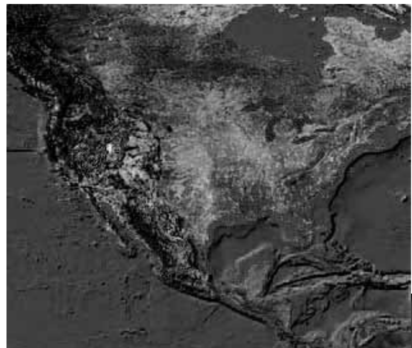
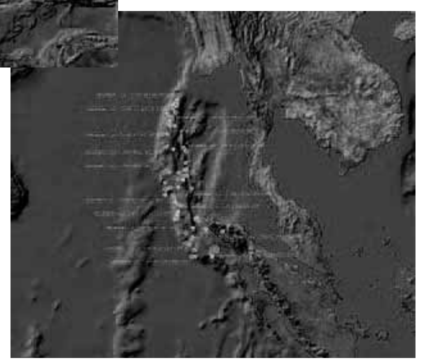
GeoSemantica Explores Near Real Time Weather Information from NOAA





Left: Figure 1. NOAAS's weather stations showing wind direction and speed.

Below: Figure 2. USGS NRT seismic events of the recent earthquake of magnitude 9.0 off the west coast of northern Sumatra and related strong aftershocks (most of magnitude 5 and 6, up to 7.3).

The GeoSemantica development team has initiated experiments with Open GeoSpatial Reference (OGR) to link GeoSemantica with near real time (NRT) weather information. The National Oceanic and Atmospheric Administration (NOAA) of the United Stateshas recently provided weather data in an open-access XML format. NOAA has previously provided access to the public but the data was in a format that required additional processing, and it was not easy to deal with (for more information about XML and weather data please visit: http://www.nws.noaa.gov/forecasts/xml/).

NOAA administers over 1800 weather stations in North America that provide NRT data such as temperature, barometric pressure, wind speed and direction, etc. Using OGR GeoSemantica harvests all the XML feeds from the weather stations in approximately 10 minutes and repeats the process every hour. The information captured is then plotted geospatially and the weather information is represented in point format. Unfortunately, only 475 stations have locations identified by latitude and longitude. We hope to be able to identify the geographic location of additional stations in the next few months.

In GeoSemantica's digital library we showcase the following NRT weather data from NOAA in these layers:

NRTM - NOAA's National Weather Service
NRTM - NOAA NWS Wind direction and speed
NRTM - NOAA NWS Barometric pressure

Having this type of NRT weather data in GeoSemantica is the first step in providing NRT hazard maps where weather is a major factor. We foresee the possibility of merging, for example, data for wind direction (Figure 1) with volcanic eruptions to forecast the near-source direction and extent of low level ash plumes.

NRT weather data and NRT world seismic events layers (Figure 2) in GeoSemantica are only the first steps toward a decision support tool that would provide government agencies and emergency response organizations with integrated, relevant, and recent geoscientific information in order to better respond to natural hazards.

Mr. Otto Krauth

MAP:GAC's New CIDA Officer, Mr. Brian McKay

In the middle of 2004, Ms. Nicole Côté, MAP:GAC's supporting CIDA officer, took a change in position and moved to Bolivia, and is now working in the Canadian Consulate in La Paz. We thank Côté for her support and contributions, and wish her well while hoping to continue our relationship through her new position. Mr. Brian McKay, a manager within CIDA's Americas branch, is our new officer. MAP:GAC project leaders met McKay at the GWG meetings in Lima, where he was immersed in the details of the project for three long days of meetings.

McKay comes to MAP:GAC with 18 years of international work experience throughout the Americas and Africa. He speaks Spanish and has previous experience in hazard work and inter-institutional communication – all relevant to MAP:GAC. McKay will be a great resource and knowledgeable support. We extend him a warm welcome and look forward to future collaboration.

