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Forecasting the weather
- ensemble techniques
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Exploring relations between the urban heat island effect and the morphology of a Dutch city

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The population of cities as well as the extent of urban areas is expanding rapidly in many parts of the world. This may cause a further increase in the magnitude of the Urban Heat Island effect that is already substantial in many cities, including those in the Netherlands. Taking into account the increase in the frequency of extreme warm periods due to the changing climate, this may have serious consequences for human thermal comfort and health in urban areas. This is particularly true for vulnerable groups, such as the elderly, young children and the chronically sick. Urban spatial planning offers the opportunity to mitigate the adverse effects of urbanization and extreme weather conditions. More comfortable urban regions have to be created to ensure human well being outdoors and indoors. For this, urban environmental physics need to be better understood and parameterized in atmospheric models to assess the effectiveness of proposed adaptation measures.

In this study the Single Column Model version of the Weather Research and Forecasting (WRF) mesoscale meteorological model is used. In order to assess the performance for a Dutch rural site, the model is evaluated with Cabauw tower observations. Subsequently, the model is evaluated for Dutch urban settings using a network of field measurements and observations of hobby meteorologists. The urban simulations are performed using the single layer urban canopy model (SLUM) with optimized settings for a typical Dutch city. Using the simulations in an urban environment we analyze the sensitivity of the urban heat island effect to properties of the urban canyon (albedo, heat capacity of walls, roads and roofs, Sky View Factor (SVF), aspect ratio, orientation) and general city properties such as green cover fraction, roughness length, available moisture and anthropogenic heat production. Furthermore, the relationship with a measure of thermal comfort or heat stress (Physiologically Effective Temperature (PET) or Wet Bulb Globe Temperature (WBGT)) is assessed. In order to test the robustness of the single column model results, and to study the role of advection and urban-rural mesoscale circulations, the simulations will be repeated using full 3-D version of the WRF model.