

Impacts, sensitivity, vulnerability

Work package leader : Dr. Ir. B. (Bert) Blocken (TU Eindhoven)

Content

Description work package.....	1
1.1 Problem definition, aim and central research questions	1
1.2 Interdisciplinarity and coherence between the projects	2
1.3 Stakeholders	3

Description work package

1.1 Problem definition, aim and central research questions

The Royal Netherlands Meteorological Institute (KNMI) has described the expected changes in climate for the Netherlands in terms of four climate scenarios:

- ▽ Temperatures will continue to rise; mild winters and hot summers will become more common.
- ▽ On average, winters will become wetter and extreme precipitation amounts will increase.
- ▽ The intensity of extreme rain showers in summer will increase, however the number of rainy days in summer will decrease.
- ▽ The calculated change in wind is small compared to the natural fluctuations.
- ▽ The sea level will continue to rise.

In cities, the urban heat island effect (UHI) adds to the temperature rise because of a changing climate.

The urban environment is subjected to these changes. This can result in adverse effects including overheating, flooding, drought and related increases in morbidity, mortality and damage to property. Prior to implementing adaptation measures, the potential impact of climate change and the sensitivity and vulnerability of the urban environment to climate change need to be analysed.

This analysis is the aim of workpackage 2, focused on buildings, people and neighbourhoods, and considering the important uncertainties involved. This workpackage is strongly connected to the workpackages 1 and 3. While workpackage 2 will start using the already existing climate scenarios for the Netherlands, as the KfC program progresses, these will be replaced by the refined regional and local current and future meteorological data, resulting from KfC theme 6 and from the modelling efforts in workpackage 1. Workpackage 2 is also, and especially, intended to support workpackage 3, in which adaptation measures will be analysed. The reason is that knowledge on impacts, sensitivity and vulnerability is needed to determine the need for adaptation measures.

The central research questions in this workpackage are:

- ▽ What are the potential impacts of climate change and the sensitivity and vulnerability of our urban environment to climate change?
- ▽ When, where and to what extent will adaptation measures be needed?

These research questions can be broken down into project-specific research questions:

- ▽ What are the potential impacts of climate change on the indoor environment and energy consumption of buildings?
- ▽ What are the potential impacts on human health (especially the elderly) during overheating episodes?
- ▽ What are the potential impacts of climate change on neighbourhoods, in terms of excess rainfall and overheating?
- ▽ How sensitive and vulnerable are our urban systems (neighbourhoods, urban functions, public) to the wide range of climate change parameters?
- ▽ Can a typological classification of buildings and neighbourhoods be established on which strategies for adaptation measures can be based?

1.2 Interdisciplinarity and coherence between the projects

To answer these research questions, four projects have been defined. Two of these are specific projects (2.1 and 2.2), addressing physical and physiological parameters at the building and human scale. The two others (2.3 and 2.4) are more general projects, focusing on neighbourhoods or multiple scales. They are for a large extent based on literature overview and are intended to rapidly provide direct tools for the hotspots for practical use as well as tools for other projects in other work packages.

In project 2.1, the effects of increased temperature on the indoor environmental performance and energy consumption of buildings are evaluated. The focus is on indoor temperatures, overheating, thermal comfort and heating and cooling demand of buildings. Measurements as well as numerical simulations are performed for a range of typical buildings in the Netherlands. The results are a sensitivity classification of buildings and an indication of the related indoor environmental conditions and energy performance. It provides information on if, when and where adaptation measures will be necessary at the building scale.

This information is used in project 2.2 to analyse effects of overheating on the most vulnerable group: elderly people. A measurement campaign will document a range of physiological and also psychological parameters to increase our understanding of the actual heat strain that elderly people experience during overheating episodes in buildings. Based on this information, adaptation measures will be contemplated.

Project 2.3 aims at quantifying the sensitivity and vulnerability of urban systems and to analyse how these can be reduced by strengthening the threshold capacity, the coping capacity, the recovery capacity and the adaptive capacity of buildings, facilities, infrastructure and people. Although its main focus is on the neighbourhood scale, it also encompasses other scales.

Supported by the vulnerability analysis in project 2.3, project 2.4 will establish a typology of neighbourhoods in terms of vulnerability to climate change. Its goal is to provide a tool to identify which neighbourhood types should be given the highest priority for the implementation of adaptation measures.

Work package 2: Impacts, Sensitivity, Vulnerability

This project will also allow for the extrapolation of results and knowledge obtained for a certain neighbourhood to other neighbourhoods with the same or a similar typology.

The University of Manchester will undertake comparative work to assess differences in methods and findings from building simulation work, which have used alternative simulation software to estimate the relative contributions of building types to the Urban heat Island effect in Manchester, and the influence of various building scale adaptations.

1.3 Stakeholders

A large number of stakeholders can be identified, such as local governments, urban designers and planners, project developers, health services, housing corporations, building engineers, water boards, energy companies. Specific stakeholders are the hotspots that are engaged in this programme, but also other co-funding parties (Haaglanden, Rotterdam, Amsterdam, Tilburg, Arnhem-Nijmegen).

It is important to mention that this workpackage, although it addresses several hotspot-specific research questions directly, is strongly focused on providing the basis for the projects in workpackage 3, which are more closely linked to the majority of hotspot questions.

The following hotspot-specific questions are addressed in this workpackage:

Urban residential areas

- ▽ Neighbourhood typologies – existing and new neighbourhoods
- ▽ Requested fast deliverable: fast scan of sensitivity and vulnerability of neighbourhoods
- ▽ Relationship between outdoor and indoor environment in existing buildings – heat stress
- ▽ The effect of heat strain on health in the elderly

Building and Street

- ▽ Classification of buildings in terms of relationship outdoor-indoor environment
- ▽ Heat stress agenda
- ▽ Sustainable buildings and street
- ▽ Water elements