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Impact of realistic anthropogenic heat flux on temperature across Singapore. A problem between heat release capacity and emission.

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Anthropogenic heat flux (AH) is the heat resulting from human activities. This energy flux, usually considered as an extra source of sensible heat flux in numerical modelling, represents an extra term in the surface energy balance equation and contributes to the total heat release from urban areas. As a consequence, it increases the canopy layer air temperature, especially at night. AH is not constant across the city and shows a diurnal profile, which peaks in the morning and late afternoon and remains higher during daytime reflecting particular transport emissions. Different urban areas accumulate and release heat differently, depending on their morphology and the materials used for construction. This impacts on the dissipation not only of the sensible heat accumulated during the day but also of the produced AH.

In this study, the impact of the AH on urban canyon facets surface and canopy layer temperatures and the capacity of the city to release it will be studied in different neighbourhoods across Singapore. The capacity of the city to release heat is evaluated in the first part of the study by imposing space and time constant AH. In the second part, the impact of a realistic AH emission inventory in different areas will be studied. A tropical version of the high resolution (300m) UK Met Office forecast model with the MORUSES urban canopy parameterization coupled to calculate urban surface energy fluxes is used for this purpose.

Results show an increase in surface and air temperatures, which is higher in areas with lower canyon heat capacity, when the same AH is imposed, respect to the case with no AH. The resulting sensible heat flux also increases depending on both air-to-surface temperature gradient and heat exchange coefficient of the canyon, which in turn depends on the morphology. The introduction of space-varying AH flux shows different impacts across the city depending on the morphology of the area and the value of AH, highlighting the necessity to consider realistic AH values which are allowed to change across the city. Overall, previously simulated nighttime canopy layer temperatures improve by the introduction of realistic AH.