

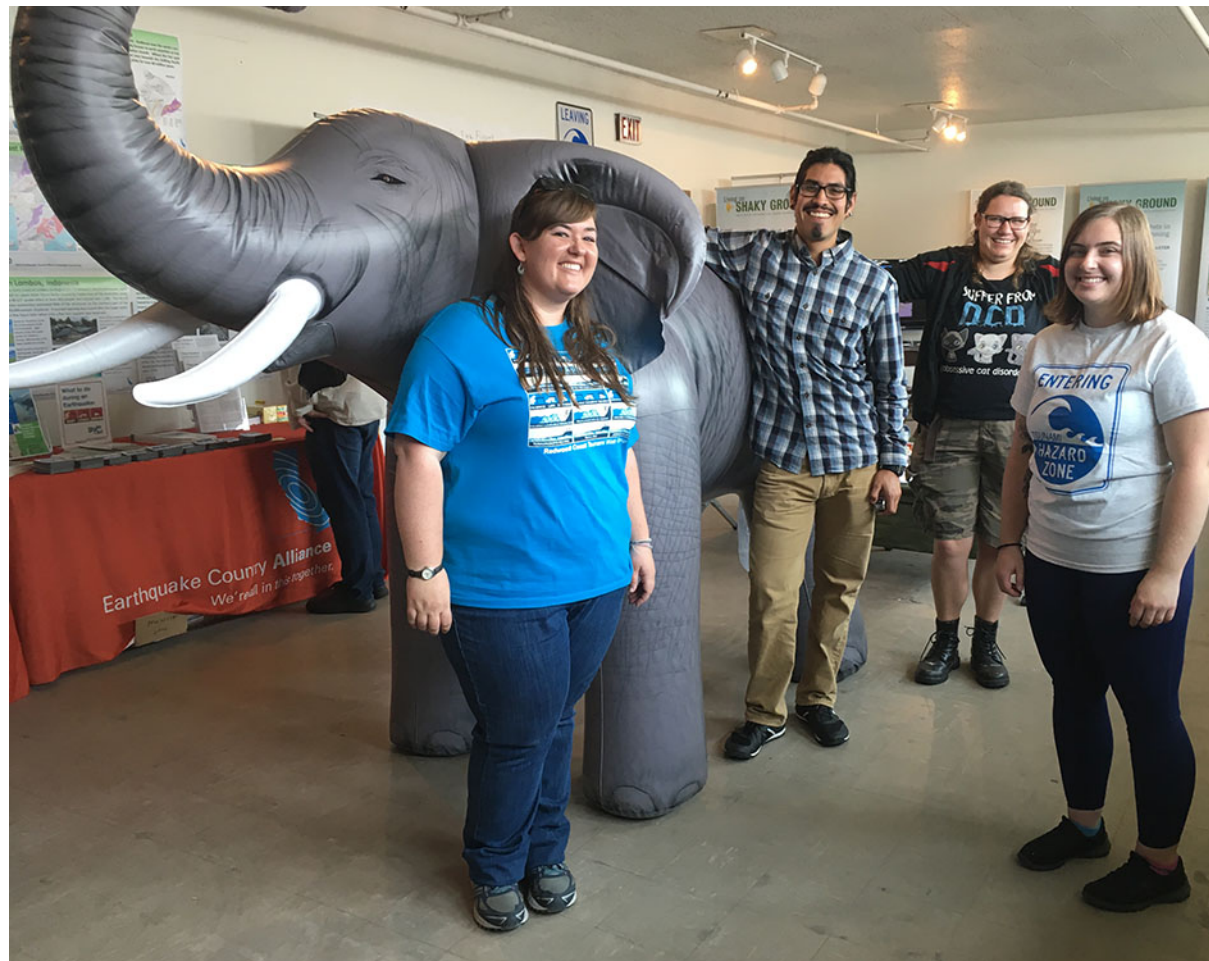
# Enter here Earthquake - Tsunami Room



Redwood Coast  
Tsunami Work Group  
a member of the  
Earthquake Country Alliance  
*We're all in this together*



