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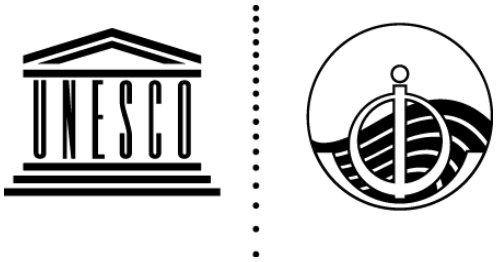

User's Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System

March 2013

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Executive Summary

The Pacific Tsunami Warning Center (PTWC), as the operational headquarters for the IOC-coordinated Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS), has provided international tsunami alerts to countries of the Pacific since 1965. In order to provide timely services, alerts (warnings and watches) have been based primarily on seismic data and the rapid determination of an earthquake's hypocenter and magnitude, followed by the monitoring of coastal sea level gauges to confirm a tsunami and its severity. Over the last 5-10 years, however, seismic and sea level data availability, analysis methods, computational capabilities, and communications have improved significantly. Additionally, better and faster numerical models, and specifically models that can incorporate the actual earthquake source, are now able to provide much more accurate forecasts of tsunami impacts along different coasts. Accordingly, and since 2007 with the guidance and approval of Member States of the ICG/PTWS, the PTWC is enhancing and evolving its existing products in 2013–2014 so as to provide countries with more useful tsunami forecast products that will give detailed tsunami threat assessments of their coasts.

The PTWC will begin the issuance of its enhanced tsunami products in an experimental phase to Member States of the ICG/PTWS on 15 April 2013. The enhanced products will be sent by email to IOC officially-designated Tsunami Warning Focal Points (TWFP) in parallel with its existing products. This introduction and familiarization period will also provide lead time for training on the new products and for countries to incorporate the necessary changes to their TWFP and National Tsunami Warning Center (NTWC) Standard Operating Procedures (SOPs). The IOC and International Tsunami Information Center will work together to meet the training requests of PTWS countries. At the Twenty-fifth Session of the ICG/PTWS (September, 2013), Member States will be asked to review and discuss the new products, and if ready, approve the products and agree on a changeover date in 2014.

The User's Guide provides a description and examples of the PTWC new enhanced products. Both improved text and additional graphical products will be available. The text products include improvements in the order and type of information provided, and in its readability. The graphical products are expected to provide more information and at a much greater level of detail than will be possible using only text products. These include maps that show the forecast directionality of the tsunami energy, the forecast position of the initial wave through time, as well as the expected maximum wave amplitudes offshore and at the coast.

1. OVERVIEW

1.1 Introduction

The Pacific Tsunami Warning Center (PTWC), operated by the United States National Oceanic and Atmospheric Administration's National Weather Service (NOAA/NWS), has served since 1965 as the operational tsunami warning center for Member States of the Intergovernmental Coordination Group for the Pacific Tsunami Warning and Mitigation System (ICG/PTWS). The ICG/PTWS is a subsidiary body of UNESCO's Intergovernmental Oceanographic Commission (IOC), and the IOC's Tsunami Unit oversees the coordination of the global tsunami warning and mitigation system. The ICG/PTWS, begun as an international response after the 1960 M9.5 Chile earthquake and tsunami, is the oldest of the four regional tsunami systems. Systems in the Indian Ocean, Caribbean and Adjacent Seas, and Northeastern Atlantic and Mediterranean were established after the 2004 Indian Ocean Tsunami.

The suite of text tsunami products issued by PTWC to countries around the Pacific in support of this mission has evolved over time as seismic and sea level data, analysis methods, computational capabilities, and communications have all improved. With order of magnitude increases in data availability and quality over the last 10 years enabling reliable real-time earthquake source characterization and more timely, detailed tsunami monitoring, and with better numerical models providing more accurate forecasts of tsunami impacts in real time, it is now time to enhance and evolve the existing PTWC products to provide countries with more informative and useful tsunami threat assessments to their coasts.

Accordingly, the Twenty-second Session of the ICG/PTWS (2007) started the process of improving the PTWS international alert products, starting first with the products of the PTWC. The Twenty-fourth Session of the ICG/PTWS (May, 2011) approved PTWC's Enhanced Tsunami Products proposal and asked them to proceed with their development. Exercise Pacific Wave 2011 (November) introduced those products and the PTWS Steering Committee met in May 2012 to review the feedback and approve the final implementation timeline. Exercise Pacific Wave 2013 (April) will be conducted to validate the products. At the Twenty-fifth Session of the ICG/PTWS (2013), Member States will be asked to approve the final products and agree on a changeover date. A more detailed background and summary is provided in Appendix I.

PTWC's New Enhanced Product suite, as described in this Users Guide with examples given in Appendix II, will be first issued in parallel with PTWC's existing products in order to familiarize recipients – the designated national Tsunami Warning Focal Points (TWFPs) -- with the new products' timing and content. Note, however, that the highest priority activity at PTWC will continue to be the issuance of the existing operational products. As a consequence, the new products may lag somewhat behind existing products at the beginning of an event and may also be issued on a different schedule. This introduction and familiarization period will also provide lead time for training on the new products and for countries to incorporate the necessary changes to their TWFP and National Tsunami Warning Center (NTWC) Standard Operating Procedures (SOPs).

1.2 Implementation Timeline

The PTWC New Products familiarization phase will begin on April 15, 2013, and be conducted through the remainder of 2013.

To support the transition to the new products, the PTWS will conduct Exercise Pacific Wave 2013 (PacWave13) between May 1-15, 2013, to encourage countries to examine and

interpret the new products using a destructive tsunami scenario. It is recommended that countries conduct a Tabletop Tsunami Exercise as part of PacWave13. As part of the PacWave13 post-exercise evaluation, countries are asked to provide feedback on the new products and their readiness for the changeover to the new products. Information, including the PacWave13 Exercise Manual and PTWC New Enhanced Product Messages, can be found at http://www.pacwave.info

The PTWS PacWave13 Task Team is overseeing the planning, conduct, and post-exercise evaluation of the new products, and working with the PTWS Enhancing Tsunami Products for the successful implementation, and ITIC and the IOC are working with the PTWC to provide the necessary training in 2013 and 2014 for the successful transition and changeover.

At the Twenty-Fifth Session of the Intergovernmental Coordination Group (ICG) of the Pacific Tsunami Warning and Mitigation System, to be held 11-13 September 2013, Member States will approve their use and agree on a timeline for the full implementation of the PTWC New Products suite. If approved, a date will be agreed to in 2014 to officially retire the existing products and changeover fully to the new products.

1.3 New Enhanced Products

There are important differences between PTWC's existing and its new enhanced products. Existing products use terminology that describes a level of alert for each country. Specifically, a country is currently designated by PTWC as being in a Tsunami Watch or a Tsunami Warning depending upon the tsunami threat presented by the event, as well as the time remaining until tsunami impact. Over the last several years, however, use of the Warning and Watch terms have caused confusion when the PTWC-designated levels of alert conflict with a country's independently-derived levels of alert. As each country is sovereign and thus responsible for the safety of its own population, the PTWC new products will change to avoid using the Warning and Watch terms, and instead provide forecast levels of impact along coasts.

The levels of expected impact will be provided as expected wave amplitudes within four categories, which are waves '< 0.3 m', '0.3 to less than 1 m', '1 m to less than 3 m', and 'over 3 m'; a fourth category will be 'not threat computed' to reflect locations where a forecast has not yet been made. With this, the designation of Alert levels, such as a Tsunami Warning, will then become the sole responsibility of the NTWCs. A list of countries and country sub-jurisdictions for which PTWC will provide forecasts is given in Appendix III, and the list of PTWC forecast polygons that divide extended coasts into segments or that surround particular island groups is given in Appendix IV. During the trial period, countries are asked to review the list and recommend changes if needed.

Further, present PTWC procedures for designating levels of alert in the existing products are extremely conservative and most places that come under a warning alert usually do not finally experience a destructive tsunami. This was in large part due to PTWC's reliance on limited historical data, and at the time the criteria were conceived and approved by the ICG/PTWS, the lack of numerical model forecasting for the Pacific in real time.

While numerical forecasts provided in the new product suite will continue to still be conservative, the provision of forecast information should nonetheless significantly reduce over-warning. In addition, by providing an expected level of impact, it is expected that national and local authorities will now be able to determine and enable more appropriate levels of response. For example, the distribution of forecast values along a coast may provide justification for national or local authorities to evacuate only a part of the coast, or to only clear beaches and harbors because a smaller tsunami is expected in these zones.

The PTWC new products will consist of both improved text products, and graphical products (examples in Appendix II). The text products include improvements in the order and type of information provided, and in its readability. The graphical products are expected to provide more information and at a much greater level of detail than will be possible using only text products. These include maps that show the forecast directionality of the tsunami energy, the forecast position of the initial wave through time, as well as the expected maximum wave amplitudes offshore and at the coast. The graphical products may also be helpful for communicating the threat quickly and clearly when time is of the essence.

1.4 New Enhanced Products Limitations

It is important to note that while the new products and the procedures behind them represent a significant improvement over the current ones, there will still be limitations that need to be recognized and understood by every country, and especially by their National Tsunami Warning Centers. The science of accurately forecasting tsunamis is still in its infancy. The greatest unknown about the tsunami in real-time (and even later) is its source. Specifically, as most tsunamis are generated by earthquakes, how did the seafloor deform when the earthquake occurred? How much was the seafloor displaced up or down, over what areas, and over what time period? The tsunami forecast models that PTWC uses must make assumptions about the source based upon the best available seismic analysis, or later, based upon the available nearby sea level gauge readings. But this only permits an approximation of the real source, and that approximation can evolve from the first few minutes after an earthquake to several hours after the earthquake when more data and analysis results become available.

The second greatest unknown is how the tsunami will interact with the coast. In most situations, a general approximation (Green's Law) must be used. Unfortunately, even when detailed bathymetry and coastal inundation models are available, properly and accurately capturing coastal resonances, trapped wave energy, and multiple wave interactions after even a few wave cycles, and in real-time as the tsunami is approaching, is not currently possible. For these reasons, the forecast model information provided in the PTWC New Products should be viewed and interpreted with care, taking into consideration the limitations that are explained later in this document.

2. PTWC CAPABILITIES AND PROCEDURES – TIMELINE FOR PRODUCT ISSUANCE

The new product suite is tied closely to PTWC new capabilities and procedures. This section of the User's Guide provides an overview of those capabilities and procedures and how they will drive the new products. The overview is presented in terms of a timeline of events that occur as an event unfolds. Times indicated are only approximate, but are typical.

Note that during the trial period beginning April 15, 2013, the new products may lag behind the existing products, because the existing products will remain PTWC's highest priority. The timeline below is expected to be fully realized after the official changeover when the new products will become as the only products issued by the PTWC.

00h00m	A large earthquake occurs in the Pacific region.
00h02m	Vibrations from the earthquake reach seismic stations near the earthquake epicenter, triggering event alarms at PTWC. PTWC duty analysts respond to the operations center and begin to analyze the event. [*PTWC currently monitors over 400 seismic stations from around the world, with data collected at most of those stations reaching PTWC within a minute of when it is collected.*]

00h08m	Using a combination of automatic and interactive analyses, duty analysts complete their preliminary determination of the earthquake epicenter, depth, and magnitude. These parameters, adjusted conservatively if necessary to account for error, are used to initiate a RIFT numerical tsunami forecast model run for a limited region near the epicenter. [*RIFT is one of three numerical forecast models in use at PTWC, each of which has its own strengths and weaknesses. RIFT is the model upon which the new products are primarily based. Forecasts from the other two models, SIFT and ATFM, are compared for consistency. For this initial RIFT run, the earthquake fault mechanism is based upon the mechanism of historical nearby earthquakes.*]
00h09m	The RIFT run completes within 5-20 seconds, providing a preliminary forecast of tsunami amplitudes for coasts generally within about 3 hours tsunami travel time of the earthquake.
00h10m	Based on the RIFT forecast, initial products are issued. • If forecast coastal tsunami amplitudes are less than 0.3m everywhere, then only a text Tsunami Information Statement is issued, indicating no tsunami threat. This is the only statement issued unless further analysis indicates a greater threat or to report observed tsunami waves. • If forecast coastal amplitudes are above 0.3m in some places, then a text Tsunami Threat Message is issued along with accompanying maps showing the forecast tsunami travel times, energy distribution and coastal amplitudes, a table summarizing forecast coastal amplitudes, and a kmz file of the individual coastal forecast points. These products will be followed by later product sets, at least one per hour, which may refine the forecast and report observations until the threat has largely passed.
00h20m	The seismic analyses continue as data from additional seismic stations arrive and are processed. If the earthquake parameters change significantly then RIFT is re-run. If there is a significant change in the forecast then appropriate supplemental products, similar to those described above, are issued.
00h25m	For earthquakes above about magnitude 7.0, the preliminary W-phase Centroid Moment Tensor (WCMT) analysis based upon broadband seismic data completes. The WCMT analysis not only gives a more accurate estimate of the earthquake location, depth and magnitude, but also an estimate of the earthquake's mechanism – the strike angle of the fault, the dip angle of the fault, and the direction of slip along the fault. These parameters help constrain the estimate of seafloor deformation that is the tsunami source, and they are used to drive a subsequent run of RIFT that covers the entire Pacific.
00h35m	For events with forecast coastal amplitudes above 0.3 m, then based upon the updated RIFT result a supplemental Tsunami Threat Message is issued along with accompanying maps, table, and KMZ file that cover the entire Pacific region and marginal seas of the PTWS.
00h30m to 02h00m	Sea level gauges are monitored for tsunami signals. Within the first 30 minutes to an hour the tsunami may arrive on the nearest one or two coastal gauges and one or two deep-ocean gauges. Tsunami amplitudes are measured and compared, when possible, with forecast amplitudes produced by the models. Model forecasts may be adjusted to be more consistent with observations.
Beyond 2h	The process of refining the earthquake parameters and collecting additional sea level observations continues, with that information used to constrain the forecast. The tsunami is monitored as it advances. When it is likely that there is no longer a significant tsunami threat then a final product is issued.

3. RIFT FORECAST MODEL DESCRIPTION AND LIMITATIONS

The PTWC will use the Real-time Forecast of Tsunamis (RIFT) model as the basis for its international forecast products for the PTWS. Developed by PTWC, RIFT is currently an experimental tsunami forecast model of NOAA that is based on the linear shallow water equations. Studies of its accuracy for a wide variety of sources and coasts are continuing. However, because of its general success in forecasting impacts from several recent tsunamis, including the February 2010 Chile tsunami and the March 2011 Japan tsunami, and its unique capability to use real-time estimates of the actual earthquake fault geometry as the primary source constraint and its capability to produce comprehensive forecast for all coasts around the world in real time, it was decided that RIFT should become the foundation of PTWC's international tsunami forecast operations. It should be noted PTWC also uses several other forecast models during an event, including NOAA's SIFT (Short-term Inundation Forecasting for Tsunamis) and ATFM (Alaska Tsunami Forecast Model), but in general these cannot be universally applied to all coasts and countries around the Pacific.

3.1 RIFT Description

Definitions: z2p=maximum absolute value of RIFT zero to peak wave amplitude
z2t=maximum absolute value of RIFT zero to trough wave amplitude

RIFT Deep-Ocean Maximum Tsunami Wave Amplitude Map
At each model grid point in the ocean, RIFT produces a time series of the sea level fluctuations caused by the passing tsunami waves. Shown on the map is the maximum amplitude of those fluctuations, A_{max}, defined by:

$A_{max} = 0.5 * (z2p + z2t)$ in meters

These are the maximum deep-ocean tsunami amplitudes. Maximum coastal amplitudes can be much larger.

RIFT Coastal Maximum Tsunami Wave Amplitude Map
For each model grid point near the coast, the tsunami amplitude at the coast can be estimated based upon Green's Law.

Green's Law: $A_{coast}=A_{offshore} * (D_{offshore} / D_{coast})^{¼}$

where A_{coast} is the tsunami amplitude at the coast
$A_{offshore}$ is the tsunami amplitude at the offshore grid point
D_{coast} is the depth of the ocean at the coast
$D_{offshore}$ is the depth of the ocean at the offshore grid point, and

The offshore ocean depth can vary from about 15m to 1000 m, depending upon the resolution at which RIFT is run - 30 arc-sec, 1 arc-min, 2 arc-min or 4 arc-min. The coastal ocean depth is set to be 1 m.

The off-shore point is the closest model grid point with a water depth greater than the offshore water depth of the model coastal point. If the distance from the coastal point to the offshore point is greater than 100 km, then no forecast is made for the coastal point. There is no confidence in the quality of the coastal forecast if Green's Law is applied over distances > 100 km. Consequently, there might not be a forecast for coasts with wide continental shelves at 4-arc-min. resolution. In those cases, a RIFT run at finer than 4 arc-min resolution is required for RIFT to produce a Green's Law coastal forecast.

3.2 RIFT Limitations

The following are overall known limitations of RIFT:

1. Initial results can vary easily by a factor of two, because of uncertainties in the preliminary magnitude, depth and assumed mechanism of the earthquake. Later results, constrained by the earthquake centroid moment tensor as well as by deep-ocean observations should be more reliable.
2. For small islands (e.g., islands less than 30 km in diameter), Green's Law can overestimate the coastal amplitude. In those cases, a forecast amplitude between the offshore and Green's Law amplitude may be more appropriate.
3. For resonant harbors, the Green's Law amplitude can underestimate the actual wave amplitude. Green's Law amplitude should be interpreted as average wave amplitude at the open coast, not necessarily the maximum amplitude inside a harbor or at a sea-level gauge.
4. The RIFT forecast coastal amplitude is not necessarily indicative of inundation depth, which is a function of the local topography. A 30-meter coastal amplitude from Green's Law does not mean the inundation depth will reach 30 meters. But it does indicate a major tsunami impact. 5. In the near field, Green’s law amplitude does not necessarily takes into account wave propagation and dissipation. Thus, a coastal amplitude of 20-30 meters can be misleading, it should also simply be interpreted as a major tsunami.

3.3 Detailed explanation of Green's law and the limitations of model forecast.

Additionally, there can be significant uncertainties in the RIFT forecast because of its assumptions and uncertainties of the earthquake source parameters. These include:

1. The forecast is sensitive to the earthquake magnitude. A difference of 0.2 in the earthquake magnitude results in factor of two in the tsunami wave amplitude.
2. The forecast is sensitive to the earthquake focal mechanism. For example, two earthquakes of magnitude 7.5 with different focal mechanisms can give vastly different results, easily by a factor of two or more. For the initial forecast without a computed mechanism, RIFT assumes the earthquake is of the shallow-thrust type to be conservative, even if the earthquake is located in regions of historical strike-slip earthquakes.
3. Experience shows that when RIFT is forced by the earthquake’s computed centroid moment tensors (CMT) mechanism, it tends to give a much better result. However, the CMT will not be become available until 25-30 minutes after the earthquake occurs. The initial CMT can be off by 0.2 or more in magnitude for large earthquakes, resulting in a factor of two difference in the RIFT tsunami wave forecast.

3.4 Key Assumptions of Green's Law

1. The coastline in question is linear and exposed to the open ocean.
2. Tsunami waves near the coast behave as one-dimensional plane waves.
3. There are no significant wave reflections and no dissipation by turbulence.
4. The bathymetry varies slowly compared to the wavelength of the tsunami waves. Thus, for steep bathymetry, the Green's Law forecast can overestimate the tsunami wave amplitudes.
5. Cliff boundary conditions are used. In other words, the coast is assumed to be a vertical wall.

3.5 RIFT References

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4. DESCRIPTION OF NEW PRODUCTS

Examples of the PTWC New Products are provided in Appendix II. The list of countries and country sub-jurisdictions that PTWC will forecast products for is provided in Appendix III, and the coastal forecast polygons that PTWC will use are listed in Appendix IV.

4.1 Threat Levels

The New Products will provide forecasts of tsunami wave amplitudes and be grouped into one of four forecast bins. These are ‘0.3 to 1 meter’, ‘1 to 3 meters’, and ‘greater than 3 meters’ above the normal tide level. A fourth bin corresponding to ‘not computed’ is assigned when a forecast has not been calculated for a forecast polygon or region.

4.2 Text Products

Text products are organized into the following discreet sections.

