MUFFIN - MULTI-SCALE URBAN FLOOD FORECASTING

NEWSLETTER 1 (August 2017)

The MUFFIN project has now been running for about 1 year and this first phase has included three main activities: (1) end-user requirement specification, (2) data collection and model development and (3) joint experiment planning and design. Please find further information about each activity below.

End-user Requirement Specification

An important component of MUFFIN is to collect and analyze end-user requirements in order to develop improved systems and products that facilitate response to and management of urban floods. This will be attained by questionnaires, interviews and workshops with relevant end-users.

An end-user workshop was held on 2017-02-28. In this workshop, groups of end-users representing different sectors and categories (e.g. consultants, governmental agencies, rescue services and county boards) related to urban flooding gathered in Aalborg (DK), Rotterdam (NL), Helsinki (FI) and Norrköping (SE) in order to discuss limitations of today's urban flood forecasting methods and systems as well as ideas for improvements. In total 40 end-users participated. Individual brainstorming sessions were held in each location, after which joint plenary wrap-up sessions were held on video. The brainstorming and the discussions generated a lot of valuable input for the design of the joint forecasting experiments to be performed in MUFFIN.

Figure 1 End-user Workshop in Norrköping, Sweden.

DATA COLLECTION AND MODEL DEVELOPMENT

This activities has consisted of three sub-activities performed in the three study basins (Table 1):

- **Observations.** Both meteorological and hydrological observations are being made using both traditional (e.g. rainfall and flow gauges) and novel sensors (e.g. Micro Rain Radar and ultrasonic monitoring).
- **Local modelling.** These set-ups are customized hydrodynamic distributed (1D/2D) local flood models (SWMM, 3Di, MIKE) that account for the urban drainage system, preferential water ways (roads, channels etc.), infiltration/runoff processes, etc. These model set-ups represent state-of-the-art with respect to dynamical flood and inundation assessment in urbanized environments.
- **Multi-basin modelling.** The 1D rainfall-runoff model HYPE is being developed to operate at high resolution for the study basins This means a 1 h time resolution and a higher level of spatial detail with regards to surface elevation as well as imperviousness in urban areas, in order to improve the prediction of runoff in urban areas.

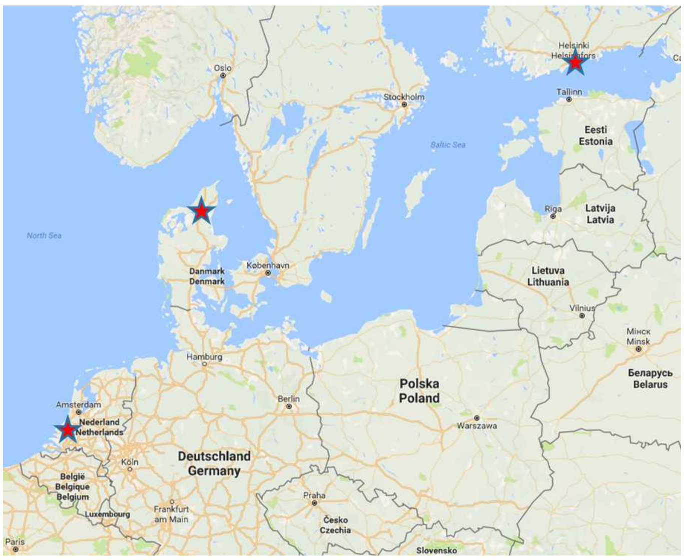
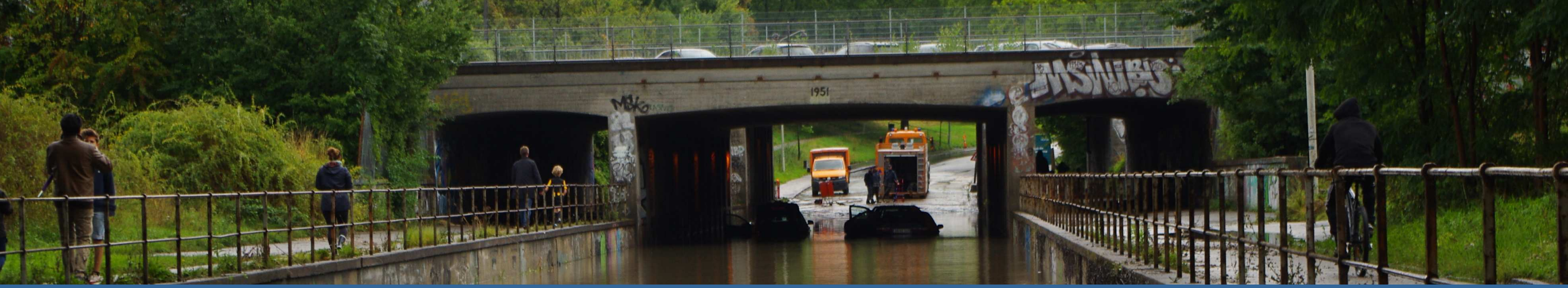


