Effects of air movement and thermal radiation on thermally comfort range in urban districts

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1. INTRODUCTION

It has been said that thermal comfort ranges are wider in field surveys than in experimental rooms. Thermal environment and sensation were measured for pedestrians in urban districts including extreme heat and cold, strong radiation and air velocity. The relationships between the environment and thermal sensations were investigated when sensations of thermal comfort, air movement and radiation were different.

2. METHODS

2.1 MEASUREMENTS

Measurements of thermal environment and sensation of the pedestrians were carried out in seven urban districts in Kyoto and in two urban districts in Osaka. Air temperature, globe temperature, humidity, air velocity, solar irradiance and surface temperatures of the buildings and the streets were measured. Thermal sensation (-3: cold ～3: hot), sensation of thermal comfort (1: comfortable ～4: very uncomfortable), air movement (1:not perceivable～4:very perceivable) and thermal radiation (1:not perceivable～4:very perceivable) were measured.

2.2 OUT_SET* FOR URBAN CANYON

OUT_SET* (new standard effective temperature) proposed originally by R. de Dear was modified in Mean radiant temperature (T_{MRT}) to consider the long wave radiation $T_{MRT,L}$ from surrounding buildings as following equations. In the equations, f_p is effective area ratio, α_{cl} is albedo of clothing, $S\downarrow$ is direct solar irradiance, $D\downarrow$ is diffuse solar irradiance, α_{GND} is albedo of ground, F_{b_i} is form factor, T_{prt_i} is plane radiant temperature, σ is Stephan-Boltzman constant, ε is emmisibity, T_k is surface temperature, T_{sky} is sky surface temperature, $L\downarrow$ is long wave radiation.

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