The Urban Climate System

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Content

Description work package

1.1 Problem definition, aim and central research questions

To ensure that effective and coherent adaptation measures and strategies are being developed for the urban environment, a thorough understanding of processes of the Urban Climate System (UCS) is essential. This includes understanding of weather, air quality and climate phenomena from mesoscale to microscale. In addition, more quantitative information regarding the UCS is needed. The aim of WP1 is to provide this information, both from observations and model simulations.

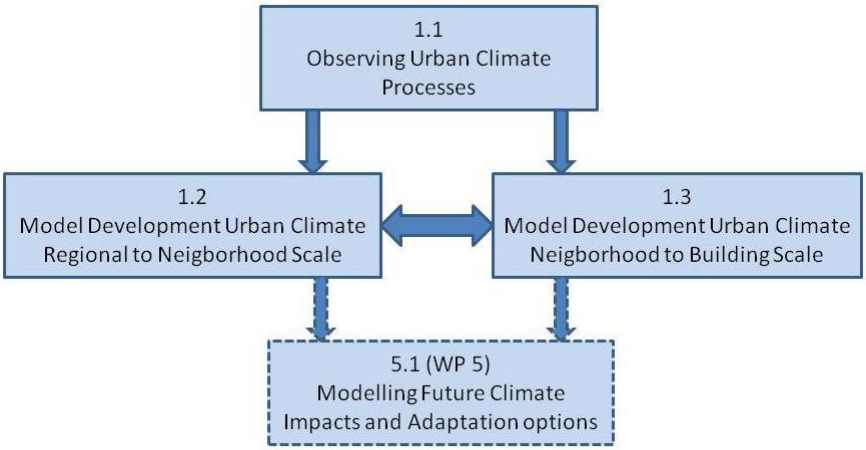
In contrast to many countries in the world, where urban meteorology has been studied for more than 3 decades, urban meteorology was not an issue in the Netherlands until recently. However, although foreign studies on urban climate may contain valuable information, they cannot be easily extrapolated to the Dutch situation. There are distinct differences in climatic conditions, urban landscape and geometry, and in building styles and materials. This implies that specific tools to assess the effect of climate change on urban climate in the Netherlands are required. Such tools can then be used to support urban planning, in order to ensure that proper adaptation measures will be taken.

Processes at different scales (metropolitan area, city, neighbourhood, street and building scale) will be studied, to unravel the complex relationships between meteorological processes, urban configuration and geometry, and anthropogenic activities. This knowledge will be integrated in simulation models, covering the different spatial and temporal scales in the UCS. WP1 aims at the development and validation of a model instrumentation with which the effects of current and future climate projections on meteorological variables (radiation, temperatures, air humidity, wind and precipitation) can be studied for urban areas. With this model instrumentation the effectiveness of various adaptation measures to cope with climate change effects in cities, can be assessed (as part of WP5).

1.2 Interdisciplinarity and coherence between the projects

Workpackage 1 is subdivided into three main tasks which are strongly linked:

1. Meteorological and hydrological observations in the urban environment (Project 1.1)
2. Development of a model instrumentation (Projects 1.2 and 1.3)



In Project 1.1, meteorological and hydrological observations in the Urban Canopy Layer (UCL) and Urban Boundary Layer (UBL) will be carried out. The resulting data will be analyzed to increase process understanding and to develop new model parameterizations. Furthermore, the data can be used to validate the models. Two types of models will be further developed and evaluated:

1. A mescoscale Numerical Weather Prediction (NWP) model, for simulating the urban climate at the regional to neighbourhood scale (Project 1.2)
2. A Computational Fluid Dynamics (CFD) model for simulating the urban climate at the micro (neighbourhood to building) scale (Project 1.3).

The modelling efforts on the mesoscale and microscale require different scientific approaches. Therefore, development of the model instrumentation will take place in two separate projects. With this model instrumentation, the impact of near-term regional climate change, particularly impacts linked to extreme weather events, on the UCS will be studied. This will be performed in WP5, using the results of the scenario studies for regional climate change (KfC Theme 6) as input. The results will be an essential component for a conurbation-scale risk assessment in WP 2, which in turn is necessary to prioritize and determine the extent of adaptation measures to be taken. In addition, the model instrumentation will be used to assess – in close cooperation with WP3 - the (feedback) effects of proposed adaptation measures and strategies on the UCS, in order to determine their suitability and effectiveness. The aforementioned results are essential to develop a coherent and effective adaptation response.

Both observations and model simulations will initially be focused on the case study areas in the hotspots. The models will be validated and parameterized with in situ meteorological and hydrological observations. However, subsequently, observational data of other urban areas will be used in order to get a more generally applicable model instrumentation.

The University of Manchester will support this work package through comparative work developd through the ASCCUE and SCORCHIO projects and the meso-scale models to be developed through the CPC project.

1.3 Stakeholders

The results of this workpackage support the following workpackage but are also of immediate interest to a wide range of stakeholders. Local governments, urban designers and planners, project developers, health services, housing corporations, building engineers, water boards, energy companies.

Specific stakeholders are the hotspots and other cities involved in the programme. The observation and modelling (to a certain extent) will be executed at sites chosen in consulation with the hotspots. Specific questions with regard to these sites can be taken into account.