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Interaction between Cities and Climate Change: Modelling Urban Morphology and Local Urban Planning Scenarios from Open Datasets across European Cities

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Cities are characterised by a large spatiotemporal diversity of local climates induced by a superposition of various factors and processes interacting at global and regional scales but also at the micro level such as the urban heat island effect. As urban areas are known as 'hot spots' prone to climate and its variability over time leading to changes in the severity and occurrence of extreme events such as heat waves, it is of crucial importance to capture the spatial heterogeneity resulting from variations in land use land cover (LULC) and urban morphology in an effective way to drive local urban climate simulations.
The first part of the study conducted in the framework of the NACLIM FP7 project funded by the European Commission focusses on the extraction of land surface parameters linked to urban morphology characteristics from detailed 3D city models and their relationship with openly accessible European datasets such as the degree of soil sealing and disaggregated population densities from the European Environment Agency (EEA) and the Joint Research Centre (JRC). While it has been demonstrated that good correlations can be found between those datasets and the planar and frontal area indices, the present work has expanded the research to other urban morphology parameters including the average and variation of the building height and the sky view factor. Correlations up to 80% have been achieved depending on the considered parameter and the specific urban area including the cities of Antwerp (Belgium), Berlin (Germany) and Almada (Portugal) represented by different climate and urban characteristics. Moreover, the transferability of the established relations has been investigated across the various cities.
Secondly, a flexible and scalable approach as a function of the required the level of detail has been elaborated to update the various morphology parameters in case of integration with urban planning data to analyse the local impact of future land use scenarios, climate adaptation strategies and mitigation measures in an effective way by comparing the future occupation of the soil against metrics derived from existing soil sealing data from the EEA.