Topic: 3D landscapes and technology

Title: Design and Calculate, a new way of working with water for urban and landscape planners

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Introduction

It has proved to be difficult to get water system experts and urban and landscape planners to work effectively together to achieve solutions which imaginatively and cost-effectively add to both the climate robustness of the built environment and the quality of life in a broader sense.

Often, water experts' input is limited to setting boundary conditions and water-related objectives which the designers have to meet. This means that the design process misses out on the potential added insights and feedback that could come from further use of water systems analysis.

Yes, water experts and designers have followed the recommendation to meet earlier in the design process and share thoughts in an early stage. The fact is, however, that in practice their workflows are still largely separated. And yes, there are numerous checklists and GIS oriented tools with ready to use 'water ideas' and measures, specially developed for landscape architects and urban planners. They can find information on measures for climate adaptation, flood protection and to limit the impact of extreme storm events. Some of the tools can automatically identify possible spots for green roofs and infiltration areas. But these don't seem to have bridged the gap. The information seems too much a set of 'ready to use building blocks' and therefore, especially in the first design stage, in which meaning and shape of elements are explored, too 'module like' to be of use.

Research questions

In the search for an integrated workflow and the developments of tools to support this, a number of interesting questions have come up:

- Why is an integrated workflow required?
- How to arrive arrive at an integrated workflow: what would it look like and how would it compare to the way water experts and planners work together now?
- Why are the existing tools not enough to make an integrated workflow possible?
- How can we develop an integrated workflow that benefits from all the available water information?
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Advantage of an integrated workflow: flexibility

How are water system experts usually involved in the design process? Normally by passing on boundary conditions based on generic standards (e.g. a fixed minimum percentage of surface water area) or more specific requirements based on calculations using mathematical models of an area (e.g. maximum water level at a certain location derived from some sort of model-based risk assessment). Such boundary values can be considered as input for the spatial designers and the water system

analysis is usually carried out more or less independently of the steps in the design process. It should be noted that boundary values are often simplified indicators for compliance with complex goals.

Often, boundary values act as a straightjacket for designers, for instance when they find potential solutions that cannot be measured in terms of the given boundary values, but nevertheless hold the promise of solving the given problem. Then, going back to the key water objectives is necessary to formulate new relevant conditions based on the new assumptions. This gives more room for designers to find the best solution, including meeting the real water system needs. In this respect an integrated workflow would offer more flexibility.

Model output for inspiration

And there is more. Mathematical models can also produce data that might inspire the spatial planner such as spatial patterns of simulated floods, simulated patterns of urban flooding during extreme rain events, the spatial consequences of 'upstream' retention. These patterns, in combination with other types of processed data (e.g. shadow maps, heat stress areas, (historic) elevation maps, and geological subsurface layers) may contribute to an imaginative plan or help to 'border the design space'.

How to arrive at an integrated workflow

First, water experts need to learn more about the workflow of designers and to recognize the crucial decision points in the design process. Designers need to understand more about the different ways in which water systems analysis could help them. And we also need better tools. At the very least the tools should be able to estimate the impact of measures at a specific location in a specific context. They should also enable 'on the fly' re-evaluation of the water goals and measures when spatial boundaries, wishes and demands change during the design process. The spatial designer should be supported interactively by the water system modeling expert through accurate, spatially detailed simulations to answer what-if questions instantly. Furthermore it should be possible to intuitively combine this information with all kinds of other relevant spatial information, for example on heat stress and acoustic pressure.

Despite many attempts, the promise of model-supported spatial design has not yet been fulfilled. Graphical possibilities of the user interface of water management modeling tools have so far not lived up to spatial designers' requirements; models have required very precise input and calculating time has often been too long.

Recent developments in high-resolution modeling however have brought us interactive and detailed water simulations that can be carried out in the cloud. 3Di (www.3di.nu) is such an innovative development. It provides instant realistic visualization of water flows on an iPad or touch table. The next step is finding the best possible way to integrate this tool into the workflow of the urban and landscape planner.

Design and Calculate

The project Design and Calculate aims to achieve this integration. The idea is to first study the workflow of designers, to discover their specific way of processing information. Then we want to identify the points in the process where the different types of water flow calculations can add value. Next we want to extend the available water related geographical information. Then we investigate the possibility of converting the spatial design into a set of model parameter adjustments within the 3Di environment (conversion from design drawing to the simulation model settings). Eventually a prototype of the connection software will be tested in real life case studies.