

Big Data Hub

BD Spokes Water Quality Project

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PROJECT SUMMARY

Overview: This project will facilitate research on efficient management of agricultural practices and their impact on water resources in the Upper Mississippi River Basin (UMRB) through a cyberinfrastructure framework. Large-scale data acquisition and dissemination, integration, analysis, and visualization using data-enabled information technologies will accelerate diffusion of knowledge, experience, and shared resources (e.g., technology, equipment, people) among communities and partners. The key element of the project is a new cyber platform, the Upper Mississippi Information System (UMIS), which will provide water quality data within a rich spatio-temporal hydrologic context. The project will build on the expertise of IIHR-Hydroscience & Engineering (IIHR) at the University of Iowa and the Great Lakes to Gulf Virtual Observatory (GLTG) at the University of Illinois and will include many partner organizations from the neighboring states. The Midwest Big Data Hub will help to amplify the impact of the platform through its tools and services.

Intellectual Merit: The proposed UMIS represents a greatly enhanced infrastructure of the Iowa Water Quality Information System (IWQIS), an on-line platform providing real-time and historical water quality data for Iowa streams and rivers. At its core, the UMIS is a complex informatics system that uses state-of-the-art web technologies for data acquisition, data management through spatial databases, custom visualization and analytics, and interfaces with hydrologic and water-quality models. UMIS development will include an integrated and scalable big data cyberinfrastructure that: a) enables cross platform data integration with data and model specifications, web services, and client libraries; and b) extends comprehensive data visualization and analysis tools with real-time data and modeling capabilities to individual researchers and stakeholders. The UMIS will leverage the Midwest Big Data Hub and expand beyond the current scopes of IWQIS and GLTG.

Broader Impacts: The UMIS directly addresses three of the Grand Challenges for Engineering identified by the National Academy of Engineering: i) Provide Access to Clean Drinking Water; ii) Manage the Nitrogen Cycle; and iii) Engineer the Tools of Scientific Discovery. Specific impacts of the UMIS may be characterized by the immediate and long-term impacts, and by the potential users and stakeholders. Immediate impacts include facilitating a centralized platform for data access, integration, and scientific discovery for water quality challenges in the UMRB. The long-term implications for this project are the broader scientific community's potential adoption of data-enabled cyberinfrastructure tools and services through the Midwest Big Data Hub to expand the reach to the UMRB, and ultimately to the entire Mississippi River and the nation.

Because anyone with Internet access will have access to water quality information within its meteorological and hydrological context, the potential broader impacts of this project on different stakeholders are boundless. The experimental design of the UMIS will enable researchers to study, for example, spatial scaling, efficiency of various land use and agricultural practices to improve water quality, and the impact of climate change on land management practices and water quality. Decision-makers, producers, and extension staff will be able to assess the relative efficacy of local (e.g., best management practices) versus system-level (e.g., state strategies) solutions to pollution reduction, the optimal use of resources, tradeoffs among competing objectives, and the effectiveness of states' nutrient reduction strategies. For all stakeholders, the UMIS will drive partnerships and collaborations, increase dissemination of information about a critical natural resource that empowers stakeholders at all levels, and set new standards in communication of scientific data.

The proposed project will allow the development of new and strengthening of existing collaborations around water-quality big data among researchers at the University of Iowa, University of Illinois, the National Great Rivers Research and Education Center, and Iowa State University, and many other participating institutions.