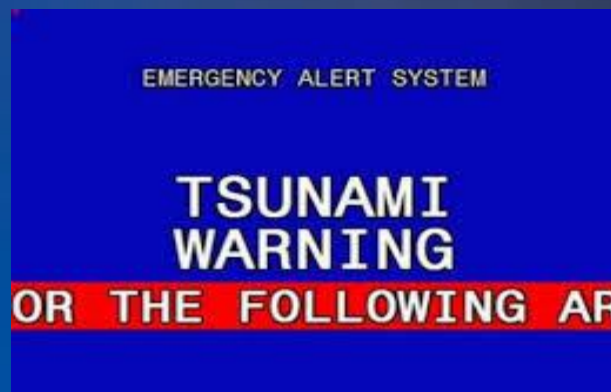
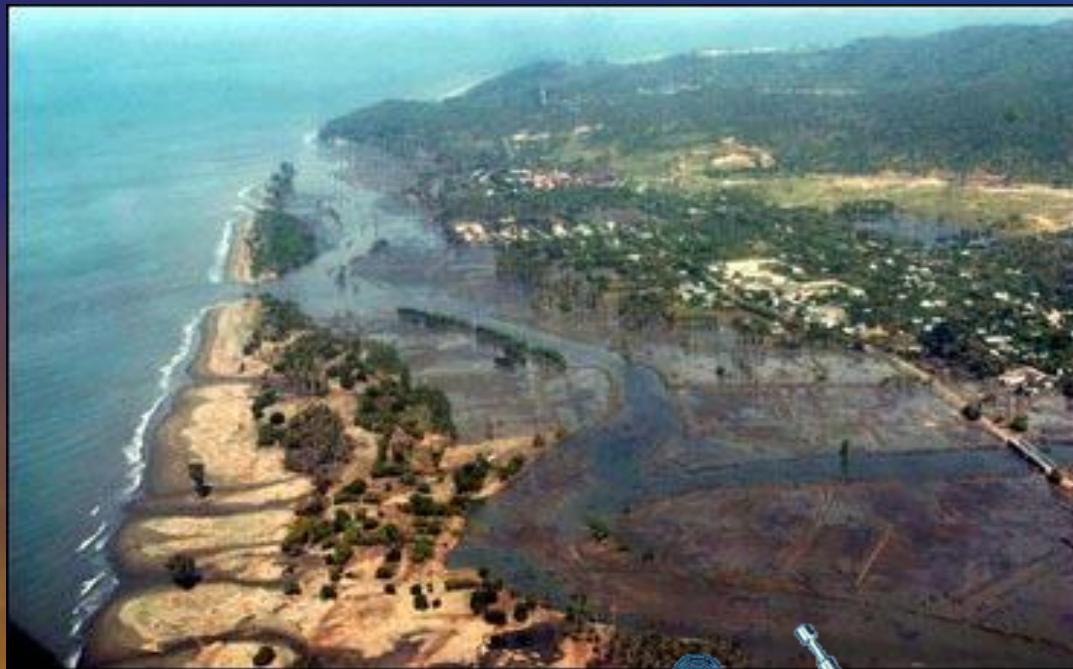




