What is Urban Climate?

Urban Heat Island (UHI) effect

Urban heat is amongst the most pressing priorities of the impacts of climate change - urban areas are already vulnerable to decreased thermal comfort during heatwaves and projected rates of urban growth mean that vulnerability will increase as the proposed impacts of climate change become realised. Although the UHI phenomenon is well documented and studies have increased our understanding of them and the basic measurement of temperatures across urban areas remains very limited due to the scarcity of high-density, in-situ measurement networks.

Climate change scenarios all suggest increases in mean temperatures: these will exacerbate the incidence of heat waves which will be most noticeable in urban areas. The 2003 heat wave was considered to be responsible for 14,802 and 2,045 excess deaths in France and the UK, respectively. Most of these deaths were in urban areas and were a direct result of the increased temperatures experienced in towns and cities. For this reason, amongst others, the study of UHI is becoming increasingly relevant. Urban areas are already vulnerable to decreased thermal comfort during heatwaves and projected rates of urban growth mean that vulnerability will increase as the proposed impacts of climate change begin to be realised. Indeed, the 2003 heatwave may be typical by 2040. Increases in heat waves will consequently impact upon human health (e.g. heat stress), society (e.g. law and order) as well as the infrastructure of the urban areas themselves, such as transportation (e.g. roads melting, rail buckling) and power supplies (e.g. transformer overloading due to increased heat and need for air conditioning). UHI intensity can be mitigated by improved planning, for example, passive cooling, green roofs and trees. Such adaptations are essential to prevent a repeat of the devastating effects of the 2003 heatwave.

However, in order to identify and mitigate the impacts of UHI, large scale measurement campaigns of current temperatures are required. Although, this can be easily achieved for surface temperatures using remote sensing techniques, these techniques clearly cannot be used to measure the air temperature of the urban heat island near the surface. Indeed, due to a paucity of high resolution air temperature measurements in cities, studies are often limited to the measurement of surface temperatures and hence the surface or ‘skin’ UHI. Instead, traditional measurements of UHI are made instead using pairs or urban/rural weather stations or temperature transects. However, in all but a few applications, it is near-surface air temperature that is the important parameter to measure, not surface temperature. Therefore, in-situ measurements from dense networks are necessary in order to validate remote sensing studies and improve our understanding of this increasingly-relevant subject.

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