



**CTIC**  
Caribbean Tsunami  
Information Centre



Regional Training Workshop on Pacific Tsunami Warning Center  
Enhanced Tsunami Products for ICG/CARIBE EWS

Oct. 30 – Nov. 1, 2017

Cartagena, Colombia

# PTWC New Enhanced Products: Product Staging

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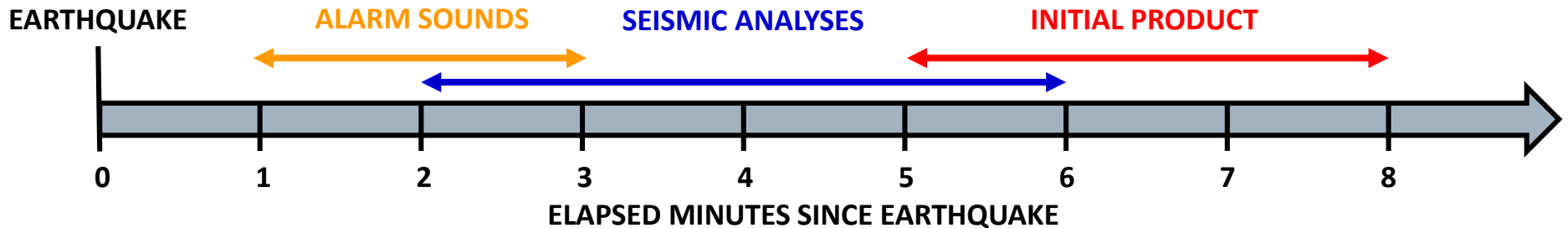
# Staging is based on TWC Capabilities

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## PTWC in 1997 as TWC for the Pacific

- ❑ Data from 8 seismic stations outside Hawaii
- ❑ Seismic data recorded on helicorders
- ❑ Remove paper and make readings manually
- ❑ Enter values manually into computer to compute location
- ❑ Wait for surface waves to get Richter Magnitude
- ❑ **First message** in 30 minutes to 1 hour
- ❑ 40 sea level gauges reporting once per hour
- ❑ Assessment based on earthquake magnitude, depth, readings, and historical data
- ❑ If waves greater than 1 m anywhere outside local area, then **entire Pacific in a warning**.

# Typical Timeline of PTWC Activities for an Earthquake / Tsunami



0 min	A large <b>earthquake</b> occurs.
1 - 3 min <b>Detect</b>	Vibrations from the earthquake reach seismic stations near the earthquake epicenter, triggering <b>event alarms at PTWC</b> . PTWC duty analysts respond to the operations center and begin to analyze the event. [PTWC currently monitors ~ 600 seismic stations from around the world, with data collected at most of those stations reaching PTWC within a minute of when it is collected.]
2 - 6 min <b>EQ Analyzed</b>	Using a combination of automatic and interactive analyses, duty analysts complete their <b>preliminary determination of the earthquake epicenter, depth, and magnitude</b> .
5 - 8 min <b>1<sup>st</sup> Product</b>	If criteria are met, then an <b>initial product is issued</b> that is either a Tsunami Information Statement or a Tsunami Threat Message.

## Typical Timeline of PTWC Activities for an Earthquake / Tsunami

5 – 8 min  
1<sup>st</sup> Product

Initial text products are generated and issued according to the following general procedures. Some deviation from these procedures may occur based upon the scientific judgments of the duty staff. A quantitative forecast is not issued yet due to having too little information this early on to properly constrain such a forecast.

Criteria for Initial Product	Initial Product Type
The EQ is deep ( $\geq 100$ km depth) or is located far inland with a magnitude $\geq 6.0/6.5^*$ .	Tsunami Information Statement ( <b>TIS</b> )
The EQ is shallow ( $< 100$ km depth) and undersea with a magnitude of <b>6.0/6.5* to 7.0</b> .	
The EQ is shallow ( $< 100$ km depth) and undersea and has a magnitude of <b>7.1 to 7.5</b> .	Tsunami Threat Message ( <b>TTM</b> ) for coasts within 300 km of epicenter.
The EQ is shallow ( $< 100$ km depth) and undersea and has a magnitude of <b>7.6 to 7.8</b> .	Tsunami Threat Message ( <b>TTM</b> ) for coasts within 1000 km of epicenter.
The EQ is shallow ( $< 100$ km depth) and undersea and has a magnitude $\geq 7.9$ .	Tsunami Threat Message ( <b>TTM</b> ) for coasts within 3 hours of tsunami ETA.

\* Caribbean/Atlantic

## Typical Timeline of PTWC Activities for an Earthquake / Tsunami

<p>15 – 20 min <b>continue analyses</b></p>	<p>Seismic analyses continue as data from additional seismic stations arrive and are processed. <b>If the earthquake parameters change significantly based on these analyses then the appropriate supplemental text product will be issued</b>, using the procedures described above.</p>
<p>20 – 30 min <b>Forecast Issued</b></p>	<p>For earthquakes with a tsunami threat, the <b><u>W-phase Centroid Moment Tensor (WCMT) analysis</u></b> is triggered with results typically available about 20 - 30 minutes after the earthquake. The WCMT analysis not only gives a more accurate estimate of the earthquake's location, depth and magnitude, but also an <b>estimate of the earthquake's faulting mechanism</b> – the strike angle of the fault, the dip angle of the fault, and the direction and amount of slip along the fault. These parameters are critical to constrain the estimate of seafloor deformation that is the tsunami source. They <b>are used to drive a run of the tsunami forecast model covering the region nearest the epicenter</b>. For events with <b>forecast coastal amplitudes above 0.3 m</b> anywhere within the PTWC area of responsibility, a <b>Tsunami Threat Message (TTM)</b> is issued along with accompanying <b>graphical maps, statistics table, and KMZ file</b> that covers the affected region.</p>

## Typical Timeline of PTWC Activities for an Earthquake / Tsunami

<p>15 min to 2 hours <b>Detect Tsunami</b></p>	<p><u>Sea level gauges</u> 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. The <u>model forecast may be adjusted to be more consistent with observations.</u></p>
<p>Beyond 2 hours <b>Monitor Tsunami</b></p>	<p>The process of refining the earthquake parameters and collecting additional sea level observations continues, with that information used to constrain the forecast if necessary. The tsunami is monitored as it advances. <u>When it is likely that there is no longer a significant continuing tsunami threat for most areas then a final product is issued.</u> Due to resonances in enclosed bays, and to tsunami energy that gets trapped around islands and along continental shelves or is re-energized by reflections, some areas may continue to experience hazardous sea level oscillations. It is <u>up to local officials to determine when coasts are safe, persons can return to evacuated areas, and normal activities may resume.</u></p>



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7–10 December 2015  
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# Thank You

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