

Using THREDDS in My World GIS™
David A. Smith, Daniel C. Edelson, Eric Russell
GEODE (Geographic Data in Education) Initiative,
Northwestern University

Project Overview

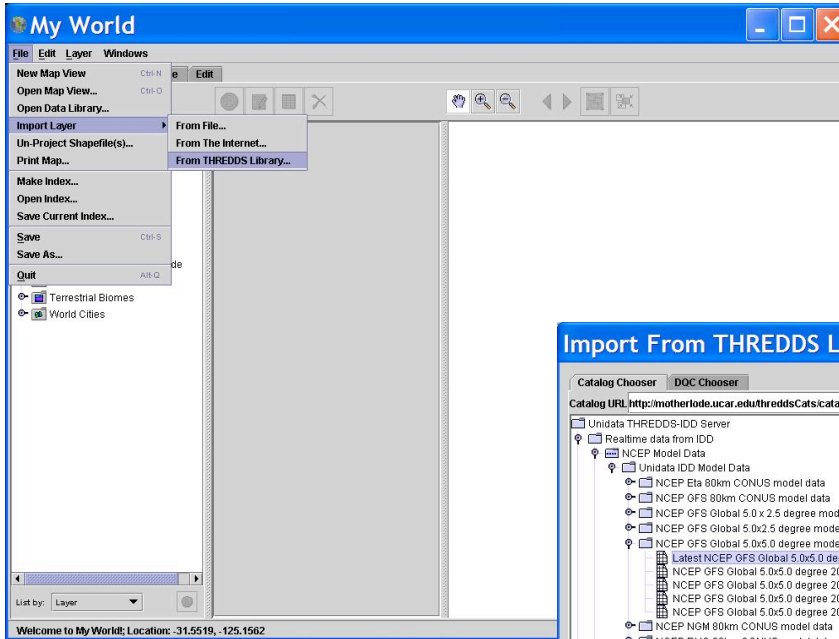
My World GIS™ is a geographic information system designed specifically for use in educational settings. Its intended audience is middle school through college geosciences and geography courses where investigations involving geographic data can support the learning goals of the course. My World is designed to meet the needs of students and teachers while keeping the constraints of educational settings in mind. It combines the power of a full-featured GIS environment with the support and structure required by novice users in an educational environment.

My World is being developed by GEODE (Geographic Data in Education) Initiative at Northwestern, drawing on more than a decade of research on the design of data visualization and analysis environments for inquiry-based learning in the geosciences. Currently we are engaged in an integrated program of user studies and software development to extend and improve the software.

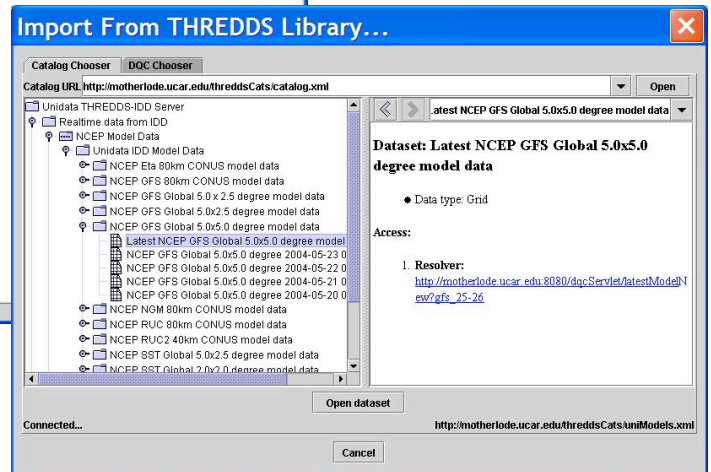
The central mission of the THREDDS project is to provide students, educators and researchers a convenient, effective, and integrated technology to publish, contribute, find, and interact with data relating to the Earth system. The initial phase of THREDDS established a working prototype of the services and tools necessary to fulfill their mission. Currently, the THREDDS 2nd Generation project seeks to expand both the team of contributors and data collections while incorporating emerging standards and related data systems.

The THREDDS 2G grant is supporting the integration of THREDDS tools for accessing data over the Internet into My World. Because My World is the only full-featured GIS environment designed specifically for use in educational settings, it is a logical client for THREDDS. It also will serve as a testbed for exploring how to extend the THREDDS architecture to the full range of GIS data types (grids, polygons, polylines, and points) and file formats. Currently, My World is able to read THREDDS catalogs and access gridded data from remote servers taking advantage of THREDDS middleware to convert the data to a My World-compatible file format.

