Surrogate modelling of coupled 1d-2d hydraulic model (MIKE FLOOD)

C. Thrysøe and J. Toke

DTU Environment, Technical University of Denmark

ABSTRACT

Climate change will change future precipitation patterns causing more extreme and frequent rain events. If no adaption measures are done, the drainage systems will be overburdened, which will result in more severe flooding in urban areas. Hydrodynamic models, such as MIKE FLOOD, are commonly used to model when and where flooding will occur. This can then be applied in the urban planning for different adaptation measures or in real-time to optimize the system. However, the usage of these models is impeded due to large computational requirements of the models and these are therefore not suitable for real-time applications. To reduce the computational requirements, 1D-1D surrogate models are developed to replace large parts of a hydrodynamic model. Aaby and Viby catchments in Aarhus are used as a case study and the catchments are divided into compartments of surrogate models with varying size. Each compartment is described by its volume of water. The model both contains a drainage and a surface unit for each compartment and water can be transferred between these two segments. The drainage compartments are developed and calibrated from the drainage model of Aarhus and modelled as linear reservoirs with backwater effects. The surface compartments are developed using GIS analysis and modelled as one large basin per compartment which is connected to the basin in the following compartment by semi physical flow routing. Transfer of water between compartments and between drainage and surface is controlled by mass balance to ensure conservation of mass in the system. The performance of the surrogate models are evaluated from: 1. model accuracy, 2. model stability and 3. computational time compared to the hydrodynamic model. It is concluded that it is possible to construct surrogate models for the Aarhus catchment with results that are comparable but not as detailed as the hydrodynamic model. The surrogate models are more stable allowing for larger time steps which also reduces the computational time significantly. Based on this it is concluded that the surrogate models are a good option in modeling real-time flooding.