


URBAN CLIMATOLOGY

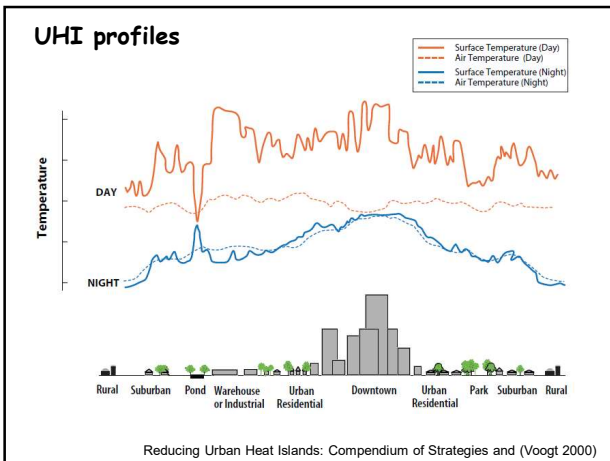
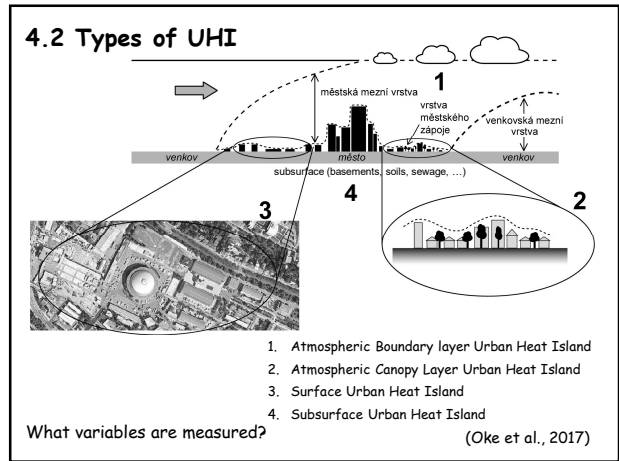
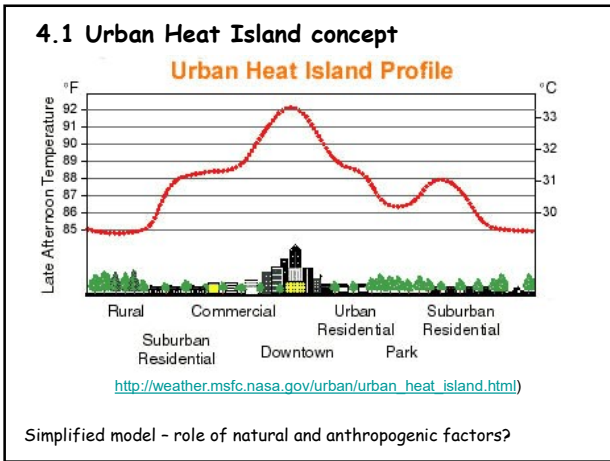
4. Urban heat Island, UHI types, atmospheric UHI, UHI intensity

Paper to read



**Reducing Urban Heat Islands:
Compendium of Strategies**
Urban Heat Island Basics

[https://is.muni.cz/auth/el/sci/jaro2021/ZX601/um/67875456/04_UHI_Basics Compendium.pdf](https://is.muni.cz/auth/el/sci/jaro2021/ZX601/um/67875456/04_UHI_Basics%20Compendium.pdf)

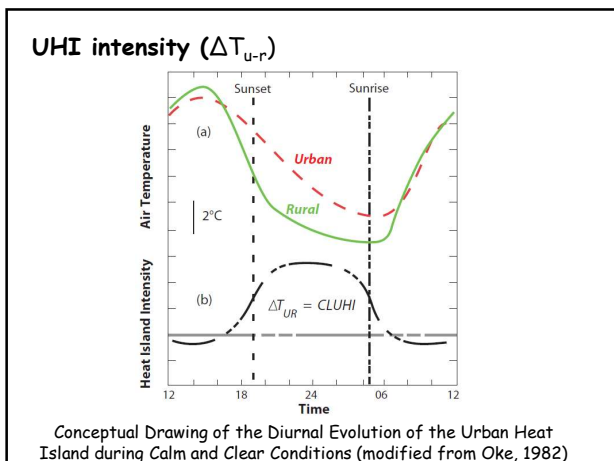


UHI types characteristic

Table 1: Basic Characteristics of Surface and Atmospheric Urban Heat Islands (UHIs)⁴

