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Connecting physical and socio-economic spaces for urban agent-based modelling

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Holistic approaches for urban modelling need to simultaneously consider the urban form, i.e., the physical characteristics of a city (e.g., urban surfaces, building morphology and fabric), urban function driven by economic, societal, cultural activities, and human behaviour. DAVE (Dynamic Anthropogenic actiVities and feedback to Emissions) is an agent-based modelling system that connects physical and socio-economic urban spaces (McGrory et al. 2023 – this meeting) to model anthropogenic heat emissions and assess human exposure to heat stress and air pollution. In this approach, humans are modelled as active components of the urban system and human exposure to and impact on urban environmental stressors are dynamic. DAVE is intended to dynamically respond to changes of multiple drivers (e.g., urban background climate, physical environment, socio-economic factors). The spatio-temporal complexity and variability of urban form, function, human behaviour and climate puts high demands on the input data needed for DAVE.
This poster presents a discussion on the approach taken to mine, process, connect and harmonise geo-spatial and socio-economic data sources for city-scale simulations based on the example of London, UK. This includes the generation of suitable building archetypes for the building-energy modelling (BEM) component of DAVE, encompassing assessments of building function, morphology and household size / occupancy. Using time-use surveys (TUS), domestic occupancy and appliance use profiles are generated for the BEM. Movement schedules of citizens of different demographic groups between different socio-economic areas of activity (e.g., home, work, school, shops, restaurants) are also based on TUS information and statistically invoked in the model. Non-domestic / commercial areas of activity and associated building archetypes are characterised by their baseline energy-demand. Available travel routes for different modes within the city are informed by public transport stops and timetables as well as the road network density and speed limits. DAVE is coupled to a land-surface model, for which landcover and morphology information is provided.
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