HUMBOLDT STATE UNIVERSITY



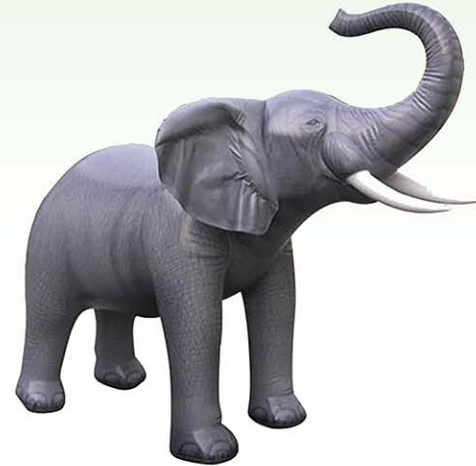
# Earthquake - Tsunami Room

*What is an elephant doing in the room?*

*Come in and find out*

- *Make a tsunami with the tsunami wave tank*
- *Find out about recent earthquakes and eruptions*
- *Real time seismic monitor*
- *Free preparedness materials*

*.....and much more*



**Inside and to the right**



Living on

**SHAKY GROUND**

HOW TO SURVIVE EARTHQUAKES AND TSUNAMIS IN NORTHERN CALIFORNIA

Sponsored by the **Redwood Coast  
Tsunami Work Group**  
a member of the  
**Earthquake Country Alliance**  
*"We're all in this together"*





# The Most Important Take-Away Message



Protecting yourself from injury during the earthquake is where it all begins. You can't evacuate if you are injured during the shaking!



As soon as it is safe to move, get your "grab and go" kit and walk to high ground or inland away from the coast. Take the time to put on shoes as debris may make walking hazardous. Practice the evacuation route before hand so you know where to go.



Tsunamis are TRICKY! Just when you think the waves are done, another damaging surge may arrive. The largest waves may arrive many hours after the first. Stay away from the coast until officials say it is safe to return.

# Ellie – the earthquake preparedness elephant



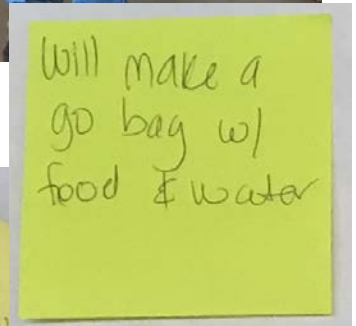
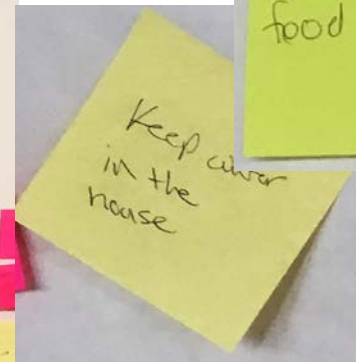
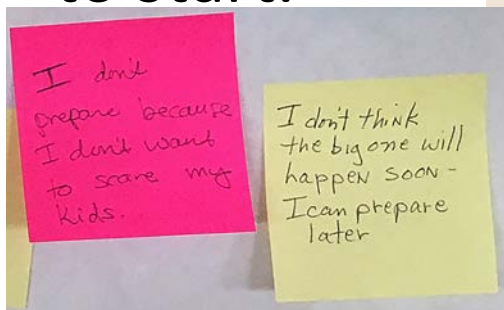


# Everybody liked Ellie

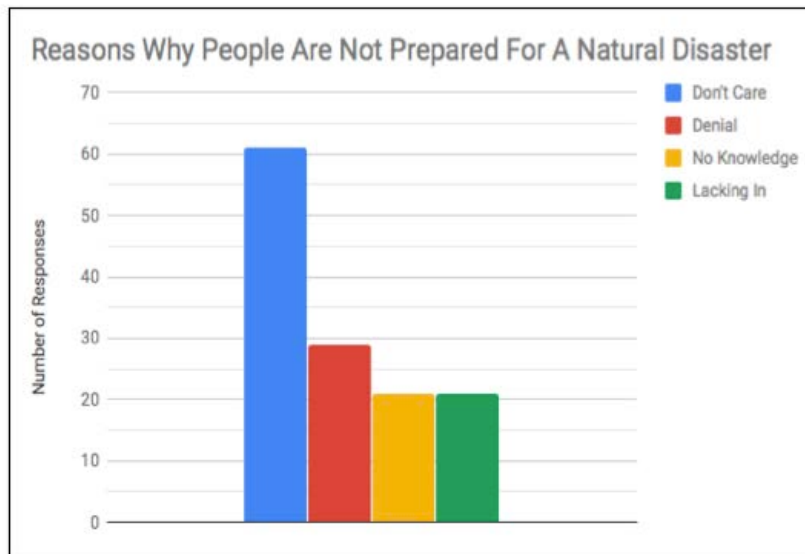




Staff engaged visitors by asking them if they knew the expression “The elephant in the room,” something big and obvious that everyone tries to ignore. Our elephant represented how people ignore the importance of preparing. Visitors filled out post-it notes on why they found it hard to prepare, and what steps they could take to start.



