UNESCO/IOC – NOAA ITIC Training Program in Hawaii (ITP-TEWS Hawaii)
TSUNAMI EARLY WARNING SYSTEMS
AND THE PACIFIC TSUNAMI WARNING CENTER (PTWC) ENHANCED PRODUCTS
TSUNAMI EVACUATION PLANNING AND UNESCO IOC TSUNAMI READY PROGRAMME
15-26 September 2025, Honolulu, Hawaii

Hawaii End-to-End Tsunami. Warning: Emergency Alert System (EAS)

Dr. Laura Kong
Director, ITIC
Hawaii State Tsunami Advisor

Tsunamis are Hawai‘i’s deadliest hazard

ESTIMATED FATALITIES IN HAWAI‘I

1900-2024

EARTHQUAKES - 0

VOLCANOES - 2

HURRICANES / TS
Direct - 20
Indirect - 6

TSUNAMIS - 293

WILDFIRE - 102

HAZARD MITIGATION PLAN 2023

Table F-89. 2023 State and County Hazard Ranking Summary

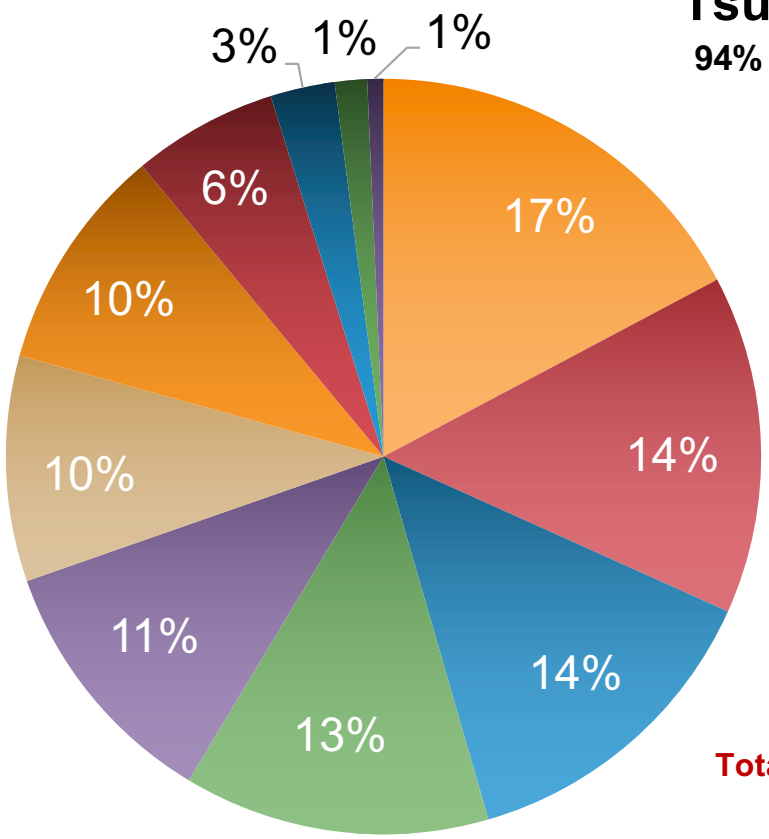
Hazard	Statewide	County of Kaua‘i	City and County of Honolulu	County of Maui	County of Hawai‘i
Climate Change and Sea Level Rise	High	High	High	High	High
Cyber Threat	Medium	Medium	Medium	Medium	Medium
Drought	Medium	Medium	Medium	Medium	Medium
Earthquake	High	Medium	High	High	High
Flood	Medium	Medium	High	High	Medium
Hazardous Materials	Low	Low	Low	Low	Low
Health Risks	High	High	High	High	High
Hurricane	High	High	High	High	High
Infrastructure Failure	Low	Low	Low	Medium	Low
Landslide and Rockfall	Medium	Medium	Medium	Medium	High
Terrorism	Low	Low	Low	Low	Low
Tsunami	High	High	High	High	High
Volcanic Hazards	Medium	Low	Low	Medium	High
Wildfire	Medium	High	High	High	High
Windstorm	Medium	Medium	Medium	Medium	Medium

Risk Factor Scores - High: > 4.0; Medium: 3.0 to 4.0; Low < 3.0

Hilo, April 1946

Hilo, May 1960

HAWAI‘I: Observed Tsunamis



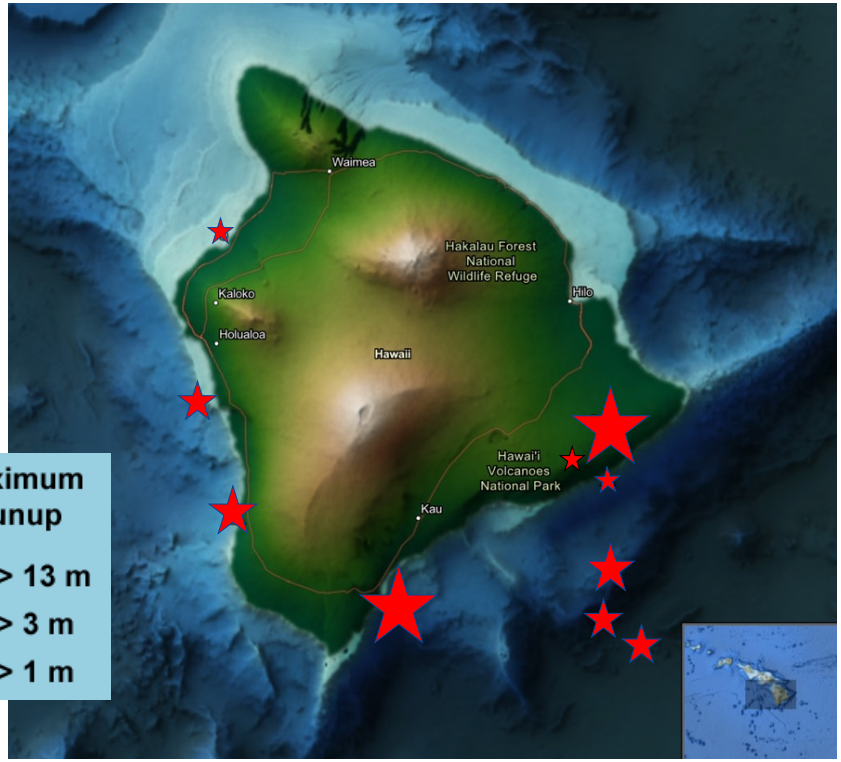
Tsunamis Observed in Statewide (1812-2025)

