

URBAN CLIMATOLOGY

Map of the local climate zones

practical exercise

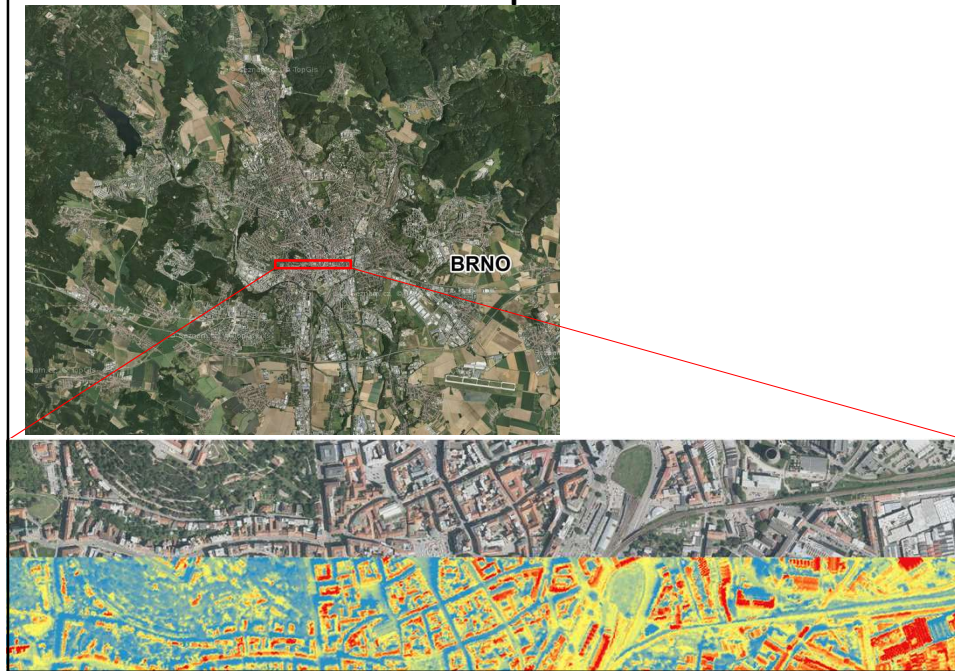


Local Climate Zones - basic premises

- Urban climate is **highly variable** in space and time
- If we want to study the urban climate, we need to **classify** it somehow
- One of the main factors that create a characteristic urban climate are **fabric (materials), land cover, structure and metabolism**.
- Land cover mapping can serve as a basis for urban climate classification
- In urban climatology, the **concept of the Local Climate Zones** was created during the last decade



