



Using Models and Data to Learn: The Need for a Perspective based in Characterization of Information (John Dalton Medal Lecture)

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The hydrological community has recently engaged in a discussion regarding future directions of Hydrology as an Earth Science. In this context, I will comment on the role of “dynamical systems modeling” (and more generally the systems-theoretic perspective) as a vehicle for informing the Discovery and Learning Process. I propose that significant advances can occur through a better understanding of what is meant by “Information”, and by focusing on ways to characterize and quantify the nature, quality and quantity of information in models and data, thereby establishing a more robust and insightful (less ad-hoc) basis for learning through the model-data juxtaposition. While the mathematics of Information Theory has much to offer, it will need to be augmented and extended by bringing to bear contextual perspectives from both dynamical systems modeling and the Hydrological Sciences. A natural consequence will be to re-emphasize the a priori role of Process Modeling (particularly specification of System Architecture) over that of the selection of System Parameterizations, thereby shifting the emphasis to the more creative inductive aspects of scientific investigation.