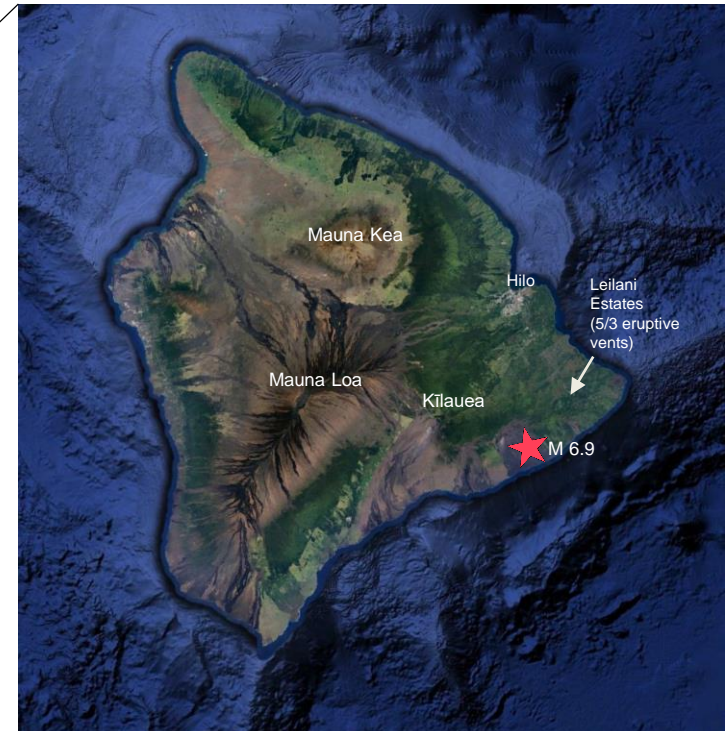




As Civil Defense grappled with eruptions from two fissures in the Leilani Estates subdivision that began yesterday (5/3), the Big Island was shaken by a widely felt 5.4 magnitude quake that was followed less than an hour later by this 5 km deep M 6.9 quake felt as far away as Oahu.

No major damage has been reported, and no tsunami occurred during the M 6.9 event. Hawai'i Volcanoes National Park closed due to rock slides on trails and roads.

This is the largest earthquake in Hawai'i since the 1975, M 7.1 Kalapana earthquake, which generated a local tsunami that took 2 lives. Damage due to that earthquake and tsunami was estimated to total \$4.1 million in Hawai'i.



The Modified-Mercalli Intensity scale is a twelve-stage scale, from I to XII, that indicates the severity of ground shaking.

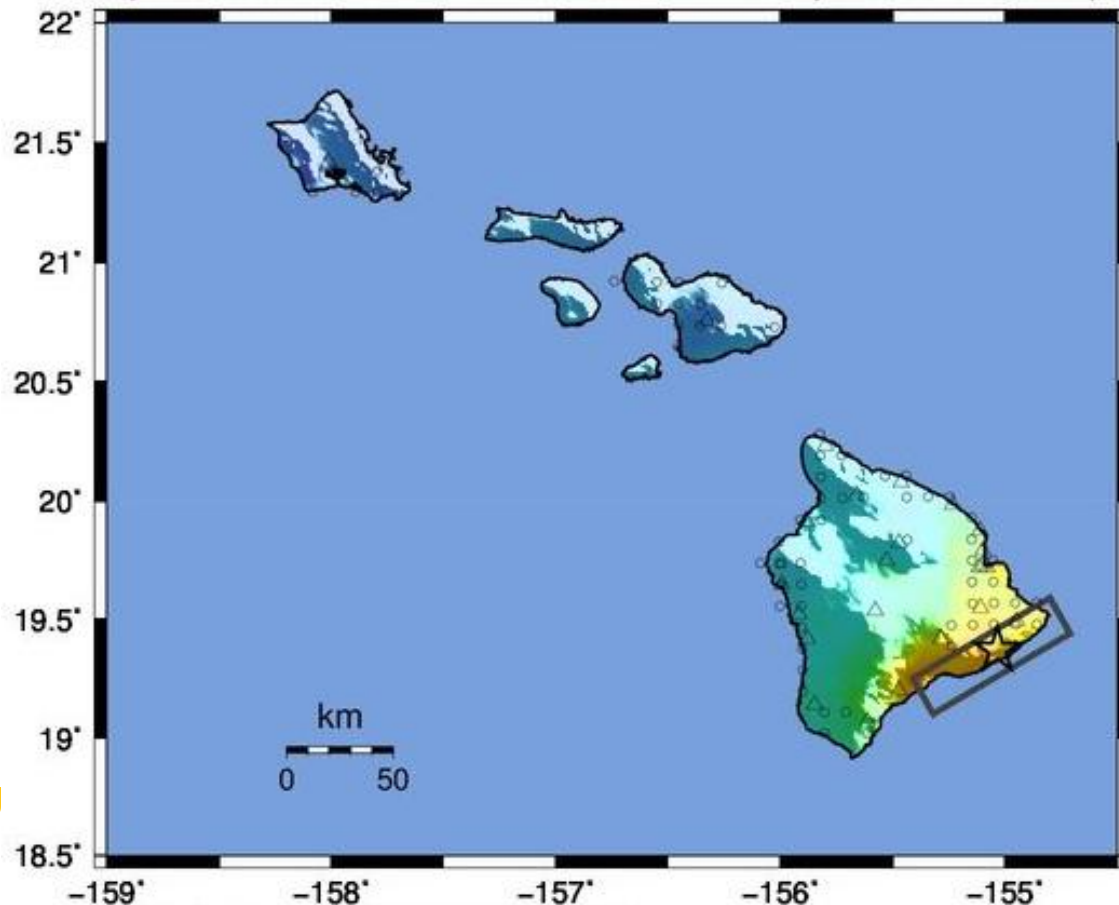
Those nearest the earthquake experienced very strong shaking.

