



Jun 26th, 2:00 PM - 3:20 PM

## Robustness metrics: how the quantification of system performance under deep uncertainty influences decision making.

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McPhail, Cameron; Maier, Holger R.; Kwakkel, Jan; Giuliani, Matteo; Castelletti, Andrea; and Westra, Seth, "Robustness metrics: how the quantification of system performance under deep uncertainty influences decision making." (2018). *International Congress on Environmental Modelling and Software*. 36. <https://scholarsarchive.byu.edu/iemssconference/2018/Stream-F/36>

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## Robustness metrics: how the quantification of system performance under deep uncertainty influences decision making

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**Abstract:** Uncertainty has long been considered in environmental decision-making. However, due to drivers of change such as climatic, technological, economic and socio-political changes, it is recognised that the consideration of multiple plausible futures and deep uncertainty is important. Robustness metrics have emerged as a means of quantifying system performance under deep uncertainty, although each metric does this in a different way. Recent research has shown that the choice of metric greatly influences the optimality of decision alternatives. Our research helps explain why these metrics sometimes disagree, by contrasting how different quantifications of system performance under deep uncertainty can lead to different decisions. This has led us to develop a framework for robustness metrics (based on the decision-context and the decision-maker's preferences), and provide a greater understanding of how different robustness metrics can lead to different decisions. This is confirmed using a number of environmental system model case studies including water supply augmentation in Adelaide, Australia, the operation of a multipurpose regulated lake in Italy, and flood protection for a hypothetical river based on a reach of the river Rhine in the Netherlands. The increased understanding of robustness metrics also indicates to decision-makers what the most appropriate metric is for their case-study.

**Keywords:** robustness; decision-making; deep uncertainty; scenarios;