

Editorial

# Data-Modelling Applications in Water System Management

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Water system management has a direct impact on natural and urban environments, covering a wide spectrum of field applications, ranging from watershed and groundwater management to natural and anthropic systems for water supply and wastewater harvesting. The analysis of such systems is a very complex challenge for researchers and technicians, since it comprises many processes, sub-processes, and state variables with their associated causal factors, feedback loops, and interrelationships.

The complexity of such phenomena has motivated many researchers, in the last few decades, in exploiting data-driven modeling, including techniques such as artificial neural networks, rule-based models, or population-based strategies. On the one hand, these techniques permit the determination of the relationships between input and output field data using representative training sets. On the other hand, data-driven modeling is used to mine knowledge from data, thus unveiling new relationships among the observed variables, which would be difficult or exceptionally time/money consuming to discover using physically-based approaches.

This Special Issue collects various contributions in the area of water system management, where some data-modeling techniques are used for system analysis and decision support purposes. The main aim is to promote the interdisciplinary exchange of experiences and to provide stimuli for future research in data-driven modeling for water system management. The call for contributions includes—though is not limited to—development and application of novel data-driven modeling for ad hoc water system management purposes; comparisons among different data-modeling techniques applied to water system analysis and management; and application of data-driven modeling to support water system regulation.

The selected papers focus on some relevant emerging problems of water system management, trying to give some new insight to researchers and planners in the wide panorama of data-modelling applications. This issue contains four papers that have been selected as emerging studies dealing with the following topics:

- design and operation of water reservoirs;
- drinking water treatment plants' impact on the environment;
- water quality issues in drinking water distribution systems;
- eco-sustainability of humans demand for water resources;
- employing various data-modelling techniques such as: regression analysis; self-organizing maps; classification trees; and random forests.

In particular, the first paper of this issue investigated a methodology to introduce uncertainty of hydrological and operational input data into mathematical models needed for the design and operation of reservoirs. The water management analysis of a reservoir in the Czech Republic was accomplished showing interesting abilities of the proposed methodology in improving the robustness of the retrieved solution for drinking water reservoir design [1].

The second key point is analyzed by Bertone and O'Halloran (2016) [2], which tried to understand and predict taste and odor events in drinking water treatment plants. Historical manual sampling data, as well as data remotely collected by a vertical profiler, were collected, and regression analysis and self-organizing maps were used to determine correlations between taste and odor compounds and potential input variables.

The third paper presents an investigation of water quality in drinking water distribution systems, exploring the application of Self Organizing Map techniques to derive more insight about the number and complexity of interacting physical, chemical, and biological processes occurring within vast, deteriorating pipe networks. The results from international data sets demonstrate how multivariate, non-linear techniques can be used to identify relationships that are not discernible using univariate and/or linear analysis methods for drinking water quality [3].

Finally, the fourth paper proposes a study to identify and locate groundwater dependent ecosystems in order to protect them. The paper develops a methodology to identify the probability of an ecosystem being groundwater dependent, exploiting the relationship between the known locations of GDEs and factors influencing groundwater dependence. The model selected results from the performance comparison of classification trees and random forests [4].

The Editors hope that the analyses, findings, and discussions included in the above-mentioned papers will provide useful contributions to understanding the potentialities of data-modelling techniques for supporting future research achievements, assisting the solution of complex real-world problems, and providing new tools and approaches for the advanced training of students and water experts.

**Conflicts of Interest:** The authors declare no conflict of interest.

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