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Human thermal sensation (comfort) levels in summertime to create adequate human bioclimatic maps using computer modeling for the use of urban and landscape planning and design

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Human bioclimatic maps are created based on human thermal sensation or comfort results and include one of the most useful climatic information for urban and landscape planning and design. However, the maps often show wrong information because of inaccuracies of input climatic data and/or existing problems of computer simulation programs.
This study examined microclimatic aspects and human thermal sensation between in situ measurement and computer modeling using ENVI-met. Two study sites were tested: a central business district (CBD) and a campus of Changwon National University (CNU) in Changwon, Republic of Korea, in summer 2012.
The computer modeling results showed that air temperatures were underestimated and relative humidities and mean radiant temperatures were greatly overestimated. Wind speeds were underestimated in CBD but overestimated in CNU. Human thermal sensation, PMV and UTCI, were also overestimated in the daytime, up to 2.3 PMV and 5.7 °C UTCI, but underestimated in the nighttime, up to 1.4 PMV and 5.0 °C UTCI.
In a sensitivity test of climatic factors for human thermal sensation, half a level of PMV (0.5) and UTCI (3 °C) in heat stress can be changed by changes of 3 °C of air temperature in PMV and 3-5 °C in UTCI, 60 % of relative humidity in PMV and 15-45 % in UTCI, 0.5-1.4 m/s of wind speed in PMV and over 2.0 m/s in UTCI, and 4-5 °C of mean radiant temperature in PMV and 12 °C in UTCI.
Therefore, limiting differences between in situ data and computer modeling results within half a level as well as dividing existing levels into more detail, e.g. 4 PMV levels (slightly warm-warm-hot-very hot) to 7 levels (slightly warm-warm-very warm-slightly hot-hot-very hot-extremely hot), could improve inaccuracy of computer modeling in human bioclimatic maps for urban and landscape planning and design.