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Water Smart Cities world view on model uses

Roland Löwe on behalf of the Water Smart Cities Working Group *

Abstract

This talk will give an overview of the modelling world view developed in the Water Smart Cities project (funded by Innovation Fund Denmark) and illustrate it with examples from the project. The world view is shown in the Figure. The digital utility uses models for both planning and real-time purposes, and in both cases fit-for-purpose models were applied, i.e. models with very different complexity depending on the problem at hand.

We used detailed, physically-based models derived from the utilities asset database for monitoring and planning applications where high levels of detail were required, for example, in the form of digital twins for monitoring in detail the flows in the sewer system and for testing the design of water management measures in high detail and on small spatial scales.

Much simpler models were developed and applied where fast runtimes or large number of model runs were required. Examples from the project are forecasting models for flow and ammonia, representations of the sewer system inside model predictive control algorithms, and the evaluation of water management measures and system behaviour for a variety of climate and urban development scenarios. In these cases, fit-for-purpose models were created through either a semi-automated simplification of detailed models or by directly combining grey-box model structures to sensor data. The former approach allows for an exploitation of physical knowledge about the water system, while the latter approach can be used directly whenever sensor data are available.

Further developments point towards a further integration of models, model results and data. For example, digital twins can be combined with sensor data to provide an improved monitoring of the system states and emissions from the urban water system. Similarly, remote sensing data can be combined with hydraulic model results to provide a direct and visual impact assessment of urban water management.

