

Revisiting Frazier's Subdeltas: Enhancing Datasets with Dimensionality, Better to Understand Geologic Systems

James Flocks

U.S. Geological Survey, Center for Coastal and Watershed Studies, 600 4th Street South,
St. Petersburg, FL 33701

ABSTRACT

Scientific knowledge from the past century is commonly represented by two-dimensional figures and graphs, as presented in manuscripts and maps. Using today's computer technology, this information can be extracted and projected into three- and four-dimensional perspectives. Computer models can be applied to datasets to provide additional insight into complex spatial and temporal systems. This process can be demonstrated by applying digitizing and modeling techniques to valuable information within widely used publications.

The seminal paper by D. Frazier, published in 1967, identified 16 separate delta lobes formed by the Mississippi River during the past 6,000 yrs. The paper includes stratigraphic descriptions through geologic cross-sections, and provides distribution and chronologies of the delta lobes. The data from Frazier's publication are extensively referenced in the literature. Additional information can be extracted from the data through computer modeling.

Digitizing and geo-rectifying Frazier's geologic cross-sections produce a three-dimensional perspective of the delta lobes. Adding the chronological data included in the report provides the fourth-dimension of the delta cycles, which can be visualized through computer-generated animation. Supplemental information can be added to the model, such as post-abandonment subsidence of the delta-lobe surface. Analyzing the regional, net surface-elevation balance between delta progradations and land subsidence is computationally intensive. By visualizing this process during the past 4,500 yrs through multi-dimensional animation, the importance of sediment compaction in influencing both the shape and direction of subsequent delta progradations becomes apparent. Visualization enhances a classic dataset, and can be further refined using additional data, as well as provide a guide for identifying future areas of study.