



Testing modeling frameworks

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Modeling frameworks include many ideas about, for example, how to parameterize models, conduct sensitivity analysis (including identifying observations and parameters important to calibration and prediction), quantify uncertainty, and so on. Of concern in this talk is meaningful testing of how ideas proposed for any modeling framework perform. The design of meaningful tests depends on the aspect of the framework being tested and the timing of system dynamics. Consider a situation in which the aspect being tested is prediction accuracy and the quantities of concern are readily measured and change quickly, such as for precipitation, floods, or hurricanes. In such cases meaningful tests involve comparing simulated and measured values and tests can be conducted daily, hourly or even more frequently. Though often challenged by measurement difficulties, this remains the simplest circumstance for conducting meaningful tests of modeling frameworks. If measurements are not readily available and(or) the system responds to changes over decades or centuries, as generally occurs for climate change, saltwater intrusion of groundwater systems, and dewatering of aquifers, prediction accuracy needs to be evaluated in other ways. Often these require high performance computing. For example, complex and simple models can be compared or cross-validation experiments can be conducted. Both can require massive computational resources for any but the simplest of problems. Testing other aspects of a modeling framework can require different types of tests. For example, testing methods of identifying observations or parameters important to model calibration or predictions might entail evaluation of many circumstances for methods that are themselves commonly computationally demanding. Again, high performance computing is needed even when the goal is to include computationally frugal methods in the modeling framework. In this talk we discuss the importance of such testing, stress the need to design and implement tests when any modeling framework is developed, and provide examples of tests from several recent publications.