Headers
At the top of each text product are some header lines that include the World Meteorological Organization Product ID and issue date/time, an AWIPS ID, a product type line, an issuing office line, and an issuance date/time line.

Headline
Immediately below the header lines is a brief headline, leading and trailing with an ellipsis (…). The headline indicates either an information statement or a tsunami threat message.

Target Area
Below the headline is a statement indicating the geographic area that the product is intended for. The products are for most of the Pacific except those parts exclusively covered by other centers. This statement is to help avoid confusion in areas not covered by the product.

Tsunami Threat Forecast
Within this section, in bulleted form, are indicated the levels of threat that have been forecast and to which countries or places they apply. The levels are tsunami heights of 0.3-1 meter, 1-3 meters, and greater than 3 meters above the normal tide level.

Evaluation
The evaluation section always includes a narrative statement describing the key earthquake parameters. It may also include one or two short statements about the tsunami threat.

Recommended Actions
This section gives brief statements about recommended actions. Since the product is intended primarily for government agencies and not the public, the recommended actions are left very general to avoid conflicting with actions directed by the local authoritative government agencies.

Estimated Times of Arrival
Within this section are listed, in table form, estimated first tsunami wave arrival times for specific points within or near areas identified with a tsunami threat of at least 0.3 meters above the tide. These times should only be viewed as approximate. For a long-duration event, estimated arrival times more than an hour in the past will be removed from the list.

Potential Impacts
This section contains brief statements about tsunami behavior and the hazard presented by each level of threat.

Tsunami Observations
Within this section are readings of the maximum tsunami height recorded so far on certain coastal and/or deep-ocean sea-level gauges.

Preliminary Earthquake Parameters
The earthquake parameters, origin time, epicenter coordinates, depth, magnitude, and descriptive location are provided here in bulleted form.

Next Update and Additional Information
This final section indicates when the next product, if any, can be expected. It is usually within an hour. It also tells where additional information about the event may be found.

4.3 Forecast Polygon Map

The forecast polygon map provides a quick and general view of the tsunami threat. All coastal areas of the Pacific covered by the product are enclosed within a set of polygons. Some countries or places are covered by a single polygon and some by multiple polygons. Each polygon is given a color depending upon its maximum level of threat. Some polygons are uncolored because either 1) the forecast model domain did not include those areas, or 2) the forecast model could not make a forecast because its resolution was insufficient in areas of shallow water.

The forecast polygons that divide extended coasts into segments or that surround particular island groups were chosen and named somewhat arbitrarily based upon geological and political boundaries. During the trail period, Member States are encouraged to review the polygons and recommend changes in boundaries or names to make the polygons more useful.

4.4 Forecast Polygon Table

The forecast polygon table shows, for each polygon with a threat, the maximum, mean, and median forecast coastal tsunami height as well as the maximum, mean, and median offshore tsunami height. Offshore heights are translated to coastal heights using Green's Law. Rows are ordered by the maximum Green's Law value, from largest to smallest. For places like islands that have dimensions much smaller than the tsunami wavelength, Green's Law overestimates and the offshore height may be more appropriate. In all cases, height is measured relative to the tide level. Also provided are the standard deviation of the values, the total number of forecast points within each polygon, and a descriptive name for each polygon. Polygons shown in the Forecast Polygon Map are colored according to the maximum coastal height as given in this table.

4.5 Energy Forecast Map

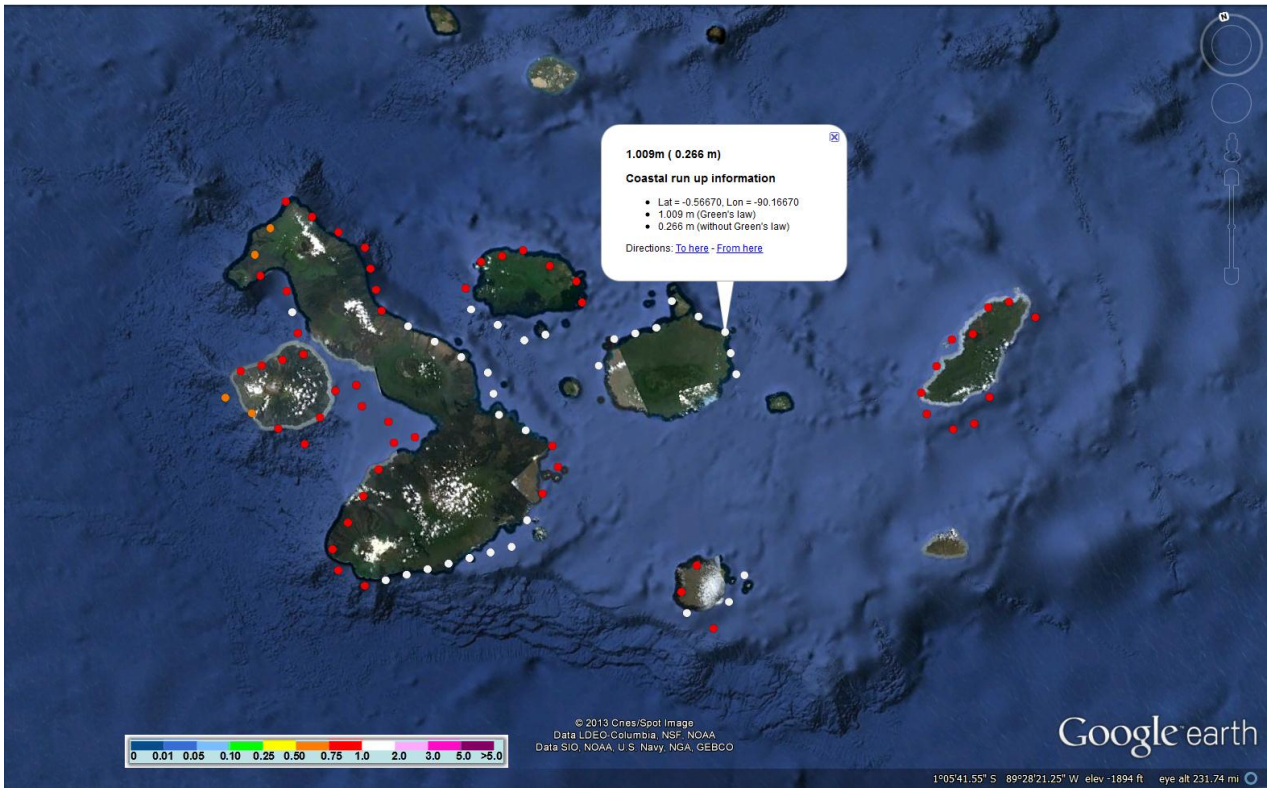
The energy map shows the maximum tsunami amplitude at each place in the deep ocean. It shows how the tsunami is directed away from the earthquake, how it is focused and defocused by the shape of the seafloor, and how it diminishes by spreading. It is useful for understanding why some areas may be more threatened because they are in a "beam" of directed tsunami energy. The color scale is chosen to best depict the range of expected forecasts, with the maximum forecast indicated as the largest value on the scale.

4.6 Coastal Forecast Map

This map shows the individual coastal forecast points colored according to the forecast tsunami height at each point. It provides significantly more spatial detail than the polygons. This can be useful for identifying when only part of a coast within a polygon is under threat. The accuracy of individual points, however, is less than points as a group. The color scale is according to the threat level ranges, with the maximum forecast indicated as the largest value on the scale.

4.7 Coastal Forecast KMZ File

Also provided with each forecast is a KMZ file containing the individual tsunami forecast height values for each forecast point. When combined with a program like GoogleEarth, the user can drill down into the forecast to examine individual forecast points. Again, however, it is important to note that the accuracy of individual points is less than the group value.



GoogleEarth screenshot of sample RIFT coastal tsunami forecast points around the Galapagos Islands. By mousing over and clicking on a forecast point, the metadata for the point is shown.

5. GENERAL RESPONSE GUIDANCE

In the existing products, a warning for a particular coast means that there is a possibility of destructive tsunami waves, and the criterion for issuing a warning is the possibility of tsunami waves that will be more than one meter above normal tide level (or mean sea level). Without additional information, the conservative response to a PTWC warning should be the maximum evacuation of entire coastal areas.

In the PTWC New Products, there are four categories of forecast tsunami threat that are based on the maximum wave amplitude forecast. These categories are: less than 0.3 meters, 0.3 to 1 meter, 1 to 3 meters, and more than 3 meters. The categories are intended to generally correspond to different levels of public safety response.

A tsunami that is forecast to have less than 0.3 meter fluctuations from mean sea level is generally not a hazard, and the tsunami would usually not be observed except in places where there is still water, or on sea level gauges.

A tsunami that is forecast to have sea level fluctuations of 0.3 to 1 meter above and below mean sea level is usually a hazard only for ocean recreation activities, such as swimming, diving, and leisure boating, due to strong and unusual near-shore ocean currents, and to minor flooding of beaches and harbors immediately adjacent to the coast. It does not necessarily require a full evacuation of coastal areas, but may require safety actions that recommend swimmers and divers to exit the ocean and persons in low-lying areas of beaches and harbors to stay aware from the ocean or evacuate.

A tsunami that is forecast to have sea level fluctuations of 1 to 3 meters above or below mean sea level is a much more dangerous hazard and in most cases would require a significant evacuation of the coast to protect lives. However, in places with elevated

coastlines, or places where multiple evacuation zones have been designated, a public safety action that is less than the maximum evacuation may be appropriate.

A tsunami that is forecast to reach more than 3 meters above mean sea level is a very serious threat that would require a maximum evacuation.

Standard response procedures for the PTWC forecast threat levels should be developed nationally and/or locally, taking into consideration the character of the coast, the range and state of the tides, the various vulnerabilities at the coast, and the capability of emergency officials to issue evacuation notices to vulnerable communities in a timely manner.

Further definitions and guidance on warning centers and their products, threat levels, and other terms used in tsunami warning and emergency response can be found in Section 5 (Tsunami Warning System, Acronyms, & Organizations) of the 2013 Tsunami Glossary (Intergovernmental Oceanographic Commission. Revised Edition 2013. Tsunami Glossary, 2013. Paris, UNESCO. IOC Technical Series, 85. (English) (IOC/2008/TS/85 rev.). The 2013 Tsunami Glossary was updated to reflect the establishment of warning centers in the Indian Ocean and North Atlantic and Mediterranean region, and to reflect that PTWS PTWC New Products. PTWC's existing products (Tsunami Watch, Warnings, and Information Bulletins) are described in Section 5 Acronyms & Organizations of the 2008 Tsunami Glossary.

Both documents can be downloaded in low-resolution from the ITIC web site at: http://itic.ioc-unesco.org/index.php?option=com_content&view=article&id=1328&Itemid=2305&lang=en

APPENDIX I. BACKGROUND AND MOTIVATION

Over the past decade, PTWC has gone from ingesting data from only about 10 seismic stations outside of Hawaii to over 400 stations now. In addition, its seismic data processing capabilities have become faster and more accurate due to a combination of a better information technology and communications infrastructure, as well as improved science and techniques of its implementation. Within the past five years, and especially since the 2004 Indian Ocean tsunami, the quantity, quality, and timeliness of sea level observations available to PTWC have also increased dramatically. Notably, data are now being received from 39 deep-ocean tsunami gauges in the Pacific that provide measurements of tsunami waveforms unaltered by non-linear effects near the coast, and over 400 sea level stations along country coasts. Lastly, numerical forecast models implemented into PTWC's operations over the past several years have demonstrated that they are capable of providing much more detailed and precise guidance on the expected level of tsunami impacts than was previously possible using PTWC's current PTWS warning procedures based only on limited historical data and general properties of tsunami generation, propagation and impact. While the predictive capabilities of the forecast models are not perfect, it is felt that they are now accurate enough to provide reliable guidance on the expected levels of impact to areas that are threatened, and thus should greatly reduce the number of areas warned unnecessarily.

During the Twenty-second and Twenty-third sessions of the ICG/PTWS (2007, 2009), the PTWC reported on operational enhancements that are now permitting the PTWC to provide more timely and accurate assessments of tsunami threat, and asked Member States for input on how PTWC can improve its services. In response, Recommendation ICG/PTWS-XXIII.1 established a Task Team on Enhancing Tsunami Warning Products under the PTWS Working Group on Detection, Warning and Dissemination (WG 2) to review current capabilities, obtain customer feedback, consider best practices, and develop recommendations to improve existing or create new products, and improve dissemination for more effective, functional, and timely delivery.

At the Twenty-fourth session of the ICG/PTWS (May, 2011), Recommendation ICG/PTWS-XXIV.1 asked PTWC to proceed with its development of improved tsunami procedures and products with the Task Team on Enhancing Products guiding and providing feedback and related documentation to PTWC and the ICG/PTWS regarding these changes and the proposed implementation timeline. Any new products and procedures should be exercised in an experimental mode as they are developed and until they are approved for official use by the ICG/PTWS-XXV or later. Recommendation ICG/PTWS-XXIV.3 on PTWS Exercises asked the Working Group Two Task Team on PacWave11 to oversee the conduct of Exercise Pacific Wave 2011 (PacWave11); PacWave11 took place in November 2011 as an international exercise aimed at improving local and regional tsunami response and additionally, introduced the new products to Member States. Through the post-exercise evaluation, comments were received on the staging, format, and contents of the new products.

In May 2012, the Task Teams on PacWave11 and Enhanced Products met to review the feedback on the new products from PacWave11 and other tsunami meetings, and provided recommendations to the following PTWS Steering Committee (PTWS-SC). The PTWS-SC endorsed the recommendations, approved a revised timeline for implementation, and asked the Task Team on PacWave11 to continue and organize Exercise Pacific Wave 2013 to further validate the new products. Since 2009, the Task Teams on Enhanced Products and Exercise Pacific Wave have worked closely to develop, exercise, and obtain feedback from Member States for the implementation and changeover to the new products that is expected in 2014.

APPENDIX II. EXAMPLES OF PTWS PTWC NEW ENHANCED PRODUCTS

A. Tsunami Information Statement (earthquake with no tsunami threat)

a. Initial Product

i. Text Product

```
ZCZC
WEPA42 PHEB 081118
TIBPAC

TSUNAMI INFORMATION STATEMENT NUMBER 1
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1118 UCT FRI FEB 8 2013

...TSUNAMI INFORMATION STATEMENT...

THIS STATEMENT IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


EVALUATION
----------

  * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 6.7 OCCURRED
    OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY
    8 2013.

  * BASED ON ALL AVAILABLE DATA... THERE IS NO TSUNAMI THREAT
    FROM THIS EARTHQUAKE.


RECOMMENDED ACTIONS
-------------------

  * NO ACTION IS REQUIRED.


PRELIMINARY EARTHQUAKE PARAMETERS
---------------------------------

  * MAGNITUDE      6.7
  * ORIGIN TIME    1112 UTC FEB 8 2013
  * COORDINATES    33.7 SOUTH  72.3 WEST
  * DEPTH          20 KM / 12 MILES
  * LOCATION       OFF THE COAST OF CENTRAL CHILE


NEXT UPDATE AND ADDITIONAL INFORMATION
--------------------------------------

  * THIS WILL BE THE ONLY STATEMENT ISSUED FOR THIS EVENT UNLESS
    ADDITIONAL DATA ARE RECEIVED OR THE SITUATION CHANGES.

  * COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI
    WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT
    PTWC.WEATHER.GOV.

  * COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON...
    BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND
    ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT
    WCATWC.ARH.NOAA.GOV.

  * AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S.
    GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT
    EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

  * FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT
    PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

$$
```

B. Tsunami Information Statement (earthquake with minimal tsunami threat)

a. Initial Product

i. Text Product

```
ZCZC
WEPA42 PHEB 081119
TIBPAC

TSUNAMI INFORMATION STATEMENT NUMBER 1
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1119 UCT FRI FEB 8 2013

...TSUNAMI INFORMATION STATEMENT...

THIS STATEMENT IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


EVALUATION
----------

  * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 6.7 OCCURRED
    OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY
    8 2013.

  * BASED ON ALL AVAILABLE DATA... THERE IS NO TSUNAMI THREAT
    FROM THIS EARTHQUAKE ALTHOUGH SOME MINOR SEA LEVEL
    FLUCTUATIONS MAY OCCUR.


RECOMMENDED ACTIONS
-------------------

  * PERSONS ALONG COASTAL AREAS NEAR THE EARTHQUAKE SHOULD BE
    OBSERVANT AND EXERCISE NORMAL CAUTION. OTHERWISE... NO ACTION
    IS REQUIRED.


POTENTIAL IMPACTS
-----------------

  * MINOR SEA LEVEL FLUCTUATIONS UP TO 0.3 METERS ABOVE AND BELOW
    THE NORMAL TIDE MAY OCCUR IN COASTAL AREAS NEAR THE EARTHQUAKE
    OVER THE NEXT FEW HOURS.


PRELIMINARY EARTHQUAKE PARAMETERS
---------------------------------

  * MAGNITUDE      6.7
  * ORIGIN TIME    1112 UTC FEB 8 2013
  * COORDINATES    33.7 SOUTH  72.3 WEST
  * DEPTH          20 KM / 12 MILES
  * LOCATION       OFF THE COAST OF CENTRAL CHILE


NEXT UPDATE AND ADDITIONAL INFORMATION
--------------------------------------

  * THIS WILL BE THE ONLY STATEMENT ISSUED FOR THIS EVENT UNLESS
    ADDITIONAL DATA ARE RECEIVED OR THE SITUATION CHANGES.

  * COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI
    WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT
    PTWC.WEATHER.GOV.

  * COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON...
    BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND
    ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT
    WCATWC.ARH.NOAA.GOV.
```

```
  * AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S.
    GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT
    EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

  * FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT
    PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

$$
```

C. Tsunami Threat Message (earthquake with low-level tsunami threat)

a. Initial Products (initial forecast)

i. Text Product

```
ZCZC
WEPA40 PHEB 081119
TSUPAC

TSUNAMI MESSAGE NUMBER 1
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1119 UCT FRI FEB 8 2013

...TSUNAMI THREAT MESSAGE...

THIS MESSAGE IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


TSUNAMI THREAT FORECAST
-----------------------

  * TSUNAMI WAVES REACHING 0.3 TO 1 METERS ABOVE THE NORMAL TIDE
    ARE FORECAST FOR COASTS IN

      CHILE.


EVALUATION
----------

  * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 7.1 OCCURRED
    OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY
    8 2013.

  * BASED ON THE PRELIMINARY SEISMIC PARAMETERS... HAZARDOUS
    TSUNAMI WAVES ARE FORECAST FOR SOME COASTS.


RECOMMENDED ACTIONS
-------------------

  * GOVERNMENT AGENCIES RESPONSIBLE FOR THREATENED COASTAL AREAS
    SHOULD TAKE ACTION TO INFORM AND INSTRUCT ANY COASTAL
    POPULATIONS AT RISK IN ACCORDANCE WITH THEIR OWN EVALUATION...
    PROCEDURES AND THE LEVEL OF THREAT.

  * PERSONS LOCATED IN THREATENED COASTAL AREAS SHOULD STAY ALERT
    FOR INFORMATION AND FOLLOW INSTRUCTIONS FROM LOCAL
    AUTHORITIES.


ESTIMATED TIMES OF ARRIVAL
--------------------------

  * ESTIMATED TIMES OF ARRIVAL -ETA- OF THE INITIAL TSUNAMI WAVE
    ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE
    INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF
    WAVES AND THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE
    HOUR.
```

LOCATION	REGION	COORDINATES	ETA(UTC)
VALPARAISO	CHILE	33.0S 71.6W	1130 02/08
COQUIMBO	CHILE	29.9S 71.4W	1153 02/08
TALCAHUANO	CHILE	36.7S 73.1W	1204 02/08
CALDERA	CHILE	27.1S 70.8W	1213 02/08
CORRAL	CHILE	39.8S 73.5W	1235 02/08
PUERTO MONTT	CHILE	41.5S 73.0W	1531 02/08

POTENTIAL IMPACTS

* TSUNAMI WAVES OF 0.3 TO 1 METER MAY CAUSE STRONG AND UNUSUAL OCEAN CURRENTS AND MINOR FLOODING OF BEACH AND HARBOR AREAS.

* A TSUNAMI IS A SERIES OF WAVES. THE TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR. THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE INITIAL WAVE.

* IMPACTS CAN VARY SIGNIFICANTLY FROM ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND THE SHAPE AND ELEVATION OF THE SHORELINE.