NOAA's Tsunami Warning Program



*Tyree Wilde
Warning Coordination Meteorologist
NWS Portland, OR*



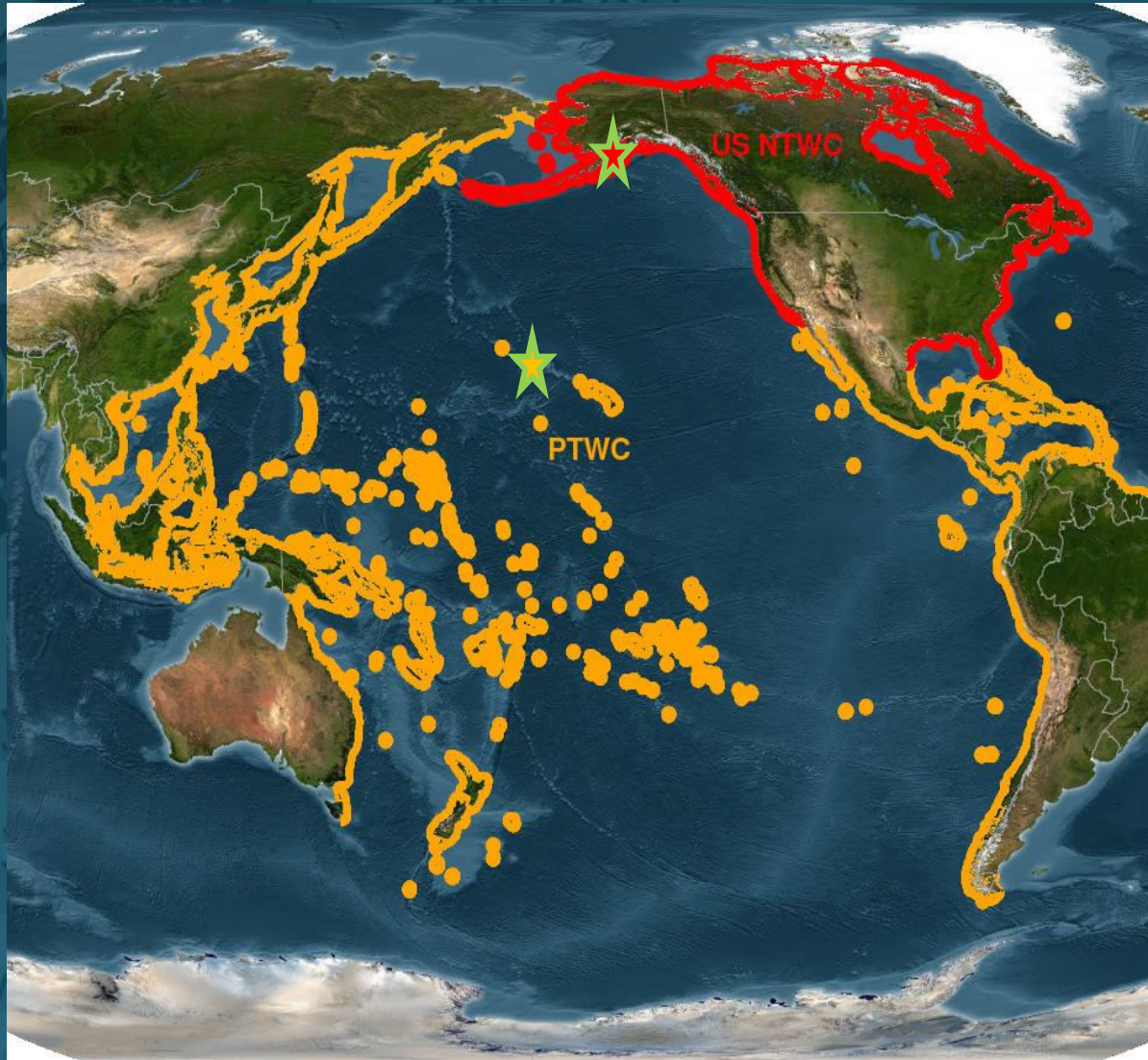
Overview

- **NOAA's Tsunami Warning Program**
- **Message Definitions**
- **Dissemination of Tsunami Warnings**
- **How to stay informed**



NWS: 2x Tsunami Warning Centers

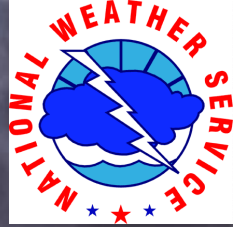
Pacific
Tsunami
Warning
Center
(Honolulu, HI)



National
Tsunami
Warning
Center
(Palmer, AK)



National Weather Service Tsunami Program



- Operates two centers
 - *National Tsunami Warning Center (Palmer, AK)*
 - *Pacific Tsunami Warning Center (Honolulu, HI)*

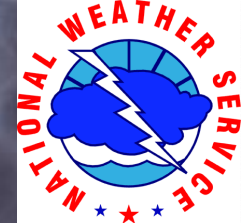




Role of the Natl Tsunami Warning Center

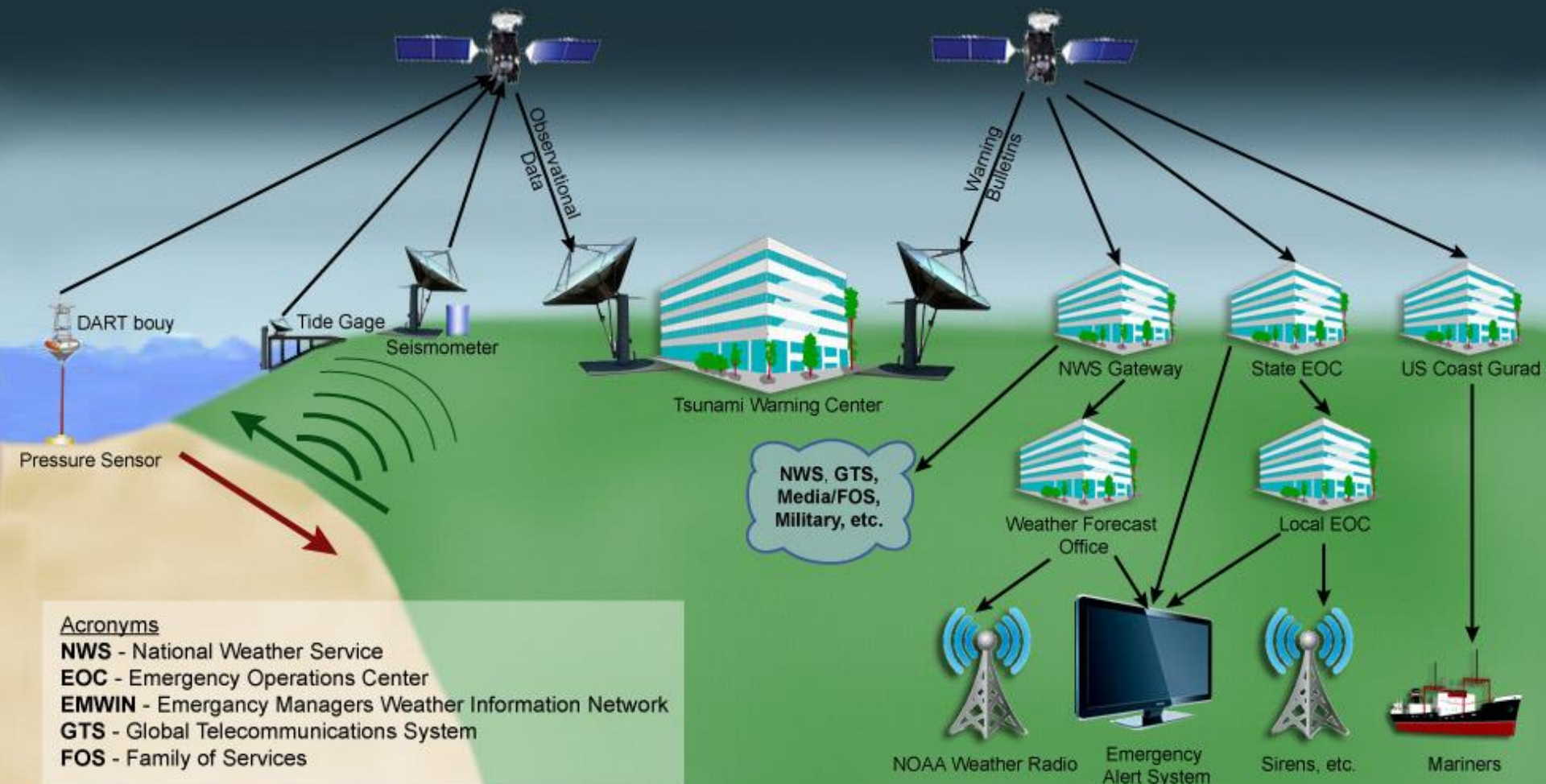


- **Issues all tsunami products for AK, BC, WA, OR, CA**
 - ***All of North America***
- **When an earthquake occurs anywhere that could cause a tsunami**
 - ***Evaluate for tsunami generation***
 - ***Send warning, watch, advisory, info statement as appropriate***
 - ***Disseminate to State Warning Points, NWS offices, USCG, many others***
- **Backup for Pacific Tsunami Warning Center**
 - ***Communication outages, facility damage, etc.***



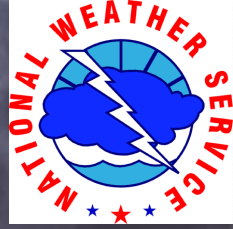
Tsunami Warning System

What is it?

