VERSION 3.0

Model Tsunami Warning Information Dissemination Protocol

Development of Tsunami and Other Coastal Hazards Warning Dissemination Protocols for the Caribbean Disaster Emergency Management Agency (CDEMA) Participating States

For the
Tsunami and Other Coastal Hazards Warning Systems Project
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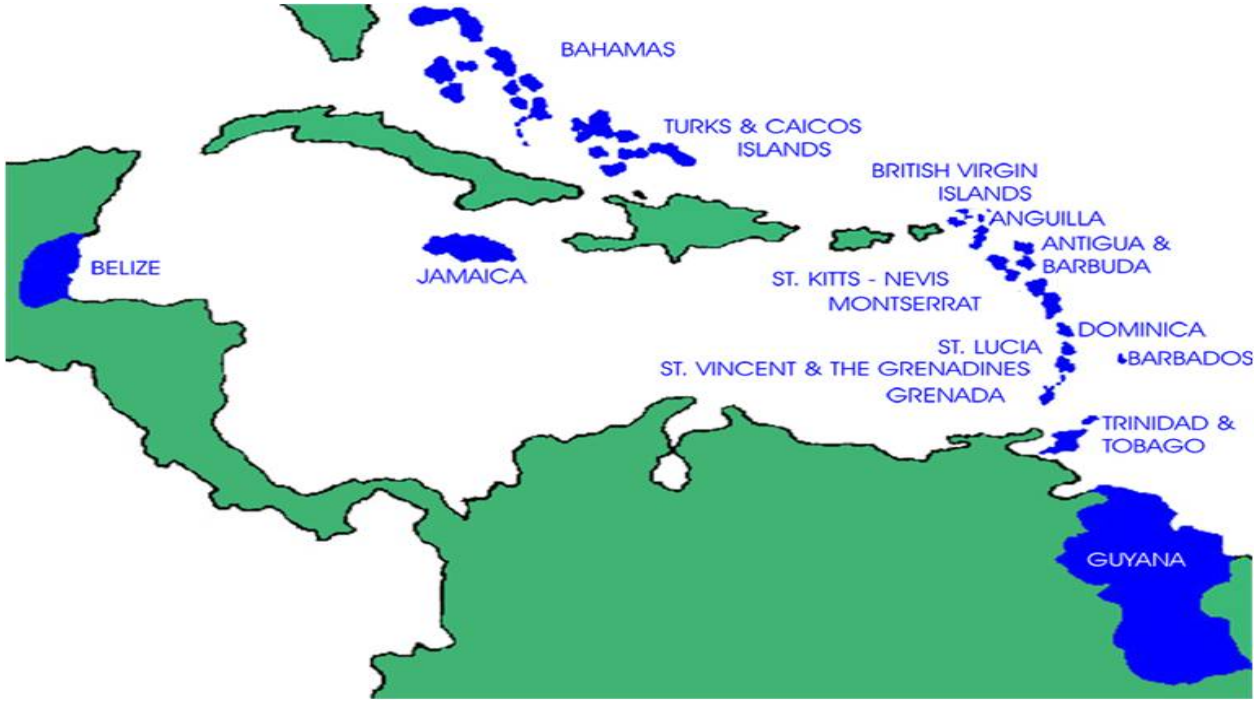

Map of the CDEMA States

Prefix

Tsunamis are an uncommon but devastating form of natural disaster that has been documented since early civilization. Throughout history, many major tsunamis have impacted on the world's coastlines, causing heavy loss of lives and damage to properties. While the Sumatran tsunami in December 2004 demonstrated the sheer scale of destruction, the implications of such obliteration have significant consequence for disaster planning and management. Until recently, as tsunami events began to be recorded in written form, information about tsunami's was derived entirely from paleotsunami research. This research is based on deposits found in coastal areas and their similarity with sediments found elsewhere locally, regionally, or across the ocean.

Since 1900, there have been two earthquakes recorded which resulted in tsunamis in the CDEMA Participating States. One earthquake struck in Kingston, Jamaica in 1907 and one (actually an 8 magnitude earthquake with a magnitude 7.6 aftershock) in Samana, Dominica in 1946. Further, in 1918, in Puerto Rico (not a member of the CDEMA Participating States but situated in the Caribbean Sea), there was a magnitude 7.5 earthquake that triggered a tsunami with waves measured at approximately 5.5 meters (20 feet).

Due to the devastation from the Sumatran tsunami in December 2004, emergency preparedness planners and governments have begun adding tsunami hazards to their multi-hazards disaster planning. This report is the direct result of the planning underway by CDEMA as part of its Comprehensive Disaster Management (CDM) Strategy and Framework 2007 – 2012. CDEMA is implementing major initiatives aimed at reducing the vulnerability of its Participating States (PS) to hazards. This document is the Model Tsunami Warning Protocol for the Tsunami and Other Coastal Hazards (TCHWS) Project currently being implemented by CDEMA.

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List of Acronyms/Abbreviations

CTWC	-	Caribbean Tsunami Warning Centre
CTIC	-	Caribbean Tsunami Information Centre
DMO	-	Disaster Management Organization
EQ	-	Earthquake
EOC	-	Emergency Operations Centre
FUNSIVIS	-	Venezuelan Foundation for Seismic Research
FWI	-	French West Indies
GO's	-	Government Organizations
IPGP	-	Institut de Physique du Globe de Paris, French West Indies
JMA	-	Japan Meteorology Agency
Km	-	kilometer
Mon	-	Monitoring
NEO	-	National Emergency Organization
NEOC	-	National Emergency Operations Centre
NGO's	-	Non-Government Organizations
NWPTAC	-	Northwest Pacific Tsunami Advisory Center
PRSN	-	Puerto Rico Seismic Network
PS	-	Participating State
PTWC	-	Pacific Tsunami Warning Center
PVO's	-	Private Voluntary Organizations
SMS	-	Short Message Service
SRC	-	Seismic Reseach Centre
TNC	-	Tsunami National Contact
TWC	-	Tsunami Warning Center
TWFP	-	Tsunami Warning Focal Point
UWI	-	University of the West Indies
WC/ATWC	-	West Coast/Alaska Warning Center

1. INTRODUCTION

1.1 BACKGROUND

Under the auspices of the Intergovernmental Oceanographic Commission (IOC), the Intergovernmental Coordination Group for the Caribbean and Adjacent Regions (ICG/CARIBE) is currently coordinating the establishment of a tsunami and other coastal hazards warning system for the Caribbean and Adjacent Regions (ICG/CARIBE EWS). This report documents the initial Tsunami Warning Information Dissemination Protocol and Standard Operating Procedures (SOPs) for the CDEMA Participating States which would guide the Participating State's National Tsunami Warning Focal Point (TWFP) to respond to the receipt of Tsunami Warning Bulletins from a Tsunami Warning Centre. Interim warning services are presently provided to the Caribbean and Adjacent Regions by the Pacific Tsunami Warning Center (PTWC). Appendix A is a copy of the Pacific Tsunami Warning Center Interim Communications Plan which details its bulletins to the Caribbean Region and provides examples. A Caribbean Tsunami Warning Centre (CTWC) is being planned by the ICG/CARIBE and the this Centre is to be provisionally established by 2010.

There are four key elements of an "end-to-end" tsunami warning system:

1. Monitoring and Detection – this involves the collection of seismic and sea-level data from sensors, networks and instruments as well as interpretation and verification of this data by a Warning Centre.

2. Hazard Assessment – this involves tsunami moddelling and mapping of vulnerability and risk assesments which would identify vulnerable areas, inundation zones and inform the evacuation process.

3. Dissemination and Communication of Warning Information – this is essentially the component which is covered by the protocol and SOPs presented in this document which seek to set guidelines and rules and procedures for communicating the message received by the National TWFP from the Warning Centre to to every person within the vulnerable coastal communities i.e."to the last mile".

4. Public Awareness and Education – this section of the system complements the other three elements as it provides the education and awareness activities to ensure that the vulnerable communities are prepared and resilient to the tsunami threat. In the case of the ICG/CARIBE EWS, responsibility for Public Awareness and Education for the CDEMA PS will be primarily that of the Caribbean Tsunami Information Centre (CTIC).

To develop emergency preparedness for infrequent events but those with potentially highly disastrous consequences, one must identify the best response for any potential cause, one which can be tested and practiced, and one which is considered relevant to the emergency response professionals as well as the public. There is no essential difference between the response for an underwater landslide or an earthquake; neither can be predicted by scientific advancements at this time and if either of these events occurs, generation of a disastrous tsunami is possible. One difference that does exist is that when earthquakes occur they are felt for a wide radius around the epicenter of the event; this is not the case for underwater landslides. Although just as hazardous, existing volcanoes are monitored and their eruptions are usually predicted days in advance, providing time for emergency response professionals to prepare the public for a possible tsunami as well.

It must also be pointed out that much of the science regarding tsunami warning has concentrated on the earthquake-generated tsunami. On this basis, an earthquake generated tsunami is therefore the main focus of this document for tsunami response.

The model Tsunami Warning Protocol is an illustrative description of the process flow from tsunami hazard data collection through to warning of the vulnerable locations. SOPs are the implementation procedures (guidelines) to be followed when a Tsunami Bulletin is received. Each SOP is designed to assist the emergency system (and its personnel) in immediately and accurately responding to Tsunami Bulletins.

The Tsunami Warning SOPs are the implementation procedures (guidelines) to be followed when a Tsunami Bulletin is received by the National TWFP. Each Tsunami Warning SOP is designed to assist the state's TWFP in:

1. Immediately notifying the the National Office of Disaster Preparedness and Emergency Management, the State Police Force, the Fire Brigade, and the Defence Force (who in turn will activate their response processes and procedures); and,

2. Immediately activating public alerting mechanisms when a tsunami threat may be imminent.

1.2 MODEL PROTOCOL AND SOP DOCUMENT

The purpose of this Model Tsunami Warning Protocol is to provide a baseline for each of the 16 Caribbean nations that comprise the CDEMA Participating States. The Tsunami Warning Protocol Model is to be adapted by each of the Participating States to their own existing infrastructure to achieve a "multi-hazards" system for use in managing the dissemination and communication of information during an emergency within their country.

While many documents on protocols and SOPs are available, none of them is based on the specific structure of the Caribbean states. The Caribbean states cannot afford each single state to have a large establishment that serves as a Tsunami National Warning Center. The Caribbean Tsunami Warning Centre may have larger role than the Pacific Tsunami warning Center (that serves the area today) to enable the participating states to have lighter role in the process. The preparation of this model protocol and the SOPs that follows is therefore necessary to reflect this situation.

This document was already adapted for four pilot states, and was modified based on the experience gained during this process to make it easy for other states to adapt it for their environment.

1.3 ASSUMPTIONS

The CDEMA Participating States Tsunami Warning **Protocol Model** is built on several assumptions:

1. There is (planning underway for 2010 operation) a Caribbean Tsunami Warning Centre (interim operations are provided by the Pacific Tsunami Warning Center).
2. The primary cause of tsunamis is earthquakes.
3. The National Focal Point will be responsible for receiving the Tsunami Bulletins, analyzing it and acting upon it.

4. The model protocol was developed to utilize standard operating procedures and assumes a similar national infrastructure among the Participating States.
5. Each country will adapt this protocol to their specific organizations and community. Four such adaptations were done by the Consultant.

2. PROTOCOL GUIDING PRINCIPLES

2.1 PURPOSE

The purpose of this protocol is to document the process (protocol) and the SOPs for the transfer of bulletins from the Tsunami Warning Centre to the public. ***These bulletins are being issued on an interim basis by the Pacific Tsunami Warning Center until such time as the Caribbean Tsunami Warning Centre (CTWC) is operational.***

Standard Operating Procedures (SOPs) provide procedural guidance for actions to be taken and are defined as a description and procedure on agreed upon steps by institutions who will follow the steps to coordinate who, what, when, where and how for tsunami early warning and response.

The SOPs herein described outline initial alert and warning responsibilities and actions to be taken in the event of a potential tsunami affecting the state. *It is anticipated* that this document will provide a base from which the Participating State's Disaster Management Organization (DMO) will further develop the State's response procedures and prepare and train their emergency response community for the circumstances of a tsunami.

2.2 STATEMENT OF THE CARIBBEAN REGION'S VULNERABILITY TO A POSSIBLE TSUNAMI

"Since its formation, natural hazard processes (includes shallow, intermediate and deep focus earthquakes, volcanism, active tectonics and geological faults, mountainous terrain, and volcanic soils) have been shaping the Circum-Caribbean region from a combination of multiple geophysical and geological processes and inherent physical conditions that characterize the region.

Following the December 26, 2004 Sumatran Tsunami, the scientific community identified evidence that the Caribbean is vulnerable also to a similar event (for example, Lander *et al*., 2002; Ahmad *et al*., 2005; Grindlay *etal.*, 2005; Scheffers *et al*., 2005; Robinson *et al*., 2006)."[1] The Caribbean Sea and the Atlantic Ocean are a potential source for tsunamis.[2]

[1]Ahmad, Rafi, University of the West Indies, Dept. Geography and Geology, Unit for Disaster Studies, Mona GeoInformatics Institute, Risk Management, Vulnerability and Natural Disasters in the Caribbean Report prepared for the International Red Cross, April-May 2007.

[2] Reported by Aurelio Mercado-Irizarry (Department of Marine Sciences, University of Puerto Rico at Mayagüez) and Philip L.-F. Liu (Department of Civil and Environmental Engineering, Cornell University), at the NSF Caribbean Tsunami Workshop, March 30-31, 2004, San Juan Beach Hotel, San Juan, P.R.

"A tsunami is a large ocean wave that is caused by sudden motion on the ocean floor. This sudden motion could be an earthquake, a powerful volcanic eruption, or an underwater landslide. The impact of a large meteorite could also cause a tsunami. Tsunamis travel across the open ocean at great speeds and build into large deadly waves in the shallow water of a shoreline."[3] Tsunamis are generated when an earthquake occurs 100 km or less under the ocean bottom or a huge landslide takes place near a coast and displaces a large body of sea water. Huge landslides can be caused by a volcanic eruption or lava flow into the ocean. Undersea volcanoes can also displace large bodies of sea water.

Arrival of damaging tsunami waves from the time of the seismic event within the Caribbean can occur almost immediately (within 5 minutes to 60 minutes if the event is locally generated and within 60 minutes to 3 hours if generated regionally) depending on the distance of the shoreline from the earthquake epicenter.

"Most destructive tsunami can be classified as local or regional…Less frequent, but more hazardous than regional tsunamis, are ocean-wide or distant tsunamis. Usually starting as a local tsunai that causes extensive destruction near the source, these waves continue to travel across an entire ocean basin with sufficient energy to cause additional casualties and destruction on shores.

> Local Tsunami: A tsunami from a nearby source for which its destructive effects are confined to coasts within about 100 km (or, alternatively, less than 1 hour tsunami travel time) from its source. A local tsunami is usually generated by an earthquake, but can also be caused by a landslide or a pyroclastic flow from a volcanic eruption.
>
> Regional Tsunami: A tsunami capable of destruction in a particular geographic region, generally within 1,000 km or 1-3 hours tsunami travel time from its source. Regional tsunamis also occasionally have very limited and localized effects outside the region.
>
> Distant/Teletsunami: A tsunami originating from a far away source, generally more than 1,000 km or more than 3 hours tsunami travel time from its source. "[4]

The immediate provision of tsunami warning for coastal regions is essential in reducing and mitigating the catastrophic losses that such waves can bring. Earthquakes are not predictable as of yet; hence, when one occurs its potential is immediately assessed to predict the potential for an ensuing tsunami. Active Volcanoes in the Caribbean are monitored and scientists monitoring their acitivities provide warning about a potential eruption (and likely ensuing tsunami) from within 3 to 14 days in advance of the eruption.

All islands in the Caribbean Sea are vulnerable to tsunamis that may be generated either in the Caribbean or the Atlantic Ocean.[5] The following satellite map illustrates tsunami source locations from historical tsunamis occuring in the Caribbean Sea. The symbols indicate cause of the tsunami: Brown Square is a landslide, Red Triangle is a volcanic eruption, Question Mark is an unknown cause, and White Circle is an earthquake and the size of the circle is graduated to indicate the earthquake magnitude.

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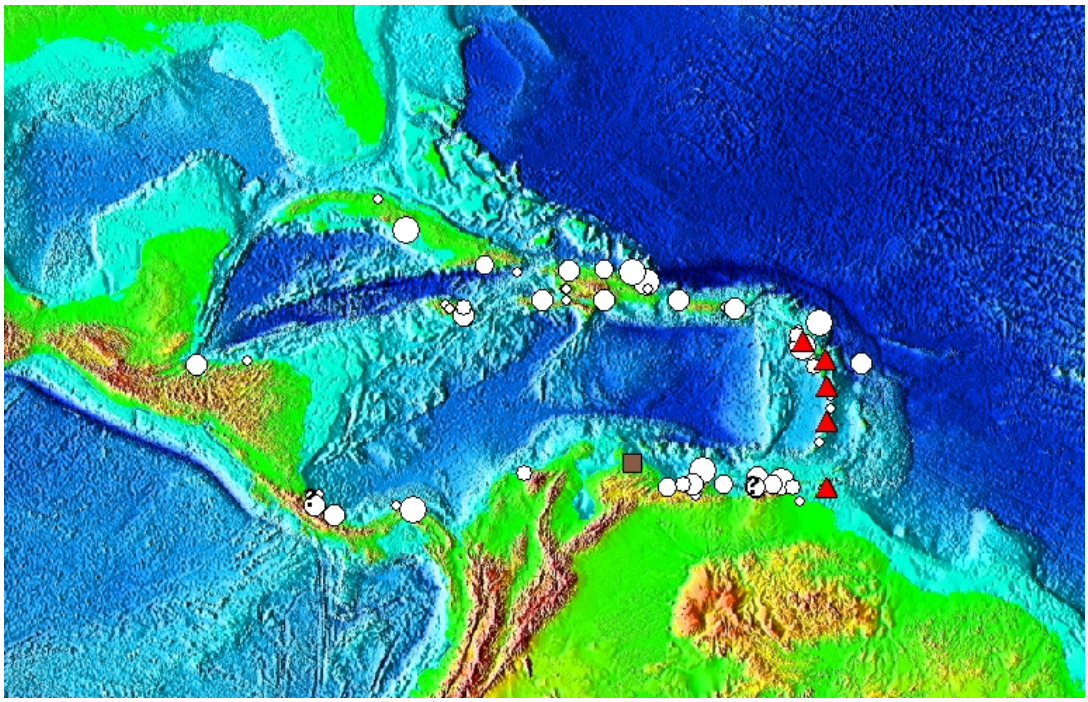
[3] Geology.com.

[4] Intergovernmental Oceanographic Commission, 2008, Tsunami Glossary 2008, Paris, UNESCO, IOC Technical Series, 85. (English).

[5] Reported by Aurelio Mercado-Irizarry (Department of Marine Sciences, University of Puerto Rico at Mayagüez) and Philip L.-F. Liu (Department of Civil and Environmental Engineering, Cornell University), at the NSF Caribbean Tsunami Workshop, March 30-31, 2004, San Juan Beach Hotel, San Juan, P.R.



