EGU23-17062, updated on 20 Apr 2024
https://doi.org/10.5194/egusphere-egu23-17062
EGU General Assembly 2023

VlinderNET – a tool for Probabilistic Hydraulic Water Distribution Modelling and Visualization

Mark Morley, **Peter van Thienen**, Ina Vertommen, and Mollie Torello
KWR Water Research Institute, Hydroinformatics Team, Nieuwegein, Netherlands (mark.morley@kwrwater.nl)

Modelling and, as a consequence, decision-making for water distribution networks is ordinarily performed using the deterministic paradigm in which a single set of input conditions gives rise to a single output "truth". Reality is not so accommodating, however, and it is readily apparent that significant uncertainties remain in both our knowledge of the condition and the operating constraints of the network. These uncertainties include variables such as the effective diameter of pipes, characterised by degradation with age and water chemistry, and the quantities of water demanded by consumers. Traditionally, where these uncertainties have been accommodated in the decision-making process this has been by considering multiple scenarios to model a small number of model states.

The application of probabilistic modelling for water distribution networks has gained significant traction in the literature in recent years – particularly in the context of decision support systems where stochastic parameter sampling is employed to improve the robustness of the obtained solutions. Nevertheless, the wide interest in probabilistic modelling has yet to be reflected in the emergence of tools to apply this paradigm.

This paper introduces VlinderNET a novel tool developed by KWR which seeks to bridge this gap by allowing the user to evaluate and visualize the impact of the manifest uncertainties in the network through the use of probabilistic hydraulic simulation. VlinderNET permits the specification of complex, cascading Probability Density Functions for the input parameters for a hydraulic simulation. These PDFs are extensively sampled to produce a wide range of stochastic input variables which are evaluated in a succession of hydraulic simulations which can be parallelized either on a local computer or with cloud support. The results of the simulations are aggregated and the effects of the uncertain inputs are presented by the tool graphically and spatially both at the component and network level. The tool further provides an API for third-party applications to integrate the probabilistic paradigm directly into decision support tools in a straightforward and consistent fashion.