94% Distant, 6% Local

25	South America
21	Kamchatka and Kuril Islands
19	North (6) and Central America (14)
16	Alaska
14	Fiji, Samoa, Tonga, New Zealand
14	New Caledonia, New Guinea, Solomons, Vanuatu
20	Japan
9	Hawai'i
3	Philippines, Mariana Islands
2	Indonesia (Indian Ocean)
1	Southwest Atlantic Ocean

Total Nbr 145

HAWAIʻI: Dangerous Local Tsunamis



Confirmed Locally Generated Tsunamis in the Hawaiian Islands				
Yr	**Mo**	**Day**	**Ms**	**Runups or Tide Gauge Readings**
1868	04	03	7.5	45 ft (13.7 m) Keauhou Landing; 2 ft (0.6 m) Honolulu; observed Lahaina; many other runups on the Big Island.
1908	09	21	6.8	4 ft (1.2 m) Hilo; no other observations.
1919	10	02	--	14 ft (4.3 m) Hoopuloa; 8 ft (2.4 m) Keauhou; 3 ft (0.9 m) Kailua-Kona; no other observations.
1951	08	21	6.9	4 ft (1.2 m) Hookena; 3 ft (0.9 m) Kailua-Kona, Napoopoo, Milolii; < 0.1 m Hilo, Honolulu, Port Allen.
1952	03	17	4.5	10 ft (3.0 m) Kalapana; no other observations.
1975	11	29	7.2	47 ft (14.3 m) Keauhou Landing; 1 ft (0.4 m) Kahului; 0.1 m Nawiliwili; < 0.1 m Coconut Island on Oahu, Honolulu; observed Lahaina, Hana; many other runups on the Big Island.
1989	06	26	6.5	1 ft (0.29 m) Honuapo, 0.3 ft (0.1 m) Kapoho, Hilo
2006	10	15	6.7	0.3 ft (0.1 m) Kawaihae
2018	05	04	6.9	2 ft (0.4 m) Kapoho, 0.5 ft (0.15 m) Honuapo, Kawaihae, Kahalui

Sources: Lander and Lockridge (1989). All available data are given unless otherwise indicated. Maui sites are Lahaina, Kahului, and Hana. Kauai sites are Port Allen and Nawiliwili (Issues related to local tsunamis in Hawai'i, D.A. Walker, Science of Tsunami Hazards, Vol 17, No. 2 (1999), p. 77); 1989, 2006, 2018 data from Global Historical Tsunami Database, NOAA NCEI, Mar 2025

- ***1868 M7.9 Kaʻu, Largest EQ, 47 deaths, 45-ft runup***
- ***1975 M7.2 Kalapana, 2 deaths, ground dropped 12 ft, 47-ft runup***