Ms. Malaika Ulmi

Word of the Month

MAP:GAC is working towards creating standardized Spanish terminology, specifically with respect to landslides. The importance of employing a common terminology lies in the expression of this language through representation in maps, documents and other products used as tools contributed by geoscientists to land-use planners, politicians, and the community in general. As such, these must be as clear and precise as possible. This standardized terminology will better facilitate communication, mapping efficiency, and ease of map reading, as well as increasing the quality of work of participating geoscience agencies. Along these lines, we are featuring a word relating to geological hazards to showcase another aspect of the project work and the challenges of standardization.

Our first word in this series will be "disaster" as it is appropriate with the United Nations World Conference on Disaster Reduction in Kobe, Japan (January 18–22, 2005). Dr. Catherine Hickson, MAP:GAC Project Manager, is attending the conference to present MAP:GAC and exchange knowledge with the international disaster reduction community.

Definition of Disaster

(from Living with Risk: A global review of disaster reduction initiatives (UN/ISDR))

A serious disruption of the functioning of a community or a society causing widespread human, material, economic, or environmental losses which exceed the ability of the affected community/society to cope using its own resources.

A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability, and insufficient capacity or measures to reduce the potential negative consequences of risk.

Ms. Malaika Ulmi

Disaster Disaster Disaster Disaster Disaster Disaster Disaster

MAP:GAC Newsletter Production Team

Editor-in-Chief:
Catherine Hickson

Features:
Oscar Cerritos
Mike Ellerbeck
Jennifer Getsinger
Reginald Hermanns
Lionel Jackson
Monica Jaramillo
Otto Krauth
Paul Rovers
Mark Stasiuk
Malaika Ulmi

Design & Layout:
Loretta Wong

Geological Survey of Canada
101-605 Robson Street
Vancouver, B.C.
V6B 5J3
Tel: 604.666.0183
Fax: 604.666.7507
Email: map@pma-map.com
Web: www.pma-map.com
NRCan / RNCan
Funded by:
CIDA / ACDI

Multinational Andean Project:
map:gac
http://www.pma-map.com
Geoscience for Andean Communities
January 2005 - Vol. 4, No. 10

From the Manager's Desk
January 2005

As 2005 is now here, the New Year has dawned upon a world filled with sorrow. Though it is our neighbours in Asia and Africa who are directly affected by recent earthquakes and tsunamis, I doubt there is a nation on Earth that does not have citizens with personal connections to one or more of those countries – relatives, friends, or business associates – who have been affected by this natural tragedy. We are all touched by the immensity of the catastrophe. Our thoughts and prayers go out to the survivors and to those who are trying to restore order amidst chaos. It will be the most difficult task many people will ever be asked to face, and as natural hazard practitioners we must use this event to learn as much as possible.

How is it possible that so many people have perished when the means to save thousands was at hand? A tsunami warning system and a public education initiative would have spared literally countless thousands of lives. The article on page 3 provides some details for the Pacific Ocean.

The greater question is how do we make our political representatives wake up to the reality of natural hazards? Does it take an event of this magnitude? Does it take 10,000 lives or 100,000 lives? What price is to be paid for natural disaster mitigation? No, a destructive natural event may not occur during the reign of any given government, and no, we (the scientists) can't give precise details as to the timing, size and magnitude of any one event, but we can state with certainty that the same type of megathrust earthquake that occurred December 26, 2004, at 00:58:53 UTC off the northern tip of the island of Sumatra will happen again, at another time and another place where the geological conditions are ripe. And we can give pretty good odds as to where those places are and the types of events to be expected. But when they happen again, let us hope the death toll is not so staggering. However, in order to be able to make this statement, governments around the world must wake up to the fact that spending a few thousands or maybe even a few millions of dollars could ultimately save them or their successors millions to tens of millions of dollars as well as the priceless lives of their citizens.

