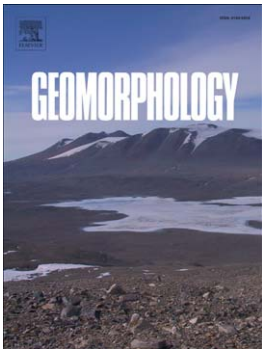

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Jonathan W.F. Remo, Brian S. Ickes, Julia K. Ryherd, Ross J. Guida, Matthew D. Therrell

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Assessing the impacts of dams and levees on the hydrologic record of the Middle and Lower Mississippi River, USA

Jonathan W.F. Remo[1*], Brian S. Ickes[2], Julia K. Ryherd[1], Ross J. Guida[3] & Matthew D. Therrell[4]

[1] Department of Geography and Environmental Resources, Southern Illinois University, 1000 Faner Drive, Carbondale IL 62901, USA
[2] U.S. Geological Survey, Upper Midwest Environmental Center, 2630 Fanta Reed RD, La Crosse, WI 54603, USA
[3] Department of Geography and Geology, Sam Houston State University, Huntsville, TX 77341, USA
[4] Department of Geography, The University of Alabama, 204 Farrah Hall, Tuscaloosa, AL 35487, USA
* Corresponding Author e-mail address: diamict@siu.edu

Abstract

The impacts of dams and levees on the long-term (>130 years) discharge record was assessed along a ~1200 km segment of the Mississippi River between St. Louis, Missouri, and Vicksburg, Mississippi. To aid in our evaluation of dam impacts, we used data from the U.S. National Inventory of Dams to calculate the rate of reservoir expansion at five long-term hydrologic monitoring stations along the study segment. We divided the hydrologic record at each station into three periods: (1) a pre-rapid reservoir expansion period; (2) a rapid reservoir expansion period; and (3) a post-rapid reservoir expansion period. We then used three approaches to assess changes in the hydrologic record at each station. Indicators of hydrologic alteration (IHA) and flow duration hydrographs were used to quantify changes in flow conditions between the pre- and post-rapid reservoir expansion periods. Auto-regressive interrupted time series analysis (ARITS) was used to assess trends in maximum annual discharge, mean annual discharge, minimum annual discharge, and standard deviation of daily discharges within a given water year. A one-dimensional HEC-RAS hydraulic model was used to assess the impact of levees on flood flows. Our results revealed that minimum annual discharges and low-flow IHA parameters showed the most significant changes. Additionally, increasing trends in minimum annual