

URBAN CLIMATOLOGY

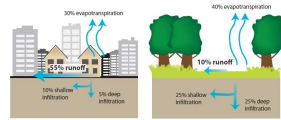
VII. Spatio-temporal variability of other meteorological elements in urban areas

7.1 Urban climate effects

Table U2 Urban climate effects for a mid-latitude city with about 1 million inhabitants (values for summer unless otherwise noted)

Variable	Change	Magnitude/comments
Turbulence intensity	Greater	10–50%
Wind speed	Decreased Increased	5–30% at 10 m in strong flow In weak flow with heat island
Wind direction	Altered	1–10 degrees
UV radiation	Much less	25–90%
Solar radiation	Less	1–25%
Infrared input	Greater	5–40%
Visibility	Reduced	
Evaporation	Less	About 50%
Convective heat flux	Greater	About 50%
Heat storage	Greater	About 200%
Air temperature	Warmer	1–3°C per 100 years; 1–3°C annual mean up to 12°C hourly mean
Humidity	Drier More moist	Summer daytime Summer night, all day winter
Cloud	More haze More cloud	In and downwind of city Especially in lee of city
Fog	More or less	Depends on aerosol and surroundings
Precipitation		
Snow	Less	Some turns to rain
Total	More?	To the lee of rather than in city
Thunderstorms	More	

7.2 Humidity in urban areas



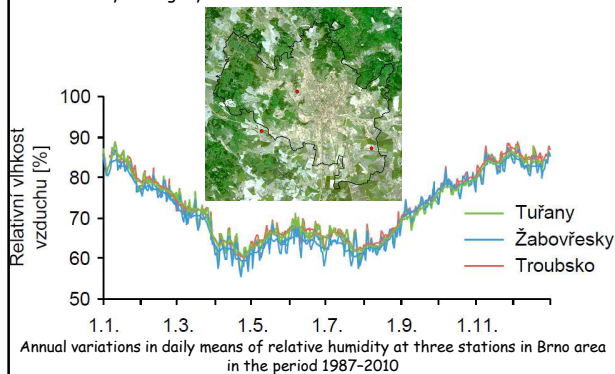
- Spatial and temporal variability of air humidity in urban areas is the result of evapotranspiration, condensation and advection processes.
- There are several positive and negative feedbacks.
- Higher temperature → higher intensity of evapotranspiration (that is however low due to lack of vegetation)
- No consumption of latent heat → rising temperature
- Fast runoff → less intensity of evaporation
- Urban dry island**

Humidity in urban areas

- Atmospheric humidity** is generally **lower** in cities during **daytime** (due to lower evapotranspiration compared to rural areas – there is smaller fraction of vegetation cover)
- At night and in winter there is an urban moisture excess (UME)** in mid- and high latitude cities. The reason is: i) additional water vapor from anthropogenic activities; ii) weak evapotranspiration in unstable atmosphere
- In some situations (dry spells, arid climate) **humidity can be higher** in cities due to extensive irrigation compared to neighborhoods
- Bad air quality mostly cause increase of fog frequency and intensity

