



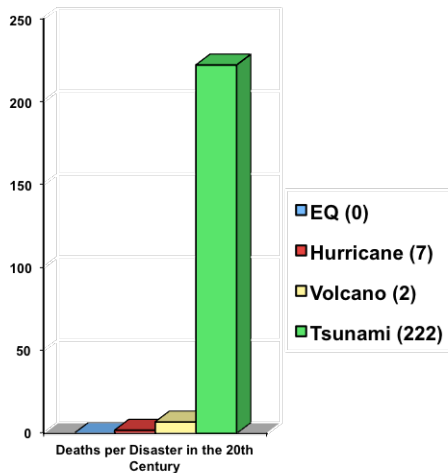
UNESCO/IOC – NOAA ITIC Training Program in Hawaii (ITP-Hawaii)
TSUNAMI EARLY WARNING SYSTEMS
AND THE PACIFIC TSUNAMI WARNING CENTER (PTWC) ENHANCED PRODUCTS
TSUNAMI EVACUATION PLANNING AND UNESCO IOC TSUNAMI READY PROGRAMME
7-18 August 2023, Honolulu, Hawaii USA

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

Dr. Laura Kong
Director, ITIC



Major Natural Disaster Fatalities in Hawaii during the 20th Century



ESTIMATED FATALITIES IN HAWAI'I

1900-2022

EARTHQUAKES - 0

VOLCANOES - 2

HURRICANES / TS

Direct - 20

Indirect - 6

TSUNAMIS - 293

Distant Tsunamis

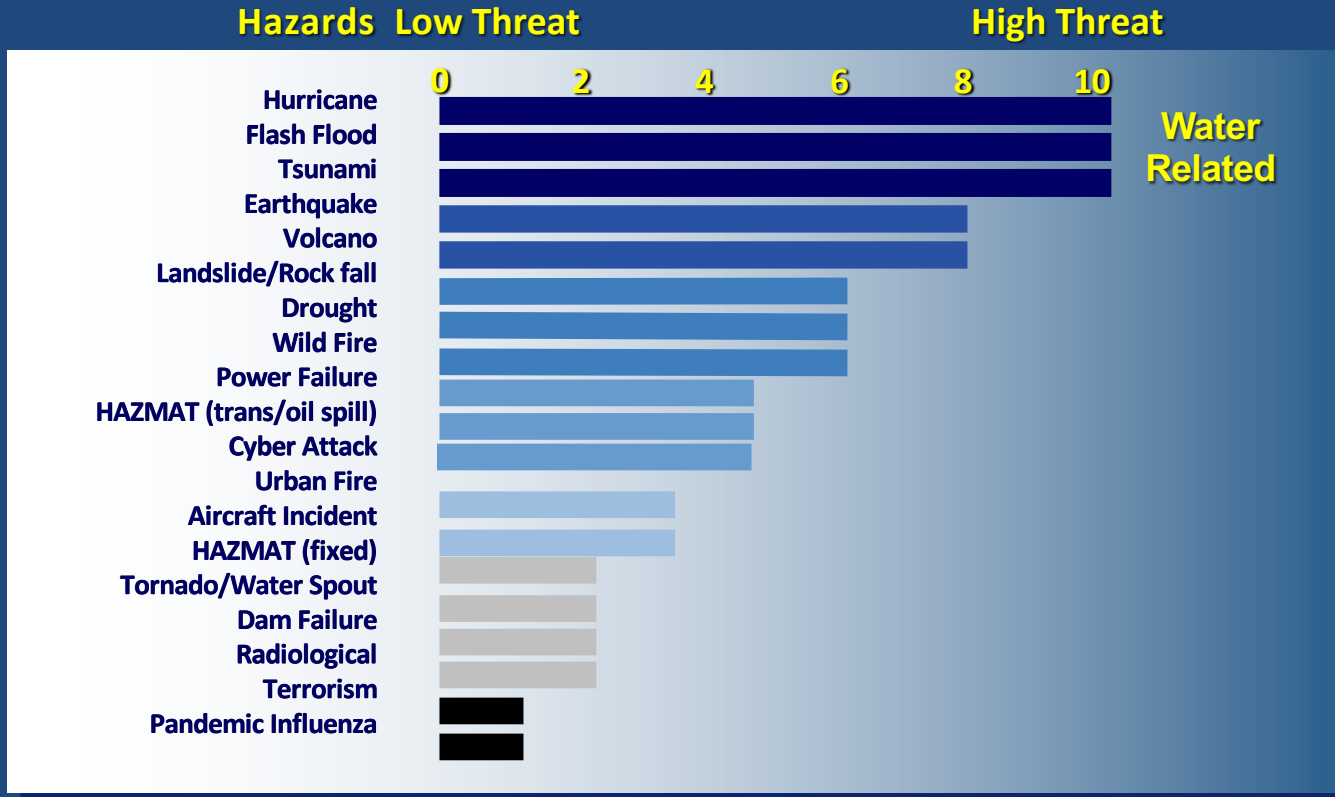
- 25 tsunamis > 1 m (3.3 ft)
- 244 deaths, \$618 M dmg

