

CDI SSF Category 4: Community Innovation

Title: Novel web-enabled data visualization applications for serially-structured time-ordered data Case study 1: Mississippi River and select tributary watershed hydrology.

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Abstract:

Major advances have been made over the last two decades to help public data users find, retrieve, and utilize hydrologic data across the United States. This work has involved identifying, assembling, and navigating many data repositories, developing and deploying a novel cyber-infrastructure, and implementing semantic mediation technologies to empower a distributed user clientele. An excellent example of these efforts is USGS's National Water Inventory System (NWIS).

Concurrent with these advances have been shifts in modes of inquiry away from gage-specific inquiries and studies seeking information on hydrologic patterns and trajectories to integrated basin-scale management, application, and research. This shift necessitates new powerful tools to enable data discovery, inquiry, and application at larger integrated spatial and temporal scales. Thus, we propose the development of a series of web-enabled data visualization tools that will animate basin-scale data visualizations of hydrologic observations.

Our first case study will enable a serially structured (spatially) visualization of hydrologic stage data from three watersheds: (a) The entire navigable Mississippi River (N gages ~200); (b) the Root River, Minnesota watershed (rural); and (c) the Rock River, Illinois watershed (urban/suburban). The

visualization tool will be web-enabled, permitting the on-line animation of time-ordered daily stage observations over the period of record for each watershed. Our initial application will be to empirically characterize large regional flood events within smaller watersheds (rural/agricultural – Root River; urban/suburban – Rock River) and their effect upon mainstem Mississippi hydrology, to explore the impacts of shifting regionalized climate on Mississippi mainstem flood conveyance.

While initially conceived for hydrological applications, our initial tool will be generally applicable to any serially-structured time-ordered data set. Thus, this tool will also have application to alternative responses, such as NAQWA water chemistry observations or ecological observations made by ecological monitoring networks (e.g., the Upper Mississippi River Restoration- Environmental Management Program). Our goal is to enable user-driven and user-defined visualizations of spatially-structured time series data, thus empowering basin-scale discovery on the dynamics of basin hydrology, limnology, and ecology. We expect this tool to play a prominent role in gaining basin-scale context on topics such as flood hydrology and risk assessment, inorganic and organic nutrient dynamics with implications for eutrophication and hypoxia management, and ecological responses to basin-scale management actions.

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Total in-kind funding: \$21,542

Datasets:

USGS National Water Information System, period of record, contiguous US; hydrology

US Army Corps of Engineers, Mississippi Valley Division, river gauging network, period of record; hydrology

National Science Foundation “River stage and discharge for the Mississippi, Missouri, and Illinois Rivers, USA”, period of record (1861 – present), 7 million records, hydrology

Geographic/geologic/ecosystem/habitat/taxonomic/other context:

Mississippi, Missouri, Illinois, and selected tributary rivers, hydrology with application to any generalized and serialized time-ordered set of ecosystem attributes (e.g., limnology, water chemistry, geomorphology, floral, faunal and community indices, etc...).

Type of Product(s) Generated:

Data driven web application, Conference presentation, manuscript