Source: National Geophysical Data Center / World Data Center.

2.3 DEFINITION OF TWFP AND TNC

The TWFP is the designated official or point of contact (primary and alternate) available twenty-four hours a day, seven days a week to receive tsunami and other coast hazard-related information bulletins and warning guidance. The TWFP has the responsibility of notifying the emergency authorities (civil defence agencies or other designated agency responsible for public safety) of the event characteristics (earthquake and/or tsunami), in accordance with the procedures of the Tsunami Response Plan. The TWFP receives tsunami advisory information for the PTWC, Northwest Pacific Tsunami Advisory Centre (NWPTAC), or other regional warning centers. In the Caribbean and Adjacent Regions this warning focal point also acts as the focal point for other coastal hazards.

The Tsunami National Contact Point (TNC) is the person designated by an ICG Member State government 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 program. In the Caribbean and adjacent Regions this contact point also holds responsibility for other coastal hazards. This person may be the same as the 24/7 Tsunami Warning Focal Point.

2.4 TSUNAMI WARNING PROTOCOL

Illustration 1 which follows demonstrates the Model Tsunami Warning Protocol and provides a high level view of the tsunami warning alert and notification process beginning with a Tsunami Bulletin emanating from the Tsunami Warning Center.

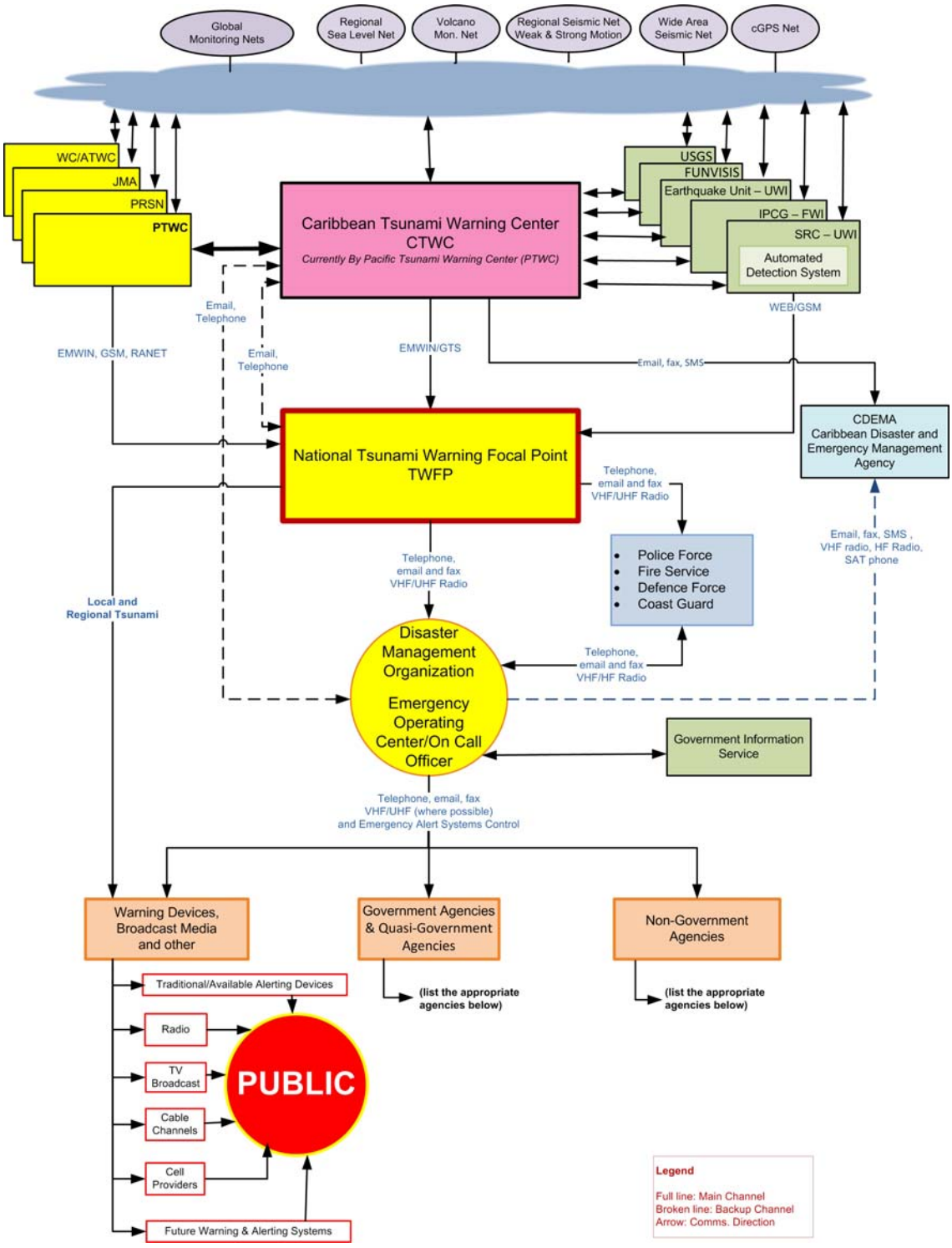


Illustration 1: Model Tsunami Warning Protocol

The preceding Model Tsunami Warning Protocol demonstrates the process by which information concerning a tsunami event is gathered, analysed and disseminated, and the vulnerable communities are notified and alerted:

1. Seismic and sea level data are gathered from a variety of monitoring networks and systems and then the information is transmitted to a central Tsunami Warning Center.

2. The central Tsunami Warning Center analyzes the sea level data calculating the potential landfall impact for all locations within their jurisdiction. Warning center staff develop various Tsunami Bulletins (Information Statements, and Local, Regional, and Ocean-wide Watch Messages) and disseminate the information to CDEMA PSs TWFPs (currently Bulletins are provided to the Caribbean and Adjacent Regions from the PTWC).

3. Upon receipt of the messages, the National TWFP immediately analyzes the message to identify landfall areas within their country, initiates public alert mechanisms (for local and regional tsunamis), notifies the Director of the Disaster Management Organization and specific civil defence authoriities, and continues to monitor developments accordingly.

The urgency of the potential emergency and the number of immediate notifications to be made by the National TWFP underscores the requirement for a centralized and automated notification system for emergency responders. *In the meantime, traditional alert and notification tools should be utilized and practiced (among these are police and fire station and vehicle sirens, church bells, town criers, etc.). The traditional alerting tools should remain in place as a backup for a new, automated system.* The automated notification system should also incorporate report features which indicate who acknowledged receipt of the message, date and time stamped. Further, the same critical issues represent significant justification for public alerting systems that can also be automated and activated immediately by the TWFP.

2.5 TYPES OF TSUNAMI BULLETINS ISSUED

When established, the CTWC will issue Tsunami Warning Bulletins based on its own assessments and data gathering points. (It is expected that additional seismic monitoring and sea level monitoring including deep sea monitor devices will become operational before the activation of the CTWC.) It is further anticipated that the CTWC, when operational, will provide messages to the CDEMA PS that are similar to those provided by other international warning centers, as follows:

"Tsunami Warning

The highest level of tsunami alert. Warnings are issued due to the imminent threat of a tsunami from a large undersea earthquake or following confirmation that a potentially destructive tsunami is underway. They may initially be based only on seismic information as a means of providing the earliest possible alert. Warnings advise that appropriate actions be taken in response to the tsunami threat. Such actions could include the evacuation of low-lying coastal areas and the movement of boats and ships out of harbors to deep water. Warnings are updated at least hourly or as conditions warrant to continue, expand, restrict, or end the warning.

Tsunami Watch

The second highest level of tsunami alert. Watches are issued by the TWCs based on seismic information without confirmation that a destructive tsunami is underway. It is issued as a means of providing an advance alert to areas that could be impacted by destructive tsunami waves. Watches are updated at least hourly to continue them, expand their coverage, upgrade them to a Warning, or end the alert. A Watch for a particular area may be included in the text of the message that disseminates a Warning for another area.

Tsunami Advisory

The third highest level of tsunami alert. Advisories are issued to coastal populations within areas not currently in either warning or watch status when a tsunami warning has been issued for another region of the same ocean. An Advisory indicates that an area is either outside the current warning and watch regions or that the tsunami poses no danger to that area. The Center(s) issuing the Advisory will continue to monitor the event, issuing updates at least hourly. As conditions warrant, the Advisory will either be continued, upgraded to a watch or warning, or ended.

Tsunami Information Bulletin/Statement

A text product issued to inform that an earthquake has occurred and to advise regarding its potential to generate a tsunami. In most cases, a Tsunami Information Bulletin indicates there is no threat of a destructive tsunami, and are used to prevent unnecessary evacuations as the earthquake may have been felt in coastal areas. A Tsunami Information Bulletin may, in appropriate situations, caution about the possibility of a destructive local tsunami. A supplemental Tsunami Information Bulletin may be issued if important additional information is received such as a sea level reading showing a tsunami signal. A Tsunami Information Bulletin may also be upgraded to a watch or warning if appropriate. "[6]

In the meantime, the PTWC currently provides limited bulletins to the Caribbean and Adjacent Regions based on the data available. The PTWC in providing interim services currently issues the following Bulletins ***whose labels may be somewhat misleading in reference to the urgency of the potential situation***:

Tsunami Watch Bulletin for the CDEMA Participating States stating a "potential for a destructive" tsunami under the following conditions:

> An earthquake occurs with a preliminary 7.1 to 7.8 or greater magnitude in the Caribbean where the depth of the earthquake is equal to or less than 100km (arrival time 5 to 60 minutes after the earthquake).
>
> An earthquake occurs with a preliminary 7.9 or greater magnitude in the Atlantic where the depth of the earthquake is equal to or less than 100km (arrival time 60 plus minutes after the earthquake and depending on the location may be longer than 3 hours).

[6] http://www.prh.noaa.gov/ptwc/about_messages.php?region=3

Tsunami Information Statement stating a very small potential for a tsunami under the following conditions:

An earthquake occurs with a preliminary 6.0 to 7.0 magnitude in the Caribbean where the depth of the earthquake is equal to or less than 100km (arrival time 5 to 60 minutes after earthquake).

An earthquake occurs with a preliminary 6.5 to 7.8 in the Atlantic Ocean where the depth of the earthquake is equal to or less than 100km (arrival time 60 plus minutes after the earthquake and depending on the location may be longer than 3 hours).

Tsunami Information Statement stating that an earthquake with no potential for a tsunami occurred under the following conditions:

An earthquake occurs more than 100 km from the surface for all locations and is less than or equal to a 6.0 magnitude earthquake in the Caribbean or 6.5 magnitude earthquake in the Atlantic.

3. TSUNAMI WARNING FOCAL POINT SOP

3.1 INTRODUCTION

The TWFP SOPs were developed based on the Tsunami Bulletins received from the PTWC, and an analysis of what the urgency of each of the bulletins may be advising and the time required to evacuate vulnerable locations. Until Tsunami Bulletins are provided by an operational CTWC which may include more data points and whose labels may more fully identify the urgency of the situation, the PTWC Bulletins will be used to activate a full Alert (includes immediate evacuation in vulnerable areas), monitor the situation, or take no action.

There are basically five SOPs:

SOP A: For **any potential Caribbean generated tsunami** whether it is considered local or regional.

SOP B: For **any potential Atlantic generated tsunami** (distant tsunami) and in the event of early notification of a potential volcanic eruption which may result in sea water displacement.

SOP C: For any bulletin advising about an earthquake with no potential for tsunami occuring either in the Caribbean or in the Atlantic.

SOP D: For Cancellation bulletins from the Tsunami warning Centre advising there is no longer a threat from a tsunami.

SOP E: For test bulletins.

A draft Tsunami Warning Responsibility Agreement is provided as Appendix B for your information and use as necessary.

Illustration 2 which follows demonstrates the requirements of the TWFP to address seven (7) different bulletins that may presently be received from the PTWC. In each situation where the TWFP determines that a tsunami threatens the coastline (actions to be taken are reflected in SOPs A and B), the immediate public

alert message issued will be for everyone to move away from the coastline to higher ground. At present, given the lack of comprehensive tsunami hazard mapping, the TWFP is required to alert all populations along all coastlines. In the future, as more is clarified about the vulnerable coastlines, the TWFP and relevant stakeholders within the National Emergency Management System would need to decide based on the availability of the requisite modeling and hazard maps whether the decision would be taken to evacuate the entire coastline or specific coastlines, and the SOPs make allowance for this.

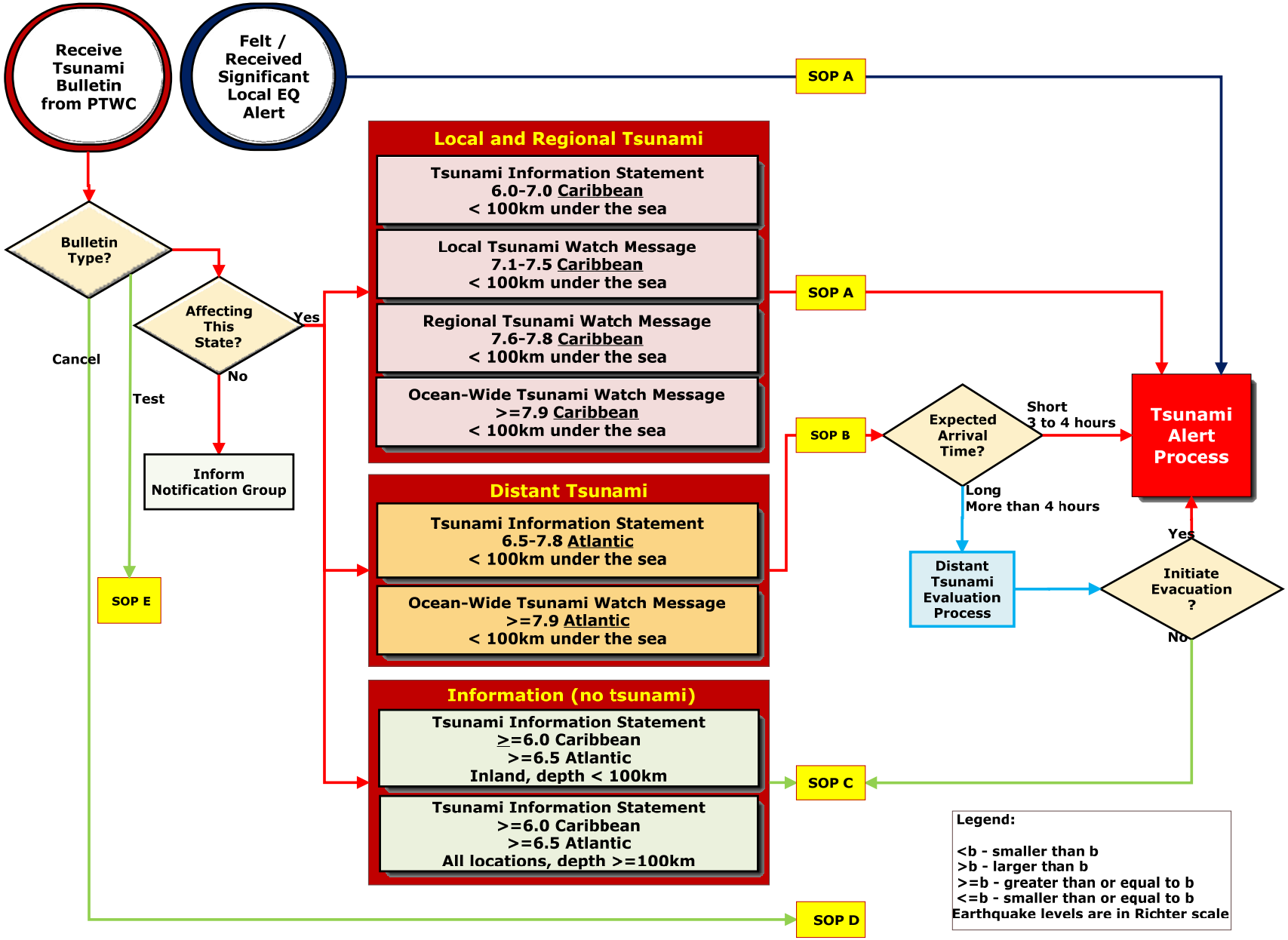


Illustration 2: TWFP/TWCP Standard Operating Procedures

3.2 TSUNAMI BULLETIN – DESCRIPTION OF SECTIONS

Tsunami messages from the PTWC are divided into a few general sections:

- "A **header** gives the product number. It starts at 1 for each event and is incremented if subsequent products are issued for the same event. The header also indicates who issued the product, in this case PTWC, and the time the product is issued.

- The header is followed by a statement about **who the product is intended for** -- all areas of the Caribbean.

- The next line is a banner indicating the **type of product**, a Tsunami Information Statement or a Tsunami Watch Message. If a Tsunami Watch is in effect, the countries in a watch are indicated. This is followed by the **preliminary earthquake parameters** including the origin time, coordinates, location name, and earthquake magnitude. If any **sea level observations** are available, they are provided next. Until more real time reporting sea level gauges are installed, however, such observations will be very limited or non-existent. The next section is the **evaluation**. It contains descriptive language about the potential for a destructive tsunami. If a Tsunami Watch is issued, **estimated arrival times** for forecast points (Figure) within the Watch area are provided.

- Last is a statement about **if and when a subsequent product** will be issued for the event."[7]

3.3 TSUNAMI BULLETIN – BEST PRACTICE REGARDING TIMING OF RESPONSE

The 'best practice' in the international community is achieved by Japan. The Japan Meteorology Agency (JMA) has been operational (many name and organizational reporting changes over the years) since Meteorological services in Japapn were initiated in 1875. The JMA has developed it processes and network of seismic stations such that the timeline following a seismic event is:

1. **2 minutes:** the JMA has a least three regions reporting the intensity data from the seismic event.
2. **3 minutes:** the JMA knows the location and magnitude of the seismic event.
3. **3 to 5 minutes**: the JMA can forecast a tsunami and predict height and arrival time of an initial wave.
4. **5 minutes**: the JMA knows the location/magnitude of the earthquake and seimis intensity distribution.
5. **5+ minutes**: the JMA is recording sea level data concerning the tsunami wave.

[7] Excerpts from the Pacific Tsuanmi Warning Center's Communication Plan for the Caribbean and Adjacent Regions, dated 2006.

In addition, the JMA has an agreement in place with the largest broadcast media network in the Country and automated and preprogrammed messages about the seismic event and warning about a tsunami are broadcast within minutes of a seismic event. Also, seismic and tsunami alert messages are preprogrammed and sent automatically to the local officials who in turn sound sirens to warn of a tsunami, prepare evacuation routes, and open shelters. The general public has been trained and begin evacuations at once when alerted.

The JMA model is clearly the 'best practice' and the JMA timelines should be established as the goal for the CTWC. There are many reasons for the success of the JMA which evolved over time and will be a challenge to achieve in a short time frame:

1. *Japan experiences large earthquakes often*.
2. Japan's earthquakes generate tsunamis *frequently* (much of their coastline is vulnerable).
3. Japan spends considerable resources on its JMA annually and has done so for many years.
4. Japan's public has a long history of confidence in the government's advice and leadership and when provided information from the government either as education and preparedness or to take immediate action, the public embraces the education and integrates the response actions into their daily lives.