Local Tsunamis

- 7 tsunamis > 1 m (3.3 ft)
- 49 deaths

Hawaii's Hazard Profile

Threat ranking incl likelihood /effect of population & property



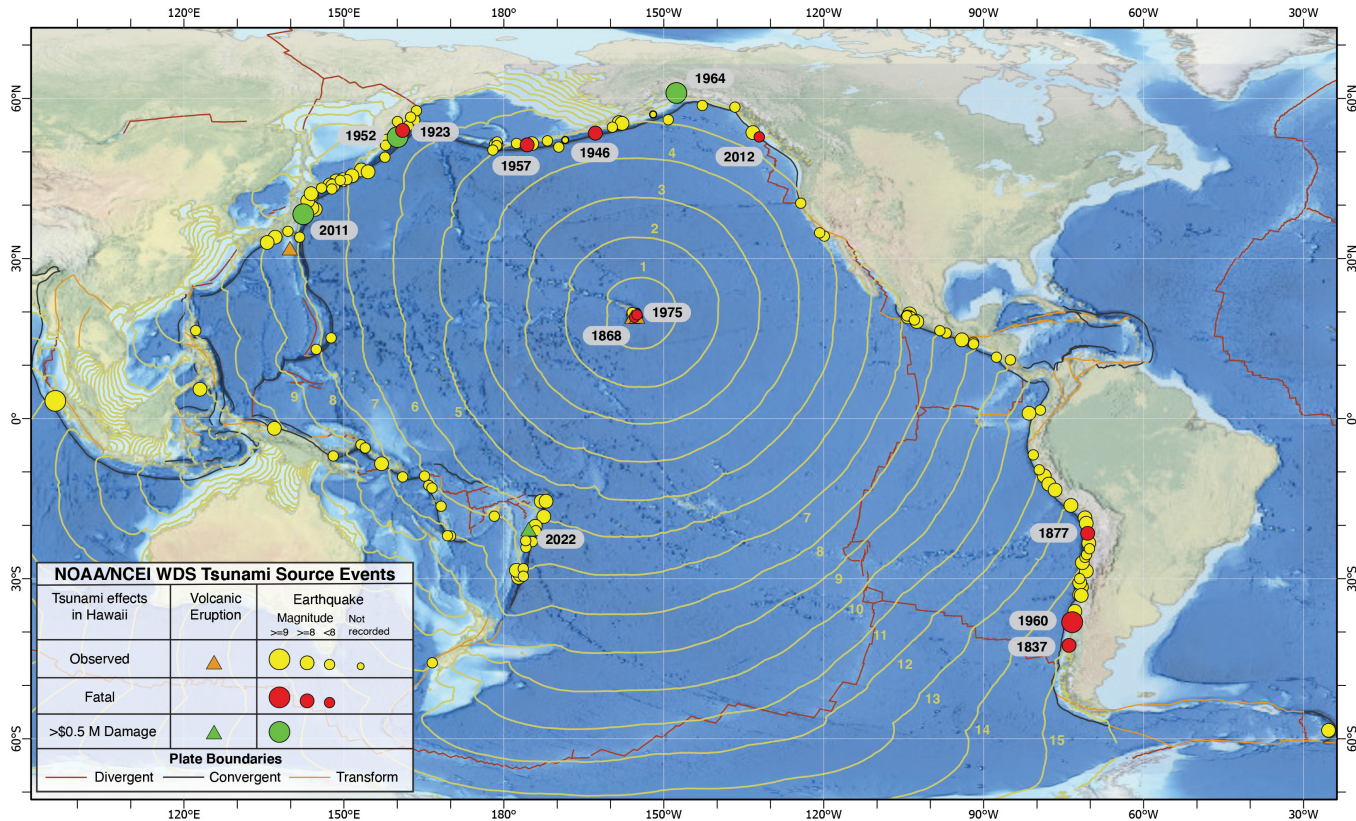
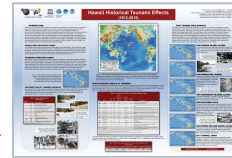
Hilo, April 1946



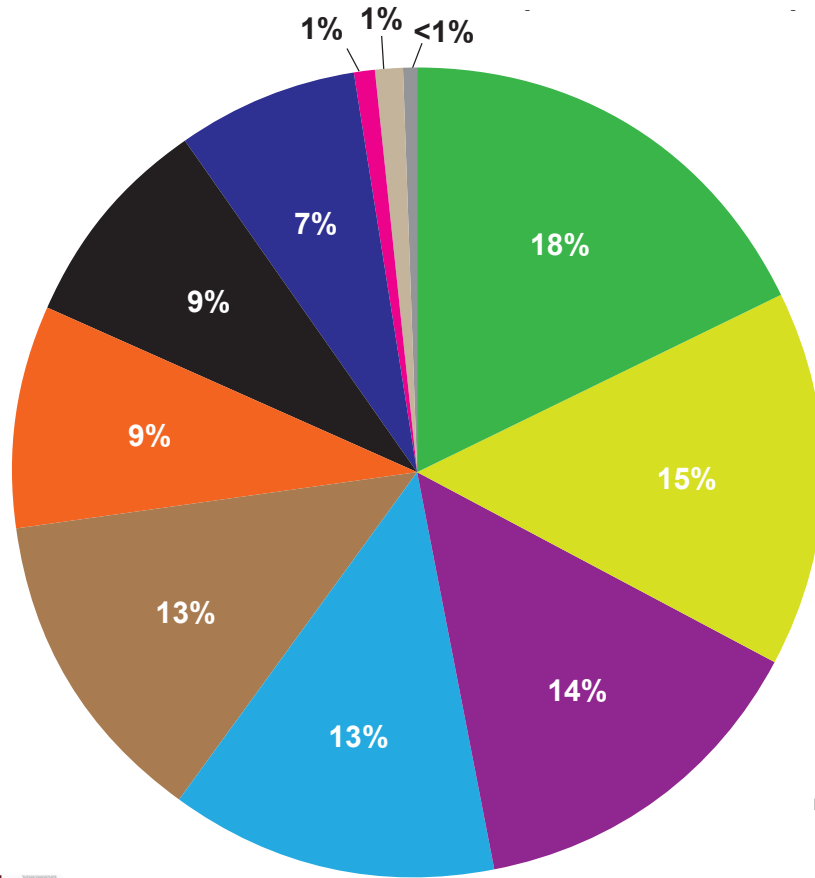
Hilo, May 1960



HAWAI'I TSUNAMIS, 1821-2022



Confirmed Tsunamis (1812-2022) - State of Hawai'i



- South America
- Kamchatka & Kuril Islands
- Alaska
- North & Central America
- New Zealand & South Pacific Islands
- Japan
- New Caledonia, Papua New Guinea, Solomon Islands, Vanuatu
- Hawai'i
- Philippines
- Indonesia
- Southwest Atlantic

