Spatial Technologies for Coastal Management

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Abstract

This demonstration will be presented at the 2004 National Conference on Digital Government Research. The third year results of the project "Digitalization of Coastal Management and Decision Making Supported by Multi-Dimensional Geospatial Information and Analysis" will be presented. Mobile wireless communications, internet web services, and web GIS are integrated into a web-based decision-making system for coastal management. Employing three-dimensional visualization technology, athe system also provides a visualization tool for multisource spatial-temporal data integration and uncertainty analysis. Also demonstrated is an interactive QuickBird image processing subsystem used for high resolution DEM and three-dimensional shoreline extraction of Tampa Bay.

The goal of this project is to develop technologies to enhance the operational capabilities of federal, state, and local agencies responsible for coastal management and decision making. The pilot test site is along the Lake Erie coastline from Port Clinton to East Cleveland, Ohio. Research strategies are currently being applied to Painesville, OH and Tampa Bay, Florida. The demonstration will include the following sections.

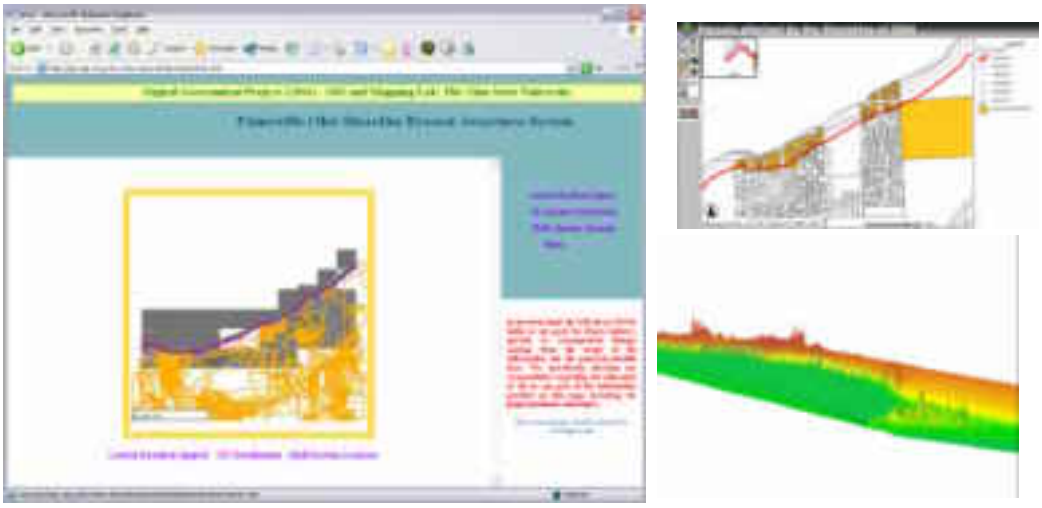

Figure 1. Web-based Coatal Zone Management System

1. A Web-based System for Coastal Zone Management

This system (Figure 1) consists of three subsystems: a shoreline erosion awareness subsystem, a coastal structure permitting subsystem, and an on-site mobile spatial subsystem. This entire system has been upgraded to a web-based decision-making system.

Based on historical shorelines, future shorelines are predicted and published in the shoreline erosion awareness subsystem based on a shoreline prediction model that has been designed in GIS and Mapping Laboratory at OSU. Landowners along coastal area are able to utilize this system to observe future changes of the shoreline and take proactive approach for protection of their properties. For those landowners who decide to build coastal structures for protection of their properties, the coastal structure permit subsystem can be used to submit construction applications online. Then, state officials of ODNR (Ohio Department of Natural Resources) will be able to review these applications, examine the site conditions, and make decisions. With the support of mobile wireless communications and web services, an on-site mobile spatial subsystem will provide officials with an effective tool for coastal site data collection, data transfer, and application evaluation.

2. Three-Dimensional Visualization for Spatial-temporal Coastal Data Integration and Analysis

Multi-source spatial-temporal coastal data that are used in this project include satellite imagery, airborne photographs, water-gauge data, satellite altimetry, water surfaces derived from a hydrodynamic model, historical shoreline data, high-resolution DTMs (Digital Terrain Models), GPS observations, and so on. A coastal data integration system (Figure 2) has been designed and implemented to demonstrate the qualities of the data and the capabilities of various sensors for coastal zone monitoring. Using the visualization technology of Java3D, this system provides the functionalities of three-dimensional uncertainty visualization and analysis.

3. QuickBird Image Processing

Submeter resolution QuickBird satellite imagery is processed with our specially designed QuickBird Image Processing System (Figure 3). Based on ESRI ArcObjects 8.3 and Microsoft .Net technology, interactive tools have been designed and implemented for tie-point selection, image matching, DEM generation, and 3D feature extraction. This system is very effective for coastal mapping applications.

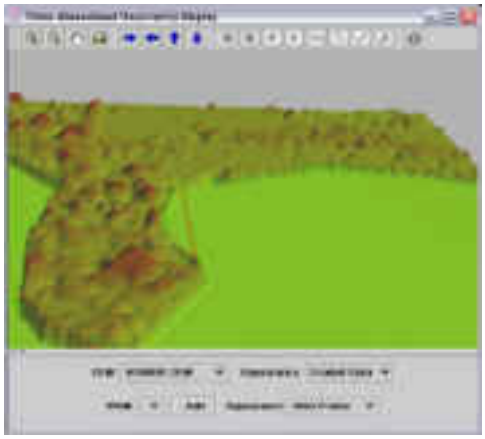

Figure 2. 3D Uncertainty Visualization

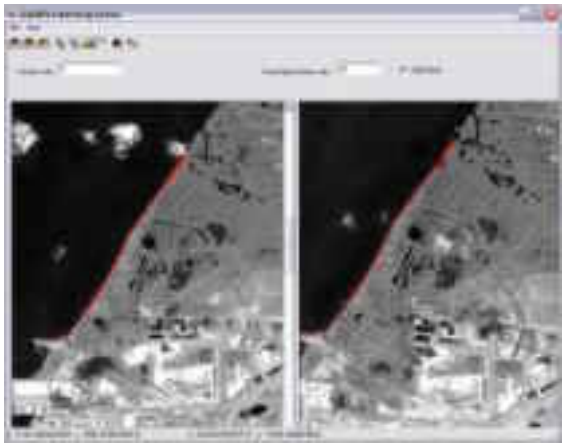

Figure 3. QuickBird Image Processing