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Assessing uncertainties for the calculation of perceived temperature in an urban environment

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The design of livable public urban outdoor spaces becomes more important due to the increasing fraction of urban population around the world. One aspect of livable public spaces is the thermal environment. People perceive the thermal environment as a combined effect of temperature, humidity, wind and radiation. To quantify the effects of the thermal environment on the human body, thermo-physiological models and thermal indices are used. Although various indices and models exist, it remains unclear, how complex the calculation of perceived temperature needs to be in an urban environment where the meteorological variables are influenced by the urban morphology. Consequently, the aim of the present study is to determine the sensitivity of the perceived temperature to various parameters and to assess the accuracies required for the calculation of perceived temperature within a specific uncertainty range in an urban environment.

As an indicator for the perceived temperature the physiological equivalent temperature (PET) is used. To account for urban effects on radiation, a simple model for mean radiant temperature within the urban canopy is developed. Among others, the sensitivities of PET to building height and meteorological parameters are determined. These sensitivities are compared to PET's sensitivities on physiological parameters (population groups, e.g. age and gender). Based on the results, we conclude how detailed the simulation of individual population groups needs to be in comparison to physical and meteorological factors including their uncertainties that arise from the inexact detailed knowledge of the environmental conditions within a city.