Accessing THREDDS Libraries



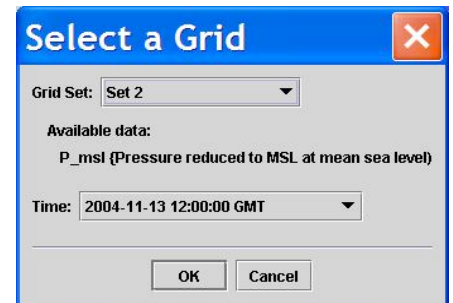
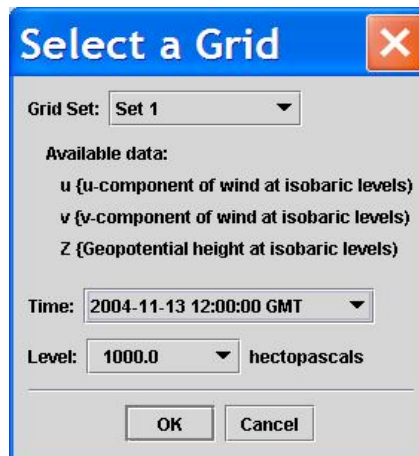
Import a layer from THREDDS Library into My World. This brings up a THREDDS catalog browser



A THREDDS Catalog Browser in My World.

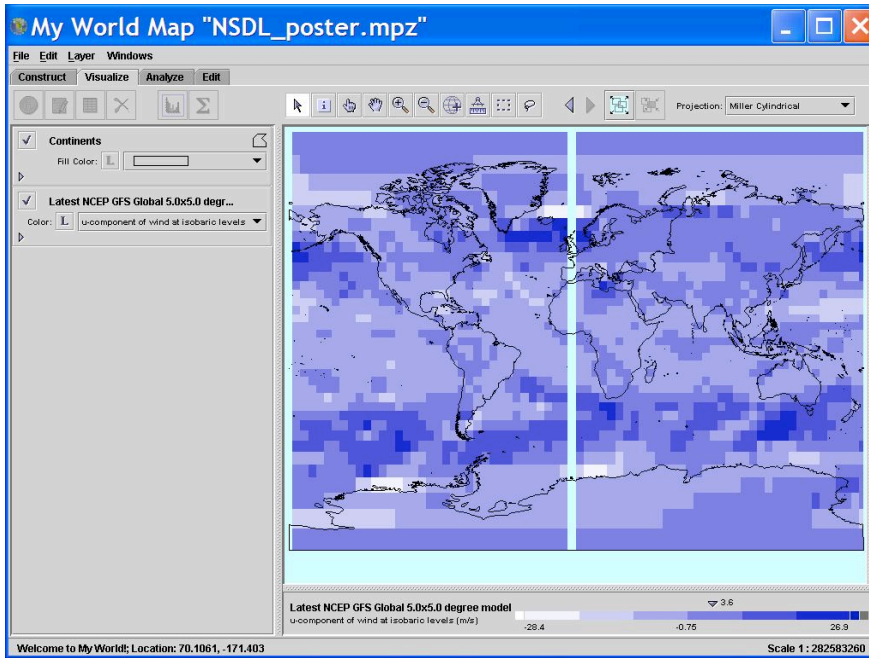
And multi-dimensional data sets

Because My World's layers are two-dimensional and THREDDS datasets can have as many as four dimensions, it was necessary to implement an interface for choosing a particular time and/or level from a dataset to view in My World, and to save that information along with the link to the dataset.

