Urbanisation of weather data lead for more sustainable building design: urban land surface model used to generate Typical Meteorological Year (TMY) datasets

Ting Sun¹, Yihao Tang¹,², Jie Xiong¹,³,⁴, Hamidreza Omidvar¹, and Sue Grimmond¹

¹University of Reading, Meteorology, United Kingdom of Great Britain and Northern Ireland (ting.sun@reading.ac.uk)
²Climate Centre of Hunan Province, CMA, Changsha, China
³Joint International Research Laboratory of Green Buildings and Built Environments (Ministry of Education), Chongqing University, Chongqing 400045, China
⁴School of the Built Environment, University of Reading, Reading RG6 6DF, UK

Typical Meteorological Year (TMY) datasets are widely used in building energy design simulations to assess needs (cooling/heat). Currently, TMY data used are representative of the past climate (from observations) of the region and generally do not account for urban climate or building-city interactions. Here we use an urban land surface model, SUEWS (Surface Urban Energy and Water Balance Scheme) driven by ERA5 reanalysis data to bridge this gap.

Using 0.25 ° large-scale ERA5 reanalysis data (1979–2018) with SUEWS we generate an urbanised TMY (uTMY) dataset for Changsha, a city with more than 4.4 million residents in the hot-summer-cold-winter region of China, to demonstrate the proposed workflow. The SUEWS simulation are evaluated at the Leifeng site (WMO code 57687) for 2016.

Through comparison of DOE EnergyPlus simulations, we also assess the impact on design building energy consumption using uTMY and cTMY (conventional TMY) data. The building design energy needs evaluation is for a common Chinese apartment building. This should allow for more spatially explicit building design, and hence more sustainable.