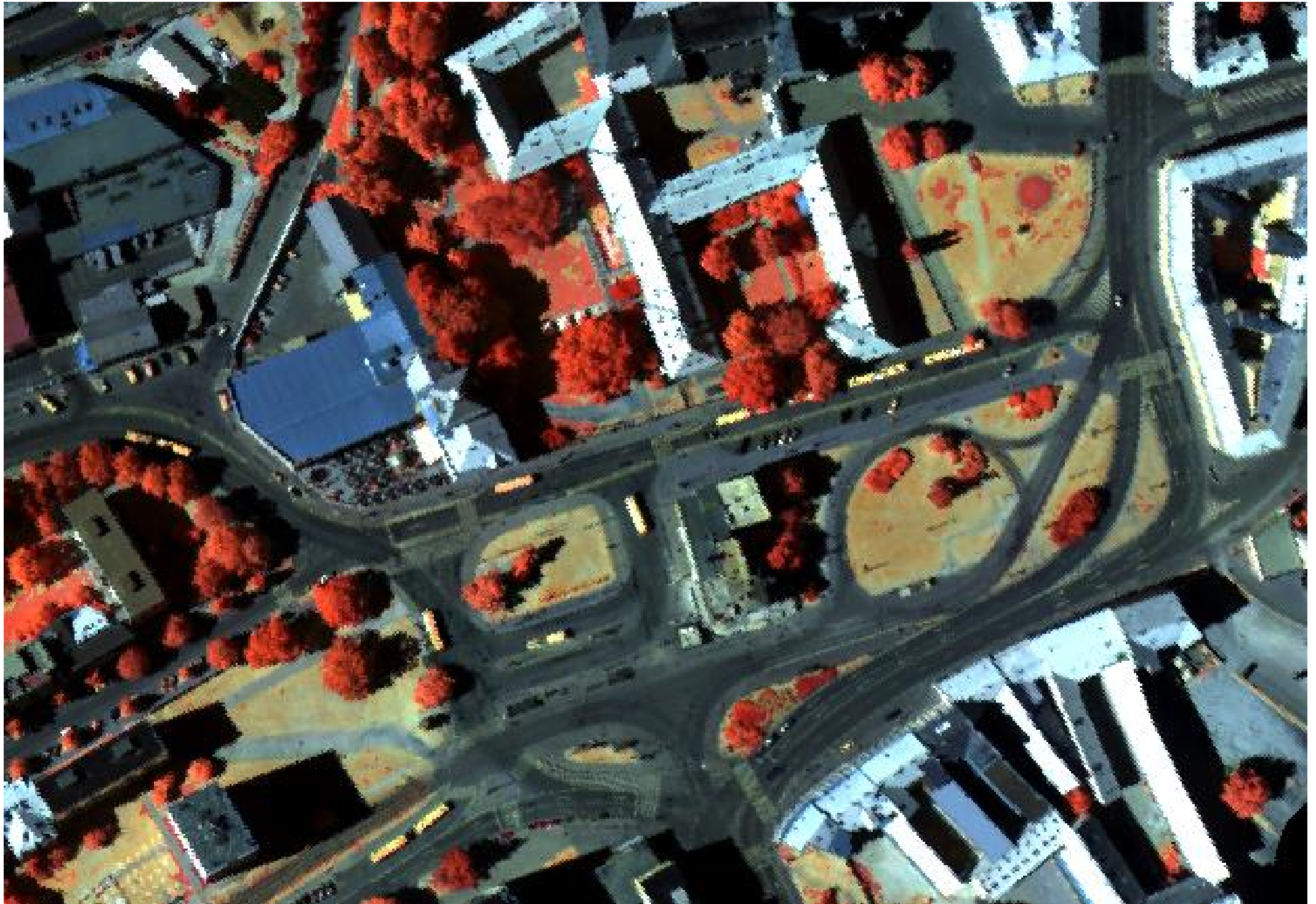
# CASI – VNIR (RGB) summer afternoon



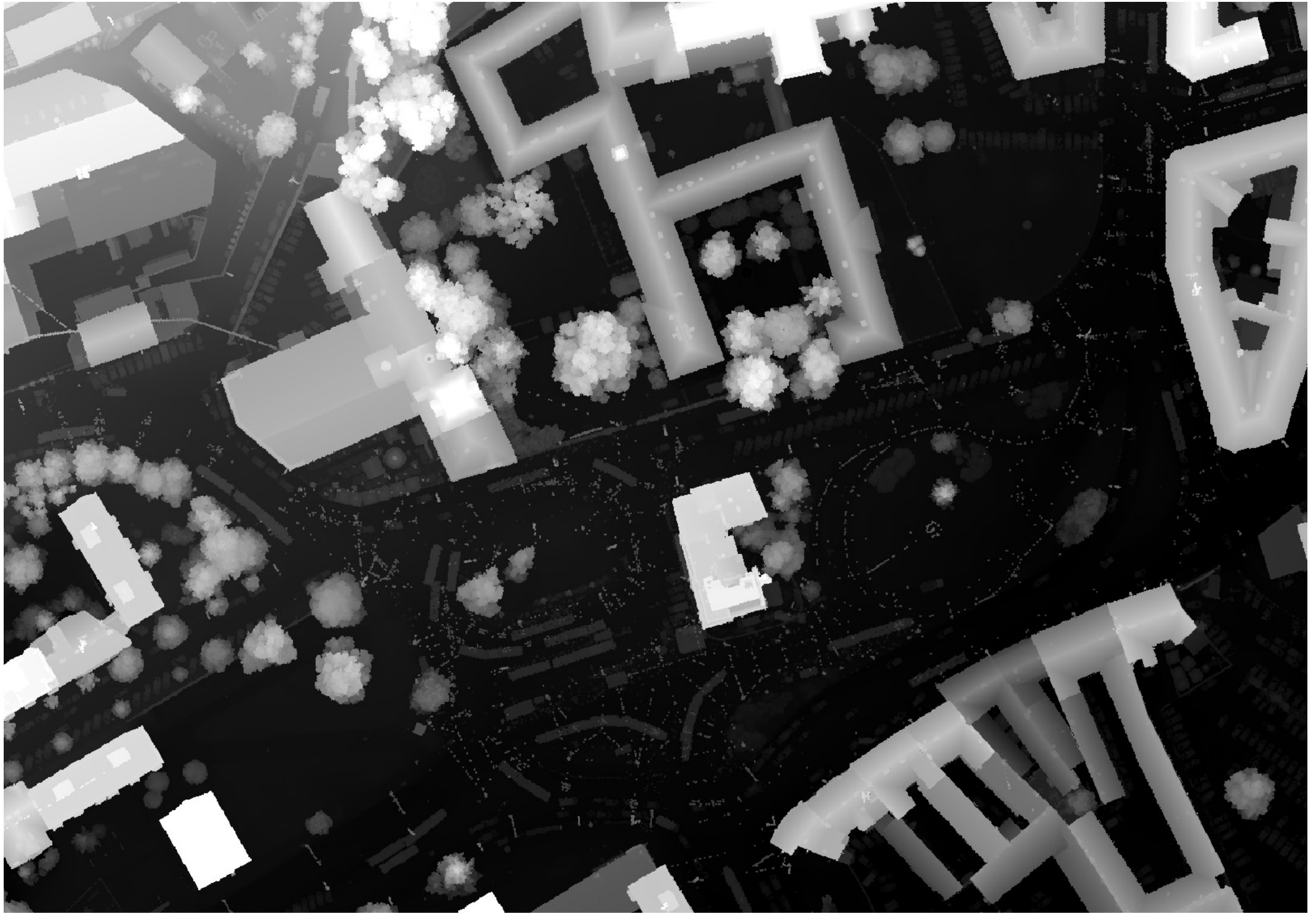
Spectral Profile



# SASI – SWIR, summer afternoon



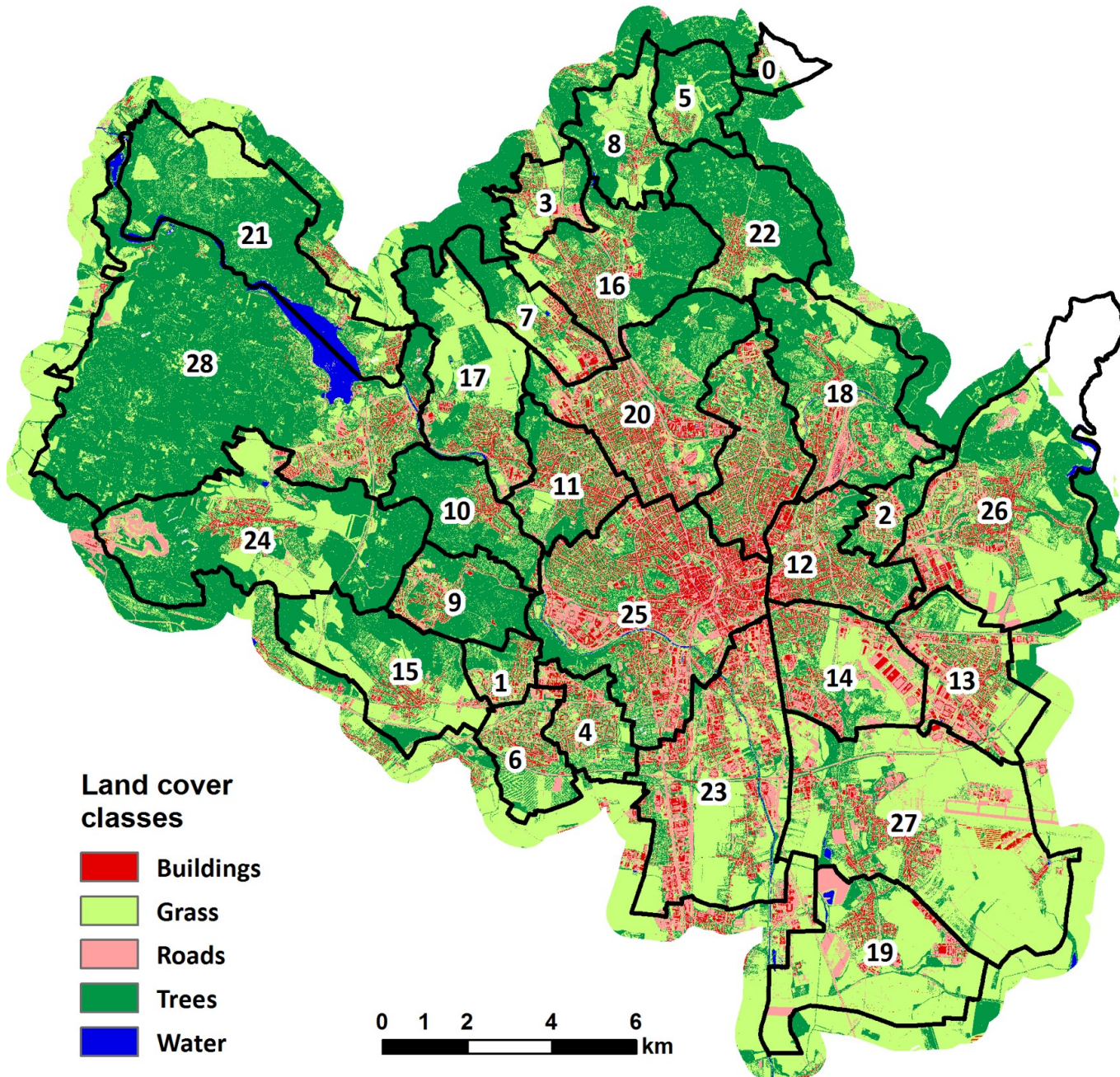
# DSM from LiDAR data



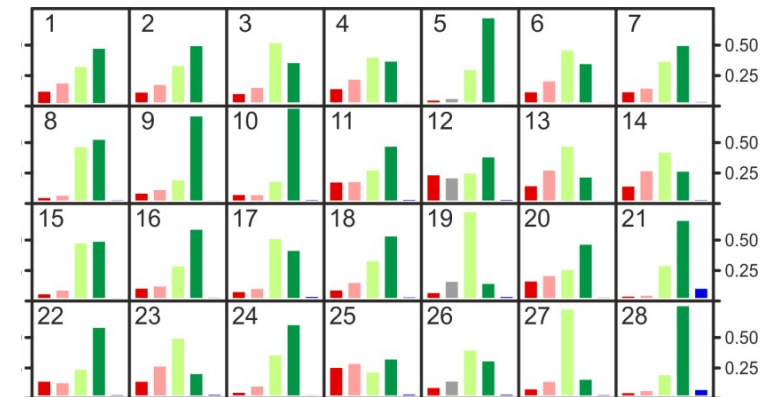
# 3D from LiDAR data



# Land cover from CASI, SASI, LiDAR



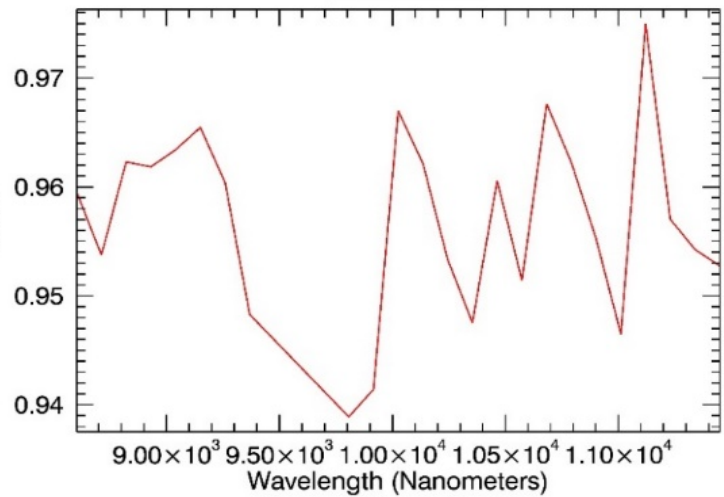
- |                        |                                 |
|------------------------|---------------------------------|
| 1) Brno-Nový Lískovec  | 15) Brno-Bosonohy               |
| 2) Brno-Vinohrady      | 16) Brno-Řečkovice a Mokrá Hora |
| 3) Brno-Ivanovice      | 17) Brno-Komín                  |
| 4) Brno-Bohunice       | 18) Brno-Maloměřice a Obřany    |
| 5) Brno-Ořešín         | 19) Brno-Chrlice                |
| 6) Brno-Starý Lískovec | 20) Brno-Královo Pole           |
| 7) Brno-Medlánky       | 21) Brno-Kníničky               |
| 8) Brno-Jehnice        | 22) Brno-Sever                  |
| 9) Brno-Kohoutovice    | 23) Brno-Jih                    |
| 10) Brno-Jundrov       | 24) Brno-Žebětín                |
| 11) Brno-Žabovřesky    | 25) Brno-Střed                  |
| 12) Brno-Židenice      | 26) Brno-Líšeň                  |
| 13) Brno-Slatina       | 27) Brno-Tuřany                 |
| 14) Brno-Černovice     | 28) Brno-Bystrc                 |