### Modified Mercalli Intensity



### Perceived Shaking

**Extreme**  
**Violent**  
**Severe**  
**Very Strong**  
**Strong**  
 Moderate  
 Light  
 Weak  
 Not Felt

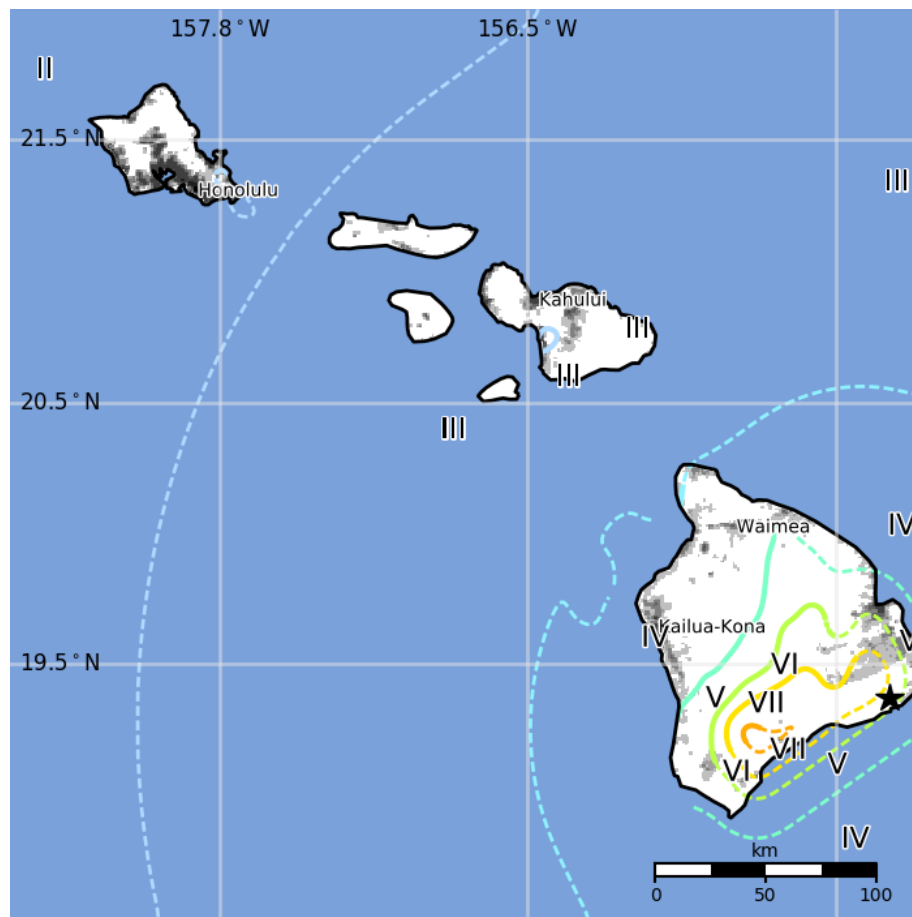


*USGS Estimated Shaking Intensity from M 6.9 Earthquake*

The USGS PAGER map shows the population exposed to different Modified Mercalli Intensity (MMI) levels.

