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Using the urban signature for downscaling the climate in different European cities

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Within the URCLIM project the aim is set up and provide climate services to cities based on reliable climate data from high-resolution simulations. In order to go to city-scale resolution (below 1-km), realistic meteorological forcings are required at the boundaries of the city domain. These forcings must therefore preferably be generated using different downscaling steps. A large set of low-resolution climate simulations are done at the global scale within the CMIP5 project that serves as a basis for IPCC WG 1. However, a set of regional high-resolution downscaling simulation have only recently become available. The different model types (global, regional) and scenarios are typically identified as uncertainty to the climate runs at the regional scale, that is, at scales ranging from 10-50 km. However, impact studies on human societies and their urban environment including adaptation measures, require an additional downscaling step to the city level. Hamdi et al. (2016) recently explored changes in the Urban Heat Island effect and urban heat waves for the Brussels Capital Region under the IPCC A1B scenario for the 2050s. However, in order to sample the uncertainty, these findings must be extended to propagate all RCMs results. Unfortunately the computational costs of climatological simulations that use a direct (or in-line) coupling between urban climate models and regional climate models is enormous. On the other hand, results using computationally-cheap one-way (or off-line) coupling between the two models are unsatisfactory. Therefore an innovative statistical method is developed that corrects the input of the urban climate models using a one-way coupling, based on a limited set of climate simulations with two-way coupling. This approach is validated here and enables (relatively) cheap climate urban scenarios forced with a large set of RCM models to sample the uncertainty. The validation of the method is done using ALARO-0 as the RCM model and SURFEX-TEB as the land surface model, all forced with reanalysis ERA-Interim data. The model outputs will be compared to data over Brussels, Ghent (Belgium), Helsinki (Finland) and Toulouse (France) using available urban station networks. Thereby we will focus on how well the new off-line model runs are able to represent heat-wave characteristics and the urban heat island effect.