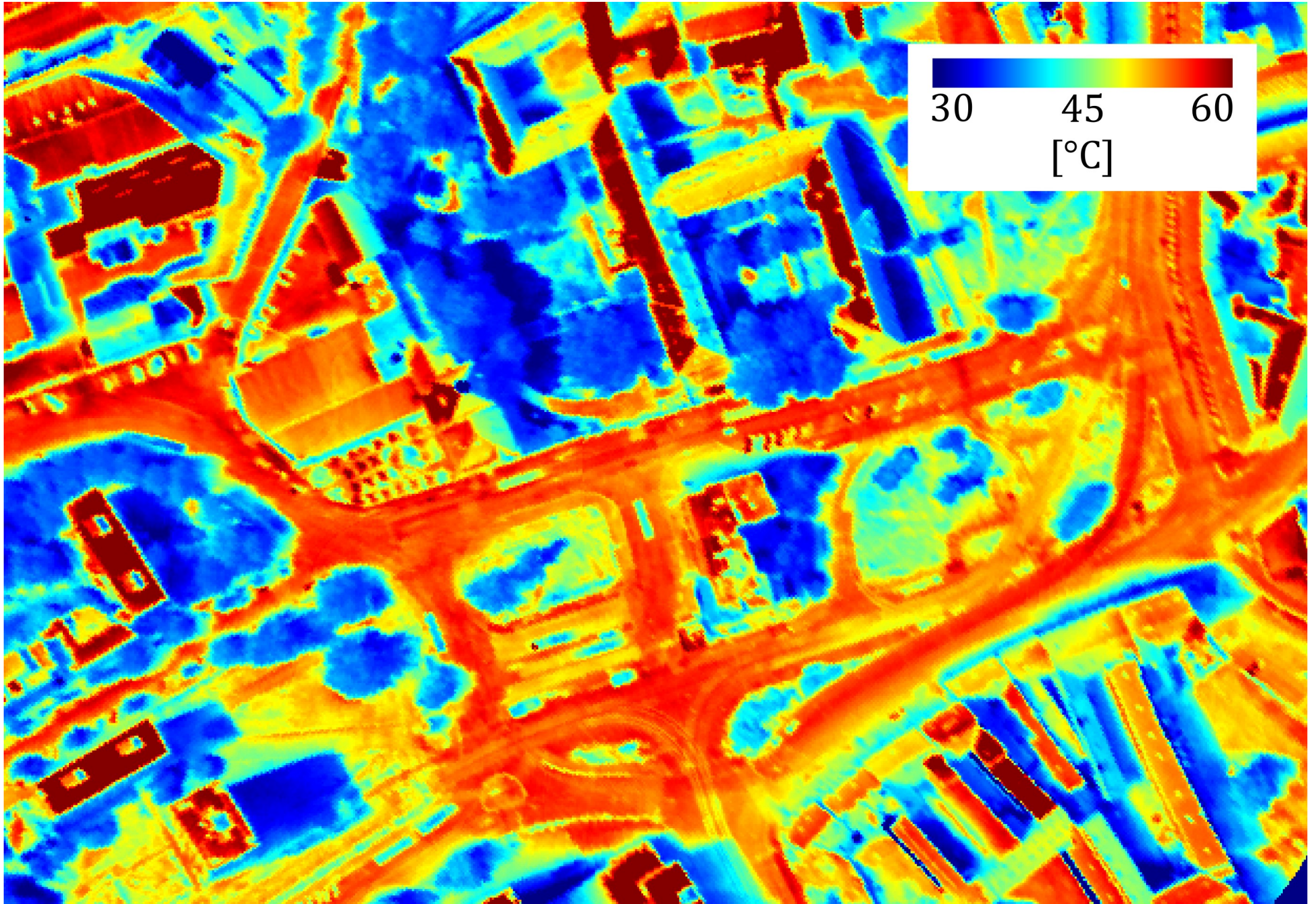
# Color composition of emissivity from TIR



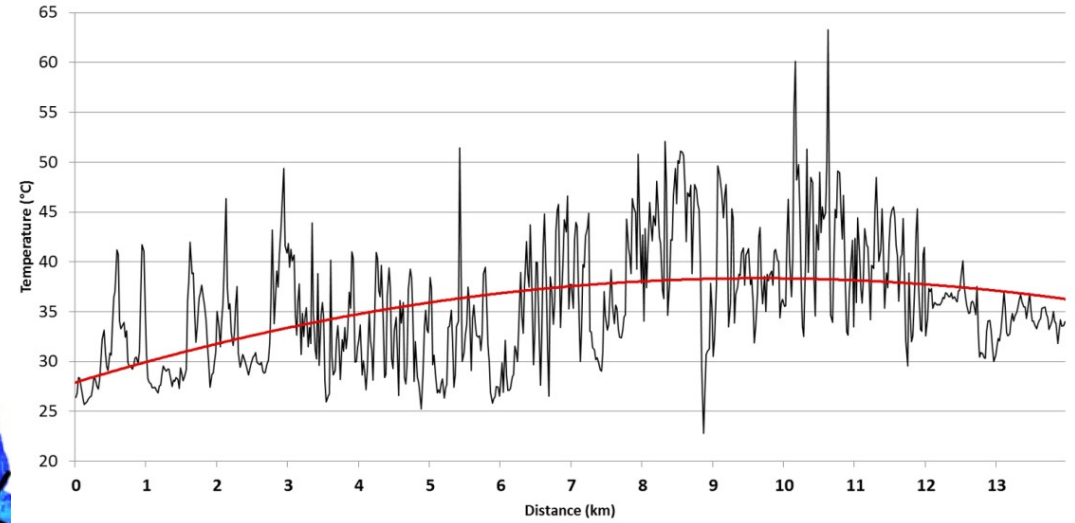
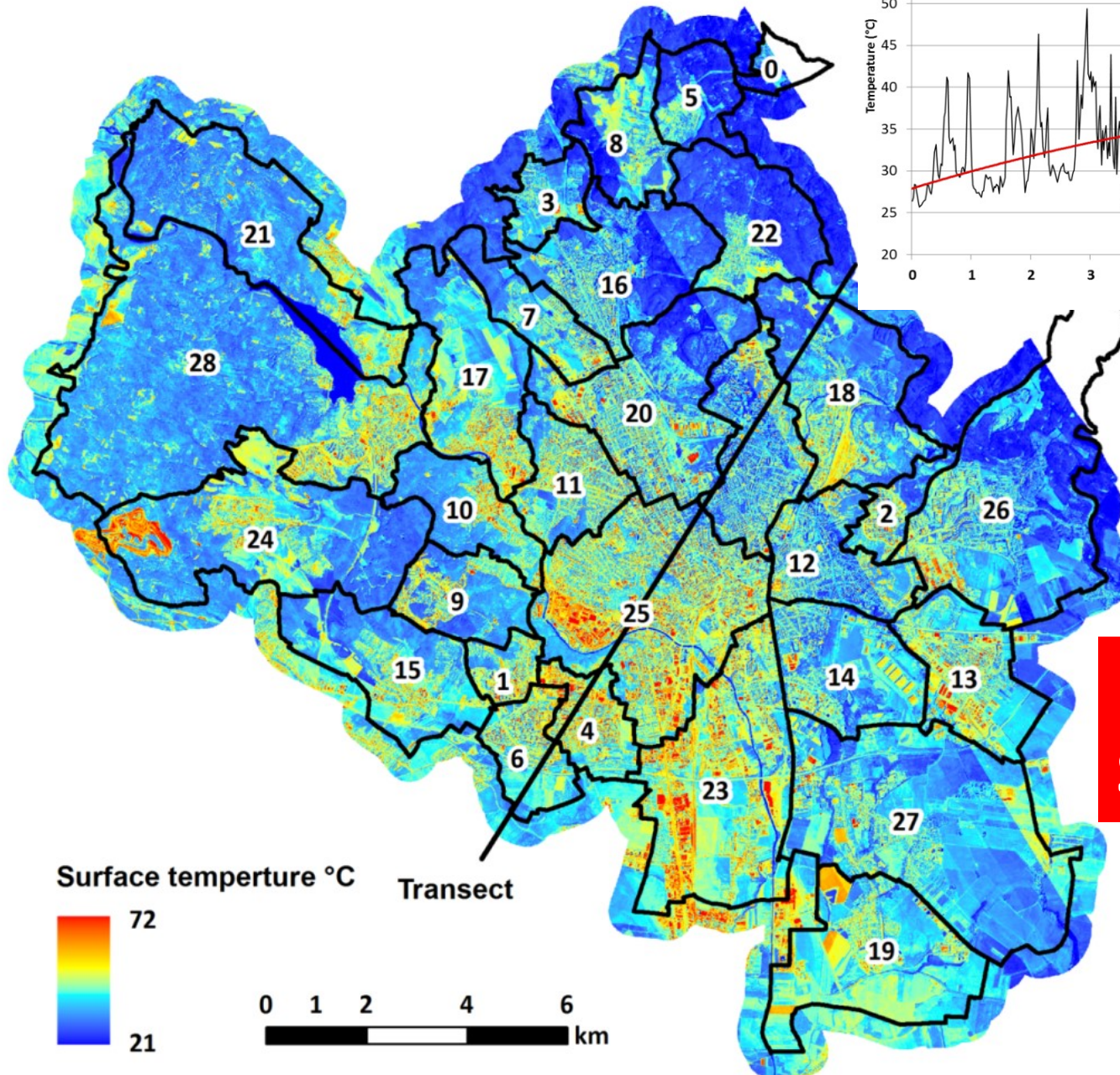
Spectral Profile



