ANNEX 3

TEMPLATE FOR NATIONAL REPORTS

National Reports will be posted to the ICG/PTWS-XXV web site without TWFP contact details.

NATIONAL REPORT
Submitted by CHILE

BASIC INFORMATION

1. ICG/PTWS Tsunami National Contact (TNC)
The person designated by a Member State to an Intergovernmental Coordination Group (ICG) to represent his/her country in the coordination of international tsunami warning and mitigation activities. The person is part of the main stakeholders of the national tsunami warning and mitigation system. The person may be the Tsunami Warning Focal Point, from the national disaster management organization, from a technical or scientific institution, or from another agency with tsunami warning and mitigation responsibilities.

   Name: Captain Patricio J. Carrasco
   Title: Director
   Organization: Hydrographic and Oceanographic Service of the Chilean Navy (SHOA)
   Postal Address: Errázuriz #254, Playa Ancha, Valparaíso
   E-mail Address: director@shoa.cl
   Telephone Number: 56-32-2266502
   Fax Number: 56-32-2266542
   Cellular Telephone Number:

2. ICG/PTWS Tsunami Warning Focal Point (TWFP)
The 7x24 contact person, or other official point of contact or address, is available at the national level for rapidly receiving and issuing tsunami event information (such as warnings). The Tsunami Warning Focal Point either is the emergency authority (civil defense or other designated agency responsible for public safety), or has the responsibility of notifying the emergency authority of the event characteristics (earthquake and/or tsunami), in accordance with national standard operating procedures. The Tsunami Warning Focal Point receives international tsunami warnings from the PTWC, WC/ATWC, the JMA NWPTAC, or other regional warning centres.

   Name: National Tsunami Warning System (SNAM)
   Title: National Tsunami Warning System (SNAM)
   Responsible Organization: Hydrographic and Oceanographic Service of the Chilean Navy (SHOA)
   Postal Address: Errázuriz #254, Playa Ancha, Valparaíso
   E-mail Address: snam@shoa.cl / snam2@shoa.cl / snam@snamchile.cl
   Emergency Telephone Number: 56-32-2266755
   Emergency Fax Number: 56-32-2266542
   Emergency Cellular Telephone Number: 56-9-95482706

National Tsunami Warning Centre (if different from the above)
Person in Charge:
Title:
Responsible Organization:
Postal Address:
E-mail Address:
Emergency Telephone Number:
Emergency Fax Number:
Emergency Cellular Telephone Number:
3. **Tsunami Advisor(s), if applicable**  
*Person, Committee or Agency managing Tsunami Mitigation in country*  
Name: National Office of Emergency of the Department on the Interior (ONEMI)  
Title:  
Postal Address: Beaucheff #1671, Santiago, Región Metropolitana  
E-mail Address: cat@onemi.gov.cl  
Emergency Telephone Number: 56-2-6882069  
Emergency Fax Number: 56-2-2524338  
Emergency Cellular Telephone Number:  

4. **Tsunami Standard Operating Procedures for a Local Tsunami**  
(when a local tsunami hazard exists)  

- Hydrographic and Oceanographic Service of the Chilean Navy (SHOA) identifies and characterizes tsunamigenic events.  
- The threshold for declaring a tsunami advisory, is an Earthquake with magnitude equal to or above 7.0 and location near to the coast.  
- The tsunami information is disseminated to ONEMI using VHF and HF radio communications; Fixed, Mobile and Satellite phones; Fax, emails and the Navy Emergency Communications Network (DATAMAR2).  
- National Office of Emergency of the Department of the Interior (ONEMI) acts on the information provided by SHOA and disseminates the proper information to the rest of the country.  
- This information is disseminated to regional and communal agencies (Municipalities, Police, Fire; etc) by the Early Warning Center (CAT) of ONEMI.  

5. **Tsunami Standard Operating Procedures for a Distant Tsunami**  
(when a distant tsunami hazard exists)  

*For each situation, please provide the following:*

- **What organization identifies and characterizes tsunamigenic events?**  
  ✓ Hydrographic and Oceanographic Service of the Chilean Navy (SHOA)  

- **What is the threshold or criteria for declaring a potential tsunami emergency?**  
  ✓ According to PTWC's Bulletins for Chile.  

- **What organization acts on the information provided by the agency responsible for characterizing the potential tsunami threat?**  
  ✓ National Office of Emergency of the Department of the Interior (ONEMI)  

- **How is the tsunami information (warning, public safety action, etc) disseminated within country? Who is it disseminated to?**  
  ✓ The tsunami information is disseminated to ONEMI using VHF and HF radio communications; Fixed, Mobile and Satellite phones; Fax, emails and the Navy Emergency Communications Network (DATAMAR2).  
  ✓ National Office of Emergency of the Department of the Interior (ONEMI) acts on the information provided by SHOA and disseminates the proper information to the rest of the country.
- This information is disseminated to regional and communal agencies (Municipalities, Police, Fire; etc) by the Early Warning Center (CAT) of ONEMI.

- **How is the emergency situation terminated?**
  - The emergency situation terminated with the cancellation of the tsunami warning/watch by SHOA and the all clear it's declared by ONEMI.

