Thermal environment in simulated offices with convective and radiant cooling systems under cooling (summer) mode of operation - DTU Orbit (08/11/2017)

Thermal environment in simulated offices with convective and radiant cooling systems under cooling (summer) mode of operation

The thermal environment in a double office room and in a six-person meeting room obtained with chilled beam (CB), chilled beam with radiant panel (CBR), chilled ceiling with ceiling installed mixing ventilation (CCMV) and four desk partition-mounted local radiant cooling panels with mixing ventilation (MVRC) under summer (cooling) condition was compared. MVRC system was measured only for the office room case. CB provided convective cooling while the remaining three systems (CBR, CCMV and MVRC) provided combined radiant and convective cooling. Solar radiation, office equipment, lighting and occupants were simulated to obtain two different heat load conditions: 38 W/m^2 and 64 W/m^2 in the case of office room, and 71 W/m^2 and 86 W/m^2 in the case of meeting room. Air temperature, globe (operative) temperature, radiant asymmetry, air velocity and turbulent intensity were measured and draught rate calculated. Manikin-based equivalent temperature (MBET) was determined by using two thermal manikins to identify the impact of the local thermal conditions generated by the studied systems on occupants' thermal perception. The results revealed that the differences in the thermal conditions achieved with the four systems were not significant. CB and CBR provided slightly higher velocity level in the occupied zone. The operative temperature in the studied cases with chilled ceiling in operation with mixing ventilation was almost the same as the operative temperature obtained with the active chilled beam (i.e. only convective cooling). The heat load distribution played major role for the airflow pattern in all studied systems.

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