Preparation of the CDEMA PS will not occur overnight; it is now only the beginning. However, the examples of systems provided from such as the Japanese and the United States and others, the lessons learned from both successful and unsuccessful experiences within the region and from outside the region, the advancement of new technologies, the improvements in the local infrastructures and tools for data collection and alerting, the keen ambition of CDEMA to protect the lives of the citizens of the PS, all of these will bring the collaboration and resources necessary for the CTWC and the individual country tsunami warning systems to mature well over the next 5 to 10 years.

4. SOP A (CARIBBEAN EARTHQUAKE)

4.1 PURPOSE

To provide procedural guidance and action steps to be followed in responding to a PTWC issued TSUNAMI WATCH BULLETIN or a TSUNAMI INFORMATION STATE MENT due to ***a local/regional seismic event to determine whether the Tsunami Watch Bulletin identifies a Participating State as threatened or a significant "felt earthquake" is experienced.***

4.2 GENERAL

Please note: When a significant "felt earthquake" is experienced, and before any bulletins are received, it is recommended that the TWFP be authorized to activate all components of SOP A, Section 2.3 Immediate Actions Checklist. Appendix C provides a chart which outlines the charcteristics of a felt earthquake indicating comparison levels for Richter Scale magnitude. All of the following may be used to judge a felt earthquake with a magnitude of 7.0 or higher:

- ***Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.***
- ***Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.***
- ***Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.***
- ***Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.***
- ***Damage total. Lines of sight and level are distorted. Objects thrown into the air.***

The PTWC will issue TSUNAMI WATCH/INFORMATION STATEMENT BULLETINS under the following conditions:

- An earthquake occurs with a preliminary 7.1 to 7.8 or greater magnitude in the Caribbean where the depth of the earthquake is equal to or less than 100km.
- An earthquake occurs with a preliminary 6.0 to 7.0 magnitude in the Caribbean where the depth of the earthquake is equal to or less than 100km.

At a future date, when the CTWC is built and operational, this information may include coastal tide stations and recorder information about the tsunami waves and their likely size.

4.3 TSUNAMI WARNING: SOP A IMMEDIATE ACTIONS CHECKLIST

[ ] 1.	**SOP A IMMEDIATE ACTIONS CHECKLIST** TWFP Duty Officer must review the message from the PTWC and learn if the tsunami is forecast to arrive at (insert name of CDEMA PS). [8] [ ] a. Does not threaten (insert name of CDEMA PS). After assessment of the Bulletin, the TWFP determines the event does not threaten (insert name of CDEMA PS's) coastlines. The TWFP should continue to monitor information about the event and contact civil authorities to advise that a Tsunami Bulletin was received; that assessment shows that it will not impact (insert name of CDEMA PS); and, that no further action is required. (Use Attachment A, page 34, for directory of Civil Authorities' Contact Information) [ ] i. Contact the Director, (insert name of CDEMA PS Disaster Management Organization). [ ] ii. Contact the (insert name of CDEMA PS) Police Force. [ ] iii. Contact the (insert name of CDEMA PS) Fire Brigade. [ ]iv. Contact the (insert name of CDEMA PS) Defence Force. [ ] b. Tsunami threatens (insert name of CDEMA PS). Initiate Evacuation. [ ] i. Evacuate all coastal areas of (insert name of CDEMA PS, and its outlying islands and cays) Or [ ] ii. Evacuate all vulnerable coastal areas. (Use Attachment B, page 35, for Listing of Vulnerable Coastal Areas.) And [ ] iii. Notify Civil Authorities. (Use Attachment A, page 34, for directory of Civil Authorities' Contact Information)

[8] Examples of sample Tsunami Watch Bulletin and Tsunami Information Statements which illustrates the kind of information a Participating State can expect to receive from the PTWC are provided in Appendix A.

[ ] 2.	ACTIVATE PUBLIC ALERTING (Use Attachment C, page 36, for Listing of Alerting Devices and Directory of Contact Information for Device Activation)
[ ] 3.	CONTACT RADIO, TV, AND CABLE BROADCAST STATIONS. (Use Attachment D, page 37, for Directory of Broadcast Media Partner Contact Information). Advise -- Tsunami Evacuation Alert (Use Attachment F, page 39, for Broadcast Message—Tsunami Evacuation Alert) [ ] a. Evacuate all coastal areas of (insert name of CDEMA PS, and its outlying islands and cays) Or [ ] b. Evacuate all vulnerable coastal areas. (Use Attachment B, page 35, for Listing of Vulnerable Coastal Areas.)
[ ] 4.	CONTACT CELL PROVIDERS. (Use Attachment E, page 38, for Directory of Cell Service Company Partner's Contact Information.)
[ ] 5.	CONTACT COAST GUARD DISPATCH. Advise Tsunami Alert. (Use Attachment G, page 40, for Broadcast Message to Mariners.)
[ ] 6.	TWFP Duty Officer reports to the Director (insert name of CDEMA PS National Disaster Management Organization) at the National Emergency Operations Centre (NEOC) to provide continuing assistance throughout the remainder of the alert.
[ ] 7.	End of Procedure.

5. SOP B (ATLANTIC OCEAN GENERATED TSUNAMI)[9]

5.0 PURPOSE

To provide procedural guidance and action steps to be followed in responding to a PTWC issued TSUNAMI WATCH BULLETIN due to a distant (ocean wide) seismic event ***to determine whether the Tsunami Watch Bulletin identifies Participating State as threatened.***

5.1 GENERAL

The PTWC will issue a Tsunami Watch Bulletin or Tsunami Information Statement under the following conditions in the Caribbean:

- An earthquake occurs with a preliminary 6.5 to 7.8 in the Atlantic Ocean.
- An earthquake occurs with a preliminary 7.9 or greater magnitude in the Atlantic Ocean.

Arrival time of tsunami generated by either of the preceding events is over 3 hours. While this does not mean there is significant time with which to evaluate danger or to begin warning the public; it does provide more opportunity for the Tsunami Warning Center and the Participating State's National TWFP to evaluate the situation and make better forecasts for wave arrival time and arrival locations.

[9] SOP B may also be used for tsunamis expected as a result of an anticipated volcanic eruption when there are several days to prepare for both the volcanic eruption and the expected tsunami.

5.3 TSUNAMI WARNING: SOP B IMMEDIATE ACTIONS CHECKLIST

SOP B IMMEDIATE ACTIONS CHECKLIST

[ ] 1. TWFP Duty Officer must review the message from the PTWC and learn if the tsunami is forecast to arrive at (insert name of CDEMA PS).

[ ] a. If the event does not threaten (insert name of CDEMA PS).

After assessment of the Bulletin (the TWFP determines the event does not threaten Participating State's coastlines) the TWFP should continue to monitor information about the event and contact civil authorities to advise that a Tsunami Bulletin was received; that assessment shows that it will not impact CDEMA PS; and, that no further action is required. (Use Attachment A, page 34, for Directory of Civil Authority's Contact Information)

[ ] i. Contact the Director, (insert name of CDEMA PS Disaster Management Organization)

[ ] ii. Contact the (insert name of CDEMA PS's Police Force)

[ ] iii. Contact the (insert name of CDEMA PS's Fire Brigade)

[ ]iv. Contact the (insert name of CDEMA PS's Defence Force)

[ ] b. Tsunami threatens (insert name of CDEMA PS)

Current:
(Insert name of CDEMA PS's) TWFP Duty Officer will initate dialogue with the PTWC Duty Officer to verify assessment of tsunami wave arrival time, potential for size of wave, etc. It is presumed that this should take no longer that 15 to 20 minutes. Following this discussion, (insert name of CDEMA PS) National TWFP Duty Officer should poceed with remainder of the SOP.

Or

Future:
(Insert name of CDEMA PS) TWFP Duty Officer will participate in a CTWC Conference Call (this will only be possible once the CTWC is built and operational)
Conference Call in Number:_____
Participant Code:_____
Following the Conference Call, (insert name of CDEMA PS) National TWFP Duty Officer should poceed with remainder of the SOP.

[ ] c. Immediately contact Civil Authorities, advise expected Tsunami Arrival Time. (Use Attachment A, page 34, for Directory of Civil Authority's Contact Information)

[ ] 2.	ACTIVATE PUBLIC ALERTING (Use Attachment C, page 36, for listing of alerting devices and directory of contact information device activation)
[ ] 3.	CONTACT RADIO, TV, AND CABLE BROADCAST STATIONS. (Use Attachment D, page 37, for Directory of Broadcast Media Partner Contact Information). Advise -- Tsunami Evacuation Alert (Use Attachment F, page 39, for Broadcast Message—Tsunami Evacuation Alert) [ ] a. Evacuate COASTAL (insert name of CDEMA PS, and outlying islands and cays) Or [ ] b. Evacuate all vulnerable coastal areas. (Use Attachment B, page 35,for Listing of Vulnerable Coastal Areas.)
[ ] 4.	CONTACT CELL PROVIDERS. (Use Attachment E, page 38, for Directory of Broadcast Media Contact Information.)
[ ] 5.	CONTACT COAST GUARD DISPATCH. Advise Tsunami Alert. (Use Attachment G, page 40, for Broadcast Message to Mariners.)
[ ] 6.	TWFP Duty Officer reports to the Director (insert name of PS National Disaster Management Organization) at the National Emergency Operations Centre(NEOC) to provide continuing assistance throughout the remainder of the alert.
[ ] 7.	End of Procedure.

6. SOP C (No Potential for Tsunami)

6.1 PURPOSE

To provide procedural guidance and action steps to be followed in responding to a PTWC issued TSUNAMI INFORMATION STATEMENT due to a local or regional seismic event.

6.2 GENERAL

The PTWC will issue a Tsunami Information Statement under the following conditions:

- An earthquake occurs more than 100 km from the surface for all locations and is less than or equal to 6.0 magnitude in the Caribbean or 6.5 magnitude in the Atlantic.

6.3 IMMEDIATE ACTIONS CHECKLIST

[ ] 1.	**SOP C IMMEDIATE ACTIONS CHECKLIST** TWFP Duty Officer must review the message from the PTWC and contact civil authorities to advise that a Tsunami Bulletin was received; that review/assessment shows that it will not impact Participating State; and, that no further action is required. (Use Attachment A, page 34, for directory of Civil Authorities' Contact Information) [ ] i. Contact the Director, (insert name of CDEMA PS Disaster Management Organization) [ ] ii. Contact the (insert name of CDEMA PS's Police Force) [ ] iii. Contact the (insert name of CDEMA PS's Fire Brigade) [ ]iv. Contact the (insert name of CDEMA PS's Defence Force)
[ ] 2.	No further action required. End of Procedure.

7. SOP D (CANCELLATION)

7.1 PURPOSE

To provide procedural guidance and action steps to be followed in responding to a PTWC issued TSUNAMI INFORMATION STATEMENT due to a local or regional seismic event.

7.2 GENERAL

The PTWC will issue a Tsunami Information Statement advising that all danger of a Tsunami has passed.

- Cancellation Message

7.3 IMMEDIATE ACTIONS CHECKLIST

[ ] 1.	**SOP D IMMEDIATE ACTIONS CHECKLIST** TWFP Duty Officer must contact the Director of the Disaster Management Organization and report receipt of cancellation message from the PTWC but take no further action. (Use Attachment A, page 34, for directory of Civil Authorities' Contact Information.) [ ] i. Contact the Director, (insert name of CDEMA PS Disaster Management Organization).
[ ] 2.	No further action required. End of Procedure.

8. SOP E (TEST MESSAGE)

8.1 PURPOSE

To provide procedural guidance and action steps to be followed in responding to a PTWC issued TSUNAMI TEST BULLETIN.

8.2 GENERAL

The PTWC will issue a Tsunami Test Bulletin approximately 4 times a year.

- Test Bulletin

8.3 IMMEDIATE ACTIONS CHECKLIST

[ ] 1.	**SOP E IMMEDIATE ACTIONS CHECKLIST**[10] TWFP Duty Officer must contact the Civil Authorities and report receipt of Test Bulletin from the PTWC. (Use Attachment A, page 34, for directory of Civil Authorities' Contact Information) [ ] i. Contact the Director, (insert name of CDEMA PS Disaster Management Organization) [ ] ii. Contact the (insert name of CDEMA PS's Police Force) [ ] iii. Contact the (insert name of CDEMA PS's Fire Brigade) [ ]iv. Contact the (insert name of CDEMA PS's Defence Force)
[ ] 2.	No further action required. End of Procedure.

[10] It is recommended that (insert name of CDEMA PS) TWFP and Director, (insert name of CDEMA PS Disaster Management Organization) develop a series of tests of their tsunami systems to coincide with receipt of each PTWC Test message. Such exercises can be used to update contact information lists and identify weaknesses in operations which can then be remedied.

9. SOP F (Drill/Prepare Procedure)

9.1 PURPOSE

To provide opportunity for all first responder organizations to drill and practice their SOPs for a tsunami. Tsunami's are rare events but the hazard is real throughout the Caribbean. Unless dedicated drills are held routinely and thinking given to the prodedures of the drill, improvements integrated, first responders will not be ready, they will not know how to respond to protect the public during the tsunami (assist with evacuations, shelter requirements, etc.) and the follow up recovery efforts when a devastating tsunami occurs.

There are several components to adequate preparation:

1. Drills that address technical and operational responsibilities:
    a. Assure technical infrastructure is available at all times
    b. Verifies accuracy of contact information
    c. Keeps track of and constantly seeks to improve response time
    d. Practices that test response during various days of the week and times of days
    e. Provides incentive to all participant organizations to further prepare their organization for response activities once the alert is received

2. Routine Training Sessions to address ideas and thoughts for improvements for infrastructure and operations.

3. Annual Tests to assure readiness and understanding of an individuals responsibility in such an event.

7.2 GENERAL

This SOP is intended as an initial drill/prepare procedure. It is expected that each organization that participates in the process will develop further SOPs that prepare their own organizations for response to tsunami alerts. To begin, this drill procedure will address the practice requirements of the key organizations to receive the alert message and to check the readiness of tools involved in the tsunami alert and notification process:

1. Tsunami Warning Focal Point
2. National Disaster Management Organization
3. Police
4. Fire
5. Defense
6. Coast Guard
7. Broadcast Media/Cell Service Providers
8. Public Alerting Tools

9.3 NATIONAL TSUNAMI DRILL SCHEDULE

Because the responsibility for Disaster Management lies with the National DMO, it is recommended that the Director of the DMO initiate the drill procedure. Further, to establish drills at random times on random days to assist each organizations preparations for a "what if" scenario, it is recommended that the DMO activate drills according to the following schedule.

2009:

February:	First Sunday of the Month, at 11:00 a.m.
April:	First Wednesday of the Month, at 3:00 a.m.
June:	First Friday of the Month, at 7:00 p.m.
August:	First Monday of the Month, at 11:00 a.m.
October:	First Thursday of the Month, at 3:00 a.m.
December:	First Saturday of the Month, at 7:00 p.m.

2010

January:	First Tuesday of the Month, at 12:00 noon
March:	First Friday of the Month, at 4:00 a.m.
May:	First Sunday of the Month, at 8:00 p.m.
July:	First Wednesday of the Month, at 12:00 noon
September:	First Saturday of the Month, at 4:00 a.m.
November:	First Monday of the Month, at 8:00 p.m.

2011

February:	First Thursday of the Month, at 1:00 p.m.
April:	First Saturday of the Month, at 5:00 a.m.
June:	First Monday of the Month, at 9:00 p.m.
August:	First Friday of the Month, at 1:00 p.m.
October:	First Sunday of the Month, at 5:00 a.m.
December:	First Tuesday of the Month, at 9:00 p.m.

2012: Repeat 2009 Day Schedule, using 2:00 p.m., 6:00 a.m., and 10:00 p.m. as drill times.

2013: Repeat 2010 Day Schedule, using 3:00 p.m., 7:00 a.m., and 11:00 p.m. as drill times.

2014: Repeat 2011 Day Schedule, using 4:00 p.m., 8:00 a.m., and 12:00 midnight as drill times.

2015: Repeat 2009 Day Schedule, using 5:00 p.m., 9:00 a.m., and 1:00 a.m. as drill times.

2016: Repeat 2010 Day Schedule, using 6:00 p.m., 10:00 a.m., and 2:00 a.m. as drill times.

2017: Repeat 2011 Day Schedule, using 7:00 p.m., 11:00 a.m., and 3:00 a.m. as drill times.

9.3.1 IMMEDIATE ACTIONS CHECKLIST

[ ] 1.	**SOP F IMMEDIATE ACTIONS CHECKLIST** ***Director of the (insert name of DMO)*** must make contact with TWFP Duty Officer using the same mechanism/s that is/are used for a real tsunami alert(EMWIN/GTS, and in some cases fax machines) and announce a ***National Drill of the Tsunami Warning System***. Initiation of the ***National Drill Message*** by the ***(insert name of DMO)*** begins the clock ticking for the drill records. Attachment H on page 41, provides a timeline reporting document for use by the DMO. [ ] Contact the National TWFP (insert all appropriate communication tool contact numbers).
[ ] 2.	***TWFP Duty Officer*** must review the National Drill message from the DMO, note the exact time of receipt and the mechanism of delivery used (if multiple messages received, note all of them) and immediately must contact the Civil Authorities and report receipt of a ***National Drill Message*** from the ***(insert name of DMO)***. (Use Attachment A, page34, for Directory of Civil Authorities' Contact Information) [ ] i. Contact the Director, ***(insert name of DMO)*** [ ] ii. Contact the **(insert name of CDEMA PS)** Police Force [ ] iii. Contact the **(insert name of CDEMA PS)** Fire Brigade [ ]iv. Contact the **(insert name of CDEMA PS)** Defence Force
[ ] 3.	***TWFP Duty Officer*** must contact persons responsible for activating PUBLIC ALERTING DEVICES; advise ***National Tsunami Drill***. (Use Attachment C, page 36, for Listing of Alerting Devices and Directory of Device Activation Contact Information).
[ ] 4.	***TWFP Duty Officer*** must CONTACT RADIO, TV, AND CABLE BROADCAST STATIONS. (Use Attachment D, page 37, for Directory of Broadcast Media Partner Contact Information). Advise – ***National Tsunami Drill*** (Use Attachment F, page 39, for Broadcast Message—Tsunami Evacuation Alert).

