GOAL

Boletín No 3 – Setiembre 2012

Contenido

1. Palabras del Coordinador Regional

Por Prof. Reinaldo García, rgarcia1945@yahoo.es

¡GOAL SIGUE VIVA!

El título de este mensaje expresa el estado actual de nuestra Red. Ciertamente estamos en una especie de *intermezzo* -que esperamos sea corto- derivado de circunstancias que ya son conocidas por ustedes, a través del Boletín anterior, de la página web de GOAL y de sus Coordinadores Nacionales. Dentro de esas circunstancias vale la pena destacar como hecho emergente la renuncia de la coordinación alemana por parte de Hans Gursky.

Las vacaciones de verano en el hemisferio norte han retrasado un poco las actividades que se han venido realizando en procura de un coordinador alemán. Esto quiere decir que se han hecho contactos, y con satisfacción adelantada les puedo decir que lo más probable es que vaya a ser un ejercicio de funciones, compartido por dos profesores alemanes y alternados anualmente. Tan pronto como este proceso se formalice se dará a conocer.

A pesar de no haber podido presentarse una propuesta al DAAD para realizar un curso-taller compaginado con LAK el año entrante (como se llevó a efecto en ocasiones anteriores), GOAL como Red sigue vigente. Una muestra es, justamente, el presente Boletín, y la organización para implementar la plataforma de E-learning.

A todos nos corresponde, en consecuencia, participar en la vida y vigencia de GOAL, mediante medios como la continua comunicación, las colaboraciones para el Boletín, la presencia como GOAListas en encuentros profesionales, y, en general, la disposición para promover el refuerzo de lazos científicos entre Alemania y Latinoamérica.

Agosto de 2012

Recovery from and Education on Natural Disasters and Geoparks

By Prof. Setsuya Nakada, nakada@eri.u-tokyo.ac.jp and Makito Watanabe mht.watanabe@aist.go.jp.

Natural hazards such as earthquakes, tsunamis and volcanic eruptions tend to take place with a given cycles and rules. It is natural that larger events are less frequent than smaller events. When the magnitude of earthquakes (even of volcanic eruptions) increases by one, their frequency decreases in one order. People, who live in the areas moving actively in the geological time scale, easily forget preparatory for large earthquake/tsunami disasters, even though they are experiencing daily small quakes. Of course, the scale of disasters depends on not only the magnitude of events but also sizes of communities and property present in those areas. New risk may be produced by the primary disaster like the example of the accident of nuclear power plants in Fukushima, which were destroyed by tsunami and are posing the danger of radiation exposure. For people who are living in those areas or who plan constructing and utilizing the permanent facilities in there, it is essentially important to understand the natural system and repetition of the geological hazards, and to prepare for the future disasters.

Many geoparks are symbolized by geoheritages created by the phenomena accompanying large geological hazards; big fault scarps, sea terraces, volcanic landscapes, etc. It is our advantage to be able to use these geoheritages for education on the geological hazards and the future preparedness for the disasters. In addition, recovery from geological disasters becomes the important process for local communities not only for reforming themselves, but also for reevaluation of geoheritages and geodiversities, which may be damaged by those hazards or born from the disaster inversely. Two global geoparks in Japan are characterized by the recovery from repeated volcanic disasters. It is very welcomed that local communities in the Tohoku area, damaged by tsunamis in March 2011, started their recovery from the horrible disasters by utilizing the function of geopark activity.

You can get more information about the abstracts of Geoparks2012, Japan from the URL below:

http://www.geoparks2012.com/jp/fs.pdf

5th International Unesco Conference on Geoparks, Japan 2012 (Abstract is courtesy of Prof. Nakada)

3. Tsunami hazard assessment in Central America

By Natalia Zamora, GeoSim and GeoForschungsZentrum GFZ-Potsdam, nzamorasauma@yahoo.com.br

Tsunamis are caused by the sudden displacement of water generated by earthquakes, submarine landslides, underwater volcanic eruption or asteroid impact. This displacement of the sea surface and radiation of energy begins with a series of waves propagating from the initial disturbance. The propagation of the wave and the arrival at the coast can take minutes or hours depending on the distance of origin. Tsunami research has been developed for decades both from the geological point of view and the wave propagation numerical modeling. However, not many studies have been developed for Central America where historical records show that these events might occur due to the highly tectonic regime of this region.

