

URBAN CLIMATOLOGY

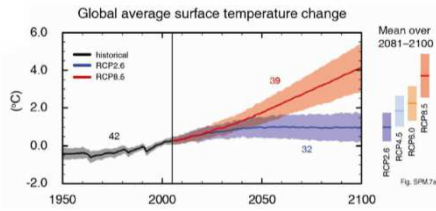
1. Motivation to study urban climates, historical overview

1.1 Motivation



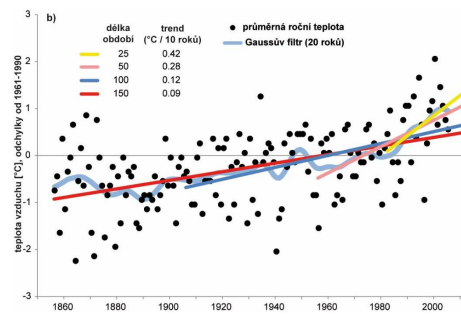
- Built-up areas create specific category of local climate - urban climate
- Climate in urban areas differ from that of rural areas due to process of urbanization
- Most of main meteorological elements and climatological characteristics have specific features of their spatial and temporal variability in urbanized areas
- However, typical spatiotemporal variability of urban climate in individual cities is formed as a superposition of natural and anthropogenic factors
- Specific features of urban climate may strongly affect economic activities infrastructure functioning, quality of life, etc.
- Importance of urban climate studies increase in recent decades due to global climate change

1.1 Motivation



Global climate change: increase of the mean global near-surface air temperature in the 2016-2035 period compared to the 1986-2005 period will reach with high probability $0.3^{\circ}\text{C} \sim 0.7^{\circ}\text{C}$

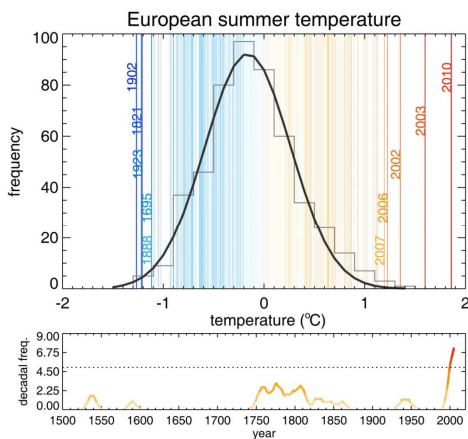
For the period 2081-2100 it will be about $0.3^{\circ}\text{C} \sim 1.7^{\circ}\text{C}$ (RCP2.6), $2.6^{\circ}\text{C} \sim 4.8^{\circ}\text{C}$ (RCP8.5) (IPCC 2013)



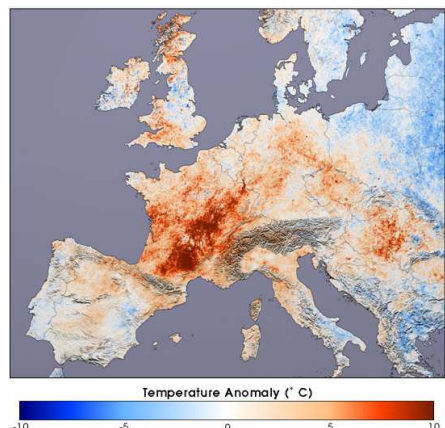
Mean annual air temperature on the territory of CR in the 1856-2005 period (Brázdil et al. 2012) completed with estimates of the linear trend for the last 150, 100, 50 and 25 years

1.1 Motivation

It is very probable that the frequency and intensity of hydrometeorological extremes will be higher in the near future



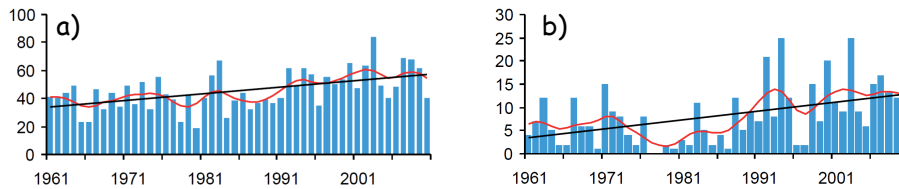
Distribution of mean summer temperatures in Europe in the 1500-2010 period



Heat wave in the western Europe: temperature differences between July 2003 and July 2001

<http://earthobservatory.nasa.gov/NaturalHazards>

1.1 Motivation



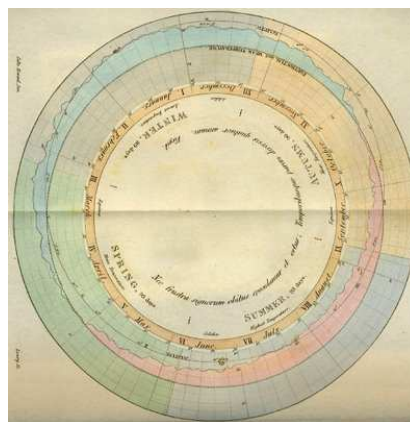
Annual number of summer days (a) and tropical days (b) in Brno, airport station in the 1961-2010 period completed with the low-pass Gaussian filter (10 years) and with the estimate of the linear trend

- **Higher heat load and higher extremity of weather and climate** may negatively influence living conditions in urban areas with the direct impact to quality of life and health of population
- Better knowledge of causes and mechanisms that form urban climate are necessary for the **mitigation** of negative impacts and for the realization of **adaptation** strategies

1.2 History

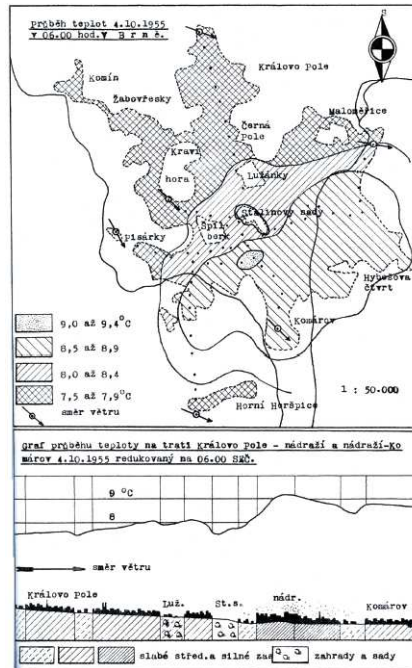


- Antiquity, middle ages
- bad quality of air in the cities, air pollution
- Luke Howard (1772-1864)
The Climate of London (1833)



1.2 History

- 20th century
- Special purpose measurements
- Mobile measurements
- Urban remote sensing



- dr. Quitt (1957) The climate of Brno,
 - mobile measurements

1.2 History

- 21th century
- concept of Local Climate Zones
- urban climate modelling (WRF, MUKLIMO_3D, ENVIMET)
- mitigation
- practical realisation of adaptation strategies



- www.urban-climate.org/

1.3 Final remarks and questions



Oke (2006) described the evolution of urban climatology using **eight modes of investigation or practice**:

- Conceptualisation
- Theorisation
- Field observation
- Modelling
- Model evaluation
- Application in urban design and planning
- Impact assessment (post-implementation)
- Policy development and modification.

1.3 Final remarks and questions



1. Is it an actual problem to study urban climates?
2. What do you know about history of urban meteorology and climatology?
3. What is the difference between "descriptive" and "physical" urban climatology?
4. May there be positive aspects of the climate change?
5. What are the main topics of urban climatology in the near future?