[ ] 5.	***TWFP Duty Officer*** must CONTACT CELL PROVIDERS. (Use Attachment E, page 38, for Directory of Cell Service Provider Company Partner Contact Information.) Advise -- ***National Tsunami Drill*** (Use Attachment I, page 43, for Broadcast Message— ***National Tsunami Drill***)
[ ] 6.	***TWFP Duty Officer*** must CONTACT COAST GUARD DISPATCH at (please complete by adding correct contact numbers/radio frequencies). Advise -- ***National Tsunami Drill*** (Use Attachment J, page 44, for Mariners Broadcast Message— ***National Tsunami Drill***)
[ ] 7.	***TWFP Duty Officer*** must report to the ***Director National DMO*** that the National Drill Message has been delivered and provide the DMO the contact name, time of message delivery, mechanism/s by which the message was delivered. Use Attachments A, C, D, and E, pages 34, 36, 37, and 38 respectively, for making the report about who was reached and when. In the event a contact person telephone/radio contact number/s are not answered, the TWFP Duty Officer must submit a written report about the attempt to the Director National DMO so that the situation can be immediately addressed.
[ ] 8.	***Director National (insert name of DMO)*** must prepare a Drill Summary Report and follow up with each agency, advising about the results of the drill, explaining how it compared with previous drills in terms of overall time taken to get the alert message out. Once the Drill Summary Report is finalized, the ***Director National (insert name of DMO)*** may make a report to the Prime Ministers Office along with any recommendations for improvements in responses that are required.
[ ] 9.	End of National Drill Procedure. All drill activity log files to be sent to the drill manager (Director—***insert name of DMO)***, CDEMA and CTWC for analysis. Drill summary report to be issued within 10 business days from the execution of drill.

10. SOP ATTACHMENTS

ATTACHMENT A. DIRECTORY OF CIVIL AUTHORITIES CONTACT LIST

AGENCY NAME	Emergency Contact Name	24x7 Telelphone Number	24x7 Cell Phone Number	SAT Phone Number	Via Radio Channel/s (HF & VHF)	Name of Recipient and Time Message Received.
National Disaster Management Organization						
Police Force	(POLICE FORCE DISPATCH)					
Fire	(FIRE DISPATCH)					
Defence Force						

ATTACHMENT B. LISTING OF TSUNAMI VULNERABLE COASTAL AREAS

(Insert name of CDEMA PS) VULNERABLE COASTLINE LOCATIONS BY NAME

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

(Insert name of CDEMA PS) OUTLYING ISLAND'S & CAY'S VULNERABLE COASTLINE LOCATIONS BY NAME

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

ATTACHMENT C. LISTING OF ALERTING DEVICES AND DEVICE ACTIVATION CONTACT INFORMATION

Alert Device	Device Activation Emergency Contact Name	24x7 Telelphone Number	24x7 Cell Phone Number	Name of Recipient and Time Message Received.

ATTACHMENT D. DIRECTORY OF TSUNAMI ALERT MEDIA PARTNERS

BROADCAST STATIONS (Radio, Television, Cable)	Emergency Contact Name	24x7 Telelphone Number	24x7 Cell Phone Number	Via Radio Channel/s (HF & VHF)	Name of Recipient and Time Message Received.

ATTACHMENT E. DIRECTORY OF TSUNAMI ALERT CELL SERVICE COMPANY PARTNERS

Cell Service Company	Emergency Contact Name	24x7 Telelphone Number	24x7 Cell Phone Number	Via Radio Channel/s (HF & VHF)	Name of Recipient and Time Message Received.

ATTACHMENT F. BROADCAST MESSAGE FOR MEDIA PARTNERS

URGENT TSUNAMI WARNING
BROADCAST SCRIPT

A TSUNAMI WARNING HAS BEEN ISSUED.
THIS IS AN URGENT TSUNAMI WARNING FOR

[ ] 1. ALL COASTAL AREAS OF (insert name of PARTICIPATING STATE & OUTLYING ISLANDS)

OR

[ ] 2. ALL VULNERABLE COASTAL AREAS OF (insert name of PARTICIPATING STATE & PARTICIPATING STATE'S OUTLYING ISLANDS)[11]

A TSUNAMI HAS BEEN GENERATED. IMMEDIATELY EVACUATE ALL BEACHES AND ALL LOW LYING COASTAL AREAS. MOVE INLAND TO HIGHER GROUND

[11] The locations of Vulnerable Coastal areas (when identified by analysis will be listed on Attachment B).

ATTACHMENT G. BROADCAST MESSAGE FOR MARINERS

URGENT TSUNAMI WARNING
MARINERS WARNING SCRIPT

A TSUNAMI WARNING HAS BEEN ISSUED. THIS IS AN
URGENT TSUNAMI WARNING FOR (insert name of PARTICIPATING STATE)

A TSUNAMI HAS BEEN GENERATED. DO NOT APPROACH HARBORS UNTIL THE TSUNAMI ALL CLEAR HAS BEEN ANNOUNCED. IF YOU ARE NEAR THE HARBORS MOVE AWAY FROM LAND TO A LOCATION FURTHER OUT. STAY TUNED FOR FURTHER INFORMATION.

ATTACHMENT H. NATIONAL TSUNAMI DRILL RECORD

Date of Drill: _____ _____

Day & Time Drill Initiated: _____ _____

Name of Recorder: _____ _____

Title of Recorder: _____ _____

Complete the following which document the various steps in the process, the contact infrastructure used, the success, the time of message delivery and message receipt.

[ ] Initiate Drill

1. Document the various means of delivering the message:

List Mechanism of Message Delivery (list all that are available)	Provide Message Delivery Time	Provide Message Acknowledgement Time, if any, noting how acknowledgement was received. If no acknowledgement received, mark as none.	Provide Comments, as necessary

[ ] Received Completed Attachment A.

[ ] Received Completed Attachment C.

[ ] Received Completed Attachment D.

[ ] Received Completed Attachment E.

[ ] End Drill

Record Day & Time Drill Ended: _____

[ ] Record Comments, if any:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____.

ATTACHMENT I. NATIONAL TSUNAMI DRILL BROADCAST MESSAGE FOR MEDIA PARTNERS

NATIONAL TSUNAMI DRILL
BROADCAST SCRIPT

A NATIONAL DRILL OF THE TSUNAMI WARNING SYSTEM IS BEING CONDUCTED BY THE DISASTER MANAGEMENT ORGANIZATION & OTHER KEY EMERGENCY RESPONSE AGENCIES. IF THIS HAD BEEN A REAL TSUNAMI ALERT, YOU WOULD BE ADVISED WHAT COASTAL AREAS MUST BE EVACUATED IMMEDIATELY. THERE IS NO TSUNAMI; THIS IS ONLY A TSUNAMI DRILL.

ATTACHMENT J. NATIONAL TSUNAMI DRILL BROADCAST MESSAGE FOR MARINERS

NATIONAL TSUNAMI DRILL
BROADCAST SCRIPT

A NATIONAL DRILL OF THE TSUNAMI WARNING SYSTEM IS BEING CONDUCTED BY THE DISASTER MANAGEMENT ORGANIZATION & OTHER KEY EMERGENCY RESPONSE AGENCIES. IF THIS HAD BEEN A REAL TSUNAMI ALERT, YOU WOULD BE ADVISED NOT TO MOVE YOUR VESSELS TOWARDS THE COAST LINE AND TO HEAD FOR OPEN WATERS UNTIL AN ALL CLEAR IS SOUNDED. THERE IS NO TSUNAMI; THIS IS ONLY A TSUNAMI DRILL.

11. NEXT STEPS

1. To establish country-wide tsunami risk and understanding of the special operational concepts, organization, tasks, and coordinated emergency actions of public agencies, utility districts, and other organizations and institutions which would be involved in a tsunami warning response and rapid deployment of mutual aid; and,

2. to provide for mobilization and direction of national and various district emergency organizations in support of tsunami evacuation and security operations.

What is required is a full integration of these herein described tsunami protocols and SOPs into the state disaster/communications/education legislation and adopted plans which include among others:

Insert names of Participating State National Disaster Plans, etc.

The types of processes outlined in these previous disaster/communications/education documents do not address the urgent nature of a tsunami. To integrate the tsunami protocols and SOPs will require that CDEMA and/or the National Disaster Management Organization convene a disaster/ communications/ education planning update process **with the participation (decision makers from each of these agencies need to be sitting at the same table)** from at a minimum, all of the agencies that are members of the State National Emergency Operations Centre's (NEOC) Executive Group. This should be a comprehensive undertaking and result in good preparation for such an undertaking and anticipation of a couple different 2 or 3 day workshops over a period of several months to formulate and agree to actual revisions to the current documents.

12. ALERT AND COMMUNICATIONS TOOLS

12.1 INTRODUCTION

Dissemination technologies and methods for Tsunami alerts in the Caribbean have to be adapted to the local situation, requirements and capacities to be effective. There may be no single best method of warning dissemination that fits all participating states. There are many factors and questions which need to be considered before the technical setup of a warning message dissemination system. Key factors and questions are:

- Who needs to be informed
- Where are recipients located
- What are they doing at what time of the day/night
- What specific needs do recipients have
- How will people understand and react to a warning
- Season (e.g. fishing, harvesting, tourist season)
- What happens in the case of an electric power failure etc.
- Do people have landline and cell phones?
- Do they have access to TV and radio?

Notification systems and related activation procedures should respond to tsunami warnings triggered by the National TWFP based on the tsunami warning bulletin received and evaluated (SOPs are provided in other sections of the document). Notification systems incorporate both dissemination of information and alert warnings for emergency response agencies and citizens alike and use a variety of alert and notification tools depending somewhat on the existing infrastructure.

The effectiveness of any local community warning system depends on the reliability of the interface between the source(s) of information and the community notified, alerted and warned. Effectiveness also depends on operator and recepient training and also, the accuracy of the source information. A poorly defined interface results in a poor system. A well-defined system can result in a response that is protective, predictable, and reliable.

Good warning system should have at least the following characteristics:

- Reach all people within the risk area
- Familiar, understood and accepted by all
- Always operational and ready to warn
- Easy to operate (especially necessary in stressful situations)
- Secure enabling only authorized persons to initiate an alert (hoax proof)
- Redundant configuration of components available even in the absence of power
- Fast, accurate transmission with assured delivery and automatic confirmation
- Common standardized message that fits all warning tools, and not vendor specific.

There are many additional characteristics that can be added, but the above represent the minimum set for a good system.

The warning tools provide two components that comprise the public alert: 1) Alert and 2) Notification. Alert is to grab people attention and cause them to feel that there is an emergency that might affect them, and notification is event specific messages with situation description and instructions.

In all cases, training, including regular public information, is of singular importance. Special information must be provided to transients, such as tourists and seasonal workers, who are less likely to know how to react to tsunami warnings.

12.2 TSUNAMI EMERGENCY RESPONSE ACTION PRINCIPLES

Following are Tsunami Emergency Response Action Principles[12] to be used in guiding the development of alert and warning systems:

1. TWFP must understand and interpret Tsunami Warning Center messages into actions (i.e. evacuations – yes or no)
2. TWFP must Receipt of TWC messages on a 24x7 basis at all level of government (SOPs enclosed address the requirements to notify the key first responder officials, further actions will need to be developed by each of those first responder agencies to assure all appropriate government officials are notified)
3. Rapid Notification of Decision Makers
4. Rapid Notification of the Public
5. Rapid Notification of the Broadcast Media
6. Rapid Notification and Recall of Emergency Staffs (this will only be possible after each CDEMA PS Disaster Management Organization and key first responder officials have developed SOPs for actions to be taken)
7. Rapid Notification of Government agencies and key NGO's and other organizations who are tasked with assisting in the alert notification and response activities
8. Ability to enact land (inland and vertical) evacuation and sea evacuation procedure.
9. Open shelters available for evacuees.

12.3 AVAILABLE NOTIFICATION SYSTEMS AND PROCEDURES

There are various types of tools and procedures for notifying coastal residents and visitors of tsunamis and other coastal hazards. Technology developments have facilitated having all systems and tools functioning as a whole under one umbrella of activities referred to as a 'common protocol.' This allows one operator, to initiate one preprogrammed series of actions, which activates all tools (notification and alert and warning) fostering more immediate notification and response activities.

[12]Tsunami Emergency Action Principals provided by Brian Yanagi, Disaster Management Specialist, International Tsunami Information Centre

CDEMA PS's officials/TWFP is required to send alert and warning messages using multiple warning tools, most of which may use different coding schemes, activation methods, and technologies. This might result in the delivery of different messages being provided to the public based on what type of system is being used. Activating the various tools individually will also significantly increase the workload on the individual(s) activating the various systems and could create different versions for the same message. All systems should be designed to be simply and accurately activated by a single operator and a single message that fits all warning tools.

Notification systems include sirens, strobe lights, telephones (land lines, cell and SAT phones), text messaging, special warning radios and many other tools. The goal for any community is to have the most effective coverage for the lowest cost. *Therefore, it is critical to have local needs professionally evaluated.* The costs of implementing new systems can be relatively high. They include not only systems costs, but costs for other component systems (such as radios, etc.), labor, maintenance, and training. If several adjacent communities decide to use the same system, costs could be reduced by purchasing equipment in quantity. In addition to the cost savings, similar systems will allow for improved coordination in multi-nation events.

12.3 SIRENS

Sirens are devices that transmit different sounds or voice messages depending on the action that is required. They can be either electro-mechanical or electronic. Sirens are triggered locally (at the siren) or centrally (automatically). Siren units, whether electro-mechanical or electronic, are essentially of two basic types:

1. Those designed to project sound at once in a 360 degree pattern (omnidirectional), or
2. Those designed to project sound in one direction while the unit rotates or oscillates through 360 degrees.
3. Sirens can also be fixed to project sound only in one direction.

The benefit of a directional siren is that coverage is provided only in those areas that are needed. The main difference between fixed and rotating is the amount of coverage area. A rotating siren increases the coverage area. For example the coverage area for a fixed siren would be a 1,000-2,500' feet radius from the siren; a rotating siren would increase the coverage to a one mile radius. For a stationary listener, the sound from a rotating siren goes up and down in loudness, while sending out the sound wave in all directions.

When electronic sirens are used, they can be used to issue public address announcements (where announcements are pre-recorded memory devices containing short instructive announcements sent through the same speakers as the siren, or live broadcast).

12.4 TELEPHONES

Telephone notification systems are designed to automatically ring in the operational area (homes and businesses) and notify recipients of the needed action to take (in the case of a tsunami, this would be to evacuate immediately to higher ground). The pre-recorded telephone message would announce evacuation in a clear and concise manner and would be activated from an emergency operation center or as part of a preprogrammed 'common protocol.'

Telephone notification systems can deliver accurate information to the targeted audience; however, its speed is limited due:

1. telephone infrastructure such as switches
2. number of lines that can be used by the delivery infrastructure.

Hence this method is used more as notification tool rather than alerting tool.

12.5 SPECIAL RADIOS

12.5.1 WEATHER RADIO

In the United States, National Weather Service broadcasts all its warnings, including tsunami warnings, on its existing VHF-FM network, known as NOAA Weather Radio. Upon broadcast, these warnings activate alarms on specially designed receivers. Similar system can be built elsewhere. In Mexico City a simple network of 3 transmitters provides the infrastructure, enabling the use low cost American receivers.

12.5.2 RDS RADIO

RDS Alert Network uses a specially designed clock radio to wake people up and send them messages that they can read on the display. A pilot system is installed in Anguilla.
The RDS system can also be used as a one way activation mechanism for sirens.

12.6 ELECTRONIC SIGNS

Electronic signs can be fixed or mobile. They are mostly installed along busy roads, and often on movable trailers and used for traffic warnings etc. Existing electronic signs can be utilized for tsunami early warning purposes. Electronic signs are often remotely controlled and can be linked to the tsunami warning system. They can also be linked to FM-RDS technology.

12.7 SIGNS

Signs can be set up on important strategic locations like beaches or busy roads and intersections. They can display that a tsunami is immanent and give instructions.
People can be signaled that the tsunami warning sign is active through a strobe light and/or a siren on top. In Japan such warning signs are used e.g. on beaches.
Flashlights can be activated through remote control and powered by batteries.

12.8 AERIAL FLARES OR EXPLOSIVE REPORTS

Aerial flares and explosive bangs (blank ammunition) would be useful for beach goers or others who are remotely located and, often by desire, not near conventional information sources. They could be used to supplement other notification systems in the case of a distant tsunami. They could be used to notify people to evacuate in the case of a local tsunami only if there is action within seconds after earthquake shaking stops. The liabilities of aerial flares or explosive reports are: 1. They would likely attract people to the source rather than encourage them to leave. 2. They are considered distress signals and can generate false alarms that must be investigated by the Coast Guard while they are dealing with the tsunami alert. 3. Pyrotechnics are dangerous to store and use without proper training.

12.9 BILLBOARDS

Strategically placed billboards are an excellent method to educate the public to the significance of other alert systems. Supplemental light signals (strobes or flashers) can be used to draw attention to them to clarify the meaning of a primary public alert system when it has been activated.

12.10 AIRCRAFT

Aircraft could announce the evacuation notification for distant tsunamis from a loudspeaker. This system would most likely be coordinated by local fire, police and emergency management offices in coordination with Civil Air authorities. The contact would be personal and perhaps more believable. Aircraft can cover isolated areas effectively. Voice delivery requires a significant public address system that is not typically installed in aircrafts. It is important to use pre-scripted messages.
Text delivery requires designing, preparing, and staging leaflets in advance. Once dropped, all of the leaflets would need to be recovered or quickly (less than a week) decomposed to prevent false alarms or pollution.

Towed banners or message boards are a possible option. (Towed banners for fixed wing; message boards for helicopters.) Fixed wing aircraft have significant range and are relatively quiet; however, flying low and slow to deliver a message places the aircraft in significant risk. Helicopters are able to fly low and slow; however, they are very noisy and have limited range. Aircraft could be called on to fly at any time and in any weather conditions. However, flying in foul weather or at night requires specialized aircraft and training. Having the appropriate resources available on short notice requires significant prior planning. Coast Guard aircraft are available on a 24/7 basis, but are primarily needed for search and rescue.

12.11 MOBILE LOUDSPEAKERS

Public address vehicles are a viable option for areas where installing fixed public address systems is not cost effective. The system can be designed to quickly bolt onto an existing vehicle and amplify a pre-recorded or transmitted message. This system could be practical for large beaches and parks. However, there would be limited staff covering a large area by vehicle.

12.12 E-MAIL

E-mail is useful when a text message is needed. E-mail can be used not only to desktop computers, but to transmit text messages to digital cell phones. Digital messaging for cellular phones does not operate if digital service shared with the cell provider is unavailable.

12.13 AMATEUR RADIO

Amateur radio operators can transmit messages along the coast for distant events. They are especially important in situations where power is out. This notification system is limited, because correspondence would only be between individual operators and homes and businesses adjacent to the operator.

12.14 CHURCH BELLS

During hundreds of years, church bells would toll to let residents know of any emergency. While this is associated with large metallic bells with a rope that a person draw to stroke the bell, new church bells are modernized and consist of electronic sound generator and high level speaker, resembling electronic sirens. Church bells can connect either automatically or manually to the tsunami warning system.

12.15 FLAGS

Flags can be raised to indicate that a tsunami warning was issued. Different flags can be assigned to different simple messages. Flags will only work if the public is educated about their meaning. Flags can only carry very limited information, like sirens without broadcasting function. Flags are only making sense where they can be seen, so their range is limited. Flags could be used on beaches that are frequented by tourists or locals. To be effectively recognized flags rely on daylight.

