Pathways for climate change adaptation in urban areas - first results from field measurements and ENVI-met modeling

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In the context of climate change, more frequent and intensive exposure to heat stress is observed and predicted for many cities worldwide. Urban climatological studies in recent decades have shown significant positive trends in the number of hot days. As heat stress poses a considerable health risk, adaptation measures need to be developed. Against this background, the research study aims to measure and model the urban microclimate of a 15 ha study area in Cologne. A network of IButtons and Netatmo weather stations with ultrasonic anemometers is used to measure temperature, humidity and wind speed/direction for assessing the climate character of the study area. The low cost sensors are calibrated against built up research grade meteorological stations. Utilizing low cost sensors also provides opportunities to activate citizens in microclimate research and to foster participation in mitigating climate change effects. The measurement network is set up as transects along street corridors and is used to a) identify the local climatic impacts of different surface types, vegetation areas and building structures, and b) to later calibrate and validate the ENVI-met model. Processes affecting the urban energy balance and microclimate are identified focussing particularly on source areas of excessive heat. Effects of urban green infrastructures are analysed with regard to their mitigation potential for heat stress, water demand for evapotranspiration, and their potential to modify the partitioning of the radiation balance into sensible heat and latent heat flux. We will use the validated ENVI-met model to simulate various adaptation scenarios and climate change scenarios. Adaptation measures will comprise changes in surface (e.g. urban water bodies and vegetation areas), facade/roof greenings or cooling materials. Climate projections until 2099 will be used with ENVI-met by downscaling meteorological data using the Statistical DownScaling Model (SDSM) and assuming the HadCM3 future emission scenarios.