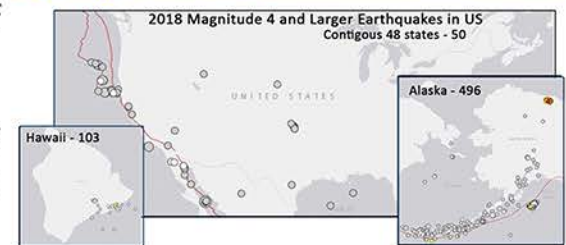
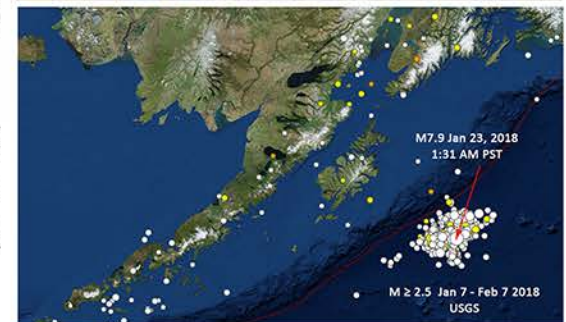
HSU Capstone Geology students analyzed the responses and identified the primary blocks to taking preparedness actions and what people identified as ways to take action





# Notable quakes of 2018 (to date):

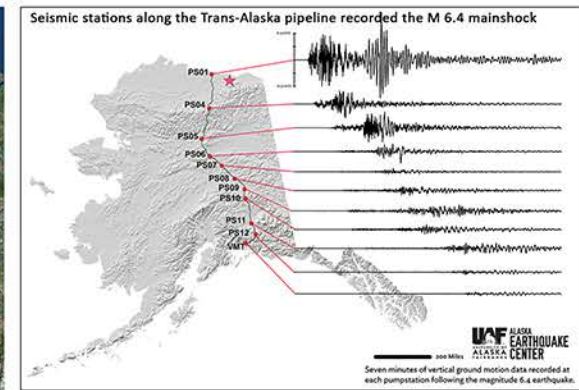
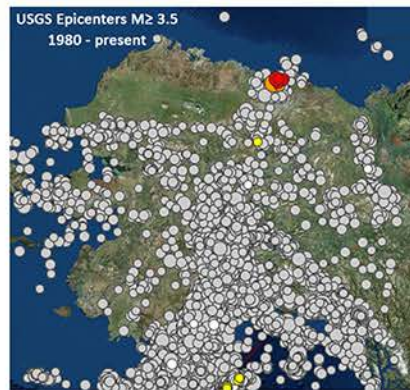
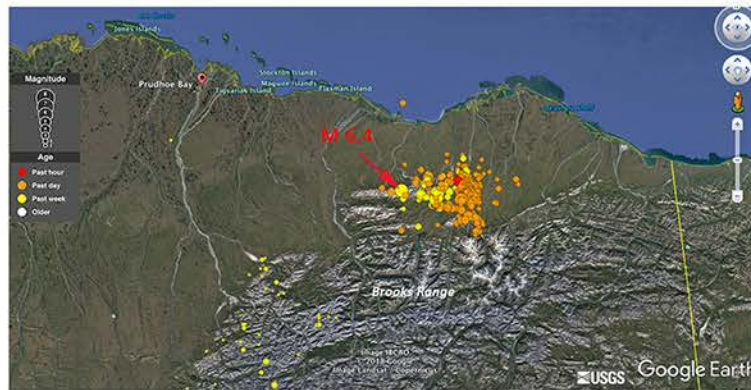
- **Deadliest quake:** Aug. 5 M 6.9 Lombok Indonesia. 460 dead, 1,353 injured (as of 8/14). Impacts exacerbated by a M 6.4 foreshock on July 29 that weakened buildings and aftershocks that caused further damage.
- **Largest quake:** Jan. 23 M 7.9 Gulf of Alaska. Felt on Kodiak Island, no damage. Small tsunami – 10 inches high in Crescent City.
- **Largest quake elsewhere in the world:** Feb. 25 M 7.5 Papua New Guinea. Located in the Southern Highlands, a zone of faulting caused by the collision between the Pacific and Australian plates. 160 deaths and many injuries.
- **Largest US quake outside of Alaska:** May 3 M 6.9 on the Big Island - biggest earthquake to hit the area since 1975. Many buildings damaged, landslides, and damaged a road, causing it to be shut down. A new eruptive phase began at Kilauea at the same time.
- **Largest quake in the lower 48:** Jan. 25 M 5.8 Off the coast of Cape Mendocino. Felt lightly from Mendocino to Coos Bay.
- **Tsunamis:** 2018 has been a quiet year - eight tsunamis detected, only one caused any impacts. A German tourist died after being swept away in a 3-foot high meteorological-tsunami in Mallorca, Spain on July 18.





