WORKING GROUP 2

2015-2016 REPORT

Alberto M. López (Chair)
University of Puerto Rico – Mayagüez

Franck Audemard (Vice-Chair)
FUNVISIS

Silvia Chacón
RONMAC - SINAMOT

Xlth Session of the ICG/CARIBE-EWS - Cartagena, Colombia - May 5-8, 2016
WG2 focused on three main action items that were recommended on previous ICG/CARIBE-EWS Sessions:

- Caribbean Tsunami sources
- Bathymetry Inventory: 2nd stage
- CaribeWave 2015 collaborative project
1. Caribbean Tsunami Sources

- A sub-group of the WG2 specializing on tectonics of the Caribbean region worked during the Fall of 2015 to develop a comprehensive list of tectonically-induced tsunami sources for the Caribbean.

- The boundaries of the Caribbean plate were divided and assigned:
  - Northern/Northeastern: Alberto López-Venegas
  - Eastern: Valerie Clouard and Frédéric Dondin
  - Southeastern: Franck Audemard
  - Southwest and western: Silvia Chacón and Natalia Zamora

- Results were consulted with Carl Harbitz and Finn Løvholt.

The study proved to be a fascinating collaborative work among colleagues.
Fall 2015 American Geophysical Union Annual Meeting: Poster presented at Session “New Insights into the Active Deformation, Tectonic Evolution, and Hazard Mitigation of the Caribbean Plate and South America”

Tsunami sources for the Northern CA

Sources postulated at the IOC Haiti Experts meeting were modeled by Gailler et al. (2015) and Grilli et al. (2016)
Several scenarios were considered for the eastern Caribbean.

Most attention is being given to the Mw 8.4 event on February 8, 1843, which have been suggested to have ruptured 300 km along the northern portion of the trench (Feuillet et al., 2011; Roger et al., 2013)

Table of sources and picture provided by V. Clouard and F. Dondin
Tsunami sources for the western CA

Picture provided by N. Zamora and S. Chacón.
1\textsuperscript{st} stage of survey performed last year to quantify the existence of bathymetry, and tsunami inundation and evacuation maps of member states. This 2\textsuperscript{nd} stage survey sought to gauge interest of member states in developing tsunami inundation and evacuation maps.

Survey was developed in January 2016 and deployed on February 3\textsuperscript{rd} as an online survey. Secretariat sent an email to TNC’s to fill the survey. WG2 members sent reminders to TWFP’s as well.
EVALUATION ON THE NEEDS FOR GENERATING TSUNAMI EVACUATION AND INUNDATION MAPS FOR ICG/CARIBE-EWS MEMBER STATES

Working Group 2
Silvia Chacón
Alberto López
Interest on evacuation maps

- Yes: 29 (94%)
- No: 2 (6%)

Type of tsunami evacuation maps

- Fixed-height: 3 (10%)
- Inundation maps: 27 (87%)
- N/A: 1 (3%)

Interested on receiving assistance

- Yes: 27 (93%)
- No: 2 (7%)
EVACUATION maps generated by the state after receiving the appropriate training on determining the inundation region and creating the evacuation maps.

- EVACUATION maps of previously identified inundation regions to be generated by the state after receiving appropriate training (14)
- EVACUATION maps to be generated on-site by an external group during a site visit (13)
- EVACUATION maps to be generated remotely by an external group (9)
- Inundation maps to be generated remotely by an external group (8)
- Inundation maps to be generated on-site by an external group during a site visit (7)

Type of assistance preferred
DATA REQUIRED FOR TSUNAMI EVACUATION MAPS
Ownership or access to:

**Vulnerability data**
- Yes: 16 (52%)
- No: 3 (9%)
- Other: 7 (23%)
- N/A: 2 (6%)

**Topographic data**
- Yes: 28 (88%)
- No: 1 (3%)
- N/A: 1
Access or ownership of bathymetric data

However, the states indicated the quality, extent, and/or resolution of the data might not be suitable for tsunami modeling.

