Seismic Observation Network of Nicaragua

Mr. Emilio Adan TALAVERA MARTINEZ (2014-2015 Tsunami Course)
General Direction of Geology and Geophysics, Nicaraguan Institute of Territorial Studies (INETER)

1. Seismic Observation Network

Due to its location on the plate boundary of the Coco and Caribbean tectonic plates, Nicaragua presents a high seismicity and active volcanism. Strong earthquakes can occur on the Pacific coast of Central America which can produce tsunamis. In 1992, a strong earthquake occurred off the coast of Nicaragua that generated a tsunami. This event was the largest in recent history. Monitoring of these phenomena is required for seismicity mapping, hazard assessment, early warning and planning of disaster prevention measures.

A modern monitoring system was developed for surveillance and early warning. An important part of this system is the National Seismic Network of Nicaragua with 84 seismic stations: 39 short period seismic stations, 20 digital broadband stations, and 25 accelerographic stations (Figure 1). Seismic data are exchanged in real time with neighboring countries, IRIS (Incorporated Research Institutions for Seismology), and GFZ (German Research Centre for Geosciences). Also we obtain information of more than 300 seismic stations, of the global seismic network through IRIS for the Early Warning System (Figure 2). A permanent 7x24 information and early warning service are organized on seismic events, volcanic eruption, landslides and tsunamis. Next step is to install 8 satellite broadband stations, and a software of SeisComP3 was already installed to automatically locate earthquakes.

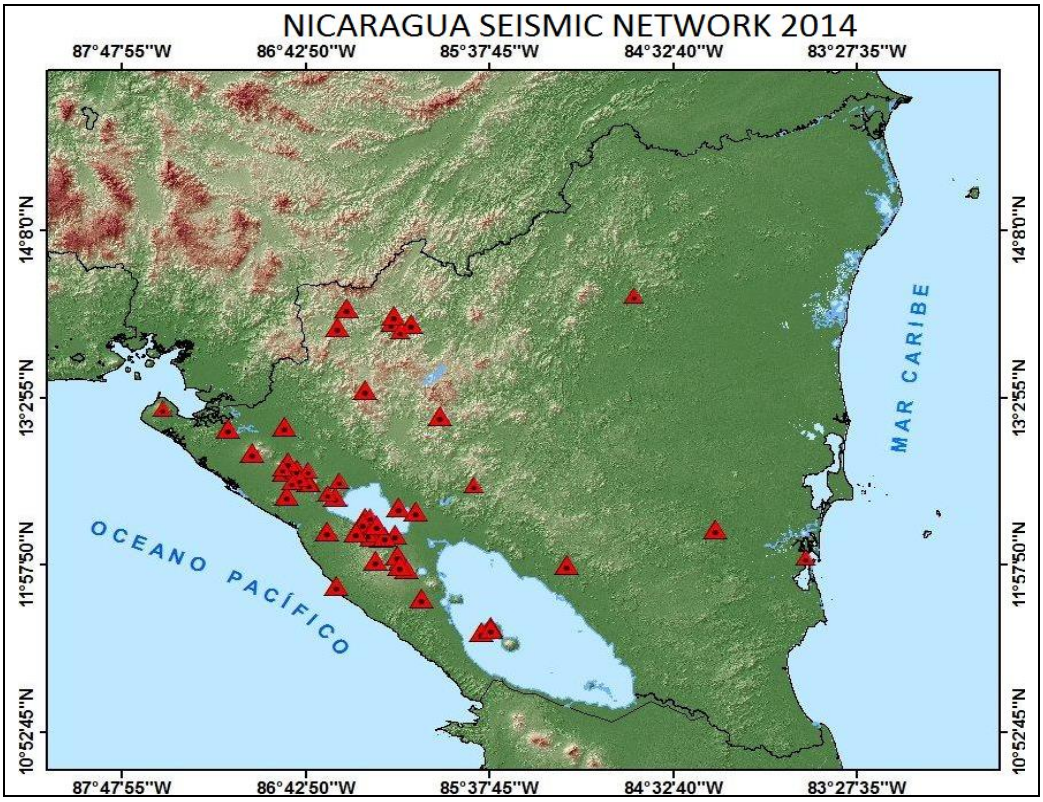

Figure 1. Local seismic observation network of Nicaragua.