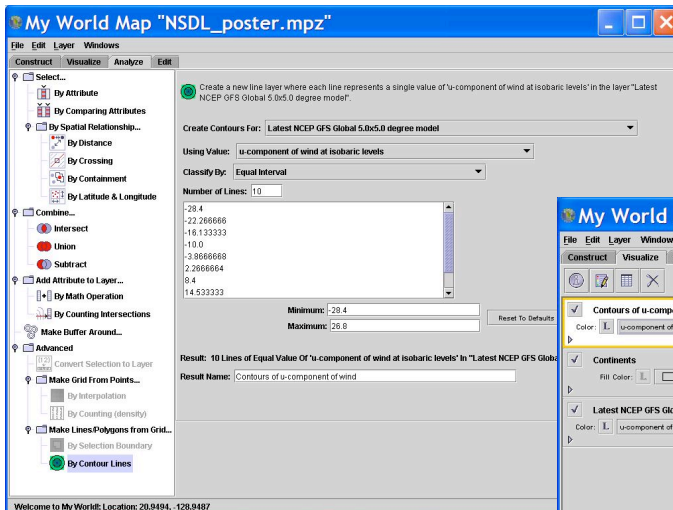


My World Interface

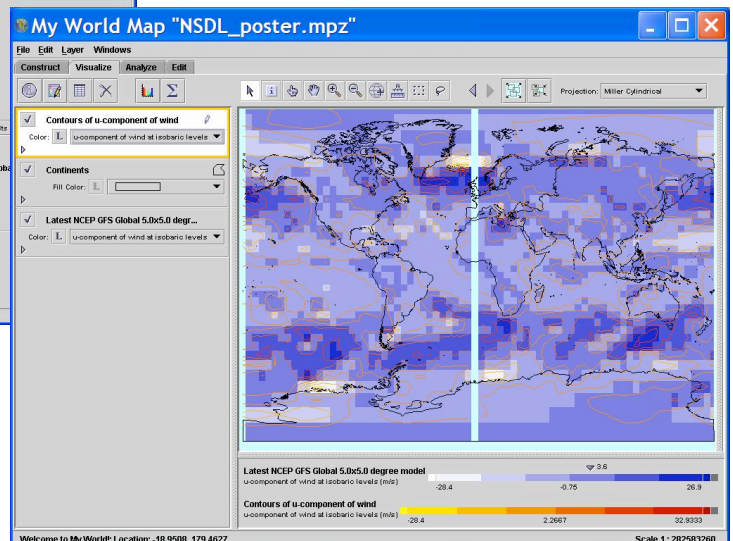
Currently My World GIS is capable of importing gridded data sets from THREDDS data catalogs, creating My World map layers from the “geogrid” data object that is part of the THREDDS standard. As GIS point, polygon, and polyline data types are added to the THREDDS standard, My World will be enhanced to create map layers from THREDDS-enabled servers containing files of those types.



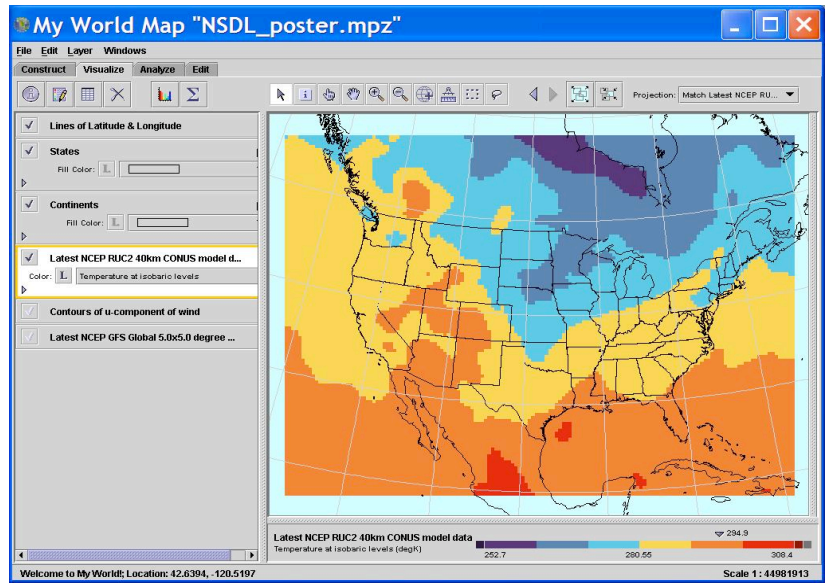
A file from the NCEP GFS Global model, accessed through THREDDS from the Unidata IDD Model Data website.



My World has the ability to create contours from any numeric data field contained in the table.



Because much of the grid data in THREDDS catalogs is projected, it was necessary to add support for projected grid layers to My World. The projection has been changed to match that of the new grid.



THREDDS 2G Accomplishments

From the perspective of the My World developers the incentive to integrate THREDDS technology into My World is to dramatically enlarge the amount of data that is available to My World users at relatively small cost in terms of development effort. My World users are now able to access gridded data through THREDDS catalogs without requiring any knowledge of the physical location or underlying data file format for that data.

