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An Integrated Modelling Framework to Assess Flood Risk under Urban Development and Changing Climate

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Subject: ECCA 2015 abstract submission
Date: 31. januar 2015 18:18:05

Dear Mr./Mrs. Roland Löwe,

You have submitted the following abstract:

Abstract title	Accounting for Urban Development and Flood Risk in an Integrated Modelling Framework
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Topic	Adaptation to changing flood risk
Presentation Preference	Oral presentation
Abstract text	

Flood risk in cities is strongly affected by the development of the city itself. Many studies focus on changes in the flood hazard as a result of, for example, changed degrees of sealing in the catchment or climatic changes. However, urban developments in flood prone areas can affect the exposure to the hazard and thus have large impacts on flood risk. Different urban socio-economic development scenarios, rainfall inputs and options for the mitigation of flood risk, quickly lead to a large number of scenarios that need to be considered in the planning of the development of a city. This calls for automated analyses that allow the planner to quickly identify if, when and how infrastructure should be modified. Such analysis, which accounts for the two-way interactions between city development and flood risk, is possible only to a limited extent in existing tools.

We have developed a software framework that combines a model for the socio-economic development of cities (DANCE4WATER) with an urban flood model. The urban flood model is a 1D-2D spatially distributed hydrologic and hydraulic model that, for a given urban layout, simulates flow in the sewer system and the surface flow in the catchment (MIKE FLOOD). The socio-economic model computes urban layouts that are transferred to the hydraulic model in the form of changes of impervious area and potential flow paths on the surface. Estimates of flood prone areas, as well as the expected annual damage due to flooding, are returned to the socio-economic model as an input for further refinement of the scenarios for the urban development.

Our results in an Australian case study suggest that urban development is a major driver for flood risk and vice versa that flood risk can be significantly reduced if it is accounted for in the development of the cities. In particular, flood risk in a scenario with strong urban growth and almost a doubling of the amount of sealed area in the catchment was found to remain almost unchanged, if flood hazards were used as a constraint on the urban development, i.e. as an input to the socio-economic model.

Further developments will focus on improving the socio-economic model, on the evaluation of flood damages as well as the required complexity of the hydraulic model.

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