

Working Paper on Hydrologic Models in the Courtroom

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Abstract: The quality and reliability of hydrologic models is a regular feature of surface water and groundwater disputes that make it to the courtroom. These models can be enormously useful, but at the same time are often suspect because of their complexity and their lack of transparency. In this paper I wish to visit the question of whether and how courts could approach the use of models, including the assessment of models and their results, before formal proceedings commence. My underlying assumption is that an improved assessment process can lead to better models, and, ultimately, to fairer and more efficient outcomes. To do this, I review some of the literature on model building and testing, and some of the proposed guidelines on a number of the features of model construction and testing. I also look at two cases in which models played a central role, the Arkansas River Compact alteration (*Kansas v. Colorado*) and the Republican River Compact dispute (*Kansas v. Nebraska and Colorado*). They offer very different examples (if not extremes) of model building and use. Finally, I discuss some alternatives to cross examination of experts, once models are introduced.

- I. Introduction
 - II. The Model Building Process and Brief Literature Review of Model Assessment
 1. General Features of Models
 2. Types of Error in Modeling Physical and Operational Systems
 3. Model Calibration
 4. Examples of Calibration Processes
 5. Sensitivity Analysis
 6. Opinions on Calibration, Validation and Model Assessment
 - III. Criteria for Judging Adequacy of Models
 1. American Society of Testing and Materials
 2. Daubert Criteria
 3. Federal Judicial Reference Manual on Scientific Evidence and Other Material on Expert Testimony
 - IV. Case Examples of the Use of Models in Complex Adversarial Proceedings
 1. Arkansas River Compact: *Kansas v. Colorado*
 2. Republican River Compact: *Kansas v. Nebraska and Colorado*
 - V. Threshold Criteria for Model Use in Adversarial Proceedings: Comparing the RRCA Model with the HIM
 - VI. Judging/Assessing Models and Model Based Expert Testimony
 - VII. Concluding Comment
- Bibliography
- Appendix A: Mathematical Approaches to Model Calibration

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