Let us not allow the deaths of these tens of thousands of people, and the hundreds of thousands that have died in natural disasters in the past, go unheeded; let this be the reminder we all need to continue pursuing natural hazard reduction through assessment, mitigation, public information, community activism, and any other means at our disposal. Even when our governments appear to be unresponsive, let us use this catastrophic event as the catalyst to strengthen our resolve to help create a safer world through natural hazard reduction. The goals of MAP:GAC are clearly aligned with what needs to be done – let's get on with it, and make 2005 as productive a year as possible, in memory of the thousands who have died and in support of the millions who continue to suffer.

Dr. Catherine Hickson

World Report: Living with Risk
A global review of disaster reduction initiatives

Acknowledging the importance of the UN/ISDR (Secretariat of International Strategy for Disaster Reduction of the United Nations) in the management and dissemination of information in the field of disaster reduction, the Multinational Andean Project: Geoscience for Andean Communities (MAP:GAC) adopted the World Report Living with Risk: A global review of disaster reduction initiatives as a reference text in this area. MAP:GAC has also supported the dissemination of this useful document among its member countries through the production of the Spanish version of the guide.

Living with Risk: A global review of disaster reduction initiatives

The Spanish version will be released in digital format – CD, in the World Conference on Disaster Reduction in Kobe, Japan (January 18–22, 2005) http://www.unisdr.org .

The CRID (Regional Disaster Information Centre) in Costa Rica, MAP:GAC, and the Secretariat of the ISDR in Switzerland coordinated the production of the Spanish version. ISDR hopes to release paper copies a few months after releasing the CD version.

The information displayed in this World Report (Living with Risk: A global review of disaster reduction initiatives) is based on studies led by the ISRD Secretariat, and carried out by regional organizations, agencies of the United Nations, experts and other people, as narrated in the following lines from the forthcoming Spanish version, soon to be released:

In 2001, the ISRD Secretariat carried out a world survey about disaster risk reduction, requesting from national authorities their evaluation of institutional development and policies, risk assessment and planning. In the period 2001–2002, a group of international experts in disaster reduction were consulted on the preparation of this report.

Several contributions were received from members of the Inter-institutional Task Force for Disaster Reduction (ETI/RD), and from participants in two debates. The first took place in May 2002 as part of the preparations for the World Conference on Sustainable Development, and was organized together with the Multi-Stakeholder Forum for Our Common Future NGO network and the ISDR Secretariat. The second debate, in August 2003, aimed to develop a framework to guide and monitor disaster risk reduction. http://www.unisdr.org/dialogue

Drafted during the foregoing activities, in July 2002 a preliminary version of the work was released, which stimulated numerous comments and additional contributions throughout the world.

The Spanish CD version incorporates and emphasizes important concepts in Latin America. We hope that the outcome of this joint initiative among MAP:GAC, UN/ISDR, CRID, and FUNDACRID will be useful in the management and dissemination of information in the field of disaster reduction.

Ms. Monica Jaramillo

GPS Training in Peru: *Differential GPS workshop and field survey, Lima and Quebrada Payhua*

Figure 1. Mr. Bilberto Zavala Carrión (INGEMMET) and Mr. Manuel Zapata (Civil Defense) explaining GPS surveying work and its role in hazard mitigation to school children at J.C. Tello Elementary School, site of a GPS base station, November 2004.

Top: Figure 2. Differential GPS workshop, INGEMMET, Lima, Peru, November 2004.

Right: Figure 3. Mr. Bilberto Zavala Carrión and Mr. Carlos Guerrero Bohórquez of INGEMMET, setting up an "Automobile" kinematic survey, Matucana, Peru, November 2004.