The USGS estimates that nearly 79,000 people felt strong to very-strong shaking from this earthquake.

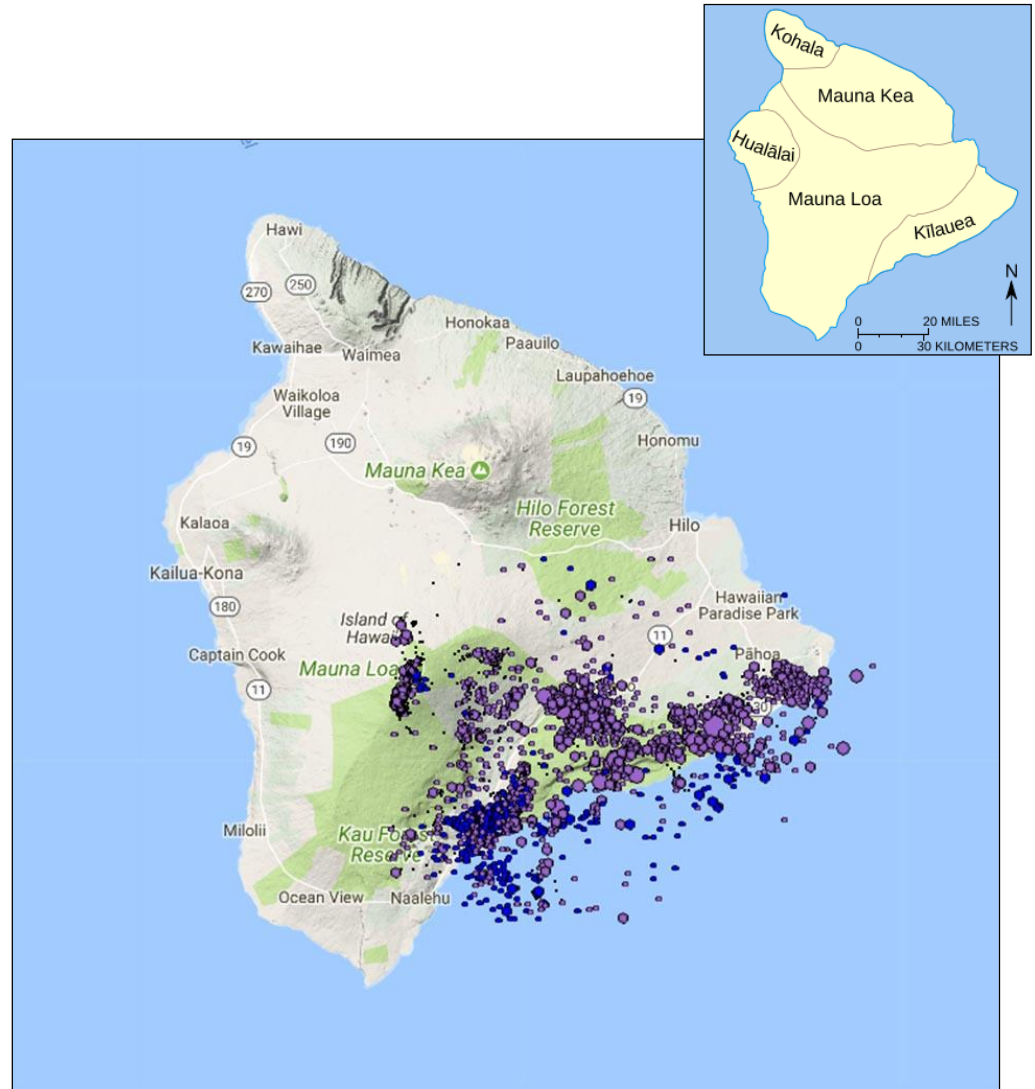
MMI	Shaking	Pop.
I	Not Felt	--*
II-III	Weak	1,202 k*
IV	Light	78 k*
V	Moderate	27 k
VI	Strong	77 k
VII	Very Strong	2 k
VIII	Severe	0 k
IX	Violent	0 k
X	Extreme	0 k



The color coded contour lines outline regions of MMI intensity. The total population exposure to a given MMI value is obtained by summing the population between the contour lines. The estimated population exposure to each MMI Intensity is shown in the table.