12.16 KITES

Kites are a very uncommon communication tool. They are only effective under the right wind conditions and during bright daylight. In Bali for example, kites are kept in the air day and night over weeks due to special wind conditions. Kites can be quite large and carry simple messages consisting of a few words. These messages should be prepared in advance. To be effective people need to be informed about the kites existence as a warning tool otherwise they will not be recognized as credible. If at all, kites are only a complementary warning tool.

12.17 COMPUTER POP-UP

A computer pop-up alert is a recent alert and warning tool. The massive use of computers linked in a network enabled the technology to evolve, while the huge number of individuals spending more time in front of the monitors created the demand. California tsunami alerts use this tool (among the others) – http://edis.oes.ca.gov.

12.18 PAGERS

The initial purchase price and subscriber cost-of-ownership make pagers an overpriced option for public notification. While it may not be feasible in many places to do this on a large scale, it may be practical for some small or special settings. Pagers allow direct communication with responsible authorities (e.g., teachers), who then can direct actions to be taken. Pagers can be triggered by a broadcast calling service, through e-mail, or by a government-owned paging system. Pagers can be discontinued if not needed at far less cost than other systems and they can be distributed quickly without the planning, engineering, bidding, and contracting processes involved with establishing siren or other hardware-intensive systems.

13. CONCLUSION

The potential for a tsunami event is real. The risk is credible that a tsunami could occur that would affect the coastline/s of CDEMA PS. The degree of damage experienced by tsunami waves will depend on:

1. the local sea bottom and coastal topography as well as the incoming direction of the tsunami;
2. how well the emergency response agencies have planned for and are prepared to respond to the event immediately;
3. how well the alert systems advising the public to evacuate function and how quickly they can be made to sound; and,
4. how well the public is educated and responds to the evacuation alerts.

13.1 TSUNAMI WARNING PROTOCOL ADAPTATION WORKSHOP

13.1.1 WORKSHOP AGENDA SUGGESTIONS

Upon completion of draft adapted protocols and SOPs, a workshop should be held by the Disaster Management Organization in the Participating State to review and refine the adaptation of the TCHWS Model Protocol. Provide an illustration of the Protocol showing the three basic requirements of tsunami warning: data gathering; communication; and public alerting. The role of the TWFP in the Tsunami Warning Protocol should be outlined and descriptions should be provided for the types of Tsunami Bulletins currently received by the TWFP. In addition, during each workshop, the SOP diagram should be introduced and participants walked carefully through an SOP example, highlighting the role of the TWFP.

In an effort to assure a comprehensive test/review of the proposed Tsunami Warning Protocol during the workshop, four (4) different working groups might be established from among the workshop participants, as follows:

1. Communications
2. Coastal Evacuation Planning
3. Tsunami Public Awareness & Education
4. Next Steps: The Way Forward & Development of Broadcast Media, Cell Service Company and Other Public Alert & Notification Partnerships

Participants in each group should be asked to review the protocol and the related SOPs and assess and report on the practical requirements of tsunami warning, to identify the challenges for implementation based on existing resources (staff and technical), and to make recommendations for resource, protocol and/or infrastructure improvements for their group.

13.1.2 RECOMMENDATIONS FOR WORKSHOP PARTICIPANTS

Recommendations to be considered during the Participating State's National Workshop for Adaptation of the CDEMA Tsunami Warning & Other Coastal Hazards System's Tsunami Warning Protocol & SOPs:

- The TWFP will receive the official message from the PTWC. The TWFP/TWCP initiates Tsunami Alert and Warning Dissemination Procedures according to the Participating State's Adapted Tsunami Warning SOPs.

- All possible alerting devices will be used during a Tsunami Warning to the public.

- The Disaster Management Organization will document the requirements for a comprehensive end to end alert warning system, identify the costs and seek funding for implementation.

- The (*insert name of Participating Agency*) is the delegated legal authority to evacuate residents and this fact will be clarified in all emergency management agency educational trainings concerning tsunami risk and related preparedness for immediate tsunami alert and warning of Participating residents.

- A monthly drill of tsunami alert and warning protocol will be initiated to assure that all contact information contained in the SOPs is up to date and relevant. The monthly drill may incorporate public alerting devices; this will enhance the emergency responders preparation, the news media's preparedness and understanding, and ongoing public education about how the public will know that a tsunami is imminent.

- The Disaster Management Organization will engage in further development of their existing emergency situation protocols to include tsunami warning information dissemination to all necessary government and non-government agencies involved in alerting, warning, and relief and recover activities and further develop the Protocol.

- SOPs for tsunamis must be reviewed and updated frequently, procedures tested and drilled and emergency staff trained. This because a tsunami is a rare event, but if such an event occurs everyone must be well trained and ready to act immediately.

- When a local earthquake has ***ANY*** potential for a tsunami, a full alert will be issued immediately. (Further to this point, that no loss of life is acceptable and given the urgency, the current lack of adequate information to make fully informed evaluations, no other course of action is reasonable.)

- Key to successful tsunami response includes:

    - Education of the Public.
    - Installation of a comprehensive alert and warning system.
    - Practice – Practice – Practice of the SOPs.

APPENDIX A. PACIFIC TSUNAMI WARNING CENTER INTERIM COMMUNICATIONS PLAN

Limited Distribution

ICG/CARIBE EWS-II/11
Paris, 20 February 2007
Original: English only

Communication Plan for the Interim Tsunami Advisory Information Service to the Caribbean Sea and Adjacent Regions

23 July 2006 Version

NOAA Richard H. Hagemeyer
Pacific Tsunami Warning Center

Communication Plan for the Interim Tsunami Advisory Information Service for the Caribbean Sea and Adjacent Regions

29 June 2006 Version

NOAA Richard H. Hagemeyer
Pacific Tsunami Warning Center

Introduction. In the aftermath of the unprecedented December 26, 2004 tsunami disaster that occurred in the Indian Ocean it has been widely recognized that tsunami mitigation measures must be put place in all oceans and seas with a tsunami hazard. Even when that hazard is relatively small, this event demonstrated that the consequences can be tragically and unacceptably great when no mitigation measures are in place.

One part of tsunami mitigation is an early warning system. Countries in the Caribbean region are taking steps to establish such a system and have formed the Intergovernmental Coordination Group for the Tsunami and Other Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions (ICG/CARTWS). However it will likely be some time before the required infrastructure is in place, training is complete, and the region can fully provide this service for itself.

In the interim, and based on discussions that began at the International Conference for the Development of a Tsunami and Coastal Hazards Warning System for the Caribbean Sea and Adjacent Regions, organized by the UNESCO Intergovernmental Oceanographic Commission's IOCARIBE Sub-Commission jointly with the UN-ISDR, WMO, and UNEP CAR-CU, 1-3 June 2005 in Mexico City, Mexico, the NOAA Richard H. Hagemeyer Pacific Tsunami Warning Center (PTWC) has agreed to provide limited early warning services to the Caribbean Sea and Adjacent Regions (CAR).

Currently available seismic data from the region (Figure 1) will permit a preliminary earthquake evaluation within 10 to 20 minutes of the rupture. As additional stations become are added, this response time will decrease.

Currently available sea level data from the region (Figure 2) are insufficient to quickly detect if a tsunami exists nor measure its size from all the potential source regions. However, new deep ocean gauges have recently been deployed and new coastal gauges are planned to improve this coverage.

Utilizing these data, PTWC will issue "Tsunami Information Statements" for large earthquakes that may cause concern but do not have significant tsunamigenic potential, and "Tsunami Watch Messages" for large potentially tsunamigenic earthquakes as well as for confirmed teletsunamis.

The following sections describe in further detail the criteria for issuance of these products, the general content of the products, how products are disseminated, and recommended procedures for acting on the products.

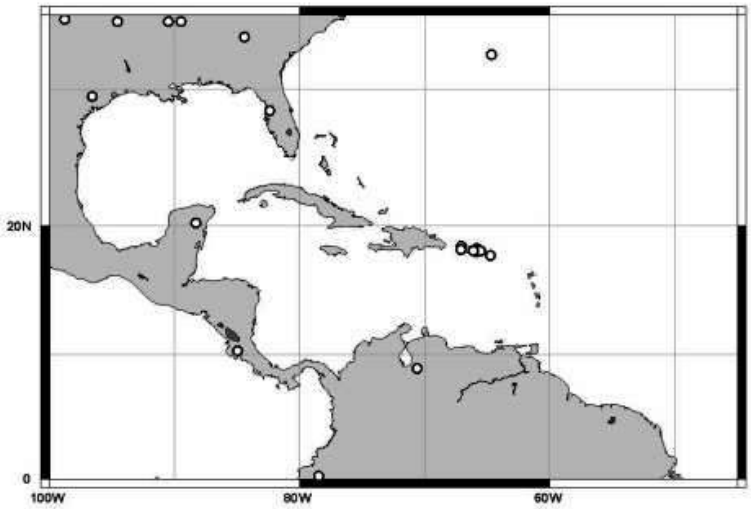


Figure 1. Location of seismic stations (open circles) in or near the Caribbean that provide real time waveform data to PTWC and are used for evaluating earthquakes in the region. A listing of all stations used by PTWC to evaluate earthquakes is provided in Appendix I.

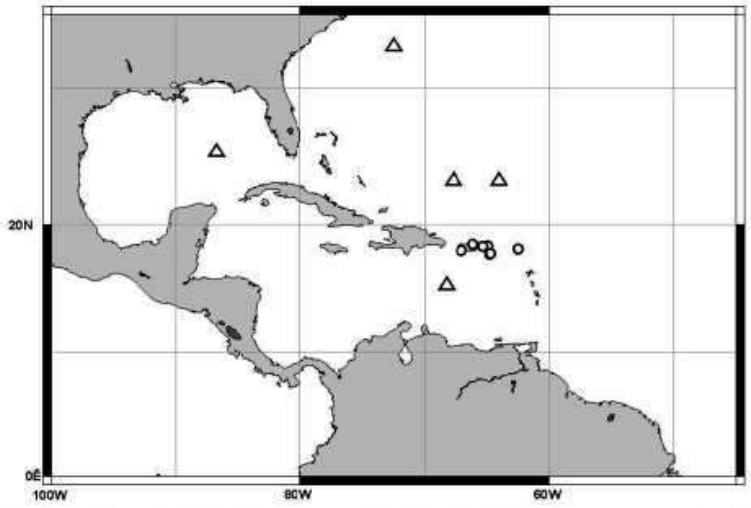


Figure 2. Coastal sea level stations (open circles) and DART deep ocean sea level stations (open triangles) in the Caribbean region with data available to PTWC in near real time. Additional coastal stations are needed to cover all likely tsunami source regions. A listing of stations is provided in Appendix II.

Product Issuance Criteria

There are three key earthquake parameters that can be determined quickly from seismic waveform data for the evaluation of an earthquake's tsunamigenic potential. They are: 1) location - whether the earthquake is located under or very near the sea, 2) depth - whether the earthquake is located close enough to the earth's surface to have caused a significant deformation of that surface and consequently a movement of the sea, and 3) magnitude - the size of the earthquake. Table 1 shows various combinations of these parameters and the types of products that will be issued for the CAR by PTWC for each case. These criteria are similar to what PTWC uses in the Pacific and Indian Oceans.

Table 1. Seismic criteria for PTWC's issuance of products in the CAR.

Earthquake Depth	Earthquake Location	Earthquake Magnitude (Mw)	Description of Tsunami Potential	Product Type
< 100 km	Under or very near the sea	6.0 to 7.0 Caribbean	Very small potential for a destructive local tsunami	Tsunami Information Statement
		6.5 to 7.8 Atlantic	Very small potential for a destructive ocean-wide tsunami	Tsunami Information Statement
		7.1 to 7.5 Caribbean	Potential for a destructive local tsunami	Local Tsunami Watch Message
		7.6 to 7.8 Caribbean	Potential for a destructive regional tsunami	Regional Tsunami Watch Message
		≥ 7.9 Caribbean & Atlantic	Potential for a destructive ocean-wide tsunami	Ocean-wide Tsunami Watch Message
	Inland	≥ 6.0 Carib ≥ 6.5 Atlan	No tsunami potential	Tsunami Information Statement
≥ 100 km	All Locations	≥ 6.0 Carib ≥ 6.5 Atlan	No tsunami potential	Tsunami Information Statement

Earthquake Magnitude: The magnitude used by PTWC is the moment magnitude, Mw. It is more accurate for large earthquakes than the more common Richter magnitude. The moment magnitude determined by PTWC for initial products is Mwp, based on the first arriving seismic P waves. Subsequent estimates of Mw may be made by methods based on later arriving seismic waves.

Local Tsunami: A local tsunami is one with destructive or life threatening effects usually limited to within 100 km of the epicenter.

Regional Tsunami: A regional tsunami is one with destructive or life threatening effects usually limited to within 1000 km of the epicenter.

Ocean-wide Tsunami: An ocean-wide tsunami is one with destructive or life threatening effects that can extend across an entire ocean basin.

Message Content

Products are divided into just a few general sections. A **header** gives the product number. It starts at 1 for each event and is incremented if subsequent products are issued for the same event. The header also indicates who issued the product, in this case PTWC, and the time the product is issued. The header is followed by a statement about **who the product is intended for** -- all areas of the Caribbean. The next line is a banner indicating the **type of product**, a Tsunami Information Statement or a Tsunami Watch Message. If a Tsunami Watch is in effect, the countries in a watch are indicated. This is followed by the **preliminary earthquake parameters** including the origin time, coordinates, location name, and earthquake magnitude. If any **sea level observations** are available, they are provided next. Until more real time reporting sea level gauges are installed, however, such observations will be very limited or non-existent. The next section is the **evaluation**. It contains descriptive language about the potential for a destructive tsunami. If a Tsunami Watch is issued, **estimated arrival times** for forecast points (Figure 3 and Table 2) within the Watch area are provided. Last is a statement about **if and when a subsequent product** will be issued for the event. Sample products are provided in Appendix III.

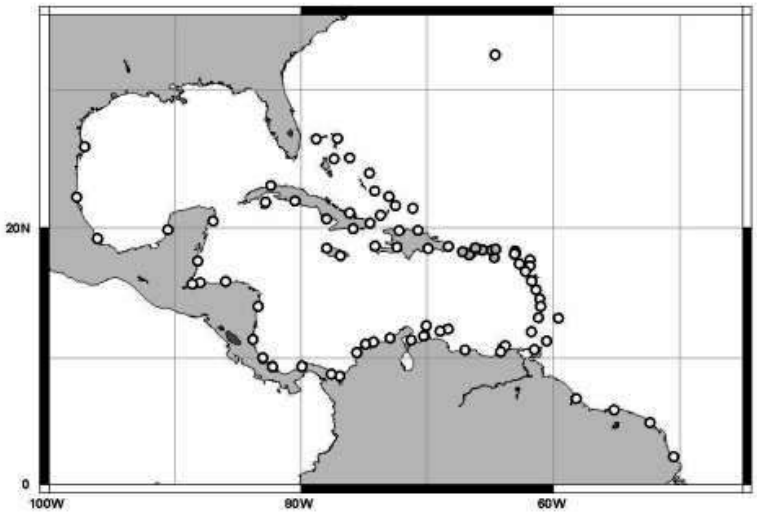


Figure 3. Preliminary forecast points for countries in the Caribbean region. Tsunami Watch Messages provide estimated times of arrival for forecast points in the region of the Tsunami Watch.

Table 2 List of preliminary forecast points for the Caribbean region.

COUNTRY	FORECAST POINT	LATITUDE (+N,-S)	LONGITUDE (+E,-W)
BAHAMAS	ABACO IS	26.556	-77.079
	FREEPORT	26.514	-78.782
	NASSAU	25.094	-77.351
	ELEUTHERA IS	25.157	-76.124
	SAN SALVADOR	24.066	-74.547
	CROOKED IS	22.747	-74.141
	MAYAGUANA	22.330	-72.999
	GREAT INAGUA	20.948	-73.684
TURKS_N_CAICOS	WEST CAICOS	21.671	-72.487
	GRAND TURK	21.468	-71.107
BERMUDA	RUTHS BAY	32.356	-64.637
CUBA	NUEVA GERONA	21.922	-82.797
	CIENFUEGOS	22.007	-80.465
	SANTA CRZ D SUR	20.682	-77.959
	LA HABANA	23.151	-82.364
	GIBARA	21.119	-76.122
	BARACOA	20.356	-74.498
	SANTIAGO D CUBA	19.947	-75.850
JAMAICA	MONTEGO BAY	18.471	-77.933
	KINGSTON	17.913	-76.854
HAITI	JEREMIE	18.641	-74.107
	CAP-HAITEN	19.792	-72.188
	PORT-AU-PRINCE	18.544	-72.369
DOMINICAN_REP	CABO ENGANO	18.612	-68.290
	PUERTO PLATA	19.813	-70.692
	SANTO DOMINGO	18.455	-69.893
PUERTO_RICO	FAJARDO	18.346	-65.626
	PONCE	17.966	-66.637
	MAYAGUEZ	18.204	-67.173
	SAN JUAN	18.489	-66.168
US_VIRGIN_IS	ST. JOHN	18.333	-64.810
	ST. CROIX	17.761	-64.709
	ST. THOMAS	18.315	-64.930
BR VIRGIN IS	TORTOLA	18.407	-64.601
ANGUILLA	THE VALLEY	18.252	-63.051
SAINT MARTIN	BAIE BLANCHE	18.117	-63.010
SAINT MAARTEN	SIMPSON BAAI	18.034	-63.104
SAINT KITTS	BASSETERRE	17.290	-62.718
BARBUDA	PALMETTO POINT	17.578	-61.863
ANTIGUA	SAINT JOHNS	17.131	-61.874
MONTSERRAT	PLYMOUTH	16.706	-62.234
GUADELOUPE	BASSE-TERRE	15.982	-61.737
DOMINICA	ROSEAU	15.297	-61.396
MARTINIQUE	FORT-DE-FRANCE	14.598	-61.082
SAINT LUCIA	CASTRIES	14.017	-61.031
BARBADOS	BRIDGETOWN	13.091	-59.622
ST VINCENT	KINGSTOWN	13.136	-61.214
GRENADA	SAINT GEORGES	12.046	-61.754
TRINIDAD_TOBAGO	PIRATES BAY	11.327	-60.559
	PORT-OF-SPAIN	10.641	-61.528

COUNTRY	FORECAST POINT	LATITUDE (+N,-S)	LONGITUDE (+E,-W)
VENEZUELA	PORLAMAR	10.948	-63.842
BONAIRE	ONIMA	12.256	-68.309
CURACAO	WILLEMSTAD	12.094	-68.934
ARUBA	ORANJESTAD	12.506	-70.042
BRAZIL	FORTALEZA	-3.707	-38.480
	SAO LUIS	-2.470	-44.309
	ILHA DE MARACA	2.208	-50.488
FRENCH GUIANA	CAYENNE	4.931	-52.350
SURINAME	PARAMARIBO	5.934	-55.198
GUYANA	GEORGETOWN	6.840	-58.196
VENEZUELA	CUMANA	10.469	-64.197
	MAIQUETIA	10.608	-66.966
	PUNTO FIJO	11.707	-70.232
	GOLFO VENEZUELA	11.399	-71.245
COLOMBIA	RIOHACHA	11.554	-72.920
	SANTA MARTA	11.247	-74.225
	BARRANQUILLA	11.070	-74.866
	CARTAGENA	10.412	-75.563
	PUNTA CARIBANA	8.624	-76.898
PANAMA	PUERTO CARRETO	8.783	-77.573
	COLON	9.372	-79.914
	BOCAS DEL TORO	9.351	-82.242
COSTA RICA	PUERTO LIMON	10.001	-83.013
NICARAGUA	PUNTA GORDA	11.437	-83.793
	PUERTO CABEZAS	14.019	-83.374
HONDURAS	TRUJILLO	15.931	-85.958
	PUERTO CORTES	15.850	-87.973
GUATEMALA	PUERTO BARRIOS	15.745	-88.597
BELIZE	BELIZE CITY	17.503	-88.178
MEXICO	COZUMEL	20.516	-86.955
	CAMPECHE	19.867	-90.539
	VERACRUZ	19.201	-96.116
	MADERO	22.291	-97.785
	TEXAS BORDER	25.972	-97.141

Product Dissemination

The following circuits and methods will be used to disseminate products:

1) Global Telecommunications System of the World Meteorological Organization (WMO/GTS)
2) Internet Email
3) Telefax
4) U.S. NOAA Weather Wire
5) U.S. Advanced Weather Information Processing System (AWIPS)

The GTS is the backbone of the international dissemination system, but telefax and email are also widely utilized. The NOAA Weather Wire facilitates making all these products available to independent subscribers such as the media through the U.S. National Weather Service's Family of Services. AWIPS distributes the products to all U.S. Weather Forecast Offices.

