

Robust and transparent planning and operation of water resource infrastructure

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Mathematical models are widely used in water resource management to anticipate and compare the effects of different planning and operational options, and hence to inform both long-term planning and short-term operation of water systems. Despite the continuous progresses in water systems models, a key challenge in their application is how to account for increasing levels of uncertainty in model predictions. In fact, human-induced environmental change means that extreme events such as floods and droughts are becoming more frequent and unpredictable, while our ability of learning from historical observations is reduced. On the other hand, the availability of an unprecedented flux of data from novel monitoring and prediction systems (such as satellites or weather prediction systems) expands the range of information sources that can be used to construct and drive models but also introduces a new range of uncertainties in the modelling chain. These emerging challenges and opportunities are well exemplified in the context of water resource systems but are common across a range of environmental systems and management problems.

In this talk I will present the current approaches to using models and handling uncertainty in water resource management, highlight the gap between the formal approaches postulated by researchers and the more informal decision-making approaches employed in practice, and discuss directions to close this gap and promote a more effective use of mathematical models. To achieve this, a paradigm change is needed to move away from the notion of models as predictive tools to "anticipate-and-act" towards a notion of models as "exploratory tools" aimed at organising and sharing uncertain knowledge.