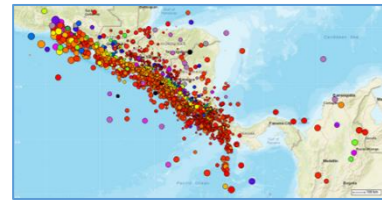
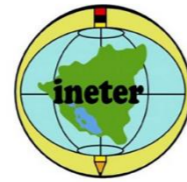


# Monitoring and Early Warning Center for Earthquakes and Tsunamis at INETER, Nicaragua – 2018



Seismicity of Central America processed by CATAC 07/2017-03/2018



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CATAC Data Center, April 2018

In the last four years, the Monitoring and Early Warning Center for Earthquakes and Tsunamis at INETER, Nicaragua, has developed rapidly due to new responsibilities acquired at national and international level.

**New tasks.** In 2015 we started to establish the Central American Tsunami Advisory Center (CATAC) within the global system of tsunami warning developed by IOC/UNESCO. In 2016, INETER started to develop Earthquake Early Warning (EEW) for Nicaragua and Central America.

To permit tsunami services and EEW we 1) extended our seismic network, and 2) created together with other network providers the “Regional Seismic Network”. Now, In Central America data of nearly all seismic stations are exchange freely in real time for Early Warning purposes. We became UNAVCO regional center for GPS data in the Caribbean and Central American Region as we pretend to use these data for earthquake and tsunami warning. We are also the National Data Center of Nicaragua in the CTBTO-



Manual Re-Processing

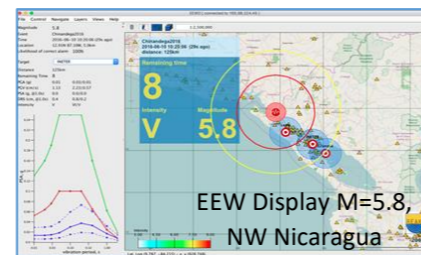
system and have access to data and capacities provided by this system.

**Personnel.** The personnel working 24x7 was trained in the use of the software and the scientific exploitation of the data. We are capacitating more people for this job and, in 2019, there will be 2 watch standers working in each shift.



Capacitation of watch standers

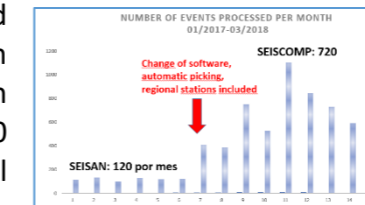
**Technical Improvements.** We enhanced greatly our computing and visualization hardware and data processing software. The SEISAN seismological software package (in place since 1991) was abandoned for routine processing and replaced by the SeisComP3 package. In 2016, we started to use experimentally the EEW modules included in SeisComP3, and in January of 2018, we installed the tsunami modules of the package. Seismic and tsunami processing



EEW Display M=5.8, NW Nicaragua

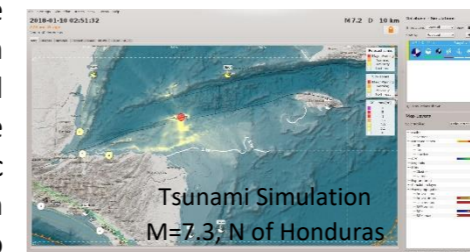
including numeric tsunami modelling in real time is first done automatically but after a few minutes the seismologist on duty revises the results.

**Network** We receive and process real time data from about 100 stations in Nicaragua, and around 250 stations from the other Central American countries, Guatemala, El Salvador, Honduras, Costa Rica and Panama. Additionally, we obtain via IRIS and GFZ real time data from around 200 global seismic stations for our global locator. The amount of wave-form data processed is about 20 Gbyte per day. The monthly number of processed local and regional seismic events increased from around 120 to around 1000.



NUMBER OF EVENTS PROCESSED PER MONTH 01/2017-03/2018  
SEISCOMP: 720  
SEISAN: 120 per mes  
Change of software, automatic picking, regional stations included

**Results.** Earthquake detection and location quality increased drastically for the events below the Pacific Ocean of Nicaragua, in the border regions to



Tsunami Simulation M=7.3; N of Honduras

the neighboring countries and in the Caribbean Sea. Information and alarm messages – still in a preliminary manner – can be sent out automatically and manually to seismological and civil protection agencies in Central America. Routine tsunami services shall begin in 2019. We pretend to make available EEW in the middle and long term; first - to a limited number of interested institutions, and, later on - to the general public.

**Aknowledgments.** We thank JICA-Nicaragua, JMA/Tokyo and University of Hokkaido on for their help in the reinforcement of CATAC and capacitation measures. The Swiss Technical Cooperation DEZA and Swiss Seismic Service SED/ETHZ for the cooperation in the development of EEW. IOC/UNESCO cooperates in the development of Standard Operation Procedures (SOP) and knowledge exchange on tsunami warning. The Government of Nicaragua funded equipment and promoted capacitation measures. The seismological institutions in Central America provide seismic data in real time.