Two levels of product are distinguished and given separate World Meteorological Organization (WMO) identifiers (Table 3).

Table 3. PTWC Caribbean Product IDs for WMO/GTS and AWIPS.

WMO/GTS ID	AWIPS ID	Product Type
WECA41 PHEB	TSUCAX	Tsunami Watch Message
WECA43 PHEB	TIBCAX	Tsunami Information Statement

Communications Tests

PTWC will conduct communications tests approximately four times per year to verify that communications links to designated contact points are functioning properly. The test will be issued with the product identifier of a Tsunami Watch Message (WEIO21 PHEB and TSUIOX), but it will only be a test. A sample communications test message is shown below.

```
FROM: PACIFIC TSUNAMI WARNING CENTER IN EWA BEACH HAWAII

TO: TSUNAMI CONTACT POINTS FOR THE FOLLOWING COUNTRIES IN
    THE CARIBBEAN REGION

      BAHAMAS
      TURKS AND CAICOS
      BERMUDA
      CUBA
      JAMAICA
      HAITI
      DOMINICAN REPUBLIC
      PUERTO RICO
      US VIRGIN IS
      BRITISH VIRGIN IS
      ANGUILLA
      SAINT MARTIN
      SAINT MAARTEN
      SAINT KITTS
      BARBUDA
      ANTIGUA
      MONTSERRAT
      GUADELOUPE
      DOMINICA
      MARTINIQUE
      SAINT LUCIA
      BARBADOS
      SAINT VINCENT
      GRENADA
      TRINIDAD TOBAGO
      VENEZUELA
      BONAIRE
      CURACAO
      ARUBA
      BRAZIL
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      FRENCH GUIANA
      SURINAME
      GUYANA
      VENEZUELA
      COLOMBIA
      PANAMA
      COSTA RICA
      NICARAGUA
      HONDURAS
      GUATEMALA
      BELIZE
      MEXICO

    --- ALL OTHERS PLEASE DISREGARD ---

SUBJECT:  TSUNAMI DUMMY (COMMUNICATION TEST).

THIS IS A TEST TO VERIFY COMMUNICATION LINKS AND DETERMINE
TRANSMISSION TIMES INVOLVED IN DISSEMINATION OF TSUNAMI
ADVISORY INFORMATION TO THE CARIBBEAN REGION.

RECIPIENTS ARE REQUESTED TO PLEASE RESPOND BACK TO THE
PACIFIC TSUNAMI WARNING CENTER. THE RESPONSE SHOULD INCLUDE

   1 - NAME OF OFFICE THAT RECEIVED THIS TEST
   2 - METHOD OR METHODS BY WHICH OFFICE RECEIVED THIS TEST
   3 - INCLUDE EMAIL ADDRESS OR FAX NUMBER OF EACH METHOD
   3 - TIME OF RECEIPT OF THIS TEST BY EACH METHOD

PLEASE RESPOND VIA ONE OF THE FOLLOWING

   EMAIL   -  PTWC@PTWC.NOAA.GOV
   TELEFAX -  808-689-4543

THANK YOU FOR YOUR PARTICIPATION IN THIS COMMUNICATION TEST.
```

Procedures for Acting on Products

It is the responsibility of the contact point for each country, where PTWC products are received, to establish procedures for acting on them in a way to save lives and reduce property damage. These procedures should include:

1) Rapid notification of decision-making authorities
2) Decision-making regarding the ordering of evacuations and other protective measures
3) If warranted, rapid and comprehensive notification of the public at risk
4) Procedures for evacuations including establishment of evacuation zones and routes
5) Response procedures in case of a tsunami disaster

A significant challenge associated with these procedures is the decision-making about evacuations, particularly since evacuations can be very costly and disruptive and there is a significant probability of false alarms owing to the current lack of adequate sea level data from the source region. Procedures can include pre-determined decisions, such as automatically notifying the media and public for nearby events when time is very limited.

Contact Points

Each country must designate an official focal point (or points) for receiving PTWC products. It is important to have an official designated point or points and a single authority to avoid confusion that could result if conflicting information is disseminated to the public from multiple authorities. Information about the focal point(s) must be kept up-to-date. Contact information should be submitted to IOC or IOCARIBE or PTWC. Necessary information is described on the form that follows.

PTWC may be contacted at the following coordinates:

Director	Day Tel:	808-689-8207
Pacific Tsunami Warning Center	24x7 Tel:	808-689-6655
91-270 Fort Weaver Road	Fax:	808-689-4543
Ewa Beach, HI 96706	Email:	charles.mccreery@noaa.gov
USA	Ops:	ptwc@ptwc.noaa.gov

Form for designating or updating official Interim Tsunami Watch contact information.

Name of Country:

Name and Address of Contact Person and Agency
Name of Person:
Title:
Agency:
Mailing Address 1:
Mailing Address 2:
Mailing Address 3:
Mailing Address 4:
Country:

Telephone numbers
Primary (24-hour):
1st alternate:
2nd alternate:

Station Location:
Latitude:
Longitude:

FAX numbers
Primary (24-hour):
1st alternate:
2nd alternate:

E-mail address
Primary (24-hour):
1st alternate:
2nd alternate:

Designated Communication Method for Products - GTS, fax, or email
Primary:
Secondary:

Date of this update:

Comments:

Appendix I. Broadband seismic stations providing real time continuous waveform data to PTWC.

STATION	LAT (+N, -S)	LON (+E, -W)
AAK	42.64	74.49
AAM	42.70	-84.39
ADK	51.88	-176.68
AFI	-13.91	-171.78
AGPR	18.47	-67.11
AHID	42.72	-112.85
AKUT	54.14	-165.77
ANMO	34.58	-107.70
ANTO	39.87	32.79
ARU	56.43	58.56
ATKA	52.20	-174.20
BAR	32.68	-116.67
BBSR	32.37	-64.70
BDFB	-15.64	-48.01
BFO	48.33	8.33
BILL	68.04	166.27
BMN	40.43	-117.22
BINY	42.72	-76.25
BJT	40.02	116.17
BGCA	5.18	18.42
BLA	37.21	-80.42
BMRM	60.96	-144.58
BOSA	-28.61	25.25
BOZ	45.65	-111.63
BRVK	53.06	70.28
BW06	42.77	-109.56
BZN	38.48	69.82
CBKS	38.65	-100.65
CBYP	18.27	-65.86
CCM	38.64	-92.53
CDVI	17.75	-64.77
CHTO	18.81	98.94
CEH	35.59	-80.33
CMB	38.03	-120.39
CPD	18.04	-65.92
COCO	-12.19	96.83
COLA	65.07	-149.45
COR	44.59	-123.03
CPUP	-26.33	-57.33
CRAG	55.47	-133.12
CTAO	-20.34	148.44
CWC	36.44	-118.08
DAC	36.28	-117.59
DBIC	6.67	-4.86
DGAR	-7.41	72.45
DIV	61.13	-145.77
DUG	40.20	-112.81

STATION	LAT (+N, -S)	LON (+E, -W)
DWPF	28.48	-82.37
EFI	-51.68	-58.06
ELK	40.68	-116.92
ERW	48.45	-122.63
ESK	55.32	-3.21
ESLA	39.67	-3.96
EYAK	60.55	-145.75
EYMN	47.80	-92.53
FFC	54.73	-101.98
FUNA	-8.53	179.20
GNI	40.05	44.72
GNW	47.56	-122.83
GOGA	33.56	-84.40
GUMO	13.59	144.87
GWDE	38.83	-75.62
H2O	27.88	-141.99
HAWA	46.39	-119.53
HIA	49.82	120.99
HKT	29.48	-96.58
HLID	43.73	-115.91
HNR	-9.43	159.95
HON	21.32	-158.01
HON1	21.32	-158.01
HOPS	38.99	-123.07
HRV	42.51	-71.56
HUMP	18.14	-65.85
HWUT	41.61	-111.57
INCN	37.63	128.12
ISA	35.66	-118.47
ISP	37.82	30.52
JCC	40.82	-124.03
JFWS	42.71	-91.51
JTS	10.29	-84.95
KHU	19.25	-155.62
KKM	6.04	116.21
KMBO	-1.13	37.25
KNB	37.02	-112.82
KWAJ	8.80	167.61
LBNH	44.74	-72.19
LBTB	-25.01	25.60
LON	46.75	-121.81
KAPI	-5.01	119.75
KBS	78.30	11.94
KCC	37.32	-119.32
KDAK	57.78	-152.58
KIP	21.42	-158.01
KIV	43.96	42.69

STATION	LAT (+N,-S)	LON (+E,-W)
KONO	59.65	9.60
KURK	50.72	78.62
LKWY	44.57	-110.40
LPAZ	-16.29	-68.13
LSCT	41.70	-74.22
LSZ	-15.28	28.19
LTX	29.33	-103.67
LVC	-22.61	-68.91
MA2	59.99	152.50
MAJO	36.54	138.21
MBAR	-0.60	30.74
MBWA	-21.16	119.73
MCK	63.73	-148.94
MCWV	39.66	-80.33
MIAR	34.58	-94.56
MIDW	28.22	-177.37
MLAC	37.63	-118.84
MNV	38.43	-118.15
MOD	41.90	-120.30
MPR	18.21	-67.14
MSEY	-4.67	55.48
MSKU	-1.66	13.61
MTP	18.09	-65.56
MYNC	35.59	-85.41
NEW	48.26	-117.12
NIKO	52.94	-168.87
NNA	-11.99	-75.84
NWAO	-32.93	117.23
OBN	55.93	36.60
OCWA	47.75	-124.18
OSI	34.61	-118.72
ORV	39.55	-121.50
OTAV	0.24	-78.45
OXF	34.58	-90.49
PAHR	39.66	-120.98
PALK	7.27	80.70
PAS	34.15	-118.17
PAYG	-0.67	-90.29
PET	53.02	158.65
PFO	33.61	-116.46
PKD	35.95	-120.54
JOHN	16.73	-169.53
PTCN	-25.07	-130.09
PLAL	34.58	-89.48
PLCA	-40.68	-71.17
PMG	-9.41	147.16
PMR	62.03	-151.50
POHA	19.76	-155.53
PMSA	-64.77	-64.09
PTGA	-0.73	-59.97
QIZ	19.03	109.84
RAO	-29.25	-177.92

STATION	LAT (+N,-S)	LON (+E,-W)
RAR	-21.21	-159.77
RCBR	-5.83	-35.90
RPN	-27.13	-109.33
RSSD	44.12	-104.04
RWW	46.96	-123.54
SAO	36.76	-121.45
SBA	-77.85	166.76
SDPT	55.35	-160.48
SDV	8.89	-70.63
SFJD	67.00	-50.62
SIT	57.06	-137.32
SJG	18.11	-66.15
SKAG	59.46	-135.33
SMY	52.73	174.10
SNCC	33.25	-119.52
SNZO	-41.31	174.70
SPA	-90.00	115.00
SPIA	57.18	-170.25
SSPA	40.64	-77.89
STC	19.39	-155.13
STKA	-31.88	141.60
SUR	-32.38	20.81
TATO	24.98	121.49
TAU	-42.91	147.32
TEIG	20.23	-88.28
TIXI	71.65	128.87
TLY	51.68	103.64
TNA	66.09	-169.79
TPH	38.64	-118.96
TPNV	36.95	-116.25
TRIS	-37.07	-12.32
TRQA	-38.06	-61.98
TUC	32.31	-110.78
ULN	47.80	107.05
UNV	53.85	-166.50
UXL	19.42	-155.29
VNDA	-77.52	161.85
WAKE	19.28	166.65
WCI	38.65	-87.44
WCN	39.65	-120.99
WDC	40.58	-122.54
WMOK	34.74	-98.78
WMQ	43.82	87.69
WRAB	-19.93	134.35
WUAZ	35.52	-111.37
WVOR	42.43	-118.64
WVT	36.13	-87.83
YAK	62.02	129.72
YBH	41.73	-122.71
YSNY	42.71	-79.30
YSS	46.96	142.76

Appendix II. Deep ocean (DART) and coastal sea level stations in the Caribbean region providing near real time data to PTWC.

LOCATION	LATITUDE	LONGITUDE	XMIT
DART GulfMex,D087	25.4097	273.1997	60
DART Atlantic,D072	32.9281	287.5303	60
DART Caribbean,D068	15.2600	291.7706	60
DART Atlantic,D067	23.3122	292.3606	60
DART Atlantic,D064	23.3994	296.0992	60
Magueyes Island	17.9767	292.9533	6
San Juan	18.4617	293.8833	6
Culebra Is.	18.3008	294.6972	6
Charlotte-Amalie	18.3333	295.0833	6
Limetree	17.7000	295.2500	6
St Croix	17.7419	295.3078	6
Vieques	18.0939	297.5286	6

Appendix II. Sample Products

Tsunami Information Statement (for earthquakes in the Caribbean with Mw ≥ 6.0 or earthquakes in the Atlantic with Mw ≥ 6.5 that have no tsunamigenic potential or at most only a very small local tsunami potential)

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TSUNAMI STATEMENT NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1343Z 24 APR 2006

THIS STATEMENT IS FOR ALL AREAS OF THE CARIBBEAN EXCEPT PUERTO
RICO AND THE VIRGIN ISLANDS. A SEPARATE PRODUCT WILL BE ISSUED
BY THIS CENTER FOR THOSE AREAS.

... TSUNAMI INFORMATION STATEMENT ...

THIS MESSAGE IS FOR INFORMATION ONLY.

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

 ORIGIN TIME -  1310Z 24 APR 2006
 COORDINATES -  17.2 NORTH   61.6 WEST
 LOCATION    -  LEEWARD ISLANDS
 MAGNITUDE   -  6.6

EVALUATION

 A DESTRUCTIVE WIDESPREAD TSUNAMI THREAT DOES NOT EXIST BASED ON
 HISTORICAL EARTHQUAKE AND TSUNAMI DATA.

 HOWEVER - THERE IS A VERY SMALL POSSIBILITY OF A LOCAL TSUNAMI
 THAT COULD AFFECT COASTS LOCATED USUALLY NO MORE THAN A HUNDRED
 KILOMETERS FROM THE EARTHQUAKE EPICENTER. AUTHORITIES IN THE
 REGION NEAR THE EPICENTER SHOULD BE MADE AWARE OF THIS
 POSSIBILITY.

THIS WILL BE THE ONLY PRODUCT ISSUED BY THE PACIFIC TSUNAMI
WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION
BECOMES AVAILABLE.
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Local Tsunami Watch Bulletin (shallow, undersea earthquake; 7.1 ≤ Mw ≤ 7.5)

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TSUNAMI MESSAGE NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1350Z 24 APR 2006

THIS MESSAGE IS FOR ALL AREAS OF THE CARIBBEAN EXCEPT PUERTO
RICO AND THE VIRGIN ISLANDS. A SEPARATE PRODUCT WILL BE ISSUED
BY THIS CENTER FOR THOSE AREAS.

... A LOCAL TSUNAMI WATCH IS IN EFFECT ...

A TSUNAMI WATCH IS IN EFFECT FOR

 ANTIGUA / MONTSERRAT / BARBUDA / GUADELOUPE / SAINT KITTS /
 DOMINICA / ANGUILLA / SAINT MAARTEN / SAINT MARTIN

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

 ORIGIN TIME -  1310Z 24 APR 2006
 COORDINATES -  17.2 NORTH   61.6 WEST
 LOCATION    -  LEEWARD ISLANDS
 MAGNITUDE   -  7.4
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EVALUATION

A DESTRUCTIVE WIDESPREAD TSUNAMI THREAT DOES NOT EXIST BASED ON HISTORICAL EARTHQUAKE AND TSUNAMI DATA.

HOWEVER - THERE IS THE POSSIBILITY OF A LOCAL TSUNAMI THAT COULD AFFECT COASTS LOCATED USUALLY NO MORE THAN A HUNDRED KILOMETERS FROM THE EARTHQUAKE EPICENTER. AUTHORITIES FOR THE REGION NEAR THE EPICENTER SHOULD BE AWARE OF THIS POSSIBILITY. AREAS FURTHER FROM THE EPICENTER COULD EXPERIENCE SMALL SEA LEVEL CHANGES AND STRONG OR UNUSUAL COASTAL CURRENTS.

DUE TO ONLY LIMITED SEA LEVEL DATA FROM THE REGION IT MAY NOT BE POSSIBLE FOR THIS CENTER TO RAPIDLY CONFIRM NOR EVALUATE THE STRENGTH OF A TSUNAMI IF ONE HAS BEEN GENERATED.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION		COORDINATES	ARRIVAL TIME
ANTIGUA	SAINT JOHNS	17.2N 62.0W	1326Z 24 APR
MONTSERRAT	PLYMOUTH	16.7N 62.2W	1329Z 24 APR
BARBUDA	PALMETTO POINT	17.6N 61.9W	1331Z 24 APR
GUADELOUPE	BASSE-TERRE	16.0N 61.8W	1337Z 24 APR
SAINT KITTS	BASSETERRE	17.3N 62.7W	1341Z 24 APR
DOMINICA	ROSEAU	15.3N 61.5W	1348Z 24 APR
ANGUILLA	THE VALLEY	18.3N 63.1W	1349Z 24 APR
SAINT MAARTEN	SIMPSON BAAI	18.0N 63.1W	1354Z 24 APR
SAINT MARTIN	BAIE BLANCHE	18.1N 63.0W	1354Z 24 APR

THIS WILL BE THE ONLY PRODUCT ISSUED BY THE PACIFIC TSUNAMI WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION BECOMES AVAILABLE.