Thousands of earthquakes occur every year in the State of Hawaii. Most of these earthquakes are directly related to magma moving within the volcanoes. As magma rises into the chamber below the volcano, it pushes on the surrounding solid rock. The resulting forces activate faults causing earthquakes.

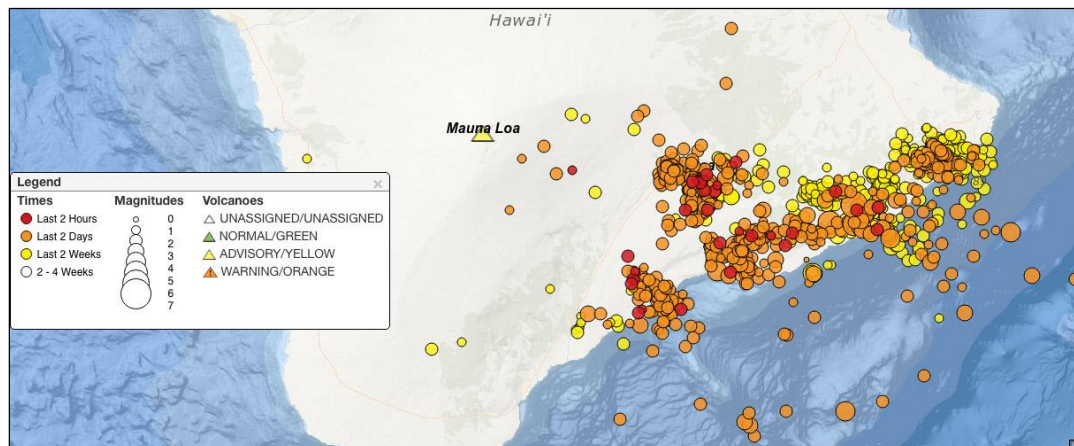
This map shows earthquakes on the Big Island since 1985. Note that most are clustered on volcanically active Kīlauea Volcano.



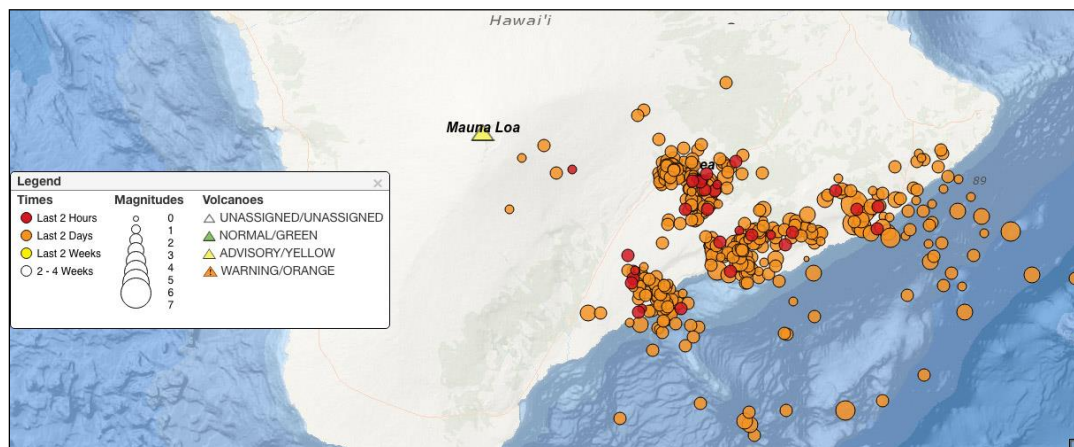
*Map created with the IRIS Earthquake Browser.  
Inset map shows the volcanoes of the Big Island.*

## Foreshocks and aftershocks

905 earthquakes occurred during the *past week* (as of May 5, 6:00 AM local time):



461 earthquakes occurred during the *past day* (as of May 5, 6:00 AM local time):



Map created from USGS:

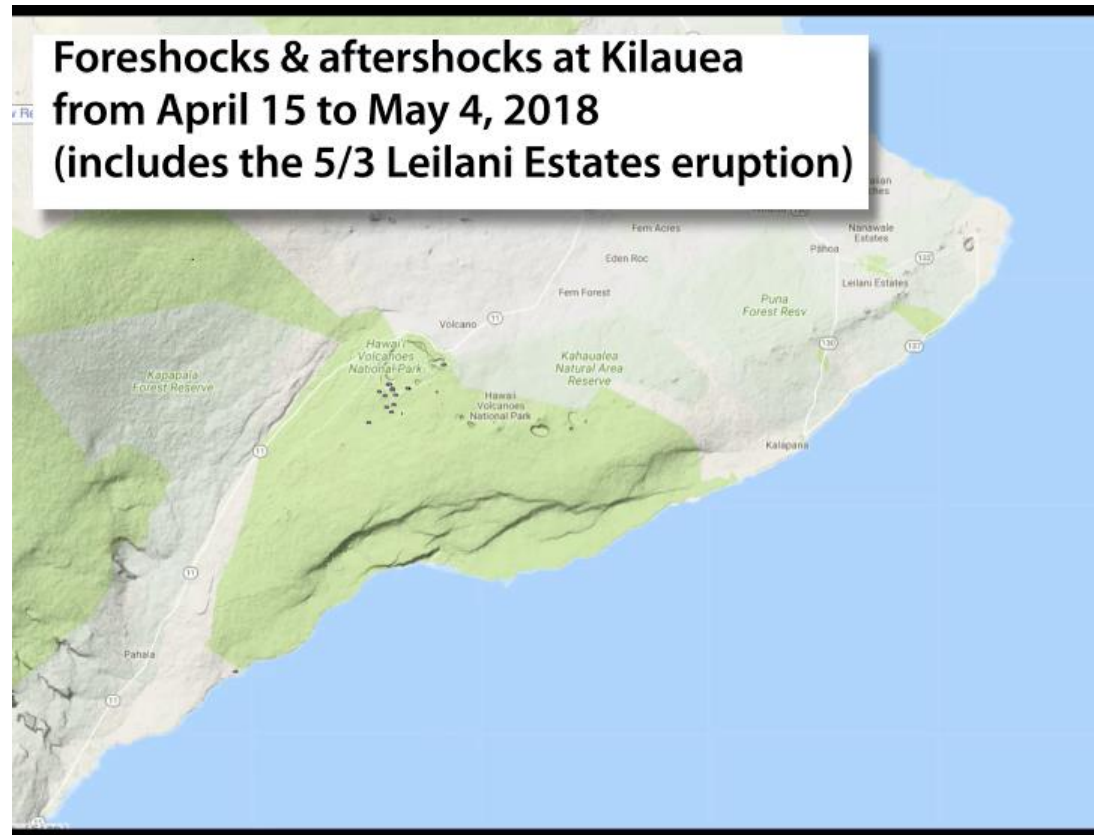
[https://volcanoes.usgs.gov/observatories/hvo/hvo\\_earthquakes.html](https://volcanoes.usgs.gov/observatories/hvo/hvo_earthquakes.html).

Animation of earthquakes during the period between April 15<sup>th</sup> and May 4<sup>th</sup>.

During the buildup to the May 4<sup>th</sup> earthquake, there was a significant amount of stress as magma pushed through the East Rift Zone.

