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RECENT GEOMORPHIC ADJUSTMENTS OF THE MISSISSIPPI-ATCHAFALAYA RIVER SYSTEM, SOUTHERN LOUISIANA.

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The Mississippi and the Atchafalaya are dynamic large rivers that have experienced considerable adjustments this century. The Mississippi River (MR), the largest river in North America, has experienced numerous modifications, most recently a set of controlled diversions into the Atchafalaya. The Atchafalaya River (AR) also has considerable discharge, combining flow of the Red River with appreciable diversion from the Mississippi (about 25% is diverted).

The Mississippi's contribution through the juncture at the Old River (OR) system generally increased through the 1900's until a major structure and an outflow channel (OROC) were built in 1963 to control flow diversion and prevent the Atchafalaya from capturing it.

There has been considerable speculation, but little analysis of the geomorphic adjustments in this river system. Previous studies have discussed spatial and temporal changes in these rivers within the last hundred years using Hydrographic surveys, specific stage trends and stage-discharge relationship, whereas this study examines a comprehensive set of data from cross-sectional summaries. Stations generally have intermittent data in the early part of the century, but several hundred to several thousand measurement in total. Variables examined included stage, discharge, width, area, and maximum and mean depth, thalweg and mean bed elevation . The primary objective is to evaluate the specific nature of stations in the vicinity of this artificial diversion in Louisiana. It is of interest to know how variable channel geometry has been over time, and more specifically how the system has responded to the changing flow and the addition of a major structure.

Stations generally cover three time periods: 1) before the diversion (MR-Red River Landing, OR-Torras); 2) after the diversion (MR-Coochie, Oroc-Knox Landing), and 3) both (MR-Tarbert Landing , AR-Simmesport). On the Mississippi, data were collected at three relative spatial locations: 1) upstream of the diversion (MR-Coochie) 2) downstream of the diversion (MR-Red River Landing), and 3) upstream before construction, downstream following construction (MR-Tarbert Landing) . Flow at stations the Mississippi downstream ofvthe diversion decreased discharges over this century and stabilized after completion of the project. Flow in the Old River and Atchafalaya River increased over this century and then stabilized following completion of the project.

Based on available data, it appears that four of the five stations show pronounced channel widdening both before the diversion (OR-Torras), after the diversion (MR-Coochie, OROC-Knox Landing) and during both periods (MR-Tarbert Landing, AR-Simmesport). Several stations also showed decreased mean and maximum depths before the diversion (OR-Torras), possibly as a result of construction , after the diversion (OROC-Knox Landing) and during both periods (MR-Tarbert Landing, AR-Simmesport). At Coochie, depths first increased and then stabilized. Mean bed and thalweg elevations first decreased, then stabilized, and have since increased. In addition, the AR-Simmesport shows less variances following the diversion, particularyin width, mean bed and thalweg elevation. Channel geometry at Red River Landing did not show strong trends for any of these variables.

Suchs results are somewhat unexpected, particulary in the case of the Mississippi and Atchafalaya. Even though discharge in the Mississippi has decreased, it is continuing to widen because the channel depths are decreasing and bed elecations increasing. These changes in terms of rate on direction appear unaffected by the nearby diversion. In the case of the Atchafalaya, earlier studies by others assumed that the channel was scouring because specific stage trends were declining. Instead, depths have decreased and bed elevations increased, and thus the decline in the trends appears due to the channel widening, rather than bottom scour. It is also interesting that stations with decreased flows and increased flows are responding similary, with both MR-Tarbert Landing and AR-Simmesport generally widening and getting shallower.

Findings have implications to flood control, navigation, and engineering structures, as they provide necessary information regarding long-term cycles of aggradation and degradation, the response and recovery associated with floods, and accompanying types of geometric changes at various time scales. Specifically, results suggest that the biggest floods of the century have had little notable effect on channel geometry, but that there are pronounced long-term trends in width, area, and bed elevation that suggest reductions in channel capacity.

Localized upgrades of the levee system may be warranted in the vicinity of this project because of decreased ability to confine floodwaters. Comprehensive analysis is warranted as findings contrast with others inferences based on stage-discharges trends and different variables have differing responses to hydrologic changes. Combined with other evidence, these channel geometry data provide useful information for engineering and management.