

Instituto Nicaragüense de Estudios Territoriales (INETER) - Nicaraguan Geosciences Institute



Dirección General de Geofísica–Geophysical Department

www.ineter.gob.ni/geofisica/geofisica.html

The Organic Law of INETER says about the responsibilities of the Geophysical department (La Gaceta - Diario Oficial, 28-07-99, p3342) Chapter II Attributions, *Arto. 8 Atribuciones en el ámbito de Geofísica*: 1.) Maintains, modernizes and operates the networks of seismic, accelerographic, geophysical stations and of the volcanic surveillance, to assure the generation and storage of the basic data, their correspondent systematic organization and their application for early warning systems on the occurrence of dangerous geological phenomena. 2.) Carries out scientific investigations to characterize the dangerous geological phenomena supporting the planning of prevention and mitigation measures by Civil Defense and National Emergency Commission. 3.) Elaborates technical Recommendations on the micro location of human settlements, economic investments and land use planning. 4.) Carries out the seismic, volcanic and geologic monitoring and elaborates and distributes official information and alert messages, to inform on the development of the dangerous geologic, seismic and volcanic phenomena.

Functional Structure

Dirección General de Geofísica (Geophysical Department)

- Dirección de Sismología (Seismology Section)

(includes Electrónica Lab)

- Dirección de Vulcanología (Volcanology Section)

- Dirección de Geología Aplicada (Geology Section)

- Unidad de SIG “Georiesgos” (GIS Unit)

+ temporal projects with their personnel

Monitoring and Early Warning

As a part of the Nacional System for the Prevention, Mitigation and attention to Disasters (**Sistema Nacional de Prevención, Mitigación y Atención de los Desastres, SINAPRED**), INETER has the responsibility to guarantee Monitoring and Early Warning of the dangerous natural phenomena.

Monitoring 24x7. INETER/Geophysical Dept. maintains a permanent round-a-clock service to guarantee monitoring and early warning as part of an information and alert system on geological phenomena like earthquakes, volcanic eruptions, tsunamis, and landslides. The technician on duty processes any seismic event a short time after it was recorded by the system and guarantees the follow up of corresponding information obtained from other sources. He monitors also the systems for volcanic surveillance and informs on any event which might be important for the prevention of disasters. www.ineter.gob.ni/geofisica/sis/monitor.html.

Integrated Monitoring and Early Warning Center – earthquakes, volcanoes, tsunamis, landslides. The Monitoring Center has computer systems which are crunching the data coming continuously and in real time from the telemetric seismic stations to automatically detect seismic events. In the Center there are also installed the servers which receive, store, process and re-distribute other data important for the monitoring of the geological phenomena. Furthermore the Center is home of the servers for the INTERNET functions, INETER’s Web site and the Georisks-GIS server.

Alert Messages and immediate publication on the Web. In case of a strong seismic event the system emits an acoustic signal to initiate its immediate processing. The technician on duty processes

the data, and reports the event within 10-15 minutes by automatic fax and email services to SINAPRED, Civil Defense, mass media and seismological institutions in Central America, in total to about 70 addresses. An informative message is also emitted when an unusual seismic behavior of the active volcanoes is detected or when relevant information is obtained from field observers, meteorological stations or Webcams. The immediate processing is important for the tsunami warning which is emitted if an earthquake is localized off the Pacific coast of Central America with a magnitude above 7.0. www.ineter.gob.ni/geofisica/tsunami/tsunami.html. A faster procedure for earthquake location and magnitude determination is in preparation which will enable the emission of event parameters within about 2 minutes.

Seismic epicenters, seismograms, Webcam images, satellite images and other information are published automatically on INETER’s Website; e.g. the map and list of strong seismic events o events felt by the population. The page of the last minute information publishes the message of the most recent felt seismic event.