- **For Distant Tsunami Procedures: What actions were taken in response to warnings issued by PTWC, WC/ATWC, and/or JMA NWPTAC during the intersessional period?**
  - The information reports by those agencies were considered as primary references to issue the bulletins, however, the final decisions considered the own elements of tsunami detection, such as DARTs Buoys, Chilean Sea Level data Network and the field observations of the sea level.
6. **National Sea Level Network**

*Please include a table with position and description of stations/sensors, and a map.*

<table>
<thead>
<tr>
<th>Station</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arica</td>
<td>18°28'33&quot;</td>
<td>70°19'23&quot;</td>
</tr>
<tr>
<td>Pisagua</td>
<td>19°35'48&quot;</td>
<td>70°12'49&quot;</td>
</tr>
<tr>
<td>Iquique</td>
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<td>70°08'52&quot;</td>
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<tr>
<td>Patache</td>
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<td>70°11'39&quot;</td>
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<tr>
<td>Tocopilla</td>
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<td>70°12'53&quot;</td>
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<td>Mejillones</td>
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<td>70°27'03&quot;</td>
</tr>
<tr>
<td>Antofagasta</td>
<td>23°39'11&quot;</td>
<td>70°24'16&quot;</td>
</tr>
<tr>
<td>Paposo</td>
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<td>70°28'07&quot;</td>
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<tr>
<td>Talca</td>
<td>25°24'26&quot;</td>
<td>70°29'23&quot;</td>
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<tr>
<td>Chañaral</td>
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<td>70°38'01&quot;</td>
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<tr>
<td>San Félix</td>
<td>26°17'32&quot;</td>
<td>80°06'31&quot;</td>
</tr>
<tr>
<td>Isla de Pascua</td>
<td>27°09'17&quot;</td>
<td>109°28'22&quot;</td>
</tr>
<tr>
<td>Caldera</td>
<td>27°03'52&quot;</td>
<td>70°49'29&quot;</td>
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<tr>
<td>Huasco</td>
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<td>71°13'25&quot;</td>
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<tr>
<td>Coquimbo</td>
<td>29°57'00&quot;</td>
<td>71°20'07&quot;</td>
</tr>
<tr>
<td>Pichidguin</td>
<td>32°08'08&quot;</td>
<td>71°31'46&quot;</td>
</tr>
<tr>
<td>Juan Fernández</td>
<td>33°38'09&quot;</td>
<td>78°49'47&quot;</td>
</tr>
<tr>
<td>Quintero</td>
<td>32°44'26&quot;</td>
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<tr>
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</tr>
<tr>
<td>Coronel</td>
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<td>73°39'50&quot;</td>
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<td>Queule</td>
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<tr>
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<td>73°25'22&quot;</td>
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<tr>
<td>Bahía Mansa</td>
<td>40°34'51&quot;</td>
<td>73°44'14&quot;</td>
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<tr>
<td>Pto Montt</td>
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<tr>
<td>Ancud</td>
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<td>73°49'55&quot;</td>
</tr>
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<td>Melinka</td>
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<td>73°44'54&quot;</td>
</tr>
<tr>
<td>Pto Chacabuco</td>
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<td>72°49'13&quot;</td>
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<tr>
<td>Pto Williams</td>
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<tr>
<td>Puerto Eden</td>
<td>49°08'00&quot;</td>
<td>74°25'00&quot;</td>
</tr>
<tr>
<td>Pta Arenas</td>
<td>53°07'25&quot;</td>
<td>70°51'37&quot;</td>
</tr>
<tr>
<td>Cta. Metrofo</td>
<td>52°57'30&quot;</td>
<td>74°04'00&quot;</td>
</tr>
<tr>
<td>Base Prat</td>
<td>62°30'00&quot;</td>
<td>59°41'00&quot;</td>
</tr>
</tbody>
</table>
**DART N01 (Pisagua)** | 19°41'54"  | 74°49'18"   |
**DART N02 (Caldera)** | 26°44'36"  | 73°58'59"   |
7. Information on Tsunami occurrences

Please include sea level observations, pictures, wave arrival descriptions, public, media, or other responses to warnings, lessons learned, etc.

PDF files are attached with the requested information.

8. Web sites (URLs) of national tsunami-related web sites

- www.shoa.mil.cl
- www.snamchile.cl
- www.onemi.cl
- www.sismologia.cl

9. Summary plans of future tsunami warning and mitigation system improvements.

This information will be used to aid the development of the PTWS Medium Term Strategy and the PTWS Implementation Plan.

- SHOA is working as a whole with scientists of Chilean and foreign universities at the development and implementation of a Decision Support System (DSS) for the SNAM. DSS will have a real time tsunami forecasting.

NATIONAL PROGRAMMES AND ACTIVITIES INFORMATION

10. EXECUTIVE SUMMARY

Brief statement of no more than one page addressing all items discussed in the Narrative section of the National Report

- Participación en el proyecto regional DIPECHO VII 2011 - 2012 que ejecutó UNESCO denominado "Fortalecimiento del Sistema Regional de Alerta Temprana ante Tsunami en Chile, Colombia, Ecuador y Perú"

- Se impartió el "Curso Internacional de Modelamiento de Tsunamis a través del código NEOWAVE", realizado en dependencias del SHOA, Valparaíso, Chile y fue dictado en conjunto con el Departamento de Geofísica de la Universidad de Chile.