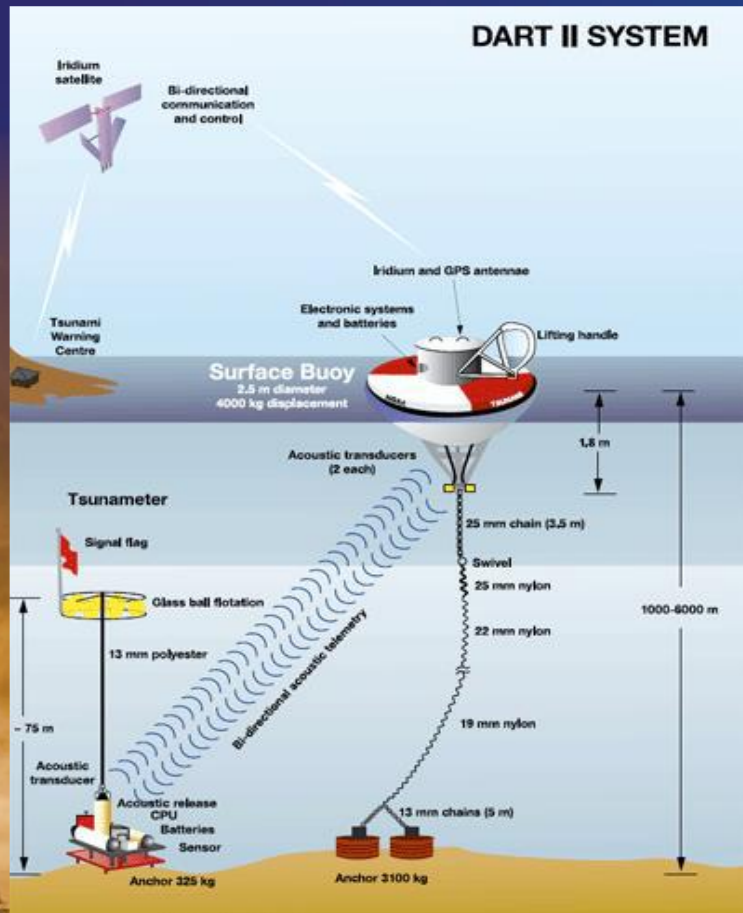


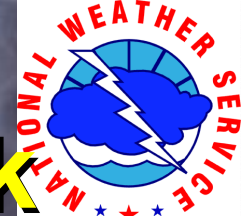


Tsunami Detectors

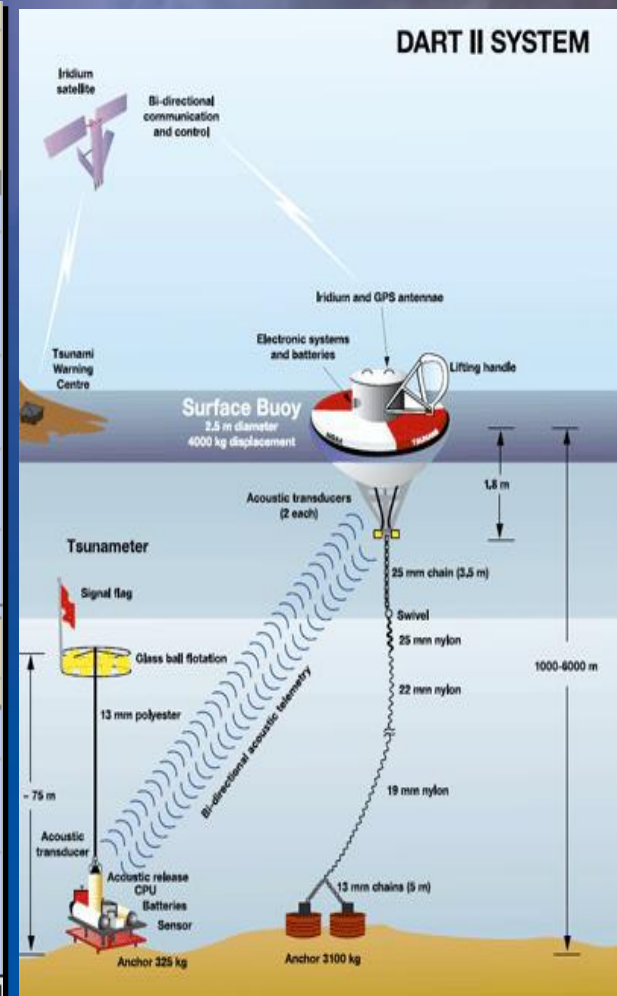
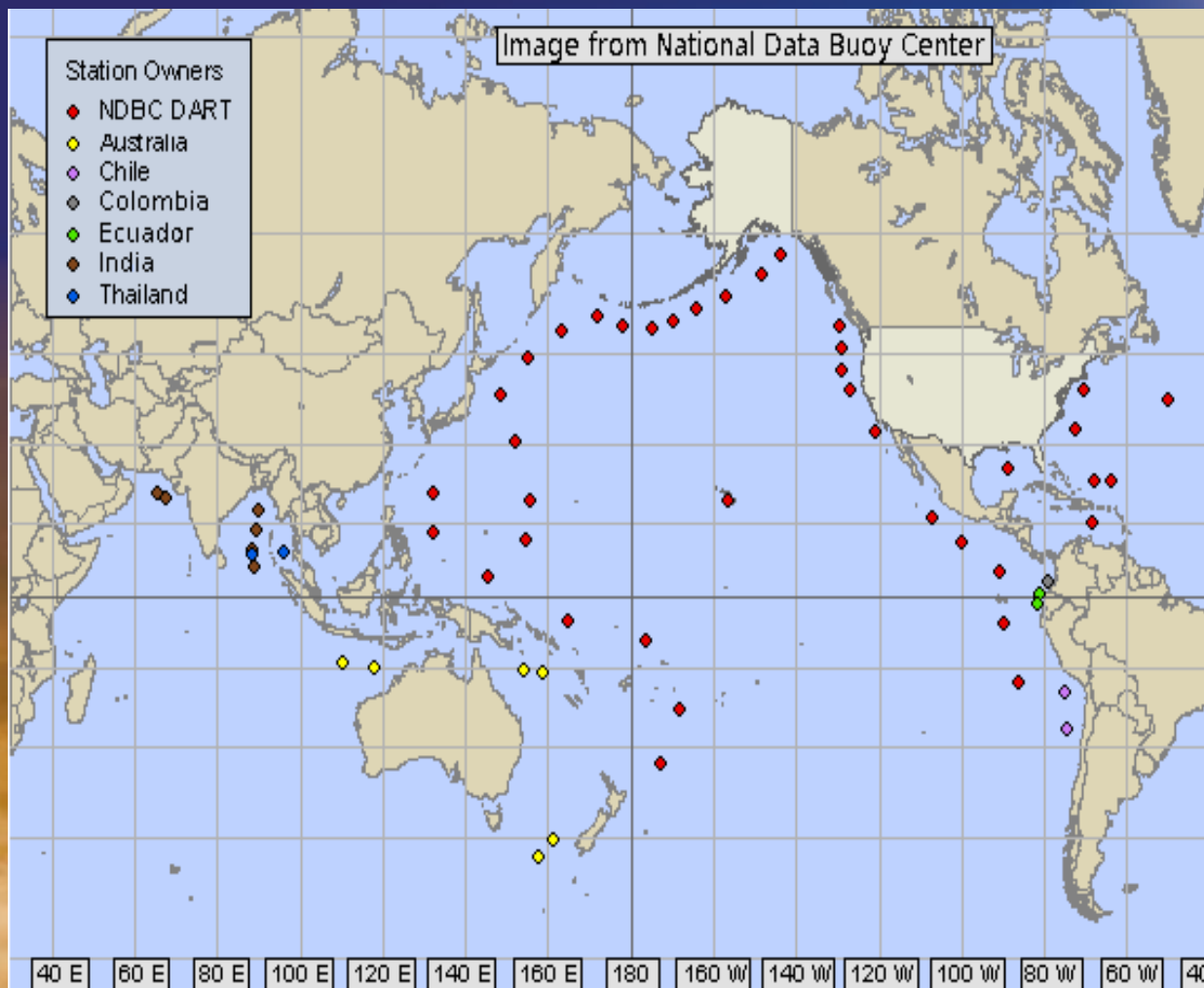