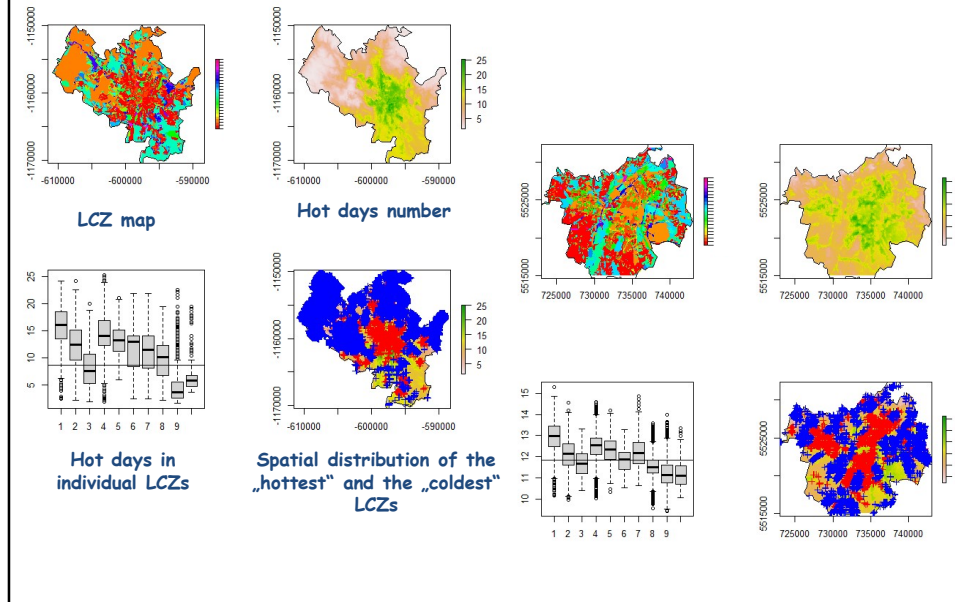
Local Climate Zones - basic premises



Local Climate Zones classification system

BUILT SERIES	LAND COVER SERIES	LCZ	OPEN LOWRISE	6
<p>LCZ 1 Compact high-rise</p>	<p>LCZ A Dense trees</p>	LCZ	OPEN LOWRISE	6
<p>LCZ 2 Compact mid-rise</p>	<p>LCZ B Scattered trees</p>	DEFINITION	<p><i>Form:</i> Small buildings 1-3 stories tall. Buildings detached or attached in rows, often in grid pattern. Sky view from street level slightly reduced. Construction materials vary (wood, brick, stone, tile). Scattered trees and abundant plant cover. Low space heating/cooling demand. Low traffic flow. <i>Function:</i> Residential (single or multi-unit housing, low density terrace/row housing); commercial (small retail shops). <i>Location:</i> City (medium density); periphery ("suburbs"); commuter towns. Rural towns. <i>Correspondence:</i> UCZ5 (Oke 2004); Do3 (Ellen 1990/91).</p>	
<p>LCZ 3 Compact low-rise</p>	<p>LCZ C Bush, scrub</p>	ILLUSTRATION	<p><i>High angle</i></p>	
<p>LCZ 4 Open high-rise</p>	<p>LCZ D Low plants</p>	PROPERTIES	<p><i>Low level</i></p>	
<p>LCZ 5 Open mid-rise</p>	<p>LCZ E Bare rock or paved</p>	<p><i>Sky view factor</i> 0.6 - 0.9</p> <p><i>Canyon aspect ratio</i> 0.3 - 0.75</p> <p><i>Mean building height</i> 3 - 10 m</p> <p><i>Terrain roughness class</i> 5 - 6</p> <p><i>Building surface fraction</i> 20 - 40 %</p> <p><i>Impervious surface fraction</i> 20 - 50 %</p> <p><i>Pervious surface fraction</i> 30 - 60 %</p> <p><i>Surface admittance</i> 1,000 - 2,200 m² s⁻¹ K⁻¹</p> <p><i>Surface albedo</i> 0.15 - 0.25</p> <p><i>Anthropogenic heat flux</i> ≤ 25 W m⁻²</p>		
<p>LCZ 6 Open low-rise</p>	<p>LCZ F Bare soil or sand</p>	<p>Variable land cover properties</p> <p><i>b</i> bare trees (i.e., deciduous, leafless) increased sky view factor, reduced albedo</p> <p><i>s</i> snow cover (> 10 cm in depth) low admittance, high albedo</p> <p><i>d</i> dry ground (e.g., parched soil) low admittance, large Bowen ratio, increased albedo</p> <p><i>w</i> wet ground (e.g., waterlogged soil) high admittance, small Bowen ratio, reduced albedo</p>		
<p>LCZ 7 Lightweight low-rise</p>	<p>LCZ G Water</p>	<p>0 100 m</p>		
<p>LCZ 8 Large low-rise</p>				
<p>LCZ 9 Sparsely built</p>				
<p>LCZ 10 Heavy industry</p>				

What can LCZs be useful for?