Feature	Surface UHI	Atmospheric UHI
Temporal Development	<ul style="list-style-type: none"> Present at all times of the day and night Most intense during the day and in the summer 	<ul style="list-style-type: none"> May be small or non-existent during the day Most intense at night or predawn and in the winter
Peak Intensity (Most intense UHI conditions)	<ul style="list-style-type: none"> More spatial and temporal variation: <ul style="list-style-type: none"> Day: 18 to 27°F (10 to 15°C) Night: 9 to 18°F (5 to 10°C) 	<ul style="list-style-type: none"> Less variation: <ul style="list-style-type: none"> Day: -1.8 to 5.4°F (-1 to 3°C) Night: 12.6 to 21.6°F (7 to 12°C)
Typical Identification Method	<ul style="list-style-type: none"> Indirect measurement: <ul style="list-style-type: none"> Remote sensing 	<ul style="list-style-type: none"> Direct measurement: <ul style="list-style-type: none"> Fixed weather stations Mobile traverses
Typical Depiction	<ul style="list-style-type: none"> Thermal image 	<ul style="list-style-type: none"> Isotherm map Temperature graph

Reducing Urban Heat Islands: Compendium of Strategies and (Voogt 2000)



UHI intensity (ΔT_{U-r})

The size of the city forms the intensity of UHI in general
 The size of the city can be characterized via number of inhabitants
 There is a relation between maximum UHI intensity (UHI_{max}) and number of dwellers (P) (van Hove et al. 2011):

$$UHI_{max} = 2,93 \log P - 11,95$$

For Brno ($P = 380$ ths.) $UHI_{max} = 4,4 \text{ }^\circ\text{C}$

How we can estimate UHI intensity depending on available data?

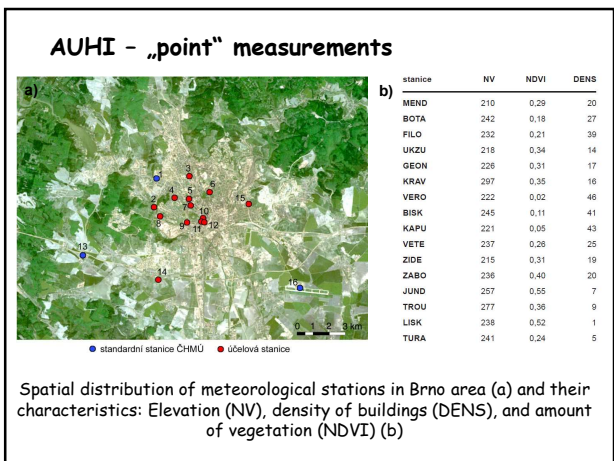
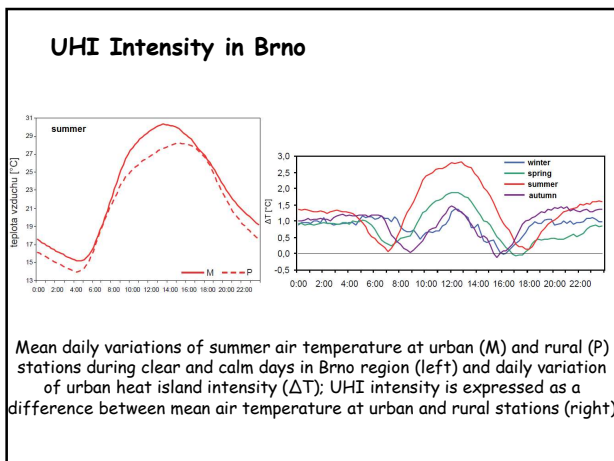
4.3 Measuring the UHI effect