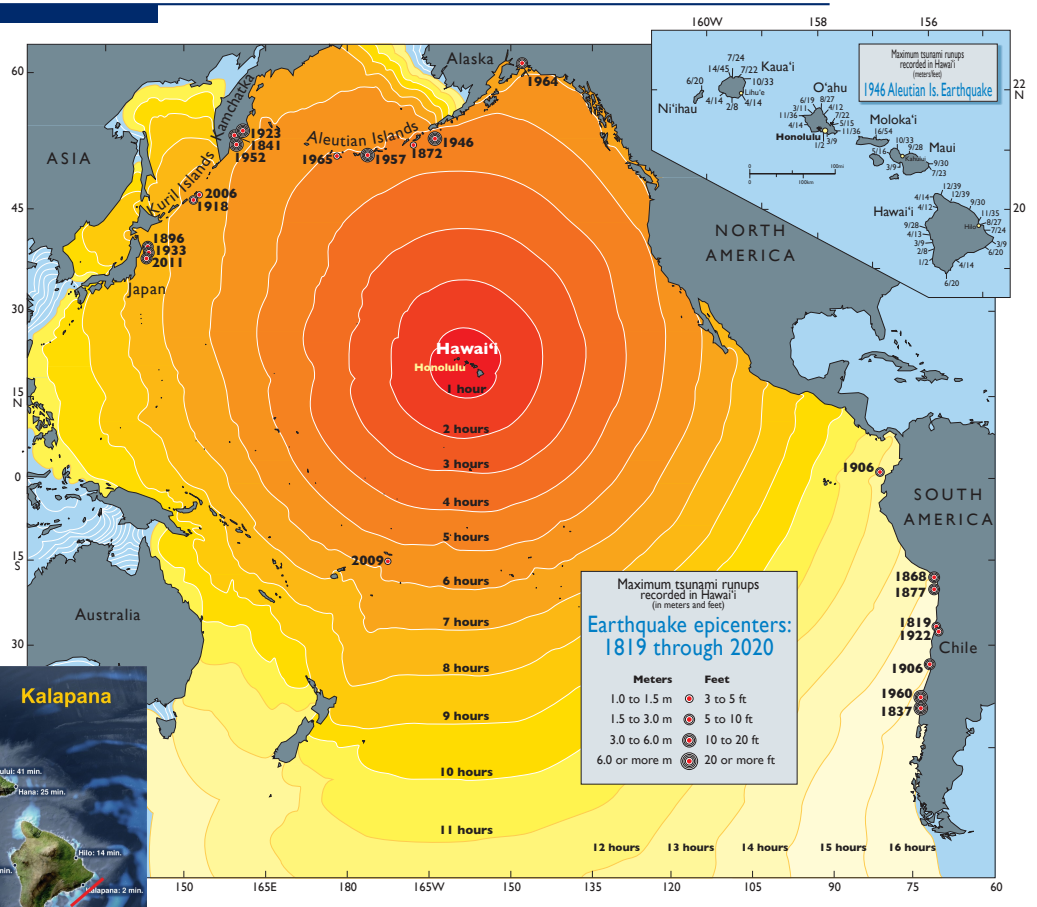
HAWAI‘I DANGEROUS TSUNAMIS

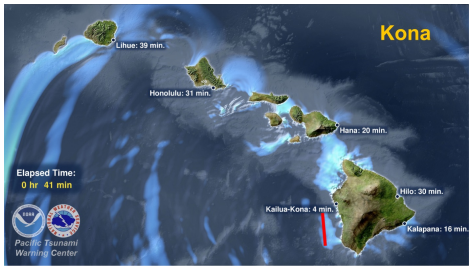
Tsunami runups > 1 m (3.3 ft)

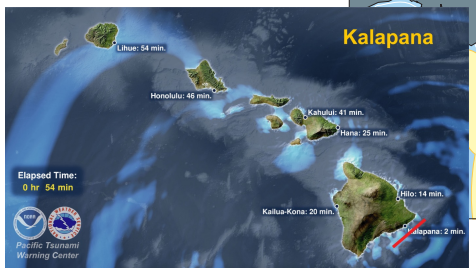
- PTWC Advisory
  strong currents or dangerous waves to those in or very near water

Tsunami Travel Time

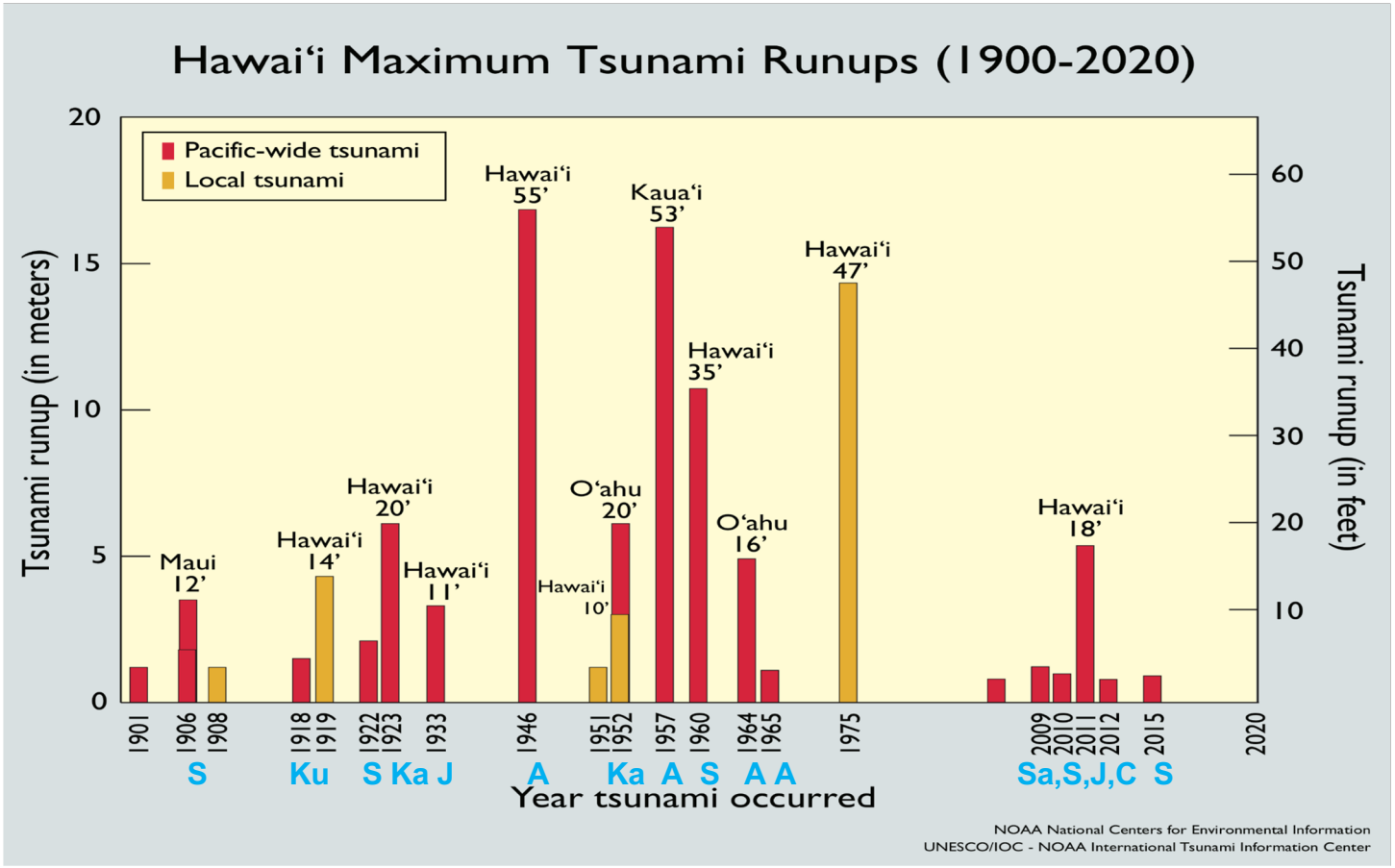
- Aleutians, 4.5 hrs
- Kamchatka, Kurils, 7 hrs
- Chile, 14-15 hrs
- Hawaii, minutes – 1 hr







How big are the waves?

