Integration of Multidimensional Geospatial Information for Coastal Management and Decision-making

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ABSTRACT
Coastal management and decision-making requires timely and accurate multidimensional geospatial data that often reside in government agencies, organizations, and institutions on various levels. Integration of such data involves research on the spatial and temporal characteristics of coastal geospatial information, interoperability of spatial databases and tools, and distributed and mobile technologies. This demonstration will present a system we have developed in last four years, which aims at integrating multidimensional coastal spatial data and information technology to enhance the operational capabilities of federal, state, and local agencies responsible for coastal management and decision making.

Categories and Subject Descriptors:
H.4 [**Information Systems and Applications**]: Spatial information technology

General Terms:
Management, Design, Verification.

Key Words:
GIS, remote sensing, satellite images, 3D visualization.

This demonstration will present the system we have developed in last four years, which aims at enhancing the operational capabilities of federal, state, and local agencies responsible for coastal management and decision making. The research project is being carried out primarily in the Great Lakes area in Ohio and in Tampa Bay, FL. The system consists of a web-based data inventory subsystem, a wireless mobile coastal spatial management and decision-making subsystem, and a three-dimensional visualization system for spatial-temporal coastal data integration and analysis.

1. A web-based spatial data inventory subsystem
Multi-source spatio-temporal data are used in this project. In order to efficiently manage the data, a web-based data inventory system has been developed using ESRI's ArcIMS. The available spatial data and the related metadata information can be visualized and retrieved easily from this subsystem.

The 2005 Annual National Conference on Digital Government Research, May 15–18, 2005, Atlanta, GA, USA.

2. A wireless mobile spatial subsystem for coastal spatial management and decision-making
Wireless technology and mobile communication devices are used in this subsystem to support coastal management and decision-making processes. This subsystem consists of three components: a shoreline erosion awareness subsystem, a coastal structure permitting subsystem, and an on-site mobile spatial subsystem. Based on historical shorelines, future shorelines are predicted and published in the shoreline erosion awareness subsystem. Landowners along coastal areas are able to utilize this system to observe future changes of shoreline and take a proactive approach towards protecting their properties. For those landowners who want to build coastal structures to protect their properties, they can use the coastal structure permitting subsystem to submit their applications online. Local officials of the ODNR (Ohio Department of Natural Resources) will then review these applications, examine the site conditions, and make the final decisions. With the support of mobile wireless communication and web services, the on-site mobile spatial subsystem provides officials with an effective tool for coastal site data collection, data transfer, and application evaluation.

3. Three-dimensional visualization subsystem for spatio-temporal coastal data integration and analysis
In this project, multidimensional coastal spatio-temporal data need to be integrated and deployed under a common georeference framework. The data quality and conversion accuracy must be investigated. A coastal data integration subsystem is designed and implemented to demonstrate the qualities of the data and the capability of various sensors for coastal monitoring tasks. Through the use of three-dimensional visualization technology, this subsystem provides the functionality of three-dimensional uncertainty visualization and analysis. Results of a preliminary study of seagrass degradation in Tampa Bay, FL, including satellite images, ground truth, airborne video images, and other related data will be presented.

ACKNOWLEDGMENTS
This project is supported by the National Science Foundation—Digital Government Program. We would like to acknowledge our governmental collaborators at NOAA National Geodetic Survey, Office of Coastal Survey, and National Geophysical Data Center; USGS Coastal and Marine Geology Program; Ohio Department of Natural Resources; Lake County Planning Commission of Ohio, and Tampa Bay Estuary Program.