Integrated Water Prediction from regional to national scales

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The scientific challenges for addressing the water needs of the 21st century are complex. Better integration of data, knowledge, and modeling tools across scientific disciplines and organizations will be required to improve and accelerate the development of water prediction capabilities. To face the growing demand on the Nation's water resources, we are developing the capacity to improve the forecasting of hydrologic states, fluxes, and outcomes for water availability, including water budgets, water use, temperature, constituents, and ecological conditions that traditionally have been modeled separately. The improved predictions of water availability will be at a range of temporal and spatial scales. Through iterative cycles of model development and testing, regional scale studies will inform national scale modeling applications and yield nationally consistent approaches that are also locally relevant.

The integrated modeling approach of the USGS Water Mission Area has been initiated in the Delaware River Basin and seeks to capture top down and bottom-up interactions through a variety of model coupling strategies and approaches including process-based, data-driven, and hybrid. Top-down factors like climate and land use jointly impact water availability for humans and aquatic ecosystems. Bottom-up factors like water quality, quantity and ecology change how the system is being managed and used. The Integrated Water Science Basins enable more rapid and agile model experimentation to evaluate ensembling approaches, new model components, coupling strategies, data assimilation techniques, new physical process representations, workflows, and observations. This approach will ultimately become repeatable, reproducible, extensible, and discoverable because of the capabilities we are creating through the Hydro-terrestrial Earth System Testbed (HyTEST), a collaborative effort to establish community-based metrics for model evaluation and shared tools and workflows.