Tsunamis in Central America

Central America is located in the Circum-Pacific Ring of Fire, a region with the highest seismicity rates where about 56% of the world tsunamis have been generated (according to the NOAA Geophysical Datacenter database- NGDC). At least 84 tsunamis were generated in the Pacific and Caribbean coast of Central America. Moreover, 39 tsunamis of those events were generated along the Middle America Trench (Fig. 2; NGDC, Molina, 1996; Fernández et al., 1999, 2000 and references therein) as consequence of earthquakes caused by the subduction of the Cocos plate beneath the Caribbean plate with convergence rates between 7.5 – 9.5 cm/a (DeMets et al., 1994) (Fig. 1). In the past two decades, three tsunamis were recorded between latitude 4 N - 17 N. The largest tsunami instrumentally recorded in this region occurred at the Nicaraguan Pacific coast on September 2, 1992 (Kanamori and Kikuchi, 1993). Unusual characteristics of this event open a question if another event of such size can occur along the Middle America region in the near future and how much damage can it bring to the local coastal communities.

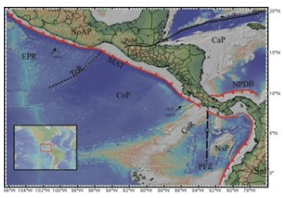

Figure 1. *Tectonic setting. Figure 1. South Mexico, Central America and northern part of South America tectonic features. EPR: East Pacific Rise, CoP: Cocos Plate, CoR: Cocos Ridge, PFZ: Panama Fracture Zone, NaP: Nazca plate, CaP: Caribbean Plate, NPDB: North Panama Deformation Belt, MAT: Middle America Trench.*

Additionally, on April 22, 1991 an earthquake (Mw 7.6) occurred in Limón at the Costa Rican Caribbean coast. This earthquake generated a tsunami that was recorded mainly in Bocas del Toro, Panama (Camacho, 1992).

Project goals

The main aim proposed for this project is to assess the probability of tsunami hazard along the Pacific margin of Central America. The basis of this project reside on previous deterministic results that we have been developed in the last years using deterministic scenarios such as most credible scenarios for the Pacific coast of Costa Rica (Fig. 4). A large amount of seismic and geodetic data has been acquired in the last years by several research groups from Germany, Costa Rica, United States, Japan, Switzerland, Spain, among others. These seismological data were used as input data to perform tsunami simulations to assess the inundation potential and vulnerability assessment for Nicoya, Costa Rica. The Hyflux2 numerical code was used to simulate water propagation and inundation. This code was developed at the Joint Research Centre (EU-JRC; Franchello, 2008).

Nevertheless, it has been recognized that it is important to extend the understanding of the tsunamigenic potential of different sources along the Middle America Trench and assess the probability of exceedance of tsunami waves along this region that might be caused by different seismic sources.

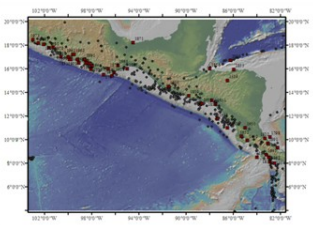

Figure 2. *Earthquakes with Mw > 5.5 along Middle America between from 1976-2011 from CMT catalog (grey) and tsunami events that occurred along Central America according to NGDC (red).*

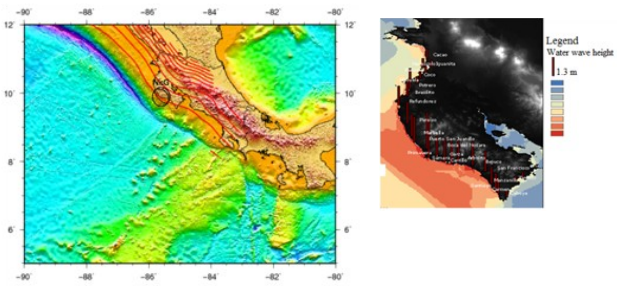

Figure 3. a. Location of probable earthquake. ***b****.Tsunami simulation done at the Nicoya Peninsula (HyFlux code). This is just a preliminary result since we are currently setting up input scenario using updated geodetic data to better constraint the possible rupture.*

3. Tsunami hazard assessment in Central America

Continuation

Tsunamis are caused by the sudden displacement of water generated by earthquakes, submarine landslides, underwater volcanic eruption or asteroid impact. This displacement of the sea surface and radiation of energy begins with a series of waves propagating from the initial disturbance. The propagation of the wave and the arrival at the coast can take minutes or hours depending on the distance of origin. Tsunami research has been developed for decades both from the geological point of view and the wave propagation numerical modeling. However, not many studies have been developed for Central America where historical records show that these events might occur due to the highly tectonic regime of this region.