# Surface temperature - summer afternoon



# Heating islands?

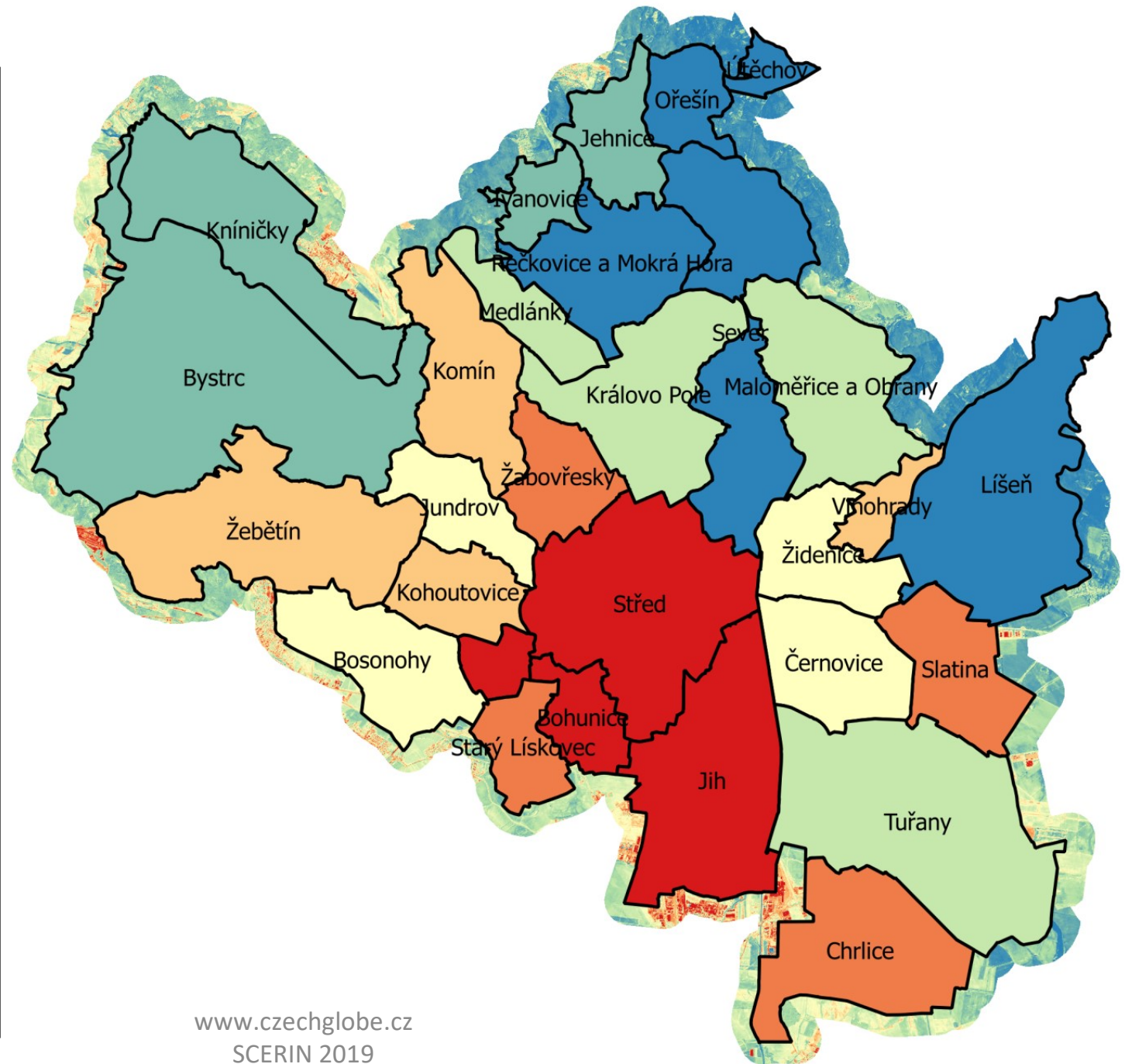


