



The Urban Heat Island of Hamburg for a 2K warming scenario considering urban development

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The European Union has established a 2K warming of global surface temperature (compared to pre-industrial levels) as a target to avoid disruptive climate change. The Hamburg 2K project investigates the climate in the region of Hamburg (Germany) subject to this target warming by 2100 and quantifies local change through contributions from both the meteorology and urban development.

To quantify the changes due to regional climate change, the area of Hamburg is modelled in a nested approach at 4 km and 1 km horizontal resolution using the Mesoscale Transport and fluid Stream Model (METRAS). A statistical-dynamical downscaling technique is applied based on regional climate results from the ECHAM5/REMO model system. The target variable of interest is the urban heat island (UHI). Cluster analysis of the current and projected climate from REMO-ECHAM5, yields seasonal weather types with respect to the UHI. These weather types provide the initial and boundary conditions for METRAS simulations to investigate the UHI in detail.

To consider urban development, a detailed surface cover map is generated, aggregated from a high-resolution raster image containing over 100 urban land-use classes. The off-line urban planning model Metronomica is used to derive estimates of future surface cover maps based on construction plans and demographic and infrastructural changes. These data are selected consistent with a 2K scenario. Comparison of METRAS estimates using current and future surface cover maps demonstrates the urban climate change due to urban development.

Results indicate that the magnitude of overall change is small for such a moderate surface cover change scenario. However, local conditions not only result in small scale local changes of temperature but, in addition, in some urban scale temperature changes. Thus, urban development even on a local scale can have an impact on the UHI.