Source of bathymetric data:

- Nautical charts: 20
- Bathymetric surveys: 20
- LIDAR: 7
- Other: 8
- N/A: 3
Surveys for high-resolution bathymetry data

**Interest**

- Yes: 27 (87%)
- No: 3 (10%)
- N/A: 1 (3%)

**Assistance required**

- Yes: 25 (78%)
- No: 5 (16%)
- N/A: 2 (6%)
Type of assistance for bathymetric survey

- **Financial**: 10
- **Training**: 7
- **Technical**: 6
- **Equipment**: 5
- **Counseling**: 4
- **Ships**: 2
- **Manpower**: 2
Means to obtain assistance for bathymetric survey

- Hiring a private company: 12
- Signing a bilateral agreement with another state: 17
- As part of an academic international project: 23
- Other (Academic national grant): 1
- N/A: 6
States able to provide assistance for bathymetric survey

- Yes: 9 (29%)
- No: 21 (68%)
- N/A: 1 (3%)
CONCLUSIONS & RECOMMENDATIONS
• **Training**: preferred mean to build tsunami evacuation maps
• Funding to organize training similar to TEMPP?
• Funding for bathymetric surveys
• International academic projects for bathymetric surveys

• Bathymetric data available requires a case by case analysis
3. Workshop on Tsunami Maps

• Interest in organizing a series of workshops to Caribbean member states in the development of tsunami inundation and evacuation maps.
• Proposal submitted in late 2015 to OFDA-USAID to sponsor these workshops (that would follow the TEMPPP initiative) could be potentially funded.
• Resources from NCTR-PMEL in charge of modeling and tsunami map development would be available for 2017.
• Selection of participant member states would be based on a priority list.
• Priority list would be based on available bathymetry data, vulnerability, exposure indices, population at risk of the member states.
• A maximum of 10 countries would be chosen first – this low number would guarantee a low instructor – student ratio.
4. CaribeWave2015 Collaborative Project

- Initiative from RONMAC (Costa Rica)
- Model the source of CaribeWave15 in northern Panama along the Northern Panamá Deformed Belt
- Pilot project consisting of 4 countries: Costa Rica, Colombia, Panamá, Puerto Rico
- NEOWAVE tsunami numerical model using up to 5 nested grids
- Compare ETA’s and maximum wave amplitudes to manual
4. CaribeWave2015 Collaborative Project

CaribeWave2016 scenario: Two segments on the Northern Panamá Deformed Belt
4. CaribeWave2015 Collaborative Project

Simulation for 5 hrs
Nested grids at Costa Rica (Limón & Caribe Sur), Panamá (Viento Frío & Palenque), and Colombia (San Andrés Island).
• **Acknowledge** a list of tsunami sources from tectonic origin has been made and presented at the Fall 2015 American Geophysical Union annual meeting. Recommends to perform tsunami numerical simulations from tectonic-origin sources that were included in that study.

• **Consider** that other sources from non-tectonic origin could also affect the Caribbean basin.

• **Recommends** to expand the list of sources for the Caribbean and include those sources that are from non-tectonic origin.

• **Acknowledge** a survey to quantify the status, format, quality and availability of bathymetry data, as well as to learn about the existence of tsunami inundation and evacuation maps was carried out to gauge which member states are interested in learning how to develop their own maps.
Recommendations (II)

- **Consider** that 93% of member states demonstrated in the survey that there is interest in receiving assistance for the generation of tsunami inundation and evacuation maps.
- **Recognize** a group of experts in tsunami modelling from WG2 is available to provide assistance to member states related to tsunami modelling and development of tsunami inundation maps.
- **Acknowledge** a pilot-project known as Tsunami Evacuation Maps, Plans Procedures (TEMPP) is currently on-going for Central America that came as a recommendation from PTWS, and of which ITIC has organised.
- **Recommends** a similar series of workshops be organised for ICG/CARIBE-EWS member states requiring training in tsunami simulations and development of tsunami inundation and evacuation maps.
- **Note** that a proposal was submitted to USAID to seek funds to organize a series of workshops similar to TEMPP for 2017.
• **Consider** a methodology to develop a priority list of member states to participate in these workshops.