Deep-Ocean Assessment and Reporting of Tsunamis (DART)





Tsunami DART Buoy Network

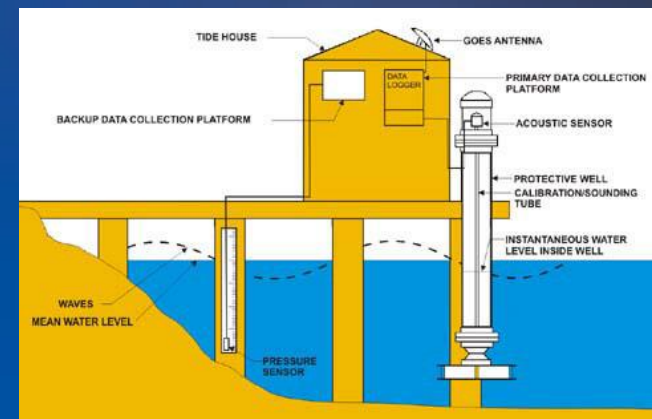
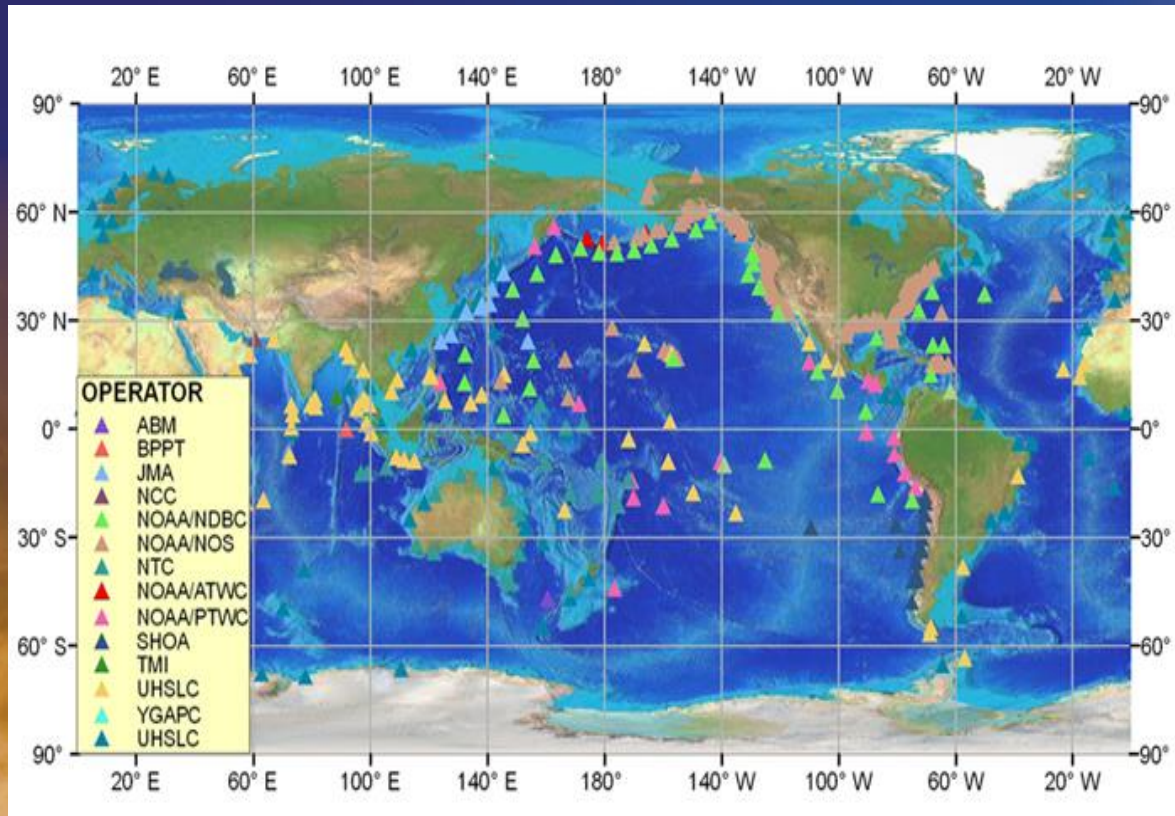




