

How climate affects our health

Human Heat Balance

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New research reveals how the human body copes with outdoor conditions

Human bioclimatology aims to find out how various atmospheric stimuli influence the condition of the human body. Traditional methods focus on analyzing either individual meteorological factors (such as solar radiation, temperature, wind, humidity), or simple biometeorological indices that illustrate the complex impact of several meteorological elements (e.g. effective temperature, wind chill index, humidex). The total composite influence of weather is considered as well.

While traditional methods are able to illustrate the relative power of atmospheric stimuli felt by man, they do not actually provide any information about the organism's physiological response. A new caliber of research on man-atmosphere associations has been achieved through the application of methods based on human heat balance. Numerous models adapted for indoor conditions are currently in use. Only a few models, however, are able to assess the physiologically realistic components of the man-environment heat exchange in an outdoor milieu.

Several thermophysiological research projects, in various meteorological conditions and different climates, have been carried out at the Institute of Geography and Spatial Organization. The results of these investigations have made it possible to develop MENEX_2002, a brand new

man-environment heat exchange model intended for use in studying outdoor human heat balance, both in motion and at rest. The model takes account of several physical parameters of the atmosphere as well as the physiological characteristics of subjects (e. g. metabolic heat production, skin temperature, sweating, insulation from clothing).

The main indices derived from the MENEX_2002 model are: subjective temperature, heat load, physiological strain, maximal time of exposure and water loss. As the human heat balance components and model output indices provide actual information concerning the intensity of the organism's physiological response to atmospheric stimuli, they are used in various bioclimatic and thermophysiological analyses.

Killer heatwaves

The MENEX_2002 model was used to evaluate the therapeutic features of the bioclimate in Polish health resorts, and to assess the general biothermal conditions in Poland. The indices were also very useful in researching the specific urban bioclimate of the Warsaw metropolitan area, as well as in evaluating biothermal conditions during full-body solar exposure and during mountain hiking.

Very interesting research was done concerning the impact of weather conditions on human health. A statistical analysis of data from Warsaw showed that the number of hospital cases with major cardiac problems is strongly correlated with both daily weather variability and the occurrence of heatwaves. In the popular Polish mountain resort Zakopane, large diurnal swings of biothermal conditions caused a notable rise in the number of heart attacks.

Current research is being carried out within two European projects. The PHEWE project aims to develop methods for assessing and preventing the acute health effects of weather conditions in Europe. In this project the MENEX_2002 model is used to determine the most dangerous meteorological situations that can result in an increase of morbidity and mortality. The e-Clat project tries to identify relations between climate change and tourism. We want to learn how multianual fluctuations of bioclimatic conditions can influence tourism and how the tourism industry can adapt to climate change. Another new project will look into relations between concentrations of carbon dioxide and the microclimate in European cities. ■

Further reading:

Błażejczyk K. (2003). Weather fluctuations and tourism in Poland. In: *Proceedings of the NATO Advanced Research Workshop "Climate Change and Tourism: Assessment and Coping Strategies"*, Warsaw, 6-8 November 2003.



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The influence of weather depends on personal characteristics