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Offline evaluation of the Community Land Model - Urban for Toulouse (France) and Melbourne (Australia)

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Urban climate models provide a useful tool for assessing the impacts of urban land surface modification on urban climates. It provides a mechanism for trialling different scenarios for urban heat island mitigation. Only recently, urban land surfaces have been included in global and regional climate models. Often they represent a trade-off between the complexity of the biophysical processes of the urban canopy layer and the computational demands in order to be workable on regional climate time scales.

This study employs the Community Land Model (CLM) which was recently extended with a single layer urban canopy scheme (CLM-U). And although it is primarily developed as a tool for regional climate scales, we intent to extend its reach and use it for local (neighborhood) scales in a changing climate context. Hence, an off-line validation is performed using meteorological observations for Toulouse (France) and multiple medium density urban areas in Melbourne (Australia). Model results are evaluated against observations of the surface energy balance from flux towers, including evapotranspiration, and show that the model is able to correctly address (urban) energy partitioning including high urban heat storage, and low evapotranspiration rates.

Furthermore an investigation was undertaken to explore first of all the capacity of the model to incorporate Water Sensitive Urban Design (WSUD) features, mimicking vegetated and non-vegetated infiltration systems, open water bodies and other green infrastructure. In a second step, the effectiveness of WSUD integration scenarios are also compared with other common mitigation strategies such as increasing albedo and controlling urban morphology.