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Microclimatic effects of different building development plans as evaluated by a microclimate and a building energy model

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Processes of increasing urbanisation, modification of the urban surface or reconstruction within cities are affecting the urban microclimate. On the local scale, say on horizontal scales of tenths to hundreds of meters, the effects of microclimatic modifications due to reconstruction or land development (e.g. building construction) are generally small in absolute numbers, e.g. < 0.5 K of air temperature in comparison of status-quo to construction scenario. However, in the context of microclimatic effects, nocturnal temperature modifications or human thermal comfort assessment those differences might still be significant. To transfer the relevance of those findings to decision makers, urban planners or to the general public other, more 'general metrics', might be appropriate.

In the present study the microclimatic effects of a real construction project in Braunschweig, Germany were analysed with a combination of the microclimate model ENVI-met and the building energy model EnergyPlus. The idea was to transfer microclimatic differences into costs for energy consumption (heating and cooling demand) of a virtual building under different construction scenarios. This results in a very general metric to assess microclimatic differences. The difference of meteorological parameters between different scenarios turned out to be relatively small in the simulations, e.g. a maximum for air temperature difference of 0.43 K for an August day. Differences in wind speed were also small with less than 0.1 m s-1 differences. However, under different scenarios monthly differences for energy consumption costs resulted in up to 51 €.

The combination of microclimate and building energy simulations might help to transfer small but significant effects of microclimatic modifications by urban planning (e.g. construction) to the public. This will increase the awareness of applied aspects in urban climatology.