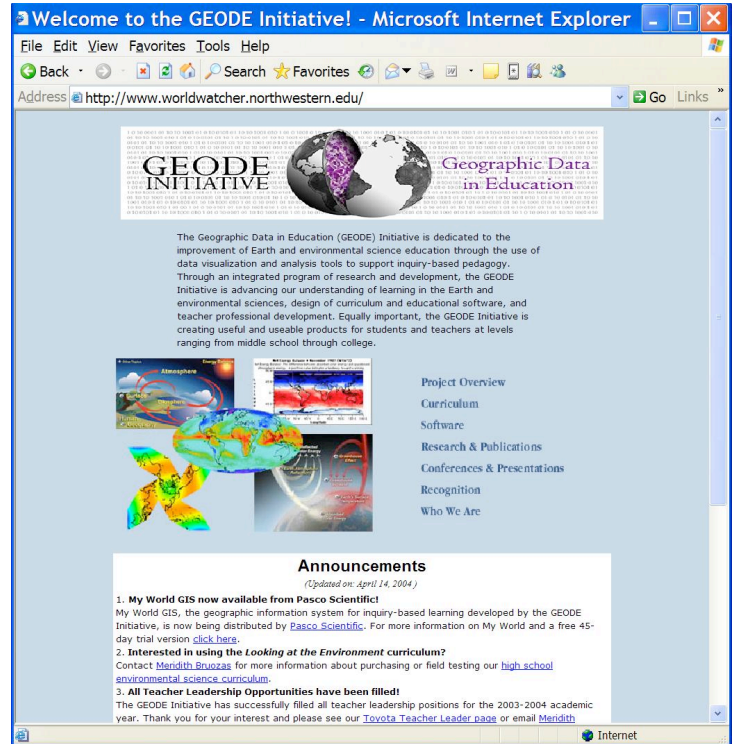
- Participated in the DLESE data services workshop in May 2004, including presentations on pedagogical considerations in the use of geosciences data and demonstrations of the THREDDS-enhanced version of My World.
- Using the libraries provided by the THREDDS project, we added a dialog to My World for browsing THREDDS catalogs and selecting and opening datasets.
- To enable links to THREDDS layers to be saved on the local hard drive, we created a new My World file format that stores the URL for the layer that can be used to re-load the layer using the THREDDS tools.
- To enable curriculum writers to create documents that embed links to My World layers and maps, we built a new installer that registers My World file extensions with the operating system (MacOS X or Windows). This allows people to put links that will open THREDDS layers in web pages and other documents.
- We are currently upgrading to the THREDDS 1.0 specification and assisting in the definition of an API for accessing point, polygon, and polyline data using THREDDS.

This project has demonstrated the ease with which an existing Java client can be enhanced with THREDDS tools for accessing data from remote servers via THREDDS catalogs and THREDDS data conversion middleware.

GEODE Initiative

My World GIS is part of the GEODE Initiative at Northwestern University. The goal of the initiative is to improve Earth and environmental science education through the use of data visualization and analysis tools to support inquiry-based pedagogy.

In addition to My World, another software program named WorldWatcher was developed to display and analyze gridded (raster) geographic data. The GEODE Initiative is engaged in several curriculum development projects as well.



Contact Information

- Daniel Edelson, Associate Professor, Northwestern University, d-edelson@northwestern.edu
- Eric Russell, Software Engineer, Northwestern University, eric-r@northwestern.edu
- David Smith, Curriculum Developer, Northwestern University, dasmith@northwestern.edu

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Poster Abstract

Using THREDDS in My World GIS

My World GIS is a geographic information system (GIS) designed specifically for use in educational settings. Its intended audience is middle school through college geosciences and geography courses where investigations involving geographic data can support the learning goals of the course. My World is designed to meet the needs of students and teachers and the constraints of educational settings in mind. It combines the power of a full-featured GIS environment with the support and structure required by novice users in an educational environment. My World is being developed by GEODE (Geographic Data for Education) Initiative at Northwestern, drawing on more than a decade of research on the design of data visualization and analysis environments for inquiry-based learning in the geosciences. Currently we are engaged in an integrated program of user studies and software development to extend and improve the software.

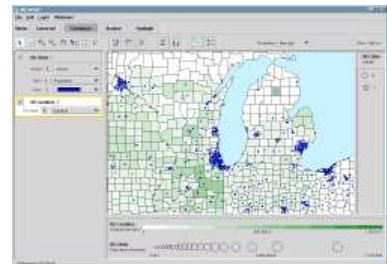
The THREDDS 2nd generation grant is supporting the integration of THREDDS tools into My World. Because My World is the only full-featured GIS environment designed specifically for use in educational settings, it is a logical client for THREDDS. It also will provide as a testbed for exploring how to extend the THREDDS architecture to the full range of GIS data types (grids, polygons, polylines, and points) and file formats. Currently, My World is able to read THREDDS catalogs and access gridded data from remote servers taking advantage of THREDDS middleware to convert the data to a My World-compatible file format.



