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Analyzing the impact of urban adaptation measures for Hamburg considering realistic atmospheric forcing

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Relying on projections of the UNFPA the urbanization will continue to increase in the future. Thus, studying the urban climate becomes more and more popular for the scientific community but is also relevant for the urban planners. With regard to the temperature increase projected by global and regional climate models the urban planners consider different adaptation measures to keep the climate comfortable for the citizens. An estimation about the impact of various adaptation measures on urban climate is found in lots of publications. Most of the impact studies make use of microscale and building-resolving models to simulate the urban canopy layer accurate in many details. However, these studies provide only a very limited view on the atmospheric dynamics - urban climate is mostly analyzed under calm wind situations with constant atmospheric forcing.
Therefore, we intend to consider full and realistic dynamics in the framework of urban climate and adaptation strategies. The mesoscale model METRAS is used to simulate the urban climate of Hamburg for 'so-called' characteristic weather regimes in the summer season. The characteristic weather regimes are chosen to represent accurately the variability of the atmospheric variables for the summer season. Based on the characteristic weather regimes, the impact of various adaptation measures is quantified. We will present different scenarios for the urban development of Hamburg, i. e. scenarios developed in the project KLIMZUG-Nord and a scenario developed in cooperation with the local authority BSU (Hamburg Ministry for Urban Development and the Environment). The BSU scenario only incorporates an estimation for future implementations of green roofs, whereas the KLIMZUG-Nord scenarios additionally incorporate partly-unsealed areas and strong reflective surfaces with an high albedo. It turns out that the high albedo surfaces seems to have the biggest impact on the urban temperature. Nevertheless, all the adaptation measures cannot compensate for the projected climate change signals, but decrease the urban heat island effect caused by a more dense building inherent in the urban scenarios.