Volcanic		
Eruption	Earthquake	Source Region
1%	91%	Total Pacific Ocean (Remote)
1%	6%	Hawai'i
	<1%	Total Atlantic Ocean (Sandwich Islands)
	<1%	Total Indian Ocean (East Indonesia)

¹ Confirmed (event validity ≥3) tsunamis



HAWAI'I DANGEROUS TSUNAMIS

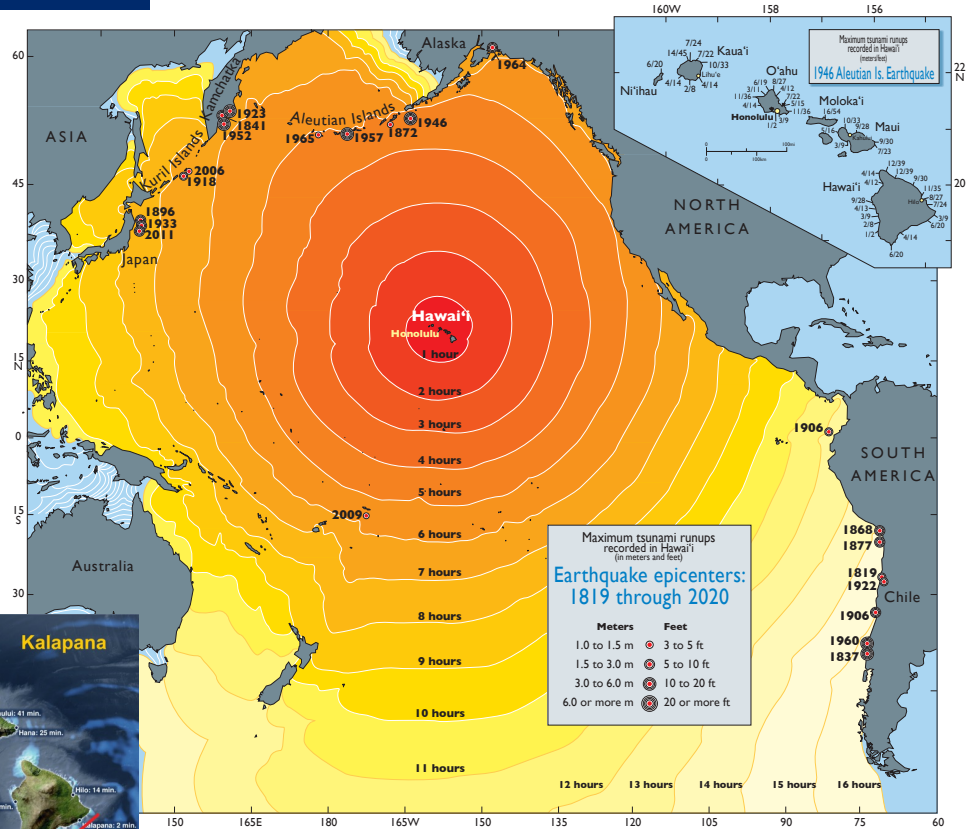


Tsunami runups > 1 m (3.3 ft)