INGEMMET, hosted a differential GPS workshop November 20–30, 2004, held in Lima and Matucana. This workshop was attended by 14 people including INGEMMET staff as well as participants from a wide array of relevant institutions such as the Instituto Geografico Nacional, Instituto Geofísico del Peru, Instituto Nacional de Concesiones Mineras, and national universities. The aim was to train geoscientists in differential GPS surveying techniques and applications as well as to carry out a real field-based differential GPS survey of the Quebrada Payhua area in Matucana, Huarochiri-Lima, Peru. The workshop, taught by Dr. Mark Stasiuk and assisted by Mr. Oscar Cerritos, provided a combination of both classroom (theory and processing) and practical (field survey) components to maximize the learning process as well as to acquire real and useful differential GPS survey data. The town of Matucana (pop. 5700) is located along the Carretera Central (main highway) that runs alongside Rio Rimac, linking Lima to the interior of Peru. The study area of Quebrada Payhua / Matucana, where the survey was carried out, was recently visited by the MAP:GAC Geoscience Working Group as part of a fieldtrip from Lima, Peru, in October 2004. Quebrada Payhua, a creek that converges with Rio Rimac just upstream from Matucana, has a history of being an active zone of flooding and mass wasting. The most recent flood happened in 1983, and a major flood event in 1959 destroyed a large portion of the town and caused loss of life. This area, like most of the Andes, has exhibited significant uplift, and is representative of problem areas affected by debris flows and flooding along narrow valleys. The study of this creek is therefore important to understand in order to model and predict possible flooding and debris flow events in the area. INGEMMET has already conducted a study of the surficial geology of Quebrada Payhua, as well as an inventory of landslides and sources of debris flow sediment, which together with the detailed topography can help determine maximum discharges (see Vol.4, No.7, October 2004 of the MAPGAC News). The differential GPS workshop gave geoscientists an opportunity to expand on this work, giving hands-on training in differential GPS surveying techniques so that participants can conduct their own surveys to collect field data including detailed topography of the area for map changes due to natural events. Possible products that could be developed from survey results include a detailed topographic map of Quebrada Payhua area and/or a Digital Elevation Model (DEM) that could be used for flood simulation analysis. For the latter, a series of steps are suggested, including first generating a DEM using stereo imagery and rapid-static GPS ground control points, overlaying the results with kinematic surveys to derive an error estimate, and incorporating zones of dense kinematic surveying to develop a more detailed and accurate DEM.

The Quebrada Payhua/ Matucana area has a rich archeological background, and draws on millennia of experience of land use practices. We must be aware of this knowledge and how it applies to hazard mitigation. For example, ancient settlements were usually located in stable areas with low natural hazard risks, and the widespread use and maintenance of terraces not only helped increase agricultural yields, but also helped minimize hazard events by stabilizing unstable slopes.

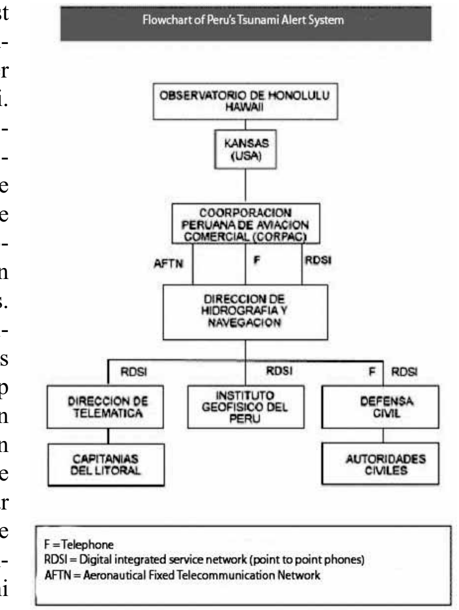
The acquisition of a high resolution Quickbird satellite image in August 2004 for fieldwork and surveying purposes had the unexpected benefit of highlighting an archeological site known as Cayashorco (3862 m) located on a ridge above Quebrada Payhua, previously known only to local people. This site dates back to the prehistoric pre-Inca 1200–1400 AD Late Intermediate Period, and was visited by the Archeologist Julio Colque of the Peruvian Scientific Archeological Society (Sociedad Cientifica Peruana de Arqueologia) while the GPS survey was being conducted. A brief kinematic survey was also conducted at the known archeological site of Cayashuro (2997 m), located on the road from Matucana to Payhua and dating back to the same period. The data obtained at this site can be used to obtain its detailed topography, including extensive terracing and dwellings. An important aspect of work in Matucana, then, consists in recognizing and incorporating the findings of archeological sites near the debris flow zone in Quebrada Payhua, in order to aid in site preservation as well as to enhance the profile of the community and encourage time-proven land use practices such as the upkeep of terraces.

