EXTENDED ABSTRACT ONLY

Uncertainty, Creativity, and Automated Model Building in the Hydrologic Sciences

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Abstract: Hydrologic modeling has advanced considerably over the last 50 years, evolving from simple mathematical representations of dominant rainfall-runoff processes, through the advent of Freeze and Harlan's (1969) blueprint for physically based models, to the complex and integrated modeling platforms that exist today. Currently, modeling approaches allow the rapid formulation and deployment of hydrologic predictions across the full range of potential applications and in response to prospective hazards. Despite this advancement, no model is perfect for any given modeling exercise. Significant effort has thus been put into the development and refinement of uncertainty frameworks that attempt to quantify and convey the imperfections in our models, and reconcile them with our observations of hydrologic systems.

One way to address model uncertainty is via the use of multi-model platforms that attempt to simplify and automate the process of model building. It can be argued that these platforms have transformed the modeler's ability to effectively develop competing hypotheses about hydrologic systems, and have unified modelers by providing a common template for previously disparate model structures. However, do they inhibit or enhance creativity and innovation in hydrologic science?

This presentation will discuss the importance of creativity in hydrologic model building, and how it might be enhanced using field observations, expert knowledge, and current or future modeling tools. Using a suite of case study catchments from the US and Australia, the lecture will consider the use of multi-model approaches for improved uncertainty analysis and understanding of model performance. We will demonstrate how field experiments can challenge the traditional conceptualization of a catchment, and how this information may be incorporated into existing uncertainty frameworks. An iterative modeling framework (where we propose, test and refine our models) remains critical to further understanding of hydrologic systems, and this presentation will demonstrate how we must challenge the necessary bounds of automated modeling platforms to propose new (creative) solutions to scenarios where our models fail.

Keywords: *Hydrologic modeling, multi-model ensembles, uncertainty quantification*