

Advances in Remote Sensing Approaches for Hazard Mitigation and Natural Resource Protection in Pacific Latin America:

A Workshop for Advanced Graduate Students, Post-Doctoral Researchers, and Junior Faculty

John S. Gierke, William I. Rose, Gregory P. Waite, Simon A. Carn, Jose Luis Palma, Essa L. Gross

Department of Geological & Mining Engineering & Sciences



Project Overview (NSF PIRE-0530109)

Develop remote sensing tools and validation methods for hazard mitigation and resource protection in Guatemala, El Salvador, Nicaragua, Costa Rica, Panama and Ecuador by:

- (1) Developing formal linkages among agencies in those countries, focusing on the collaborative development of remote sensing tools for hazard mitigation and water resource development.
- (2) Building a new educational system of applied research and engineering using two existing programs at Michigan Tech: The Peace Corp Master's International program and an undergraduate "Enterprise" program.

Project Objectives:

RESEARCH

Volcanic Hazards

- Develop volcanic gas monitoring programs
- Forecast activity of open vent volcanoes
- Develop satellite- and ground-based programs of topographic monitoring
- Characterize eruptive history of PLA volcanoes
- Perform risk assessment of several PLA volcanoes
- Development of sustained natural hazard monitoring programs using satellite imagery and geophysics

Hydrogeology

- Development and application of remote sensing tools for water resource exploration
- Develop a collaborative international approach to conduct research to improve knowledge of aquifer systems and establish a foundation for research and monitoring

Land-slides

- Determine location of past slope failures and define regions of high susceptibility to future slope failures using satellite sensors, topographic studies, and geotechnical analyses

Common to all research

- Development of collaborative international research and education
- Promotion of data-sharing dialogue between members of PLA countries

EDUCATION

- US students prepared for careers in global workplace
- Students choose education/careers in international geoscience



Counterpart Agencies



Guatemala
INSIVUMEH, CONRED, Univ. del San Valle, Univ. de San Carlos, German Development Cooperation



El Salvador
SNET, LAGEO S.A., Univ. del Salvador



Nicaragua
INETER, CIRA, SNV, Omotepe field station



Costa Rica
RSN, OVISCORI, Univ. de Costa Rica, ICE



Panama
Univ. de Panama, Instituto Geografico Nacional



Ecuador
Politecnica nacional, INHAMI, EMAAP-Q, CLIRSEN

Recent Workshops:

Remote Sensing Applications to Groundwater Exploration

Short-course at XI Congreso Latinoamericano de Hidrogeología
July 8-12, 2008, Quito, Ecuador
Presented in conjunction with CLIRSEN

Topics: Satellite Imagery types, introduction to GIS, fractured bedrock aquifers, using imagery to detect lineaments, fundamentals of natural resource protection

Remote Sensing Applications to Volcanic Hazards and Gas Cloud Detection

MARGINS NSF workshop at University of Costa Rica, June 14-15, 2007

Topics: ASTER data, detection of volcanic ash clouds with AVHRR, thermal monitoring of volcanoes from space, application of MODIS infrared data, observing and measuring SO₂ clouds from space



Abstract: Though much of the developing world has the potential to gain significantly from remote sensing techniques in terms of public health and safety, they often lack resources for advancing the development and practice of remote sensing. All countries share a mutual interest in furthering remote sensing capabilities for natural hazard mitigation and resource development. With National Science Foundation support from the Partnerships in International Research and Education program, we are developing a new educational system of applied research and engineering for advancing collaborative linkages among agencies and institutions in Pacific Latin American countries in the development of remote sensing tools for hazard mitigation and water resources management. The project aims to prepare students for careers in science and engineering through their efforts to solve suites of problems needing creative solutions: collaboration with foreign agencies; living abroad immersed in different cultures; and adapting their academic training to contend with potentially difficult field conditions and limited resources. The ultimate goal of integrating research with education is to encourage cross-disciplinary, creative, and critical thinking in problem solving and foster the ability to deal with uncertainty in analyzing problems and designing appropriate solutions. In addition to traditional approaches for graduate and undergraduate research, we have built new educational systems of applied research and engineering: (1) The Peace Corp/Master's International program in Natural Hazards which features a 2-year field assignment during service in the U.S. Peace Corps, (2) the Michigan Tech Enterprise program for undergraduates, which gives teams of students from different disciplines the opportunity to work for three years in a business-like setting to solve real-world problems, and (3) a unique university exchange program in natural hazards (E-Haz). Advancements in research have been made, for example, in using thermal remote sensing methods for studying vent and eruptive processes, and in fusing RADARSAT with ASTER imagery to delineate lineaments in volcanic terrains for siting water wells. While these and other advancements are developed in conjunction with our foreign counterparts, the impacts of this work can be broadened through more comprehensive dissemination activities. Towards this end, we are in the planning phase of a Pan American workshop on applications of remote sensing techniques for natural hazards and water resources management. The workshop will be 3 weeks in duration, sometime in early 2010, and involve 30-40 participants, with balanced participation from the U.S. and Latin America. In addition to fundamental aspects of remote sensing and digital image processing, the workshop topics will be presented in the context of new developments for studying volcanic processes and hazards and for characterizing groundwater systems.

Workshop Synopsis:

Title: Advances and Applications of Remote Sensing for Assessment of Geological Hazards and Natural Resources

Goals:

1. Increase awareness of available data and instruments for collecting data
2. Increase proficiency in acquiring and processing data
3. Increase awareness of the availability of tools for processing remotely sensed data
4. Enable more effective and comprehensive archiving and sharing of data

Preliminary Outline:

Week 1: Fundamentals and Applications of Satellite-Based Remote Sensing

Landsat
ASTER
AVHRR/MODIS
RADARSAT/InSAR
OMI
Data Sharing

Week 2: Fundamentals and Hands-on Applications of Ground-Based Remote Sensing, including Field Data Collection & Analysis

Broad Interest Topics: FTIR, FLIR, GPS
Volcanic-Hazard Specific: Seismic-Acoustic, DOAS, UV-Camera
Water-Resources Specific: Electrical Resistivity, VLF-EM, Pumping Tests

Week 3: Potentially Optional Activities for Interested Participants

Making Hazard Assessments
Availability of Freeware for Data Processing and Visualization

Potential Field Sites: Turrialba, Poas, and Arenal volcanos in Costa Rica

Modes of Instruction

English and Espanol
Class Room, Hands-on Computer, Hands-on Field

We are seeking interested participants:

Advanced Graduate Students, Post-Doctoral Researchers, & Relatively New Faculty
From the U.S. and Pan American Countries

Proposal to be submitted to NSF Pan American Advanced Studies Institute Program to support travel for participants

More Information: <http://www.geo.mtu.edu/rs4hazards> (Click Workshop Link)