The differential GPS group was asked by the technical secretary of Matucana Civil Defense, Mr. Manuel Zapata, to be present at a flooding simulation in Matucana on November 26, 2004. This experience provided an excellent opportunity to raise public awareness and see firsthand how the community prepares for possible emergencies such as hazard events.

Considering most of the data represented kinematic points and was acquired in rough and difficult terrain with lots of satellite signal blocking problems, the differential GPS survey was very successful. A significant resource of data was acquired in a short time, with most data having less than one metre error levels and falling within the metre positional error levels of the available high resolution Quickbird imagery. For landslide and debris flow hazards studies and detailed topographical mapping this is more than adequate. The work conducted in Matucana was enhanced due to great inter-institutional cooperation as well as good communication with the local authorities, both facilitated and made possible by our colleagues at INGEMMET. We thank them for all their hard work, and look forward to future successful MAP:GAC activities and cooperation.

Mr. Oscar Cerritos

Tsunami Alert Systems



Tsunamis are large, fast sea waves caused by sudden significant shifts in water displacement (http://www-sci.pac.dfo-mpo.gc.ca/osap/projects/tsunami/tsunamiphysics_e.htm). Most common are tsunamis created by submarine earthquakes, the largest associated with "megathrusts" on convergent plate boundaries. "Telegenic" tsunamis, travelling hundreds to thousands of kilometres at velocities up to 200 m/s or 700 km/hour in open ocean, can cross ocean basins in a few hours, and are thus able to devastate areas far from the epicentre without the natural warning of a felt earthquake. This type of tsunami resulted from the M 9.0 subduction earthquake in south Asia on December 26, 2004. (Maps http://earthquake.usgs.gov/eqinthenews/2004/usslav/) Although the recent great earthquake was the fourth largest since 1900, it was still smaller than the M 9.5 earthquake that struck Chile in 1960, also caused by subduction. Both events generated gigantic, far reaching, and destructive tsunamis.

With warning systems in place, large tsunamis can be predicted and warnings sent to coastal communities minutes to hours in advance of the waves hitting their coastlines. However, there must be adequate communications in place locally, a system of evacuation, and knowledge among the community as to what to do when a warning is issued.

According to the ISDR's position on early warning systems in 2004 (http://www.unisdr.org/wcdr/basic-inf/wcdr-presskit/wcdr-press-kit.pdf), "Lack of early warnings and lack of preparedness can turn an ordinary hazardous event into a major disaster. Clear warnings, received in time, coupled with the knowledge of how to react, can mean the difference between life and death, or between economic survival and ruin, for individuals and communities. Too many countries and communities do not have effective early warning and preparedness systems…. Technical early warning services often exist, but the warnings do not reach those at risk, or they lack meaning for the locality and people. Those threatened often do not know what to do, or are poorly equipped to take necessary action."

Unfortunately this has echoed true once more in recent events, and though there are calls to implement a warning system in the Indian Ocean, everyone should pause and consider the ISDR's words: "There is a great deal of experience and expertise throughout the world that needs to be better codified and disseminated…. The primary need is to take a systematic approach to building early warning and preparedness for those at risk. The most important five tasks [are] as follows.

1. Demonstrate and promote the benefits of broad-based early warning systems, including [them] as a tool to protect development gains.
2. Integrate early warning systems into development planning.
3. Document existing early warning systems in different countries and settings, as a basis for identifying gaps and choosing investment priorities.
4. Develop information, guidelines, and tools for early warning systems that can be used with confidence by governments and communities.
5. Support developing countries to develop locally tailored, sustainable, people centered early warning systems."

