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The impact of anthropogenic emissions on the London's temperatures

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The anthropogenic heat flux in the city center of London sometimes exceeds 400 Wm-2. This magnitude is comparable to the other terms of the urban surface energy balance in some locations. With weather forecast models approaching the kilometer scale we can now determine the impact of the spatial and temporal variability of the anthropogenic heat flux on the urban boundary layer structure and urban air temperatures.

We implemented spatially and temporally varying anthropogenic emissions at 1km resolution into the Met Office Reading Urban Surface Exchange Scheme (MORUSES) using the Met Office Unified Model. The anthropogenic heat flux is estimated from energy demand data for London and is specified on the models 1km horizontal grid resolution. We present simulations for a winter and a spring case study for London and show how anthropogenic emissions change the urban surface energy balance and the urban heat island intensity. We found that anthropogenic emissions play a bigger role in winter than in spring when the boundary layer is deeper. About 1/3 of the additional heat is increasing the outgoing long wave radiation and about 2/3 increase the sensible heat flux that warms the atmosphere and consequently affects urban temperatures. For the specific winter case the anthropogenic emissions maintained a well-mixed boundary layer, which might have implications for air quality in winter.