Tidal Gage Network

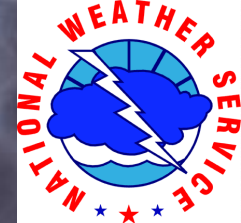


Wave height assessment from tide gauge and buoy data

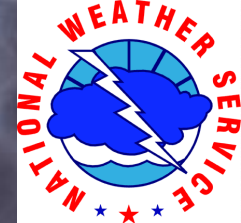




Process for Issuing a Tsunami Warning






- Earthquake occurs
- Automated seismic sensors alert TWC's
- Earthquake is initially located and sized automatically
- Information compared to historical database
- Tsunami Warning/alert messages disseminated
- Monitor tide gauges and DART buoys to confirm tsunami
- If no wave is recorded on tide gages, warning is cancelled.



Alert Definitions

Tsunami Alerts

| Alert Name | Actions | Potential Hazards |
|--|--|--|
|  WARNING | Get to high ground or inland IMMEDIATELY Follow tsunami evacuation signage | Danger! Tsunami imminent! Flooding/powerful currents Wave heights > 3 ft. or unknown |
|  ADVISORY | Stay out of the water and away from the shore | Strong currents and dangerous waves in or very near water Wave heights of 1 - 3 ft. |
|  WATCH | Be prepared to take action Stay tuned to local radio/TV/ NOAA "alert" weather radios | Tsunami possible Alert level may change once more information is known |
|  INFORMATION STATEMENT | No action needed | No tsunami impact expected Alert level may change once more information is known |

THREAT Message: Intended to alert international partners only. Not applicable to U.S. coasts

**Tsunamis affect wide areas & alerts are issued for specific locations. Always read the full alert.
For information on current alerts, check: tsunami.gov**

Tsunami Alert Thresholds

| Type | Magnitude | Depth | Distance |
|-------------------|-------------|--------------|--|
| Warning | M7.9 to 10 | Depth<100 km | < 3 hours travel time |
| Warning | M7.6 to 7.8 | Depth<100 km | < 500 km from source (310mi) |
| Warning | M7.1 to 7.5 | Depth<100 km | < 250 km from source (150mi) |
| Advisory | M7.6 to 7.8 | Depth<100 km | 500 - 1000 km from source (310-621mi) |
| Advisory | M7.1 to 7.5 | Depth<100km | > 250 km from source (150mi) |
| Watch | M7.9 to 10 | Depth<100 km | > 3 hours travel time |
| Info Statement | M6.5 to 7.8 | Depth>100 km | |
| Info Statement | M4.5 to 6.4 | | > 100 km from source (60mi) |
| Info Statement | M4.0 to 4.4 | | < 50 km from source (30mi) |