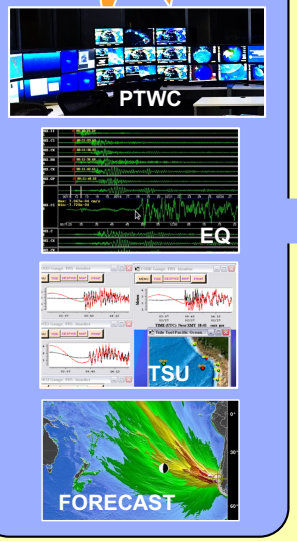


Source Location

- **S**outh America
- **Ku**rils
- **Ka**mchatka
- **J**apan
- **A**leutians
- **Sa**moa
- **C**anada

Tsunami Warning chain

EQ
Tsunami



TWC - Science

Intl / Natl

Hawaii Alert System

Emergency Alert System & Mass Media

EMA – Response, Safety

Natl / State / Local Govt

Public

Community

ITIC

Race against Time

LIVES SAVED

Tsunami Warning System
3 Main Components

- **The Tsunami Warning Centers**

⇒ Detect Earthquakes. Evaluate tsunami potential.

⇒ Look for sea-level changes. Issue message products.

- **Emergency Management System**

⇒ Develop evacuation plan, communication system.

⇒ Receive warning center message products.

⇒ Take action for public safety

- **Educate Citizenry in Hazard Risk Areas**

⇒ Public should know what to do in tsunami emergency.

⇒ Public should move quickly inland in if strong ground shaking or ocean draw-down.

PTWC, ITIC, HAWAII
EXAMPLE OF END-TO-END SYSTEM

- **HAZARD ASSESSMENTS** DONE 1970's and UPDATED
- **EVACUATION ZONES** in TELEPHONE BOOKS (1990); on Emergency Management WEBSITES.
- PUBLIC **EDUCATION PROGRAMS** - ANNUAL "TSUNAMI AWARENESS MONTH" since 1990s
- STATE AND COUNTIES RECEIVE PTWC BULLETINS BY **MULTIPLE MEANS**
- PUBLIC BY **MULTIPLE MEANS**: SIRENS, RADIO, TELEVISION, AIRPLANES

PTWC, ITIC, HAWAII
EXAMPLE OF END-TO-END SYSTEM

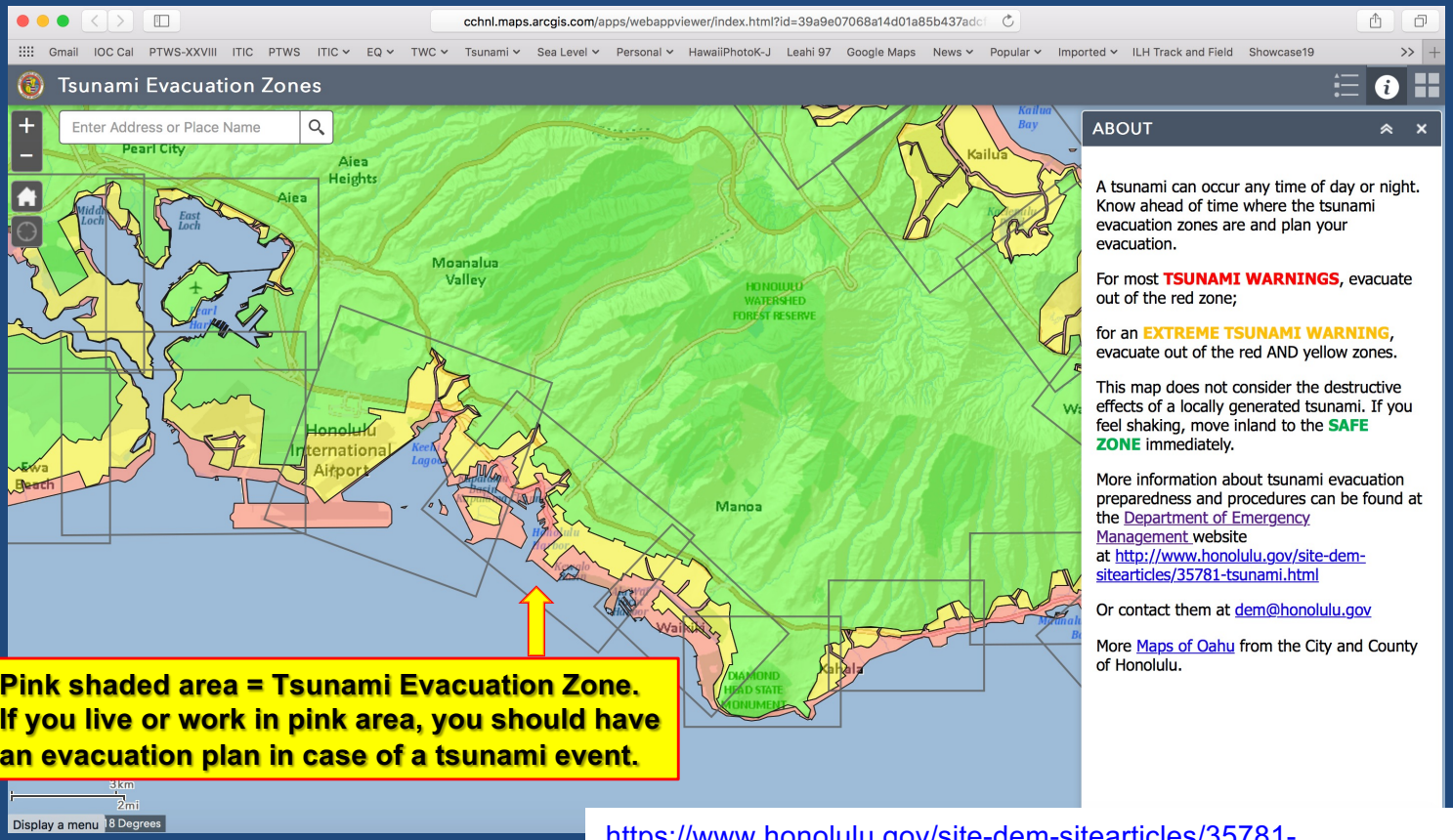
- GOVT CONDUCT SEMI-ANNUAL TSUNAMI EXERCISES
- PRE-ESTABLISHED PROCEDURES (SOPS) FOR TSUNAMI EVACUATION AND RESPONSE WITH POLICE, FIRE, AND OTHER DEPARTMENTS
- STAKEHOLDERS MEETINGS – STATE HAWAII EARTHQUAKE AND TSUNAMI ADVISORY COMMITTEE INCLUDES PTWC, ITIC, EMERGENCY MANAGERS / RESPONDERS, SCIENTISTS
- STATE OF HAWAII / COUNTIES - TSUNAMI ADVISOR EXPERTS (STATE – LAURA KONG, OAHU – DAN WALKER)