Figure 2 Study locations in Finland, Denmark and the Netherlands.

MUFFIN is funded by the EU and FORMAS, financed under the ERA-NET Cofund WaterWorks2014 Call. This ERA-NET is an integral part of the 2015 Joint Activities developed by the Water Challenges for a Changing World Joint Programme Initiative (Water JPI).



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Joint Experiment Planning and Design

In WP 4 multi scale flood forecasting experiments are set up, tested and compared across different case study catchments, spatial and temporal scales, and with different input and forcing data, catchment characteristics, etc. The main objective is to evaluate high-resolution multi-basin flood forecasting against local fine scale catchment flood forecasting through joint case studies. By comparing accuracy and uncertainty in critical runoff/discharge, predicted flood prone areas, potential lead-time, etc. the two model scales are evaluated with regards to the resolution required of inputs and outputs and their potential in real-time urban flood forecasting. Key issues include the following:

- **Rainfall forcing.** What is the impact of (temporal and spatial) resolution in rainfall observations and forecasts? How can different types of observational sensors be used and combined? What is the relation to weather situation?
- **Hydrological simulation.** What is the impact of land-use information? What is the value of high-resolution multi-basin hydrological forecasting in an urban context? Can large-scale information support local flood models?
- **End-user communication.** Which information is relevant for which end-user? How can we increase the relevance and "sharpness" of the information? How should ensemble forecasts be used and presented for optimum value?

Table 1 below shows an overview of the joint forecasting experiments, scheduled to be performed during 2018.

Table1 Characterization of the study basins and the joint experiments

	Rotterdam	Helsinki	Aalborg
Large scale catchment (HYPE setup)	Delfland (~400 km^2) Catchment type: Rural/urban	Haaganpuro (11km^2) Catchment type: Urban	Østerå catchment (150 km^2) Catchment type: Rural/urban
Local scale catchment	Rotterdam (~22 km^2) Model: 3Di Catchment type: Urban	Länsi-Pakila (1 km^2) Model: SWMM Catchment type: Urban	Kærby (1 km^2) Model: MIKE Catchment type: Urban
Hydrological forcing data for calibration and validation	Water level sensors Flow and pump data from drainage system	Flow measurements at both catchments	Water level and GRW gauges CSO registrations Pump data
Rainfall observations	Rain gauges KNMI C-band radar data TUD X-band Stochastic rainfall simulator	Rain gauges University of Helsinki composite radar data FMI radar data	SVK Rain gauge network Local rain gauges + disdrometer DMI C-band radar AAU X-band radars
Rainfall forecasts	KNMI C-band nowcasts HARMONIE forecasts WRF-forecast	Aalto radar nowcast FMI HIRLAM HARMONIE	AAU ensemble nowcast on X/C-band radar DMI-HIRLAM SMHI MEPS GLAMEPS
Special focus experiments	• Space/resolutions of models and inputs • Evaluation of accuracy between different rainfall products and forecast products • Display of flood risk maps • Detailed investigation of rainfall / flood response using artificial rainfall fields	• Predictive skills of large scale model local catchment • Impacts of land-use in flooding • Impacts of temporal resolution on small catchment simulations.	• Space/resolutions of models and inputs • Comparisons of return periods of rainfall and flood response • Predictive skills of large scale model local catchment • Use of HYPE model as boundary condition for local model • Development of fast and distributed flood model based on pre-simulated multiple system states

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