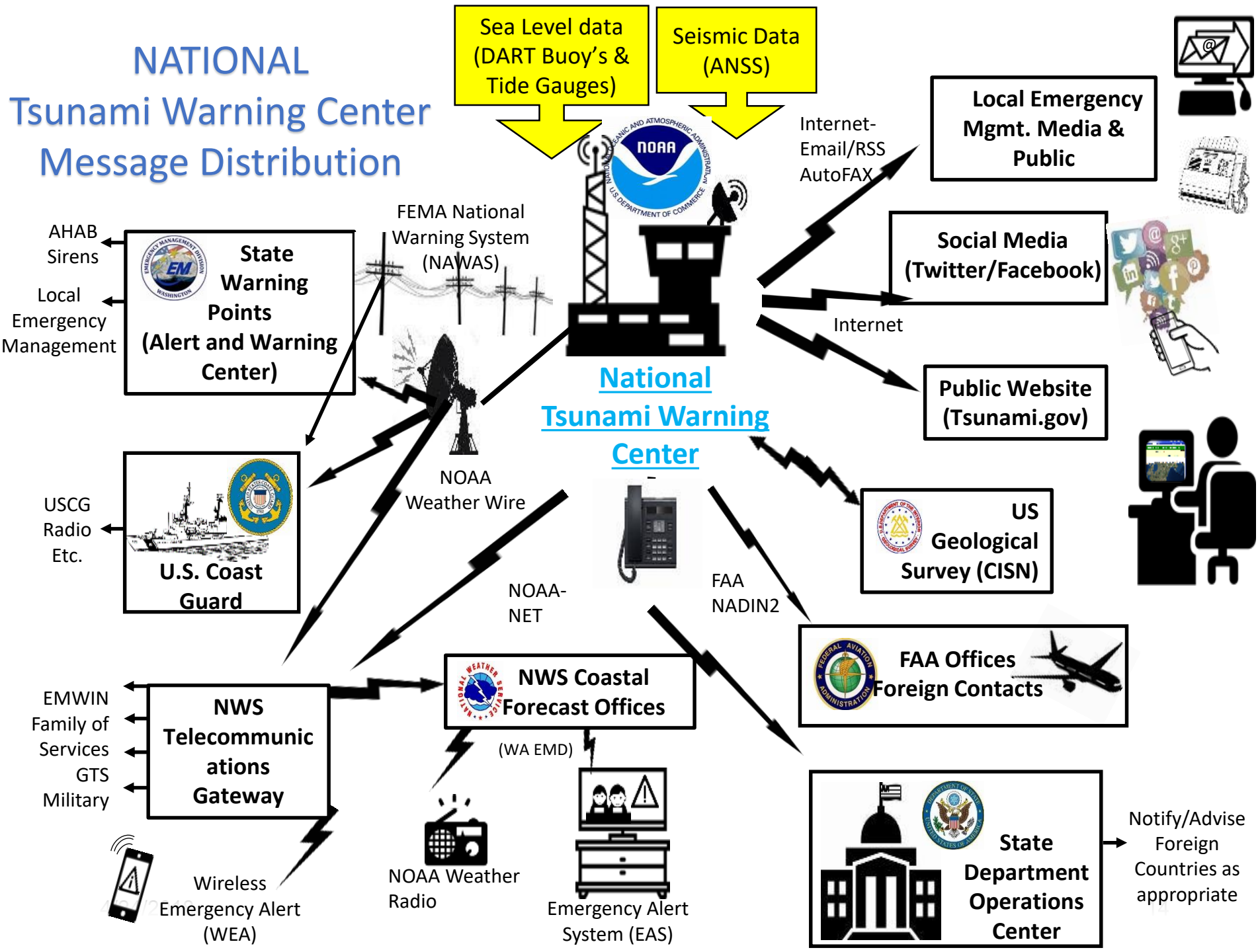


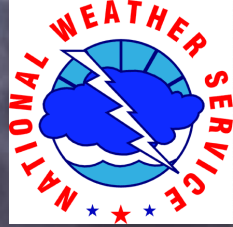
Dissemination of Tsunami Alerts



Many Others

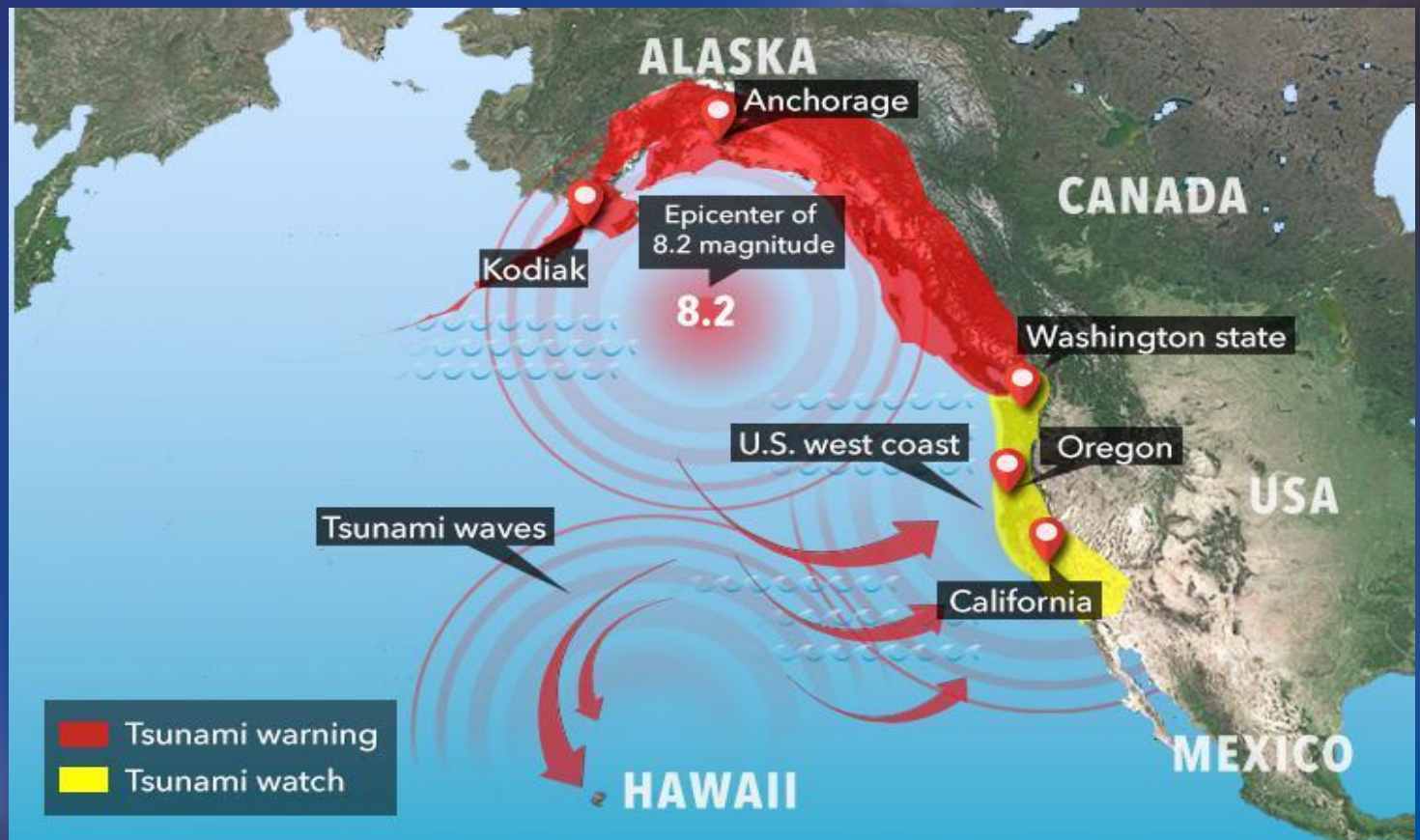
NATIONAL Tsunami Warning Center Message Distribution





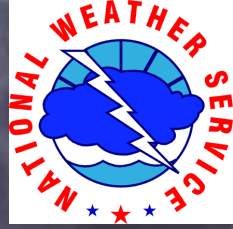
Tsunami Alerts

- How do I receive alerts
- How to stay informed

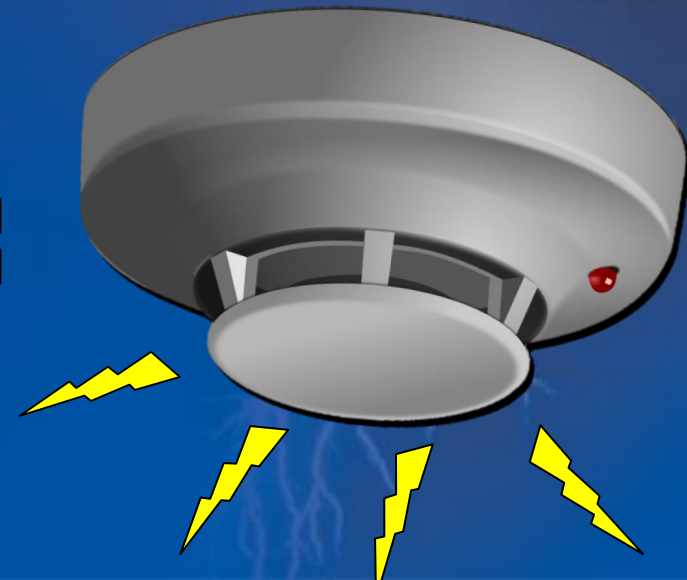


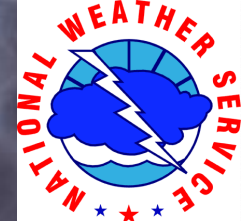


NOAA Weather Radio



- 16 Stations in Washington
- Warning Alarm Feature
- NWS Portal into the Emergency Alert System (EAS)