* IMPACTS CAN ALSO VARY DEPENDING UPON THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI WAVES.

PRELIMINARY EARTHQUAKE PARAMETERS

* MAGNITUDE 7.1
* ORIGIN TIME 1112 UTC FEB 8 2013
* COORDINATES 33.7 SOUTH 72.3 WEST
* DEPTH 20 KM / 12 MILES
* LOCATION OFF THE COAST OF CENTRAL CHILE

NEXT UPDATE AND ADDITIONAL INFORMATION

* THE NEXT MESSAGE WILL BE ISSUED IN ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

* COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT PTWC.WEATHER.GOV.

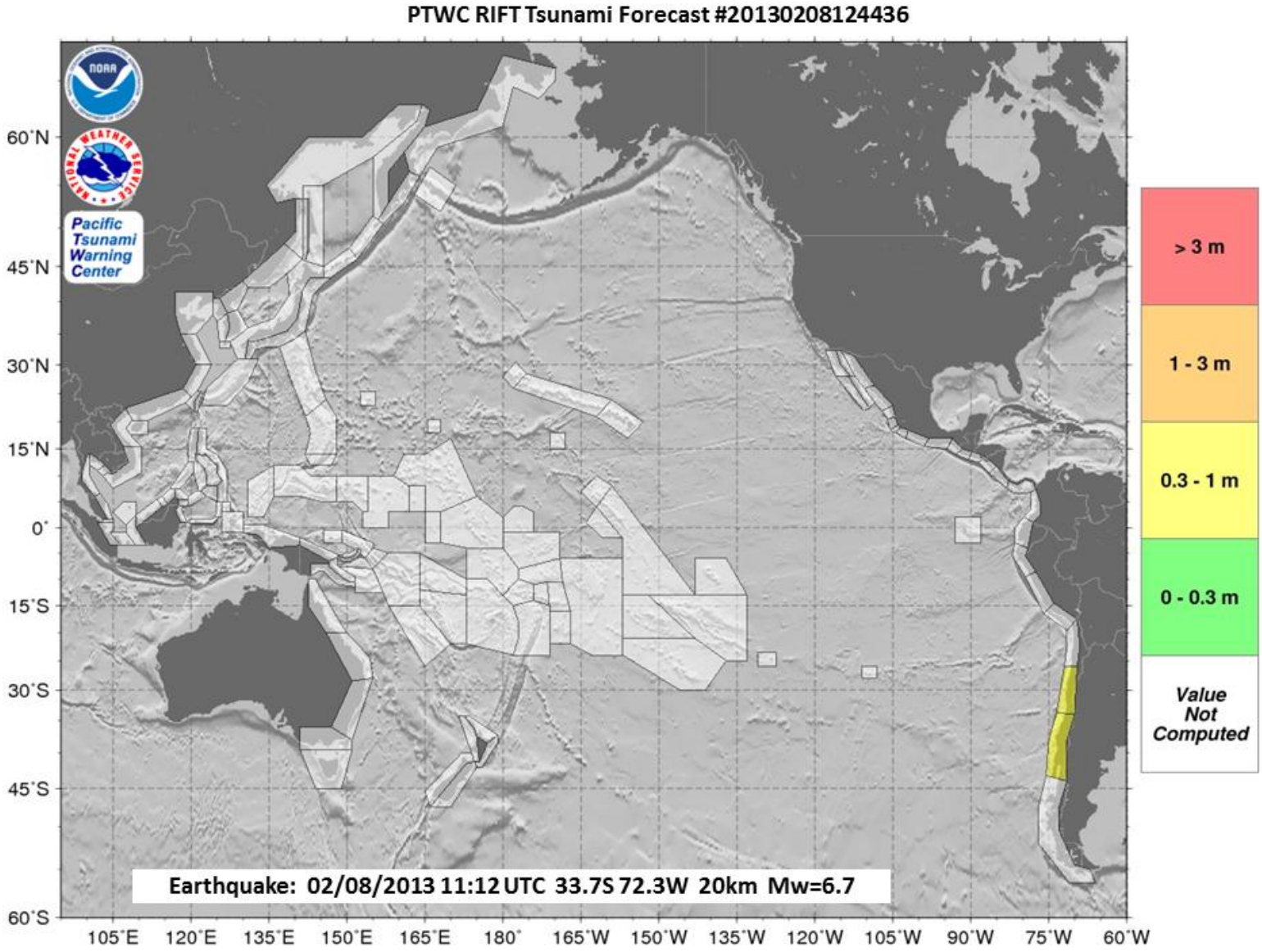
* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT WCATWC.ARH.NOAA.GOV.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

* FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

$$

ii. Forecast Polygons Map

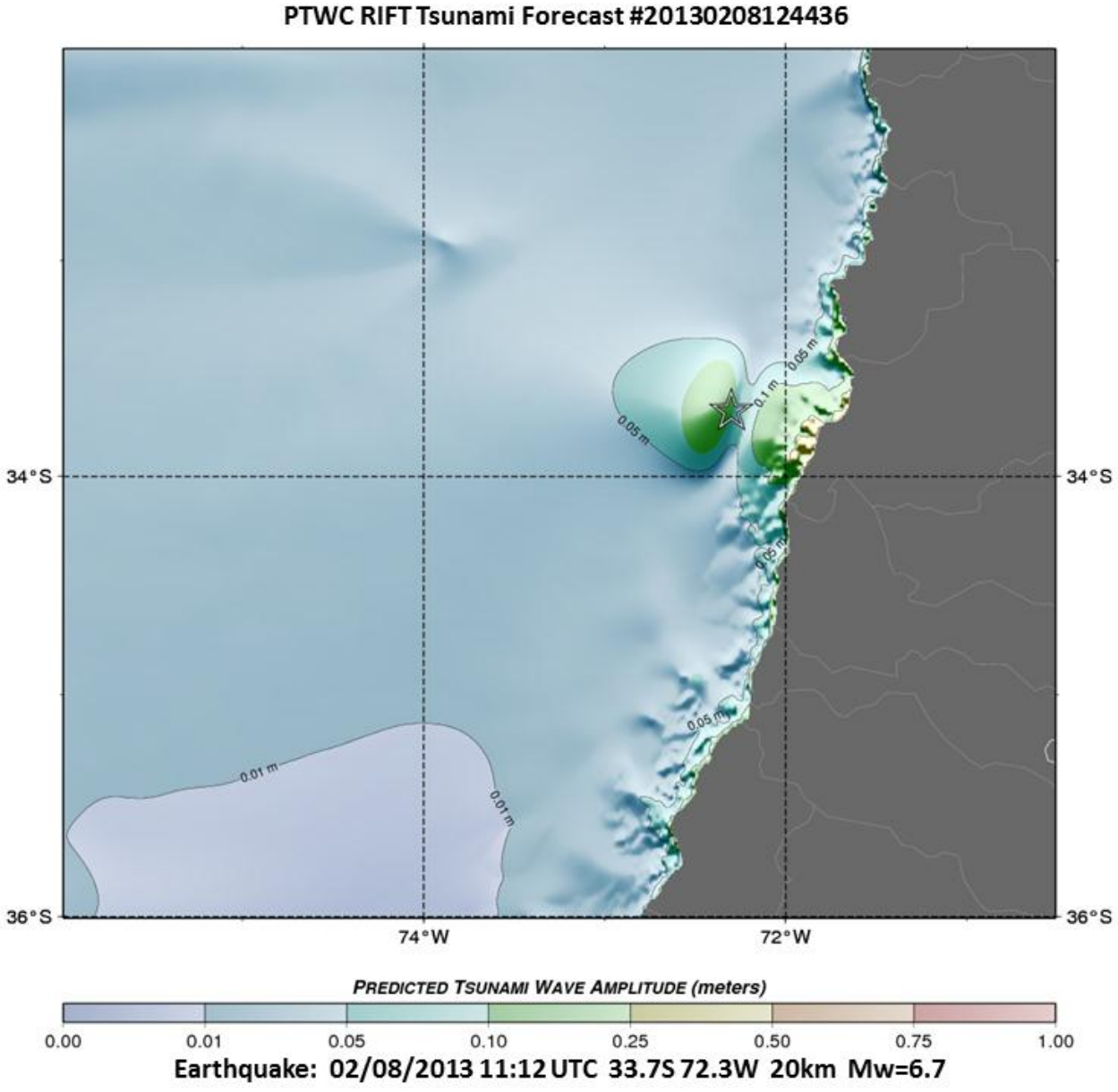


iii. Forecast Polygons Table

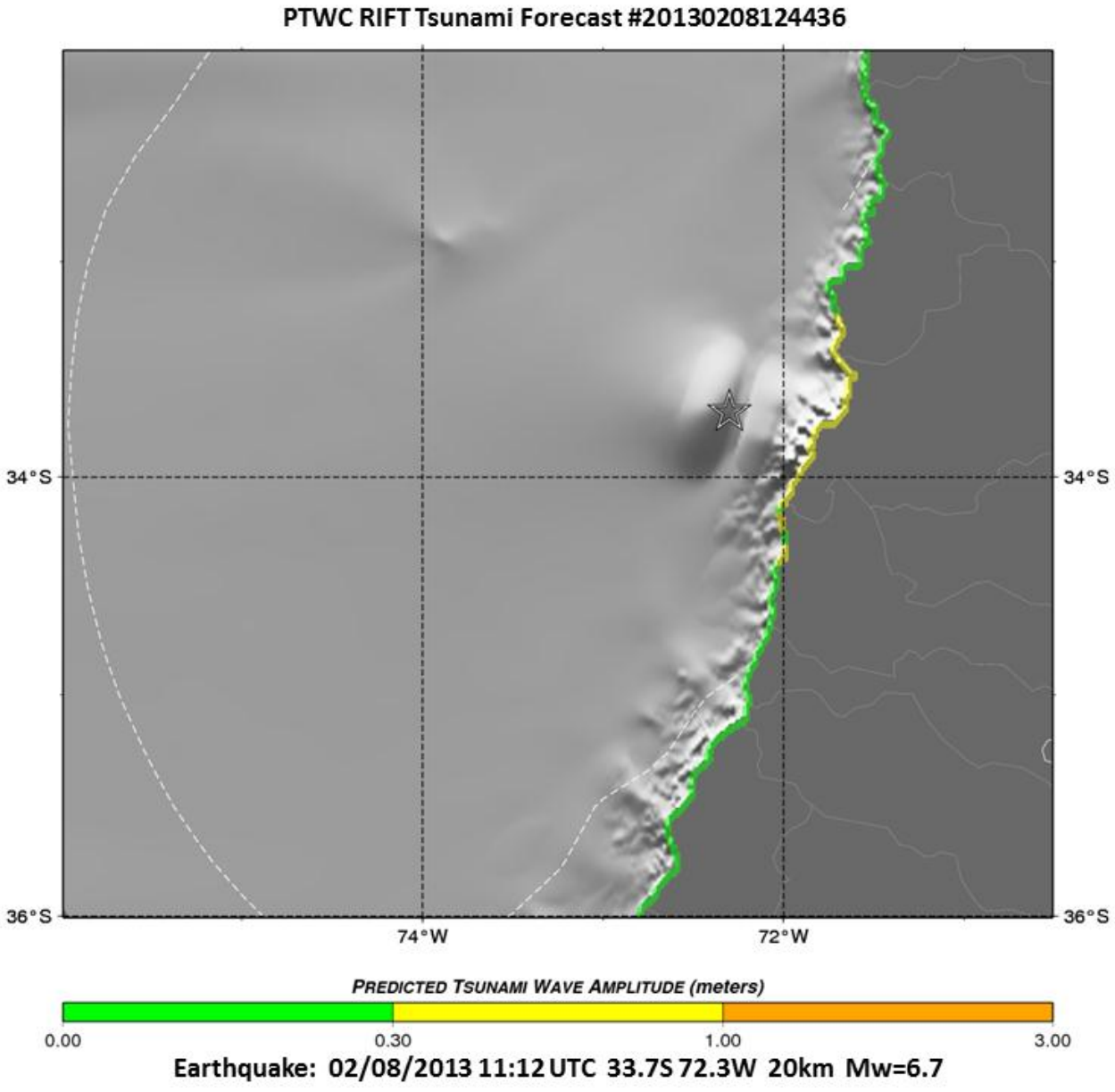
PTWC RIFT Tsunami Forecast Model - Run ID: 2013020812443
Earthquake - Origin: 02/08/2013 11:12:13 UTC Coordinates: 33.7S 72.3W Depth: 020km Magnitude: 7.1

Coastal Forecast (meters)				Offshore Forecast (meters)				Total	
Maximum	Mean	Median	STD	Maximum	Mean	Median	STD	Points	Region Name
0.65	0.26	0.18	0.16	0.58	0.18	0.12	0.13	132	North Central Chile
0.62	0.20	0.16	0.10	0.62	0.14	0.12	0.09	138	South Central Chile

iv. Energy Forecast Map



v. Coastal Forecast Map



b. Supplemental Products (revised forecast and observations)

i. Text Product

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ZCZC
WEPA40 PHEB 081151
TSUPAC

TSUNAMI MESSAGE NUMBER 2
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1151 UCT FRI FEB 8 2013

...TSUNAMI THREAT MESSAGE...

THIS MESSAGE IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


TSUNAMI THREAT FORECAST
-----------------------

  * TSUNAMI WAVES REACHING 0.3 TO 1 METERS ABOVE THE NORMAL TIDE
    ARE FORECAST FOR COASTS IN

      CHILE.


EVALUATION
----------

  * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 7.1 OCCURRED
    OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY
    8 2013.

  * TSUNAMI WAVES HAVE BEEN OBSERVED.

  * BASED ON ALL AVAILABLE DATA... HAZARDOUS TSUNAMI WAVES ARE
    FORECAST FOR SOME COASTS.


RECOMMENDED ACTIONS
-------------------

  * GOVERNMENT AGENCIES RESPONSIBLE FOR THREATENED COASTAL AREAS
    SHOULD TAKE ACTION TO INFORM AND INSTRUCT ANY COASTAL
    POPULATIONS AT RISK IN ACCORDANCE WITH THEIR OWN EVALUATION...
    PROCEDURES AND THE LEVEL OF THREAT.

  * PERSONS LOCATED IN THREATENED COASTAL AREAS SHOULD STAY ALERT
    FOR INFORMATION AND FOLLOW INSTRUCTIONS FROM LOCAL
    AUTHORITIES.


ESTIMATED TIMES OF ARRIVAL
--------------------------

  * ESTIMATED TIMES OF ARRIVAL -ETA- OF THE INITIAL TSUNAMI WAVE
    ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE
    INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF
    WAVES AND THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE
    HOUR.

