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Towards a fine-scale urban climate simulation of Hong Kong using MesoNH-TEB with a detailed urban land cover description

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Numerical models have become indispensable tools for quantifying urban climate conditions and understanding the potential impacts of climate change on cities. Urban canopy models, such as the Town Energy Balance (TEB), are commonly coupled to mesoscale atmospheric models like Meso-NH to simulate the altered surface energy balance due to buildings, impervious surfaces, and human activities. As shown in previous studies, the performance of such models can be significantly improved by providing detailed surface land cover descriptions and employing an appropriate urban land surface scheme. This is particularly the case for the complex terrain of subtropical Hong Kong, with a heterogeneous land cover and compact high-rise urban settings. In the current study, we aim to simulate the thermal microclimate in the urban cores of Hong Kong by downscaling ECMWF analysis data via nested models to a spatial resolution of 200 m. The study period is a week-long hot spell from 2 to 8 September 2009. The novelty lies in the detailed urban database employed for the initialisation of MesoNH-TEB, which provides precise information on urban land covers, building geometry, as well as building archetypes derived from real building data, land utilisation study, satellite imagery, and field surveys. For the building archetypes, a detailed description of construction materials and their physical characteristics is provided. Initial simulation results will be evaluated against observations from selected Hong Kong Observatory weather stations. With subsequent model validation and improvement, findings are expected to allow for a better understanding of the spatial and temporal variations of the city's thermal environment during prolonged hot weather conditions.