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Climate change adaptation through citizen participation: Simulation of the effect of willingness to act on the heat mitigation potential in urban neighborhoods with different social milieu composition

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The urban population is particularly affected by the consequences of climate change. The increasing frequency and intensity of extreme weather events such as heat, drought, extreme precipitation and flooding has significant negative effects on human comfort, well-being, health and mortality rate. Sustainable urban development therefore requires the implementation of climate change adaptation measures as well as the acceptance, activation and participation of urban dwellers. The feasibility and effectiveness of climate change adaptation measures vary spatially due to the given local conditions. Additionally, the awareness, ability and willingness to act and pay differ between social milieus. The aim of this study is to analyse how a difference in the milieu-related willingness to act and operational ability to implement climate change adaptation measures affects the heat mitigation potential in two neighbourhoods in the city of Cologne/Germany with a significantly different social milieu composition. To investigate the relationship between the degree of willingness to act and the cooling effects of technical and nature-based solutions for heat mitigation, scenario analyses are performed using the physically-based, 3D gridded urban microclimate model ENVI-met for a neighbourhood in Cologne Suedstadt which is dominated by the social milieus of performers, post-materialists, neo-ecologists and conservatives. The model was parameterized based on field measurements and remote sensing data, and has been validated by a setup quality-controlled, densely-distributed microclimate sensor network in the study area. The agent-based scenarios represent a different percentage of residents willing to implement climate change adaptation measures in their living environment. These measures include facade greenings, roof greenings, cooling building materials and light surfaces. To identify the microclimate sensitivity, a scenario with a willingness to act of 0%, 25%, 50%, 75% and 100% of all dwellers in the neighbourhood is designed in the model domain. Simulation results show that the willingness to act has a significant influence on the cooling effect and thus the heat mitigation potential in this study area. In future research, the willingness to act in this upper-middle class neighborhood will be compared to a neighbourhood in Cologne Muelheim which has a significantly different social structure and is dominated by consumer-hedonism and traditional milieus. It will also be investigated how citizen science approaches, participation and activation measures can change the willingness to act and the acceptance of

climate change adaptation measures in these contrary urban neighborhoods.