04.09 Bioclimate (Edition 2014)

Text Abstract

Original Situation

While implementing the Climate Model Berlin 2014, a variety of meteorological parameters were calculated at different times of day and on specific threshold days as part of the analysis phase. On the one hand, they describe the climatic situation in the Berlin area on a typical summer day, and on the other hand, they form the basis for the Urban Climate Evaluation Maps 2015.

In the climate analysis, special emphasis is put on the assessment of the bioclimatic burden on humans, as it is at the core of the final planning advice maps. Various indicators are available for the evaluation of the bioclimate. It is important that these are used rather than “basic” climate parameters, such as air temperature. The latter are not detailed enough in their reflection of the population’s thermal sensitivity to varying meteorological conditions.

Previous applications of the Berlin climate model used the dimensionless parameter PMV as the basis for evaluation. The 2014 version employs the index **Physiological Equivalent Temperature (PET)** instead, following the progress made in discussions in the field (Höppe and Mayer 1987).

As the PET is denoted in °C, it is easily accessible also to laypeople, which is its main advantage over the PMV. In addition, the PET is a parameter that has meanwhile developed into a “de facto **standard**” in the field and pays greater attention to aspects of environmental medicine. Results from Berlin could therefore generally also be compared with those from other cities (even beyond Germany’s borders).

Method

The calculation of the PET is based on the heat exchange of humans with their environment that transpires during daytime hours (the PET is unsuitable for nighttime evaluations; air temperature remains the evaluation factor here).

In Tab. 1, the thermal sensitivity (derived from the behaviour of a “standard person” representing an average thermal sensitivity) and the physiological load level are compared to the PET index. Optimal comfort levels set in at 20°C. Higher temperatures cause heat-related stress, while lower temperatures result in cold-related stress.

Tab. 1: Assignment of threshold values for the evaluation index PET during daytime hours

PET in °C	Thermal sensitivity	Physiological load level
4	Very cold	Extreme cold stress
8	Cold	Strong cold stress
13	Cool	Moderate cold stress
18	Slightly cool	Weak cold stress
20	**Comfortable**	**No heat load**
23	Slightly warm	Weak heat stress
29	Warm	Moderate heat stress
35	Hot	Strong heat stress
41	Very hot	Extreme heat stress

Tab. 1: Assignment of threshold values for the evaluation index PET during daytime hours (Matzarakis 1996; VDI 2008)

Results

The **2 pm** PET values demonstrate that the heat load occurring during the day highly depends on the local shading situation. In **forest areas** and areas where trees and groves predominate, the heat load is moderate on cloudless summer days with strong solar irradiation. Here, the shadows cast by vegetation reduce the direct solar irradiation. This and the evaporation of water contribute to the comparatively low load potential. Green spaces in the inner city, especially in and around **built-up neighbourhoods,** play an important role, due to their sojourn quality. This is contrasted with extremely sunny areas, where the daytime heat load is the highest. Temperatures measured above **lawns** are similarly high to those recorded above **impervious areas**.

Visit our topic "**Climate Model Berlin – Analysis Maps 2014**" for a more detailed description and to discover how it fits into the overall climate analysis 2014.

Literature

[1] **Höppe, P. 1984:**
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[3] **Matzarakis, A., Mayer, H., 1996:**
Another Kind of Environmental Stress: Thermal Stress. NEWSLETTERS No. 18, 7-10. WHO Collaborating Centre for Air Quality Management and Air Pollution Control.

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