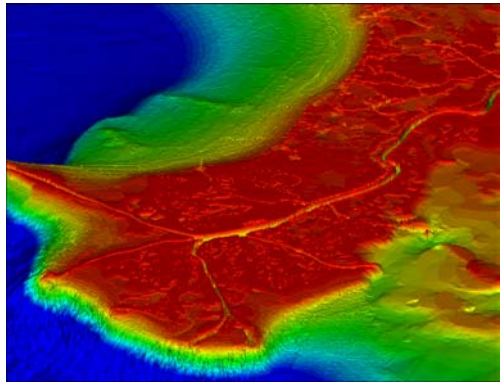
Hydro-Ecological Modeling of the Lower Mississippi River

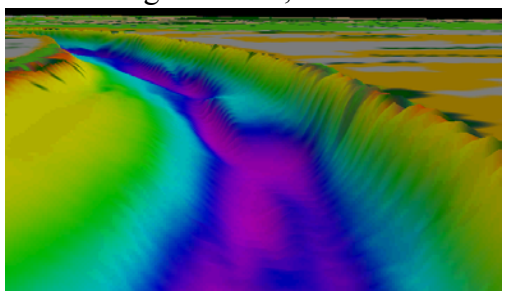
Sponsor: The Governor's Coastal Research and Development Program

Brief Description:



The Mississippi River has major economic, environmental, ecological, and industrial values not only to Louisiana but also to the entire United States. At present, the Mississippi River Delta (shown in the figure to the right) is being deprived of practically all the sediment (about 220 million tons annually) that the river transports to the Gulf of Mexico. Therefore, alternative solutions to recover or re-direct portion of this massive amount of valuable sediment to benefit the restoration of Louisiana coastal lands should be carefully investigated. In order for such investigation to be successful, the impact of restoration projects on the River (supply side) and on the surrounding wetland and water bodies (demand side) should be considered.

The objective of this project is to develop a three-dimensional model for the Lower Mississippi River (from Tarbert Landing to Venice). This river reach is over 300 miles, and therefore, the model will be developed in stages. The model will provide information on the spatial and temporal patterns of the river's hydrodynamics, salinity, sediment, and water quality parameters. Such model is crucial to provide information on the availability of fresh water and sediment for diversion to surrounding wetlands; and to determine quantitatively the impact of diversion projects on the dynamics of the river from hydrologic, ecologic, and navigation point of views. The model will be an excellent management and analysis tool for the Lower Mississippi River.



The project includes the following main components: 1) Compiling and collecting new field data to setup (such as high-resolution bathymetry shown in the figure to the left) and calibrate the numerical model; 2) Selecting the most efficient and accurate models; 3) Setup an adequate temporal and spatial resolution for the models; 4) Calibrating the hydrodynamic,

sediment, and water quality modules of these models.

The focus of the first year of the project was on the first two components. Through a collaborative effort with the Baton Rouge District Office of USGS, a monitoring station was installed (see figure to the right) on the river at Baton Rouge (approximately mile 220 from the river's mouth). The station collects continuous velocity and water level measurements. The station will be rated such that discharge information will be available. The information collected by the station is already available online. Effort is underway to upgrade the station to monitor nutrient levels. The information provided from this station is crucial to the modeling effort.

Extensive effort is ongoing to examine the accuracy and computational efficiency of several computer models. A river reach (approximately 18 miles long) for which detailed bathymetric, and three-dimensional velocity measurements are available, was selected to perform the model selection step. The objective of this step is to identify the most accurate and efficient models for eventual use of modeling the Mississippi River.

The focus of the second year will be setting up and calibrating the selected models for the Lower Mississippi River. The selected models will be calibrated against field data that is currently being compiled from existing records and gathered in the field. The modules calibrated will include hydrodynamics, sediment, and water quality.

The finite element grid generated for the Head of Passes is shown in the figure to the right, while preliminary model results for the Mississippi River is shown below. The figure below shows velocity vectors and stream lines.