

Heatwave impacts on human thermal comfort in the urban context: a case study in Bologna (Italy)

Andrea Faggi ⁽¹⁾ - Tiziano Maestri ⁽¹⁾ - Laura Tositti ⁽²⁾ - Alessandro Zappi ⁽²⁾ - Michele Martinazzo ⁽¹⁾ - Giorgia Proietti Pelliccia ⁽¹⁾ - Erika Brattich ⁽¹⁾

⁽¹⁾ University Of Bologna, Department Of Physics And Astronomy "augusto Righi", Bologna, Italy - ⁽²⁾ University Of Bologna, Department Of Chemistry "g. Ciamician", Bologna, Italy

Keywords: heat extremes, thermal comfort, urban areas, urban heat island

Abstract Climate change is intensifying the severity of various types of extreme weather events, including heatwaves, droughts, heavy rainfall, and intense storms. Among these, heat extremes pose significant health risks, leading to heat exhaustion, heatstroke, and the exacerbation of pre-existing conditions like cardiovascular and respiratory illnesses and also impacting mental health and wellbeing. Southern Europe is facing increasing vulnerability to extreme heat due to climate change, with potential impacts on public health, infrastructure, and the economy. Additionally, several studies have demonstrated the synergetic effect between heat waves and the "urban heat island", further intensifying the magnitude of urban overheating globally up to 5–10 °C during heat waves.

This work presents a detailed characterization and analysis of an intense heatwave event impacting on the city of Bologna (Italy) during the period of 11-20 July 2023. After identifying the event based on two different indexes, i.e. the Warm Spell Duration Index (WSDI) and the Excess Heat Factor (EHF), the analysis of the geopotential pattern as well as of the satellite data pointed out the extension of African anticyclone over the Italian Peninsula, with the arrival of hot air masses to the Northern part of Italy, a phenomenon which is intensifying and often recognized as responsible of extreme heat in the Mediterranean region. By integrating observations of essential climate variables collected by ground-based official reference stations with observations from amateur meteorological stations, we created spatial maps of biometrical indexes in the metropolitan area of the city. The analysis of the spatial and temporal variability of such indexes points out very clearly the emergence of wide differences in the exposure of resident population to thermal stress, connected with the Urban Heat Island (UHI) phenomenon and its multiple scale intrinsic nature. The results thus showcase the usefulness of these indexes to support policy makers in the definition of measures and plans to mitigate the impacts posed by heat extremes.