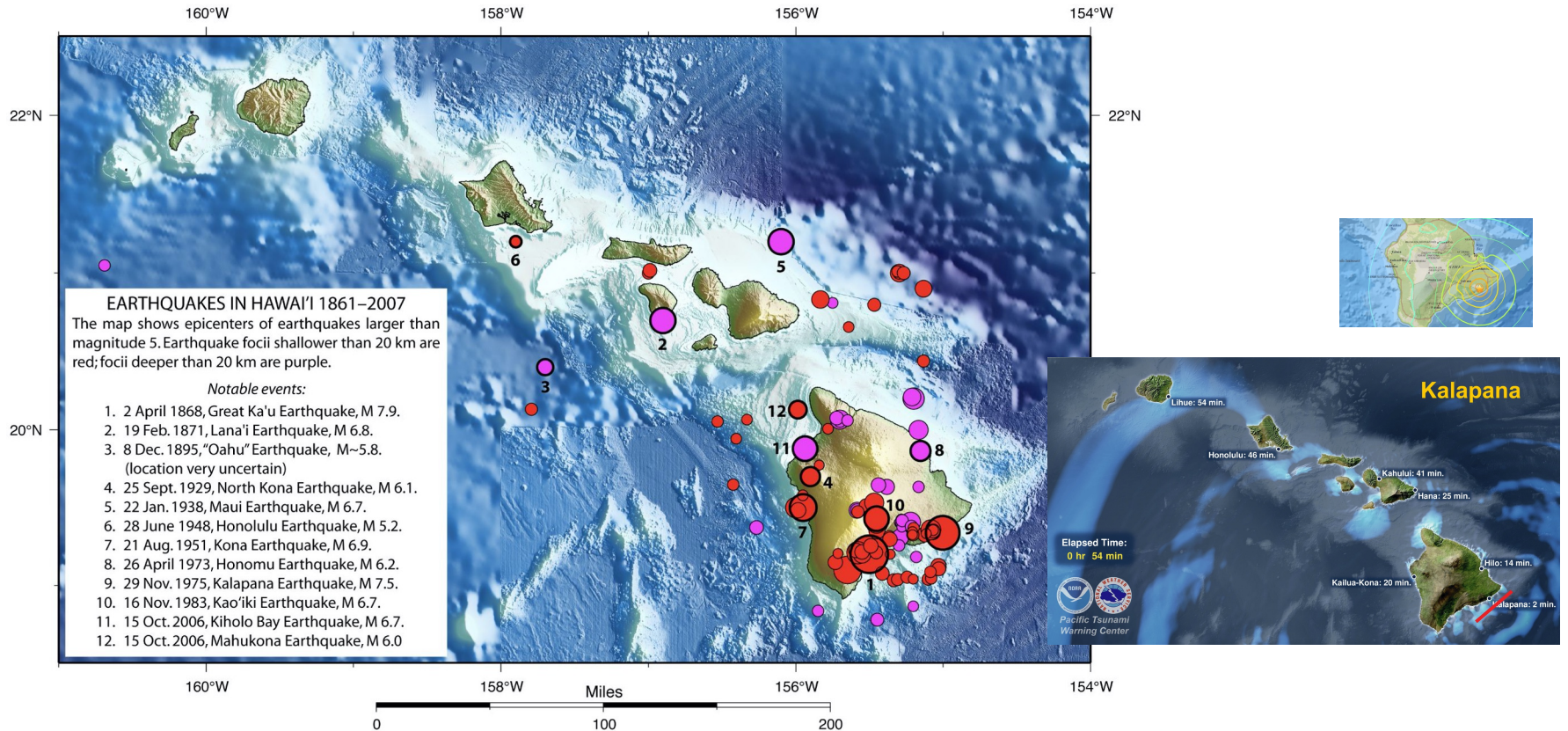
- PTWC Advisory *strong currents or dangerous waves to those in or very near water*

Tsunami Travel Time

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



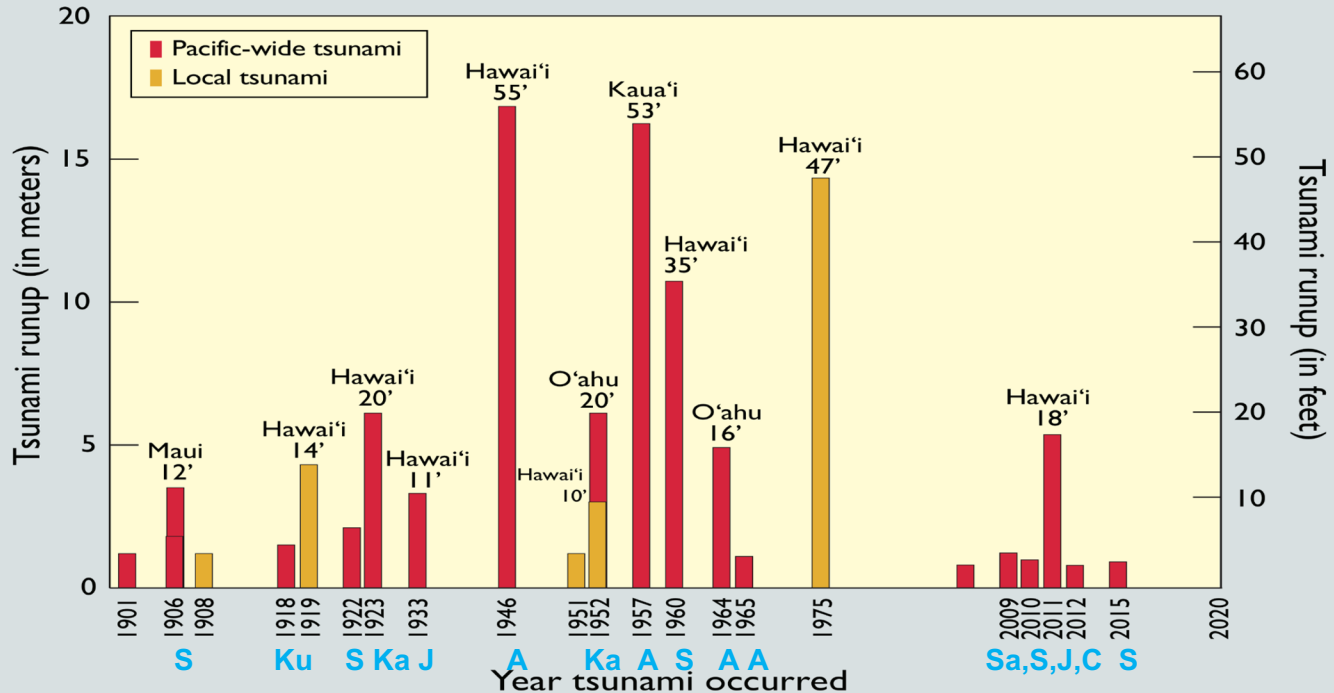
EARTHQUAKES and TSUNAMIS - HAWAI'I



How big are the waves?