# August 12 Kaktovik Alaska Earthquake

Earthquakes are no surprise in Alaska. The most active part of Alaska is close to the Alaska-Aleutian subduction zone. Fewer earthquakes have occurred in the far north. On August 12th at 6:58 am ADT a magnitude 6.4 earthquake struck the NE corner of the state about 80 miles ESE of Prudhoe Bay. It was followed by a vigorous aftershock sequence including a M6 and three earthquakes in the M5 range. It is the largest earthquake ever recorded on the North Slope north of the Brooks Range.

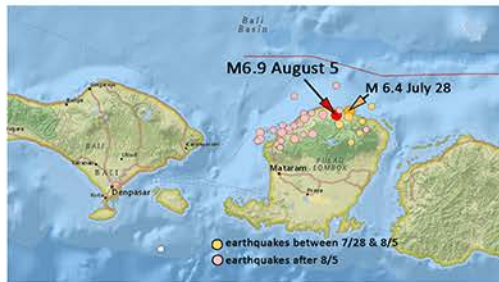


Because of its proximity to the Prudhoe Bay oil field, seismologists are looking into whether this sequence could be the result of induced seismicity related to the disposal of drilling waste fluids. At this point in time, everything known about the sequence is consistent with natural earthquake activity. The orientation of the strike-slip mechanism aligns perfectly with known tectonics and previous earthquakes in the region. The Alaska Earthquake center at the University of Alaska has recorded over 4000 smaller earthquakes in this area since 1970.

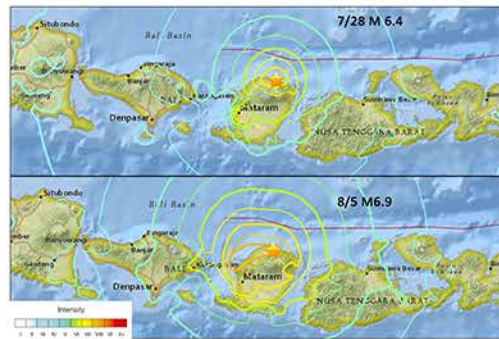


# Earthquakes in Lombok, Indonesia

A M 6.9 earthquake struck the north coast of Lombok on August 5th. It followed a M 6.4 earthquake eight days earlier. Both were located on upper plate thrust faults caused by subduction of the Australian plate along the Sunda trench. The M 6.9 quake killed at least 460 people and injured over 1,300. The M 6.4 foreshock killed 20. Indonesian authorities estimated 80% of the structures on the northern part of the island were damaged and 350,000 people displaced. A tsunami warning was issued after the larger earthquake which was cancelled a few hours later when only a five inch tsunami was observed.



*Epicenter locations of the M 6.4 foreshock and M 6.9 mainshock. Aftershocks of the first earthquake are shown in orange, aftershocks of the larger quake are in pink.*



*Both the M 6.4 and M 6.9 earthquakes were felt throughout Lombok and on neighboring islands. Only about 10% of earthquakes are preceded by foreshocks and there was nothing about the July quake that suggested a larger one was coming.*



*Much of the construction on the island is unreinforced brick and stone that is vulnerable to collapse in strong shaking. Impacts were exacerbated by structures weakened in the foreshock collapsing in the larger quake.*



*Toursits waiting to be evacuated from the Gili Islands. Some people lost belongings when hotels and cottages collapsed. It is a reminder to keep your essential documents and a few emergency supplies with you.*