Method of the probabilistic approach

The probabilistic tsunami hazard assessment takes into account the uncertainties of model parameters and probabilistic uncertainty related to the occurrence of events. Several ways to get estimation of the probability of occurrence of tsunamis, based on statistical approaches have been implemented in several regions of the world (Geist and Parsons, 2006; Thio et al., 2007; Burbridge et al., 2008; Tsunami Pilot Study Working Group, 2006; Heidarzadeh and Kijko, 2011; Sorensen et al., 2012). We are trying to implement a method based on the procedure that has been widely used to perform probabilistic seismic hazard assessment since Cornell (1968). In this case we base our analysis on the 500-years seismic catalog obtain for Central America. The probabilistic assessment is obtained after several considerations; however main steps are pointed:

- Segmentation along Middle America Trench considering seismicity and tectonic characteristics of the area.
- Quantification of seismicity rates for each zone (e.g. based on Gutenberg-Richter and calculations of maximum likelihood).
- Consider uncertainties using logic trees (Annaka et al., 2007)
- Increase of catalog window time: based on sesimic parameters and assuming that earthquakes follow a Poissonian distribution, a synthetic seismic catalog has been expanded to 1000000 years.

Consequently, the seismic scenarios with Mw> 6.5 are the input data to perform thousand of tsunami simulations.

-Tsunami simulations: EasyWave linear code (A. Babeyko) and Hyflux2 finite volume numerical code will be used for the propagation and the inundation assessment, respectively.

-Calculation of hazard curves (e.g. probability of exceedance of wave heights within specific time).

- Dessagregation of sources will be done to evaluate source contribution to tsunami inundation. Finally, this gives the possibility as well to perform tsunami posed higher hazard.

-Dessagregation of sources will be done to evaluate source contribution to tsunami inundation. Finally, this gives the possibility as well to perform tsunami inundation assessment in more detail on regions that posed higher hazard.

Final remarks

With implementation of a probabilistic approach it is intended to assess with a multidisciplinary approach the seismic tsunamigenic sources and evaluate inundation that could affect Central America.

Probabilistic tsunami hazard assessment is suitable for regional evaluation. Moreover, the probability assessment provides the basis to evaluate the possibility of exceedance of events and to quantify which sources are posing the highest hazard.

This project is the framework for future risk assessment for specific regions and could contribute into the coastal planning.

Acknowledgement

I am deeply grateful to Helmholtz graduate research school GeoSim and GeoForschungsZentrum GFZ-Potsdam for funding my PhD studies. I express gratitude for providing the seismic catalog of Central America and the support given at the beginning of my studies by the Central American seismologists performing the Probabilistic Seismic Hazard Assessment in Central America. This project is led by Dr. Belén Benito at UPM. I appreciate the fruitful discussions and support of my supervisor Dr. Andrey Babeyko (GFZ-Potsdam). Figure 3a was generated with Generic Mapping Tools and figures 1, 2, 3b and 5 using ArcGis10.

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3. Tsunami hazard assessment in Central America

Continuation

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4. Cursos y eventos importantes

Congreso Peruano de Geología, Lima, Perú, 23-26 setiembre 2012. Información: http://www.congresosgp.com/

XX Congreso Geológico Boliviano, Ciudad la Paz, Bolivia, 1 – 4 octubre 2012. Información www.cgb.org.bo

III INQUA – IGCP Congreso Internacional en tectónica activa, paleosismología y arqueosismología, Morelia, México, 19 -24 de noviembre del 2012. Información: http://www.acambay1912.org/

VII Conferencia Volcanes en las ciudades, Colima, México, 19-23 de noviembre del 2012. Información: http://www.citiesonvolcanoes7.com/

Conferencia Internacional Anual en Geología y Ciencias de la Tierra, Singapur, 3-4 Noviembre 2012. Información: http://www.conference-service.com/conferences/geophysics-and-geology.html

IX Conferencia Internacional en Estructuras de Ingeniería resistente a Terremotos, Coruña, España (2013), 8 – 10 julio del 2012. Información: http://www.wessex.ac.uk/13-conferences/eres-2013.html

Cursos Internacionales

Curso Internacional en Sismología, Amenazas y Mitigación de Riesgos, Centro de Investigación Alemán, Marruecos, 17-21 de Octubre 2012. Información: http://www.gfz-potsdam.de/portal/gfz/Struktur/Departments/Department+2/sec21/InternationalTrainingCourses

Estamos en la página Web: ***www.goaldaad.com.ar***

Cualquier pregunta o comentario respecto al Boletín, por favor comuníquese con *Dra. Nury Morales-Simfors, nury.simfors2@comhem.se / nusi0453@gmail.com*

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