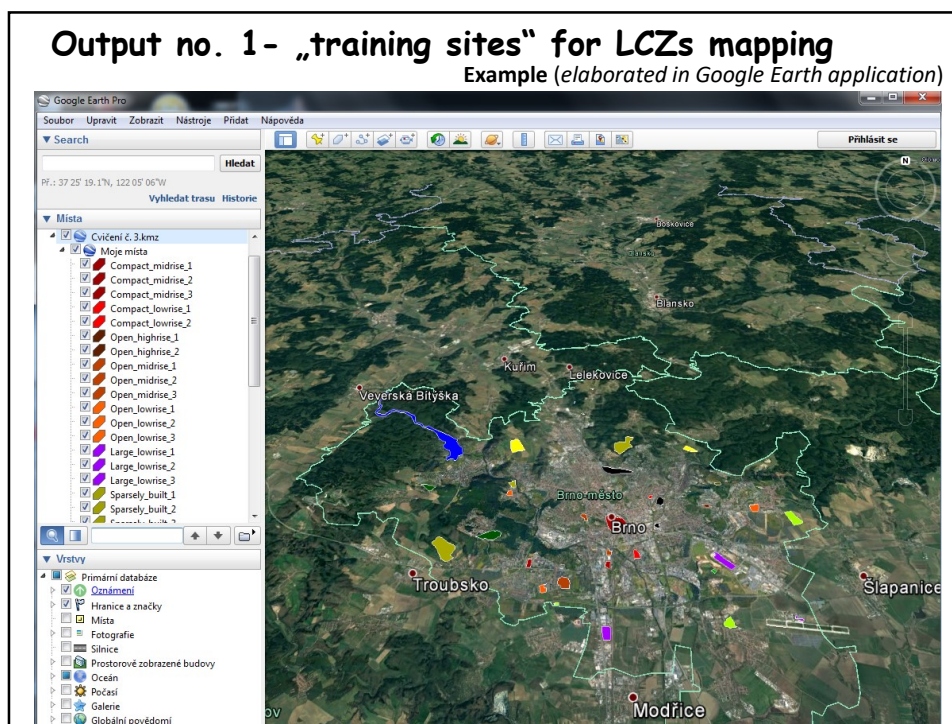
Excercise - LCZs mapping

Motivation: Land cover types and spatial structure of built-up areas, which can be directly seen on aerial photographs, well correlate with typical features of local climate in urban environment.

Tasks:

1. Learn about the concept of Local Climate Zones and its classification system
2. Choose a larger city that you are at least familiar with, for example your capital city
3. Use Google Earth map or some other internet map source (www.mapy.cz) and find a typical representative of individual LCZs in Your city (two typical snapshots).
4. Characterize each LCZ briefly - where it occurs (w.r.t. the city centre), is it rare or quite common LCZ, ... key words
5. Describe typical LCZs that are well represented in Your city. Mention those LCZs that do not occur in Your area.

https://is.muni.cz/auth/el/sci/podzim2022/ZX601/um/exercise/Local_climate_zones.pdf



Output no. 1 - „training sites“ for LCZs mapping

Draw 1-3 polygons that well represent individual LCZs in Your city. See Figure below as an example. In Google Earth You can add the legend (LCZ types with selected color) as follows:

Right click on

My places -> Add -> Folder

Create name of the of the folder – e.g. LCZ3

Then right click on LCZ3 folder

LCZ3 -> Add -> Polygon

Create name of the polygon (e.g. Site_3_1) and select color of the polygon, do not close window and place mouse over the map.

Find suitable place - left click defines polygon outer points, right click close the polygon

Repeat for 2–3 polygons for each LCZ

Now create folder for another LCZ – e.g. LCZ4 and repeat as above

Alternatively, You can create only the polygons (without folders). In this case You need to add proper names to individual polygons (see example – figure below)

Finally save Your map as follows:

File -> Save -> Save folder My places

This creates file My places.KMZ on Your computer.

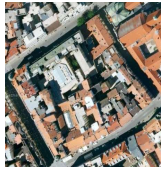
Make also a simple print screen of Your map.

Output no. 2- LCZ overview

When finished, write a report shortly discussing:

- 1) Which LCZs can be easily found (are typical) in Your city according Your opinion;
- 2) Which LCZs do not exist in Your area or which are hard to recognize

Besides the text, the final report will include the LCZ map (e.g. printscreen) and a short description of typical LCZs in Your city:



LCZ2 – compact mid-rise:
short paragraph with the LCZ characteristics



LCZ5 – open mid-rise:

Output no. 3- „positive“ and „negative“ sites

Select in Your city two sites representing according to You

- 1) A part of the city that contributes to **reducing the negative effects** of climate change on the urban climate
- 2) It is a part of the city that, on the contrary, **amplifies the negative effects** of climate change on the urban climate
- 3) Suggest what **realistic climate change adaptation measures** could be done in your city.



Excercise - final notes

- Prepare short PPT presentation (10-15 minutes)
- At the last meeting on December 4th, you will inform us of your results

Excercise - sources

IS learning materials

https://is.muni.cz/auth/el/sci/podzim2024/ZA311/um/exercise/Local_climate_zones.pdf

LCZ map generator - You can compare Your results

<https://lcz-generator.rub.de/>