- Participación en el "Taller Nacional sobre Procedimientos Estándar para el Fortalecimiento de los Sistemas de Alerta temprana ante tsunamis", el cual estaba contemplado dentro del marco del proyecto DIPECHO VII.

- Se realizó el "Taller Internacional sobre estandarización de parámetros y metodologías para la producción de Cartas de Inundación por Tsunamis" en dependencias del Servicio Hidrográfico y Oceanográfico (SHOA).

- Se impartió el Diplomado subregional "Tsunami en la costa Pacífica de Sudamérica: Bases científicas, amenaza y vulnerabilidad", el que fue organizado por la Escuela de Ciencias del Mar de la Pontificia Universidad Católica de Valparaíso de Chile (ECM-PUCV) y UNESCO en el marco de su proyecto DIPECHO VII.
Se efectuaron en dependencias del Servicio Hidrográfico y Oceanográfico de la Armada (SHOA), dos Pasantías Profesionales sobre el Sistema Nacional de Alarma de Maremotos (SNAM) de Chile, para personal de Ecuador, Colombia y Perú.

Se realizó en el SHOA el primer “Curso Internacional para el Reforzamiento sobre los Procedimientos Operacionales Estándar (POE) ante unaAlerta de Tsunami y Respuesta de la Emergencia”, a nivel regional, para los países que integran el Sistema Internacional de Alerta de Tsunami del Pacífico (PTWS).

Se participó en una pasantía en Japón orientada a la “Adquisición de los conocimientos para el desarrollo de una base de datos para un sistema de pronóstico de tsunami en Chile".
11. NARRATIVE
Detailed description of innovations or modifications to National tsunami warnings procedures or operations since last National Report, tsunami research projects, tsunami mitigation activities and best practices (especially in preparedness and emergency management), as well as public education programmes or other measures taken to heighten awareness of the tsunami hazard and risk.

1. Taller regional de planificación DIPECHO 2011 – 2012, América del sur, realizado entre el 8 y 10 de junio de 2011 en Quito, Ecuador. En el marco del proyecto regional DIPECHO que ejecuta UNESCO “Fortalecimiento del Sistema Regional de Alerta Temprana ante Tsunami en Chile, Colombia, Ecuador y Perú”, se organizó una sesión paralela en la cual participaron representantes de instituciones nacionales vinculadas con el proyecto, así como representantes de socios DIPECHO VII que han considerado en sus proyectos la amenaza de tsunami. Algunas de las actividades y resultados más relevantes son los siguientes:

   a) Presentación de los acuerdos del Taller Regional final del DIPECHO VI de la UNESCO llevado a cabo en Santiago de Chile - Octubre 2010.
   b) Presentación del Cronograma de trabajo propuesto para el proyecto DIPECHO VII de la UNESCO.
   c) Presentación de los proyectos nacionales DIPECHO VII en Sudamérica sobre preparativos ante tsunami.
   d) Trabajo de grupos por país para establecer planes de trabajo por país integrando proyectos DIPECHO nacionales.
   e) Experiencias nacionales de coordinación frente a los tsunamis de: 27 de febrero de 2010 (Chile) y 11 de marzo de 2011 (Japón).
   f) Propuesta de Protocolo de comunicaciones del Sistema Regional de Alerta temprana ante Tsunami en el Pacífico Sudeste.
2. "Curso Internacional de Modelamiento de Tsunamis a través del código NEOWAVE", realizado entre el 21 y 25 de noviembre del año 2011, en dependencias del SHOA, Valparaíso, Chile y fue dictado en conjunto con el Departamento de Geofísica de la Universidad de Chile. Esta actividad contó con el apoyo financiero y estaba contemplada en el Plan de Trabajo del proyecto de UNESCO en el marco del Plan de Acción de DIPECHO VII "Fortalecimiento del Sistema Regional de Alerta Temprana ante Tsunami. Preparativos en Chile, Colombia, Ecuador y Perú". El curso tuvo por objeto iniciar un proceso de transferencia tecnológica y de esta forma contribuir al desarrollo y formación de profesionales de alto nivel que puedan aportar al manejo y mitigación del riesgo de tsunami a nivel sub-regional y nacional y, de este modo, que las actuales capacidades instaladas en Chile, puedan ser transferidas y utilizadas por todos los países miembros del Sistema Regional de Alerta de Tsunamis del Pacífico Sudoccidental (SAT).

3. Durante el año 2012 se realizaron en forma independiente en los países de Colombia, Chile, Ecuador y Perú los "Talleres Nacionales sobre Procedimientos Estándar para el Fortalecimiento de los Sistemas de Alerta temprana ante tsunamis", los cuales estaban contemplados dentro del marco del proyecto DIPECHO VII. Dichos talleres nacionales tuvieron por objeto promover la revisión y mejora de los mecanismos de coordinación inter-institucional existentes en situaciones de alerta ante tsunamis en cada país de la región. La organización y ejecución de los Talleres estuvo a cargo de UNESCO y las instituciones
encargadas del manejo de la emergencia de tsunamis en cada país. En Chile esta actividad se desarrollo entre el 26 y 28 de marzo de 2012, en Santiago.

