Geophysical Research Abstracts
Vol. 19, EGU2017-2733, 2017
EGU General Assembly 2017

Thermal (dis)comfort experienced from physiological movements across indoor, transitional and outdoor spaces in Singapore: A pilot study

Su Li Heng (1) and Winston Chow (2)

(1) Department of Geography, National University of Singapore, Singapore (a0118865@nus.edu.sg), (2) Department of Geography, National University of Singapore, Singapore (winstonchow@nus.edu.sg)

Human thermal comfort research is important as climate discomfort can adversely affect both health and work productivity in cities; however, such biometeorological work in low-latitude urban areas is still relatively unstudied hitherto. In the tropical metropolis of Singapore, a suite of policies have been implemented aimed at improving environmental sustainability via increasing car-free commutes and pedestrian movement during work/school journeys, with the consequence that individuals will likely have increased personal exposure through a variety of spaces (and climates) during typical daily activities. As such, research into exploring the thermal (dis)comfort experienced during pedestrian movements across these indoor, outdoor and transitional (semi-outdoor) spaces would yield interesting applied biometerological insights. This pilot study thus investigates how pedestrian thermal comfort varies spatially across a university campus, and how the physical intensity of pedestrian travel affects thermal comfort across these spaces.

Over a 10-week period, we profiled six students for both their objective and subjective pedestrian thermal comfort during traverses across different spaces. Data were obtained through use of (a.) of a heat stress sensor, (b.) a fitness tracker, and (b.) a questionnaire survey to record traverse measurements of the microclimate, their physiological data, and their perceived microclimate comfort respectively. Measured climate and physiological data were used to derive commonly-used thermal comfort indices like wet-bulb globe temperature (WBGT) and physiological equivalent temperature (PET). Further, interviews were conducted with all six subjects at the end of the fieldwork period to ascertain details on individual acclimatization behavior and adaptation strategies.

The results indicate that (a.) more than 50% of the microclimatic conditions within each indoor, semi-outdoor, and outdoor space exceeded heat stress thresholds of both PET and WBGT, and that participants often were at “high” risk of heat stress from pedestrian movement; (b.) participants were most comfortable with humidity sensations across all spaces compared to other microclimate sensations (e.g. wind, heat, sun); (c.) correlation between microclimate sensation and WBGT varied across participants and across spaces, with stronger correlation between sun sensation votes and WBGT for most participants, and (d.) heart rates of individuals were not significant in estimating and predicting PET for activities such as pedestrian walking.

Present results confirm that WBGT applies better to hot climates and outdoor thermal comfort, but not so for hot, humid climates and indoor thermal comfort. Self-reported (subjective) thermal comfort also differed from measured (objective) thermal comfort and across participants because acclimatized individuals can have different sensitivities and acceptance towards (dis)comfort arising from pedestrian movement across spaces. Finally, we suggest that future pedestrian thermal comfort studies employ longitudinal studies and traverse measurements to consider the critical aspects of thermal history and individual sensitivities to on (dis)comfort levels.