PTWC MISSION

- **US HAWAII STATE CENTER - PROVIDE WARNINGS TO HAWAII FOR LOCAL & REGIONAL TSUNAMIS GENERATED IN HAWAIIAN WATERS**
- **US TERRITORY CENTER - PROVIDE WARNINGS TO ALL US INTERESTS IN THE PACIFIC AND CARIBBEAN OUTSIDE THE WC/ATWC AOR FOR REGIONAL & DISTANT TSUNAMIS**
- **INTERNATIONAL CENTER - PROVIDE TSUNAMI THREAT INFORMATION (NO WARNING) TO ALL COUNTRIES IN THE PACIFIC AND CARIBBEAN FOR REGIONAL & DISTANT TSUNAMIS**

Tsunami Evacuation Zone Tools

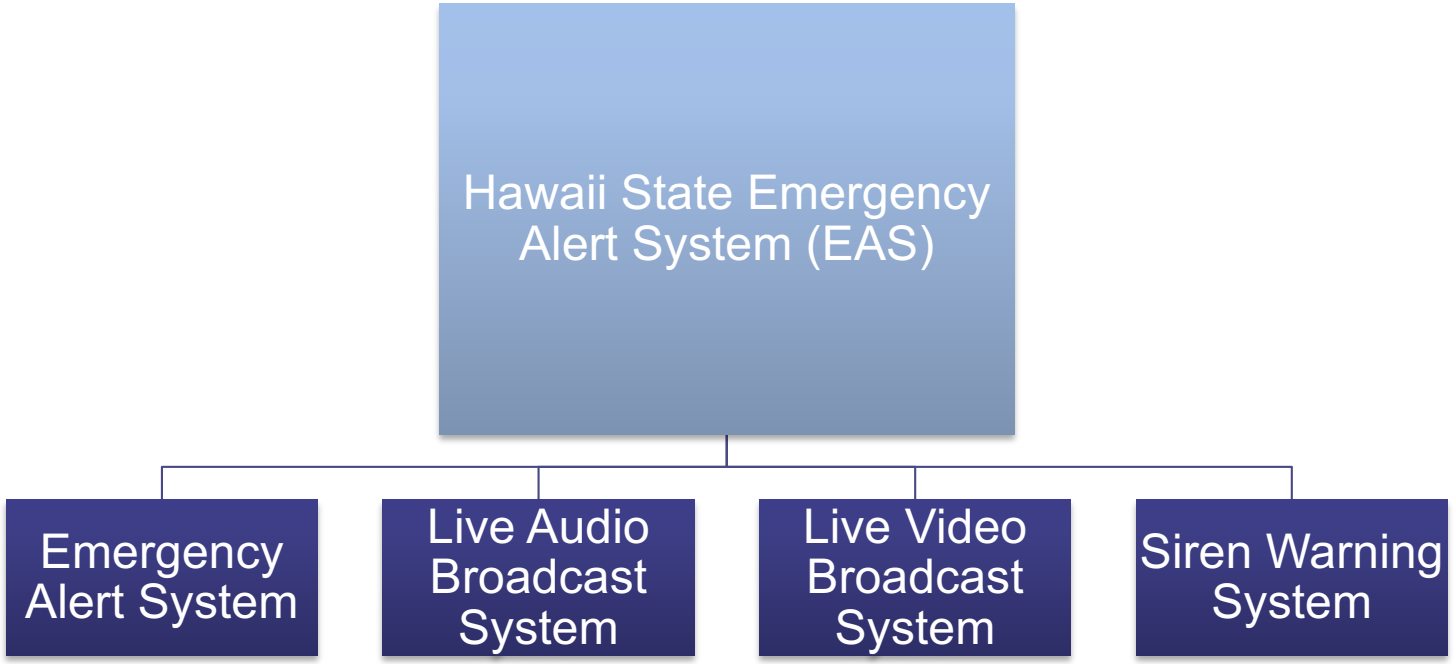
Where am I ? Online GIS tool



http://cchnl.maps.arcgis.com/apps/w