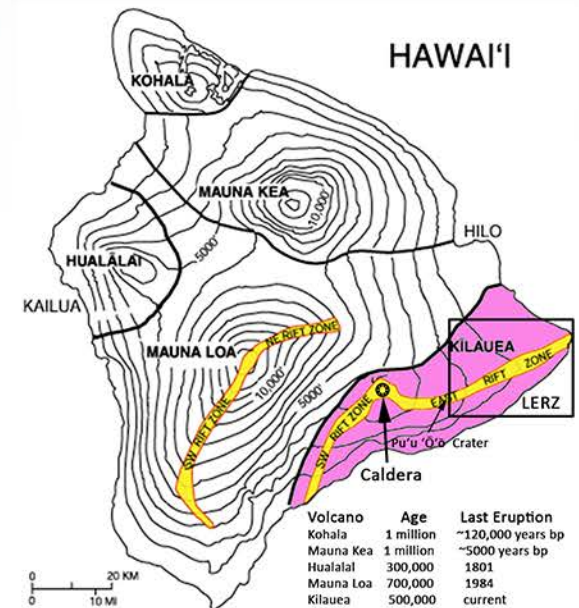
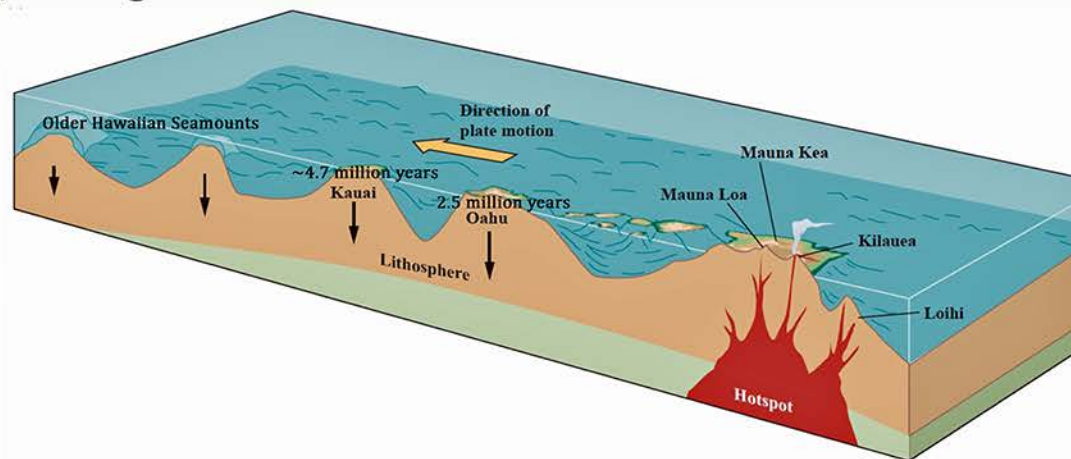