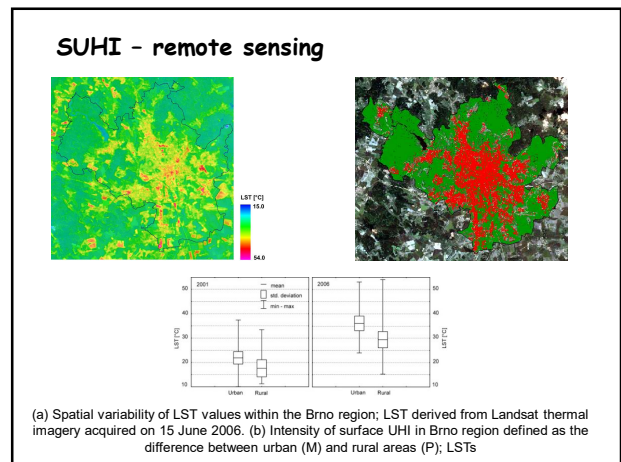
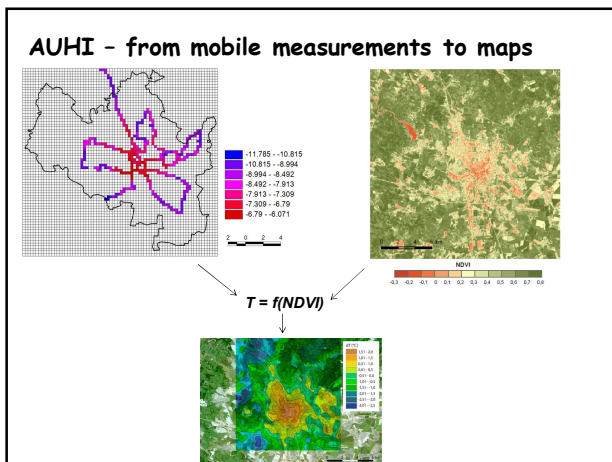
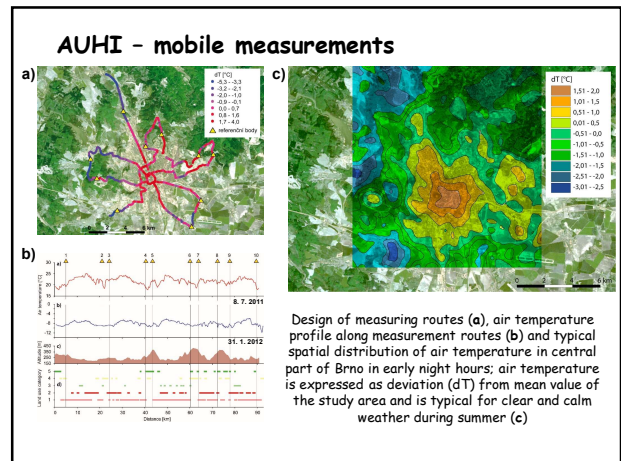
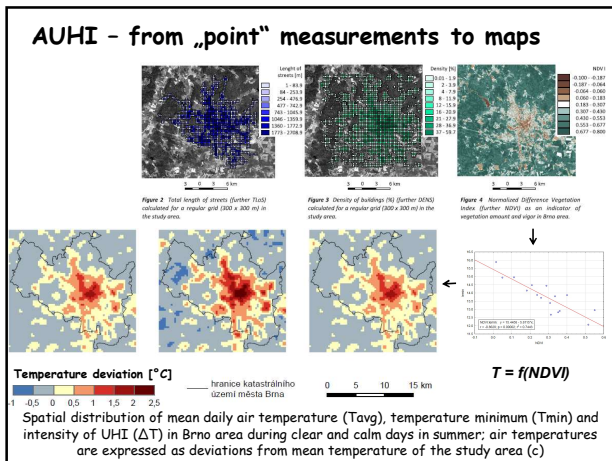
- „Point“ measurements - standard meteorological stations
- „Point“ measurements - special-purpose automatic stations
- Mobile measurements
- Urban remote sensing
- Urban climate and UHI intensity modelling

All types of measurements also involve three different components that are hardly to quantify (Lowry 1977):

1. the „background“ climate
2. the effects of local climate (topoclimate)
3. the effect of local urbanization

Where are the spatial limits of the urban effect?





UHI consequences

- UHI impacts may be **direct** and **indirect**, negative effects prevail in general
- Diurnal Temperature Range is smaller in cities
- Higher air pollution reduce nighttime cooling, both factors increase a discomfort for city dwellers
- Increased temperatures during summer in cities amplify energy demand for air conditioning.
- Higher surface temperatures can heat storm water runoff with negative effect of various water ecosystems (thermal pollution)
- Impacts to plants through changes in phenology may be ambiguous (beginning and end of individual phases of the growing cycle)