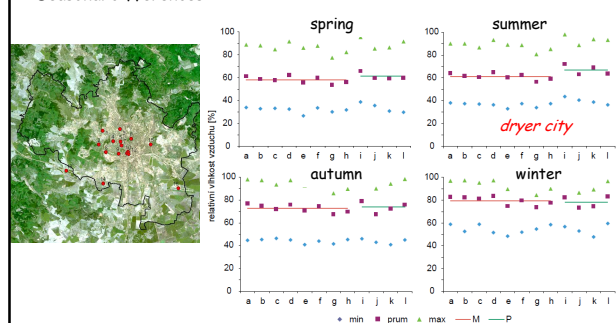
Relative humidity in Brno

Variability during a year

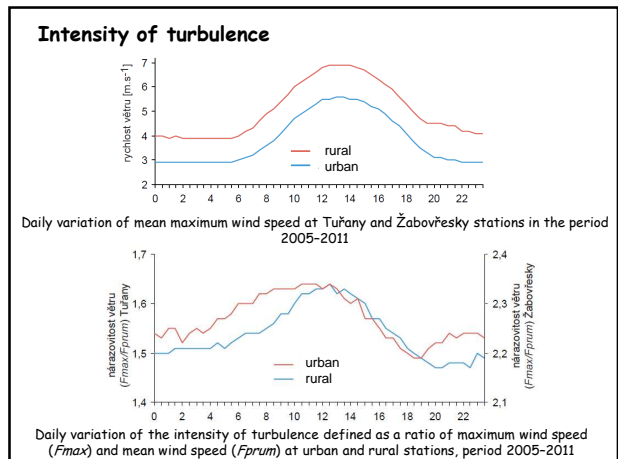
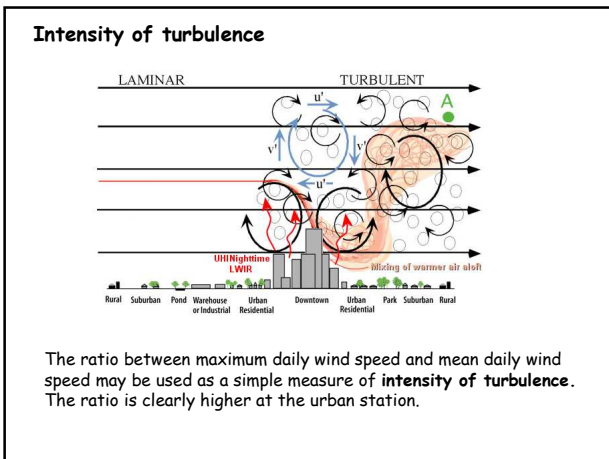
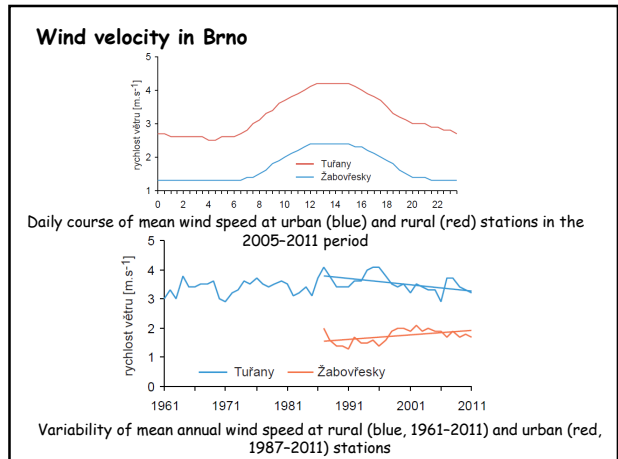
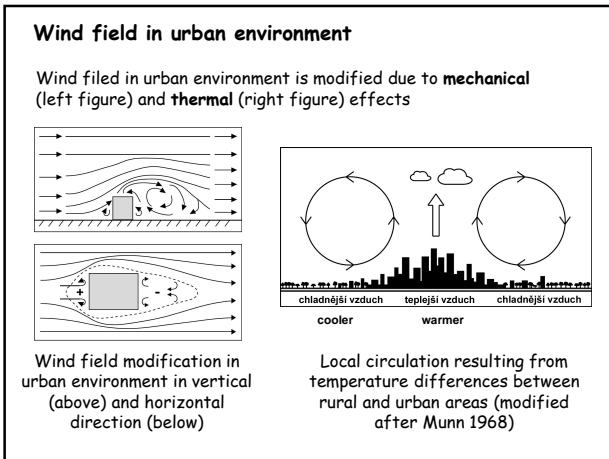
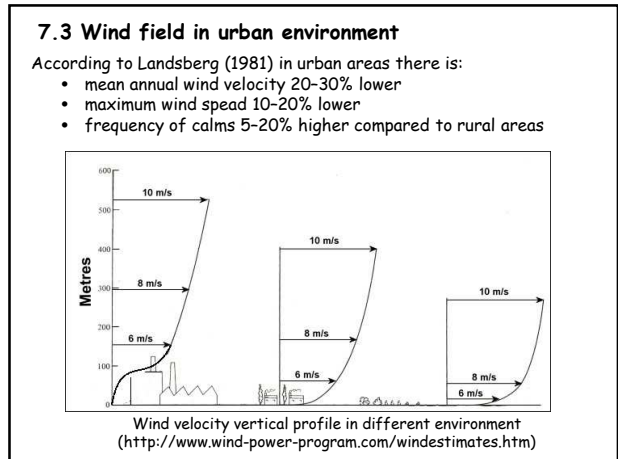
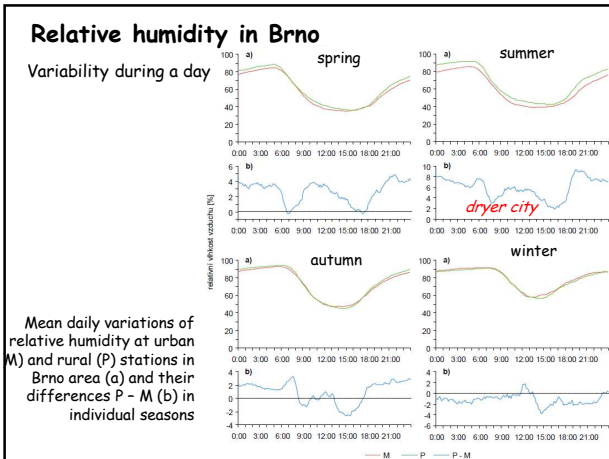


