



## **Appropriate thermal indices and micro scale models for applications**

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Application of thermal indices has become very popular over the last three decades. It is mostly aimed at urban areas and is also used in weather forecasting, especially for heat health warning systems. Recent studies also show the relevance of thermal indices and their justification to thermal perception. Only twelve out of 165 indices of human thermal perception are classified to be principally suitable for the human biometeorological evaluation of climate for urban and regional planning: this requests that the thermal indices provide an equivalent air temperature of an isothermal reference with minor wind velocity. Furthermore, thermal indices must be traceable to complete human energy budget models consisting of both a controlled passive system (heat transfer between body and environment) and a controlling active system, which provides a positive feedback on temperature deviations from neutral conditions of the body core and skin as it is the case in nature. Seven out of the twelve indices are fully suitable, out of which three overlap with the others. Accordingly, the following four indices were selected as appropriate: Universal Thermal Climate Index (UTCI), Perceived Temperature (PTJ), Physiologically Equivalent Temperature (PET), rational Standard Effective Temperature (SET\*) and optionally mPET (modified PET). The modelling is performed by RayMan model, which can calculate mean radiant temperature and thermal indices (PMV, PET, SET\*, UTCI and PT). For the calculation of mean radiant temperature RayMan is able to calculate short and long wave radiation fluxes based on several methods of spatial inputs environments (fish eye photos, geometrical characteristics of obstacles, free-drawing) and providing output of mean radiation temperature, shade, sunshine durations and thermal indices. Another model is the SkyHelios model. In contrast to RayMan model, SkyHelios allows for spatial calculations for thermal comfort (PET, UTCI, ...) and several input and influencing parameters. SkyHelios supports the calculation of PET, UTCI and PT. Various common spatial data formats can be used as input for the calculations.