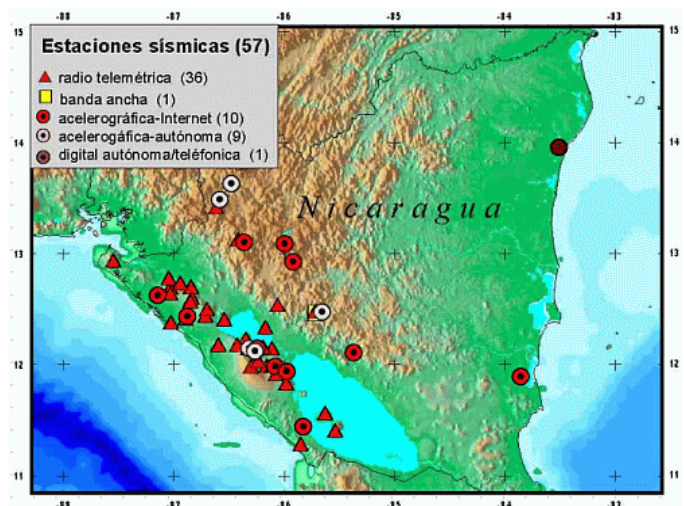
Volcano Monitoring. Includes seismic monitoring, monthly visits to the active volcanoes, on-line processing of satellite images, measurements with GPS, observations with meteorological stations in the volcanoes. www.ineter.gob.ni/geofisica/vol/dep-vol.html

Geological Monitoring. Sites susceptible for landslides or lahars are visited regularly. The works of private geologists for prospecting active seismic faults are supervised, especially in Managua.

Final data processing and bulletins. Around the 15-th of the following month the monthly bulletin is published. It includes not information related to the monitored seismic and volcanic activity in Nicaragua, but also short reports on our recent scientific investigations. www.ineter.gob.ni/geofisica/sis/bolsis/bolsis.html

Monitoring Network

Nicaraguan seismic network. INETER operates 37 telemetric seismic short period stations and 15 broad band stations. At the Data Center in Managua there are installed 3-component sets of short period seismometers, a broad band sensor and an accelerometer. Additionally, INETER counts with 19 digital accelerographic stations installed in the most important towns of Nicaragua. Local seismic networks are installed in the active volcanoes. Several of them are accessible via INTERNET. and their data can be used for the data processing in real time of strong seismic events. Additionally 30 seismic stations from Central America, and the larger region (Mexico, USA, Caribbean, Venezuela, Ecuador) are registered and processed on line to monitor the seismicity of Central America and to be able to process very strong seismic events.



Geochemical station, Mini-DOAS. Four MiniDOAS telemetric stations are used to monitor SO₂ flux from San Cristóbal and Masaya volcanoes.

Meteorological stations in the volcanoes. Four meteorological stations are installed in the volcanoes San Cristóbal, Casita, Mombacho and Concepción. The data are transmitted via satellite to a receiving station in the USA and are automatically downloaded via INTERNET to a server at our Data Center. The data are used for the monitoring and warning on lahars and are presented at INETER's Web site.

Web Cams. There are 6 Webcams installed for the visual observation of the active volcanoes San Cristóbal, Telica, Cerro Negro, Momotombo, Masaya and Concepción. The images are transmitted every five minutes to INETER's Webserver and are available at www.ineter.gob.ni/geofisica/webcam/index.html.

NOAA satellite antenna and receiver station. Six to eight times the day images taken by NOAA polar orbiting satellites are received in real time and processed automatically. The temperature of the crater area of 24 volcanoes in Nicaragua y Central América is determined to be used as a parameter eruption prediction. The system emails automatically alert messages to anybody interested in these data. During ongoing eruptions the gas and ash column can be observed in the images what is important real time hazard estimations to the population. The images are converted to ArcGIS coverages and can be used immediately together with other topographic or hazards coverage existing in the GIS system. www.ineter.gob.ni/geofisica/imagessat/page03/countries.htm

Digital Communications Network. WLAN infrastructure was installed along the volcanic chain to enable data communication with the monitoring stations. The Electrical Power Transmission Company provided access to their nation wide optical fiber system what enabled us to extend the communications and monitoring network to the Northwestern Nicaragua and the Atlantic part (Bluefields). Their transformer stations are used as nodes of the communications system where WLAN links can be connected.