    LOCATION         REGION             COORDINATES    ETA(UTC)
    ------------------------------------------------------------
    VALPARAISO       CHILE             33.0S  71.6W   1130 02/08
    COQUIMBO         CHILE             29.9S  71.4W   1153 02/08
    TALCAHUANO       CHILE             36.7S  73.1W   1204 02/08
    CALDERA          CHILE             27.1S  70.8W   1213 02/08
    CORRAL           CHILE             39.8S  73.5W   1235 02/08
    PUERTO MONTT     CHILE             41.5S  73.0W   1531 02/08
```

POTENTIAL IMPACTS
---

* TSUNAMI WAVES OF 0.3 TO 1 METER MAY CAUSE STRONG AND UNUSUAL OCEAN CURRENTS AND MINOR FLOODING OF BEACH AND HARBOR AREAS.

* A TSUNAMI IS A SERIES OF WAVES. THE TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR. THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE INITIAL WAVE.

* IMPACTS CAN VARY SIGNIFICANTLY FROM ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND THE SHAPE AND ELEVATION OF THE SHORELINE.

* IMPACTS CAN ALSO VARY DEPENDING UPON THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI WAVES.

TSUNAMI OBSERVATIONS
---

* THE FOLLOWING ARE TSUNAMI WAVE OBSERVATIONS FROM COASTAL AND/OR DEEP-OCEAN SEA LEVEL GAUGES AT THE INDICATED LOCATIONS. THE MAXIMUM TSUNAMI HEIGHT IS MEASURED WITH RESPECT TO THE NORMAL TIDE LEVEL.

GAUGE LOCATION	GAUGE COORDINATES LAT	LON	TIME OF MEASURE (UTC)	MAXIMUM TSUNAMI HEIGHT	WAVE PERIOD (MIN)
VALPARAISO CL	33.0S	71.6W	1113	0.6M/ 2.1FT	30

PRELIMINARY EARTHQUAKE PARAMETERS
---

* MAGNITUDE 7.1
* ORIGIN TIME 1112 UTC FEB 8 2013
* COORDINATES 33.7 SOUTH 72.3 WEST
* DEPTH 20 KM / 12 MILES
* LOCATION OFF THE COAST OF CENTRAL CHILE

NEXT UPDATE AND ADDITIONAL INFORMATION
---

* THE NEXT MESSAGE WILL BE ISSUED IN ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

* COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT PTWC.WEATHER.GOV.

* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT WCATWC.ARH.NOAA.GOV.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

* FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

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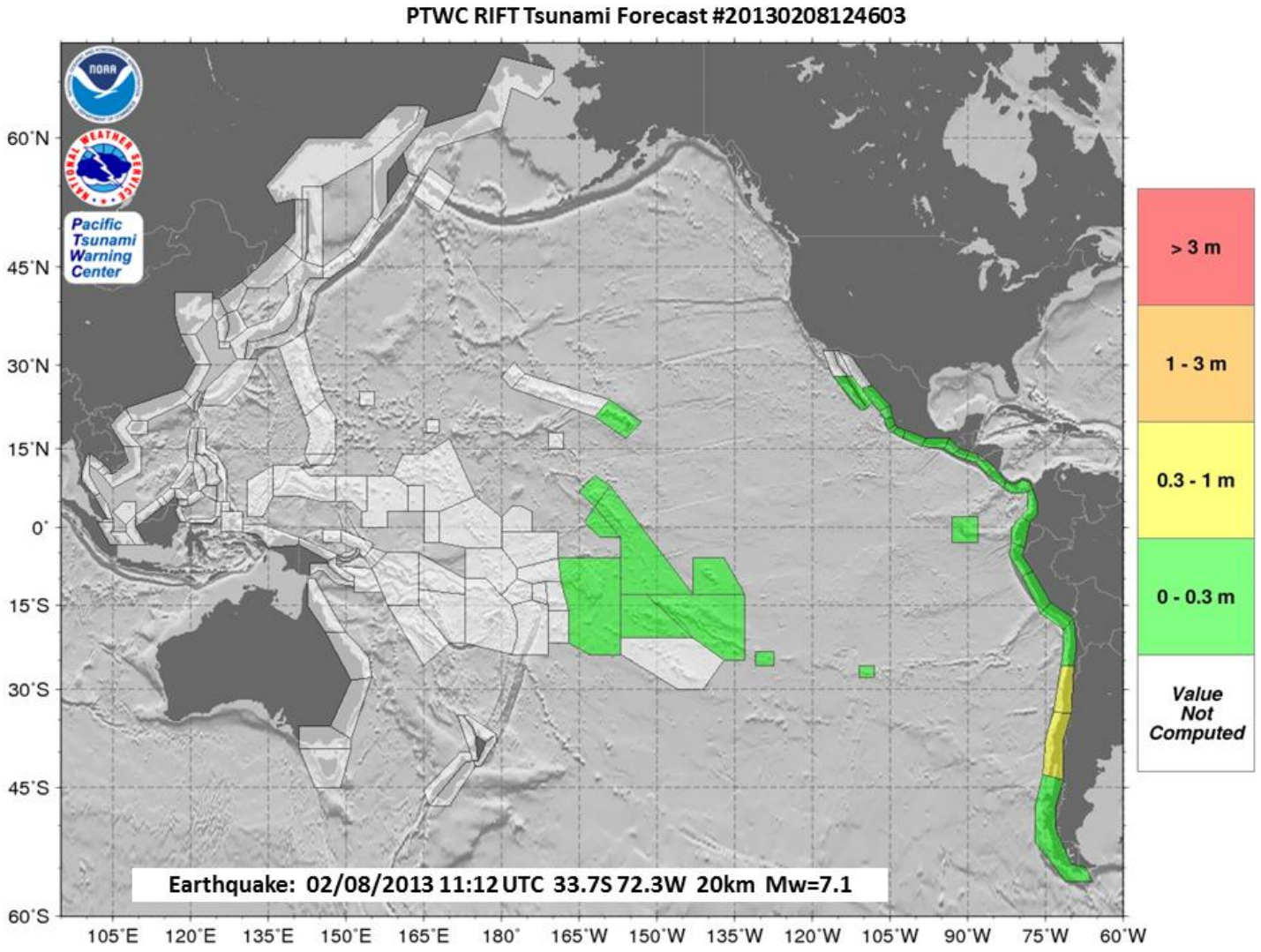
ii. Forecast Polygons Map



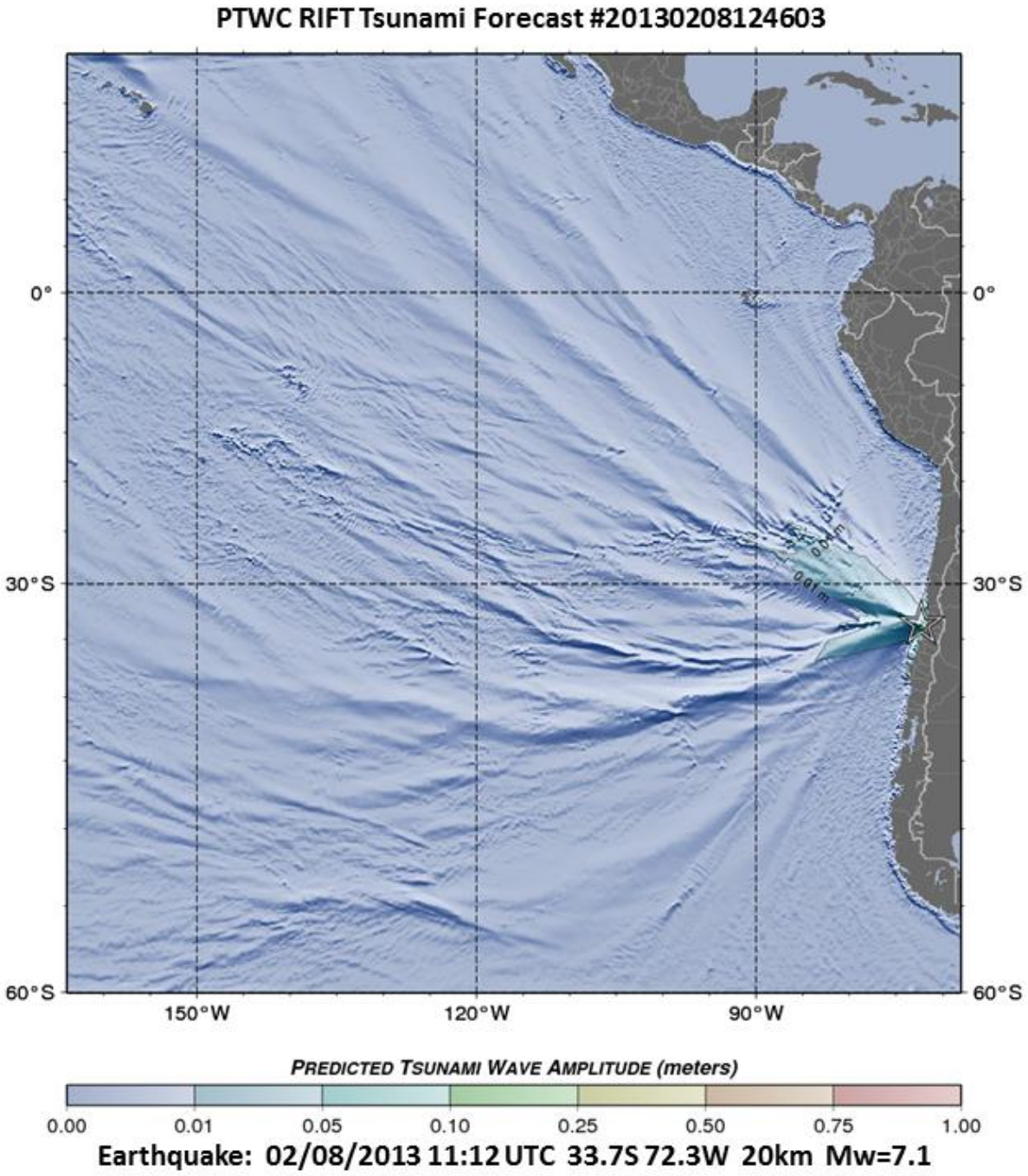
iii. Forecast Polygons Table

PTWC RIFT Tsunami Forecast Model - Run ID: 2013020812460
Earthquake - Origin: 02/08/2013 11:12:13 UTC Coordinates: 33.7S 72.3W Depth: 020km Magnitude: 7.1

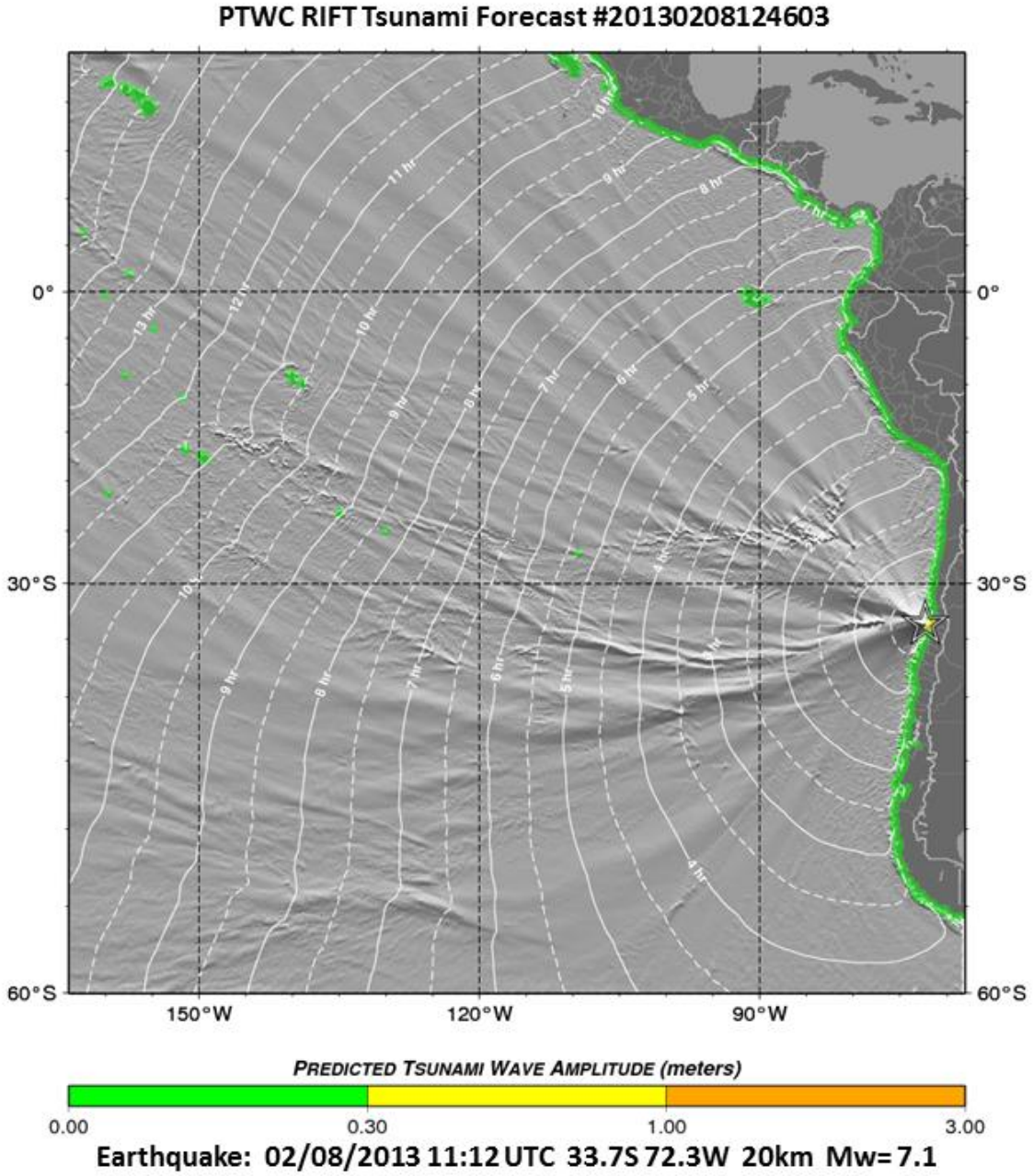
Coastal Forecast (meters)				Offshore Forecast (meters)				Total	
Maximum	Mean	Median	STD	Maximum	Mean	Median	STD	Points	Region Name
0.58	0.05	0.02	0.08	0.19	0.03	0.01	0.03	160	South Central Chile
0.58	0.09	0.04	0.09	0.17	0.04	0.02	0.04	120	North Central Chile
0.06	0.03	0.03	0.01	0.03	0.01	0.01	0.01	27	Marquesas Islands
0.05	0.02	0.01	0.01	0.02	0.01	0.00	0.00	145	Hawaii
0.04	0.02	0.02	0.00	0.02	0.01	0.01	0.00	101	Central Peru
0.03	0.03	0.03	0.00	0.01	0.01	0.01	0.00	1	Easter Island
0.03	0.03	0.03	0.00	0.02	0.01	0.01	0.01	4	Tuamotu Archipelago
0.03	0.03	0.03	0.00	0.01	0.01	0.01	0.00	1	Pitcairn Island
0.03	0.03	0.03	0.00	0.02	0.01	0.01	0.00	73	Southern Peru
0.03	0.02	0.02	0.00	0.01	0.01	0.01	0.00	119	Northern Chile
0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	1	Palmyra Island
0.02	0.02	0.02	0.00	0.01	0.00	0.00	0.00	36	Society Islands
0.02	0.01	0.01	0.00	0.01	0.01	0.01	0.01	2	Cook Islands
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	89	Galapagos Islands
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	32	Jalisco Mexico
0.02	0.01	0.01	0.00	0.01	0.01	0.01	0.00	48	Pacific Side of Baja Sud Mexico
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	72	Oaxaca Mexico
0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	37	El Salvador
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	56	Guerrero Mexico
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	77	Pacific Coast of Costa Rica
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	101	Northern Peru
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	3	Line Islands
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	46	Gulf Side of Baja Sud Mexico
0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	328	Southern Chile
0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	27	Michoacan Mexico
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	12	Colima Mexico
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	28	Chiapas Mexico
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	32	Pacific Coast of Guatemala
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	27	Nayarit Mexico
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	43	Sinaloa Mexico
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	1	Jarvis Island
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	37	Pacific Side of Nicaragua

0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	89	Pacific Side of Panama
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	99	Ecuador
0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	96	Pacific Coast of Colombia

iv. Energy Forecast Map



v. Coastal Forecast Map



Note that only a small section of Chilean coast is forecast to have amplitudes between 0.3 and 1 meter. Its yellow color can be seen through the star (which indicates the earthquake epicenter).

c. Final Product (threat ended)

i. Text Product

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ZCZC
WEPA40 PHEB 081235
TSUPAC

TSUNAMI MESSAGE NUMBER 3
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1235 UCT FRI FEB 8 2013

...FINAL TSUNAMI THREAT MESSAGE...

THIS MESSAGE IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


TSUNAMI THREAT FORECAST
-----------------------

  * THERE IS NO LONGER A TSUNAMI THREAT FROM THIS EARTHQUAKE.


EVALUATION
----------

  * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 7.1 OCCURRED
    OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY
    8 2013.

  * BASED ON ALL AVAILABLE DATA... THE TSUNAMI THREAT FROM THIS
    EARTHQUAKE HAS PASSED AND THERE IS NO FURTHER THREAT.


RECOMMENDED ACTIONS
-------------------

  * REMAIN OBSERVANT AND EXERCISE NORMAL CAUTION NEAR THE SEA.
    OTHERWISE... NO ACTION IS REQUIRED.


POTENTIAL IMPACTS
-----------------

  * MINOR SEA LEVEL FLUCTUATIONS OF UP TO 0.3 METERS ABOVE AND
    BELOW THE NORMAL TIDE MAY CONTINUE OVER THE NEXT FEW HOURS.


TSUNAMI OBSERVATIONS
--------------------

  * THE FOLLOWING ARE TSUNAMI WAVE OBSERVATIONS FROM COASTAL
    AND/OR DEEP-OCEAN SEA LEVEL GAUGES AT THE INDICATED LOCATIONS.
    THE MAXIMUM TSUNAMI HEIGHT IS MEASURED WITH RESPECT TO THE
    NORMAL TIDE LEVEL.

                          GAUGE      TIME OF   MAXIMUM     WAVE
                       COORDINATES   MEASURE   TSUNAMI   PERIOD
    GAUGE LOCATION      LAT   LON     (UTC)     HEIGHT    (MIN)
    ------------------------------------------------------------
    VALPARAISO CL      33.0S  71.6W    1113    0.6M/ 2.1FT  30
```

```
PRELIMINARY EARTHQUAKE PARAMETERS
---------------------------------

  * MAGNITUDE      7.1
  * ORIGIN TIME    1112 UTC FEB 8 2013
  * COORDINATES    33.7 SOUTH  72.3 WEST
  * DEPTH          20 KM / 12 MILES
  * LOCATION       OFF THE COAST OF CENTRAL CHILE


NEXT UPDATE AND ADDITIONAL INFORMATION
--------------------------------------

  * THIS WILL BE THE FINAL STATEMENT ISSUED FOR THIS EVENT UNLESS
    NEW INFORMATION IS RECEIVED OR THE SITUATION CHANGES.

  * COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI
    WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT
    PTWC.WEATHER.GOV.

  * COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON...
    BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND
    ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT
    WCATWC.ARH.NOAA.GOV.

  * AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S.
    GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT
    EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

  * FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT
    PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

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D. Tsunami Threat Message (earthquake with major tsunami threat)

a. Initial Products (initial forecast)

i. Text Product

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ZCZC
WEPA40 PHEB 081118
TSUPAC

TSUNAMI MESSAGE NUMBER 1
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1118 UCT FRI FEB 8 2013

...TSUNAMI THREAT MESSAGE...

THIS MESSAGE IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


TSUNAMI THREAT FORECAST...UPDATED
---------------------------------

  * TSUNAMI WAVES REACHING MORE THAN 3 METERS ABOVE THE NORMAL TIDE
    ARE FORECAST FOR COASTS IN

      CHILE.


  * TSUNAMI WAVES REACHING 1 TO 3 METERS ABOVE THE NORMAL TIDE
    ARE FORECAST FOR COASTS IN

      PERU.
```

EVALUATION
---

* AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 8.7 OCCURRED OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY 8 2013.

* BASED ON THE PRELIMINARY SEISMIC PARAMETERS... HAZARDOUS TSUNAMI WAVES ARE FORECAST FOR SOME COASTS.

RECOMMENDED ACTIONS
---

* GOVERNMENT AGENCIES RESPONSIBLE FOR THREATENED COASTAL AREAS SHOULD TAKE ACTION TO INFORM AND INSTRUCT ANY COASTAL POPULATIONS AT RISK IN ACCORDANCE WITH THEIR OWN EVALUATION... PROCEDURES AND THE LEVEL OF THREAT.

* PERSONS LOCATED IN THREATENED COASTAL AREAS SHOULD STAY ALERT FOR INFORMATION AND FOLLOW INSTRUCTIONS FROM LOCAL AUTHORITIES.

ESTIMATED TIMES OF ARRIVAL
---

* ESTIMATED TIMES OF ARRIVAL -ETA- OF THE INITIAL TSUNAMI WAVE ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	REGION	COORDINATES	ETA(UTC)
VALPARAISO	CHILE	33.0S 71.6W	1130 02/08
COQUIMBO	CHILE	29.9S 71.4W	1153 02/08
TALCAHUANO	CHILE	36.7S 73.1W	1204 02/08
CALDERA	CHILE	27.1S 70.8W	1213 02/08
ANTOFAGASTA	CHILE	23.3S 70.4W	1235 02/08
CORRAL	CHILE	39.8S 73.5W	1235 02/08
IQUIQUE	CHILE	20.2S 70.1W	1307 02/08
ARICA	CHILE	18.5S 70.3W	1319 02/08
MOLLENDO	PERU	17.1S 72.0W	1326 02/08
SAN JUAN	PERU	15.3S 75.2W	1344 02/08
GOLFO DE PENAS	CHILE	47.1S 74.9W	1348 02/08
LA PUNTA	PERU	12.1S 77.2W	1436 02/08
PUERTO MONTT	CHILE	41.5S 73.0W	1531 02/08

POTENTIAL IMPACTS
---

* TSUNAMI WAVES OF MORE THAN 3 METERS ARE CAPABLE OF CAUSING ALMOST COMPLETE DESTRUCTION OF COASTAL STRUCTURES AND INFRASTRUCTURE IN LOW-LYING COASTAL AREAS.

* TSUNAMI WAVES OF 1 TO 3 METERS ARE CAPABLE OF FLOODING AND DAMAGING STRUCTURES AND INFRASTRUCTURE IN LOW-LYING COASTAL AREAS.

* PERSONS CAUGHT IN THE WATER OF A TSUNAMI MAY DROWN... BE CRUSHED BY DEBRIS IN THE WATER... OR BE SWEPT OUT TO SEA.

* A TSUNAMI IS A SERIES OF WAVES. THE TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR. THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE INITIAL WAVE.

* IMPACTS CAN VARY SIGNIFICANTLY FROM ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND THE SHAPE AND ELEVATION OF THE SHORELINE.

* IMPACTS CAN ALSO VARY DEPENDING UPON THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI WAVES.

PRELIMINARY EARTHQUAKE PARAMETERS
---

* MAGNITUDE 8.7
* ORIGIN TIME 1112 UTC FEB 8 2013
* COORDINATES 33.7 SOUTH 72.3 WEST
* DEPTH 20 KM / 12 MILES
* LOCATION OFF THE COAST OF CENTRAL CHILE

NEXT UPDATE AND ADDITIONAL INFORMATION
---

* THE NEXT MESSAGE WILL BE ISSUED IN ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

* COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT PTWC.WEATHER.GOV.

* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT WCATWC.ARH.NOAA.GOV.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

* FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

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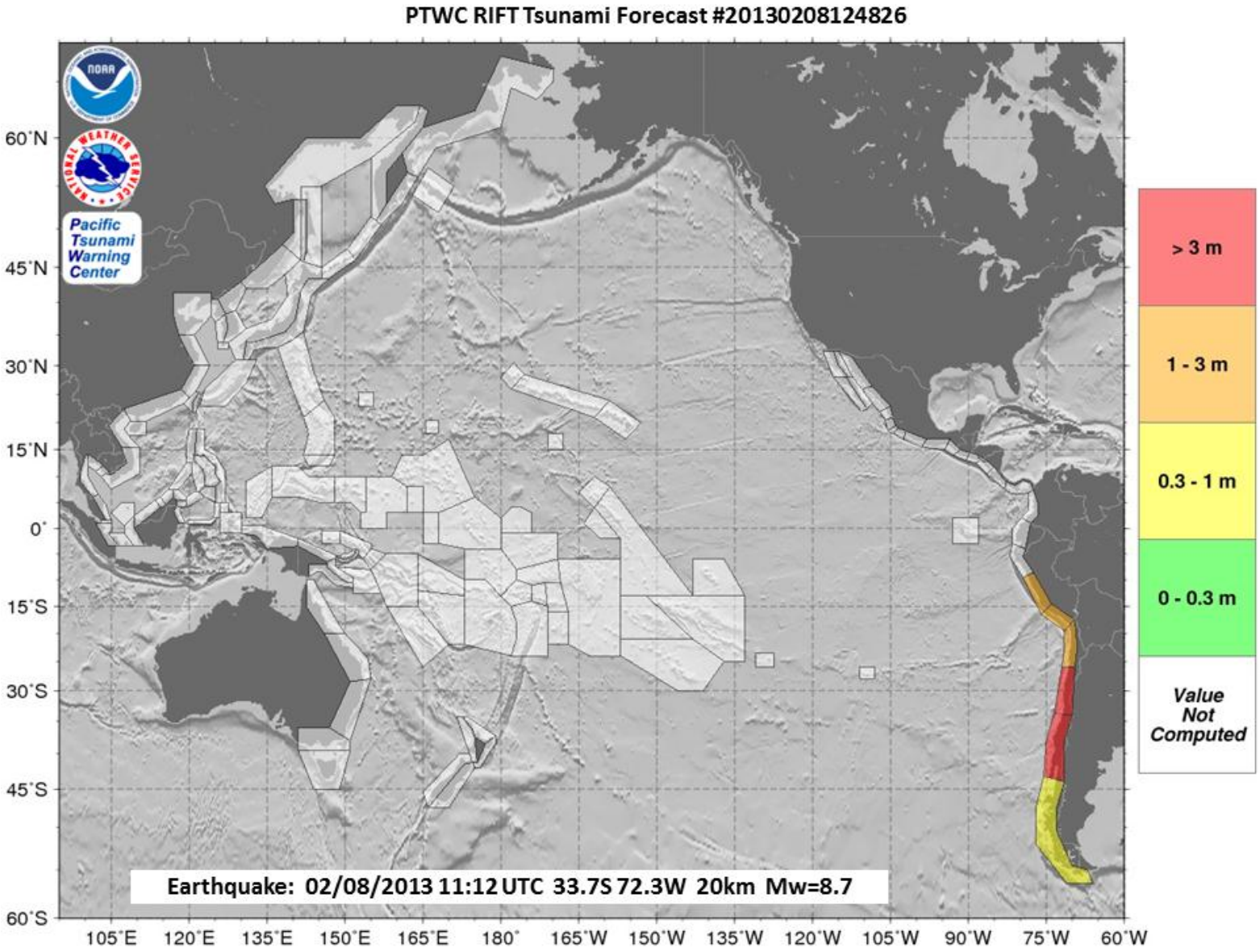
ii. Forecast Polygons Map

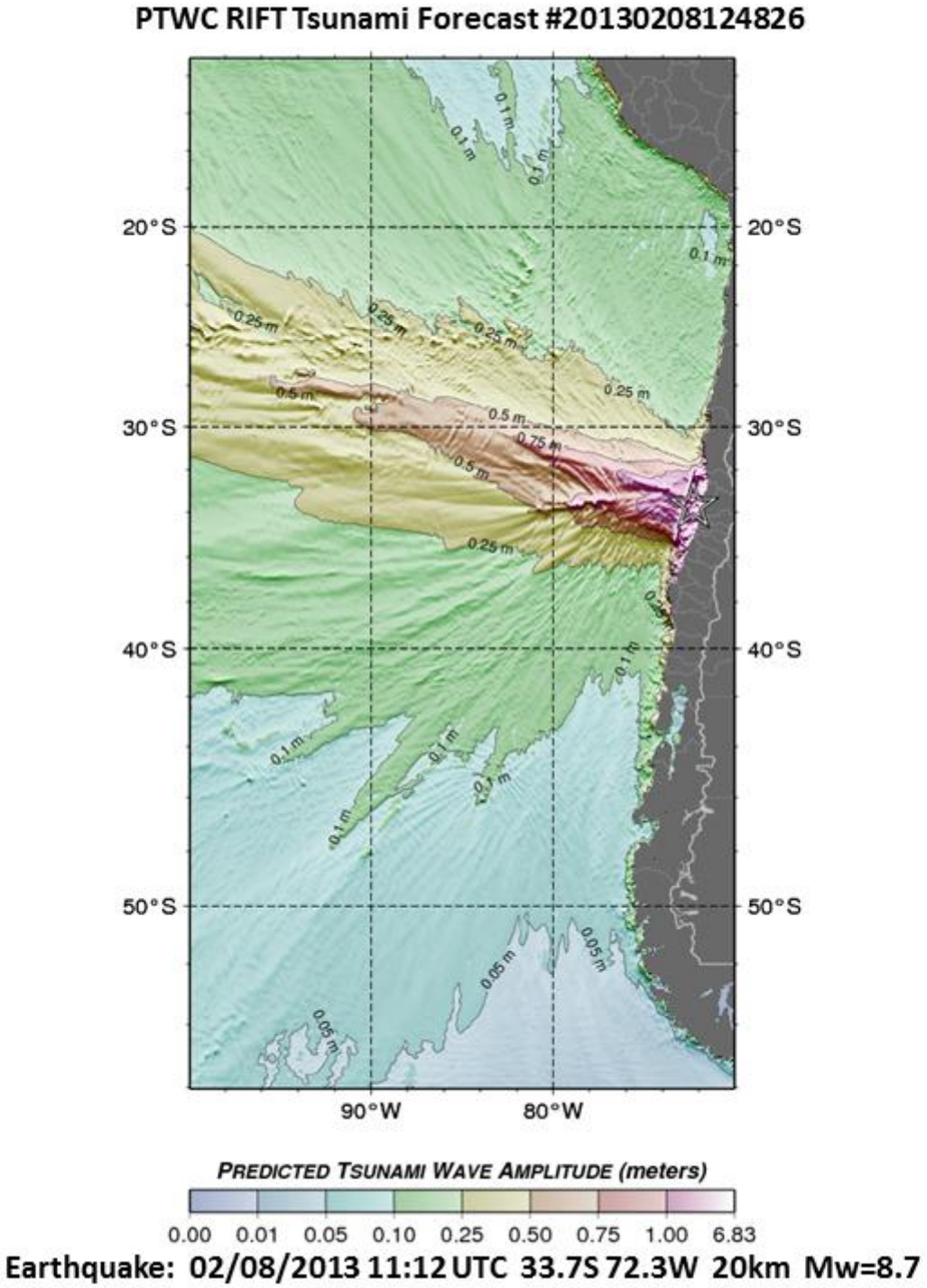


iii. Forecast Polygons Table

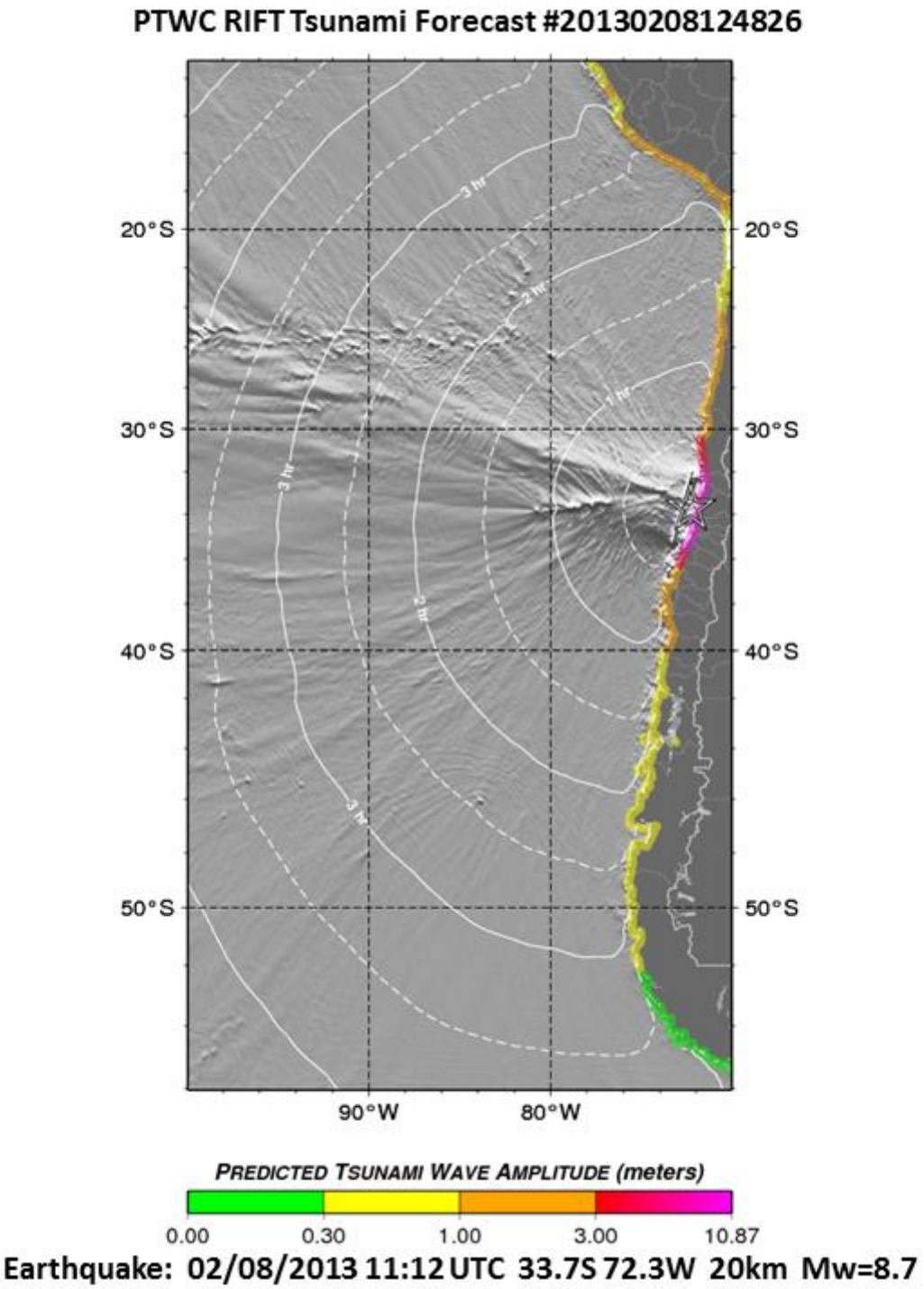
PTWC RIFT Tsunami Forecast Model - Run ID: 2013020812482
Earthquake - Origin: 02/08/2013 11:12:13 UTC Coordinates: 33.7S 72.3W Depth: 020km Magnitude: 8.7

Coastal Forecast (meters)				Offshore Forecast (meters)				Total	
Maximum	Mean	Median	STD	Maximum	Mean	Median	STD	Points	Region Name
10.87	2.78	1.08	3.21	5.80	1.17	0.63	1.19	160	South Central Chile
10.14	3.82	2.08	3.18	6.83	1.50	0.80	1.47	120	North Central Chile
1.37	1.12	1.13	0.10	0.47	0.33	0.31	0.07	73	Southern Peru
1.22	0.89	0.84	0.16	0.65	0.39	0.38	0.09	71	Central Peru
1.19	0.91	0.87	0.12	0.53	0.25	0.21	0.09	119	Northern Chile
0.64	0.37	0.41	0.14	0.33	0.14	0.13	0.06	299	Southern Chile

iv. Energy Forecast Map



v. Coastal Forecast Map



b. Supplemental Products (updated forecast and observations)

i. Text Product

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ZCZC
WEPA40 PHEB 081340
TSUPAC

TSUNAMI MESSAGE NUMBER 4
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1340 UCT FRI FEB 8 2013

...TSUNAMI THREAT MESSAGE...

THIS MESSAGE IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


TSUNAMI THREAT FORECAST...UPDATED
---------------------------------

  * TSUNAMI WAVES REACHING MORE THAN 3 METERS ABOVE THE NORMAL TIDE
    ARE FORECAST FOR COASTS IN

      CHILE... AND FRENCH POLYNESIA.


  * TSUNAMI WAVES REACHING 1 TO 3 METERS ABOVE THE NORMAL TIDE
    ARE FORECAST FOR COASTS IN

      MEXICO... ECUADOR... PERU... ANTARCTICA... JAPAN...
      PHILIPPINES... NEW ZEALAND... MARSHALL ISLANDS... FIJI...
      SAMOA... COOK ISLANDS... VANUATU... KIRIBATI... MIDWAY ISLAND...
      JARVIS ISLAND... PALMYRA ISLAND... TONGA... PITCAIRN... SOLOMON
      ISLANDS... PAPUA NEW GUINEA... AND RUSSIA.


  * TSUNAMI WAVES REACHING 0.3 TO 1 METERS ABOVE THE NORMAL TIDE
    ARE FORECAST FOR COASTS IN

      EL SALVADOR... GUATEMALA... COSTA RICA... NICARAGUA...
      PANAMA... COLOMBIA... AUSTRALIA... NEW CALEDONIA... TAIWAN...
      CHINA... MINAMITORISHIMA... NORTHERN MARIANAS... GUAM...
      YAP... AMERICAN SAMOA... TOKELAU... NAURU... WAKE ISLAND...
      HOWLAND AND BAKER... TUVALU... WALLIS AND FUTUNA... NIUE...
      AND INDONESIA.


EVALUATION
----------

  * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 8.9 OCCURRED
    OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY
    8 2013.

  * TSUNAMI WAVES HAVE BEEN OBSERVED.

  * BASED ON ALL AVAILABLE DATA... HAZARDOUS TSUNAMI WAVES ARE
    FORECAST FOR SOME COASTS.


RECOMMENDED ACTIONS
-------------------

  * GOVERNMENT AGENCIES RESPONSIBLE FOR THREATENED COASTAL AREAS
    SHOULD TAKE ACTION TO INFORM AND INSTRUCT ANY COASTAL
    POPULATIONS AT RISK IN ACCORDANCE WITH THEIR OWN EVALUATION...
    PROCEDURES AND THE LEVEL OF THREAT.