Hawai'i Maximum Tsunami Runups (1900-2020)

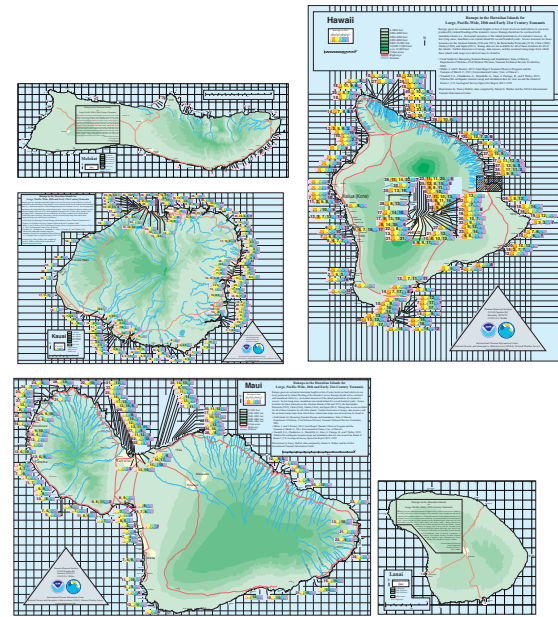
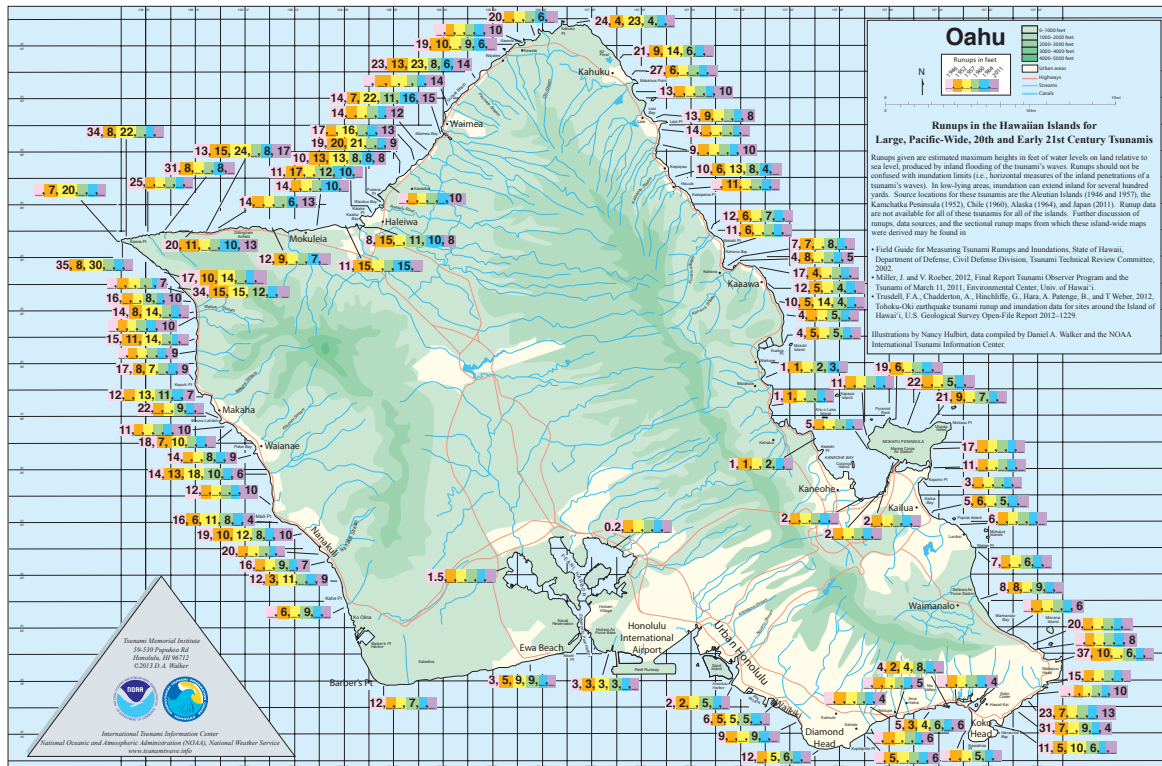


- Source
- Location
- [South America](#)
- [Kurils](#)
- [Kamchatka](#)
- [Japan](#)
- [Aleutians](#)
- [Samoa](#)
- [Canada](#)

Observed Tsunami Runups



- 1946, 1952, 1957, 1960, 1964, 2011 tsunamis



Resources - ITIC

❑ 1-Stop web site for Hawai'i

<http://hawaiiitsunami.org>

<http://hawaiiitsunamikids.org>

Information (sources, travel times, evacuation, runups, safety and awareness, etc,
Visuals, Links to Hawaii agencies)

❑ Maps and Posters (hard copy)

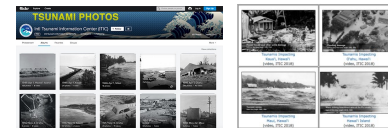
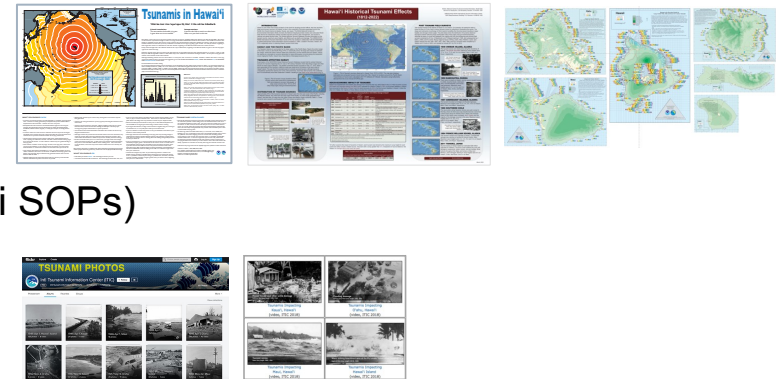
- Tsunamis in Hawaii (2020)
- Historical Tsunami Effects (2015)
- Tsunami Runups (all islands)
- Awareness (comic book, Aleutian source, Hawaii SOPs)

