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The impact of land cover on pedestrians' thermal comfort within a university campus (Tromp Foundation Travel Award)

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The urban heat island (UHI) phenomena is defined as the air temperature difference between a city and its suburbs. The UHI in Manchester (UK) reaches to 5 'C during summer time. Several studies have shown the impact of UHI on human thermal comfort and energy consumption in buildings. Computer modelling makes it possible to explore the impact of different urban elements within a neighbourhood on the thermal conditions.
In this study, the climatic conditions of the open spaces of the campus of the University of Salford is investigated. The campus is modelled in a computational fluid dynamic (CFD) program for a summer heat wave in Manchester. The impact of different land cover (such as asphalt pavements, vegetation and buildings) on outdoor thermal comfort are discussed. This campus is very close to the city centre of Manchester, therefore, the understanding of the thermal conditions of the campus is used to propose practical solutions to mitigate heat at the city centre.
The weather within the campus of the University of Salford has been measured by a weather station in 2016. The weather station was located on the roof of the Energy House building, and measured air temperature, wind speed and direction, relative humidity, precipitation and solar radiation. This weather data was used to find the hottest day in 2016 (19 July). The early morning weather data of the hottest day was used to run the CFD simulations, as the initial weather data.
The campus of the University of Salford was modelled in ENVI-met based on the actual land cover retrieved from Google Maps. The campus is surrounded by a highway (south), a vegetated park (north and east), and a railway (west).
Our results showed that during the hottest day of 2016, the maximum air temperatures occurred in the campus at 16:00 (at the height of 1.2m which is the closest height to pedestrians' body core). The air temperature within the whole campus ranges between 27 'C (park in the north east) to 32 'C (stony paved areas in west and north parts of the campus).