  * PERSONS LOCATED IN THREATENED COASTAL AREAS SHOULD STAY ALERT
    FOR INFORMATION AND FOLLOW INSTRUCTIONS FROM LOCAL
    AUTHORITIES.
ESTIMATED TIMES OF ARRIVAL
--------------------------
```

* ESTIMATED TIMES OF ARRIVAL -ETA- OF THE INITIAL TSUNAMI WAVE ARE GIVEN BELOW. ACTUAL ARRIVAL TIMES MAY DIFFER AND THE INITIAL WAVE MAY NOT BE THE LARGEST. A TSUNAMI IS A SERIES OF WAVES AND THE TIME BETWEEN WAVES CAN BE FIVE MINUTES TO ONE HOUR.

LOCATION	REGION	COORDINATES	ETA(UTC)
IQUIQUE	CHILE	20.2S 70.1W	1307 02/08
ARICA	CHILE	18.5S 70.3W	1319 02/08
MOLLENDO	PERU	17.1S 72.0W	1326 02/08
SAN JUAN	PERU	15.3S 75.2W	1344 02/08
GOLFO DE PENAS	CHILE	47.1S 74.9W	1348 02/08
LA PUNTA	PERU	12.1S 77.2W	1436 02/08
TALARA	PERU	4.6S 81.5W	1523 02/08
CHIMBOTE	PERU	9.0S 78.8W	1530 02/08
PUERTO MONTT	CHILE	41.5S 73.0W	1531 02/08
LA LIBERTAD	ECUADOR	2.2S 81.2W	1544 02/08
PIMENTAL	PERU	6.9S 80.0W	1555 02/08
EASTER ISLAND	CHILE	27.1S 109.4W	1629 02/08
ESMERELDAS	ECUADOR	1.2N 79.8W	1632 02/08
TUMACO	COLOMBIA	1.8N 78.9W	1651 02/08
BAHIA SOLANO	COLOMBIA	6.3N 77.4W	1722 02/08
PUERTO PINA	PANAMA	7.4N 78.0W	1732 02/08
PUNTA MALA	PANAMA	7.5N 80.0W	1734 02/08
BALTRA ISLAND	ECUADOR	0.5S 90.3W	1734 02/08
BUENAVENTURA	COLOMBIA	3.8N 77.2W	1738 02/08
THURSTON ISLAND	ANTARCTICA	72.0S 100.0W	1744 02/08
CABO MATAPALO	COSTA RICA	8.4N 83.3W	1746 02/08
PUNTA BURICA	PANAMA	8.0N 82.9W	1746 02/08
PUERTO QUEPOS	COSTA RICA	9.4N 84.2W	1819 02/08
CABO SAN ELENA	COSTA RICA	10.9N 86.0W	1836 02/08
SAN JUAN DL SUR	NICARAGUA	11.2N 85.9W	1902 02/08
PUERTO SANDINO	NICARAGUA	12.2N 86.8W	1914 02/08
CORINTO	NICARAGUA	12.5N 87.2W	1914 02/08
PITCAIRN ISLAND	PITCAIRN	25.1S 130.1W	1927 02/08
ACAJUTLA	EL SALVADOR	13.6N 89.8W	1933 02/08
SIPICATE	GUATEMALA	13.9N 91.2W	1947 02/08
BALBOA HEIGHTS	PANAMA	9.0N 79.6W	1950 02/08
PUERTO MADERO	MEXICO	14.8N 92.5W	1954 02/08
AMAPALA	HONDURAS	13.2N 87.6W	2000 02/08
RIKITEA	FRENCH POLYNESIA	23.1S 135.0W	2015 02/08
ACAPULCO	MEXICO	16.9N 99.9W	2016 02/08
SALINA CRUZ	MEXICO	16.5N 95.2W	2018 02/08
LAZARO CARDENAS	MEXICO	17.9N 102.2W	2040 02/08
MANZANILLO	MEXICO	19.1N 104.3W	2101 02/08
PUERTO VALLARTA	MEXICO	20.6N 105.3W	2124 02/08
CAPE ADARE	ANTARCTICA	71.0S 170.0E	2130 02/08
HIVA OA	FRENCH POLYNESIA	10.0S 139.0W	2142 02/08
CABO SAN LUCAS	MEXICO	22.8N 110.0W	2154 02/08
MAZATLAN	MEXICO	23.2N 106.4W	2155 02/08
SAN BLAS	MEXICO	21.5N 105.3W	2158 02/08
PAPEETE	FRENCH POLYNESIA	17.5S 149.6W	2220 02/08
RAROTONGA	COOK ISLANDS	21.2S 159.8W	2250 02/08
GUAYMAS	MEXICO	27.9N 110.9W	2256 02/08
PUNTA ABREOJOS	MEXICO	26.7N 113.6W	2307 02/08
FLINT ISLAND	KIRIBATI	11.4S 151.8W	2308 02/08
NIUE ISLAND	NIUE	19.0S 170.0W	2355 02/08
PENRYN ISLAND	COOK ISLANDS	8.9S 157.8W	2356 02/08
ENSENADA	MEXICO	31.8N 116.8W	2357 02/08
MALDEN ISLAND	KIRIBATI	3.9S 154.9W	2358 02/08
GISBORNE	NEW ZEALAND	38.7S 178.0E	0018 02/09
NUKUALOFA	TONGA	21.0S 175.2W	0022 02/09
EAST CAPE	NEW ZEALAND	37.7S 178.5E	0024 02/09
DUNEDIN	NEW ZEALAND	45.9S 170.5E	0025 02/09
WELLINGTON	NEW ZEALAND	41.3S 174.8E	0028 02/09
PUKAPUKA ISLAND	COOK ISLANDS	10.8S 165.9W	0028 02/09
PAGO PAGO	AMERICAN SAMOA	14.3S 170.7W	0032 02/09
APIA	SAMOA	13.8S 171.8W	0046 02/09
NORTH CAPE	NEW ZEALAND	34.4S 173.3E	0050 02/09
JARVIS ISLAND	JARVIS ISLAND	0.4S 160.1W	0050 02/09
CHRISTMAS ISLAN	KIRIBATI	2.0N 157.5W	0053 02/09
MILFORD SOUND	NEW ZEALAND	44.6S 167.9E	0059 02/09
NAPIER	NEW ZEALAND	39.5S 176.9E	0100 02/09
WALLIS ISLAND	WALLIS AND FUTUN	13.3S 176.3W	0105 02/09
NUKUNONU ISLAND	TOKELAU	9.2S 171.8W	0109 02/09

FUTUNA ISLAND	WALLIS AND FUTUN	14.3S	178.2W	0128 02/09
SAN FELIPE	MEXICO	31.0N	114.8W	0128 02/09
HOBART	AUSTRALIA	43.3S	147.6E	0139 02/09
AUCKLAND EAST	NEW ZEALAND	36.7S	175.0E	0141 02/09
SUVA	FIJI	18.1S	178.4E	0142 02/09
PALMYRA ISLAND	PALMYRA ISLAND	5.9N	162.1W	0145 02/09
KANTON ISLAND	KIRIBATI	2.8S	171.7W	0150 02/09
FUNAFUTI ISLAND	TUVALU	7.9S	178.5E	0212 02/09
ANATOM ISLAND	VANUATU	20.2S	169.9E	0217 02/09
WESTPORT	NEW ZEALAND	41.8S	171.6E	0219 02/09
BLUFF	NEW ZEALAND	46.6S	168.3E	0221 02/09
AUCKLAND WEST	NEW ZEALAND	37.1S	174.2E	0222 02/09
LYTTELTON	NEW ZEALAND	43.6S	172.7E	0224 02/09
SYDNEY	AUSTRALIA	33.9S	151.4E	0232 02/09
HOWLAND ISLAND	HOWLAND AND BAKE	0.6N	176.6W	0234 02/09
NOUMEA	NEW CALEDONIA	22.3S	166.5E	0257 02/09
JOHNSTON ISLAND	JOHNSTON ISLAND	16.7N	169.5W	0303 02/09
NEW PLYMOUTH	NEW ZEALAND	39.1S	174.1E	0307 02/09
ESPERITU SANTO	VANUATU	15.1S	167.3E	0318 02/09
SANTA CRUZ ISLA	SOLOMON ISLANDS	10.9S	165.9E	0342 02/09
NELSON	NEW ZEALAND	41.3S	173.3E	0351 02/09
TARAWA ISLAND	KIRIBATI	1.5N	173.0E	0402 02/09
BRISBANE	AUSTRALIA	27.2S	153.3E	0405 02/09
KIRAKIRA	SOLOMON ISLANDS	10.4S	161.9E	0406 02/09
NAURU	NAURU	0.5S	166.9E	0413 02/09
MAJURO	MARSHALL ISLANDS	7.1N	171.4E	0427 02/09
AUKI	SOLOMON ISLANDS	8.8S	160.6E	0431 02/09
HONIARA	SOLOMON ISLANDS	9.3S	160.0E	0437 02/09
MIDWAY ISLAND	MIDWAY ISLAND	28.2N	177.4W	0441 02/09
GHATERE	SOLOMON ISLANDS	7.8S	159.2E	0448 02/09
MUNDA	SOLOMON ISLANDS	8.4S	157.2E	0449 02/09
KWAJALEIN	MARSHALL ISLANDS	8.7N	167.7E	0454 02/09
PANGGOE	SOLOMON ISLANDS	6.9S	157.2E	0506 02/09
KOSRAE ISLAND	KOSRAE	5.5N	163.0E	0506 02/09
FALAMAE	SOLOMON ISLANDS	7.4S	155.6E	0508 02/09
WOODLARK ISLAND	PAPUA NEW GUINEA	9.0S	152.9E	0521 02/09
AMUN	PAPUA NEW GUINEA	6.0S	154.7E	0522 02/09
KIETA	PAPUA NEW GUINEA	6.1S	155.6E	0525 02/09
RABAUL	PAPUA NEW GUINEA	4.2S	152.3E	0546 02/09
WAKE ISLAND	WAKE ISLAND	19.3N	166.6E	0552 02/09
ENIWETOK	MARSHALL ISLANDS	11.4N	162.3E	0555 02/09
GLADSTONE	AUSTRALIA	23.8S	151.4E	0556 02/09
POHNPEI ISLAND	POHNPEI	7.0N	158.2E	0603 02/09
PORT MORESBY	PAPUA NEW GUINEA	9.3S	146.9E	0611 02/09
LAE	PAPUA NEW GUINEA	6.8S	147.0E	0618 02/09
ULAMONA	PAPUA NEW GUINEA	5.0S	151.3E	0619 02/09
KAVIENG	PAPUA NEW GUINEA	2.5S	150.7E	0622 02/09
MADANG	PAPUA NEW GUINEA	5.2S	145.8E	0643 02/09
MANUS ISLAND	PAPUA NEW GUINEA	2.0S	147.5E	0701 02/09
MEDNNY ISLAND	RUSSIA	54.7N	167.4E	0715 02/09
UST KAMCHATSK	RUSSIA	56.1N	162.6E	0721 02/09
WEWAK	PAPUA NEW GUINEA	3.5S	143.6E	0725 02/09
MINAMITORISHIMA	MINAMITORISHIMA	24.3N	154.0E	0730 02/09
CHUUK ISLAND	CHUUK	7.4N	151.8E	0734 02/09
OSTROV KARAGINS	RUSSIA	58.8N	164.5E	0744 02/09
VANIMO	PAPUA NEW GUINEA	2.6S	141.3E	0746 02/09
SAIPAN	NORTHERN MARIANA	15.3N	145.8E	0747 02/09
PETROPAVLOVSK	RUSSIA	53.2N	159.6E	0752 02/09
JAYAPURA	INDONESIA	2.4S	140.8E	0753 02/09
GUAM	GUAM	13.4N	144.7E	0754 02/09
URUP ISLAND	RUSSIA	46.1N	150.5E	0812 02/09
YAP ISLAND	YAP	9.5N	138.1E	0835 02/09
WARSA	INDONESIA	0.6S	135.8E	0837 02/09
SEVERO KURILSK	RUSSIA	50.8N	156.1E	0842 02/09
MACKAY	AUSTRALIA	21.1S	149.3E	0849 02/09
KUSHIRO	JAPAN	42.9N	144.3E	0855 02/09
MANOKWARI	INDONESIA	0.8S	134.2E	0856 02/09
CHICHI JIMA	JAPAN	27.0N	142.3E	0902 02/09
MALAKAL	BELAU	7.3N	134.5E	0914 02/09
KATSUURA	JAPAN	35.1N	140.3E	0925 02/09
SORONG	INDONESIA	0.8S	131.1E	0926 02/09
HACHIJO JIMA	JAPAN	33.1N	139.8E	0928 02/09
HACHINOHE	JAPAN	40.5N	141.5E	0935 02/09
BEREBERE	INDONESIA	2.5N	128.7E	0945 02/09
PATANI	INDONESIA	0.4N	128.8E	0955 02/09
GEME	INDONESIA	4.6N	126.8E	1005 02/09
DAVAO	PHILIPPINES	6.8N	125.7E	1021 02/09

TABUKAN TENGAH	INDONESIA	3.6N 125.6E	1032 02/09
SHIMIZU	JAPAN	32.8N 133.0E	1039 02/09
LEGASPI	PHILIPPINES	13.2N 123.8E	1041 02/09
NOBEOKA	JAPAN	32.5N 131.8E	1042 02/09
PALANAN	PHILIPPINES	17.1N 122.6E	1046 02/09
SAPPORO	JAPAN	43.5N 141.0E	1103 02/09
GASTELLO	RUSSIA	49.1N 143.0E	1105 02/09
HUALIEN	TAIWAN	24.0N 121.7E	1110 02/09
TAITUNG	TAIWAN	22.7N 121.2E	1112 02/09
OKINAWA	JAPAN	26.2N 127.8E	1112 02/09
NIIGATA	JAPAN	38.0N 139.0E	1122 02/09
CHILUNG	TAIWAN	25.2N 121.8E	1144 02/09
NAGASAKI	JAPAN	32.7N 129.7E	1215 02/09
SHIMANE	JAPAN	35.8N 133.0E	1221 02/09
UST KAHYRYUZOVO	RUSSIA	57.1N 156.7E	1308 02/09
QUANZHOU	CHINA	24.8N 118.8E	1436 02/09

POTENTIAL IMPACTS
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* TSUNAMI WAVES OF MORE THAN 3 METERS ARE CAPABLE OF CAUSING ALMOST COMPLETE DESTRUCTION OF COASTAL STRUCTURES AND INFRASTRUCTURE IN LOW-LYING COASTAL AREAS.

* TSUNAMI WAVES OF 1 TO 3 METERS ARE CAPABLE OF FLOODING AND DAMAGING STRUCTURES AND INFRASTRUCTURE IN LOW-LYING COASTAL AREAS.

* TSUNAMI WAVES OF 0.3 TO 1 METER MAY CAUSE STRONG AND UNUSUAL OCEAN CURRENTS AND MINOR FLOODING OF BEACH AND HARBOR AREAS.

* PERSONS CAUGHT IN THE WATER OF A TSUNAMI MAY DROWN... BE CRUSHED BY DEBRIS IN THE WATER... OR BE SWEPT OUT TO SEA.

* A TSUNAMI IS A SERIES OF WAVES. THE TIME BETWEEN WAVE CRESTS CAN VARY FROM 5 MINUTES TO AN HOUR. THE HAZARD MAY PERSIST FOR MANY HOURS OR LONGER AFTER THE INITIAL WAVE.

* IMPACTS CAN VARY SIGNIFICANTLY FROM ONE SECTION OF COAST TO THE NEXT DUE TO LOCAL BATHYMETRY AND THE SHAPE AND ELEVATION OF THE SHORELINE.

* IMPACTS CAN ALSO VARY DEPENDING UPON THE STATE OF THE TIDE AT THE TIME OF THE MAXIMUM TSUNAMI WAVES.

TSUNAMI OBSERVATIONS
---

* THE FOLLOWING ARE TSUNAMI WAVE OBSERVATIONS FROM COASTAL AND/OR DEEP-OCEAN SEA LEVEL GAUGES AT THE INDICATED LOCATIONS. THE MAXIMUM TSUNAMI HEIGHT IS MEASURED WITH RESPECT TO THE NORMAL TIDE LEVEL.

	GAUGE COORDINATES		TIME OF MEASURE	MAXIMUM TSUNAMI	WAVE PERIOD
GAUGE LOCATION	LAT	LON	(UTC)	HEIGHT	(MIN)
LEBU CL	37.6S	73.7W	1246	0.3M/ 1.0FT	36
DART	19.3S	74.7W	1150	0.1M/ 0.3FT	12
EASTER CL	27.2S	109.5W	1153	0.2M/ 0.8FT	98
VALPARAISO CL	33.0S	71.6W	1113	0.6M/ 2.1FT	30

PRELIMINARY EARTHQUAKE PARAMETERS
---

* MAGNITUDE 8.9
* ORIGIN TIME 1112 UTC FEB 8 2013
* COORDINATES 33.7 SOUTH 72.3 WEST
* DEPTH 20 KM / 12 MILES
* LOCATION OFF THE COAST OF CENTRAL CHILE

NEXT UPDATE AND ADDITIONAL INFORMATION
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* THE NEXT MESSAGE WILL BE ISSUED IN ONE HOUR... OR SOONER IF THE SITUATION WARRANTS.

* COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT PTWC.WEATHER.GOV.

* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT WCATWC.ARH.NOAA.GOV.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

* FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

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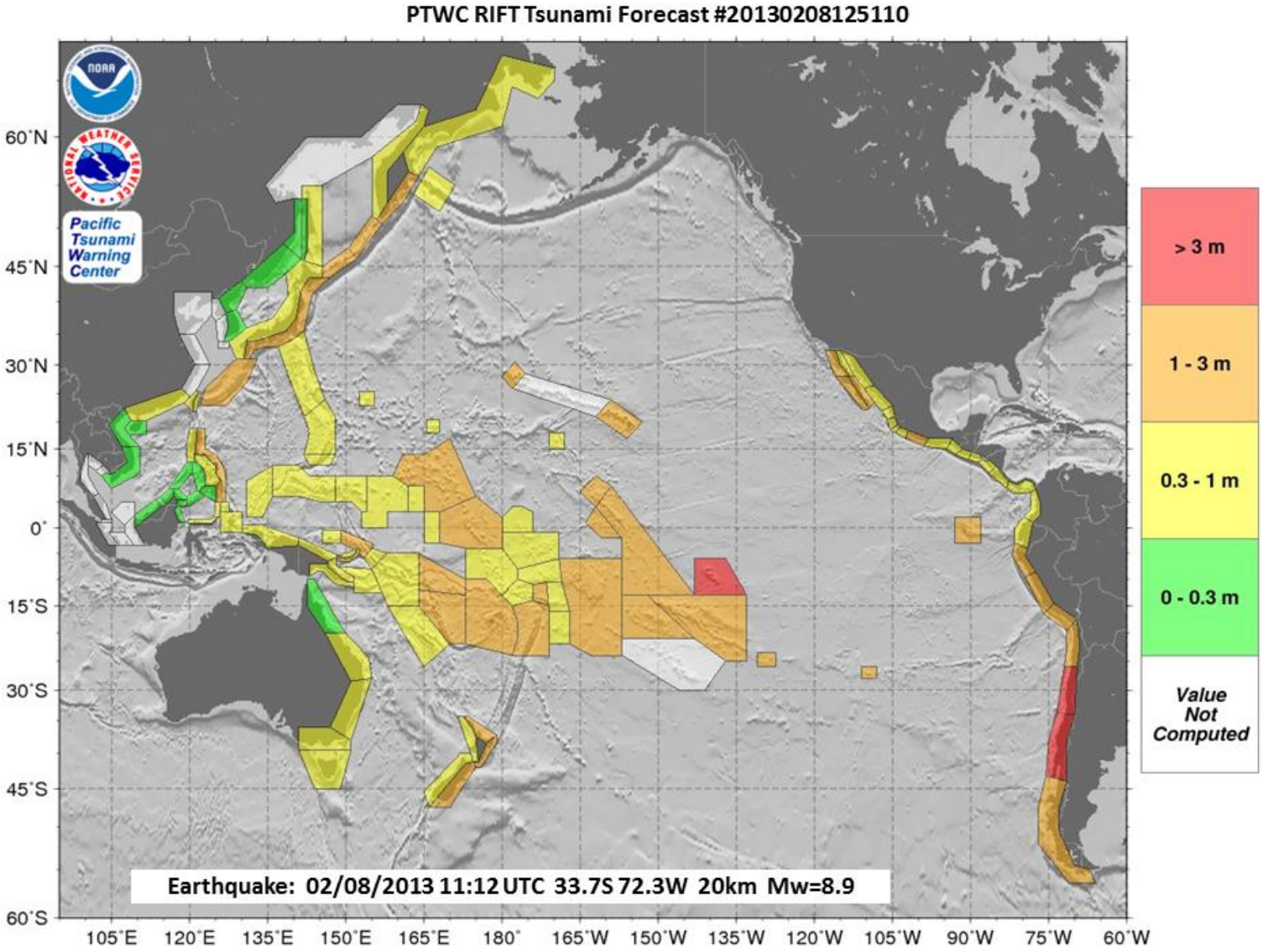
ii. Forecast Polygons Map



iii. Forecast Polygons Table

PTWC RIFT Tsunami Forecast Model - Run ID: 2013020812511
Earthquake - Origin: 02/08/2013 11:12:13 UTC Coordinates: 33.7S 72.3W Depth: 020km Magnitude: 8.9

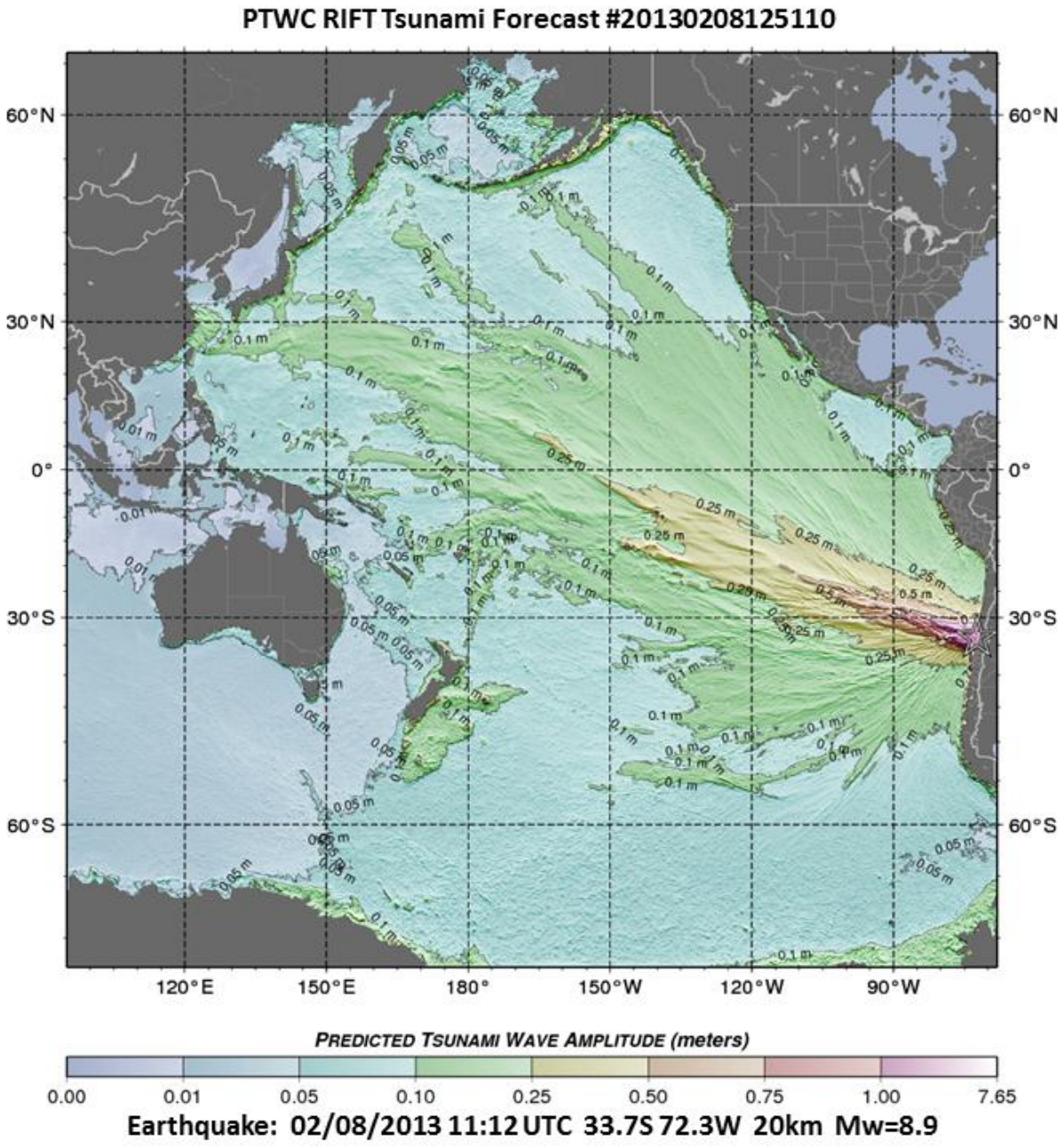
Coastal Forecast (meters)				Offshore Forecast (meters)				Total	
Maximum	Mean	Median	STD	Maximum	Mean	Median	STD	Points	Region Name
14.48	6.05	3.29	4.53	6.60	2.12	1.40	1.69	120	North Central Chile
13.81	4.39	1.78	4.52	7.65	1.83	1.21	1.41	160	South Central Chile
6.28	3.66	3.44	1.24	2.47	0.89	0.72	0.57	27	Marquesas Islands
2.47	2.47	2.47	0.00	0.41	0.41	0.41	0.00	1	Palmyra Island
2.23	1.18	1.08	0.35	0.98	0.36	0.31	0.15	145	Hawaii
2.20	1.75	1.77	0.43	1.09	0.82	0.86	0.24	4	Tuamotu Archipelago
2.09	1.39	1.37	0.23	1.01	0.71	0.71	0.14	101	Central Peru
1.95	1.69	1.65	0.09	1.00	0.53	0.51	0.12	73	Southern Peru
1.92	1.37	1.20	0.39	0.40	0.25	0.18	0.10	3	Line Islands
1.89	1.89	1.89	0.00	0.42	0.42	0.42	0.00	1	Easter Island
1.74	1.41	1.40	0.15	1.17	0.45	0.38	0.18	119	Northern Chile
1.71	1.41	1.44	0.16	0.64	0.32	0.28	0.12	36	Society Islands
1.62	1.10	0.85	0.37	0.24	0.17	0.14	0.05	3	Cook Islands
1.58	1.05	1.01	0.21	1.56	0.62	0.60	0.25	149	Pacific Coast of Kamchatka
1.56	0.91	0.86	0.18	1.72	0.46	0.41	0.22	398	East Coast of Japanese Main Islands
1.49	1.49	1.49	0.00	0.46	0.46	0.46	0.00	1	Pitcairn Island
1.48	1.01	0.93	0.19	0.86	0.53	0.56	0.19	15	Tonga
1.32	1.01	0.98	0.14	1.12	0.47	0.47	0.16	87	East Side of North Island New Zealand
1.32	0.80	0.82	0.20	0.85	0.43	0.41	0.14	328	Southern Chile
1.30	1.02	1.00	0.16	1.09	0.36	0.28	0.20	41	Samoa
1.30	0.85	0.83	0.17	1.09	0.38	0.36	0.18	154	Fiji
1.29	0.55	0.46	0.28	0.67	0.21	0.16	0.14	98	Urup Etorofu Kunashiri Shikotan and Habomai Islands
1.28	0.83	0.82	0.24	0.64	0.23	0.21	0.09	202	Vanuatu
1.25	0.63	0.56	0.26	1.03	0.27	0.22	0.19	100	Kuril Islands
1.24	0.95	0.93	0.12	0.77	0.29	0.27	0.11	89	Galapagos Islands
1.22	1.22	1.22	0.00	0.69	0.69	0.69	0.00	1	Gilbert Islands
1.15	0.83	0.82	0.15	1.32	0.62	0.60	0.28	101	Northern Peru
1.12	0.94	0.94	0.08	0.80	0.48	0.47	0.10	75	Pacific Side of Baja Mexico
1.11	0.93	0.91	0.10	1.27	0.55	0.54	0.16	110	Pacific Side of Baja Sud Mexico
1.11	0.83	0.81	0.14	1.09	0.49	0.46	0.16	155	East Side of South Island New Zealand
1.08	0.62	0.60	0.16	0.43	0.17	0.16	0.08	103	Gulf Side of Baja Sud Mexico

1.07	0.78	0.75	0.17	1.16	0.33	0. 30	0.17	79	Nansei Islands
1.06	1.01	1.06	0.07	0.55	0.55	0.55	0.00	3	Midway Island
1.06	0.81	0.79	0.09	0.62	0.34	0.33	0.09	56	Guerrero Mexico
1.06	0.66	0.66	0.19	2.13	0.26	0.24	0.18	350	Pacific Side of the Philippines
1.05	1.05	1.05	0.00	0.17	0.17	0.17	0.00	1	Jarvis Island
1.03	0.80	0.80	0.12	1.15	0.38	0.31	0.27	14	Marshall Islands
1.03	0.79	0.78	0.11	0.65	0.27	0.23	0.12	19	Santa Cruz Islands
1.03	0.71	0.72	0.13	1.12	0.19	0.17	0.10	2438	Pacific Side of Antarctica
1.02	0.77	0.76	0.08	0.80	0.48	0.47	0.10	113	North Side of North Island New Zealand
1.02	0.69	0.64	0.15	0.60	0.20	0.16	0.11	132	New Ireland
0.99	0.83	0.80	0.10	0.49	0.28	0.28	0.07	27	Michoacan Mexico
0.99	0.46	0.48	0.08	0.67	0.26	0.25	0.09	316	Bering Sea Coast of Eastern Russia
0.98	0.88	0.87	0.07	0.85	0.34	0.31	0.14	32	Jalisco Mexico
0.98	0.80	0.74	0.10	0.32	0.29	0.31	0.03	5	Wallis and Futuna
0.97	0.78	0.76	0.06	0.83	0.38	0.36	0.14	72	Oaxaca Mexico
0.97	0.56	0.48	0.20	1.03	0.21	0.17	0.14	329	Choisel to Philip Solomon Islands
0.96	0.96	0.96	0.00	0.28	0.28	0.28	0.00	2	American Samoa
0.96	0.63	0.69	0.24	1.12	0.31	0.27	0.17	73	Bouganville Papua New Guinea