❑ Tsunamis

- Photos, videos (waves)
- By Island, event summaries

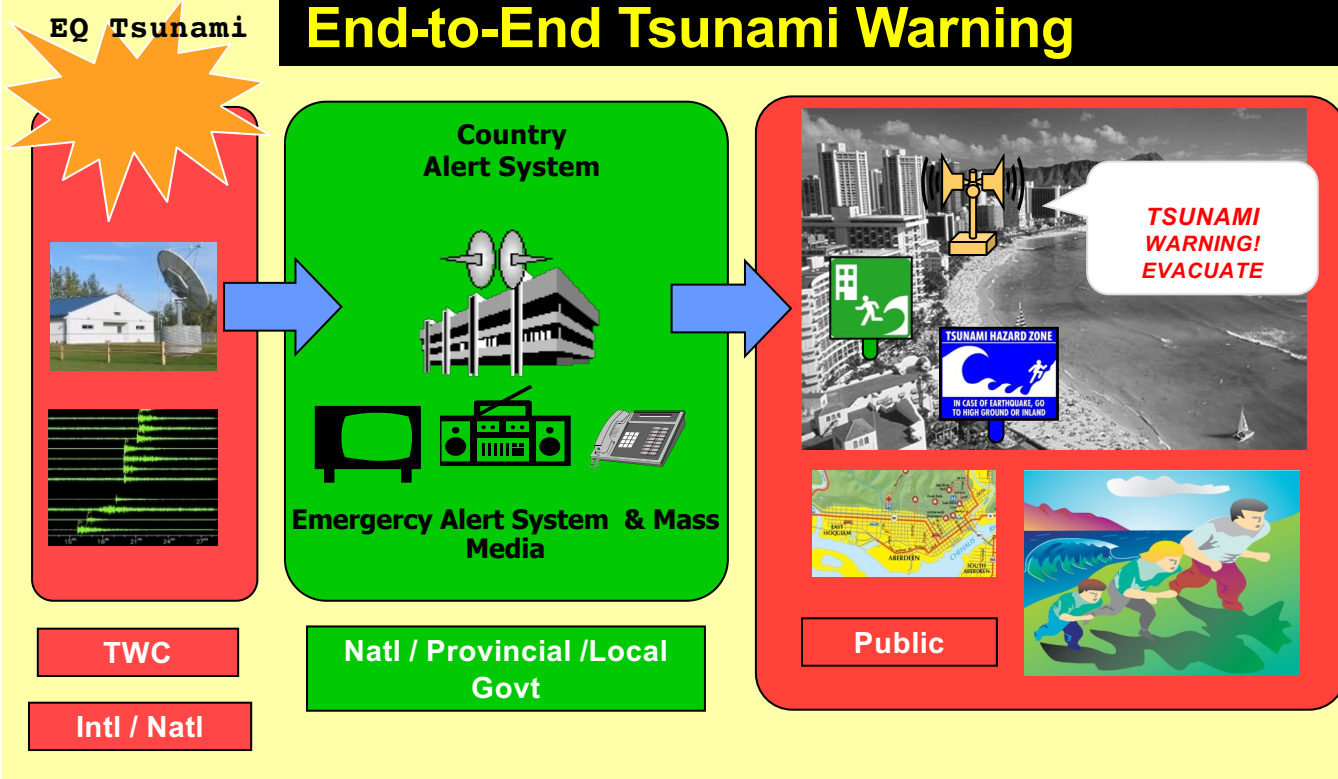
❑ Tsunami Facts tri-fold – safety and awareness (2016, 2018)

- By County, 14 languages



EQ Tsunami

End-to-End Tsunami Warning



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

- **HAWAII REGIONAL CENTER** - PROVIDE WARNINGS TO HAWAII FOR LOCAL & REGIONAL TSUNAMIS GENERATED IN HAWAIIAN WATERS
- **US NATIONAL 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

Enter Address or Place Name

ABOUT

A tsunami can occur any time of day or night. Know ahead of time where the tsunami evacuation zones are and plan your evacuation.

For most **TSUNAMI WARNINGS**, evacuate out of the red zone;

for an **EXTREME TSUNAMI WARNING**, evacuate out of the red AND yellow zones.

This map does not consider the destructive effects of a locally generated tsunami. If you feel shaking, move inland to the **SAFE ZONE** immediately.

More information about tsunami evacuation preparedness and procedures can be found at the [Department of Emergency Management](http://www.honolulu.gov/site-dem-sitearticles/35781-tsunami.html) website at <http://www.honolulu.gov/site-dem-sitearticles/35781-tsunami.html>

Or contact them at dem@honolulu.gov

More [Maps of Oahu](#) from the City and County of Honolulu.

3km
2mi
Display a menu 8 Degrees

Pink shaded area = Tsunami Evacuation Zone. If you live or work in pink area, you should have an evacuation plan in case of a tsunami event.

