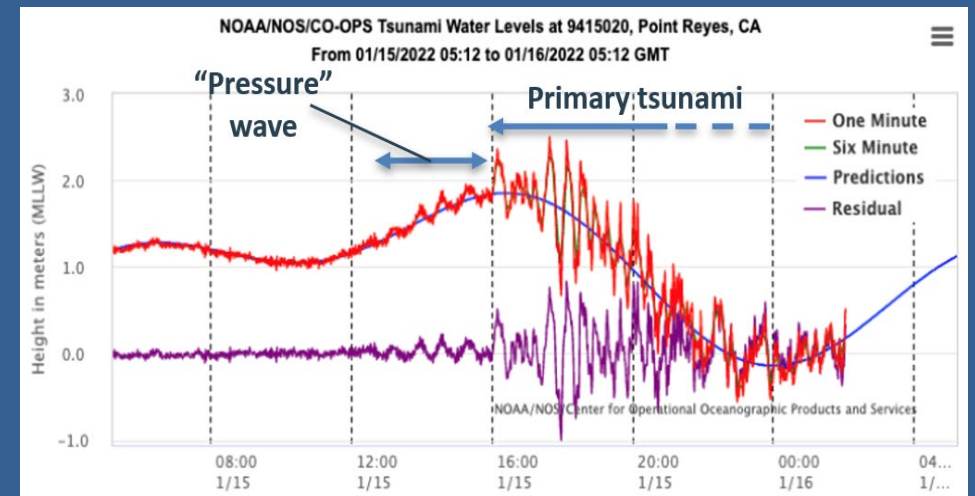


## TIMELINE: January 15, 2022, Tsunami **Advisory** along the US West Coast from Tonga Volcano Eruption

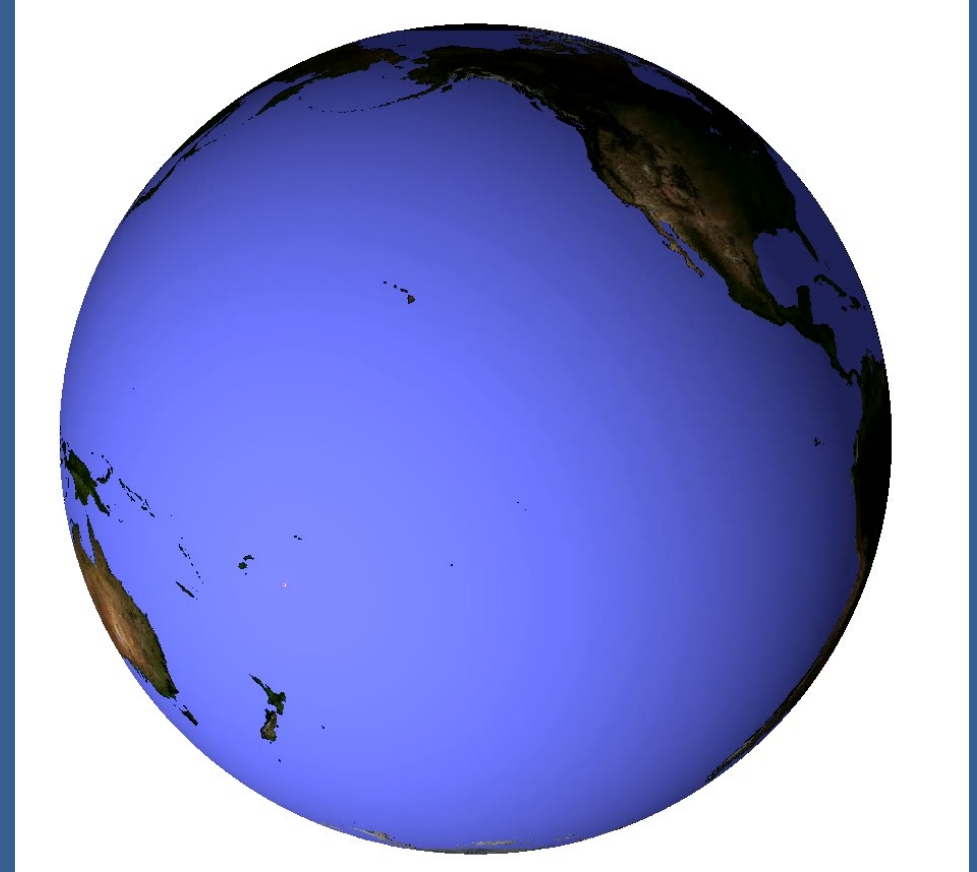
- 2015 PST Jan. 14– Underwater explosive volcanic eruption occurred.
- 0326 Jan. 15- First NTWC Alert: “analyzing event to determine level of dangers (for U.S. West Coast)”
- 0430 PST – NTWC holds 1<sup>st</sup> stakeholder call
- 0456 PST – **Tsunami Advisory** (0.3m to 1.0m amplitude) issued for U.S. West Coast. NWS communicates tsunami arrival at high tide and potential for minor flooding/damage in harbors and beaches. Advise keeping people away from water and off beaches.