• **Acknowledge** USAID have notified of potential funds for carrying out similar workshops.

• **Consider** recommendations from PTWS to evaluate the Green’s Law used in the new products from PTWC that relate to minimise under and over estimation of forecasted inundation levels for small islands in the Caribbean.

• **Recognising** that the reason for the discrepancies lie on the quality of the bathymetry used in the forecasting computation, we therefore, **recommend** again for member states to provide a database and/or coverage map of available bathymetry to quantify which states could be evaluated for the Green’s Law modifications.
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution/Agency</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Franck Audemard</em> (Vice-Chair)</td>
<td>FUNVISIS</td>
<td>Venezuela</td>
</tr>
<tr>
<td>2. Paula Dunbar</td>
<td>NOAA (NGDC)</td>
<td>USA</td>
</tr>
<tr>
<td>3. Ricardo Arthur</td>
<td>CZMU</td>
<td>Barbados</td>
</tr>
<tr>
<td>4. Jeffrey Simmons</td>
<td>Meteorological Service</td>
<td>Bahamas</td>
</tr>
<tr>
<td>5. Narcisse Zahibo</td>
<td>Université des Antilles et Guyane</td>
<td>France</td>
</tr>
<tr>
<td>6. Ronald Sánchez Escobar</td>
<td>DIMAR</td>
<td>Colombia</td>
</tr>
<tr>
<td>7. Cap. De Corbeta Gabriel Vallejo López</td>
<td>DIMAR</td>
<td>Colombia</td>
</tr>
<tr>
<td>8. Alex Martín Castellón Meyrat</td>
<td>INETER</td>
<td>Nicaragua</td>
</tr>
<tr>
<td>9. Judith Ephraim</td>
<td>Sustainable Development Officer</td>
<td>Saint Lucia</td>
</tr>
<tr>
<td>10. Aurelio Mercado-Irizarry†</td>
<td>UPRM</td>
<td>USA</td>
</tr>
<tr>
<td>11. Carl B. Harbitz†</td>
<td>Norwegian Geotechnical Institut</td>
<td>Norway</td>
</tr>
<tr>
<td>12. Frederic Dondin</td>
<td>Seismic Research Center - UWI</td>
<td>Trinidad &amp; Tobago</td>
</tr>
<tr>
<td>13. Modesto Ortiz</td>
<td>CICESE</td>
<td>México</td>
</tr>
<tr>
<td>14. *Alberto López-Venegas† (Chair)</td>
<td>UPRM</td>
<td>USA</td>
</tr>
<tr>
<td>15. Hermann Fritz†</td>
<td>Georgia Tech University</td>
<td>USA</td>
</tr>
<tr>
<td>16. Dailing Wang</td>
<td>PTWC</td>
<td>USA</td>
</tr>
<tr>
<td>17. Valerie Clouard</td>
<td>OVS-Martinique (IPGP)</td>
<td>France</td>
</tr>
<tr>
<td>18. Maxlitrer Vallee</td>
<td>FUNVISIS</td>
<td>Venezuela</td>
</tr>
<tr>
<td>19. Heriberto Fabián</td>
<td>ONAMET</td>
<td>Dominican Republic</td>
</tr>
<tr>
<td>20. Jean Francois Dorville</td>
<td>UWI MONA</td>
<td>Jamaica</td>
</tr>
<tr>
<td>21. Jorge Macías†</td>
<td>Universidad de Málaga</td>
<td>Spain</td>
</tr>
<tr>
<td>22. Vasily Titov</td>
<td>NOAA/PMEl</td>
<td>USA</td>
</tr>
<tr>
<td>23. Silvia Chacón†</td>
<td>RONMAC/SINAMOT</td>
<td>Costa Rica</td>
</tr>
<tr>
<td>24. Natalia Zamora†</td>
<td>FUNTROPOS</td>
<td>Costa Rica</td>
</tr>
<tr>
<td>25. Marcelino Hernández González</td>
<td>Instituto de Oceanología</td>
<td>Cuba</td>
</tr>
</tbody>
</table>