4. El "Taller Internacional sobre estandarización de parámetros y metodologías para la producción de Cartas de Inundación por Tsunamis" se realizó entre el 14 y 17 de agosto de 2012 en dependencias del Servicio Hidrográfico y Oceanográfico (SHOA), y contó con el apoyo financiero del Sub Comité de Aumento de Capacidades de la Organización Hidrográfica Internacional (OHI). El objetivo del taller fue dar inicio a un proceso de estandarización de las bases metodológicas en la elaboración de Cartas o Mapas de inundación por Tsunamis a nivel Regional y de esta forma mejorar las capacidades de los países para la Mitigación del riesgo de Tsunamis.
5. Entre el 25 y 27 de septiembre de 2012 en la ciudad de Lima, Perú, se realizó el "Taller Procedimientos Estandarizados para el Fortalecimiento de los Sistemas de Alerta ante Tsunamis en el Pacífico Sudeste", el cual se enmarca en el proyecto DIPECHO VII. El objetivo del taller fue recoger, sistematizar y generar recomendaciones sobre la base de la opinión de los participantes con el propósito de reconocer los principales aspectos que obstaculizaron el trabajo de las instituciones; identificar los logros y avances; y definir las estrategias que hagan sostenibles los objetivos del proyecto. El Taller definió el Protocolo de Comunicaciones para el Sistema Regional de Alerta de Tsunamis, que será socializado con las instituciones y las respectivas Secciones Nacionales de la CPPS, para implementarlo como un mecanismo de coordinación regional en esta materia.

6. Entre el 24 de septiembre y 12 de octubre de 2012 se impartió el Diplomado subregional “Tsunami en la costa Pacífica de Sudamérica: Bases científicas, amenaza y vulnerabilidad”, el que fue organizado por la Escuela de Ciencias del Mar de la Pontificia Universidad Católica de Valparaíso de Chile (ECM-PUCV) y UNESCO en el marco de su proyecto DIPECHO VII: Fortalecimiento del Sistema Regional de alerta Temprana ante Tsunamis en Chile, Colombia, Ecuador y Perú, financiado por la Dirección General de Ayuda Humanitaria y Protección Civil de la Comisión Europea. El diplomado estuvo dirigido a profesionales de Colombia, Ecuador, Perú y Chile y el objetivo general fue el de es entregar a los participantes los conocimientos teórico-prácticos que permiten el reforzamiento de las acciones de reducción de riesgo de tsunami en la costa pacífica de Sudamérica. Como el Diplomado estuvo orientado a los integrantes de los sistemas de alerta de esta costa, se abordó de manera integral el fenómeno tsunami, considerando los aspectos científicos, que les ayudarán a mejorar su comprensión, y los aspectos sociales, incluyendo acciones de mitigación y reducción del riesgo que pudieran ser implementadas desde la educación a la gobernabilidad local.
7. Entre el 08 y 12 de octubre de 2012 y entre el 10 y 14 de junio de 2013, se efectuaron en dependencias del Servicio Hidrográfico y Oceanográfico de la Armada (SHOA), dos **Pasantías Profesionales sobre el Sistema Nacional de Alarma de Maremotos** (SNAM) **de Chile**, en la cual participaron personal del Centro de Alerta de Tsunamis del Centro de Investigaciones Oceanográficas e Hidrográficas del Pacífico (CIOH), de la Dirección General Marítima de Colombia y del Instituto Oceanográfico de la Armada de Ecuador (INOCAR) y de la Dirección de Hidrografía y Navegación de la Marina de Guerra del Perú (DHN). Las citadas pasantías, se enfocaron en intercambiar conocimientos en temáticas de operatividad del Sistema Nacional de Alarma de Maremotos de Chile; Red de Estaciones del Nivel del Mar y Sistemas de Difusión y Sismología asociada a la generación de Tsunamis.

8. Entre el 04 y 08 de marzo de 2013, se realizó el Primer **“Curso Internacional para el Reforzamiento sobre los Procedimientos Operacionales Estándar (POE) ante una Alerta de Tsunami y Respuesta de la Emergencia”**, a nivel regional, para los países que integran el Sistema Internacional de Alerta de Tsunami del Pacífico (PTWS), organizado en conjunto por el Centro Internacional de Información de Tsunamis (ITIC), la Comisión Oceanográfica Intergubernamental de UNESCO (UNESCO/IOC) y el SHOA. Su objetivo es el de reforzar los planes y capacidades del manejo de las alertas de tsunami y las respuestas ante una emergencia e introducir los nuevos productos y boletines que desde febrero del presente año distribuirá en forma de prueba el Centro de Alerta del Pacífico (PTWC). Este Curso forma parte de los acuerdos logrados por los Estados Miembros en la XXIV Sesión del Grupo de Coordinación Intergubernamental del Sistema Internacional de Alerta de Tsunamis del Pacífico (ICG/PTWS) efectuada en Beijing, China, en mayo del 2011. Los patrocinadores fueron la Agencia de los Estados Unidos para el Desarrollo (USAID) y la Comisión Oceanográfica Intergubernamental de la UNESCO (COI).
Entre el 27 de Mayo al 20 de Junio del 2013, se efectuó en Tokyo, Japón, la pasantía “Adquisición de los Conocimientos para el Desarrollo de una Base de Datos para un Sistema de Pronóstico de Tsunami”, en el marco del proyecto de cooperación Investigación de mejoramiento Tecnológico para el Desarrollo de una Comunidad con Resiliencia a Tsunami” (SATREPS). En la pasantía participo personal del SHOA y de la Universidad Tecnica Federico Santa María (UTFSM), también pertenecientes al proyecto SATREPS. La pasantía se centralizó en las dependencias de la Agencia de Cooperación Internacional de Japón (JICA), ubicada en las ciudades de Tokyo y Tsukuba. Contempló visitas y conferencias en las instituciones encargadas de la temática de terremotos, tsunamis, sistemas de alerta y prevención, así como visitas a terreno a las instalaciones de mitigación de tsunamis de la prefectura de MIE al sur de Tokyo.
1. SEISMIC BACKGROUND