*Marigram showing peak tsunami activity coincident with high tide.*

TIMELINE: January 15, 2022, U.S. West Coast **Tsunami Advisory** from Tonga Volcano Eruption

- 0700 PST – Tsunami arrives on West Coast
- 0800 Jan. 15 to 0030 Jan. 16 – NTWC holds stakeholder calls
- 0030 PST 16 Jan. **Tsunami Advisory** cancelled at last location.
- **Tsunami Advisory** lasted 19-1/2 hours for some locations.
- Damage assessment estimate ~\$10M (California)



*Model of atmospheric pressure wave (red) and tsunami (white) as they cross the ocean (courtesy Dr. Patrick Lynett at Univ. of Southern CA).*

## Observations & Findings Alignment with TSTAP Report Recommendations

Observations & Findings	TSTAP Report Recommendations
<p><b>1. Both TWCs did not have a system to provide accurate tsunami forecast information for a non-seismic source event.</b> Expanding TWC capabilities to include volcanic and other non-seismic sources is required.</p>	<p>1.2 – Upgrade enterprise-wide technology. 1.3 – Work with USGS to improve non-seismic source analysis, like volcanoes. 2.2 – Expand detection capabilities. 2.4 – Consider use of airborne and satellite observing platforms. 5.1 – Standardized sources including volcanic and landslide sources. 8.1 – Leverage research to assess volcanic and landslide sources.</p>
<p><b>2. NTWC did not issue Tsunami Advisory for U.S. West Coast until 9 hours after event initiated.</b> Timelier IDSS required.</p>	<p>3.2 – Early messaging and providing information in a timely manner.</p>

# Observations & Findings Alignment with TSTAP Report Recommendations

Observations & Findings	TSTAP Report Recommendations
<p><b>3. Some NTWC tsunami bulletins were confusing</b> or different due to changes in methods employed by NTWC to activate or update alerts. Upgrading the notification and messaging system could address these issues.</p>	<p>1.2 – Upgrade enterprise-wide technology 3.2 – Tsunami Bulletins – simplifying the bulletins.</p>
<p><b>4. Tsunami Advisory term was confusing.</b> Some media outlets miscommunicated a “tsunami warning.” While the NWS is evaluating the “Advisory” term overall, more professional oceanographic social science review is needed before implementation of any changes to tsunami alert terminology.</p>	<p>3.2 – Improve tsunami message composition to explain potential impacts.</p>

## Observations & Findings Alignment with TSTAP Report Recommendations

Observations & Findings	TSTAP Report Recommendations
<p><b>5. Tsunami forecast amplitude data was not provided.</b> Incorporating tides and other potential flood factors globally in real time was needed.</p>	<p>1.1 – Producing consistent products (forecast amplitudes) by both TWCs. 2.1 – Improve observation networks, increasing tide gauges. 4.2 – Update forecast areas, breakpoints, and forecast points. 7.1 – Improvements to hydrodynamic modeling, including tides.</p>
<p><b>6. NTWC was unable to provide wave arrival times or forecast information for inland waterways.</b> TWCs have indicated that improvements to alerting for complicated waterways cannot be made until the enterprise-wide upgrades have been performed on the tsunami warning system.</p>	<p>1.2 – Upgrade enterprise-wide technology 4.1 – Expand granularity in tsunami alert regions where complicated waterways exist (e.g., Puget Sound, San Francisco Bay, etc.) 4.2 – Update forecast areas, breakpoints, and forecast points.</p>

## Observations & Findings Alignment with TSTAP Report Recommendations

Observations & Findings	TSTAP Report Recommendations
<p><b>7. Tsunami Advisory canceled for British Columbia hours before it was canceled for Washington</b> for a shared waterway, the Strait of Juan de Fuca. Confusion resulted on both sides of the border.</p>	<p>4.1 – Expand granularity in tsunami alert regions where complicated waterways exist (e.g., Puget Sound, San Francisco Bay, etc.) 4.2 – Update forecast areas, breakpoints, and forecast points.</p>
<p><b>8. There were significant delays in downgrading/canceling tsunami alerts</b> due to the current protocol for obtaining tide gauge observations.</p>	<p>2.1 – Increase tide gauges and other observation systems. 2.2 – Expand detection capabilities. 3.2 – Early messaging and providing information in a timely manner.</p>

## Observations & Findings Alignment with TSTAP Report Recommendations

Observations & Findings	TSTAP Report Recommendation
<p><b>9. TWCs communicated with each other.</b> Demonstrates the benefits of both TWCs working more closely together.</p>	<p>1.2 – TWC unification and software. 1.4 – Improved collaboration between TWCs.</p>
<p><b>10. Delays in NOAA's tsunami.gov refreshing.</b> Although the website performed well at times, there were occasions when it failed perhaps due to overloading. Improving the capacity of online visitors during a tsunami is vital.</p>	<p>3.2 – Improve performance of tsunami.gov</p>

# Observations & Findings Alignment with TSTAP Report Recommendations

Observations & Findings	TSTAP Report Recommendation
<p><b>11. Tsunami Advisory “lit up” entire West Coast of North America revealing limitations for Wireless Emergency Alerts if this were a “whole coast” Tsunami Warning.</b> Getting device-based geofencing (DBGF, “WEA 3.0”) to work is essential, but not available now.</p>	<p>2.1 – Increase tide gauges and other observation systems. 2.2 – Expand detection 1.2 – Upgrade enterprise-wide technology 3.1 – Testing WEA and other platforms 4.1 – Increase capabilities of WEA</p>
<p><b>12. Forecasts on tsunami current velocities was not provided,</b> revealing limitations in IDSS for impact on ports, harbors, and maritime operations.</p>	<p>3.3 – Make available foundational forecast data.</p>



# Observations & Findings Alignment with TSTAP Report Recommendations

Observations & Findings	TSTAP Report Recommendations
<p><b>13. No information was provided about wave arrival time from pressure wave induced tsunami. Very difficult to communicate and determine what impacts might be.</b></p>	<p>3.2 – Early messaging and providing information in a timely manner 8.1 – Leveraging research to assess volcanic and landslide sources.</p>

