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Localizing Convection‐Permitting Regional Climate Model Output for Urban Climate Impact Assessment

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Urban areas exhibit complex and spatially heterogeneous climate conditions driven by urban fabrics, surface materials, land cover, and anthropogenic heat emissions, requiring tailored approaches to analyze climate information at spatial scales relevant for cities. Convection-permitting regional climate models (CPRCMs), with horizontal resolutions of around 3 km, offer new opportunities to investigate urban climate dynamics over climatological timescales and are therefore well-suited for urban climate change impact assessments. To fully exploit this potential, dedicated approaches are required to localize CPRCM output and extract relevant climate change information. This contribution aims to explore such a methodological framework, focusing on classifying urban and rural areas in CPRCMs according to their individual land cover representations including built-up and impervious surfaces as well as green spaces and water bodies. We develop a new weighting method to integrate the CPRCM output data suitable for localized urban climate impact assessments. The localized datasets can further provide a foundation for exploring climate indicators across different urban-rural classification schemes. In addition to near‐surface air temperature, composite thermal metrics such as Globe Temperature (GT) as presented in Puri et al. (2025, preprint) can be considered to illustrate the added value of localized CPRCM output. GT integrates the effects of air temperature, radiative fluxes, and wind, and thus captures environmental thermal loads relevant for sun‐ and wind-exposed urban surfaces and infrastructure more comprehensively than air temperature alone does. Overall, this work, part of the Urban Climate Future Lab (UCFL), contributes to the development of a transferable and reproducible framework for generating urban‐scale climate information from high‐resolution RCMs, supporting climate projections, future analyses, climate services, and climate‐aware adaptation planning for cities.