**Brno - July 7th,  
Summer - afternoon**

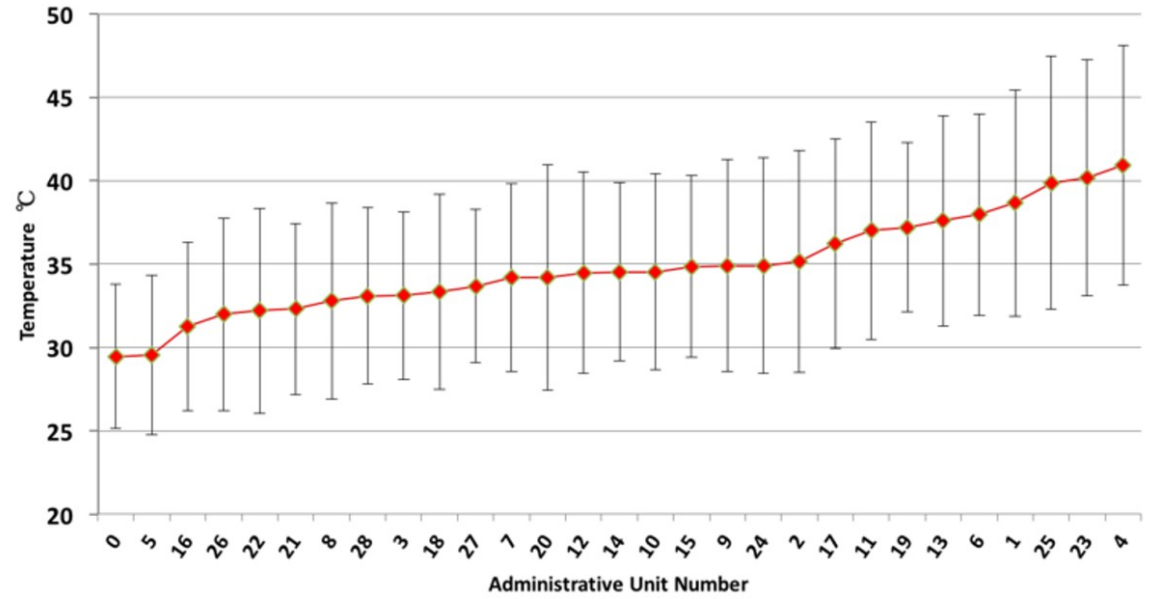
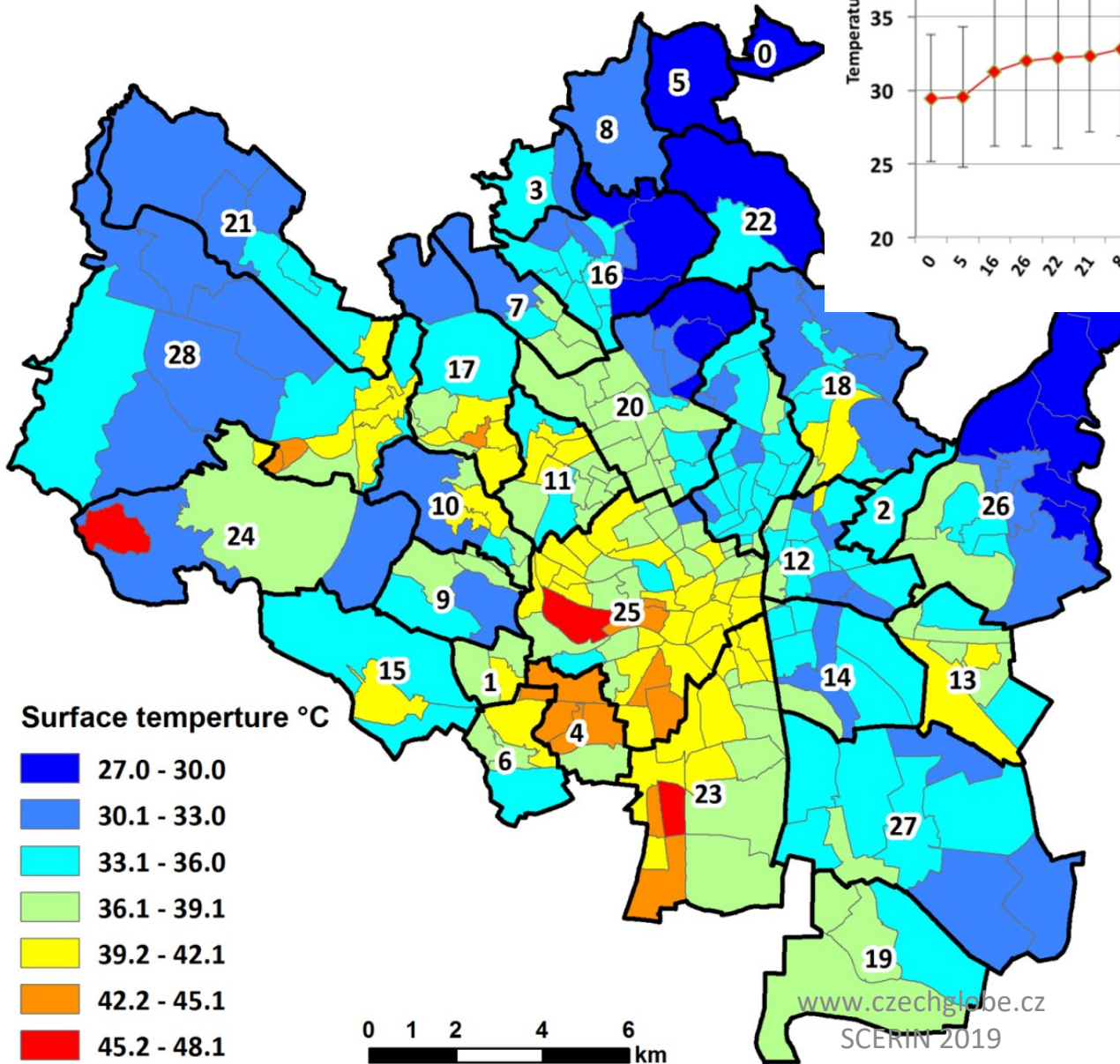


