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What does the new breed of decision-making methodologies mean for choices and norms in hydrological science?

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Hydrological sciences are increasingly utilized in decision-making contexts that need to manage deep uncertainty, changing conditions and very long-lead times and lifetimes. Traditional optimizing approaches become problematic in such situations. For example, optimizing approaches may underestimate the importance of low probability outcomes, or very uncertain outcomes. Alternative decision-making strategies are therefore increasingly used in hydrological applications, including "bottom-up/top-down", "context-first", "decision-scaling", "assess risk of policy", "robust", "resilient" or "flexible" approaches. These kinds of strategies are typically designed to handle very uncertain and diverse outcomes, and often start from the particular decision-making context, in contrast to more traditional "predict-then-act" or "science first" approaches.

Contemporary research in philosophy of science stress the influence of value judgments and norms in scientific assessments. In particular, this literature points out that implicit anticipated applications often influence choices made in scientific assessments. Furthermore, this literature also emphasize that choices made at within scientific assessments have consequences for decision-making later on. One reason is that it is often difficult for decision-makers to see what choices are made and the implications of these choices. Another reason is that information that could be of use for decision-makers are lost at an early stage. For example, the choice to focus on central estimates and not providing assessments on more unlikely outcomes is a choice that has consequences for what outcomes are taken into account in the decision-making process.

This paper develops this argument and then analyzes the implications of these new developments for hydrological science. One implication of the increasing use of the new breed of planning strategies is that a broader range of uncertainty in scientific assessments becomes desirable in order to fully benefit from the power of the new decision-making strategies. Another implication is that bayesian probability assessments become more important. Finally, advantages and risks involved in changing scientific assessments in order to anticipate the new decision-making strategies are discussed.