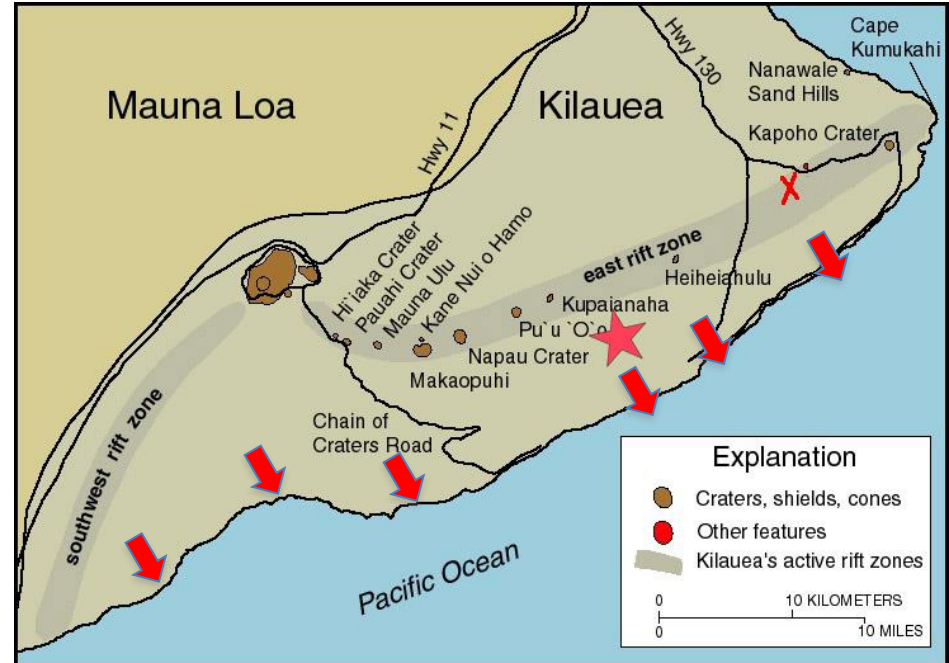
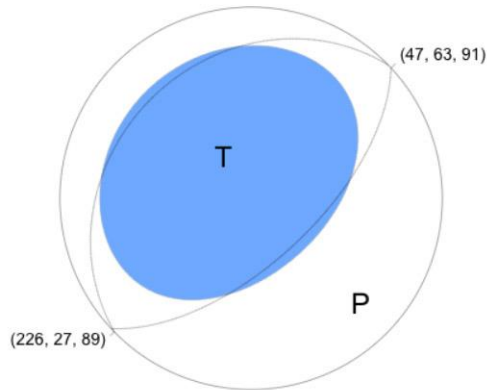
Seismicity and deformation were consistent with continued accumulation of magma within the rift zone.

Seismic activity had been elevated around Kilauea volcano over the past month, punctuated during the previous ~24 hours with at least 7 earthquakes of M 4.5 or larger. About an hour prior to the M 6.9 event, a M 5.4 earthquake also struck in a similar location. Following the M 6.9 earthquake, 4 aftershocks of M 4.5 or larger were located (all in the 30 minutes following the mainshock).



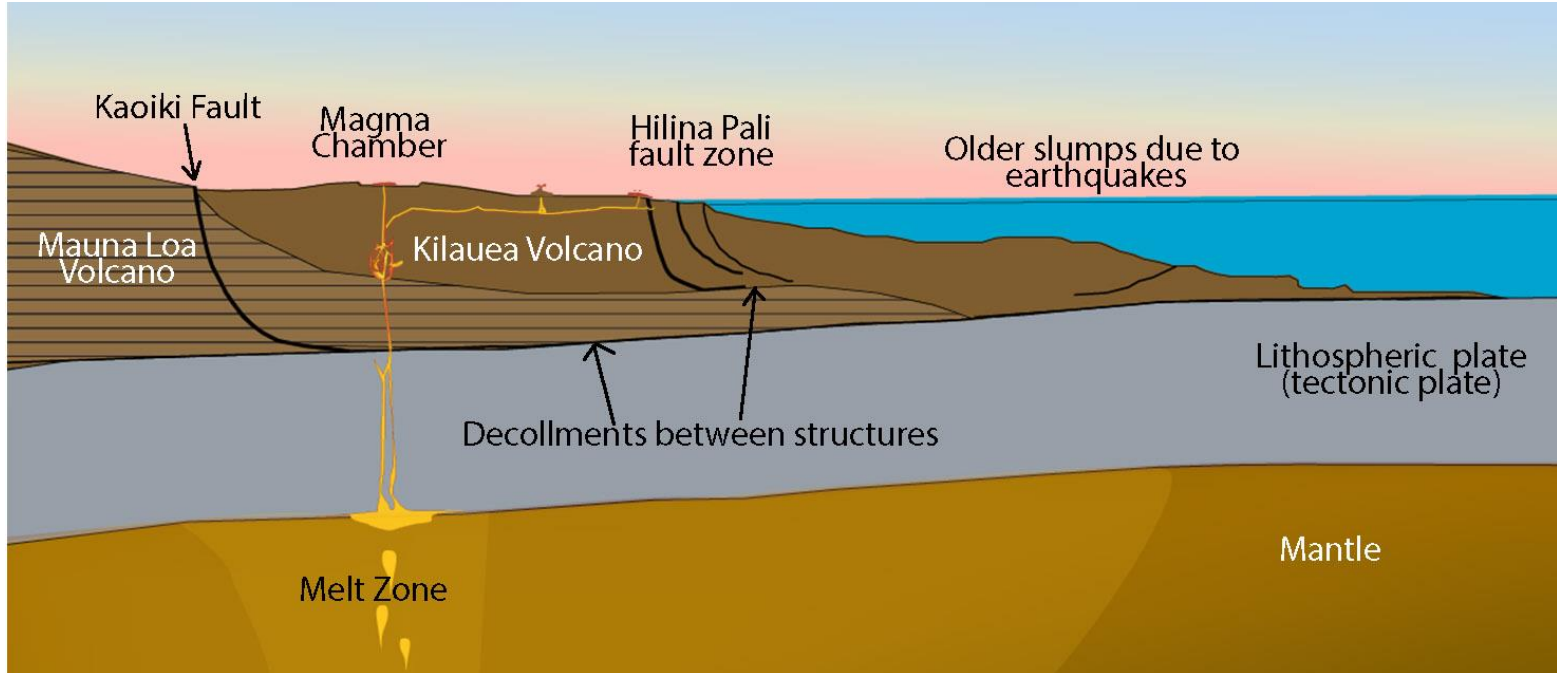
Preliminary focal mechanism solutions indicate rupture occurred on a shallow dipping thrust fault. The reverse fault is on the décollement (boundary between Kīlauea volcano and old ocean island underlying the young volcano. See next slide).