The 2018 fair also featured videos and posters about the Kilauea eruption



# The Hawaiian Hotspot and Kilauea

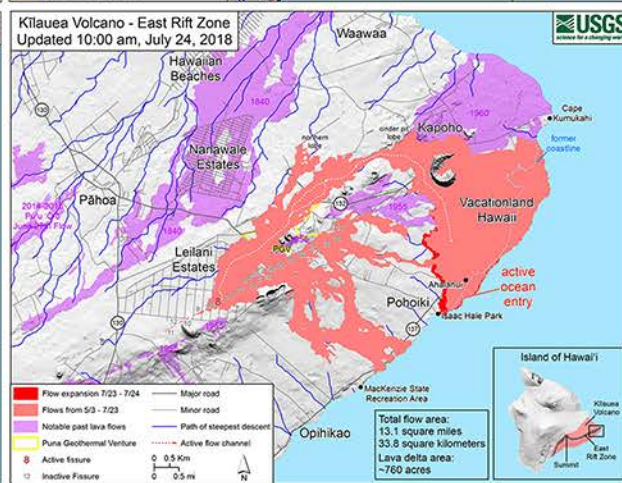
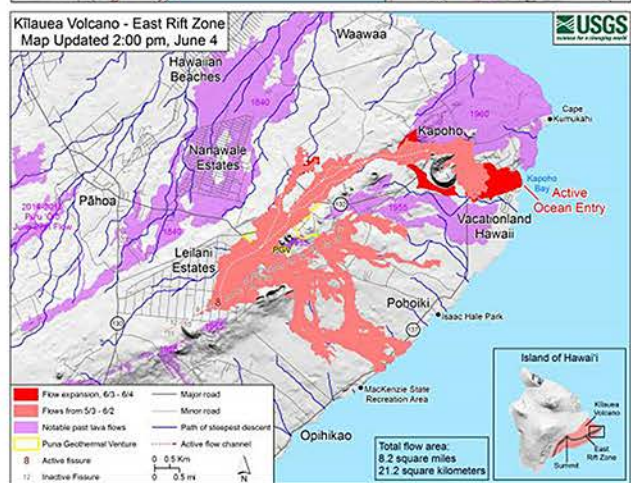
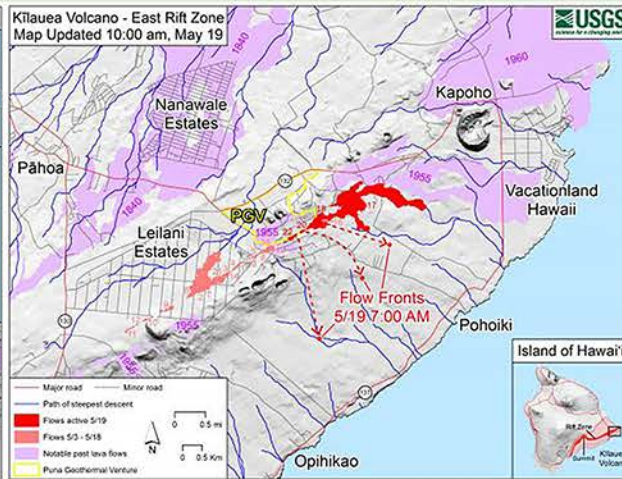
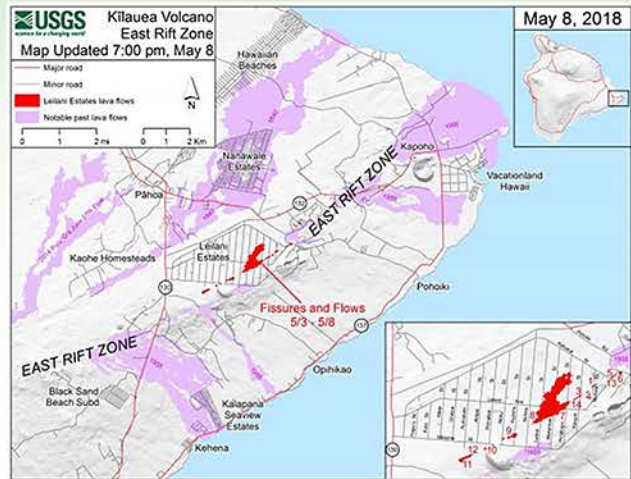
Most volcanic activity occurs near plate boundaries. Hawaii is different. Scattered over the earth's surface are more than a hundred small regions of isolated volcanic activity known to earth scientists as hot spots. The most well known is the one that has generated the Hawaiian Islands. Where the hot spot reaches the surface, volcanic activity occurs. In Hawaii, the hot spot rises beneath the drifting Pacific plate, leaving a record of volcanism and the rate of movement of the plate for over 80 million years.



Kilauea is the most active of Hawaii's five volcanoes. The name means "spewing," a reflection of its very active eruptive history. Kilauea has a large caldera at its summit and two active rift zones: the East Rift Zone extending to the eastern tip of the island and the SW Rift Zone near the boundary with Mauna Loa. It has a complex plumbing system with magma rising and falling beneath the caldera and feeding the rift zones. It has been in nearly continuous eruption since January 1983, with activity concentrated along the East Rift Zone at the Pu'u Ō'ō crater and, most recently, the Lower East Rift Zone (LERZ).



# The 2018 Lower East Rift Zone Eruption

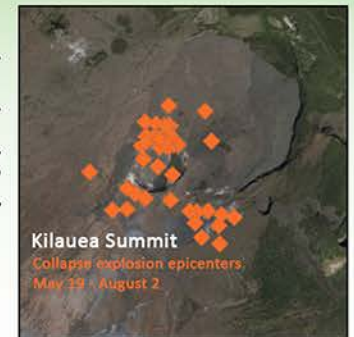


These USGS maps published by the Hawaii Volcanoes Observatory provide a snapshot of the current eruption. Fissures began forming along the LERZ in early May. By May 22, 22 new fissures had formed, primarily in the Leilani Estates area. Fissure 8 became the most active and during the height of the eruption, was emitting the equivalent of 26,000 US gallons per second. By the time the eruption slowed in early August, 13.7 square miles had been covered by new lava, Kapoho Bay was completely filled and 700 acres added to the coast.

