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Value of Information and Prospect theory as tools to involve decision-makers in water-related design, operation and planning of water systems

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The role of decision-makers is to take the outputs from hydrological and hydraulic analyses and, in some extent, use them as inputs to make decisions that are related to planning, design and operation of water systems. However, the use of these technical analyses is frequently limited, since there are other non-hydrological issues that must be considered, that may end up in very different solutions than those envisaged by the purely technical ones.

A possibility to account for the nature of the human decisions under uncertainty is by exploring the use of concepts from decision theory and behavioural economics, such as Value of Information and Prospect Theory and embed them into the methodologies we use in the hydrology practice. Three examples are presented to illustrate these multidisciplinary interactions. The first one, for monitoring network design, uses Value of Information within a methodology to locate water level stations in a complex canal of networks in the Netherlands. The second example, for operation, shows how the Value of Information concept can be used to formulate alternative methods to evaluate flood risk according to the set of options available for decision-making during a flood event. The third example, for planning, uses Prospect Theory concepts to understand how the "losses hurt more than gains feel good" effect can determine the final decision of urbanise or not a flood-prone area.

It is demonstrated that decision theory and behavioural economic principles are promising to evaluate the complex decision-making process in water-related issues.