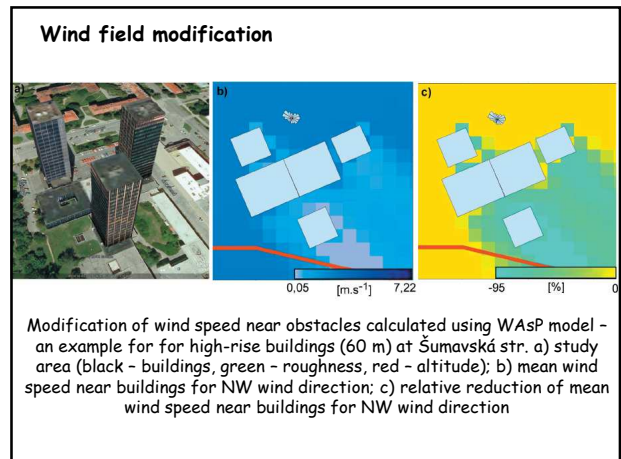
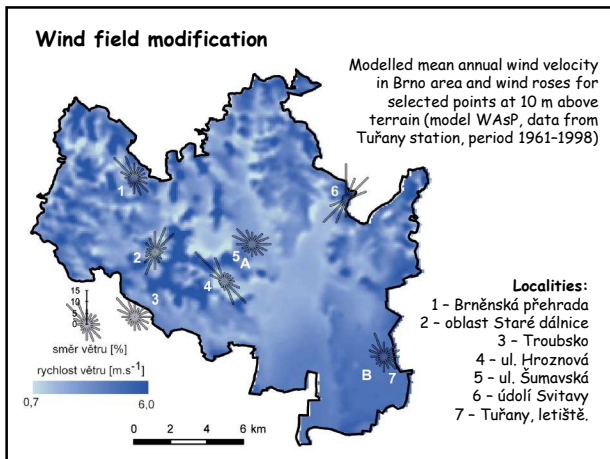
Relative humidity in Brno

Seasonal differences



Mean, min a max relative humidity in Brno area in individual seasons during days with radiation driven weather for urban stations (red) and rural stations (blue)





7.4 Final remarks and questions



1. How does the vegetation in urban areas influence humidity?
2. What is a typical variability of humidity in urban area during a day and during a year?
3. What are main factors modifying wind field in urban areas
4. What can be the most important negative effects of wind field modification in urban areas?