<table>
<thead>
<tr>
<th>Magnitude</th>
<th>7.4 (Richter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date - Time</td>
<td>Monday 27th August 2012 at 00:37:20 LOCAL TIME 04:37:20 UTC.</td>
</tr>
<tr>
<td>Epicenter</td>
<td>12.2° N 88.5° W</td>
</tr>
<tr>
<td>Depth</td>
<td>51 km</td>
</tr>
<tr>
<td>Location</td>
<td>In front of the Central American coast</td>
</tr>
<tr>
<td>Source</td>
<td>PTWC</td>
</tr>
</tbody>
</table>

Figure 1. Map of the location of the earthquake’s hypocenter. Source: USGS/NEIC
2. BACKGROUND

The earthquake occurred on August 27th generated a local tsunami affecting the coasts of the Central American countries (Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala, Panama, Mexico). (However, damages or casualties have not yet been registered).

Significant sea level rises were observed at the Chilean sea level stations, in Easter Island, but these were non-destructive as local observers.

3. ACTIONS TAKEN BY SNAM (LOCAL TIME)

00:43: PTWC P–Time bulletin was received. It informed that a magnitude 7.4 earthquake struck off the Central American coast (LAT: 12.2 ºN 88.5 ºW).

00:46: PTWC issued Tsunami Information Statement Bulletin No 1 for the areas bordering the Pacific Ocean and adjacent seas. The evaluation showed that A TSUNAMI WOULD NOT OCCURR BASED ON HISTORICAL EARTHQUAKE DATA.

00:46: SNAM disseminated “EARTHQUAKE INFORMATION STATEMENT” to the ONEMI and Maritime and Naval Authorities by VHF, indicating that the earthquake’s characteristics did not meet the necessary conditions to generate a tsunami off the coast of Chile.

00:48: The above-mentioned information was issued via Datamar 2 communications network.

00:52: SNAM issued “TSUNAMI INFORMATION STATEMENT FOR THE CHILEAN COASTS” Bulletin No 1 via communications system, indicating that the earthquake’s characteristics did not meet the necessary conditions to generate a tsunami off the coast of Chile. This tsunami information statement was posted on the web site.

00:59: PTWC disseminated Tsunami WARNING for Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala, Panama and Mexico Bulletin No 2. For other areas bordering the Pacific Ocean and adjacent areas, this bulletin was for information only. The evaluation showed that a tsunami had not been generated. However, the WARNING was based only on seismic information. Tsunami wave arrival times were given for the affected areas.

01:42: PTWC issued and ratified tsunami WARNING for Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala, Panama and Mexico Bulletin No 3. For other areas bordering the Pacific Ocean and adjacent areas, this bulletin was for information only. The evaluation showed that a tsunami had not been generated.
However, the WARNING was based only on seismic information. Tsunami Wave arrival times were given for the affected areas.

02:17: PTWC issued and ratified tsunami WARNING for Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala, Panama and Mexico Bulletin No 4. For other areas bordering the Pacific Ocean and adjacent areas, this bulletin was for information only. The evaluation showed that a small tsunami had been observed in Acajutla, El Salvador, (located at 210 km from the earthquake’s epicenter) with amplitude of 0.1 m. Tsunami wave arrival times were given for the affected areas.

02:28: PTWC issued TSUNAMI WARNING CANCELLATION for Costa Rica, Nicaragua, El Salvador, Honduras, Guatemala, Panama and Mexico Bulletin No 5. The evaluation showed that a tsunami occurred in Acajutla, El Salvador, with amplitude of 0.1 m. There was no tsunami in La Unión, El Salvador, located at 140 km from the earthquake’s epicenter.

03:03: PTWC issued Bulletin No 6 reporting additional sea level data. It indicated that a tsunami occurred in Acajutla, El Salvador, with maximum amplitude of 0.1 m, La Unión, El Salvador, with maximum amplitude of 0.02 m and DART buoy 43413, with maximum amplitude of 0.01 m (See figures)

![Figure 1: Sea Level Station at Acajutla (El Salvador). Operational station that is closer to the epicenter.](image)

![Figure 2: Sea Level Station at La Unión (El Salvador).](image)
Figure 2: Sea level Station at La Unión (El Salvador).

