

The University Consortium for Geographic Information Science

Research Priorities



GLOBAL REPRESENTATION AND MODELING

THE PRIORITY

Global geographic phenomena based on empirical data and conceptual abstractions pose significant problems for both fundamental representation and data, phenomena, and process modeling.

DESCRIPTION OF RESEARCH CHALLENGE

The development and availability of global geographic data at resolutions of 30 arc seconds and higher provide fundamental challenges in accurate representation and modeling. Recent research has shown that geographic processing systems lack the global perspective necessary to provide accurate results with these massive and detailed empirical sets of geographic data.

Significant problems include translation of spherical or ellipsoidal Earth data to an appropriate processing representation. Traditional map projections are effective for single point transformations but were not designed to handle data from satellite sources which image the earth in a series of snapshots or instantaneous-field-of-views (IFOV's) which must be assimilated into a global perspective. Often these IFOV's are obtained over sig-

nificant temporal ranges and must be composited for the global view. Examples of these datasets include the current Moderate Resolution Imaging Spectrometer (MODIS) and Advanced Very High Resolution Radiometer (AVHRR) that have been used in developing a global land cover database.

More advanced sensor systems, the availability of *in situ* sensors, and both sensor-based and handheld Global Positioning System (GPS) collection devices are currently exacerbating the problem of appropriate representation and modeling systems. Systems of representation are needed that provide accurate results at both local scales for high-resolution data and global scales for Earth systems modeling. The ability to accomplish both the local and global processing and modeling requirements from a single representation is the basic research priority.

The proposed alternatives for representation include better map projection algorithms, discrete global grid representations based on platonic solids or other figures, direct use of spherical coordinates, and design of completely new coordinate system representations. Combinations of these approaches are also being examined, although the extent of these

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The UCGIS is a non-profit organization of universities and other research institutions dedicated to advancing the understanding of geographic processes and spatial relationships through improved theory, methods, technology, and data.

types of research and the support for it has been limited.

IMPORTANCE OF RESEARCH CHALLENGE

As more global datasets are acquired and as the world becomes more interconnected in a global society, it becomes increasingly important to be able to connect local events with global outcomes. Global modeling continues to increase in importance for planning at global, national, and local levels. The accuracy of the results of these models and our basic understanding of the science of geographic phenomena and processes depends to a large extent on the accuracy of our representation. It thus becomes paramount from a geographic information science research perspective and for the United States national research agenda that we address these fundamental problems.

EMINENT RESEARCH QUESTIONS

Can a global representation be developed that provides adequate flexibility to accommodate a variety of data types and generates accurate results from local and global models? Discrete global grids offer an alternative representation, but can the archives of global data in existence and can new data acquired by satellite sensors be appropriately mapped to these grids? Can the grids be used in accurate and effective global models? Can we develop representation and processing systems operable completely in spherical or ellipsoidal coordinate systems? Can we design new projections that completely accommodate global data and be used as a basis for mapping satellite data and modeling Earth systems?

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