Board 1850: *High-Resolution Microclimate Modelling to Evaluate Urban Heat Mitigation Potentials of Rainfed Climate Change Adaptation Measures on Buildings under Various Climatic Conditions*

Tuesday, 12 December 2023
23:10 - 03:30
Poster Hall A-C - South (Exhibition Level, South, Moscone Center)

Abstract

Due to global warming, heat stress is becoming a major challenge especially in cities where an intensification of the urban heat island effect is observed and further expected. Climate change adaptation measures are a key strategy to mitigate heat stress and health consequences. Successful adaptation should cool down both indoor and outdoor conditions. As indoor heat is mainly caused by wall heat flux, measures like green, blue or blue-green roofs or facades are a promising approach. These measures on buildings can also easily be scaled as they do not require additional space. However, cooling effects of evaporation-based measures are largely limited by water availability to enable latent heat flux and reduce wall heat flux at extreme heat events or prolonged drought periods. Rainfed water storage systems at buildings like cisterns with a PV-driven pumping mechanism not only supply water for greenings or wet roofs during hot days, but also store storm water to reduce flooding risks. This research aims to simulate heat mitigation effects of rainfed nature-based and technical solutions on buildings using the physically-based high-resolving microclimate model ENVI-met in contrasting climatic conditions. A 3D gridded 16 ha model domain of an urban high-density area in the mid-latitude city of Cologne/Germany and monsoon driven city of Pune/India was parameterised using field observations and remote sensing data. Both models are validated based on a setup quality-controlled, densely-distributed microclimate sensor network. Scenario analyses are performed to quantify cooling effects of intensive/extensive roof greenings, (non-)ground-based facade greenings, wet roofs and combinations. Specific water demands for irrigation of greenings or blue roofs from a managed local rainfed storage are determined to analyse how often and effectively the systems can be operated. Simulation results show significant potential cooling effects in both study areas which are stronger for Pune. Due to water scarcity in the Indian pre-monsoon season, actual heat mitigation potentials are significantly lower than in Cologne as measures can rarely be operated for extreme heat waves at the end of the season. To effectively improve thermal comfort in monsoon conditions, potentials of other measures will be simulated in further research.

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