Figure 3: Operating DART Buoy (Mexico).

Figure 4: Tsunami wave arrival to Isla Baltra, Galapagos (Ecuador). Maximum amplitude of 0.69 meters.
Figure 5: Tsunami filtered signal in Isla Baltra, Galapagos (Ecuador).

Figure 6: Tsunami wave arrival to Isla Santa Cruz, Galapagos (Ecuador), with maximum amplitude of 0.36 meters.

Figure 7: Tsunami wave arrival to Galapagos DART buoy, with maximum amplitude of 0.01 meters.
During the 27th of August, the continuous sea level monitoring showed a small tsunami in Easter Island (Figure 9) with a maximum peak between the valley and the crest of 0.989 m. Simultaneously, local observers reported that the variations were non-destructive.
4. CONCLUSION

The earthquake did not generate a destructive tsunami off the coast of Chile, but the tsunami wave arrival occurred in Central America could be observed in the sea level station of Easter Island, with sea level variations that were non-destructive. This was corroborated by the reports of local observers of the Port Authority of Hanga Roa. Although the variations have been not proven scientifically, these suggested that their behavior was caused by the diffraction of waves upon arriving at the island producing trapped wave energy around the bay of Hanga Piko, which has a close shape and thereby resonance effects occurred (Figure 10). This behavior has been observed for example in Hawaii and Samoa.

Figure 10: Image of Google Earth in which sea level station is located (Hanga Piko cove).
TECHNICAL REPORT

EARTHQUAKE AND TSUNAMI OCCURRED IN “EL SALVADOR” 27/08/2012

1. SEISMIC BACKGROUND

<table>
<thead>
<tr>
<th>Magnitude</th>
<th>7.7 (RICHTER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date - Time</td>
<td>Sunday 28th of October 2012 at 00:04:09 LOCAL TIME 03:04:09 UTC.</td>
</tr>
<tr>
<td>Epicenter</td>
<td>52.74° N 132.13° W</td>
</tr>
<tr>
<td>Depth</td>
<td>20 km</td>
</tr>
<tr>
<td>Location</td>
<td>Queen Charlotte islands, Canada</td>
</tr>
<tr>
<td>Source</td>
<td>USGS</td>
</tr>
</tbody>
</table>

Figure 1. Map of location of the earthquake’s hypocenter. Source: USGS/NEIC.
2. BACKGROUND

A magnitude 7.7 earthquake struck off Queen Charlotte Islands, Canada, at 00:04 local time. It generated a small and non-destructive tsunami that was measured in Alaska, British Columbia, southern California and Hawaii. Smaller waves were also observed at the sea level stations of the Pacific Ocean.

Both ATWC and PTWC disseminated tsunami warnings for the American and Canadian territory from northern California and for the Islands of Hawaii. A tsunami information statement bulletin was issued for the rest of the Pacific Ocean. Subsequent to the main earthquake, a number of aftershocks with magnitudes of less than 6.0 Richter were recorded in the area.

3. ACTIONS TAKEN BY SNAM (LOCAL TIME)

00:15: PTWC issued Tsunami Information Statement Bulletin No 1 for the areas bordering the Pacific Ocean and adjacent seas. The evaluation showed that A TSUNAMI WOULD NOT OCCURR BASED ON HISTORICAL EARTHQUAKE DATA.

00:16: SNAM issued Tsunami Information Statement for the Chilean coasts Bulletin No 1 via communications system, indicating that the earthquake’s characteristics did not meet the necessary conditions to generate a tsunami off the coast of Chile. This tsunami information statement was posted on the web site.

00:22: PTWC issued Tsunami Information Statement Bulletin No 2 for the Pacific Ocean.

00:43: PTWC issued Bulletin No 3 and it ratified that this bulletin was for information only, but the magnitude was modified to 7.7. ATWC also disseminated a regional WARNING for the areas adjacent to the earthquake’s epicenter.

The sea level stations and buoy data showed that the earthquake occurred on Queen Charlotte Islands generated a small tsunami which was recorded by some sea level stations at Canada and Hawaii. In Chile, the tsunami was only observed at the sea level station of Easter Island.
Figure 1: Sea level station at Winter Harbour. (Canada).

Figure 2: Sea level station at Kawaihae (Hawaii).
Figure 3: Sea Level Station at Honolulu, Oahu (Hawaii).

Figure 4: Sea Level Station at Kaumalapau, Hawaii (Hawaii).
Small sea level variations associated with the tsunami were recorded in Easter Island approximately at 13:10 UTC. The values did not exceed 0.10 meters of variation with respect to the tide curve.