The Geographic Data in Education (GEODE) Initiative at Northwestern University is dedicated to the improvement of Earth and environmental science education through the use of data visualization and analysis tools to support inquiry-based pedagogy. Through an integrated program of research and development, the GEODE Initiative is advancing our understanding of learning in the Earth and environmental sciences, design of curriculum and educational software, and teacher professional development. Equally important, the GEODE Initiative is creating useful and useable products for students and teachers at levels ranging from middle school through college. The GEODE Initiative is directed by Daniel C. Edelson, Associate Professor of the Learning Sciences and Computer Science.

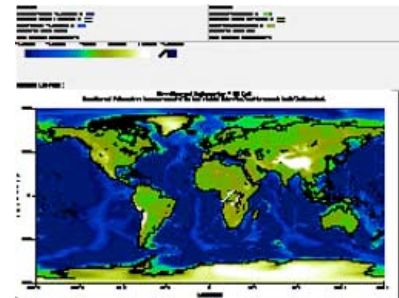
Software

My World GIS™ is a Geographic Information System (GIS) that enables users to construct interactive maps and analyze them using database and geospatial queries. It provides a carefully selected subset of the features of a professional GIS environment including: multiple geographic projections, table and map views of data, distance-measurement tools, buffering and query operations, and customizable map display. They have been selected to provide the greatest value to students without overwhelming them with complexity. The features are accessed through a supportive interface designed with the needs of students and teachers in mind. *My World* reads data in the industry-standard shapefile format, as well as tab and comma-delimited text files. *My World* is available for Windows, Macintosh OS X, and Unix.



WorldWatcher, a supportive scientific visualization environment for the investigation of scientific data, has been in use in K-12 and college classrooms since 1996. It is a tool for displaying and analyzing gridded (raster) geographic data in the form of color maps.

WorldWatcher provides an accessible and supportive environment for students to explore, create, and analyze scientific data. Its goal is to provide students with access to the same features found in the powerful, general-purpose visualization environments that scientists use while providing them with the support they require to learn through the use of the tools. WorldWatcher is available for both Windows and Macintosh.



Curriculum

The GEODE Initiative is engaged in several curriculum development projects. These projects integrate scientific visualization and data analysis into an inquiry-based program of hands-on labs, group work, and discussions to enhance students' understanding of the scientific and social issues associated with our changing environment. These curriculum projects include:

Looking at the Environment (Grades 9-12) is a year long, inquiry-based environmental science curriculum focused on the challenge of sustainable resource use to support the demands of growing human population. It covers significant environmental science content in the context of real world cases of land-use, electricity generation, and water resources management. *Looking at the Environment* places students in the role of environmental scientists who must make recommendations for sustainable uses of resources. In the course of these investigations, students employ a variety of scientific research techniques, including computer tools for the visualization and analysis of geographic data. *Looking at the Environment* takes a geographic perspective on environmental science, addressing environmental issues at local, regional, and global scales.

Planetary Forecaster (Grades 6-8) is a 6-8 week unit in which students explore the major factors that lead to variations in temperature around the globe, including the curvature of the Earth's surface, the tilt of Earth's axis, land/water differences in specific heat, and surface elevation. The project places the students in the role of research scientists who must investigate the causes of temperature variation on Earth in order to make temperature predictions for a fictional planet.



Earth Structures and Processes (Grades 6-8) is a 6-week unit in which students investigate the processes that shape the Earth's surface. Working with topographic maps and earthquake and volcano data, they apply plate tectonic theories to explain the formation and distribution of structures, such as volcanoes, mountain ranges, ocean trenches, and islands. Students are responsible for a particular geological formation, which they are introduced to by a letter from a pen pal who lives near the formation. Students must map the boundaries and motion of the plate their Earth structure lies on and explain the origin of their structure.

Contact Information

Daniel C. Edelson
Northwestern University
School of Education and Social Policy
2120 Campus Drive
Evanston, IL 60208

Web: <http://www.worldwatcher.org>
Email: geode@letus.northwestern.edu

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