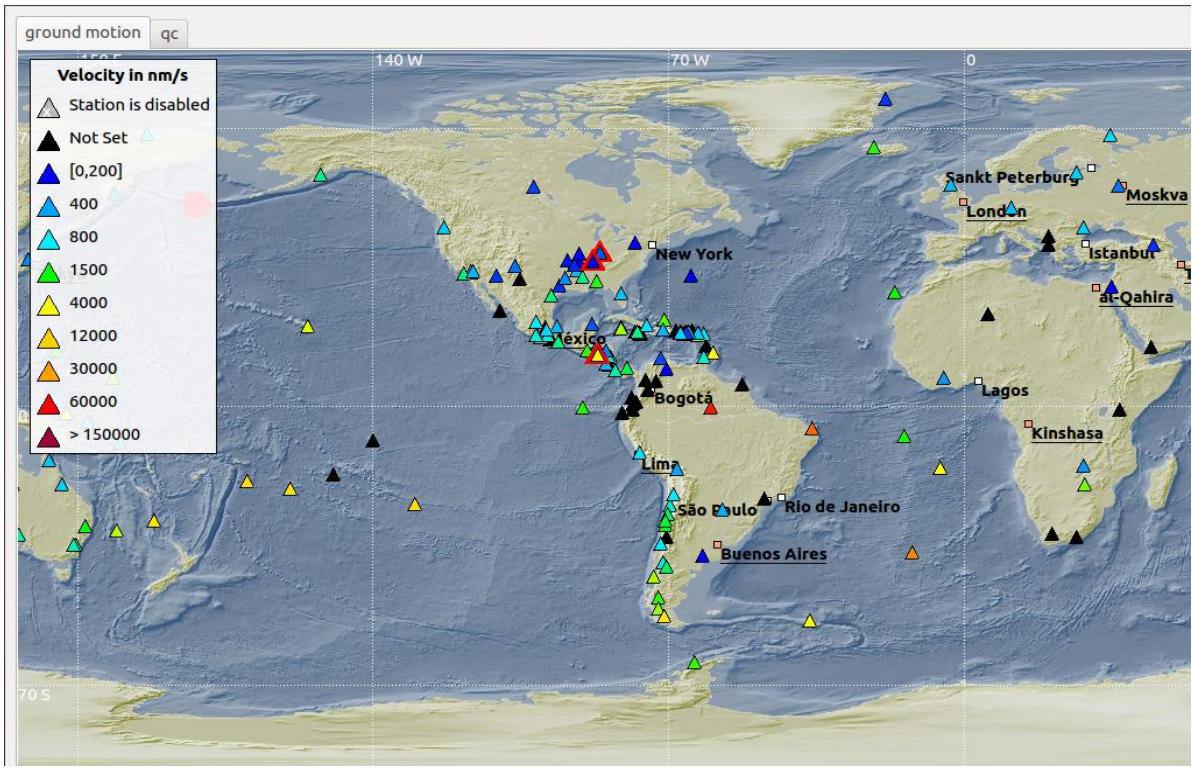

Figure 2. Global seismic observation network of Nicaragua.

The functions and tasks of the Seismic Network of Nicaragua are:

- To detect the earthquakes occurring in Nicaragua, Central America and the world,
- To locate the earthquake and to determine their magnitude, in less than 10 minutes,
- To send seismic alert messages (fax, electronic mail) in the event of strong earthquakes,
- To emit tsunami warning to authorities, if an earthquake happens in the ocean and the magnitude surpasses M=6.8 and 60km of depth,
- To detect anomalous seismic movements in the volcanoes and to send alert messages if the number of earthquakes or the amplitude of the seismic tremors surpasses a certain level,
- To detect anomalous seismic movements in the volcanoes, generated by landslides and to send messages of alert in the event of strong or repeated occurrence,
- To look for, to receive and retransmit information and messages of alert from and to the population, of other national and international institutions.