4. CONCLUSION

The earthquake did not generate a tsunami off the coast of Chile, but the tsunami occurred in Queen Charlotte Islands was only observed at the sea level station of Easter Island. A small and non-destructive tsunami was generated in Canada and Hawaii.
1. SEISMIC BACKGROUND

<table>
<thead>
<tr>
<th>Magnitude</th>
<th>8.0 (RICHTER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date - Time</td>
<td>Tuesday 05th February 2013 at 22:12 local time (01:12 UTC).</td>
</tr>
<tr>
<td>Epicenter</td>
<td>10.9° S 165.1° E</td>
</tr>
<tr>
<td>Depth</td>
<td>33 km</td>
</tr>
<tr>
<td>Location</td>
<td>Salomon Islands</td>
</tr>
<tr>
<td>Source</td>
<td>PTWC</td>
</tr>
</tbody>
</table>

Figure 1. Map of the location of the earthquake’s hypocenter. Source: USGS/NEIC
2. BACKGROUND

A magnitude 8.0 earthquake struck off Santa Cruz Islands on February 6th, 2013, as a result of a shallow reverse fault near the boundary between the Australian and Pacific plates. Because of the magnitude associated with the earthquake, PTWC disseminated a tsunami Watch bulletin for the locations closest to the earthquake’s epicenter and tsunami Warning for nearby cities. However, it indicated that there was no risk of a tsunami for other areas of the Pacific Ocean.

The sea level station at Lata located at 70 km from the earthquake’s epicenter, reported sea level variations of 0.90 m, about after 01:25 UTC.

3. ACTIONS TAKEN BY SNAM (LOCAL TIME)

22:18: PTWC P–Time bulletin was received. It informed that an earthquake with a preliminary magnitude of 8.0 struck off Santa Cruz Islands.

22:23: PTWC disseminated Tsunami WATCH Bulletin No 1 for the locations closest to the earthquake’s epicenter and tsunami Warning bulletin for nearby cities. There was no risk of a tsunami for all other areas of the Pacific Ocean.

22:28: SNAM disseminated TSUNAMI INFORMATION STATEMENT for the Chilean coasts Bulletin No 1 via communications system, indicating that the earthquake’s characteristics did not meet the necessary conditions to generate a tsunami off the coast of Chile. This tsunami information statement was posted on the web site.

22:50: PTWC issued Bulletin No 2 and disseminated tsunami WATCHES AND WARNINGS for other areas. First sea level variations were detected in the locality of Lata, Salomon Islands, with amplitude of 0.91 meters every 18 minutes.

23:12: PTWC disseminated Bulletin No 3 which changed some tsunami watch areas to tsunami warning areas. Sea level variations were not recorded.

23:52: PTWC disseminated Bulletin No 4 and disseminated again tsunami watch areas, including locations considered in this condition in bulletin No 2 and areas under a tsunami warning in Bulletin No 3. Sea level variations were not reported, but data obtained by two DART buoys was considered. The DART buoys are located to the north and south of earthquake`s epicenter, respectively.

00:08: PTWC issued Bulletin No 5 which changed the area under a tsunami watch as reported in Bulletin No 2. It also disseminated the tsunami warning area, including French Polynesia, Hawaii Islands, Philippines and Japan. As additional information of sea level variations, it included data obtained from the sea level
station at Luganville, Vanuatu Islands, with amplitude of 0.11 meters every 18 minutes.

00:17: PTWC disseminated Bulletin No 6 which maintained area under a tsunami WATCH. It also changed area under a tsunami WARNING, except for French Polynesia, Hawaii Islands, Philippines and Japan. Sea level variations were not recorded.

00:48 PTWC issued Bulletin No 8 which cancelled the tsunami WATCHES AND WARNINGS for all areas previously considered. Additional data from three sea level stations and a Dart Buoy with maximum variations of 0.55 meters was included. Note: Bulletin No 7 did not exist.

Monitoring buoys and sea level station data showed that a small tsunami was generated by an earthquake occurred on Santa Cruz Islands. The small tsunami was recorded for at least 8 sea level stations in the areas surrounding the earthquake’s epicenter.

Table I. Operating DART Buoy during the tsunami event.

<table>
<thead>
<tr>
<th>DART BUOY</th>
<th>ACTIVATING TIME (UTC)</th>
<th>MAXIMUM VARIATION (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>52406</td>
<td>02:07</td>
<td>0.07</td>
</tr>
<tr>
<td>55012</td>
<td>02:27</td>
<td>0.32</td>
</tr>
<tr>
<td>55023</td>
<td>03:08</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Figure 1: Operating DART buoy No 52406 located to the northeast of Salomon islands.
Figure 2: Operating DART Buoy No 55012 located at 1285 km to the east-northeast of Townsville, Australia.

Figure 3: Operating DART Buoy No 55012 located at 870 km to the northeast of Townsville, Australia.

Table II. Sea level stations monitoring a tsunami.

<table>
<thead>
<tr>
<th>Station</th>
<th>ACTIVATING TIME (UTC)</th>
<th>MAXIMUM VARIATION (metres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lata Warf</td>
<td>01:25</td>
<td>0.97</td>
</tr>
<tr>
<td>Honiara</td>
<td>02:42</td>
<td>0.06</td>
</tr>
<tr>
<td>55023</td>
<td>03:08</td>
<td>0.11</td>
</tr>
<tr>
<td>Lifou</td>
<td>03:10</td>
<td>0.30</td>
</tr>
<tr>
<td>Port Villa</td>
<td>02:45</td>
<td>0.30</td>
</tr>
<tr>
<td>Mare</td>
<td>03:21</td>
<td>0.45</td>
</tr>
<tr>
<td>Quinne</td>
<td>03:33</td>
<td>0.33</td>
</tr>
<tr>
<td>Hienghene</td>
<td>03:02</td>
<td>0.75</td>
</tr>
<tr>
<td>Suva Viti Levu</td>
<td>04:18</td>
<td>0.10</td>
</tr>
</tbody>
</table>
TECHNICAL REPORT

