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Evaluation of human bioclimatic indices for a thermally extreme climate zone

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Human health and well-being are in part a result of the complex influence of many factors, one of which is the thermal state of the climatic environment. The latter involves the interplay of a variety of atmospheric variables such as air temperature, humidity, wind and solar and longwave radiation, as well as physiological and behavioral variables such as activity levels, clothing insulation and body posture. Because of the complicated way these come together, a variety of bioclimatic indices have been devised. They differ in approach according to the number of variables taken into account, the relative sophistication of the underlying body-atmosphere heat exchange theory and the particular design for application. Typically indices serve to estimate human comfort and discomfort, or the influence of the atmospheric environment on human safety. The current research examines a range of indices that might be suitable for use in a thermally extreme climate zone, namely the southern part of the Russian Far East where urban climate is characterized by extremes of heat and cold. Indices suited for use in urban bioclimatic assessment are evaluated and classified. The most reliable are those that are applicable across the full range of conditions of heat and cold. The results show that indices based on the thermally integrated output of body-atmosphere energy balance models provide the best indications of the thermal significance of extreme outdoor conditions. Those indices that are likely to be most reliable are indentified. Indices of thermal strain are more relevant in assessments related to human health and physiological wellbeing generally, including specific applications such as in outdoor working conditions or endurance sport activities. In contrast, indices of thermal stress are better suited to general urban biometeorological assessments. These have applied value in outdoor comfort research and in the areas of in tourism and recreation for the timing of activities and selection of holiday destinations.