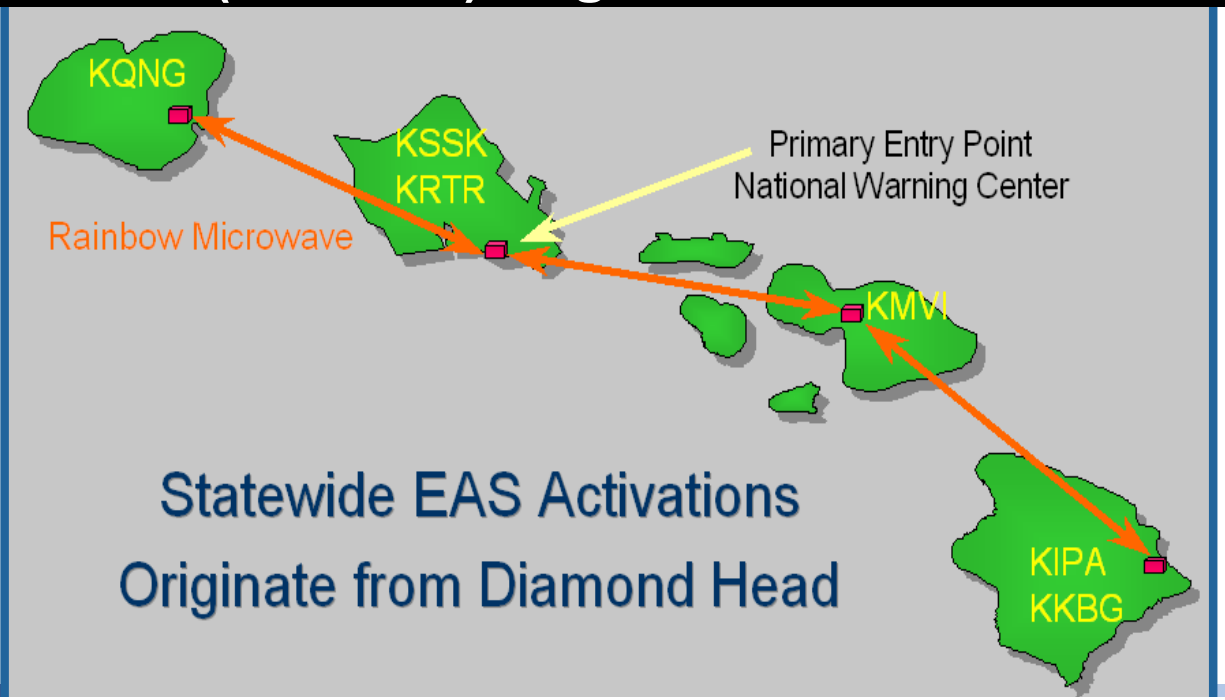
https://www.honolulu.gov/site-dem-sitearticles/35781-tsunami.html

Hawaii EAS


Hawaii State Emergency Alert System (EAS)
Emergency Alert System
Live Audio Broadcast System
Live Video Broadcast System
Siren Warning System

Emergency Alert System (EAS)

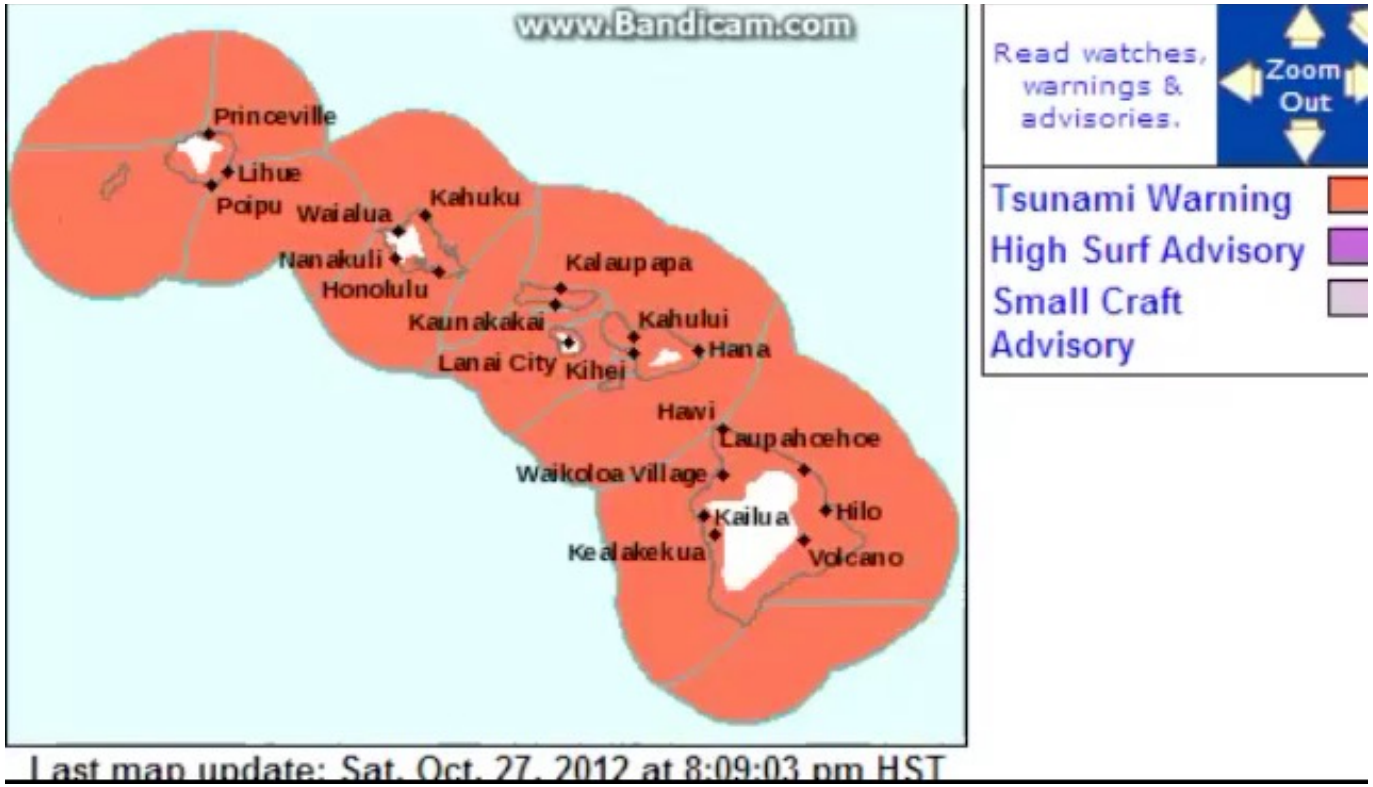
- SCD EOC coordinates 1st Siren sounding, initiates public message,
- Transmits immediately by dedicated microwave link
- Designated radio stations - neighbor islands
- TV broadcasts (crawlers) originate from Honolulu



