Development of GeoBrain Curricula at Middle Tennessee State University

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Taking advantage of easy access to enormous geoinformation databases, including many with global coverage

The GeoBrain project at the George Mason University Laboratory for Advanced Information Technology and Standards is enabling the wider use of NASA Earth Observing System (EOS) information through the development of knowledge management technologies (Deng and Di, 2005). Middle Tennessee State University (MTSU) Geoscience students and faculty initiated a two-year collaboration with GeoBrain during December 2005. Through this collaboration, MTSU will:

- Develop, implement and evaluate GeoBrain-based curricula at MTSU;
- Disseminate evaluation results through presentations and the literature on teaching and learning;
- Disseminate curricula at meetings and through the Digital Library for Earth System Education (DLESE).

Together, these three initiatives will contribute to the wider educational use of EOS information.

Situated to develop curricula

MTSU, located in Murfreesboro, Tennessee, provides an excellent environment for developing higher education curricula. The institution is a public comprehensive university with a student headcount of approximately 22,000. The Department of Geosciences is a combined department of geology and geography, with six PhD-holding faculty in the Earth Sciences. The department offers undergraduate degree programs in both geology and geography—including a career track in remote sensing and geographic information systems (GIS)—and a one-year graduate certificate. In addition, Geosciences faculty teach a general studies introductory Earth Science course to approximately 1,800 undergraduates each year. Due to all these factors, MTSU has the resources to develop and evaluate higher education curricula.

Testing the terrain

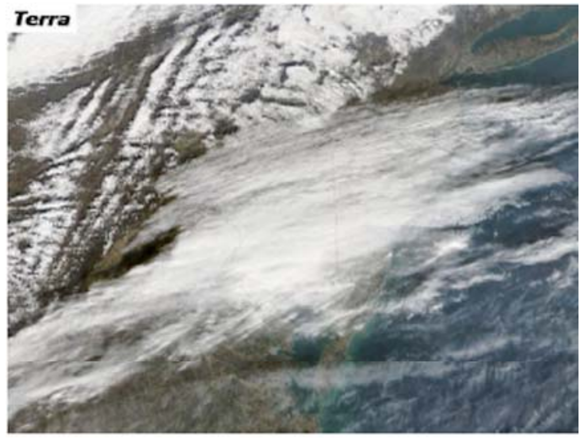
Initial investigations during December 2005 and January 2006 helped the MTSU GeoBrain group plan in detail for the development and implementation of GeoBrain-based curricula at MTSU. To better-understand GeoBrain's potential, one Geoscience undergraduate (Cole) and one Biology masters student (Cofer) completed a pair of simple curriculum development tasks under the supervision of a geologist (Abolins). Both students were somewhat familiar with geoinformation: Cole had recently completed a semester course in remote sensing and Cofer had recently completed a semester course in GIS. The two tasks were (1) development of a quick-start tutorial for GeoBrain's Multi-Protocol Geoinformation Client (MPGC), and (2) development of an introductory remote sensing educational activity utilizing EOS information.

MPGC lets users access a huge library of EOS information over the internet and includes simple display, analysis, and image processing capabilities. Cole worked with MPGC and EOS information for approximately 100 hours, while Cofer worked for somewhat less than 40 hours.

While completing the two tasks, Cole and Cofer documented MPGC's strengths and weaknesses, creating the basis for a realistic curriculum development plan.

A principal strength

MPGC's principal strength is easy access to enormous geoinformation databases, including many with global coverage. MPGC users can access EOS information and other geoinformation through the NASA Jet Propulsion Laboratory World Map Service and the Integrated Committee on Earth Observing Satellites European Data Server. In addition, MPGC provides access to a compilation of geoinformation pertaining to the December 1994 Asian tsunami. Cole used MPGC to obtain elevation images (with color indicating elevation), Blue Marble Next Generation images (Stockli et al., 2005), Shuttle Radar Topography Mapping (SRTM) magnitude images and ancillary data (e.g., highways), and he incorporated these images into an educational activity about Tennessee's natural and cultural landscape. Similarly, Abolins used MPGC to obtain Terra (MODIS), Landsat, Blue Marble and SRTM radar magnitude images of the Mid- Atlantic states for a presentation at the January 2006 GeoBrain team meeting in Maryland. Without MPGC, obtaining, processing and coregistering the preceding images would have been prohibitively time-consuming.



Room for improvement

MPGC provides a gateway to worlds of geoinformation. However, Cole and Cofer struggled with twenty aspects of MPGC version 1.0. Most of their concerns fell into the category of "lack of documentation and/or limited capabilities" (8 problems). Due to lack of documentation, they often couldn't tell if (a) the software couldn't perform a desired operation, or (b) it could, but they couldn't figure out how to make the software work. For example, they could not search for geoinformation by using eastings and northings in the Universal Transverse Mercator coordinate system. (Instead, they searched by using latitude and longitude.)

The second largest number of concerns (6) fell into the category of "opaque interface and geoinformation filenames." Many aspects of the interface (e.g., the intended uses of some tools and how to use the tools) were not readily apparent. In addition, many geoinformation files accessible over the web had opaque names. For example, the "Web Coverage Service" let users select files from a long list with uninformative filenames like

"MOD12Q1.A2001001.h12v05.004.2004149203244MOD12Q1_00." Other miscellaneous difficulties included an inability to easily install MPGC on computers predating the Dell GX270 and the lack of an "undo" capability for some operations. Due to the concerns outlined above, MPGC 1.0 should only be used by patient individuals who are experienced in the use of remote sensing and GIS software and who are knowledgeable about geoinformation.

The road ahead

After examining MPGC's principal strength as well as difficulties encountered during its use, the MTSU GeoBrain group developed a plan for further curriculum development. The group will develop curricula in three areas:

- **PowerPoint presentations for global studies.** The MTSU GeoBrain group will help faculty incorporate global geoinformation (e.g., different kinds of images of Costa Rica) into PowerPoint presentations. Development in this area builds on GeoBrain's principal strength—ready access to many different kinds of geoinformation from all over the globe—as well as MTSU's burgeoning emphasis on global studies (including study abroad). A small group of experienced students and faculty will use MPGC 1.0 to obtain images so other end users will not have to use the software directly. If successful, the GeoBrain group will expand this service to other universities in the Greater Nashville, TN region.
- **Computer-based curricula for introductory and advanced undergraduate education.** The MTSU GeoBrain group will incorporate geoinformation into interactive computer-based curricula similar to existing curricula developed with National Science Foundation funding (e.g., Hall-Wallace and McAuliffe, 2002; Hall-Wallace et al., 2003). As with existing curricula, students will use the Environmental Systems Research Institute (ESRI) family of GIS software to query and analyze the geoinformation.
- **Posters for K-12 outreach.** The MTSU GeoBrain group will incorporate geoinformation into posters for remote sensing outreach.

Curriculum development in the three areas listed above will take advantage of geoinformation made accessible by MPGC 1.0 while insulating most end users from software idiosyncrasies which would frustrate persons inexperienced with GIS, remote sensing and geoinformation.

References cited

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GeoBrain
http://geobrain.laits.gmu.edu/