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DASH of Water – water distribution system modelling in the age of smart water meters

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Worldwide, water utilities face exceptional challenges as communities are running out of water and new resources are ill-equipped to meet rising water demands. Furthermore, in many cities, years of stringent financial constraints on water utilities, unoptimized operations and the unaffordability for utilities to maintain and replace their aging infrastructure has resulted in dramatically growing leakage levels, especially in places already under high water stress. Even in Europe, as a matter of fact, nearly one quarter of treated water is lost in the distribution systems before reaching the customers. As a result, the aging water infrastructure is challenged to become more efficient.

Nowadays, an increasing number of water utilities use hydraulic simulation software to design and operate water systems in a more efficient way. However, measurements in water distribution are scarce, which results in inaccurate computer models of real systems. Recently, smart meters have become available as a promising remedy. These smart meters measure water usage of households and transmit information to water utilities in real-time. Now is the time to make water distribution simulation software fit for the future, by exploiting this new Big-data source and start a new era in hydraulic modeling, aiming to increase the operational efficiency of our drinking water systems and save our precious water resources.

This work proposes an innovative new way of combining hydraulic models, data from smart meters and stochastic demand modelling to develop beyond state-of-the-art methods to simulate water distribution systems. It is shown how data science algorithms (e.g. dynamic time warping, clustering, demand disaggregation, household activity identification, ...) can be used to extract high-level information from smart meter data (e.g. daily water use routines, work schedules, socio-economic characteristics). Such information is crucial for simulating water demand accurately. Hence, data science algorithms can be used to automatically parametrize stochastic demand models (e.g. SIMDEUM) based on smart meter data, and improve their accuracy. The improved demand models are coupled with hydraulic simulations, leading to a more realistic way of simulating real water systems. Examples on a wide range of real-world applications show how these novel modelling approaches can be used to increase the operational efficiency of drinking water systems. For instance, more accurate models enable faster detection and localization of

leaks in water pipes and, thus, minimize distribution losses. This work is part of the project “DASH of Water”, which aims to develop advanced **da**ta-driven **s**tochastic **h**ydraulic (DASH) models of drinking water distribution systems.