Data Exchange

Via INTERNET, the seismological institutions of the region and international agencies have direct access in real time to the data of the Nicaraguan seismic network.

The data obtained from the satellite images, sea gauges, meteorological data from the volcanoes are available in the Web site for all interested institutions and the general public.

Hazard, Vulnerability and Risk Maps

Geophysical Department of INETER, supported by national, international and foreign institutions, has elaborated numerous maps of seismic hazard and vulnerability, tsunami hazard, landslide susceptibility, y of other geologic phenomena or cooperated with other institutions or organizations working in this field.

Development/Use of Geographical Information System (GIS)

In the last years, INETER/Geophysics, in cooperation with national and international institutions, has developed and applied a Geographical Information System on Georisks in Nicaragua. A data base was created which includes information on dangerous geological and hydro-meteorological phenomena on one side and elements under risk on the other side; geographical information, air and satellite photos were integrated. The GIS ia pretended to interact in real time with the monitoring and early warning system. A map server (ArcIMS software) presents in real time epicenters and other geological phenomena together with maps, air photos,

satellite images, population density and other information. The GIS infrastructure and its data bases were already utilized in numerous projects.

Projects (www.ineter.gob.ni/geofisica/proyectos.html)

Besides its main routine task - monitoring and early warning of the dangerous phenomena – INETER/Geophysics works intensely with projects dedicated to 1) the further development of the monitoring and early warning system, 2) on the mapping of geologic hazards, vulnerability and risks in Nicaragua, 3) on the further development of the Georisks GIS. Since 1997, INETER/Geophysics has carried out supervised or participated in more than 60 projects, most of them in cooperation with foreign institutions, or financed by foreign funds and/or from the Government of Nicaragua. Most of the projects are related to the prevention and mitigation of disaster for large parts of the Nicaraguan population.

Some projects have a strong social component. E.g. in the project in execution together with the Nicaraguan Institute of House Construction in Rural Areas (INVUR) (below, project No.12) and local administrations there were investigated the natural hazards in 70 sites. These sites are located mainly in rural areas throughout Nicaragua, where local administrations proposed to construct new houses. Up to now, these studies made sure for more than 7,000 families that their new homes will be build in safe areas.

www.ineter.gob.ni/geofisica/proyectos/INVUR/index.html

At the moment, INETER/Geophysics executes, supervises o participates the following projects (in parenthesis the main cooperation partners):

1. *GIS on Georisks in Nicaragua and Central America (BGR, Germany/Nicaraguan Government)*
2. *Geologic Hazards and reconnaissance of construction materials in the municipalities (CGS – Czech Republic)*
3. *Consolidation of the Networks for the Monitoring of the Natural Phenomena (Gov. Nicaragua)*
4. *Subduction and Natural Disasters in Nicaragua (GEOMAR, Germany)*
6. *Determination of the structure of crustal and mantle structure with a temporary Seismic Broad Band (Boston Univ., USA)*
7. *Early Warning System on Volcanic eruptions for the communities near Telica Volcanic Complex (CARE-EU-SINAPRED-Defensa Civil – towns of de León, Telica y Malpaisillo)*
7. *Pilot Project on Tsunami Alerts – Poneloya Area (EU – Movimondo-Civil Defense – Town of León)*
8. *Volcano Hazard Maps in Nicaragua (UNAM, México)*
9. *Investigation of Natural Hazards at rural urbanization sites (INVUR, Nicaragua, BID)*
10. *Landslide Risk Reduction and National Early Warning System on Landslides caused by heavy rains (NGI, Norway)*
11. *Program for the development of a regional Tsunami Warning System in Central America (CEPREDENAC)*
12. *Installation of a regional seismic array in Eastern Nicaragua.*
13. *NOVAC - Climatic and volcanic changes, monitoring of degassing (EU, Chalmers Univ., Sweden)*
14. *Sesismic Risk in Central America (NORSAR, Norway)*
15. *GLOBVOLCANO – Use of satellite data for volcano monitoring. (EU)*

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