EARTHQUAKE OCCURRED IN COSTA RICA 05/09/2012

1. SEISMIC BACKGROUND

<table>
<thead>
<tr>
<th>Magnitude</th>
<th>7.6 (RICHTER)</th>
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</thead>
<tbody>
<tr>
<td>Date - Time</td>
<td>Wednesday 05th August 2012 at 11:42:08 LOCAL TIME 14:42:08 UTC.</td>
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<tr>
<td>Epicenter</td>
<td>10.086°N 85.305° W</td>
</tr>
<tr>
<td>Depth</td>
<td>40 km</td>
</tr>
<tr>
<td>Location</td>
<td>Costa Rica</td>
</tr>
<tr>
<td>Source</td>
<td>USGS</td>
</tr>
</tbody>
</table>

Figure 1. Map of the location of the earthquake’s hypocenter. Source: USGS/NEIC
2. BACKGROUND

The earthquake occurred on August 5th in Costa Rica caused two deaths, landslides near the earthquake’s epicenter and a damaged bridge. In addition there were disruptions in communications and power supply. The quake was felt very strong in San Jose and it was felt in most parts of Costa Rica and also in Belize, El Salvador, Guatemala, Honduras, Nicaragua and Panama.

This earthquake did not generate a destructive tsunami that would spread across the Pacific Ocean, however small sea level variations were recorded at the sea level stations of Limon and Quepos in Costa Rica and Santa Cruz in Ecuador.

3. ACTIONS TAKEN BY SNAM (LOCAL TIME)

11:50: PTWC P–Time bulletin was received. It informed that a magnitude 7.9 earthquake struck off Costa Rica coast (LAT: 9,9 øN, 85,4 øW).

11:55: PTWC issued tsunami WATCH bulletin No 1 for Costa Rica, Panama, Nicaragua, El Salvador, Honduras, Mexico, Colombia, Ecuador, Guatemala and Peru. Tsunami WARNING was disseminated for Chile.

11:58: SNAM disseminated “TSUNAMI WARNING” to the ONEMI and Maritime and Naval Authorities by VHF, indicating that there was a high probability of generating a tsunami.

11:59: The above-mentioned information was issued via Datamar 2 communications network.

12:01: SNAM issued “TSUNAMI WARNING FOR THE CHILEAN COASTS” Bulletin No 1 via communications system, indicating that there was a high probability of generating a tsunami. This tsunami warning was posted on the web site.

12:04: SNAM issued “TSUNAMI WARNING WITH WAVE ARRIVAL TIMES” Bulletin No 2, indicating that there was a tsunami warning and estimated wave arrival times for the Chilean coasts. This tsunami warning was posted on the web site.

12:28: ONEMI took preventive evacuation measures in the north of Chile.

12:36: SNAM issued “TSUNAMI INFORMATION STATEMENT” Bulletin No 3 via communication system. It indicated that PTWC reported as follows: 1.- the quake’s intensity has been reduced to 7.6 and 2.- Tsunami Watch for Costa Rica, Panama and Nicaragua is maintained. 3.- the tsunami watch changed to tsunami information statement for the rest of the countries of the Pacific Ocean. This was posted on the web site.

13:15: SNAM issued TSUNAMI WARNING CANCELLATION for the Chilean coasts Bulletin No 4 (normal sea level conditions) via communication system. This tsunami warning cancellation was posted on the web site.

13:26: PTWC issued and ratified tsunami WATCH for Costa Rica, Panama and Nicaragua Bulletin No 3. For other areas bordering the Pacific Ocean and adjacent areas, this bulletin was for information only.

14:02: PTWC issued TSUNAMI WATCH CANCELLATION for Costa Rica, Panama and Nicaragua Bulletin No 4. The evaluation indicated that there was no tsunami in the location of Acajutla.

During 5th of September, the sea level monitoring showed that a tsunami detected by sea level stations arrived at Limon and Quepos in Costa Rica with maximum amplitudes of 0.05 and 0.11 meters respectively. Also, the tsunami wave arrival was observed in Santa Cruz, Galapagos Islands, Ecuador, at 13:51 hrs. with maximum amplitude of 0.20 meters.

Figure 1: Sea level station at Limon (Costa Rica).
4. CONCLUSION

The earthquake did not generate a destructive tsunami off the coast of Chile, but the PTWC bulletin dissemination indicating the cancellation of a Tsunami Warning for the Caribbean produced confusion in the Chilean public and the media which published the tsunami warning cancellation, while SNAM maintained the Tsunami Warning for Chile. The tsunami wave arrival in Central America detected by the sea level stations was observed. The sea level variations were non-destructive.
Figure 4: Sea level variations recorded at stations near the earthquake’s epicenter.
4. CONCLUSION

The earthquake did not generate a tsunami off the coast of Chile, but the tsunami was locally destructive and caused at least nine deaths and the destruction of houses of some towns of Santa Cruz Islands. The tsunami wave arrival could be observed at the sea level stations near the earthquake’s epicenter.