



Evaluation of the simulated spatio-temporal variability of the anthropogenic heat flux in the agglomeration of Toulouse, France

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The energy and moisture exchange between the surface and the atmosphere in urbanised areas is characterised by the net radiation, the sensible and latent heat flux, the storage of heat in the construction materials as well the anthropogenic heat flux. The anthropogenic heat flux is mainly due to metabolism, traffic, industrial activities, heating and cooling of buildings, and electricity consumption for lighting and electrical equipment. The heating and cooling energy demand depends on the meteorological conditions. For this reason, it has become common to couple urban parametrisations for atmospheric models like the Town Energy Balance (TEB) with a simple Building Energy Model (BEM) to simulate the heating and cooling energy demand as a function of the prevailing meteorological conditions. However, given the large number of uncertain parameters on urban morphology, construction materials and human behaviour required for this type of simulation, the spatio-temporal variability of the anthropogenic heat flux simulated with this approach needs to be critically evaluated.

In the present study we use TEB-BEM to simulate the spatio-temporal variability of the meteorology-dependent anthropogenic heat flux for the agglomeration of Toulouse in southern France. Data describing the urban morphology (plane area building density, building heights, and so on) is taken from the French 3D vector description of the territory (BD TOPO). Information on building construction materials and the presence of isolation materials as a function of building type, construction period and building use is retrieved from an architectural database. The most important human-behaviour-related parameters are the design temperatures for heating and cooling, the internal heat release and the usage of shading and ventilation by the inhabitants. These parameters are estimated via a statistical modelling approach based on surveys and socio-economic data available from French census data. The spatio-temporal variability of the simulated anthropogenic heat release is evaluated for the period of March 2004 to March 2005 against an inventory of electricity and gas consumption available for that period.