The facilities and equipment of the Local Seismic Network are (Figure 3):

- 39 short period stations, 3-comp.
- 1 broadband seismic station at INETER`s premise in Managua, STS-2 seismometer, Q330 data logger,
- 19 seismic broadband stations at the active volcanoes, and important cities,
- 25 digital strong motion stations, REF TEK 130 -A
- Tsunami Warning System located in Masachapa, Corinto and Poneloya beach. Pacific area in Nicaragua and other important cities in the coast of Pacific using acoustic sirens activates automatically from Civil Defense in Managua.

Figure 3. Facilities and equipment of the Seismic Network.

SeisComP3 – routine data processing and scientific investigation

Now Nicaragua is using SeisComP3 for automatic location and determination the parameters of an earthquake in 3 or 5 minutes.

Recording

Central recording of seismic stations:

- SEISLOG data logger, 64 channels, 100 Hz, 64 bit, triggered and continuous recording.

-Central recording of digital seismic stations: SeisComp data logger, miniseed data format, for automatic locations of earthquakes.

-Central recording for analog and digital stations and stations coming in via Internet from neighboring countries: EARTHWORM, analog 64 channels, 100 Hz, 12 bit, triggered and continuous (volcano monitoring), digital data com in via LAN,

-Local recording of strong motion stations located in Managua and the main cities,

-REFTEK digital accelerographs, 200sps. Online access via INTERNET, digital ratios and optic fiber,

-Local recording at digital broad band stations and short period stations.

