

Long version:

From Buckets to Clouds: Building Better Environmental Models for Today's Decision-making

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Advances in software and hardware capabilities have provided the ability to bring sophisticated modeling tools to bear on societal problems. It is not clear, however, how to best leverage our new capabilities. For example, how to include and evaluate the myriad of possible observations and parameters is not always readily apparent, and doing this poorly may force the final product back to simple trial-and-error manual calibration – an approach ill-suited for many of today's decisions.

Although hard and fast rules don't universally apply, one promising approach is based on highly parameterized methods. At the confluence of theoretical and practical developments, this new approach is now readily available and implemented in open-source software. It includes: a) initial calibration to get the model into the ballpark; b) including many (buckets) of parameters in the model calibration; c) constraining the calibration using mathematics and soft-knowledge of the systems; and d) using the quantitative framework to estimate societally relevant outputs such as prediction uncertainty and monitoring network design. With a highly parameterized approach, parallel processing such as that provided by cloud computing can be used to maintain reasonable run times. An assortment of USGS project results are used to demonstrate the application of a highly parameterized approach to natural resource decision making.

Short version:

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Advances in software and hardware capabilities have provided the ability to bring sophisticated modeling tools to bear on societal problems. Highly parameterized modeling techniques are one promising approach for building better models that take advantage of improved computing capabilities. Such an approach includes many (buckets) of parameters in the model construction, then constrains the model using mathematics and soft-knowledge of the system. Although carrying many parameters requires more computer power, new capabilities such as cloud computing can be used to maintain reasonable run times. USGS project results are used to demonstrate the application of this approach to natural resource decision making.