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

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

Hawaii EAS

Hawaii State Emergency
Alert System (EAS)

Emergency
Alert System

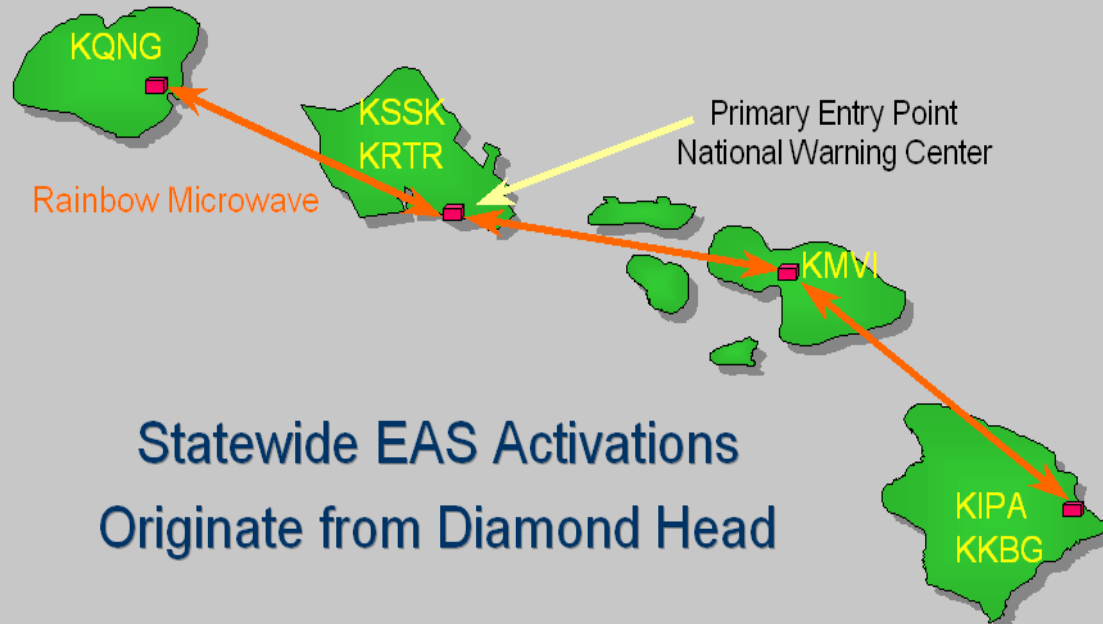
Live Audio
Broadcast
System

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



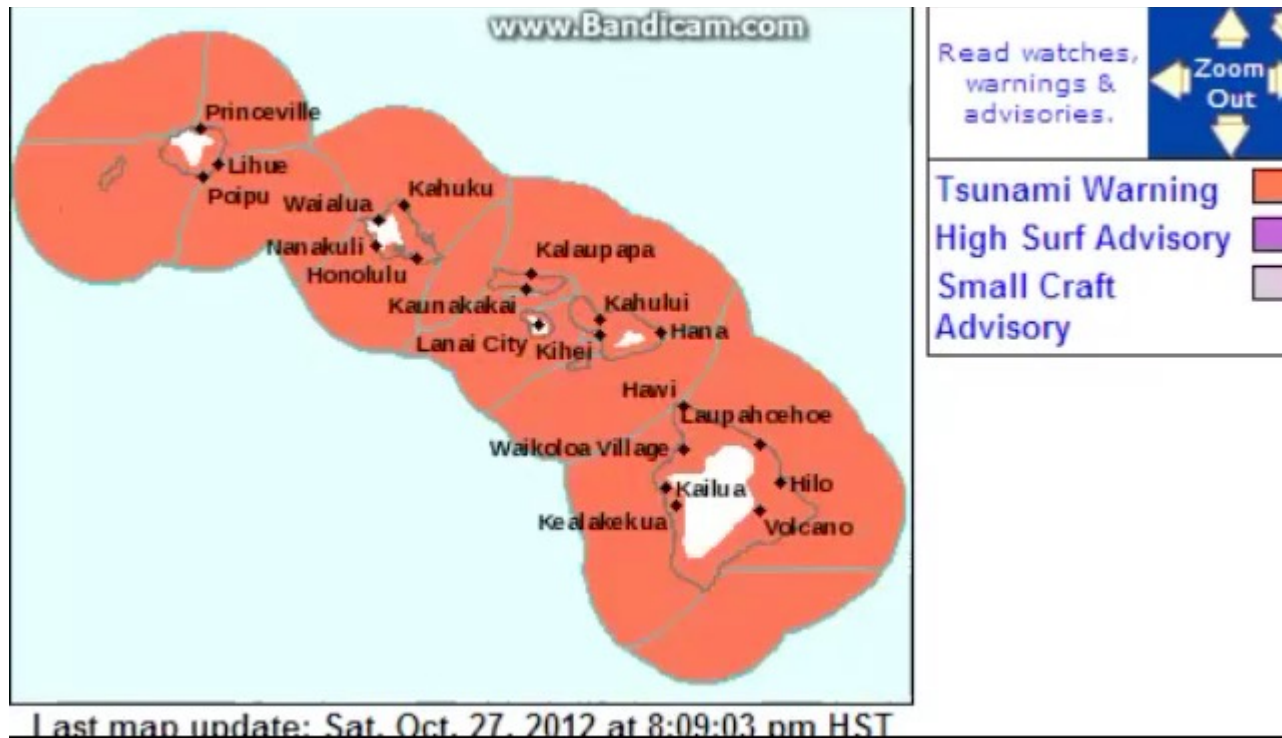
Monthly Siren Test



Monthly Radio Test



NWS EAS BROADCAST – RADIO / TV



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.

Alerting (all-hazards), What to do?

Urgent Traffic Bulletins,
Emergency Information,
Severe Weather Alerts,
City Information and
much more.



HNL.Info **STAY INFORMED**

HNL Info
Stay informed about traffic situations, weather advisories and much more!

Alert Messages
Events Calendar
Driver Licensing & Satellite Locations



DOWNLOAD THE APP TODAY



Message and Data rates may apply. Message frequency depends on account settings.

Paid for by the taxpayers of the City and County of Honolulu.