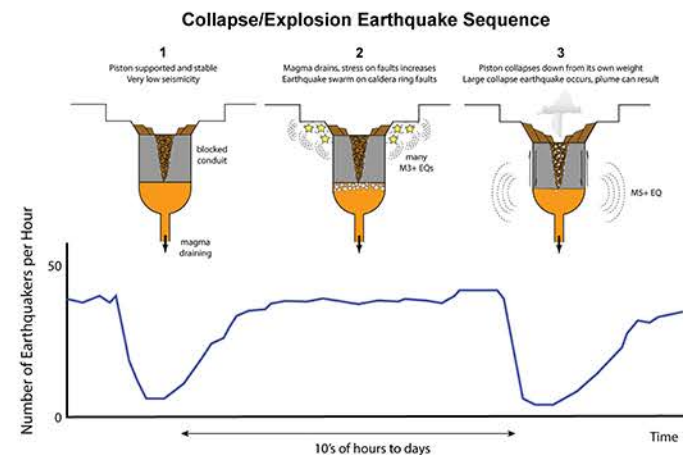


# How a Collapse Explosion Occurs

On May 19, an explosion racked the Kilauea summit. Since then 61 explosions have occurred, with magnitudes equivalent to a 5.2 – 5.4 earthquake. Hawaii Volcano Observatory scientists believe the explosions are caused by combination of magma draining beneath the summit, rock and debris clogging the caldera conduit and ground water percolating in and flashing to steam. As magma drains, it pulls away support of the rock above it. Small earthquakes occur as the crater floor sags. The explosion event is triggered when the caldera floor can no longer support its own weight and drops downward. A very regular pattern was established throughout June and August with collapse explosions occurring every about every 26 to 34 hours. On August 2, the last explosion occurred, about the time the LERZ eruption slowed.



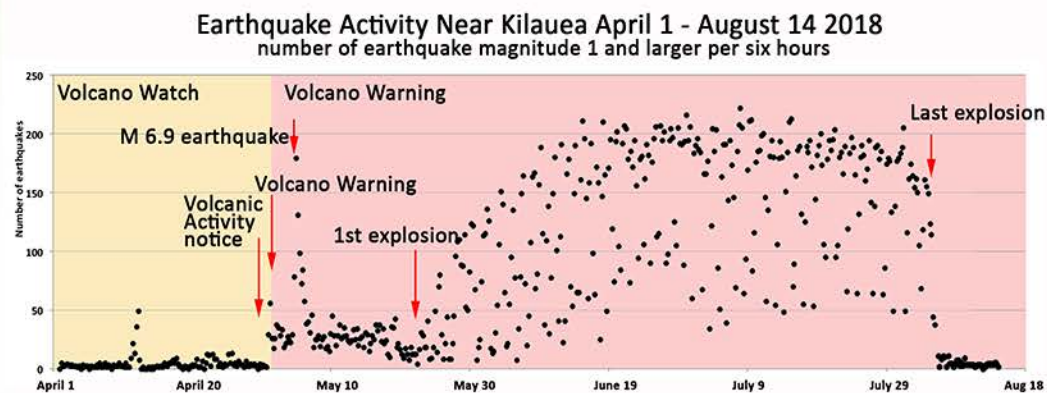
62 collapse explosions were recorded by the USGS between May 26 and August 2



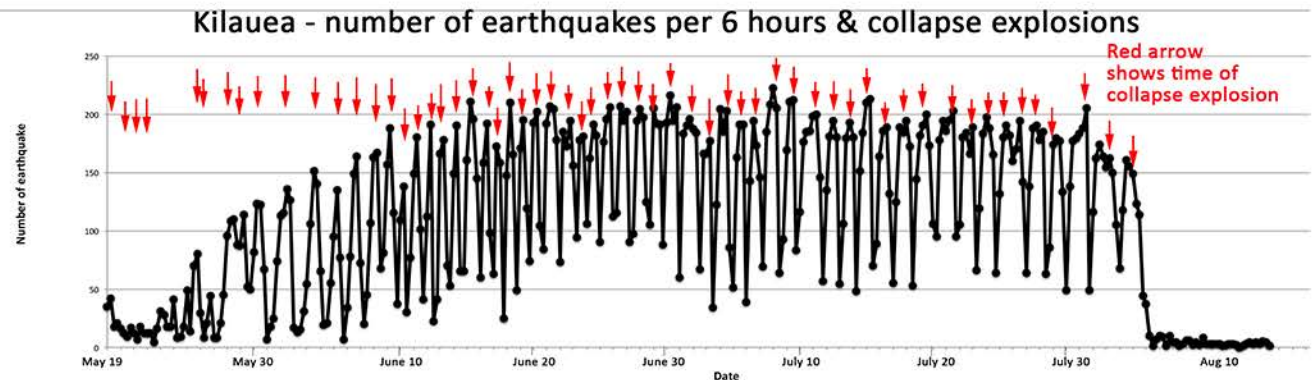


# The Hawaii Earthquake Story

There are a number of ways to monitor active volcanoes. One of the most important is seismicity. The USGS operates 60 seismic stations on the Big Island. 10 to 15 very small earthquakes are typically recorded every day. The seismicity level jumped in early May and the Hawaii Volcano Observatory (HVO) issued a notice of Volcanic Activity. Three days later after a M5 earthquake and new fissures were observed, a Volcano Warning was issued.



