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The impact of urban green areas and water bodies on the urban climate

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Due to climate change thermal loads will increase; especially in cities this will cause negative impacts on the human beings. Therefore mitigation strategies should be developed and considered in urban planning today to prevent future thermal stress.
This study numerically simulates the influence of different mitigation measures on human thermal comfort (PET) in cities employing the micro-scale urban climate model ENVI-met. The model area (21 ha) is a city center district in the city of Oberhausen as an example for the densely populated metropolitan region Ruhr, Germany. Particularly the influence on thermal comfort by enhancing areas with high evaporation capacity (green areas and water bodies) was investigated. In different scenarios areas of 1 ha were modified, i.e. in the model area residential blocks were replaced by water bodies or different kind of urban greens. Thus the effect of small-scale changes could be analysed and their effectiveness assessed.
The simulation results confirm positive effects on thermal comfort by increasing the fraction of areas with high evaporation capacity. The efficiency of PET reduction of the different mitigation scenarios is dissimilar. At day-time the park scenario reaches a maximum PET reduction between -6 and -11 K (depending on meteorological boundary conditions) and shows a positive influence on the thermal comfort in the built-up area downwind. The maximum PET reduction (-10 K) of the scenarios grass and water body is quite similar to the park scenario, whereas their range is low.
Concluding in urban areas the implementation of parks is particularly advisable, because they reduce thermal stress both by tree shading and evapotranspiration. Furthermore ventilation lanes should be kept free to ensure the ventilation of the considered site in order to achieve the maximum range of the thermal reduction effect.