EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00055, 2007
7th EMS Annual Meeting / 8th ECAM

Improvements of adaptive model considering difference of climatic conditions

Y. Horie, K. Kimura and T. Honma

Hokkaido University, Japan (horie-yuka@scc.ist.hokudai.ac.jp / Fax: +81-11-709-6280 / Phone: +81-11-706-7692)

Many engineers assessed the thermal environments from the viewpoint of human thermal comfort and sensation with thermoregulation model derived from the real-time weather and the human elements. On the other hand, Auliciems (1981) proposed the theory of Adaptive Model that is indoor comfortable temperature as the average of outdoor air temperature over the past several days or a month for the thermal acclimation especially climate-cultural factors defined by outdoor climatic parameters. Adaptive Model is based on the feedback loops of thermal adaptation. However, many researches point out what is considered is not only air temperature but also humidity, relative wind velocity and radiation. Horie (2006) reported that the correlationship between preferred preset temperature of air-conditioning and estimated temperature with Adaptive Model is stronger in summer than in winter. In addition, averaging terms for calculation of thermal comfort temperature are the several periods and each averaging term has not clearly quantitative definition.

The purpose of this study is to improve the Adaptive Model considering the difference of averaged periods and climatic parameters. To clarify the best averaged periods, we applied the autoregressive model (AR model) to several climatic parameters, i.e. Averaged Temperature (TEMP), Discomfort Index (DI) and Wind Chill Index (WCI), calculated from the data of the National Climatic Data Center. We evaluated the best term as the number of order which indicates the minimum of Akaike's Information Criteria (AIC) of AR model. To determinate the suitable climatic parameter, we also compared among AIC values of AR model applied to several thermal indexes. Finally, we evaluated the validity of obtained results with previous studies based on human experimentation.

Results are as follows. In tropical climate zone, AIC values of TEMP, DI and WCI change similarly with and are local minimal values occurring almost 14-20 days. It takes 14 days to lose completely human thermal short-term acclimatization (Williams *et. al* 1967). In addition, it takes less than seven days to get of human thermal short-term acclimatization. As described above, the best term in tropical climate zone correspond to previous studies. However, the results in arid or subarctic climate zone differ from the tendencies in tropical climate zone.