Wireless Emergency Alerts

| Warning Type | WEA Message |
|-----------------------|--|
| Tsunami Warning | Tsunami danger on the coast. Go to high ground or move inland. Listen to local news. -NWS |
| Tornado Warning | Tornado Warning in this area til hh:mm tzT. Take shelter now. Check local media. -NWS -- or -- Tornado EMERGENCY til hh:mm tzT. Tornado spotted in this area. Find shelter now! -NWS |
| Extreme Wind Warning | Extreme Wind Warning this area til hh:mm tzT ddd. Take shelter. -NWS |
| Hurricane Warning | Hurricane Warning this area. Check local media and authorities. -NWS |
| Typhoon Warning | Typhoon Warning this area til hh:mm tzT ddd. Check local media and authorities. -NWS |
| Storm Surge Warning** | NWS: Life-threatening storm surge danger. Check for possible evacuation orders. |
| Flash Flood Warning | Flash Flood Warning this area til hh:mm tzT. Avoid flooded areas. Check local media. -NWS |
| Dust Storm Warning | Dust Storm Warning til hh:mm tzT. Remember, Pull Aside, Stay Alive -NWS |

Legend

tzT = timezone

ddd= three letter abbreviation
for day of the week

**Availability of Storm Surge Warning varies by wireless carrier



EMERGENCY ALERTS

12:36 AM

Emergency Alert

Tsunami danger on the coast. Go to high ground or move inland. Listen to local news. -NWS

WIRELESS
EMERGENCY
ALERTS
CAPABLE

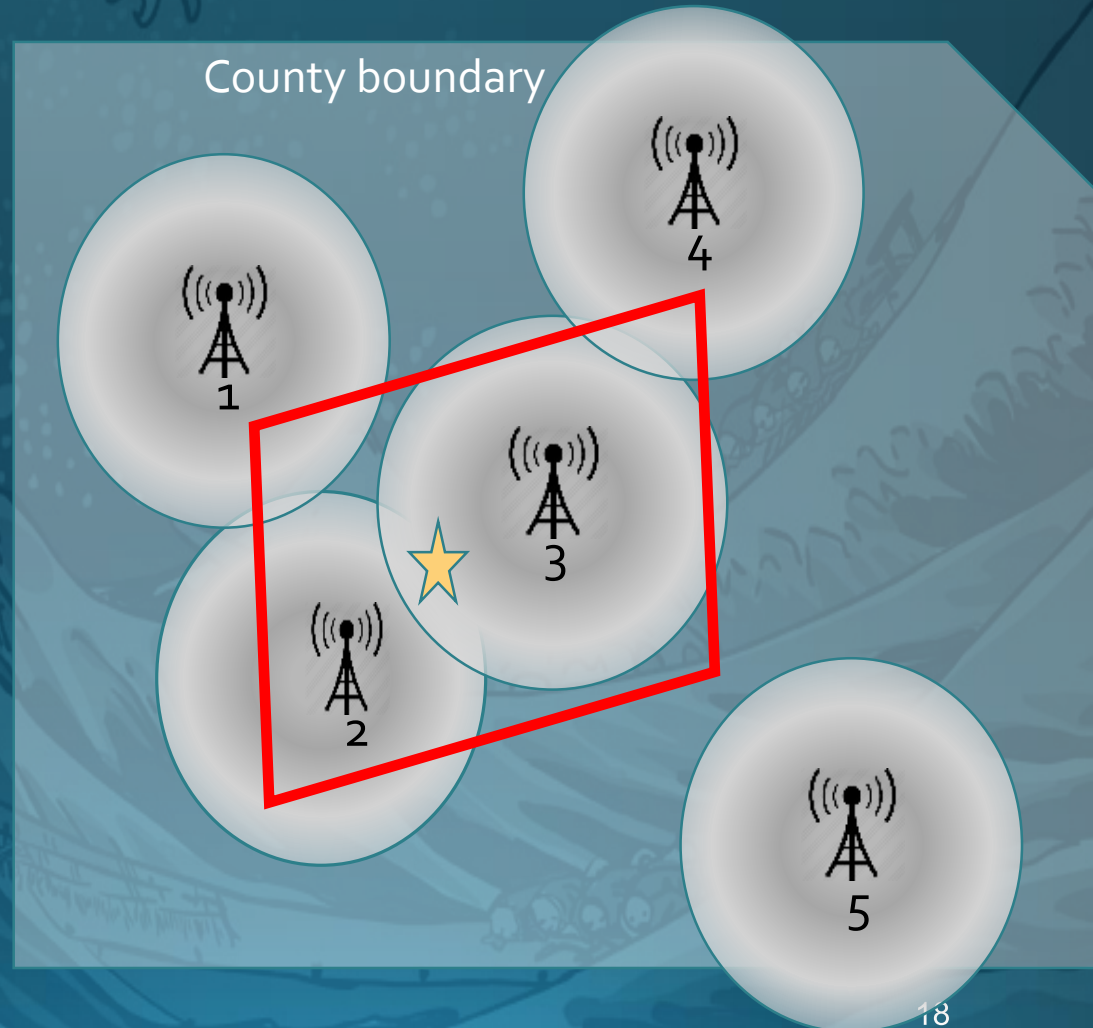


Carrier Targeting of the WEA Broadcast

Wireless Emergency Alerts

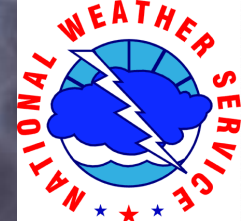
All major carriers that participate, target sub-county areas when sub-county alerts are issued (e.g. Tsunami warnings for star city)

- Red polygon represents an alert issued at the sub-county level
- Some carriers broadcast from cell towers within sub-county alert area (towers 2 & 3)
- Some also broadcast where signal overlaps sub-county alert area (adds towers 1 & 4)