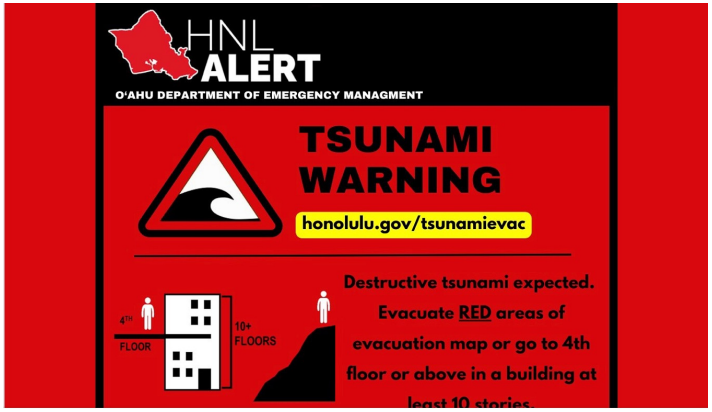
Monthly Siren Test

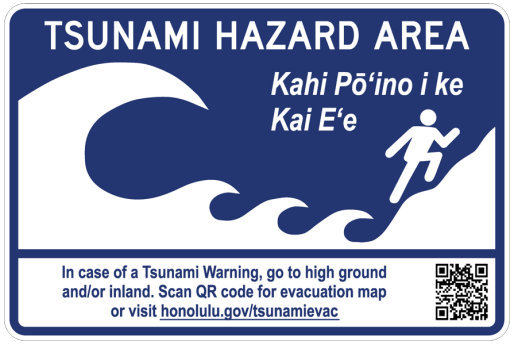
Monthly Radio Test

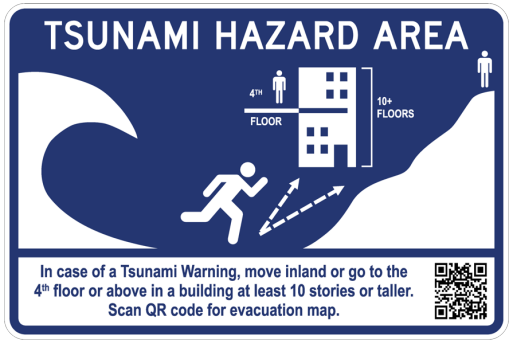
NWS EAS BROADCAST – RADIO / TV

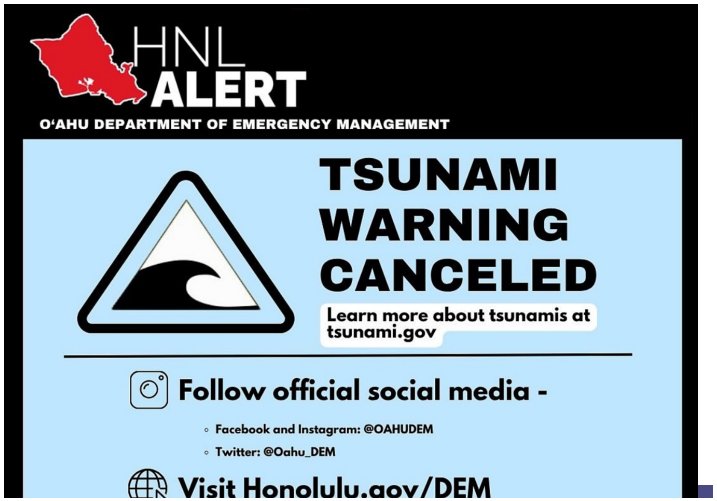


Alerting (all-hazards), What to do if tsunami?