0.96	0.47	0.39	0.24	0.53	0.17	0.14	0.11	194	Halmahera Indonesia
0.94	0.80	0.76	0.08	0.42	0.18	0.16	0.06	52	Eastern Coast of Taiwan
0.94	0.75	0.75	0.07	0.69	0.41	0.49	0.18	27	Nayarit Mexico
0.93	0.74	0.75	0.10	0.72	0.45	0.47	0.14	72	Sinaloa Mexico
0.91	0.91	0.91	0.00	0.27	0.27	0.27	0.00	1	Tokelau
0.91	0.85	0.90	0.07	0.69	0.38	0.35	0.12	12	Colima Mexico
0.91	0.76	0.76	0.07	0.83	0.50	0.48	0.09	28	Chiapas Mexico
0.89	0.89	0.89	0.00	0.14	0.14	0.14	0.00	1	Minamitorishima
0.89	0.73	0.71	0.06	0.53	0.37	0.37	0.06	32	Pacific Coast of Guatemala
0.89	0.69	0.67	0.09	0.66	0.42	0.45	0.15	22	Manus Island Papua New Guinea
0.89	0.49	0.50	0.11	0.55	0.24	0.25	0.11	128	West Side of South Island New Zealand
0.89	0.48	0.66	0.29	0.53	0.23	0.26	0.16	149	Ecuador
0.89	0.16	0.05	0.24	0.76	0.07	0.03	0.09	445	West Coast of Japanese Main Islands
0.88	0.88	0.88	0.00	0.31	0.31	0.31	0.00	1	Johnston Atoll
0.88	0.79	0.78	0.07	0.69	0.33	0.32	0.10	77	Pacific Coast of Costa Rica
0.86	0.86	0.86	0.00	0.16	0.15	0.16	0.01	3	Wake Island
0.86	0.86	0.86	0.00	0.12	0.12	0.12	0.00	1	Niue
0.86	0.78	0.77	0.06	0.67	0.41	0.41	0.07	37	El Salvador
0.86	0.61	0.60	0.10	0.58	0.21	0.17	0.10	147	Bismarck Sea Side of Papua New Guinea
0.81	0.70	0.71	0.06	1.38	0.47	0.44	0.29	15	Chuuk State Micronesia
0.81	0.69	0.68	0.08	0.44	0.25	0.24	0.09	10	Pohnpei State Micronesia

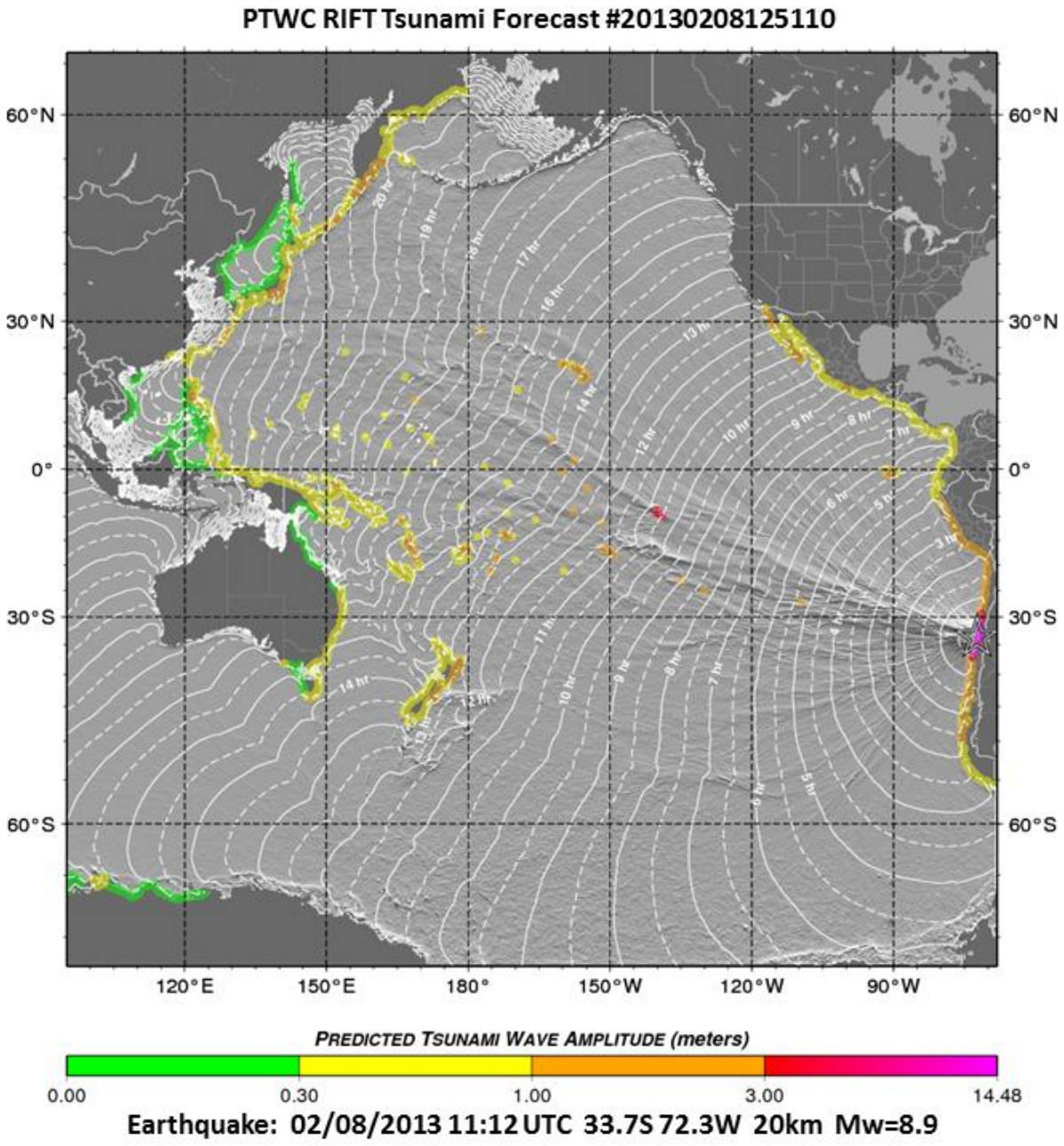
0.80	0.08	0.06	0.07	0.43	0.02	0.01	0.03	255	Interior Seas of the Philippines
0.79	0.73	0.73	0.03	0.62	0.39	0.37	0.08	37	Pacific Side of Nicaragua
0.79	0.65	0.64	0.06	0.45	0.25	0.24	0.06	96	Pacific Coast of Colombia
0.78	0.62	0.64	0.11	0.95	0.28	0.23	0.15	280	Pacific Side of Papua Indonesia
0.77	0.77	0.77	0.00	0.20	0.19	0.19	0.02	2	Izu and Ogasawara Islands
0.77	0.56	0.57	0.11	0.70	0.29	0.28	0.12	154	New Caledonia
0.75	0.54	0.46	0.12	0.74	0.32	0.29	0.15	44	Komandorsky Islands
0.74	0.74	0.74	0.00	0.09	0.09	0.09	0.00	1	Howland and Baker
0.74	0.33	0.31	0.11	0.23	0.13	0.10	0.05	32	Western Coast of Taiwan
0.73	0.64	0.64	0.04	0.57	0.28	0.25	0.11	89	Pacific Side of Panama
0.71	0.50	0.47	0.12	0.36	0.15	0.13	0.06	25	Talaud Islands
0.69	0.58	0.57	0.06	0.35	0.20	0.18	0.08	12	Guam
0.66	0.66	0.66	0.00	0.19	0.19	0.19	0.00	1	Phoenix Islands
0.65	0.36	0.30	0.11	0.33	0.11	0.10	0.06	80	Solomon Sea Side of New Britain
0.64	0.52	0.50	0.07	0.84	0.34	0.29	0.21	14	Palau
0.63	0.63	0.63	0.00	0.09	0.09	0.09	0.00	1	Tuvalu
0.63	0.58	0.57	0.03	0.19	0.13	0.12	0.04	5	Kosrae State Micronesia
0.62	0.51	0.50	0.05	0.44	0.22	0.20	0.09	81	Bismarck Sea Side of New Britain
0.62	0.42	0.40	0.06	0.70	0.27	0.25	0.10	74	West Side of North Island New Zealand
0.61	0.38	0.38	0.07	0.30	0.12	0.10	0.06	137	Solomon Sea Side of Papua New Guinea
0.60	0.56	0.56	0.03	0.41	0.20	0.17	0.09	10	Northern Marianas
0.60	0.51	0.52	0.03	0.36	0.17	0.14	0.07	86	Sonora Mexico
0.58	0.58	0.58	0.00	0.09	0.09	0.09	0.00	1	Nauru
0.56	0.53	0.52	0.01	0.11	0.10	0.10	0.01	35	Gulf Side of Baja Mexico
0.51	0.41	0.40	0.04	0.48	0.27	0.26	0.06	146	New South Wales Australia
0.51	0.36	0.36	0.06	0.43	0.19	0.18	0.08	76	Trobriand Woodlark and Louisiade Islands
0.51	0.34	0.30	0.08	0.41	0.21	0.21	0.07	104	Southern Queensland Australia
0.48	0.34	0.35	0.07	0.31	0.16	0.15	0.05	162	Tasmania
0.42	0.42	0.42	0.00	0.25	0.25	0.25	0.00	1	Yap
0.41	0.33	0.35	0.07	0.26	0.15	0.15	0.05	107	Victoria Australia
0.41	0.23	0.23	0.05	0.33	0.12	0.11	0.06	156	Coral Sea Side of Papua New Guinea
0.37	0.27	0.24	0.06	0.23	0.09	0.07	0.06	17	Sangihe Islands
0.35	0.17	0.13	0.08	0.37	0.07	0.04	0.07	118	Western Coast of Northern Philippines
0.34	0.34	0.34	0.00	0.24	0.14	0.13	0.04	15	Southern China Coast
0.33	0.26	0.26	0.04	0.38	0.19	0.18	0.06	148	Sea of Okhotsk Coast of Sakhalin
0.32	0.32	0.32	0.00	0.41	0.26	0.26	0.07	10	Western Coast of Kamchatka
0.31	0.19	0.18	0.03	0.26	0.08	0.07	0.04	88	Celebes Sea Coast of Sulawesi Indonesia
0.30	0.23	0.23	0.03	0.22	0.10	0.10	0.03	202	Northern Queensland Australia
0.23	0.20	0.20	0.02	0.28	0.12	0.10	0.06	55	Celebes Sea Coast of Borneo Indonesia

0.23	0.20	0.19	0.02	0.17	0.07	0.06	0.03	35	Celebes Sea Coast of Sabah Malaysia
0.23	0.19	0.19	0.01	0.20	0.06	0.05	0.03	75	Celebes Sea Side of the Philippines
0.20	0.15	0.17	0.05	0.12	0.05	0.05	0.02	57	Sulu Archipelago Philippines
0.14	0.14	0.14	0.00	0.10	0.07	0.07	0.02	21	Northern Coast of Vietnam
0.14	0.09	0.09	0.02	0.12	0.05	0.05	0.02	84	Southern Coast of Vietnam
0.13	0.12	0.12	0.00	0.08	0.05	0.05	0.01	47	Hainan Island
0.13	0.08	0.08	0.03	0.09	0.04	0.04	0.02	144	Palawan Island Philippines
0.12	0.05	0.05	0.02	0.05	0.01	0.01	0.01	119	Sulu Sea Coast of the Philippines
0.10	0.09	0.09	0.00	0.04	0.04	0.04	0.00	21	Southwest Coast of Sabah Malaysia
0.09	0.09	0.09	0.01	0.06	0.05	0.05	0.00	15	Brunei
0.08	0.07	0.07	0.00	0.06	0.04	0.04	0.01	54	Northwest Coast of Sabah Malaysia
0.07	0.06	0.06	0.01	0.07	0.03	0.03	0.01	45	Tatarskiy Straight Coast of Sakhalin
0.07	0.06	0.05	0.01	0.08	0.04	0.03	0.01	46	Sulu Sea Coast of Sabah Malaysia
0.06	0.04	0.04	0.01	0.03	0.02	0.02	0.01	28	East Coast of Russia on the Tatarskiy Straight
0.05	0.04	0.04	0.00	0.06	0.02	0.01	0.01	55	Eastern Coast of the Republic of Korea
0.05	0.04	0.04	0.00	0.05	0.01	0.01	0.01	88	Eastern Coast of DPR of Korea
0.04	0.03	0.03	0.00	0.04	0.01	0.01	0.01	151	East Coast of Russia North of Korean Peninsula

iv. Energy Forecast Map



v. Coastal Forecast Map



c. Final Products (end of threat)

i. Text Product

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ZCZC
WEPA40 PHEB 091228
TSUPAC

TSUNAMI MESSAGE NUMBER 18
NWS PACIFIC TSUNAMI WARNING CENTER EWA BEACH HI
1228 UCT SAT FEB 9 2013

...FINAL TSUNAMI THREAT MESSAGE...

THIS MESSAGE IS FOR ALL COASTAL AREAS OF THE PACIFIC AND ITS
ADJACENT SEAS EXCEPT THOSE OF U.S. STATES AND BRITISH COLUMBIA.
IT IS ISSUED AS ADVICE IN SUPPORT OF THE UNESCO/IOC PACIFIC
TSUNAMI WARNING SYSTEM.


TSUNAMI THREAT FORECAST
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  * THE TSUNAMI THREAT HAS NOW LARGELY PASSED.


EVALUATION
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  * AN EARTHQUAKE WITH A PRELIMINARY MAGNITUDE OF 8.9 OCCURRED
    OFF THE COAST OF CENTRAL CHILE AT 1112 UTC ON FRIDAY FEBRUARY
    8 2013.

  * BASED ON ALL AVAILABLE DATA... THE TSUNAMI THREAT FROM THIS
    EARTHQUAKE HAS LARGELY PASSED ALTHOUGH SEA LEVEL FLUCTUATIONS
    CAN CONTINUE IN IMPACTED AREAS FOR MANY HOURS.


RECOMMENDED ACTIONS
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  * GOVERNMENT AGENCIES RESPONSIBLE FOR ANY IMPACTED COASTAL
    AREAS SHOULD MONITOR CONDITIONS AT THE COAST TO DETERMINE IF
    AND WHEN IT IS SAFE TO RESUME NORMAL ACTIVITIES.

  * PERSONS LOCATED NEAR IMPACTED COASTAL AREAS SHOULD STAY ALERT
    FOR INFORMATION AND FOLLOW INSTRUCTIONS FROM LOCAL
    AUTHORITIES.

  * REMAIN OBSERVANT AND EXERCISE NORMAL CAUTION NEAR THE SEA.


POTENTIAL IMPACTS
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  * MINOR SEA LEVEL FLUCTUATIONS OF UP TO 0.3 METERS ABOVE AND
    BELOW THE NORMAL TIDE MAY CONTINUE OVER THE NEXT FEW HOURS.


PRELIMINARY EARTHQUAKE PARAMETERS
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  * MAGNITUDE      8.9
  * ORIGIN TIME    1112 UTC FEB 8 2013
  * COORDINATES    33.7 SOUTH  72.3 WEST
  * DEPTH          20 KM / 12 MILES
  * LOCATION       OFF THE COAST OF CENTRAL CHILE
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NEXT UPDATE AND ADDITIONAL INFORMATION
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* THIS WILL BE THE FINAL STATEMENT ISSUED FOR THIS EVENT UNLESS NEW INFORMATION IS RECEIVED OR THE SITUATION CHANGES.

* COASTAL REGIONS OF HAWAII SHOULD REFER TO PACIFIC TSUNAMI WARNING CENTER MESSAGES FOR HAWAII THAT CAN BE FOUND AT PTWC.WEATHER.GOV.

* COASTAL REGIONS OF CALIFORNIA... OREGON... WASHINGTON... BRITISH COLUMBIA AND ALASKA SHOULD REFER TO WEST COAST AND ALASKA TSUNAMI WARNING CENTER MESSAGES THAT CAN BE FOUND AT WCATWC.ARH.NOAA.GOV.

* AUTHORITATIVE INFORMATION ABOUT THE EARTHQUAKE FROM THE U.S. GEOLOGICAL SURVEY CAN BE FOUND ON THE INTERNET AT EARTHQUAKE.USGS.GOV/EARTHQUAKES/MAP.

* FURTHER INFORMATION ABOUT THIS EVENT MAY BE FOUND AT PTWC.WEATHER.GOV AND AT WWW.TSUNAMI.GOV.

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APPENDIX III. LIST OF PLACES COVERED IN THE PTWS PTWC NEW PRODUCTS

The countries and country sub-jurisdictions where the PTWC will provide forecasts are listed below. During the trial period, Member States are asked to review the places and recommend changes as needed.

1. AMERICAN_SAMOA
2. ANTARCTICA
3. AUSTRALIA
4. BELAU
5. BRUNEI
6. CAMBODIA
7. CHILE
8. CHINA
9. CHUUK
10. COLOMBIA
11. COOK_ISLANDS
12. COSTA_RICA
13. DPR_OF_KOREA
14. ECUADOR
15. EL_SALVADOR
16. FIJI
17. FRENCH_POLYNESIA
18. GUAM
19. GUATEMALA
20. HONDURAS
21. HOWLAND_AND_BAKER
22. INDONESIA
23. JAPAN
24. JARVIS_ISLAND
25. JOHNSTON_ISLAND
26. KERMADEC_ISLAND
27. KIRIBATI
28. KOSRAE
29. MALAYSIA
30. MARSHALL_ISLANDS
31. MEXICO
32. MIDWAY_ISLAND
33. MINAMITORISHIMA
34. NAURU
35. NEW_CALEDONIA
36. NEW_ZEALAND
37. NICARAGUA
38. NIUE
39. NORTHERN_MARIANAS
40. PALMYRA_ISLAND
41. PANAMA
42. PAPUA_NEW_GUINEA
43. PERU
44. PHILIPPINES
45. PITCAIRN
46. POHNPEI
47. REPUBLIC_OF_KOREA
48. RUSSIA
49. SAMOA
50. SINGAPORE
51. SOLOMON_ISLANDS
52. TAIWAN
53. THAILAND
54. TOKELAU
55. TONGA
56. TUVALU
57. VANUATU
58. VIETNAM
59. WAKE_ISLAND
60. WALLIS_AND_FUTUNA
61. YAP

APPENDIX IV. LIST OF PTWS PTWC FORECAST POLYGONS

The forecast polygons that divide extended coasts into segments or that surround particular island groups are listed below. These were chosen and named somewhat arbitrarily based upon geological, geographic, and/or political boundaries. During the trial period, Member States are encouraged to review the polygons and recommend changes in boundaries or names so as to make the polygons more useful.

1. Pacific Side of Antarctica
2. New South Wales Australia
3. Northern Queensland Australia
4. Southern Queensland Australia
5. Tasmania
6. Victoria Australia
7. Brunei
8. Cambodia
9. Northern Chile
10. North Central Chile
11. South Central Chile
12. Southern Chile
13. Easter Island
14. Pitcairn Island
15. Hainan Island
16. Eastern China Coast
17. Southeastern China Coast
18. Southern China Coast
19. Northeastern China Coast
20. Pacific Coast of Colombia
21. Pacific Coast of Costa Rica
22. Eastern Coast of DPR of Korea
23. Western Coast of DPR of Korea
24. Ecuador
25. El Salvador
26. Pacific Coast of Guatemala
27. Pacific Coast of Honduras
28. Western Borneo Indonesia
29. Halmahera Indonesia
30. Pacific Side of Papua Indonesia
31. Celebes Sea Coast of Borneo Indonesia
32. Celebes Sea Coast of Sulawesi Indonesia
33. Southeast Coast of Sumatra Indonesia
34. East Coast of Japanese Main Islands
35. West Coast of Japanese Main Islands
36. Western Coast of the Malay Peninsula Malaysia
37. Celebes Sea Coast of Sabah Malaysia
38. Northwest Coast of Sabah Malaysia
39. Southwest Coast of Sabah Malaysia
40. Sulu Sea Coast of Sabah Malaysia
41. Pacific Side of Baja Mexico
42. Pacific Side of Baja Sud Mexico
43. Gulf Side of Baja Sud Mexico
44. Gulf Side of Baja Mexico
45. Sonora Mexico
46. Sinaloa Mexico
47. Nayarit Mexico
48. Jalisco Mexico
49. Colima Mexico
50. Michoacan Mexico
51. Guerrero Mexico
52. Oaxaca Mexico
53. Chiapas Mexico
54. East Side of North Island New Zealand
55. North Side of North Island New Zealand
56. West Side of North Island New Zealand
57. East Side of South Island New Zealand
58. West Side of South Island New Zealand
59. Pacific Side of Nicaragua
60. Pacific Side of Panama
61. Bismarck Sea Side of Papua New Guinea
62. Bouganville Papua New Guinea
63. Coral Sea Side of Papua New Guinea
64. Manus Island Papua New Guinea
65. Bismarck Sea Side of New Britain
66. Solomon Sea Side of New Britain
67. New Ireland
68. Solomon Sea Side of Papua New Guinea
69. Northern Peru
70. Central Peru
71. Southern Peru

72. Celebes Sea Side of the Philippines
73. Interior Seas of the Philippines
74. Pacific Side of the Philippines
75. Palawan Island Philippines
76. Western Coast of Northern Philippines
77. Sulu Sea Coast of the Philippines
78. Eastern Coast of the Republic of Korea
79. Western Coast of the Republic of Korea
80. Bering Sea Coast of Eastern Russia
81. East Coast of Russia North of Korean Peninsula
82. East Coast of Russia on the Sea of Okhotsk
83. East Coast of Russia on the Tatarskiy Straight
84. Western Coast of Kamchatka
85. Pacific Coast of Kamchatka
86. Sea of Okhotsk Coast of Sakhalin
87. Tatarskiy Straight Coast of Sakhalin
88. Singapore
89. Eastern Coast of Taiwan
90. Western Coast of Taiwan
91. Eastern Gulf Coast of Thailand
92. Western Gulf Coast of Thailand
93. Northern Coast of Vietnam
94. Southern Coast of Vietnam
95. Cook Islands
96. Galapagos Islands
97. Fiji
98. Marquesas Islands
99. Tuamotu Archipelago
100. Society Islands
101. Austral Islands
102. New Caledonia
103. Wallis and Futuna
104. Bangka Islands Belitung
105. Natuna Islands
106. Sangihe Islands
107. Talaud Islands
108. Izu and Ogasawara Islands
109. Minamitorishima
110. Nansei Islands
111. Gilbert Islands
112. Line Islands
113. Phoenix Islands
114. Marshall Islands
115. Chuuk State Micronesia
116. Kosrae State Micronesia
117. Pohnpei State Micronesia
118. Yap State Micronesia
119. Nauru
120. Niue
121. Palau
122. Trobriand Woodlark and Louisiade Islands
123. Sulu Archipelago Philippines
124. Jeju Island
125. Komandorsky Islands
126. Kuril Islands
127. Urup Etorofu Kunashiri Shikotan and Habomai Islands
128. Samoa
129. Choisel to Philip Solomon Islands
