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An Open-Source Framework for Accessible Community Land Model Urban Simulations

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The Community Land Model Urban (CLMU) is a process-based numerical urban climate model that simulates the interactions between the atmosphere and urban surfaces, serving as a powerful tool for the convergence of urban and climate science research. However, CLMU presents significant challenges due to the complexities of model installation, environment and case configuration, and generating model inputs. To address these challenges, we developed an open-source framework, including a Python toolkit and a cloud-based platform, for accessible urban climate modelling. The Python toolkit streamlines the generation of model inputs and simplifies the configuration and execution for CLMU simulations. This toolkit also supports code extensibility, allowing users to develop and test new parameterizations easily. Further, by integrating the fifth generation ECMWF reanalysis (ERA5) atmospheric forcing, local climate zone (LCZ), and the 1 km urban surface data, the cloud-based platform enable on-demand simulations for any global location without requiring any local installation. This framework empowers users to rapidly explore urban climate responses under various morphological and climatic conditions and thus provides an accessible tool for urban climate research and design. (Python toolkit: <https://envdes.github.io/pyclmuapp/>; Cloud-based platform: <http://app.open-urbanclimate.com/>)