Flood risk assessment as an integral part of urban planning

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Title of abstract / presentation	Flood risk assessment as an integral part of urban planning
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Organisation/s / affiliations	Technical University of Denmark (DTU) Monash University DHI Water and Environment
Full name of proposed presenter	Karsten Arnbjerg-Nielsen
Do you give permission for your presentation to be recorded?	Yes
Do you require any special audio- visual requirements?	No
Other comments: (including any requests to change position in the program)	We suggest to be included in an Elwood-session where we can demonstrate the interaction between different CRC projects

CRC for Water Sensitive Cities

Flood risk assessment as an integral part of urban planning

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Keywords: flood risk modelling; urban development modelling; scenario planning

Background and relevance

Keeping flood risk at an acceptable level is a key aspect of urban planning. A flood-proof city can only be achieved in an economically viable manner if the reduction of flood risk becomes a part of other planning processes in the city. Recent developments in modelling urban growth (Urich and Rauch, 2014) have made it possible to evolve potential futures of cities in a modelling space and to link those futures to drivers of change, e.g. climatic changes and population growth, and to test the effectiveness of WSUD. The integration of a flood risk assessment framework allowing time varying inputs (Zhou et al, 2012), enables flood risk to be simulated over time in an automated manner and for a multitude of future scenarios.
Successful urban flood risk management strategies often involve the implementation of measures affecting the urban from. Examples are the redesign of road spaces, the implementation of policies that require freeboards for houses in flood prone areas or the implementation of new urban layouts that modify flow paths on the surface. Evaluating the potential of such measures requires detailed hydraulic simulations that consider surface flows and has so far not been possible in the integrated approach described above. We have therefore integrated the 1D-2D hydraulic simulation software MIKE FLOOD with DAnCE4Water's urban development component to be able to test the effectiveness of WSUD for urban flood risk management.

Results and Summary of key findings

Key variables of urban development that affect simulated flood risk are the location and extent of buildings and roads, the implementation of water sensitive measures such as rainwater harvesting, modifications of the terrain and changes of the stormwater pipe network, such as the increase of pipe diameters. We transfer such changes from DAnCE4Water to MIKEFLOOD by modifying runoff model parameters, pipe network description and digital elevation model in an automated manner (Figure 1.1).

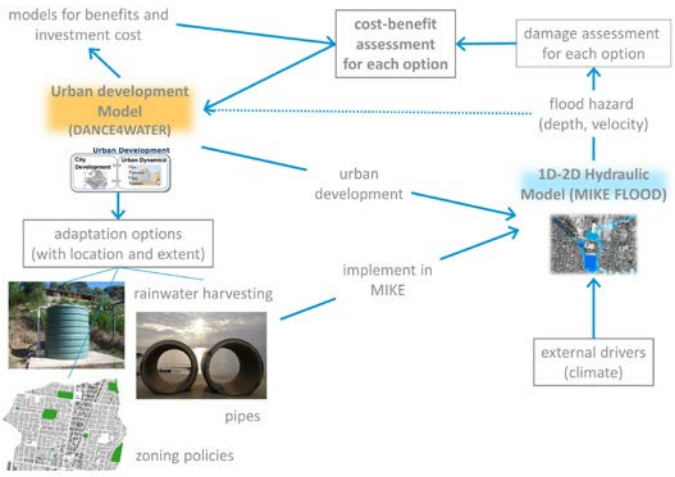

Figure 1.1: Schematic for coupling DANCE4WATER in MIKEFLOOD.

We have tested the approach for the Scotchman's Creek catchment, Melbourne, where we focused on testing the effect of policies to reduce housing densities in areas of high flood risk by penalizing development in such areas. Implementing such policies lead to a significantly reduced flood risk as compared to a business as usual scenario (50% less buildings were expected to be flooded per year). In addition, we could minimize the areas subject to such policies iteratively, by repeatedly updating the urban development simulation with simulated flood hazards.

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Discussion and application to industry

For the Scotchman's Creek catchment we have been able to demonstrate that it is possible to make flood risk modelling a part of integrated urban modelling and that this approach is beneficial in the urban planning process. A current focus of our work is to assess the required complexity of the models and to reduce simulation time.

In another case study in Elwood we are testing the approach in a large scale catchment and as a part of a progressive urban planning process. Potential futures for this very flood-prone area are explored in workshops with community and stakeholders and translated into tangible solutions by architects. These solutions are evaluated in a combination of urban development and flood risk modelling for a multitude of potential future scenarios. In conjunction with modern decision making approaches that balance investment cost, benefits and expected flood risk reduction for different solutions, we can identify robust and economically viable urban layouts in an iterative process.

References

Urich, C. and Rauch, W. (2014) Exploring critical pathways for urban water management to identify robust strategies under deep uncertainties. Water research, 66C, 374–389.

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