USING GPS GEODESY TO IMPROVE DATA AND INFORMATION LITERACY AMONG GEOSCIENCE STUDENTS

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PROJECT SUMMARY

In an increasingly technologically complex world tied together by rapid dissemination of information on the internet, the amount of data available for analysis in any discipline grows exponentially each day. Critical skills for undergraduate students who will become "knowledge workers," therefore, are the ability 1) to distinguish between data that are relevant to solving the problem at hand and data that do not constrain what is asked, 2) to identify data trends that are statistically significant, 3) to retrieve appropriate data from a variety of sources, and 4) to use the data to solve complex problems and make informed judgements about technical issues. Unfortunately, concepts of precision, accuracy, variance, periodicity, and error analysis often are left to the domain of introductory statistics and underemphasized in the geosciences at the undergraduate level. Undergraduate geoscientists, therefore, frequently are unaware of the limitations and sources of data, which are the foundation for interpretation and essential to the development of a well-prepared scientific professional.

We propose to use Global Positioning System (GPS) geodesy to improve data and information literacy among undergraduate students. Our objectives are: to address data and information literacy; to promote communication skills; to enhance critical thinking; and to build teamwork. We do not intend to replace a traditional introductory statistics course, but to illustrate important statistical concepts and techniques relevant to the geosciences that will encourage undergraduates to enroll in statistics courses. GPS geodesy is ideal for illustrating data literacy concepts. Data precision and accuracy depend upon several factors, including type of equipment, environmental conditions, length of occupations, monument design, site location, configuration of the geodetic network, and processing strategies. All of these can be varied, allowing the students to learn the trade-offs among cost, time, and quality and to determine the most efficient methodology for specific problems. In addition, precision, accuracy, and errors govern the interpretations that can be made and the potential to distinguish among competing models.

Our focus is to create an outcomes-based WWW-module that uses GPS geodesy in real-world applications and also requires integration of GPS data into oral presentations and written reports that incorporate resources found both through the WWW and traditional avenues, such as the library. The module is for use both by other educators in their own curricula and for undergraduate students to learn basic concepts independently. We will develop the module by teaching a course and subsequently transferring all materials to the WWW, including video of student presentations, team discussions, and equipment demonstrations. In the course, students will work in teams on "cases" that pose hypotheses for testing. Research suggests that working in groups in a cooperative setting produces greater growth in achievement than straining for relative gains in a competitive environment. The structure of the course will emphasize independence and self-reliance within the context of the collaborative team.

Three of the four cases we will use are derived from our on-going research projects and take advantage of on-line continuous GPS (CGPS) data as well as our archived campaign data. The case studies are: 1) Is the Puerto Rico-Virgin Islands block rigid?; 2) Do inflation/deflation cycles in Montserrat correlate with faster dome growth?; 3) Does slip occur in the New Madrid Seismic Zone?; and 4) What is the surface deformation field in Nicaragua? The first two studies are mature research projects of ours for which much data already are available either on-line (CGPS) or in our archives. The third case study is included to give students an example of a controversy where two groups of scientists have come to opposite conclusions based on the same dataset and to force students to search the WWW and journals for the data.. The fourth case is a research project in its infancy.