2. Seismicity of Nicaragua

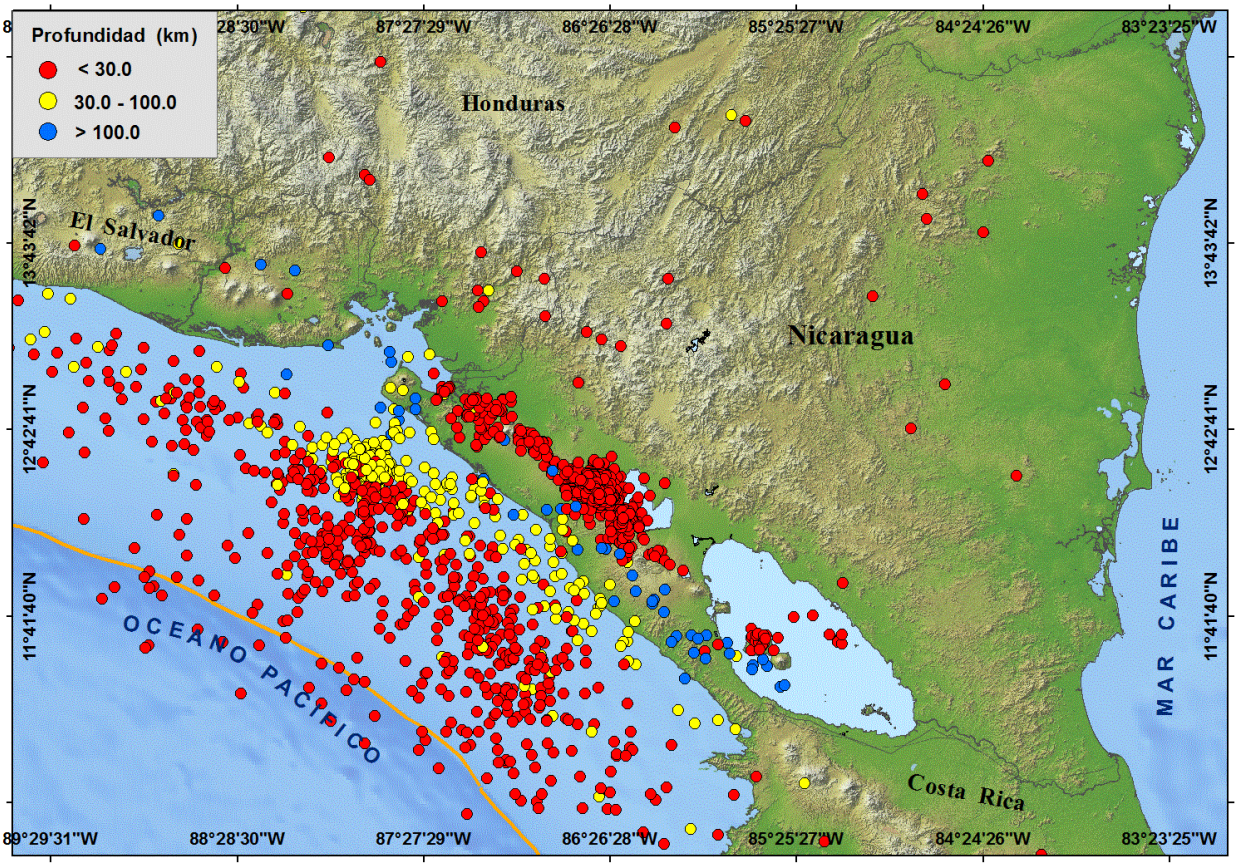

Figure 4. Seismicity of Nicaragua. (INETER, 2014)

3. Volcano Seismicity Observation

Volcano seismicity includes both tectonic seismic events in the volcanic edifices as volcanic events and tremor generated by the movements of magma and volcanic gases. A large number of seismic stations are installed in or near the volcanoes of Nicaragua. At each active volcano there is a station located at a distance of less than 3 km to the active crater (Figure 5). These stations are very important for monitoring the volcano-seismic activity. The signals of all the stations of the Nicaraguan Seismic network are registered in the Seismic Data Center by the SEISLOG and Seiscomp3 system, and then passed to an additionally system - EARTHWORM.

On our Web page, we present in real-time the:

1. Real-time earthquakes monitoring (http://webserver2.ineter.gob.ni/geofisica/sis/monitor.html),
2. Seismograms (http://geofisica-ew1.ineter.gob.ni/sismogramas/welcome.html) of the all seismic network,
3. RSAM (http://webserver2.ineter.gob.ni/geofisica/Grafica_RSAM/rsam_volcanes.html),
4. Spectrograms (http://geofisica-ew1.ineter.gob.ni/espectro/index.html) of the volcanoes.

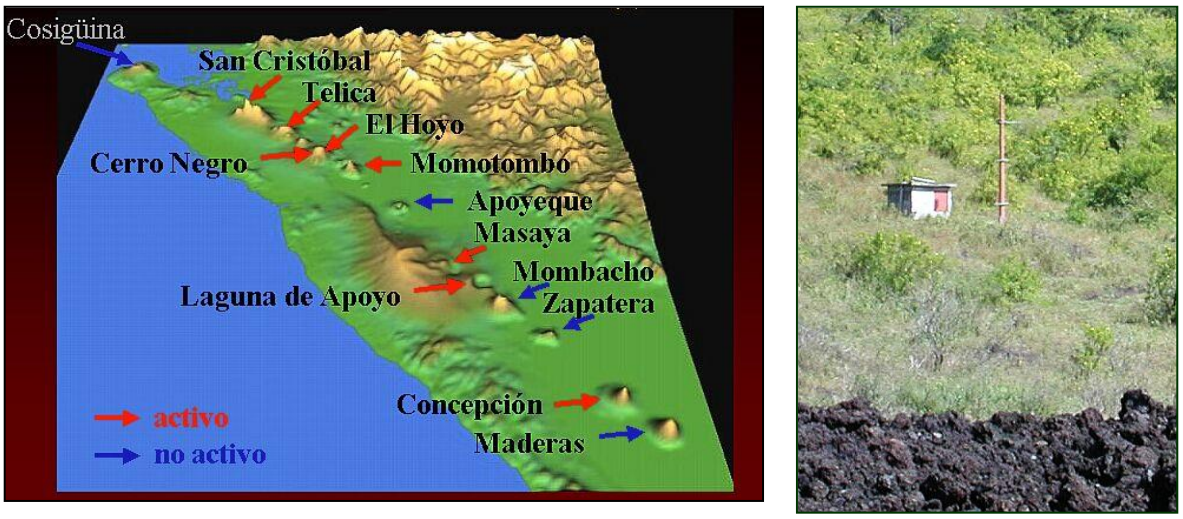

Figure 5. Left: Nicaraguan volcanic chain with the active volcanoes marked in red; Right: Photo of the seismic station at Cerro Negro volcano.