

GlobeSAR-2 - Education and Training Program Update

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Abstract

GlobeSAR-2 investigators presented results from their applications projects at the final GlobeSAR-2 symposium in Buenos Aires Argentina in May 1999, successfully ending this portion of the GlobeSAR-2 Program. However, the GlobeSAR-2 Program itself is far from over. This paper provides an update and report on the two primary activities supported under the GlobeSAR-2 University Program: the North-South University Linkages and the CD-ROM being produced from the GlobeSAR-2 training materials.

The GlobeSAR-2 University Program was designed to help ensure that educators and students at universities throughout the eight participating countries in South America could benefit from the efforts devoted to the development of the unique and comprehensive radar training program. Its objectives are to foster their involvement in research projects, and to encourage use of the GlobeSAR training materials beyond the life of the program.

The training materials produced for the GlobeSAR-2 training workshops were collected, refined, and enhanced with sections that had been suggested. A CD-ROM has been produced entitled: "GlobeSAR-2 - Educational Resources for Radar Remote Sensing". Illustrations are from Latin American and Canadian R&D projects. The product is multilingual - Spanish, Portuguese, French and English. A preview will be given at the symposium.

The GlobeSAR-2 North-South University Linkages component is creating opportunities for educators and researchers from participating countries to establish and develop joint research and educational linkages with their counterparts in Canadian universities. More than 20 exchange projects have been established involving 13 universities in 7 Latin American countries and faculty from 12 Canadian Universities. The paper presents an overview of the program and status of research results to date. A Web discussion group has been established to encourage the exchange of information, experience and expertise among GlobeSAR-2 participants.

The components of GlobeSAR-2 University Program were developed to help ensure that there will be a lasting impact and sustainable capacity in the use of SAR imagery, through curriculum resources and linkages among GlobeSAR-2 partners.

Introduction and Background

The GlobeSAR-2 Program is now in its fourth year, but there are still many activities being carried out and planned for this final year. A brief overview of the Program is useful as background. The goal of the Program is to enhance national capacities for natural resource monitoring, management, and planning in the Latin America. Organizations in Argentina,

Brazil, Bolivia, Chile, Colombia, Peru, Uruguay and Venezuela are participating in the Program this year. Costa Rica, Honduras and Panama participated until the end of October 1999. The Program's three primary purposes: (1) to demonstrate applications of RADARSAT for use in priority areas of natural resource management, as identified by participating countries; (2) to build capacity in radar remote sensing; and (3) to support the establishment of linkages between

Canadian public and private institutions and their counterparts in Latin America.

In the early part of the Program, the focus was on the demonstration of applications. The process of implementing the demonstration projects enabled investigators in each country both to gain and to create knowledge about applications of RADARSAT data relevant to the region. At the same time, the sharing of knowledge among participants fostered the development of institutional collaboration necessary to sustain further work. Sixty projects (Table 1), covering a wide range of applications of relevance to each country, were completed and reported on at the GlobeSAR-2 Final Symposium in Buenos Aires in May 1999. The results of the demonstration projects have created a substantially enhanced knowledge base about regional remote sensing applications. The reports, a majority of which are in Spanish, were published in the symposium proceedings. All GlobeSAR-2 participants received copies, and a few copies are still available on request from the GlobeSAR-2 office.

Preliminary feedback from the participants about the Program indicate benefits, including: a) The training and experience gained with radar data in individual demonstration projects have been identified by the GlobeSAR-2 investigators as the greatest benefits from the program. b) Institutional and professional cooperation during the Program has led to a domestic expansion of joint activities in several GlobeSAR-2 countries. c) Several under-graduate and graduate university courses in the region now include radar remote sensing, where little was taught previously. d) Mapping and monitoring projects being developed and carried out by government agencies and NGOs have started to use or are considering RADARSAT data as a source of information about natural resources and the environment. Feedback also indicated that RADARSAT data costs compared to other data sources represents a barrier to its wider use. To address this, some groups of investigators and the supplier are developing innovative financing options.