The fault plane is nearly flat (sloping  $2^\circ$  toward the middle of the island) and is approximately 40 km long x 30 km wide based on GPS displacements.



Map of the rift zones of Kilauea. Red arrows indicate the direction of gravitational tension. Red X marks Leilani Estates, location of eruption on May 3<sup>rd</sup>.

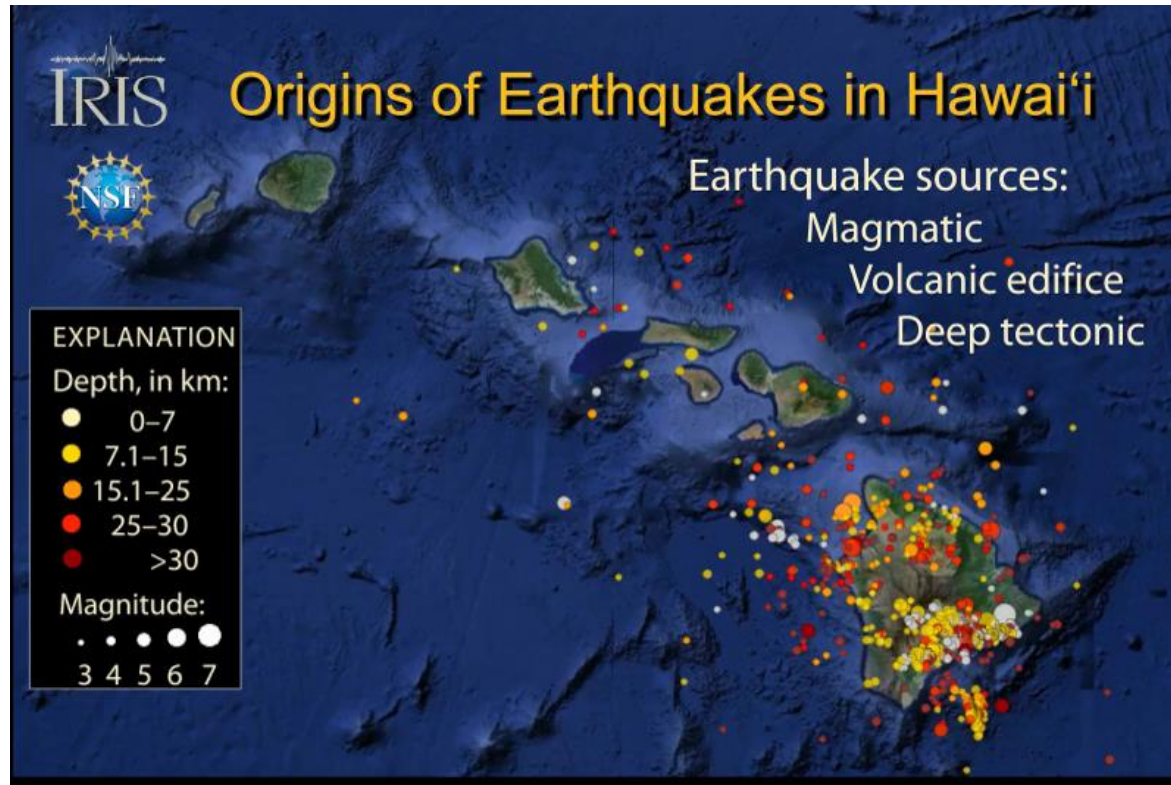
The tension axis (T) reflects the minimum compressive stress direction. The pressure axis (P) reflects the maximum compressive stress direction.