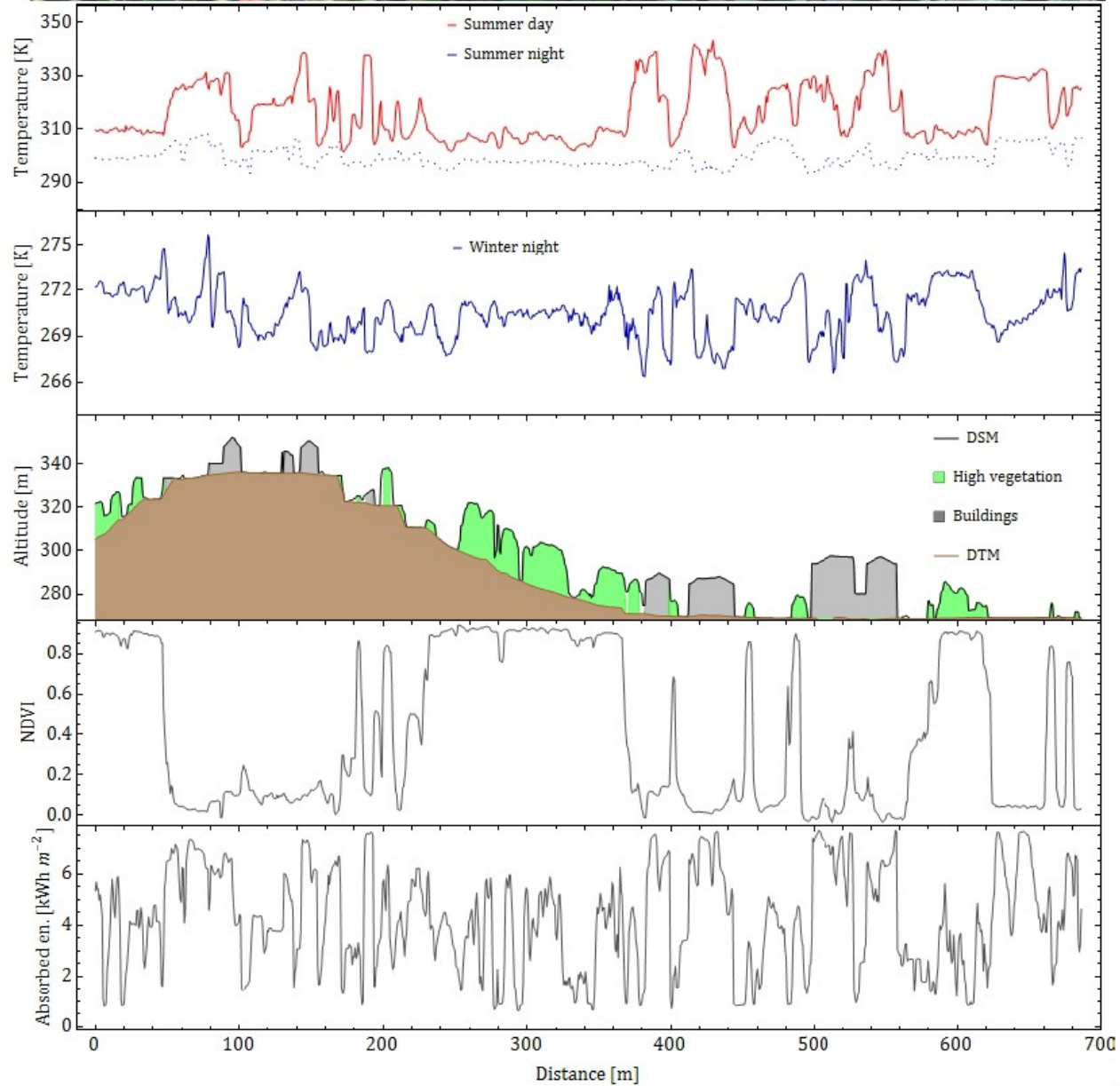
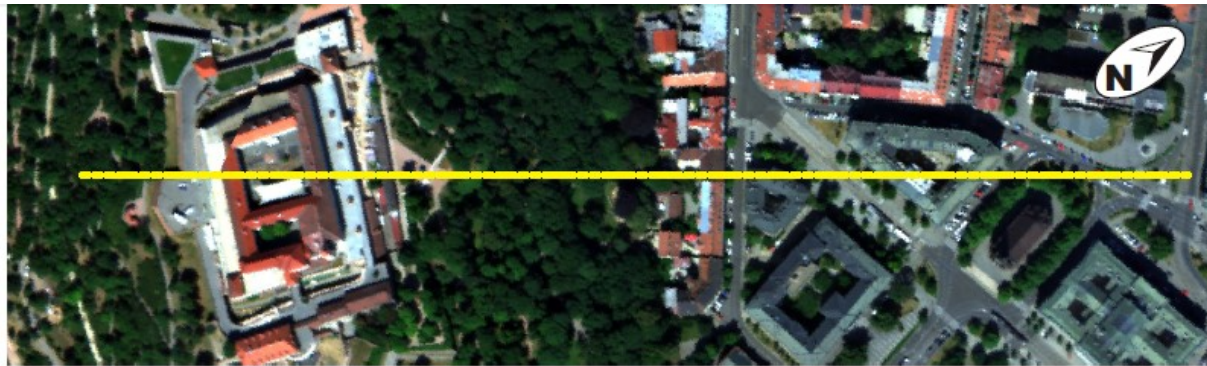
# Town administration units

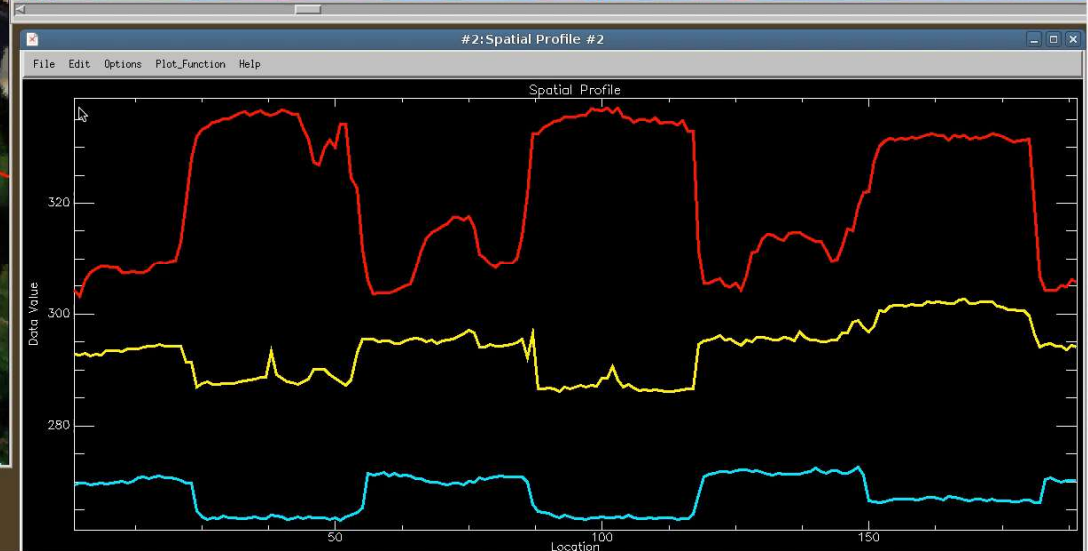
|  |         |                        |
|--|---------|------------------------|
|  | 29,49°C | Útěchov                |
|  | 29,53°C | Ořešín                 |
|  | 31,23°C | Řečkovice a Mokrá Hora |
|  | 31,97°C | Líšeň                  |
|  | 32,20°C | Sever                  |
|  | 32,32°C | Kníničky               |
|  | 32,78°C | Jehnice                |
|  | 33,09°C | Bystrc                 |
|  | 33,10°C | Ivanovice              |
|  | 33,33°C | Maloměřice a Obrany    |
|  | 33,66°C | Tuřany                 |
|  | 34,18°C | Medlánky               |
|  | 34,19°C | Královo Pole           |
|  | 34,45°C | Židenice               |
|  | 34,50°C | Černovice              |
|  | 34,53°C | Jundrov                |
|  | 34,83°C | Bosonohy               |
|  | 34,90°C | Kohoutovice            |
|  | 34,91°C | Žebětín                |
|  | 35,15°C | Vinohrady              |
|  | 36,21°C | Komín                  |
|  | 37,02°C | Žabovřesky             |
|  | 37,18°C | Chrlice                |
|  | 37,58°C | Slatina                |
|  | 37,98°C | Starý Lískovec         |
|  | 38,66°C | Nový Lískovec          |
|  | 39,85°C | Střed                  |
|  | 40,16°C | Jih                    |
|  | 40,91°C | Bohunice               |