130. Santa Cruz Islands
131. Tokelau
132. Tonga
133. Tuvalu
134. American Samoa
135. Guam
136. Hawaii
137. Howland and Baker
138. Jarvis Island
139. Johnston Atoll
140. Midway Island
141. Northern Hawaiian Islands
142. Northern Marianas
143. Palmyra Island
144. Wake Island
145. Vanuatu

No.	Title	Languages
1	Manual on International Oceanographic Data Exchange. 1965	(out of stock)
2	Intergovernmental Oceanographic Commission (Five years of work). 1966	(out of stock)
3	Radio Communication Requirements of Oceanography. 1967	(out of stock)
4	Manual on International Oceanographic Data Exchange - Second revised edition. 1967	(out of stock)
5	Legal Problems Associated with Ocean Data Acquisition Systems (ODAS). 1969	(out of stock)
6	Perspectives in Oceanography, 1968	(out of stock)
7	Comprehensive Outline of the Scope of the Long-term and Expanded Programme of Oceanic Exploration and Research. 1970	(out of stock)
8	IGOSS (Integrated Global Ocean Station System) - General Plan Implementation Programme for Phase I. 1971	(out of stock)
9	Manual on International Oceanographic Data Exchange - Third Revised Edition. 1973	(out of stock)
10	Bruun Memorial Lectures, 1971	E, F, S, R
11	Bruun Memorial Lectures, 1973	(out of stock)
12	Oceanographic Products and Methods of Analysis and Prediction. 1977	E only
13	International Decade of Ocean Exploration (IDOE), 1971-1980. 1974	(out of stock)
14	A Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment and Baseline Study Guidelines. 1976	E, F, S, R
15	Bruun Memorial Lectures, 1975 - Co-operative Study of the Kuroshio and Adjacent Regions. 1976	(out of stock)
16	Integrated Ocean Global Station System (IGOSS) General Plan and Implementation Programme 1977-1982. 1977	E, F, S, R
17	Oceanographic Components of the Global Atmospheric Research Programme (GARP) . 1977	(out of stock)
18	Global Ocean Pollution: An Overview. 1977	(out of stock)
19	Bruun Memorial Lectures - The Importance and Application of Satellite and Remotely Sensed Data to Oceanography. 1977	(out of stock)
20	A Focus for Ocean Research: The Intergovernmental Oceanographic Commission - History, Functions, Achievements. 1979	(out of stock)
21	Bruun Memorial Lectures, 1979: Marine Environment and Ocean Resources. 1986	E, F, S, R
22	Scientific Report of the Interealibration Exercise of the IOC-WMO-UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open Ocean Waters. 1982	(out of stock)
23	Operational Sea-Level Stations. 1983	E, F, S, R
24	Time-Series of Ocean Measurements. Vol.1. 1983	E, F, S, R
25	A Framework for the Implementation of the Comprehensive Plan for the Global Investigation of Pollution in the Marine Environment. 1984	(out of stock)
26	The Determination of Polychlorinated Biphenyls in Open-ocean Waters. 1984	E only
27	Ocean Observing System Development Programme. 1984	E, F, S, R
28	Bruun Memorial Lectures, 1982: Ocean Science for the Year 2000. 1984	E, F, S, R
29	Catalogue of Tide Gauges in the Pacific. 1985	E only
30	Time-Series of Ocean Measurements. Vol. 2. 1984	E only
31	Time-Series of Ocean Measurements. Vol. 3. 1986	E only
32	Summary of Radiometric Ages from the Pacific. 1987	E only
33	Time-Series of Ocean Measurements. Vol. 4. 1988	E only

(continued)

No.	Title	Languages
34	Bruun Memorial Lectures, 1987: Recent Advances in Selected Areas of Ocean Sciences in the Regions of the Caribbean, Indian Ocean and the Western Pacific. 1988	Composite E, F, S
35	Global Sea-Level Observing System (GLOSS) Implementation Plan. 1990	E only
36	Bruun Memorial Lectures 1989: Impact of New Technology on Marine Scientific Research. 1991	Composite E, F, S
37	Tsunami Glossary - A Glossary of Terms and Acronyms Used in the Tsunami Literature. 1991	E only
38	The Oceans and Climate: A Guide to Present Needs. 1991	E only
39	Bruun Memorial Lectures, 1991: Modelling and Prediction in Marine Science. 1992	E only
40	Oceanic Interdecadal Climate Variability. 1992	E only
41	Marine Debris: Solid Waste Management Action for the Wider Caribbean. 1994	E only
42	Calculation of New Depth Equations for Expendable Bathymerographs Using a Temperature-Error-Free Method (Application to Sippican/TSK T-7, T-6 and T-4 XBTS. 1994	E only
43	IGOSS Plan and Implementation Programme 1996-2003. 1996	E, F, S, R
44	Design and Implementation of some Harmful Algal Monitoring Systems. 1996	E only
45	Use of Standards and Reference Materials in the Measurement of Chlorinated Hydrocarbon Residues. 1996	E only
46	Equatorial Segment of the Mid-Atlantic Ridge. 1996	E only
47	Peace in the Oceans: Ocean Governance and the Agenda for Peace; the Proceedings of *Pacem in Maribus* XXIII, Costa Rica, 1995. 1997	E only
48	Neotectonics and fluid flow through seafloor sediments in the Eastern Mediterranean and Black Seas - Parts I and II. 1997	E only
49	Global Temperature Salinity Profile Programme: Overview and Future. 1998	E only
50	Global Sea-Level Observing System (GLOSS) Implementation Plan-1997. 1997	E only
51	L'état actuel de 1'exploitation des pêcheries maritimes au Cameroun et leur gestion intégrée dans la sous-région du Golfe de Guinée *(cancelled)*	F only
52	Cold water carbonate mounds and sediment transport on the Northeast Atlantic Margin. 1998	E only
53	The Baltic Floating University: Training Through Research in the Baltic, Barents and White Seas - 1997. 1998	E only
54	Geological Processes on the Northeast Atlantic Margin (8^{th} training-through-research cruise, June-August 1998). 1999	E only
55	Bruun Memorial Lectures, 1999: Ocean Predictability. 2000	E only
56	Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins (9^{th} training-through-research cruise, June-July 1999). 2000	E only
57	Ad hoc Benthic Indicator Group - Results of Initial Planning Meeting, Paris, France, 6-9 December 1999. 2000	E only
58	Bruun Memorial Lectures, 2001: Operational Oceanography – a perspective from the private sector. 2001	E only
59	Monitoring and Management Strategies for Harmful Algal Blooms in Coastal Waters. 2001	E only
60	Interdisciplinary Approaches to Geoscience on the North East Atlantic Margin and Mid-Atlantic Ridge (10^{th} training-through-research cruise, July-August 2000). 2001	E only
61	Forecasting Ocean Science? Pros and Cons, Potsdam Lecture, 1999. 2002	E only

No.	Title	Languages
62	Geological Processes in the Mediterranean and Black Seas and North East Atlantic (11th training-through-research cruise, July- September 2001). 2002	E only
63	Improved Global Bathymetry – Final Report of SCOR Working Group 107. 2002	E only
64	R. Revelle Memorial Lecture, 2006: Global Sea Levels, Past, Present and Future. 2007	E only
65	Bruun Memorial Lectures, 2003: Gas Hydrates – a potential source of energy from the oceans. 2003	E only
66	Bruun Memorial Lectures, 2003: Energy from the Sea: the potential and realities of Ocean Thermal Energy Conversion (OTEC). 2003	E only
67	Interdisciplinary Geoscience Research on the North East Atlantic Margin, Mediterranean Sea and Mid-Atlantic Ridge (12th training-through-research cruise, June-August 2002). 2003	E only
68	Interdisciplinary Studies of North Atlantic and Labrador Sea Margin Architecture and Sedimentary Processes (13th training-through-research cruise, July-September 2003). 2004	E only
69	Biodiversity and Distribution of the Megafauna / Biodiversité et distribution de la mégafaune. 2006 Vol.1 The polymetallic nodule ecosystem of the Eastern Equatorial Pacific Ocean / Ecosystème de nodules polymétalliques de l'océan Pacifique Est équatorial Vol.2 Annotated photographic Atlas of the echinoderms of the Clarion-Clipperton fracture zone / Atlas photographique annoté des échinodermes de la zone de fractures de Clarion et de Clipperton Vol.3 Options for the management and conservation of the biodiversity — The nodule ecosystem in the Clarion Clipperton fracture zone: scientific, legal and institutional aspects	E F
70	Interdisciplinary geoscience studies of the Gulf of Cadiz and Western Mediterranean Basin (14th training-through-research cruise, July-September 2004). 2006	E only
71	Indian Ocean Tsunami Warning and Mitigation System, IOTWS. Implementation Plan, 7–9 April 2009 (2nd Revision). 2009	E only
72	Deep-water Cold Seeps, Sedimentary Environments and Ecosystems of the Black and Tyrrhenian Seas and the Gulf of Cadiz (15th training-through-research cruise, June–August 2005). 2007	E only
73	Implementation Plan for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (NEAMTWS), 2007–2011. 2007 *(electronic only)*	E only
74	Bruun Memorial Lectures, 2005: The Ecology and Oceanography of Harmful Algal Blooms – Multidisciplinary approaches to research and management. 2007	E only
75	National Ocean Policy. The Basic Texts from: Australia, Brazil, Canada, China, Colombia, Japan, Norway, Portugal, Russian Federation, United States of America. (Also Law of Sea Dossier 1). 2008	E only
76	Deep-water Depositional Systems and Cold Seeps of the Western Mediterranean, Gulf of Cadiz and Norwegian Continental margins (16th training-through-research cruise, May–July 2006). 2008	E only
77	Indian Ocean Tsunami Warning and Mitigation System (IOTWS) – 12 September 2007 Indian Ocean Tsunami Event. Post-Event Assessment of IOTWS Performance. 2008	E only
78	Tsunami and Other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (CARIBE EWS) – Implementation Plan 2008. 2008	E only

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No.	Title	Languages
79	Filling Gaps in Large Marine Ecosystem Nitrogen Loadings Forecast for 64 LMEs – GEF/LME global project Promoting Ecosystem-based Approaches to Fisheries Conservation and Large Marine Ecosystems. 2008	E only
80	Models of the World's Large Marine Ecosystems. GEF/LME Global Project Promoting Ecosystem-based Approaches to Fisheries Conservation and Large Marine Ecosystems. 2008	E only
81	Indian Ocean Tsunami Warning and Mitigation System (IOTWS) – Implementation Plan for Regional Tsunami Watch Providers (RTWP). 2008	E only
82	Exercise Pacific Wave 08 – A Pacific-wide Tsunami Warning and Communication Exercise, 28–30 October 2008. 2008	E only
83.	*Cancelled*	
84.	Global Open Oceans and Deep Seabed (GOODS) Bio-geographic Classification. 2009	E only
85.	Tsunami Glossary	E, F, S
86	Pacific Tsunami Warning System (PTWS) Implementation Plan *(under preparation)*	
87.	Operational Users Guide for the Pacific Tsunami Warning and Mitigation System (PTWS) – Second Edition. 2011	E only
88.	Exercise Indian Ocean Wave 2009 (IOWave09) – An Indian Ocean-wide Tsunami Warning and Communication Exercise – 14 October 2009. 2009	E only
89.	Ship-based Repeat Hydrography: A Strategy for a Sustained Global Programme. 2009	E only
90.	12 January 2010 Haiti Earthquake and Tsunami Event Post-Event Assessment of CARIBE EWS Performance. 2010	E only
91.	Compendium of Definitions and Terminology on Hazards, Disasters, Vulnerability and Risks in a coastal context	*Under preparation*
92.	27 February 2010 Chile Earthquake and Tsunami Event – Post-Event Assessment of PTWS Performance (Pacific Tsunami Warning System). 2010	E only
93.	Exercise CARIBE WAVE 11 / LANTEX 11—A Caribbean Tsunami Warning Exercise, 23 March 2011	
	Vol. 1 Participant Handbook / Exercise CARIBE WAVE 11 —Exercice d'alerte au tsunami dans les Caraïbes, 23 mars 2011. Manuel du participant / Ejercicio Caribe Wave 11. Un ejercicio de alerta de tsunami en el Caribe, 23 de marzo de 2011. Manual del participante. 2010	E/F/S
	Vol. 2 Report. 2011	E only
	Vol. 3 Supplement: Media Reports. 2011	E/F/S
94.	Cold seeps, coral mounds and deep-water depositional systems of the Alboran Sea, Gulf of Cadiz and Norwegian continental margin (17th training-through-research cruise, June–July 2008)	*Under preparation*
95.	International Post-Tsunami Survey for the 25 October 2010 Mentawai, Indonesia Tsunami	*Under preparation*
96.	Pacific Tsunami Warning System (PTWS) 11 March 2011 Off Pacific coast of Tohoku, Japan, Earthquake and Tsunami Event. Post-Event Assessment of PTWS Performance	*Under preparation*
97.	Exercise PACIFIC WAVE 11: A Pacific-wide Tsunami Warning and Communication Exercise, 9–10 November 2011	
	Vol. 1 Exercise Manual. 2011	E only
98.	Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and connected seas. First Enlarged Communication Test Exercise (ECTE1). Exercise Manual and Evaluation Report. 2011	E only
99.	Exercise INDIAN OCEAN WAVE 2011 – An Indian Ocean-wide Tsunami Warning and Communication Exercise	*Under preparation*

No.	Title	Languages
100.	Global Sea Level Observing System (GLOSS) Implementation Plan – 2012. 2012	E only
101.	Exercise Caribe Wave/Lantex 13. A Caribbean Tsunami Warning Exercise, 20 March 2013. Volume 1: Participant Handbook. 2012	E only
102.	*(In preparation)*	
103.	Exercise NEAMWAVE 12. A Tsunami Warning and Communication Exercise for the North-eastern Atlantic, the Mediterranean, and Connected Seas Region, 27–28 November 2012, Volume I: Exercise Manual. 2012	E only
104.	Seísmo y tsunami del 27 de agosto de 2012 en la costa del Pacífico frente a El Salvador, y seísmo del 5 de septiembre de 2012 en la costa del Pacífico frente a Costa Rica. Evaluación subsiguiente sobre el funcionamiento del Sistema de Alerta contra los Tsunamis y Atenuación de sus Efectos en el Pacífico. 2012	Español solamente (resumen en inglés y francés)
105.	Users Guide for the Pacific Tsunami Warning Center Enhanced Products for the Pacific Tsunami Warning System. 2013	E, S