Local Tsunami Watch Bulletin Supplement

TSUNAMI MESSAGE NUMBER 002
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1348Z 24 APR 2006

THIS MESSAGE IS FOR ALL AREAS OF THE CARIBBEAN EXCEPT PUERTO RICO AND THE VIRGIN ISLANDS. A SEPARATE PRODUCT WILL BE ISSUED BY THIS CENTER FOR THOSE AREAS.

... A LOCAL TSUNAMI WATCH IS IN EFFECT ...

A TSUNAMI WATCH IS IN EFFECT FOR

ANTIGUA / MONTSERRAT / BARBUDA / GUADELOUPE / SAINT KITTS / DOMINICA / ANGUILLA / SAINT MAARTEN / SAINT MARTIN

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1310Z 24 APR 2006
COORDINATES - 17.2 NORTH 61.6 WEST
LOCATION - LEEWARD ISLANDS
MAGNITUDE - 7.4

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
OWENGA CHATHAM	44.0S	176.4W	1821Z	0.42M	34MIN
KAHULUI MAUI	20.9N	156.5W	1836Z	0.16M	46MIN
HILO HAWAII	19.7N	155.1W	1752Z	0.14M	36MIN
NUKU HIVA MARQUESAS	8.9S	140.1W	1822Z	0.56M	34MIN

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BALTRA GALAPAGS       0.4S  90.3W  1517Z   0.61M  34MIN
EASTER               27.2S 109.4W  1818Z   0.28M  16MIN
IQUIQUE              20.2S  70.2W  2006Z   0.49M  32MIN

TIME - TIME OF THE MEASUREMENT
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE
       TO TROUGH OR HALF OF THE CREST TO TROUGH
PER  - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED. IT MAY HAVE
BEEN DESTRUCTIVE ALONG COASTS NEAR THE EARTHQUAKE EPICENTER. FOR
THOSE AREAS - WHEN DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST
TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED.
DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL
HOURS DUE TO RAPID CURRENTS.  AS LOCAL CONDITIONS CAN CAUSE A
WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION
MUST BE MADE BY LOCAL AUTHORITIES.

NO TSUNAMI THREAT EXISTS FOR OTHER COASTAL AREAS IN THE
CARIBBEAN ALTHOUGH SOME OTHER AREAS MAY EXPERIENCE SMALL SEA
LEVEL CHANGES AND STRONG OR UNUSUAL COASTAL CURRENTS.

DUE TO ONLY LIMITED SEA LEVEL DATA FROM THE REGION IT MAY NOT BE
POSSIBLE FOR THIS CENTER TO RAPIDLY NOR ACCURATELY EVALUATE THE
THE STRENGTH OF A TSUNAMI IF ONE HAS BEEN GENERATED.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES
MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME
BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION                          COORDINATES     ARRIVAL TIME
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ANTIGUA           SAINT JOHNS     17.2N  62.0W    1326Z 24 APR
MONTSERRAT        PLYMOUTH        16.7N  62.2W    1329Z 24 APR
BARBUDA           PALMETTO POINT  17.6N  61.9W    1331Z 24 APR
GUADELOUPE        BASSE-TERRE     16.0N  61.8W    1337Z 24 APR
SAINT KITTS       BASSETERRE      17.3N  62.7W    1341Z 24 APR
DOMINICA          ROSEAU          15.3N  61.5W    1348Z 24 APR
ANGUILLA          THE VALLEY      18.3N  63.1W    1349Z 24 APR
SAINT MAARTEN     SIMPSON BAAI    18.0N  63.1W    1354Z 24 APR
SAINT MARTIN      BAIE BLANCHE    18.1N  63.0W    1354Z 24 APR

THIS WILL BE THE FINAL PRODUCT ISSUED BY THE PACIFIC TSUNAMI
WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION
BECOMES AVAILABLE.
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Regional Tsunami Watch Bulletin (shallow, undersea earthquake; $7.6 \leq Mw \leq 7.8$)

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TSUNAMI MESSAGE NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1351Z 24 APR 2006

THIS MESSAGE IS FOR ALL AREAS OF THE CARIBBEAN EXCEPT PUERTO
RICO AND THE VIRGIN ISLANDS. A SEPARATE PRODUCT WILL BE ISSUED
BY THIS CENTER FOR THOSE AREAS.

... A REGIONAL TSUNAMI WATCH IS IN EFFECT ...

A TSUNAMI WATCH IS IN EFFECT FOR

ANTIGUA / MONTSERRAT / BARBUDA / GUADELOUPE / SAINT KITTS /
DOMINICA / ANGUILLA / SAINT MAARTEN / SAINT MARTIN /
MARTINIQUE / SAINT LUCIA / BARBADOS / ST VINCENT / GRENADA /
DOMINICAN REP / TRINIDAD TOBAGO / TURKS N CAICOS / BONAIRE /
HAITI / BAHAMAS / CURACAO / ARUBA / CUBA / VENEZUELA /
COLOMBIA / SURINAME / GUYANA
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AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1310Z 24 APR 2006
COORDINATES - 17.2 NORTH 61.6 WEST
LOCATION - LEEWARD ISLANDS
MAGNITUDE - 7.7

EVALUATION

EARTHQUAKES OF THIS SIZE HAVE THE POTENTIAL TO GENERATE A DESTRUCTIVE LOCAL TSUNAMI AND SOMETIMES A DESTRUCTIVE REGIONAL TSUNAMI ALONG COASTS LOCATED USUALLY NO MORE THAN A THOUSAND KILOMETERS FROM THE EARTHQUAKE EPICENTER. AREAS FURTHER FROM THE EPICENTER COULD EXPERIENCE SMALL SEA LEVEL CHANGES AND STRONG OR UNUSUAL COASTAL CURRENTS.

HOWEVER - IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS WATCH IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AUTHORITIES IN THE REGION SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THIS POSSIBILITY. THE WATCH WILL NOT EXPAND TO OTHER AREAS OF THE CARIBBEAN UNLESS ADDITIONAL DATA ARE RECEIVED TO WARRANT SUCH AN EXPANSION.

DUE TO ONLY LIMITED SEA LEVEL DATA FROM THE REGION IT MAY NOT BE POSSIBLE FOR THIS CENTER TO RAPIDLY CONFIRM NOR EVALUATE THE STRENGTH OF A TSUNAMI IF ONE HAS BEEN GENERATED.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION		COORDINATES	ARRIVAL TIME
ANTIGUA	SAINT JOHNS	17.2N 62.0W	1326Z 24 APR
MONTSERRAT	PLYMOUTH	16.7N 62.2W	1329Z 24 APR
BARBUDA	PALMETTO POINT	17.6N 61.9W	1331Z 24 APR
GUADELOUPE	BASSE-TERRE	16.0N 61.8W	1337Z 24 APR
SAINT KITTS	BASSETERRE	17.3N 62.7W	1341Z 24 APR
DOMINICA	ROSEAU	15.3N 61.5W	1348Z 24 APR
ANGUILLA	THE VALLEY	18.3N 63.1W	1349Z 24 APR
SAINT MAARTEN	SIMPSON BAAI	18.0N 63.1W	1354Z 24 APR
SAINT MARTIN	BAIE BLANCHE	18.1N 63.0W	1354Z 24 APR
MARTINIQUE	FORT-DE-FRANCE	14.5N 61.2W	1356Z 24 APR
SAINT LUCIA	CASTRIES	14.0N 61.2W	1400Z 24 APR
BARBADOS	BRIDGETOWN	13.1N 59.6W	1406Z 24 APR
ST VINCENT	KINGSTOWN	13.2N 61.3W	1410Z 24 APR
GRENADA	SAINT GEORGES	12.0N 61.8W	1424Z 24 APR
DOMINICAN REP	CABO ENGANO	18.6N 68.3W	1424Z 24 APR
	PUERTO PLATA	19.8N 70.7W	1434Z 24 APR
	SANTO DOMINGO	18.3N 69.8W	1452Z 24 APR
TRINIDAD TOBAGO	PIRATES BAY	11.3N 60.6W	1429Z 24 APR
	PORT-OF-SPAIN	10.7N 61.7W	1513Z 24 APR
TURKS N CAICOS	GRAND TURK	21.5N 71.1W	1440Z 24 APR
	WEST CAICOS	21.7N 72.5W	1455Z 24 APR
BONAIRE	ONIMA	12.3N 68.3W	1448Z 24 APR
HAITI	CAP-HAITEN	19.8N 72.2W	1452Z 24 APR
	JEREMIE	18.7N 74.0W	1520Z 24 APR
	PORT-AU-PRINCE	18.7N 72.3W	1553Z 24 APR
BAHAMAS	MAYAGUANA	22.3N 73.0W	1457Z 24 APR
	GREAT INAGUA	20.8N 73.7W	1503Z 24 APR
	CROOKED IS	22.7N 74.1W	1509Z 24 APR
CURACAO	WILLEMSTAD	12.0N 69.0W	1458Z 24 APR
ARUBA	ORANJESTAD	12.5N 70.0W	1506Z 24 APR
CUBA	BARACOA	20.5N 74.5W	1510Z 24 APR
VENEZUELA	MAIQUETIA	10.6N 67.0W	1510Z 24 APR
	CUMANA	10.5N 64.2W	1521Z 24 APR
	PORLAMAR	10.8N 63.8W	1559Z 24 APR
	PUNTO FIJO	11.7N 70.3W	1606Z 24 APR
	GOLFO VENEZUELA	11.4N 71.2W	1637Z 24 APR

COLOMBIA	RIOHACHA	11.7N	73.0W	1545Z 24 APR
SURINAME	PARAMARIBO	5.9N	55.2W	1709Z 24 APR
GUYANA	GEORGETOWN	6.8N	58.2W	1744Z 24 APR

THIS WILL BE THE ONLY PRODUCT ISSUED BY THE PACIFIC TSUNAMI
WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION
BECOMES AVAILABLE.

Regional Tsunami Watch Bulletin Supplement

TSUNAMI MESSAGE NUMBER 002
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1352Z 24 APR 2006

THIS MESSAGE IS FOR ALL AREAS OF THE CARIBBEAN EXCEPT PUERTO
RICO AND THE VIRGIN ISLANDS. A SEPARATE PRODUCT WILL BE ISSUED
BY THIS CENTER FOR THOSE AREAS.

... A REGIONAL TSUNAMI WATCH IS IN EFFECT ...

A TSUNAMI WATCH IS IN EFFECT FOR

ANTIGUA / MONTSERRAT / BARBUDA / GUADELOUPE / SAINT KITTS /
DOMINICA / ANGUILLA / SAINT MAARTEN / SAINT MARTIN /
MARTINIQUE / SAINT LUCIA / BARBADOS / ST VINCENT / GRENADA /
DOMINICAN REP / TRINIDAD TOBAGO / TURKS N CAICOS / BONAIRE /
HAITI / BAHAMAS / CURACAO / ARUBA / CUBA / VENEZUELA /
COLOMBIA / SURINAME / GUYANA

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1310Z 24 APR 2006
COORDINATES - 17.2 NORTH 61.6 WEST
LOCATION - LEEWARD ISLANDS
MAGNITUDE - 7.7

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
OWENGA CHATHAM	44.0S	176.4W	1821Z	0.42M	34MIN
KAHULUI MAUI	20.9N	156.5W	1836Z	0.16M	46MIN
HILO HAWAII	19.7N	155.1W	1752Z	0.14M	36MIN
NUKU HIVA MARQUESAS	8.9S	140.1W	1822Z	0.56M	34MIN
BALTRA GALAPAGS	0.4S	90.3W	1517Z	0.61M	34MIN
EASTER	27.2S	109.4W	1818Z	0.28M	16MIN
IQUIQUE	20.2S	70.2W	2006Z	0.49M	32MIN

TIME - TIME OF THE MEASUREMENT
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE
TO TROUGH OR HALF OF THE CREST TO TROUGH
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED. IT MAY HAVE
BEEN DESTRUCTIVE ALONG COASTS NEAR THE EARTHQUAKE EPICENTER.

THE THREAT MAY CONTINUE FOR COASTAL AREAS LOCATED WITHIN ABOUT A
THOUSAND KILOMETERS OF THE EARTHQUAKE EPICENTER. FOR THOSE AREAS
WHEN NO MAJOR WAVES HAVE OCCURRED FOR AT LEAST TWO HOURS AFTER
THE ESTIMATED ARRIVAL TIME OR DAMAGING WAVES HAVE NOT OCCURRED
FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE
THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN
CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS. AS LOCAL
CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE
ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

DUE TO ONLY LIMITED SEA LEVEL DATA FROM THE REGION IT MAY NOT BE
POSSIBLE FOR THIS CENTER TO RAPIDLY NOR ACCURATELY EVALUATE THE
THE STRENGTH OF A TSUNAMI IF ONE HAS BEEN GENERATED.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES
MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME
BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION		COORDINATES		ARRIVAL TIME
ANTIGUA	SAINT JOHNS	17.2N	62.0W	1326Z 24 APR
MONTSERRAT	PLYMOUTH	16.7N	62.2W	1329Z 24 APR
BARBUDA	PALMETTO POINT	17.6N	61.9W	1331Z 24 APR
GUADELOUPE	BASSE-TERRE	16.0N	61.8W	1337Z 24 APR
SAINT KITTS	BASSETERRE	17.3N	62.7W	1341Z 24 APR
DOMINICA	ROSEAU	15.3N	61.5W	1348Z 24 APR
ANGUILLA	THE VALLEY	18.3N	63.1W	1349Z 24 APR
SAINT MAARTEN	SIMPSON BAAI	18.0N	63.1W	1354Z 24 APR
SAINT MARTIN	BAIE BLANCHE	18.1N	63.0W	1354Z 24 APR
MARTINIQUE	FORT-DE-FRANCE	14.5N	61.2W	1356Z 24 APR
SAINT LUCIA	CASTRIES	14.0N	61.2W	1400Z 24 APR
BARBADOS	BRIDGETOWN	13.1N	59.6W	1406Z 24 APR
ST VINCENT	KINGSTOWN	13.2N	61.3W	1410Z 24 APR
GRENADA	SAINT GEORGES	12.0N	61.8W	1424Z 24 APR
DOMINICAN REP	CABO ENGANO	18.6N	68.3W	1424Z 24 APR
	PUERTO PLATA	19.8N	70.7W	1434Z 24 APR
	SANTO DOMINGO	18.3N	69.8W	1452Z 24 APR
TRINIDAD TOBAGO	PIRATES BAY	11.3N	60.6W	1429Z 24 APR
	PORT-OF-SPAIN	10.7N	61.7W	1513Z 24 APR
TURKS N CAICOS	GRAND TURK	21.5N	71.1W	1440Z 24 APR
	WEST CAICOS	21.7N	72.5W	1455Z 24 APR
BONAIRE	ONIMA	12.3N	68.3W	1448Z 24 APR
HAITI	CAP-HAITEN	19.8N	72.2W	1452Z 24 APR
	JEREMIE	18.7N	74.0W	1520Z 24 APR
	PORT-AU-PRINCE	18.7N	72.3W	1553Z 24 APR
BAHAMAS	MAYAGUANA	22.3N	73.0W	1457Z 24 APR
	GREAT INAGUA	20.8N	73.7W	1503Z 24 APR
	CROOKED IS	22.7N	74.1W	1509Z 24 APR
CURACAO	WILLEMSTAD	12.0N	69.0W	1458Z 24 APR
ARUBA	ORANJESTAD	12.5N	70.0W	1506Z 24 APR
CUBA	BARACOA	20.5N	74.5W	1510Z 24 APR
VENEZUELA	MAIQUETIA	10.6N	67.0W	1510Z 24 APR
	CUMANA	10.5N	64.2W	1521Z 24 APR
	PORLAMAR	10.8N	63.8W	1559Z 24 APR
	PUNTO FIJO	11.7N	70.3W	1606Z 24 APR
	GOLFO VENEZUELA	11.4N	71.2W	1637Z 24 APR
COLOMBIA	RIOHACHA	11.7N	73.0W	1545Z 24 APR
SURINAME	PARAMARIBO	5.9N	55.2W	1709Z 24 APR
GUYANA	GEORGETOWN	6.8N	58.2W	1744Z 24 APR

THIS WILL BE THE FINAL PRODUCT ISSUED BY THE PACIFIC TSUNAMI
WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION
BECOMES AVAILABLE.

Ocean-Wide Tsunami Watch Bulletin (shallow, undersea earthquake; 7.9 ≤ Mw)

TSUNAMI MESSAGE NUMBER 001
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1353Z 24 APR 2006

THIS MESSAGE IS FOR ALL AREAS OF THE CARIBBEAN EXCEPT PUERTO
RICO AND THE VIRGIN ISLANDS. A SEPARATE PRODUCT WILL BE ISSUED
BY THIS CENTER FOR THOSE AREAS.

... A CARIBBEAN-WIDE TSUNAMI WATCH IS IN EFFECT ...

A TSUNAMI WATCH IS IN EFFECT FOR

ANTIGUA / MONTSERRAT / BARBUDA / GUADELOUPE / SAINT KITTS /
DOMINICA / ANGUILLA / SAINT MAARTEN / SAINT MARTIN /
MARTINIQUE / SAINT LUCIA / BARBADOS / ST VINCENT / GRENADA /
DOMINICAN REP / TRINIDAD TOBAGO / TURKS N CAICOS / BONAIRE /
HAITI / BAHAMAS / CURACAO / ARUBA / CUBA / VENEZUELA / BERMUDA /
JAMAICA / COLOMBIA / PANAMA / FRENCH GUIANA / HONDURAS /
MEXICO / COSTA RICA / SURINAME / BELIZE / NICARAGUA /
GUATEMALA / GUYANA / BRAZIL

AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1310Z 24 APR 2006
COORDINATES - 17.2 NORTH 61.6 WEST
LOCATION - LEEWARD ISLANDS
MAGNITUDE - 8.3

EVALUATION

EARTHQUAKES OF THIS SIZE HAVE THE POTENTIAL TO GENERATE A
WIDESPREAD DESTRUCTIVE TSUNAMI THAT CAN AFFECT COASTLINES ACROSS
THE ENTIRE CARIBBEAN REGION.

HOWEVER - IT IS NOT KNOWN THAT A TSUNAMI WAS GENERATED. THIS
WATCH IS BASED ONLY ON THE EARTHQUAKE EVALUATION. AUTHORITIES IN
THE REGION SHOULD TAKE APPROPRIATE ACTION IN RESPONSE TO THE
POSSIBILITY OF A WIDESPREAD DESTRUCTIVE TSUNAMI.