Sirens



- 68 sirens along WA coast and Strait of Juan de Fuca
- Activated by state or local government
- Siren plus aural message
- Can be used for drills, exercises





Stay Informed

- Text or emails from NTCWC
- SMS via NTCWC Twitter feed
 - Send text message to **40404** with **“Follow NWS_NTCWC”** as the message
- Email service via UNESCO/IOC email service
 - tsunami-information-ioc@lists.unesco.org





Stay Informed

- Social media
 - NWS_NTWC
 - <https://www.facebook.com/NWSNTWC>
- Individual counties notification lists
 - *Hyper-Reach*
 - *Everbridge*



Tsunami.gov

- Visually displays which coasts are impacted
- List ALL tsunami alert messages (public bulletins)
 - In chronological order
 - Only look for messages titled
AK/BC/US West Coast
- As of result of Jan 23rd event, NOAA has dedicated more servers to support event spike traffic

4/24/2018

United States Department of Commerce
NOAA / National Weather Service
U.S. Tsunami Warning System



Home News Organization Search for: NWS All NOAA Search

No Tsunami Warning, Advisory, Watch, or Threat

Earthquake:
Magnitude: 4.1 Origin Time: 3/29/2018 4:55:38 PM
Depth: 11 mi Lat: 18° N Lon: 68.1° W
Location: ABOUT 12 MILES SOUTHWEST OF ISLA MONA

Note: Times are local to your browser, unless otherwise indicated See the map or table below for more information

☒ Alerts/Threats ☒ Earthquakes
☐ Previous 40 Messages ☐ Observations ☐ Forecasts ☐ Water-Level Stations ☐ DART Systems ☐ Travel Time ☒ Auto Update 1 min

Default View   Topographic

3000km
2000mi

Earthstar Geographics esri

☒ Warning ☐ Advisory ☐ Watch ☐ Threat ☒ Earthquake

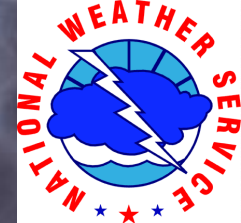
U.S. / Canada International [Map FAQ](#) [More earthquakes information](#)

Previous 40 Tsunami Messages

| Issued * | Origin Time * | Mag † | Depth ‡ | Lat † | Lon † | Location ‡ | Messages ‡ | Additional Resources ** |
|---------------------|---------------------|-------|---------|--------|----------|---------------------------------------|---------------------------------|-------------------------|
| 03-29-2018 23:50:28 | 03-29-2018 23:55:38 | 4.1 | 11 Mi. | 18° N | 68.1° W | ABOUT 12 MILES SOUTHWEST OF ISLA MONA | PR/Virgin Isl. Informational #1 | Select Resource ▾ |
| 03-29-2018 22:46:52 | 03-29-2018 21:25:35 | 7.2 | 6 Mi. | 5.6° S | 151.6° E | NEW BRITAIN REGION PAPUA NEW GUINEA | Non-US/Canada Pacific Threat #3 | Select Resource ▾ |
| 03-29-2018 21:57:46 | 03-29-2018 21:25:35 | 7.2 | 6 Mi. | 5.6° S | 151.6° E | NEW BRITAIN REGION PAPUA NEW GUINEA | Non-US/Canada Pacific Threat #2 | Select Resource ▾ |
| 03-29-2018 21:33:42 | 03-29-2018 21:25:35 | 7.2 | 6 Mi. | 5.6° S | 151.6° E | NEW BRITAIN REGION PAPUA NEW GUINEA | Guam/CNMI Informational #1 | Select Resource ▾ |
| 03-29-2018 | 03-29-2018 21:25:35 | 7.2 | 6 Mi. | 5.6° S | 151.6° E | NEW BRITAIN REGION PAPUA | American Samoa | Select Resource ▾ |



tsunami.gov weather.gov



NOAA / National Weather Service
U.S. Tsunami Warning System

Home News Organization Search for: [] NWS All NOAA Search

No Tsunami Warning, Advisory, Watch, or Threat

Earthquake:
Magnitude: 4.2 Origin Time: 3/12/2018, 8:22:23 PM
Depth: 31 mi. Lat: 59.2° N Lon: 152° W
Location: 30 miles SW of Homer, Alaska

Note: Times are local to your browser, unless otherwise indicated See the map or table below for more information

☒ Alerts/Threats ☒ Earthquakes
☐ Previous 40 Messages ☐ Observations ☐ Forecasts ☐ Water-Level Stations ☐ DART Systems ☐ Travel Time ☒ Auto Update 1 min

Default View

3000km
2000mi

Earthstar Geographics esri

Map FAQ

☒ Warning ☐ Advisory ☐ Watch ☐ Threat ☒ Earthquake

weather.gov/seattle
weather.gov/portland

National Weather Service, Portland Oregon - Netscape

File Edit View Go Communicator Help

Bookmarks Location: [http://www.weather.gov/portland/]

Back Forward Reload Home Search Guide Print Security Stop Netscape

Local Forecasts

Enter city
Get Forecast

Pacific NW Text Products

Current Hazards
Local Hazards
Storm Reports
Tsunami Info

Current Conditions

Observations
Tide Info
Cameras
Satellite
Radar
Rivers
Snow Data & elevations
Roads

Forecasts

General forecasts
Digital (proto)
Aviation
Marine
Fire
Canada
International

Model Data

Graphics
Guidance
Metograms

Climate

Local News and Information

Want to comment on NWS Marine Products and Services? Take this [Survey for Mariners](#) and help us improve.
September is NOAA Weather Radio Month in Washington
Latest Wildfire Information
Latest Drought Info and Assessment
Want to share your Weather photo? Send it to me (Portland webmaster)

Our Featured Photo

Columbia River Bar Pilots (other pic) courtesy T. Wilde

West USA TROPICAL Digital WX Digital WX

For the most accurate forecast/warnings in your area, click on map

Click on map for forecasts, warnings, and observations for a specific location. Click here for a summary of all warnings and advisories

Tsunami
Hazardous Weather Outlook

09-25-2003 2110Z
(02:10PM PDT)

start Inbox - Netsc... MapQuest: M... National Wea... map - Netsca... MapQuest: M... WordPerfect... Microsoft Po... 14:05



Questions