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Designing adaptable model-based support for multiple adaptive pathways: The USGS Mississippi Alluvial Plain project

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The US Geological Survey (USGS) is commonly asked to provide science support for societal decision-making, including numerical models. Twentieth Century workflows emphasized paper reports and a handoff of "the answer" to those charged with making decisions. Such workflows are ill suited for today's decisions – especially those involving adaptive management or large uncertainties. Moreover, as stakeholders have grown accustomed to near instant access to information such as real-time weather forecasts, water-resource support systems have not kept pace. This is the context within which local stakeholders initiated the USGS Mississippi Alluvial Plain (MAP) project in 2016. From its inception, effort was dedicated to formulating a new approach of applying USGS models to decision support involving: 1) reusable script-based model construction modules; 2) automated conduits that move new field data to the model; 3) high-throughput computing to update calibration and uncertainty outputs; 4) fast-running surrogate models; and 5) web-services suitable for feeding decision-support systems designed by others. The overarching goal is to provide responsive, consistent, and seamless high-quality science even as the forecasts and approaches of decision-making change. Challenges to this vision include building an approach that encompasses moving forecast targets, ensuring scientific reproducibility, developing a common technology and language across a large, multidisciplinary team, and robust script design extensible for new data types and numerical code updates. However, by the end of the MAP project we believe the workflow and supporting documentation developed will have transferability to many areas outside the MAP.