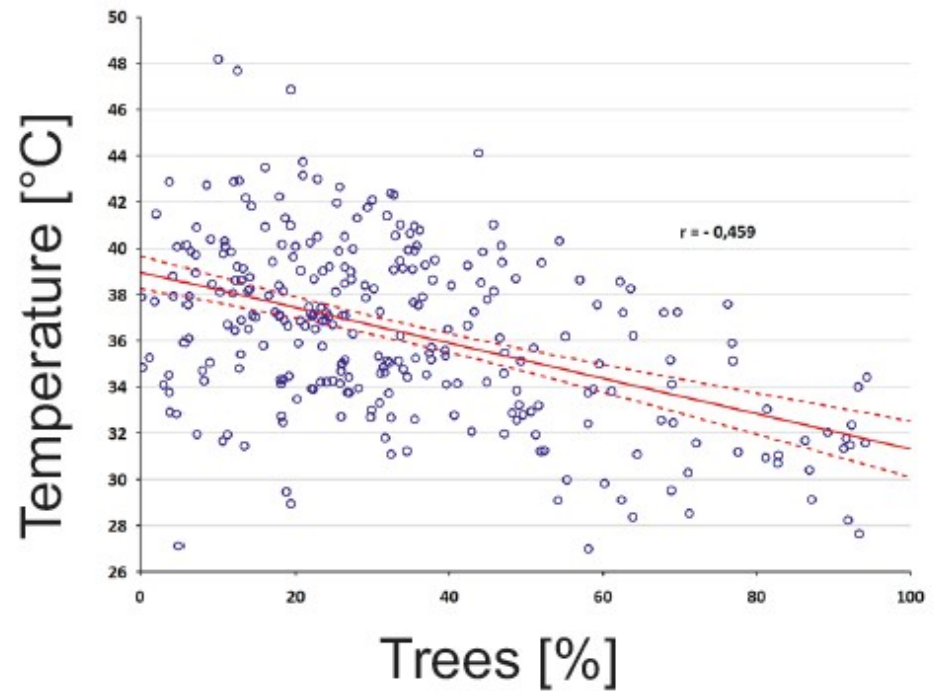
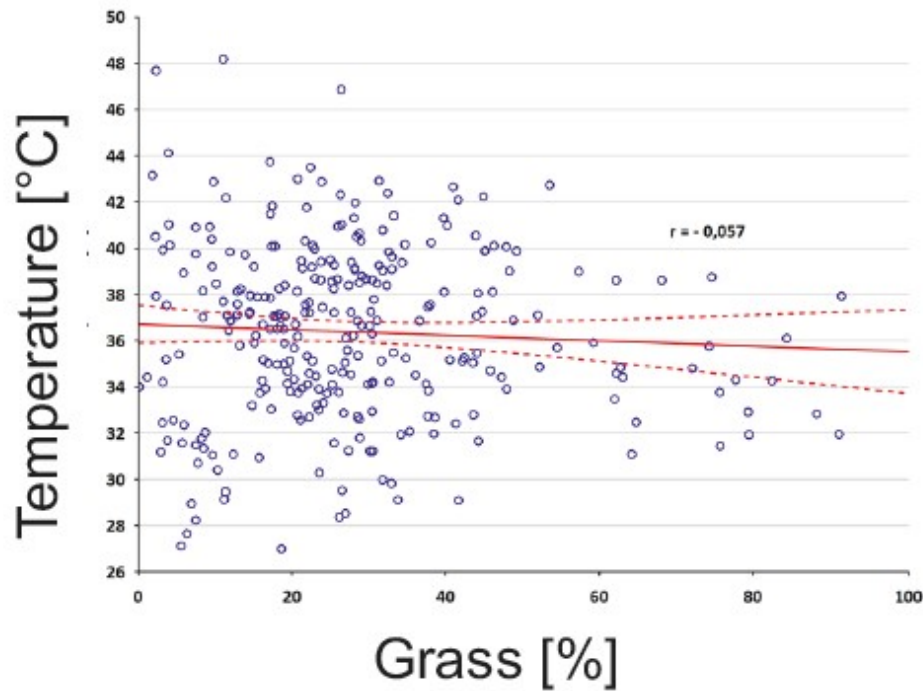
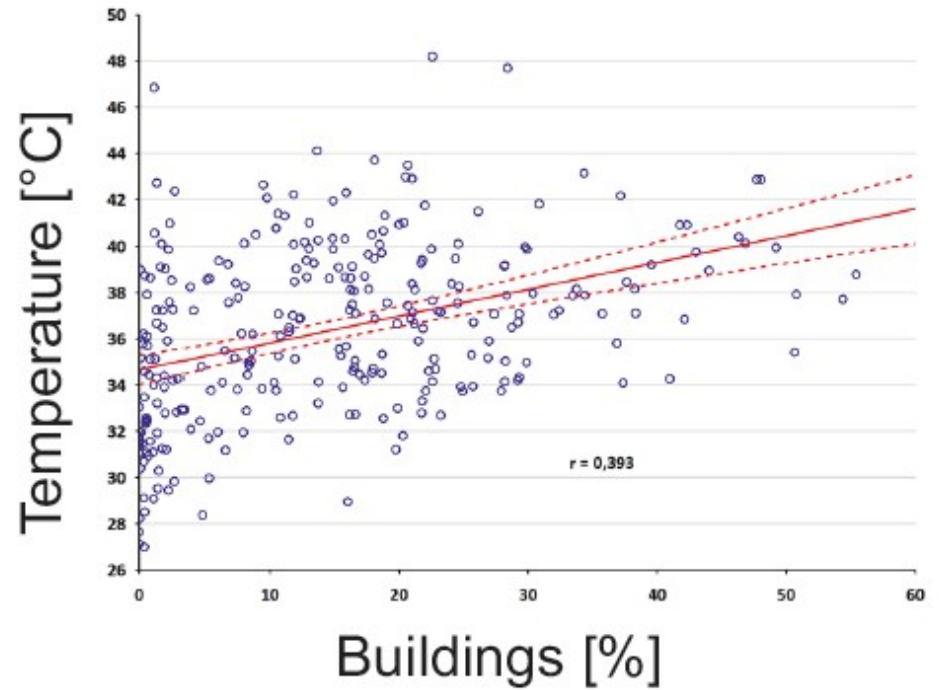
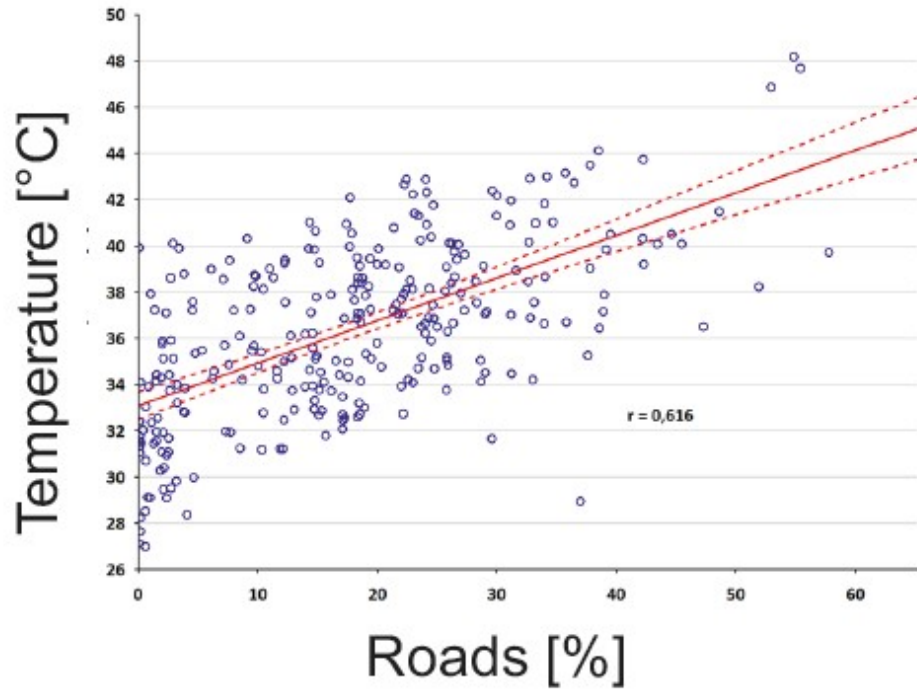
# Administration/urban units - temperature







