Street trees mitigate severe local heat stress for pedestrians in summer

Hyunjung Lee(Hyunjung.Lee@stuttgart.de)
Office for Environmental Protection, City of Stuttgart, Germany

Abstract

In order to adapt the design of cities and the urban population to climate change, urban planning aims at the balance between the grey and green infrastructure. Both types of infrastructure are necessary for a prosperous and attractive urban area. With respect to the potential of urban cooling, street trees as one of the effective green countermeasures are gradually highlighted in the urban planning. Though the qualitative heat mitigation effect of street trees for pedestrians is already well-known, a systematic quantification on how various features of street trees may reduce outdoor human heat stress is still lacking. In order to contribute to the filling of this gap, numerical scenario simulations were conducted in the city of Freiburg (Southwest Germany) for a Central European heat wave day by use of the validated version 4.0 BETA of the ENVI-met model. They were focused on the mitigation of daytime heat stress for pedestrians on both sidewalks of an E-W wide (H/W = 0.5) as well as deep (H/W = 2.0) street canyon dependent on different street tree characteristics such as dimension, arrangement and number of trees. Human heat stress was quantified in terms of mean radiant temperature (Tmrt) and physiologically equivalent temperature (PET). Taking account of the sun altitudes in Freiburg in summer, the simulation results show that there is no heat-related need for planting trees on the N-facing sidewalk, because it is widely shaded by its bordering building. On the S-facing sidewalk, however, the expected mitigation of outdoor human heat stress by street trees is clearly quantified by the Tmrt and PET results, while it is hardly reflected by results for the air temperature, which is a well-known variable to urban planners. This again implies the need for a distinctly stronger involvement of methods of urban human-biometeorology into the work of urban planners.

Keywords: *street tree, human heat stress, PET (physiologically equivalent temperature)*

Biography

Dr. Lee is working at the Department of Urban Climatology, Office of Environmental Protection, City of Stuttgart (Southwest Germany). She is mainly concerned with current issues of planning-related urban climatology and adaptation strategies within cities to regional climate change as well as the evolution and evaluation of the local urban air quality situation.