Adaptive capacities and resilience in urban and landscape planning

Motivation, Background and Aims

Climate change and the consequences for planning
Urban areas are particularly affected by climate change: the ever-advancing urban development in combination with the increased occurrence of extreme weather events has resulted in a growing number of hot days and warm nights that result in increasing heat stress. In addition, more frequent and intense heavy rain events are expected but also an increase in heavy rainfall events (IPCC 2021).

Challenges or research gaps addressed by the research project
- There is a lack of methods for the elaboration of planning advice maps.
- Changes of precipitation cannot be depicted for the small scale necessary for planning
- Deciding on the most effective measures depending on the structural-spatial framework is often complex (and costly due to complex simulations).
- There is a lack of instruments to steer and monitor implementation.

Theoretical framework concept for urban climate analyses and the planning recommendation maps

The implementation of the IPCC risk concept in urban climate analyses

Components of Urban Climate Analyses for the Development of Planning Recommendations and Planning Recommendation Maps
Urban climatic analyses must include four components to enable spatial climate change adaptation:
1. Urban climatic analysis related to the hazard component,
2. In depth social and spatial analysis related to exposure and vulnerability components,
3. Adaptation measures and effects related to the sub-component of vulnerability, the adaptive capacity component and thus
4. Planning recommendations and planning recommendation maps as “guidance to reduce the risk”.

Practical cooperation with municipalities for analysis and methods development

Test site: municipality Perchtoldsdorf
Perchtoldsdorf is a municipality in Lower Austria with ~ 15,000 inhabitants at the south-western border of the City of Vienna.

Thermal component
The simulations carried out with the urban climate model MUKLIMO_3 (Sievers, 2016) are based on real-case conditions for a selected day during a heatwave event (17.08.2022). The model was initialized with meteorological data from the weather forecast model AROME. The distribution of near-surface air temperature with a spatial resolution of 20 m indicates areas prone to heat stress, providing the basis for an urban climate analysis. (Fig. 3).

Dynamical component
To take into account the dynamic component of the analysis, the cold air drainage model KLAM_21 (Sievers, 2005) is applied to simulate important nocturnal cold air flows under fair weather conditions. Fig. 5 shows the spatial distribution of the height of the cold air layer 2 and 4 hours after sunset.

Practical cooperation with municipalities for implementation of adaptation

Important fields of action in planning for climate change adaptation in municipalities:
1. Settlement development (planning and building),
2. Green spaces,
3. Water,
4. Mobility

Potential planning measures using the example of “climate-friendly roads”:
- Effectiveness during drought
- Effectiveness during heat
- Effectiveness during heavy/rainy events

Catalogue of measures and checklist for implementing concrete measures:
- Effectiveness during heat
- Effectiveness during drought
- Effectiveness during heavy/rainy events
- Effectiveness during drought

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