In early May, between 100 and 400 earthquakes were recorded every day. In late May, when the collapse explosions began occurring with regularity, a pattern developed with earthquake activity dropping after each explosion and then building before the next one. 400 to 800 earthquakes were detected every day.

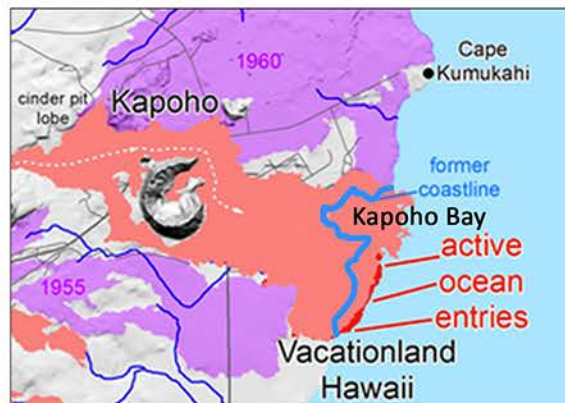




# Impacts of the LERZ Eruption

As of early August, 716 homes were reported destroyed, and 2,573 people registered for assistance from the Federal Emergency Management Agency after the event was declared a national disaster. 24 people were reported injured, primarily from lava bombs and projectiles. Most of Hawaii Volcanoes National Park remains closed and an estimated 1500 people evacuated from homes. Hawaii is considering legislation to prohibit residences in areas of lava flow threat.

*Below: The draining of magma from the Kilauea summit has tripled the depth and doubled the width of Halema'uma'u Crater. Jagger museum and USGS facilities had to be evacuated.*



*Above: Lava flows completely filled Kapoho Bay. Where lava enters the ocean, laze (lava haze - made of dense white clouds of steam, toxic gas and tiny shards of volcanic glass) is formed.*



*Lava flows threatening the Puna Geothermal Venture near Leilani Estates in early May. The plant had provided 25% of the island's power needs and was subsequently overrun by the flows.*



# Know Your Zone

## HUMBOLDT BAY REGION

Tsunami Evacuation Map Index

**Tsunami Zone**  **Safe Area**  
In case of earthquake go to safe area

 Potential Tsunami River Surge



Put a pin in the map where you live or work. If it is in the white area, you are safe. You do not need to evacuate. If it is in the yellow area, plan an evacuation route. Remember, the earthquake shaking is your warning. Head to high ground or inland as soon as the shaking subsides enough for you to safely move. Go on foot - the ground shaking is likely to have disrupted roads.



This map is designed to help you protect yourself from the biggest tsunami likely to hit our area - a magnitude 9 earthquake on the Cascadia subduction zone. It is based on the best currently available information about tsunamis in our region. The map does not show where the water is likely to flow. It shows safe areas (in white) and areas that may be at risk (in yellow). The map may be change as more information becomes available.





# Thank You

**What you see in this room is a result of the efforts of the Redwood Coast Tsunami Work Group (RCTWG), an organization of local, state and federal agencies, tribes, relief and service groups, land managers, and businesses from Del Norte, Humboldt and Mendocino Counties. The group was formed in July 1996 to define the needs of local jurisdictions to mitigate the North Coast earthquake and tsunami hazard and to promote a coordinated, consistent mitigation program for all coastal areas. The RCTWG is part of the California Earthquake Alliance, a state organization of regional work groups that foster preparedness throughout the state.**

NOAA - National Weather Service Eureka Forecast Office  
HSU Geology  
Clarke Museum  
American Red Cross  
Pacific Watershed Associates (PWA)  
U.S. Geological Survey (USGS)  
Humboldt Community Emergency Response Team (CERT)  
Del Norte County Disaster Animal Response Team (DART))  
Redwood National and State Parks  
California State Parks  
Boy Scout Troop 99, VFW - McKinleyville  
Humboldt County Sheriff's Office of Emergency Services  
Humboldt County Public Works  
Humboldt County Local Oversight Program  
Humboldt State University/University Center  
California Office of Emergency Services  
California Geological Survey  
Earthquake Country Alliance  
The Wildlands Conservancy  
Trinidad Rancheria  
Cascadia Earthscope Earthquake Tsunami Education Project  
Humboldt County Fair  
Frontier Internet  
Ferndale High School  
Humboldt County Fair Association

.....and other members of the RCTWG

