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Modified Physiologically Equivalent Temperature to Realize Evaluations of Humid-cold and Humid-hot Conditions

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Thermal environments involve the energy consumption of buildings and thermal sensations of human beings. Various thermal indices have been developed to estimate thermal conditions in many fields such as human biometeorology, building environment, urban climate, and public health for several decades. Physiologically Equivalent Temperature (PET) as one of these thermal indices has been widely applied because of the effective estimations of the sensible and radiant heat fluxes between subjects and environments. However, PET has known as limited on estimating the influences of humid impacts. This study is aimed to propose a modified PET which is more appropriate to evaluate the impacts of humid-cold and humid-hot conditions on the thermal strains of human beings.
The modification of PET implements an adaption including the influence of clothing vapor resistance to calculate dynamic balance between the skin vapor pressure and air vapor pressure instead of the steady statured vapor pressure on the shell layer according to the skin temperature, which is applied to estimate the latent heat in the original PET-model. The implement leads to a difference of latent heat of about -50 W/m2 from the original PET-model, when the air temperature (Ta) is 7 ℃ and the relative humidity (RH) is 90 %. On the other hand, the difference of latent heat between modified PET and original PET is -5 W/m2, when the Ta is 7 ℃ and RH is 10 %. In humid-hot conditions, the value of modified PET is lower than the original PET because of a rapid mechanism of sweating evaporation in modified PET-model. Nevertheless, humid-hot conditions, other than dry-hot conditions, would be evaluated as significantly warmer conditions in modified PET.

Keywords: physiologically equivalent temperature, thermal index, thermal conditions, humid-cold, humid-hot