Relation of Overheating and IAQ during Heatwaves. Case Studies in two Southern European Locations

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ABSTRACT

Heatwave events are one of the major impacts of Climate Change affecting directly wellbeing and health in the built environment. Natural ventilation remains one of the main strategies to both ensure IAQ and improve night temperatures in the residential stock of Southern Europe, although high temperatures during heatwaves can compromise its effectiveness. In addition, the occurrence of blackouts during these events could directly impact health in the most extreme climates.
This study is based in the monitoring of 23 dwellings in Pamplona and Seville in Spain, encompassing different climate classifications: Cfb and Csa according to Köppen-Geiger classification, and 4A and 3A, according to Ashrae climate classification respectively, being the latter, one of the hottest locations in the Southern Europe. Dwellings were monitored during summer 2022, which remains the year with more days of heatwaves in Spain (41 days during three events, one of them taking place very early in June).
Dwelling selection comprises multifamily buildings constructed under different Spanish Energy Codes, assessing dwellings located in intermediate and top floors, and with different ventilation and cooling strategies. In Pamplona, the coolest location, all dwellings were naturally ventilated although some of them had systems with heat recovery mechanical ventilation (MVHR). On the other hand, in Seville, the hottest location, dwellings were equipped with air conditioning systems (AC) although some of them were also naturally ventilated and others were mechanically ventilated. Main bedroom and living room of each dwelling were monitored (air temperature, relative humidity and CO2 concentration), and overheating was calculated according to UNE EN 16798 standard (IOH, Indoor overheating hours).
Results shown that during heatwaves, the milder location without AC, has the lowest indoor temperatures, but the highest overheating, and the hottest location equipped with AC, has however the highest indoor temperatures but the lowest overheating (due to the different thresholds according to the severity of the climate), and better IAQ. High variability exists among different dwellings even in the same location, due to thermal envelope characteristics, main orientations, shading systems and floor.
In a warming climate with the possibility of blackouts during extreme events as HW, better comprehension of architectonical design and passive strategies to improve resilience in the residential built environment is needed.

KEYWORDS

Heatwaves, monitoring, blackout, natural ventilation, passive strategies