An independent evaluation of the Program is currently underway, with the report scheduled for completion in November 2000.

GlobeSAR-2 University Program

Strong interest from the university community in South America was evident during the selection process of the applications projects. In response to this interest, the GlobeSAR-2 Program was extended to include a component targeted to universities. This program consisted of two main elements: North-South Linkages and the *Educational Resources for Radar Remote Sensing* CD-ROM.

North-South University Linkages

This element of the University Program fosters exchanges between universities in Canada and South America and provides support for collaborative research projects.

The University Program projects are typically one year investigations that address research challenges relevant to documented needs in Latin America and take advantage of experience and expertise of Canadian university researchers.

Results from at least two of these cooperative research programs (Presutti/Franklin, Possada/Franklin) are highlighted in separate papers presented at this conference.

Three linkages projects will be described briefly. Each one is from a different country and illustrates the diversity in the partnerships. All three examples are geological in focus and therefore they give an indication of the range of interests within one application area.

1. University of Campinas - University of Alberta

This is a collaborative research project between Alvaro P. Crósta of the University of Campinas, Brazil and Benoit Rivard of the University of Alberta. The two faculty leaders are jointly supervising the work of graduate student Enrico Campos Pedroso.

Reconnaissance geologic and structural mapping are the first steps of mineral exploration projects in geologically unknown tropical areas such as the Amazon. The study area, the Tapajós region, contains some of the most important placer and also primary gold deposits of the Brazilian Amazon. While "garimpeiros" have been producing gold from placer deposits there for almost two decades, the geology of the area is

still relatively poorly understood. The project is integrating RADARSAT and aerogeophysics (magnetics and gammaspectrometry) data. Digital image processing techniques, such as textural analysis and neural networks, are being used to enhance the geological information. Results were presented at 31st International Geological Congress: Geology and Sustainable Development: Challenges for the Third Millennium in Rio de Janeiro, Brazil, August 6-17, 2000.

2. Instituto de Recursos Minerales de la Universidad de La Plata - Université de Montréal

A collaborative research project between the Daniella Marchionni of the Instituto de Recursos Minerales de la Universidad de La Plata, Argentina (Daniela Marchionni) and the Université de Montréal (Francois Cavayas). The research is part of the work being carried out by Sra. Marchionni for her doctoral thesis.

This two-year research study is using RADARSAT imagery for mapping the geological structure of the central part of Macizo del Deseado, Province of Santa Cruz, Argentina. This morphological structure has been studied for several years by INREMI in order to locate concentrations of gold-bearing quartz minerals, associated spatially and temporally with Jurassic volcanism. Most of the mineralizations lie at pre-existing fractures that facilitate circulation and precipitation of hydrothermal fluids. Knowledge of different fracture systems in the area and their chronology is important for geologic prospecting.

The objectives of their study are to evaluate and use the information from RADARSAT images for geologic and structural mapping of Macizo del Deseado. Complementary information from traditional sources such as aerial photographs, field work, and detailed maps will also be used, as well as information from Landsat TM images. A DEM will be generated from a RADARSAT stereo pair and interpreted for morphological information, particularly that associated with volcanic activity. Image enhancement techniques will be researched to establish methods which optimize the images for discrimination of lithologic units, e.g. lineaments, circular features and structures associated with hydrothermal alteration zones.

Preliminary results were presented at the CEOS SAR Workshop, Toulouse, France October 1999.

3. Instituto Geográfico Agustín Codazzi - Université de Montréal à Québec

This project was proposed by IGAC, the national agency responsible for mapping Colombia, in order to gain further geological knowledge of the study area, and to advance skills in digital image processing of radar images. The project is lead jointly by José Alberto Cristancho Perez of IGAC and Robert Desjardins and Normand Goulet of UMAQ.