# Impact of land cover on surface temperature



**Recently - two projects related to **functioning of urban ecosystems** with common denominator:**

**Impact of town structure and urban greenery on local climate**

-main focus on **mitigation of temperature** during spans of hot days, role of greenery, improving living conditions  
-close cooperation with users

**Projects' duration: 1. 1. 2019 – 31.12. 2021**

**Future - impact of **LCLUC changes on temperature regime** of urban ecosystems**

# I. Development of instruments for planning and assessment of ecological benefit of greenery in towns

## Outputs:

- **Methodology** for assessment of **greenery functions/ecosystem services** – > monetary value of the greenery
- **Tool for calculation of the ES - software**

**Users** – town planners, architects, administration (cooperation)

1. **cooling effect**
2. **carbon sequestration (CO<sub>2</sub>)**
3. **capture of particulate matters (harmful substances)**
4. **noise reduction**
5. **cultural and aesthetic effects**

The methodology based on **interdisciplinary knowledge** (plant physiology, particle capture and noise models, dendrology, remote sensing) and standard data from dendrological survey and urban greenery passports.

## II. Thermal comfort in urban areas: human perception, physical based reality, role of greenery

### Outputs:

- **Town maps of structure and surface temperatures**
- **Education materials (pupils, students, population) – roles of greenery, special focus on trees**
- **Sci paper**
- **Workshops**

**Users** – town administration and greenery managers, the public, children, students,...

### Approach – combination of

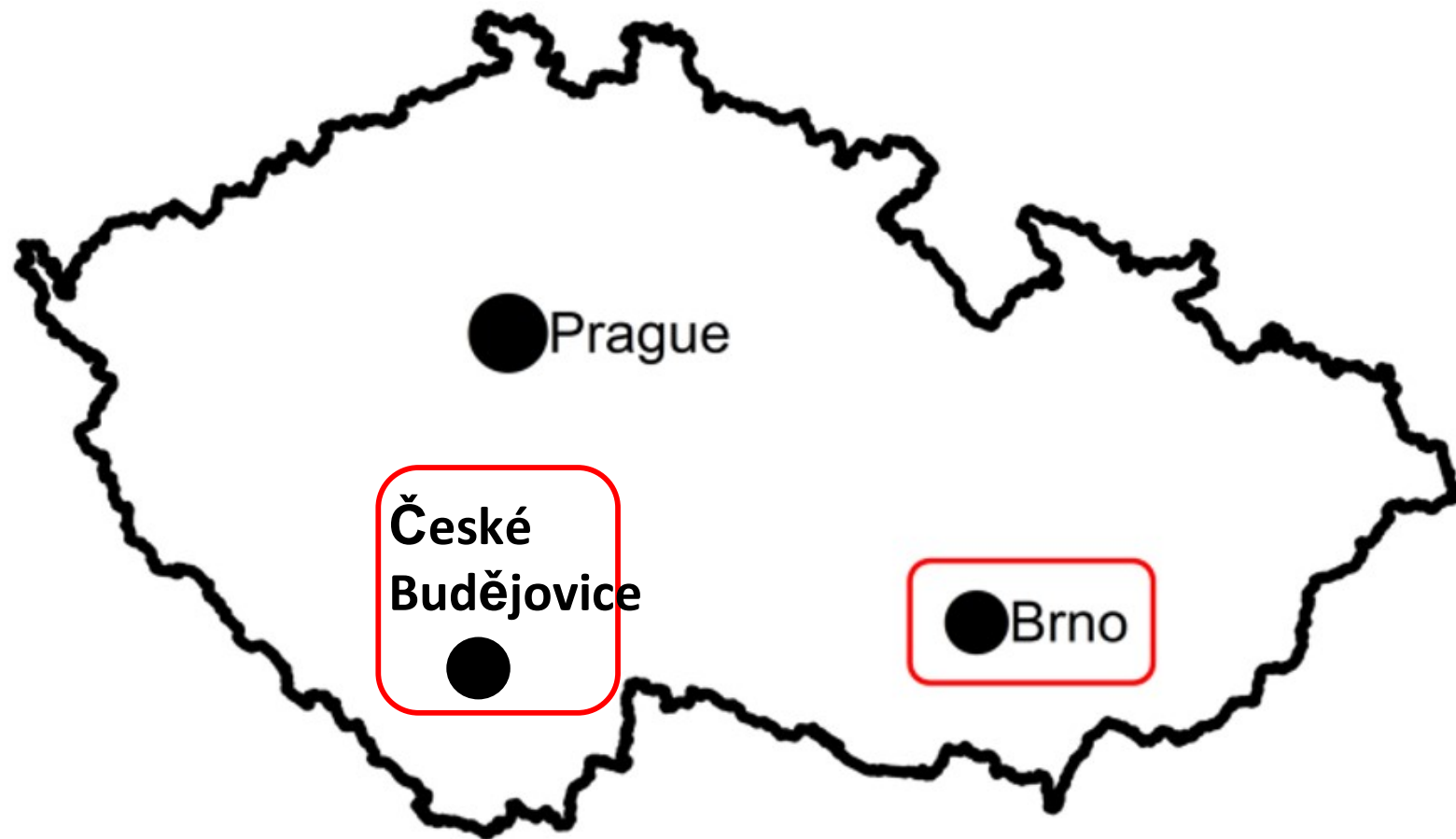
- **physical based data (airborne and ground scanning, ground measurements for calibration/validation)**
- **socio data (questionnaire surveys, perception of environment by people,...)**



**Territorially – a comparative study between:**

**1. more humid and flat region** (and perhaps more greenery) –  
South Bohemia - České Budějovice + villages

**2. dry and orographically more complex region** – South  
Moravia – Brno + villages





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Thank you for your attention

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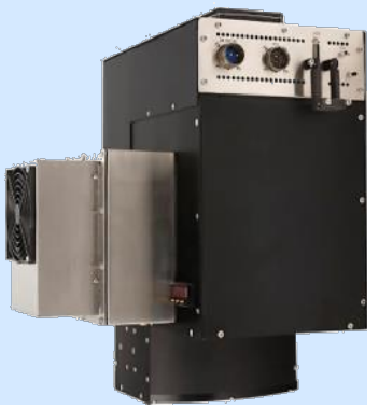
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# Flying Laboratory of Imaging Systems



**Visible and near infra-red  
imaging spectroscopy**



CASI-1500



SASI-600

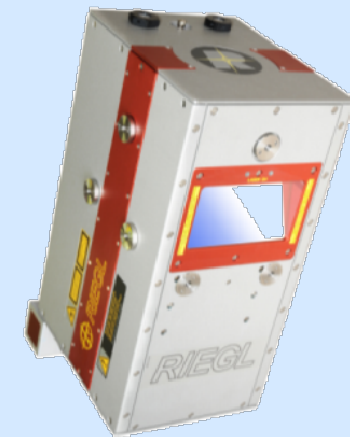
**Thermal imaging  
spectroscopy**



TASI-600

[www.czechglobe.cz](http://www.czechglobe.cz)  
SCERIN 2019

**Laser scanning**



Riegl LMS – Q780