TSUNAMI WARNING *WHAT YOU MUST KNOW*

ARE YOU IN A TSUNAMI EVACUATION ZONE – YES OR NO?

*REVIEW EVACUATION MAPS IN YOUR PHONE BOOK
or ONLINE AT www.oahuDEM.org*

YES! - YOU ARE AT RISK

Move Inland. Exit the Tsunami
Evacuation Zone **IMMEDIATELY!**

Vertical Evacuation – Proceed to the 3rd floor or
higher in steel and or concrete reinforced buildings
six stories or taller.

NO! - YOU ARE SAFE

**STAY AWAY FROM THE SHORELINE!
EVACUATION IS NOT NECESSARY!**



DEPARTMENT OF EMERGENCY
MANAGEMENT
City and County of Honolulu
650 South King Street • Honolulu, Hawaii 96813
(808) 723-8960 • Fax (808) 524-3439
www.oahuDEM.org
dem@honolulu.gov



ISSUES: MEDIA REPORTS

1986, 1994 Tsunami Warnings

Pacific -wide Tsunami Warnings Issued
Sirens sounded, Statewide evacuations
Small, non-destructive tsunamis

- 1986 - mid-afternoon to pm rush hour
1994 - early morning to am rush hour

Losses

1994 (DBEDT Study) => \$50M

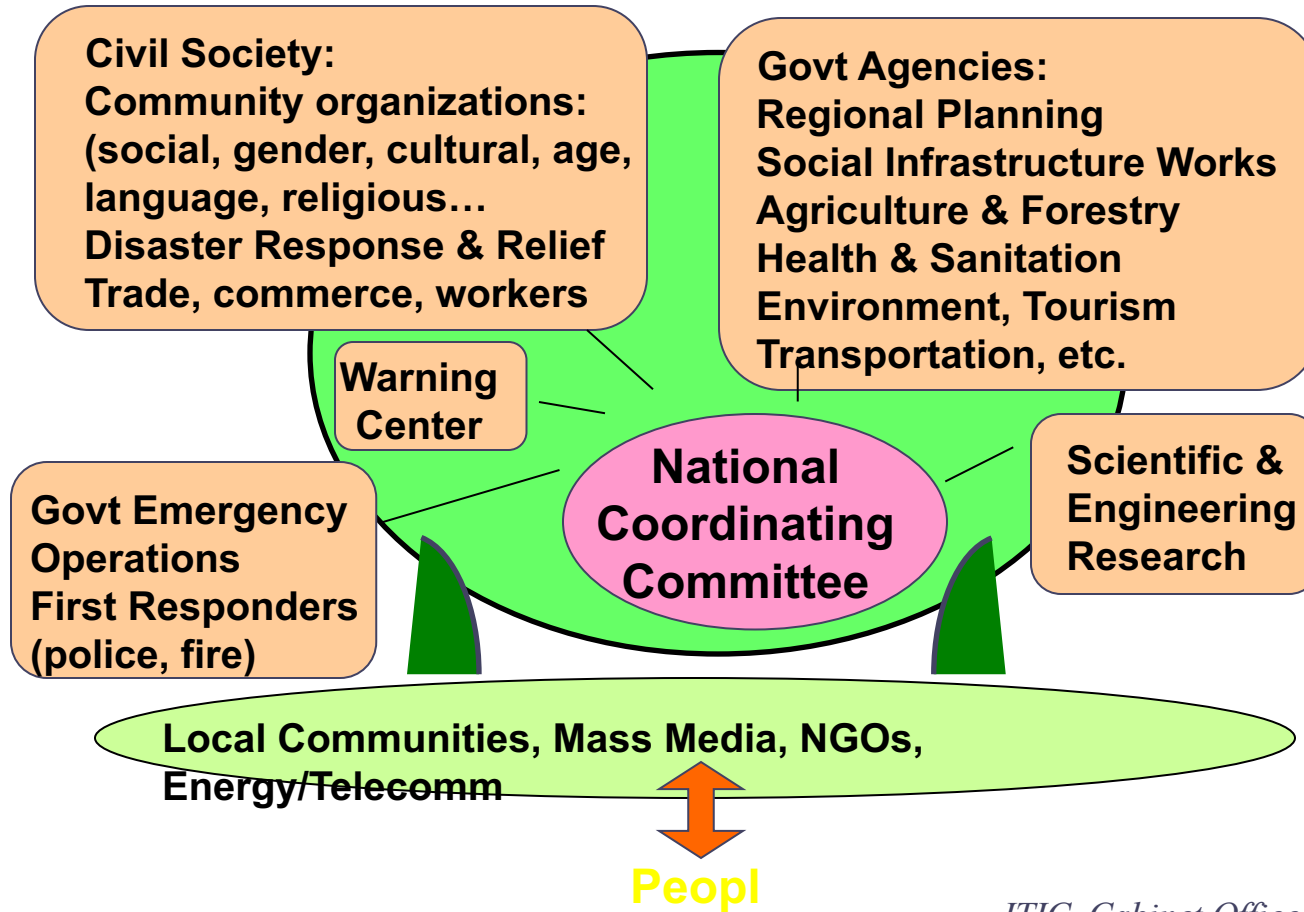
1986 (extrapolated) => \$30M

2003 (extrapolated) => \$68M



- **Media reports shape public opinion**

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 merits
Can be from:

US Federal Agencies (NOAA, USGS)

State and Local Agencies

University of Hawaii

Private Sector (Engineering)

Pacific Disaster Center,
Cross, Pacific Tsunami Museum,



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



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Thank You

Dr. Laura Kong
Director, ITIC

