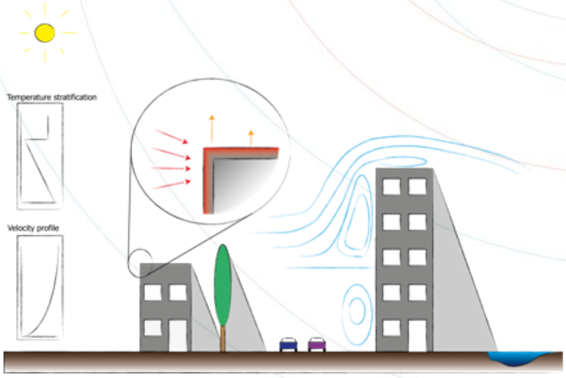
Kennis voor Klimaat
Knowledge for Climate

Project **Theme 4 | Development of a model instrumentation for simulating the urban cli at the micro-scale**

Description of research

The goal of this project is to develop a simulation model that is able to compute the local climate in an urban environment. The scale ranges from building scale (1 or 2 buildings with their environment) up to a neighbourhood scale. The model computes the surface temperature of obstacles and ground, based on the time of the day and location of the city (surface energy balance). A computational fluid dynamics (CFD) model, which computes the airflow in the domain, is then used to disperse the surface temperature and show the air temperature distribution. With this model, the effect of different adaptation measures can be computed. These can be the enhanced albedo of buildings (more solar reflection), green facades, trees, ponds, etc… The model will not only compute the cooling effect of an adaptation measure, but will also show on what scale the adaptation measure will have an effect. As an output, not only absolute temperature is considered, but also (for instance) the physiological equivalent temperature (PET), which takes into account the radiation and wind chill factor.



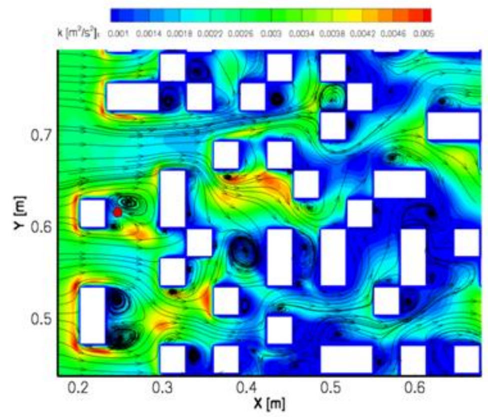
Schematic overview of the simulation program

Research question

What is the effect of different adaptation measures on the local micro-climate at neighbourhood scale

The most important conclusions

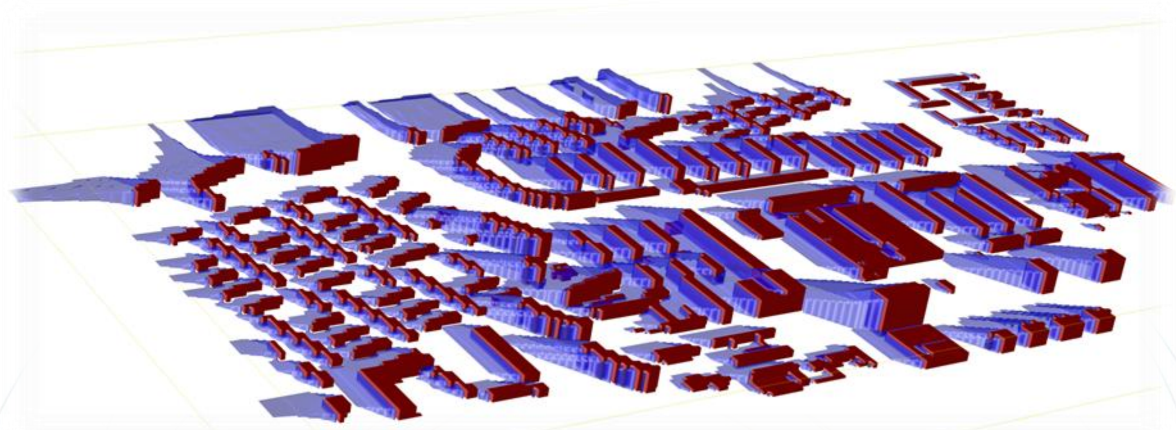
- The current CFD model is able to compute the airflow through a complex urban environment with high accuracy
- Temperature is included in the simulation program, but is not yet validated
- First steps are taken towards an urban surface energy balance, although this is still under development
- A monte-carlo approach is used to compute the radiation.



Airflow through a complex urban environment. This is one of the studies used to validate the CFD model.

Possible applications from the project

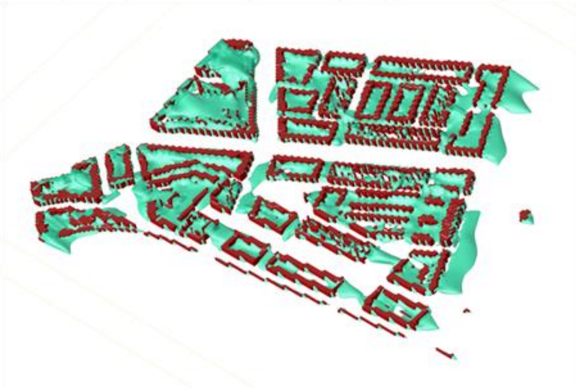
- Computing the effect of different adaptation measures
- Detailed information on airflow and local temperature hotspots in different neighbourhoods
- Computing different radiative properties (mean radiant temperature, shadow locations)



Shadow locations at "Plein '40-'45" in Amsterdam at 10:00 UTC

Bottlenecks of the project

- Validation is one of the most important aspects when developing a computational model. A wide range of experimental data is needed to get confidence in the output from the model
- Since the model is able to give very detailed answers for different adaptation measures, giving generic answers will be the other main challenge. Dependency on location and meteorological input should be minimized.



Airflow through Bergpolder Zuid, Rotterdam. In red are the obstacles, the green areas are ocations which are in the wake of the obstacle.

Opportunities for the poject

- The final model will be able to compute in high detail the effect of different adaptation measures. This can be used to find the optimal location for that measure, or give more generic answers that can be used in a design study
- In a model, certain effects can be studied in more detail. Think for instance about a tree. This model is able to compute the effect of different aspects (wind blocking, shading, evaporation), and see what is the most efficient cooling part. This can be used to create a design solution which can be cheaper or more effective.

More information

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