DUE TO ONLY LIMITED SEA LEVEL DATA FROM THE REGION IT MAY NOT BE
POSSIBLE FOR THIS CENTER TO RAPIDLY CONFIRM NOR EVALUATE THE
STRENGTH OF A TSUNAMI IF ONE HAS BEEN GENERATED.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES
MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME
BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION		COORDINATES	ARRIVAL TIME
ANTIGUA	SAINT JOHNS	17.2N 62.0W	1326Z 24 APR
MONTSERRAT	PLYMOUTH	16.7N 62.2W	1329Z 24 APR
BARBUDA	PALMETTO POINT	17.6N 61.9W	1331Z 24 APR
GUADELOUPE	BASSE-TERRE	16.0N 61.8W	1337Z 24 APR
SAINT KITTS	BASSETERRE	17.3N 62.7W	1341Z 24 APR
DOMINICA	ROSEAU	15.3N 61.5W	1348Z 24 APR
ANGUILLA	THE VALLEY	18.3N 63.1W	1349Z 24 APR
SAINT MAARTEN	SIMPSON BAAI	18.0N 63.1W	1354Z 24 APR
SAINT MARTIN	BAIE BLANCHE	18.1N 63.0W	1354Z 24 APR
MARTINIQUE	FORT-DE-FRANCE	14.5N 61.2W	1356Z 24 APR
SAINT LUCIA	CASTRIES	14.0N 61.2W	1400Z 24 APR
BARBADOS	BRIDGETOWN	13.1N 59.6W	1406Z 24 APR
ST VINCENT	KINGSTOWN	13.2N 61.3W	1410Z 24 APR
GRENADA	SAINT GEORGES	12.0N 61.8W	1424Z 24 APR
DOMINICAN REP	CABO ENGANO	18.6N 68.3W	1424Z 24 APR
	PUERTO PLATA	19.8N 70.7W	1434Z 24 APR
	SANTO DOMINGO	18.3N 69.8W	1452Z 24 APR
TRINIDAD TOBAGO	PIRATES BAY	11.3N 60.6W	1429Z 24 APR
	PORT-OF-SPAIN	10.7N 61.7W	1513Z 24 APR
TURKS N CAICOS	GRAND TURK	21.5N 71.1W	1440Z 24 APR
	WEST CAICOS	21.7N 72.5W	1455Z 24 APR
BONAIRE	ONIMA	12.3N 68.3W	1448Z 24 APR
HAITI	CAP-HAITEN	19.8N 72.2W	1452Z 24 APR
	JEREMIE	18.7N 74.0W	1520Z 24 APR
	PORT-AU-PRINCE	18.7N 72.3W	1553Z 24 APR
BAHAMAS	MAYAGUANA	22.3N 73.0W	1457Z 24 APR
	GREAT INAGUA	20.8N 73.7W	1503Z 24 APR
	CROOKED IS	22.7N 74.1W	1509Z 24 APR
	SAN SALVADOR	24.1N 74.5W	1510Z 24 APR
	ELEUTHERA IS	25.2N 76.0W	1523Z 24 APR
	ABACO IS	26.6N 77.1W	1536Z 24 APR
	NASSAU	25.1N 77.4W	1541Z 24 APR
	FREEPORT	26.5N 78.8W	1603Z 24 APR

CURACAO	WILLEMSTAD	12.0N	69.0W	1458Z 24 APR
ARUBA	ORANJESTAD	12.5N	70.0W	1506Z 24 APR
CUBA	BARACOA	20.5N	74.5W	1510Z 24 APR
	SANTIAGO D CUBA	19.8N	75.8W	1525Z 24 APR
	GIBARA	21.2N	76.0W	1528Z 24 APR
	SANTA CRZ D SUR	20.7N	78.0W	1620Z 24 APR
	CIENFUEGOS	22.0N	80.5W	1620Z 24 APR
	LA HABANA	23.2N	82.4W	1732Z 24 APR
	NUEVA GERONA	21.9N	82.8W	1737Z 24 APR
VENEZUELA	MAIQUETIA	10.6N	67.0W	1510Z 24 APR
	CUMANA	10.5N	64.2W	1521Z 24 APR
	PORLAMAR	10.8N	63.8W	1559Z 24 APR
	PUNTO FIJO	11.7N	70.3W	1606Z 24 APR
	GOLFO VENEZUELA	11.4N	71.2W	1637Z 24 APR
BERMUDA	RUTHS BAY	32.4N	64.6W	1520Z 24 APR
JAMAICA	MONTEGO BAY	18.5N	77.9W	1544Z 24 APR
	KINGSTON	17.9N	76.9W	1554Z 24 APR
COLOMBIA	RIOHACHA	11.7N	73.0W	1545Z 24 APR
	SANTA MARTA	11.3N	74.2W	1548Z 24 APR
	BARRANQUILLA	11.2N	74.8W	1552Z 24 APR
	CARTAGENA	10.5N	75.5W	1608Z 24 APR
	PUNTA CARIBANA	8.6N	76.9W	1639Z 24 APR
PANAMA	PUERTO CARRETO	8.8N	77.6W	1630Z 24 APR
	COLON	9.3N	80.0W	1649Z 24 APR
	BOCAS DEL TORO	9.4N	82.2W	1703Z 24 APR
FRENCH GUIANA	CAYENNE	4.9N	52.3W	1648Z 24 APR
HONDURAS	TRUJILLO	15.9N	86.0W	1702Z 24 APR
	PUERTO CORTES	15.9N	88.0W	1712Z 24 APR
MEXICO	COZUMEL	20.5N	87.0W	1704Z 24 APR
	MADERO	22.3N	97.7W	1937Z 24 APR
	VERACRUZ	19.2N	96.0W	1938Z 24 APR
	TEXAS BORDER	26.0N	97.0W	1957Z 24 APR
	CAMPECHE	19.8N	90.7W	2125Z 24 APR
COSTA RICA	PUERTO LIMON	10.0N	83.0W	1707Z 24 APR
SURINAME	PARAMARIBO	5.9N	55.2W	1709Z 24 APR
BELIZE	BELIZE CITY	17.5N	88.2W	1724Z 24 APR
NICARAGUA	PUNTA GORDA	11.3N	83.8W	1726Z 24 APR
	PUERTO CABEZAS	14.0N	83.4W	1853Z 24 APR
GUATEMALA	PUERTO BARRIOS	15.8N	88.7W	1734Z 24 APR
GUYANA	GEORGETOWN	6.8N	58.2W	1744Z 24 APR
BRAZIL	FORTALEZA	3.7S	38.5W	1840Z 24 APR
	ILHA DE MARACA	2.2N	50.5W	1841Z 24 APR
	SAO LUIS	2.5S	44.3W	2028Z 24 APR

THIS WILL BE THE ONLY PRODUCT ISSUED BY THE PACIFIC TSUNAMI
WARNING CENTER FOR THIS EVENT UNLESS ADDITIONAL INFORMATION
BECOMES AVAILABLE.

Ocean-Wide Tsunami Watch Supplement

TSUNAMI MESSAGE NUMBER 002
PACIFIC TSUNAMI WARNING CENTER/NOAA/NWS
ISSUED AT 1354Z 24 APR 2006

THIS MESSAGE IS FOR ALL AREAS OF THE CARIBBEAN EXCEPT PUERTO
RICO AND THE VIRGIN ISLANDS. A SEPARATE PRODUCT WILL BE ISSUED
BY THIS CENTER FOR THOSE AREAS.

... A CARIBBEAN-WIDE TSUNAMI WATCH IS IN EFFECT ...

A TSUNAMI WATCH IS IN EFFECT FOR

ANTIGUA / MONTSERRAT / BARBUDA / GUADELOUPE / SAINT KITTS /
DOMINICA / ANGUILLA / SAINT MAARTEN / SAINT MARTIN /
MARTINIQUE / SAINT LUCIA / BARBADOS / ST VINCENT / GRENADA /
DOMINICAN REP / TRINIDAD TOBAGO / TURKS N CAICOS / BONAIRE /
HAITI / BAHAMAS / CURACAO / ARUBA / CUBA / VENEZUELA / BERMUDA /
JAMAICA / COLOMBIA / PANAMA / FRENCH GUIANA / HONDURAS /

MEXICO / COSTA RICA / SURINAME / BELIZE / NICARAGUA /
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AN EARTHQUAKE HAS OCCURRED WITH THESE PRELIMINARY PARAMETERS

ORIGIN TIME - 1310Z 24 APR 2006
COORDINATES - 17.2 NORTH 61.6 WEST
LOCATION - LEEWARD ISLANDS
MAGNITUDE - 8.3

MEASUREMENTS OR REPORTS OF TSUNAMI WAVE ACTIVITY

GAUGE LOCATION	LAT	LON	TIME	AMPL	PER
OWENGA CHATHAM	44.0S	176.4W	1821Z	0.42M	34MIN
KAHULUI MAUI	20.9N	156.5W	1836Z	0.16M	46MIN
HILO HAWAII	19.7N	155.1W	1752Z	0.14M	36MIN
NUKU HIVA MARQUESAS	8.9S	140.1W	1822Z	0.56M	34MIN
BALTRA GALAPAGS	0.4S	90.3W	1517Z	0.61M	34MIN
EASTER	27.2S	109.4W	1818Z	0.28M	16MIN
IQUIQUE	20.2S	70.2W	2006Z	0.49M	32MIN

TIME - TIME OF THE MEASUREMENT
AMPL - AMPLITUDE IN METERS FROM MIDDLE TO CREST OR MIDDLE
TO TROUGH OR HALF OF THE CREST TO TROUGH
PER - PERIOD OF TIME FROM ONE WAVE CREST TO THE NEXT

EVALUATION

SEA LEVEL READINGS INDICATE A TSUNAMI WAS GENERATED. IT MAY HAVE ALREADY HAVE BEEN DESTRUCTIVE ALONG COASTS NEAR THE EARTHQUAKE EPICENTER.

BASED ON THESE DATA THE THREAT CONTINUES FOR ALL COASTAL AREAS OF THE CARIBBEAN. FOR THOSE AREAS - WHEN NO MAJOR WAVES HAVE OCCURRED FOR AT LEAST TWO HOURS AFTER THE ESTIMATED ARRIVAL TIME OR DAMAGING WAVES HAVE NOT OCCURRED FOR AT LEAST TWO HOURS THEN LOCAL AUTHORITIES CAN ASSUME THE THREAT IS PASSED. DANGER TO BOATS AND COASTAL STRUCTURES CAN CONTINUE FOR SEVERAL HOURS DUE TO RAPID CURRENTS. AS LOCAL CONDITIONS CAN CAUSE A WIDE VARIATION IN TSUNAMI WAVE ACTION THE ALL CLEAR DETERMINATION MUST BE MADE BY LOCAL AUTHORITIES.

DUE TO ONLY LIMITED SEA LEVEL DATA FROM THE REGION IT MAY NOT BE POSSIBLE FOR THIS CENTER TO RAPIDLY NOR ACCURATELY EVALUATE THE THE STRENGTH OF A TSUNAMI IF ONE HAS BEEN GENERATED.

ESTIMATED INITIAL TSUNAMI WAVE ARRIVAL TIMES. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. THE TIME BETWEEN SUCCESSIVE TSUNAMI WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION		COORDINATES		ARRIVAL TIME
ANTIGUA	SAINT JOHNS	17.2N	62.0W	1326Z 24 APR
MONTSERRAT	PLYMOUTH	16.7N	62.2W	1329Z 24 APR
BARBUDA	PALMETTO POINT	17.6N	61.9W	1331Z 24 APR
GUADELOUPE	BASSE-TERRE	16.0N	61.8W	1337Z 24 APR
SAINT KITTS	BASSETERRE	17.3N	62.7W	1341Z 24 APR
DOMINICA	ROSEAU	15.3N	61.5W	1348Z 24 APR
ANGUILLA	THE VALLEY	18.3N	63.1W	1349Z 24 APR
SAINT MAARTEN	SIMPSON BAAI	18.0N	63.1W	1354Z 24 APR
SAINT MARTIN	BAIE BLANCHE	18.1N	63.0W	1354Z 24 APR
MARTINIQUE	FORT-DE-FRANCE	14.5N	61.2W	1356Z 24 APR
SAINT LUCIA	CASTRIES	14.0N	61.2W	1400Z 24 APR
BARBADOS	BRIDGETOWN	13.1N	59.6W	1406Z 24 APR
ST VINCENT	KINGSTOWN	13.2N	61.3W	1410Z 24 APR
GRENADA	SAINT GEORGES	12.0N	61.8W	1424Z 24 APR
DOMINICAN REP	CABO ENGANO	18.6N	68.3W	1424Z 24 APR
	PUERTO PLATA	19.8N	70.7W	1434Z 24 APR
	SANTO DOMINGO	18.3N	69.8W	1452Z 24 APR

Appendix I. Broadband seismic stations providing real time continuous waveform data to PTWC.

STATION	LAT (+N,-S)	LON (+E,-W)
AAK	42.64	74.49
AAM	42.70	-84.39
ADK	51.88	-176.68
AFI	-13.91	-171.78
AGPR	18.47	-67.11
AHID	42.72	-112.85
AKUT	54.14	-165.77
ANMO	34.58	-107.70
ANTO	39.87	32.79
ARU	56.43	58.56
ATKA	52.20	-174.20
BAR	32.68	-116.67
BBSR	32.37	-64.70
BDFB	-15.64	-48.01
BFO	48.33	8.33
BILL	68.04	166.27
BMN	40.43	-117.22
BINY	42.72	-76.25
BJT	40.02	116.17
BGCA	5.18	18.42
BLA	37.21	-80.42
BMRM	60.96	-144.58
BOSA	-28.61	25.25
BOZ	45.65	-111.63
BRVK	53.06	70.28
BW06	42.77	-109.56
BZN	38.48	69.82
CBKS	38.65	-100.65
CBYP	18.27	-65.86
CCM	38.64	-92.53
CDVI	17.75	-64.77
CHTO	18.81	98.94
CEH	35.59	-80.33
CMB	38.03	-120.39
CPD	18.04	-65.92
COCO	-12.19	96.83
COLA	65.07	-149.45
COR	44.59	-123.03
CPUP	-26.33	-57.33
CRAG	55.47	-133.12
CTAO	-20.34	148.44
CWC	36.44	-118.08
DAC	36.28	-117.59
DBIC	6.67	-4.86
DGAR	-7.41	72.45
DIV	61.13	-145.77
DUG	40.20	-112.81

STATION	LAT (+N,-S)	LON (+E,-W)
DWPF	28.48	-82.37
EFI	-51.68	-58.06
ELK	40.68	-116.92
ERW	48.45	-122.63
ESK	55.32	-3.21
ESLA	39.67	-3.96
EYAK	60.55	-145.75
EYMN	47.80	-92.53
FFC	54.73	-101.98
FUNA	-8.53	179.20
GNI	40.05	44.72
GNW	47.56	-122.83
GOGA	33.56	-84.40
GUMO	13.59	144.87
GWDE	38.83	-75.62
H2O	27.88	-141.99
HAWA	46.39	-119.53
HIA	49.82	120.99
HKT	29.48	-96.58
HLID	43.73	-115.91
HNR	-9.43	159.95
HON	21.32	-158.01
HON1	21.32	-158.01
HOPS	38.99	-123.07
HRV	42.51	-71.56
HUMP	18.14	-65.85
HWUT	41.61	-111.57
INCN	37.63	128.12
ISA	35.66	-118.47
ISP	37.82	30.52
JCC	40.82	-124.03
JFWS	42.71	-91.51
JTS	10.29	-84.95
KHU	19.25	-155.62
KKM	6.04	116.21
KMBO	-1.13	37.25
KNB	37.02	-112.82
KWAJ	8.80	167.61
LBNH	44.74	-72.19
LBTB	-25.01	25.60
LON	46.75	-121.81
KAPI	-5.01	119.75
KBS	78.30	11.94
KCC	37.32	-119.32
KDAK	57.78	-152.58
KIP	21.42	-158.01
KIV	43.96	42.69

APPENDIX B. TSUNAMI WARNING RESPONSIBILITY AGREEMENT DOCUMENT

The following is a form of document which outlines the responsibility of the TWFP to implement SOPs for Tsunami and Other Coastal Hazards Warnings. It can be used as a summary document to inform all government and non government agencies and to obtain a formal sign off from the Prime Minister's Office for the activities.

TWFP RESPONSIBILITY & FUNCTIONS AGREEMENT

The TWFP staff receive a Caribbean TSUNAMI WATCH BULLETIN or TSUNAMI INFORMATION STATEMENT via pager or cell phone, EMWIN, or email advising about an earthquake which has occurred somewhere in the Caribbean or Atlantic Oceans from the PTWC. The TWFP Duty Officer will follow the Tsunami Warning SOP.

In the event of a local earthquake where the state is vulnerable to a tsunami potential:

1. All other TWFP staff (non duty officers) will immediately and as safely as possible report to the National Emergency Operating Centre (NEOC) in their area. If unable to SAFELY respond to the NEOC, they will proceed to an alternate location. TWFP staff that are unable to respond to NEOC should communicate their alternate location to the NEOC. (*Each Participating State to identify ADEQUATE AND SAFE EOC LOCATION—FOR A TSUNAMI EVENT.)*
2. TWFP staff will use discretion during off duty hours. If an TWFP staff member is with family and within close proximity to the NEOC, they should proceed to NEOC with the family.
3. At a minimum, TWFP staff should be aware as to whether primary driving routes from residence or other location where they may be to the NEOC traverse published tsunami evacuation routes.

ADMINISTRATION AND SUPPORT

The TWFP Duty Officer is responsible for maintaining a copy of the TSUNAMI BULLETIN/INFORMATION STATEMENT SOPs in the SOP Operations Manual. All TWFC staff should be provided a copy.

The TWFP will ensure that all staff are familiar with the SOP, that appropriate training about the SOP is conducted, and that all staff are drilled and prepared to respond quickly following receipt of a Tsunami Bulletin.

The National Disaster Management Organization in collaboration with TWFP will ensure that all government agencies and nongovernment agencies are educated about the Tsunami Risk, Tsunami Response SOPs, and any and all related responsibilities required of these agencies.

Recommendations for additions, deletions or modifications to the SOPs will be submitted TWFP for final approval. The Director of the Disaster Management Organization will report to the TWFP any changes in alert and notification equipment or procedures or status of equipment that might affect procedures for executing this SOP.

APPROVED: _____ DATE: _____

APPENDIX C. CHARACTERISTICS OF FELT EARTHQUAKES[13]

Magnitude / Intensity Comparison

Magnitude	Typical Maximum Modified Mercalli Intensity	Description
1.0 - 3.0	**I**	**I.** Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	**II - III**	**II**. Felt only by a few persons at rest, especially on upper floors of buildings. **III**. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 - 4.9	**IV - V**	**IV**. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably. **V**. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 - 5.9	**VI - VII**	**VI**. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. **VII**. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.

[13] http://earthquake.usgs.gov/learning/topics/mag_vs_int.php

6.0 - 6.9	**VII - IX**	**VII**. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. **VIII**. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. **IX**. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	**VIII** or higher	**VIII**. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. **IX**. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. **X**. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. **XI**. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. **XII**. Damage total. Lines of sight and level are distorted. Objects thrown into the air.