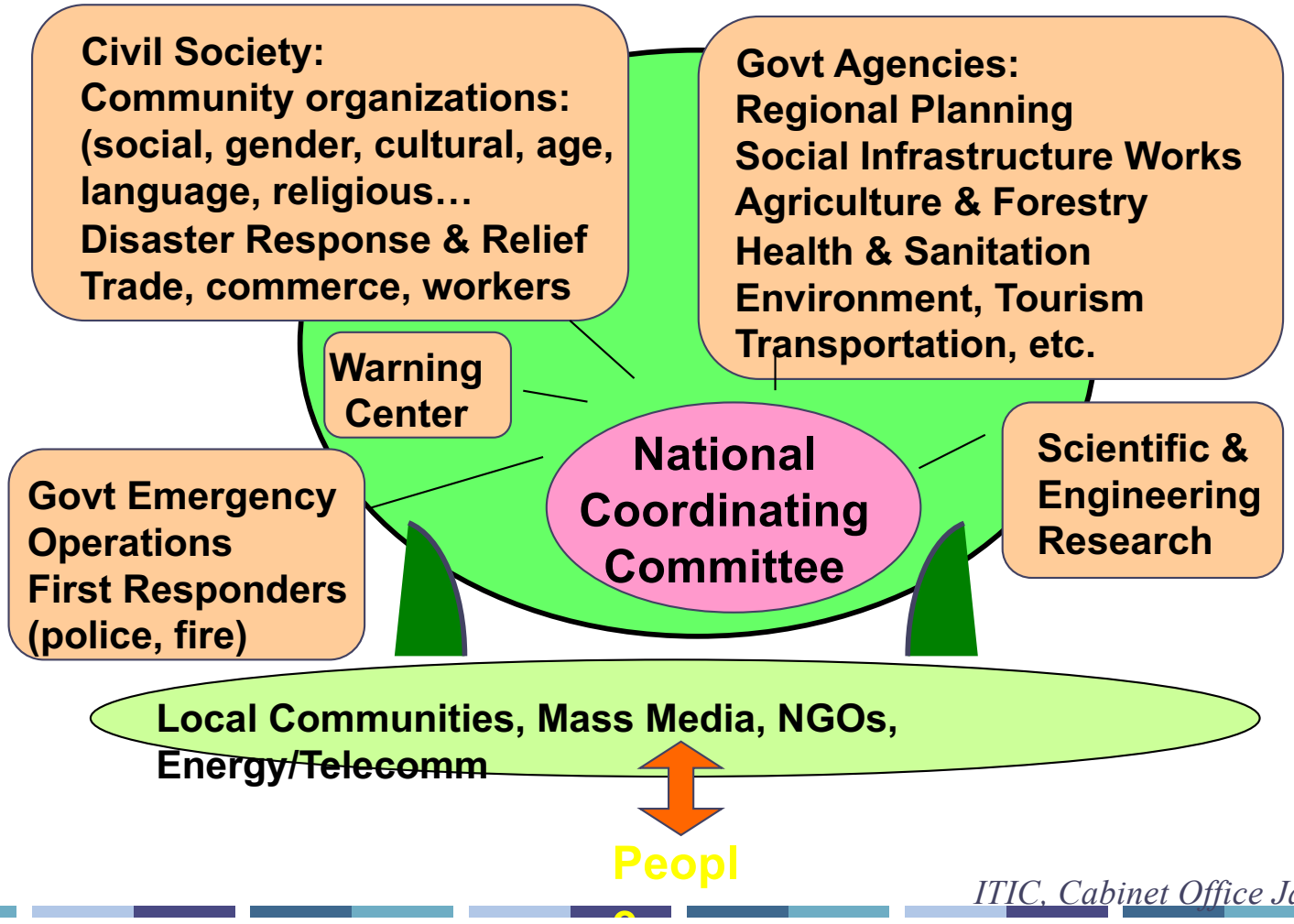
Local Tsunami Warning & Evacuation

- PTWC issues an urgent tsunami warning for local earthquakes magnitude 6.9 or greater.
- County Warning Points sound sirens in designated Counties (e.g. Hawaii and Maui Counties).
- National Weather Service broadcasts warning and evacuation through the EAS.
- EOC activate and prepare for disaster response operations.

Distant Tsunami Warning & Evacuation

- PTWC issues Tsunami Watch and Warning Bulletins to the State of Hawaii for distant earthquakes magnitude 7.9 or greater.
- Emergency Operation Centers (EOC) activate and alert emergency response agencies.
- EOC coordinate siren sounding statewide at least 3 hours before 1st wave arrival in conjunction with radio and television Emergency Alert System (EAS) broadcasts.
- EOC coordinate school closures and release of government workforce within tsunami evacuation zones.
- EOC prepare for disaster response operations.

STAKEHOLDER COORDINATION



HI-EMA HAWAII EARTHQUAKE AND TSUNAMI ADVISORY COMMITTEE (HETAC)

- ***Reduce risk of tsunamis* to State of Hawaii**
  Founded 1998, meets 4x/year
- ***Scientists, engineers, planners, Emergency managers, public affairs personnel***

Members elected on own expertise and meris

Can be from:

US Federal Agencies (NOAA, USGS)

State and Local Agencies

University of Hawaii

Privat Sector (Engineering)

HAWAII HETAC

- ***Activities***

  Hazard ID, Risk Assessment, Warning Guidance, Awareness and Mitigation

- ***Recent TTRC Agenda Topics***
  - **Tsunami Annex to the Hawaii Emergency Operations Plan (HI-EOP)**
  - **Post and Pier Retrofits on the Big Island**
  - **USGS earthquake info products for Hawaii/ Kilauea Volcano eruption**
  - **US National Tsunami Data Protocol**
  - **Hawaii high-resolution probabilistic tsunami design zone (TDZ) mapping**
  - **HAZUS - standardized tools and data for estimating risk from earthquakes, floods, tsunamis, and hurricane**
  - **Homeowner's Handbook 4th edition – communication plan**
  - ***Teacher preparedness video***

unesco
Intergovernmental Oceanographic Commission

Thank You

Mahalo

Pacific Community
Communauté du Pacifique