The last point is perhaps the most important. As we know through MAP:GAC's community communications work, if you don't get the message out to the people, the most sophisticated warning systems won't help. Community and personal knowledge is the key. If many of the people in coastal areas around the Indian Ocean had known the simple rule of heading inland or for high ground after the earthquake, or when they saw the sea receding or large walls of water approaching the coast, more would be living today.

According to information from the Pacific Tsunami Warning Centre (http://www.prh.noaa.gov/ptwc/), "During the 101-year period from 1900 to 2001, 796 tsunamis were observed or recorded in the Pacific Ocean according to the Tsunami Laboratory in Novosibirsk. [Of these,] 117 caused casualties and damage most near the source only; at least nine caused widespread destruction throughout the Pacific…. Seventeen percent of the total tsunamis were generated in or near Japan. The distribution of tsunami generation in other areas is as follows: South America, 15 percent: New Guinea Solomon Islands, 13 percent; Indonesia, 11 percent; Kuril Islands and Kamchatka, 10 percent; Mexico and Central America, 10 percent; Philippines, 9 percent; New Zealand and Tonga, 7 percent; Alaska and west coasts of Canada and the United States, 7 percent; and Hawaii, 3 percent."

With so many tsunamis generated in the Pacific let's review what we are doing to mitigate the impact. All participating countries in MAP:GAC on the Pacific coast are members of UNESCO's International Coordination Group for the Tsunami Warning System of the Pacific (IGC/ITSU). Member institutions are the naval hydrographic services in each country, with the exception of Colombia, whose membership is through the Southern Occidental Seismic Observatory (OSSO) of the University of the Valley. The IGC/ITSU issues warnings that include approximate arrival times for various parts of the Pacific.

For example, in Peru, upon reception of a warning from the IGC/ITSU, the Naval Hydrographic Service and the Commercial Aviation Corporation (CORPAC) communicate via an Aeronautical Fixed Telecommunication Network (AFTN), an integrated digital service network (programmed point to point telephone) and regular telephone, and then disseminate warnings to coastal port authorities, Jorge Chavez Airport, Peruvian Geophysical Institute (IGP) and civil defense. Civil defense then notifies civil authorities, who disseminate the warning to the public (see diagram).

In Chile, a strong national and international plan is in place as a consequence of the 1960 Chilean M 9.5 earthquake and tsunami. The national system makes use of seismic data from stations provided by the National Seismic Network run by the Department of Geophysics of the University of Chile. Information is passed on to the National Office of Emergencies of the Ministry of the Interior (ONEMI) and the Naval Hydrographic and Oceanographic Service (SHOA) for dissemination. ONEMI then disseminates to three regional authorities who notify the public and issue large scale warnings to areas affected. Internationally, SHOA receives warnings from the IGC/ITSU in Hawaii and notifies port authorities and (ONEMI) via hotline. From there, the same established lines of dissemination are followed. Within their plans for tsunami awareness, ONEMI also focuses on education and communication to the public before, during, and after an event, recognizing the importance of public awareness and engagement.

Even with an effective Pacific-wide warning system, near-source tsunamis require special attention. As Peru, Chile, and other affected countries have recognized, these near-source events require location-specific education about tsunami risk It is also vital to transmit this awareness not just to residents and workers (seasonal and year-round), but also to visitors (especially tourists) and transient populations, many with no previous knowledge of tsunami hazard. According to Dr. Peter Anderson of Simon Fraser University, "A successful mitigation strategy requires continuing commitment from local governments and other local authorities, as well as by individuals, industry, and the recreational and tourism sectors in tsunami-prone areas" (http://www.ocipep.gc.ca/research/resactivites/CI/2003-D001_e.asp). We would add that national governments also need to maintain long-term continuing commitment

Ms. Malaika Ulmi and Dr. Catherine Hickson