Geologic hazards can cause enormous losses in property damage and human casualties. The eruption of the Nevado del Ruiz volcano, 28 km SE of Manizales, Colombia on November 13, 1985, while not considered a major eruption did have a major impact, with 22,000 people left dead and 6,000 families homeless. It is possible to identify areas prone to earthquakes, volcanic eruptions and landslides and the degree of hazard can be assessed. This information can be used to implement land-use practices which avoid these hazards and building designs which can withstand their effects.

The objectives of the study are (1) to undertake to detect, discriminate and interpret lineaments, (2) to analyze the relationships between the tectonic lineaments and available seismic information, and (3) to map lithologies, particularly those of volcanic origin. Also a Digital Elevation Model and a surface model to overlay the RADARSAT images will be produced and used to analyze the volcanic flows from Nevado Del Ruiz.

This project is still in-progress, and the investigators are planning to present the results at the IX Simposio Latinoamericano de Percepción Remota to be held in Argentina in November 2000.

GlobeSAR-2 Educational Resources for Radar Remote Sensing

The CD-ROM *GlobeSAR-2 Educational Resources for Radar Remote Sensing* contains a comprehensive and unique set of radar remote sensing training materials created for use by

universities in Latin America and Canada. There are two CD-ROMs in the package: one containing the English and French versions, and one containing the Spanish and Portuguese versions. From the outset, it was recognized that this product can also serve a wider educational community around the world.

Our goal in producing this package is to help make the know-how and the know-why to effectively use radar data and analysis tools more widely available.

The CD-ROM incorporates training slides developed by scientists at the Canada Centre for Remote Sensing for international technical cooperation programs, including GlobeSAR-1, GlobeSAR-2 and ProRadar. Significant contributions have also been made by radar specialists from different disciplines and by scientists and user agencies in many countries, particularly in South and Central America.

The GlobeSAR-2 training program was designed to be an iterative learning process, reinforcing knowledge and skills gained during previous workshops and adding new information. The process was a combination of workshops, hands-on exercises, technical consultation and coaching, with the ultimate goal being to have the investigators successfully complete their own applications projects. The training program was delivered over two years. The contents of the package exceed what would normally be used in any one course.

The resource materials are divided into four main sections: basic, intermediate, advanced, and applications (Figure 1). Each section includes theory and image examples, with associated explanations. The package consists of presentation slides and for the advanced section there are accompanying notes. To increase the educational and training potential of this CD-ROM, the images used in the slides are also provided in tiff format. This format will allow higher quality reproduction/projection and is compatible with image analysis and GIS software.

It is expected that each instructor using materials from the package will combine this resource with other materials and exercises and adapt them to meet the specific learning objectives of his/her course. The product has been developed so that

the large volume of materials can be easily searched, retrieved, displayed, sorted and printed. The user can “pick-and-choose” relevant slides and use them in the order best suited to his/her needs.

Two examples of course curricula developed in this way are included on the CD-ROM – one designed for engineers and one designed for geoscientists. The product has been developed in a manner and structure that recognizes that each instructor will in all likelihood wish to customize the base curriculum materials to suit discipline and learner requirements

The Spanish version has already been tested and evaluated in two workshops in Argentina. Ian Cumming, a professor from the University of British Columbia, delivered an advanced-level radar course in early April 2000. Philip Howarth and Joni Budgen from the University of Waterloo completed an introductory-level radar course later in April. These workshops also provided an important opportunity to verify translation and evaluate the materials. Required modifications have been made based on feedback received. Every practical effort is being made to ensure a final product of high technical and linguistic quality.

There will always be the need to improve, enhance and update the teaching materials, drawing from the experience gained in using the materials. Corrections and additions suggested by the educational community will be posted on the GlobeSAR-2 Web site. One of the mechanisms for generating and sharing ideas for educational resources and activities will be the electronic network described in the next section. Other mechanisms are also being developed to further the goal of establishing stronger capabilities in South America for remote sensing education.

