CLUDEX - Climate Change and urban densification –

heat exposure and ventilation under current and future climate, current urban structure and future urban densification – 1st results

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OBJECTIVES:

CLUDEX examines the impact of urban densification on (current and future) urban climate in Vienna's 12th district Meidling.

- **3D city models** of the current urban structure and a **densification scenario** will show the areas' **building growth potential** according to the maximum building height targets.
- **Effects of urban densification on local climate** will be examined through **microclimate simulations**
- **Thermal comfort** will be **modelled** for building - and rooftop extensions
- **Adaptation measures** will be **discussed with stakeholders (**In project year 2)
- **Adaptation effects will be simulated** under future climate conditions
- Results shall feed into **urban planning guidelines**.

Figure 1: Building structure and densification potential in Vienna's 12th district. Top: current building structure:, bottom densification scenario according to the Vienna zoning plan. (Sources: AIT: 3D model, densification scenario, Wien MA18,: height zoning map)

METHODS:

3D city model generation

- The 3D city model is derived by extruding the buildings' footprints to 3D objects using their height information.
- The densification potential is modeled, based on height zoning information.

Urban climate simulation:

- Reclip:century HADCM3 simulation results from the AR4 A1B GHG scenario with 10x10 km grid spaceing has been downscaled to 4x4 and 1x1 km for Greater Vienna,
- Model: COSMO-CML with urban extension
- Simulation: 1960 to 2100, results: hourly data.

Microclimate simulations:

- Simulation tools: EMVI-MET V3;SOLWEIG Grasshopper/Ladybug
- Simulation runs: duration 3 days
- Simulation resolution 2 m

CURRENT AND FUTURE URBAN CLIMATE FRAMEWORK:

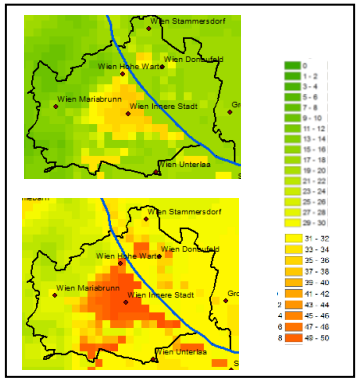

Figure 2: Tropical nights per year - decadal average 2011-2020 and 2041-2050. (Source reclip:century simulations, COSMO-CML- HADCM3 A1B scenario, downscaled to 1x1 km through COSMO-CML)

1st RESULTS: IMPACT OF DENSIFICATION ON URBAN MICRO-CLIMATE

Changes in heat exposure because of densification: Mean Radiant Temperature (MRT) pattern of a very hot day for a sample area – in Meidling (Reference day: August 10, 2014).

- **During day time the densification scenario leads to more shade and thus lower MRT and ambient air temperature,**
- **Night time is affected by higher MRT because of heat trapping due to "deeper" street canyons and more heat storage in the extended building volumes.**

Figure 3: Current building structure (base case, (left) - and densification scenario (right), extending building heights to the height zoning maximum.

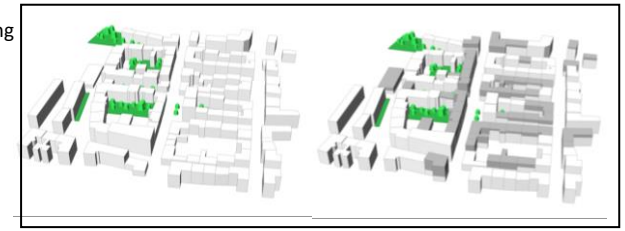

Figure 4: MRT during a hot summer day (24 hours average) for the base case (left) and the densification scenario (right).

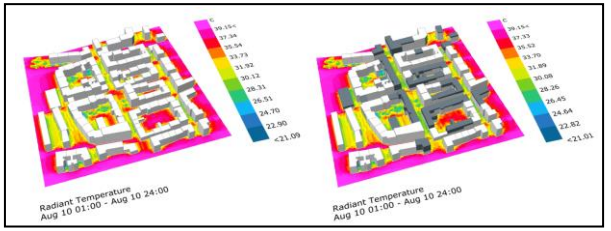

Figure 5: MRT-differences between base case and densification scenario as day-time average (left) and night-time average (right).