The GlobeSAR-2 program will distribute the package to all South American and Canadian universities participating in the program, as well as to contributors to the package, i.e., Latin American investigators who implemented the applications projects and provided feedback during their training workshops, and Canadians who helped to prepare the materials. Others may request a copy from the GlobeSAR-2 Program office. (globesar@ccrs.nrcan.gc.ca)

The wide distribution of GlobeSAR-2 educational resources for radar remote sensing will be an enduring contribution that will have impacts far beyond the direct reach of the Program.

Electronic Network

The GlobeSAR-2 program has placed a great emphasis on the exchange of knowledge and experience among researchers through workshops, seminars, and regular meetings of participants. As the program developed it became apparent that it was also fostering the development of a community of researchers within the region. In an effort to sustain this community beyond the life of GlobeSAR-2, an electronic discussion list has been established. The electronic network continues the tradition of community among researchers by providing a mechanism for on-going interaction among participants, with respect to their work on radar and radar applications. Sustained interaction among professionals with similar interests has proven to be a successful means for trouble shooting and disseminating information about advances in technology and its applications.

Instituto de Astronomia y Fisica del Espacio (IAFE) in Buenos Aires, Argentina has developed and will maintain the GlobeSAR-2 Discussion List and the supporting web page for one year starting Jan 1, 2000, with support from GlobeSAR-2 and CCRS. The accompanying Web site serves as both a reference tool and as a means of promoting the discussion list. At the end of the first year, a plan for the self-sustaining operation of this web site / discussion group is to be prepared. The discussion list opened for its first subscriptions in April 2000.

Everyone with an interest in radar and earth observation is encouraged to join the discussion list. Both those new to the field, as well as the seasoned veterans, are welcome. The electronic network is initially being promoted to the GlobeSAR-2 participant list and workshop attendee lists and to the TELSIG subscriber list. However, IAFE and CCRS are encouraging anyone with an interest in radar and its applications to join.

Items included in the Radar Discussion List and Web page will be posted in the language of

submission. They will be accepted in English, French, Spanish or Portuguese, and readers will be able to translate them (roughly) using translation tools available on the Internet.

Topics for discussion will vary widely, from earth applications to sensor developments and calibration, from classification strategies, retrieval algorithms, interferometric applications and no doubt others that we have not anticipated. The discussion items submitted will be divided according to topic into sub-discussion lists organized by subject. The Discussion List is moderated to help ensure a high standard of operation and service to subscribers. Presently the web address and instructions for subscription can be found at <http://www.iafe.uba.ar/SAR/index.html>

Other activities

The final phase of GlobeSAR-2 will see additional activities aimed at broadening the impact of the progress made and experience gained by GlobeSAR-2 participants. Several initiatives are being planned.

A special issue of the Canadian Journal of Remote Sensing will be dedicated to GlobeSAR-2 project results. This will provide both an opportunity for a broader community to share these results and for GlobeSAR-2 participants to publish their work in a respected international forum.

The GlobeSAR-2 team has cultivated and maintained contact with SELPER. GlobeSAR-2 is a sponsor for an upcoming SELPER conference in November 2000. A number of presentations and at least one workshop will be given by GlobeSAR-2 participants.

In addition to these specific initiatives, the project team will continue to seek to leverage training opportunities and encourage collaboration in the remote sensing with Canadian and international partners.

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Table 1 Summary of Applications Themes by country for the GlobeSAR-2 Program.

Country	Agri	For/L.C.	Hydro	Geol	Coastal	Oceans	Sea-ice	Mapping
Argentina	3	6	4	5		1	1	2
Bolivia	1		1	1				1
Brazil	1	4	2			1		1
Chile	1	4	2			1	1	
Columbia		4		3				1
Peru		3		1	2			
Uruguay	1	1						
Venezuela	1							
61	8	22	9	10	2	3	2	5

(Legend: Agri=Agriculture; For/L.C.=Forestry/Land-Cover; Hydro=Hydrology; Geol=Geology)

Note some projects had more than one application theme and some projects were university projects which did not receive data or software. In total, there were 60 projects.

FIGURE 1