Earthquakes occur on faults within and between the volcanic edifices. Along the Ka'ōiki fault zone on the Big Island, the Kīlauea side has moved down relative to the Mauna Loa (striped) side. Along the Hilina Pali and NE toward the NE tip of the island, the coastal block has dropped relative to the Kīlauea block driven by the weight of the volcanic layers. This earthquake occurred on the *décollement* between Kīlauea volcano and old ocean island (striped) underlying the young volcano.

*[Graphic from animation on next slide]*



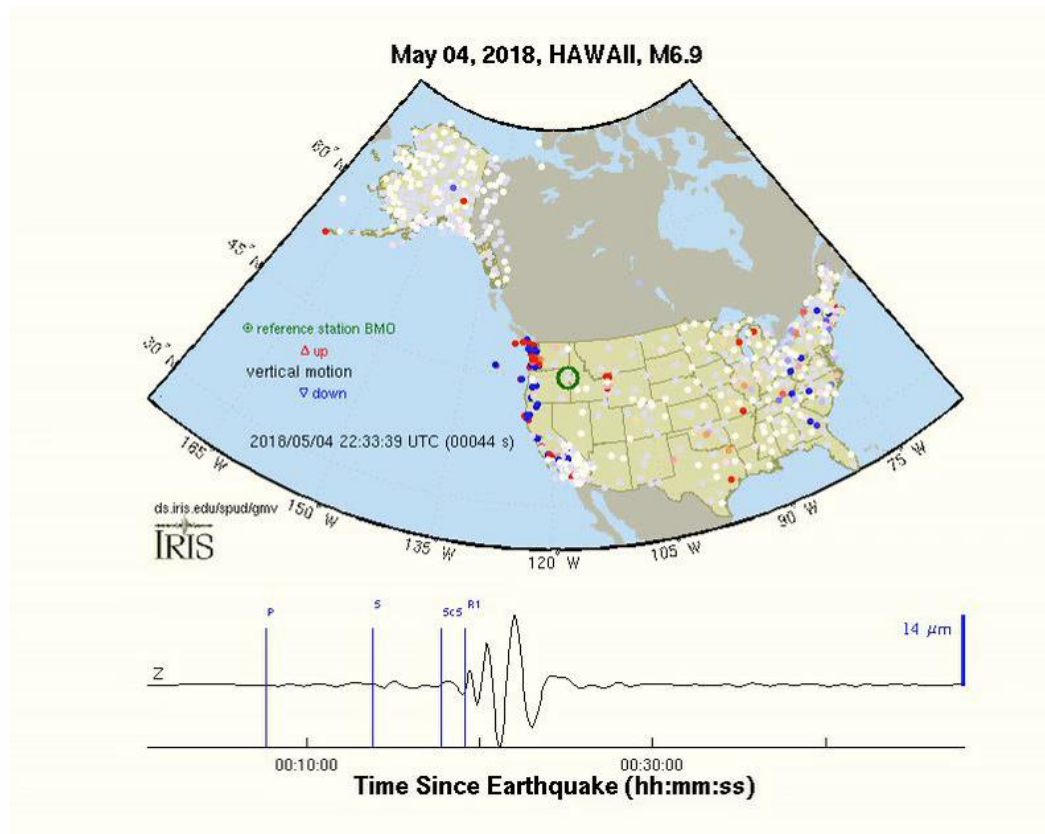


Animation shows that earthquakes occur in three regions:

- In the volcanoes;
- along the volcano-ocean floor boundary; and
- in the mantle.

# Magnitude 6.9 BIG ISLAND HAWAI'I

Friday, May 4, 2018 at 22:32:55 UTC

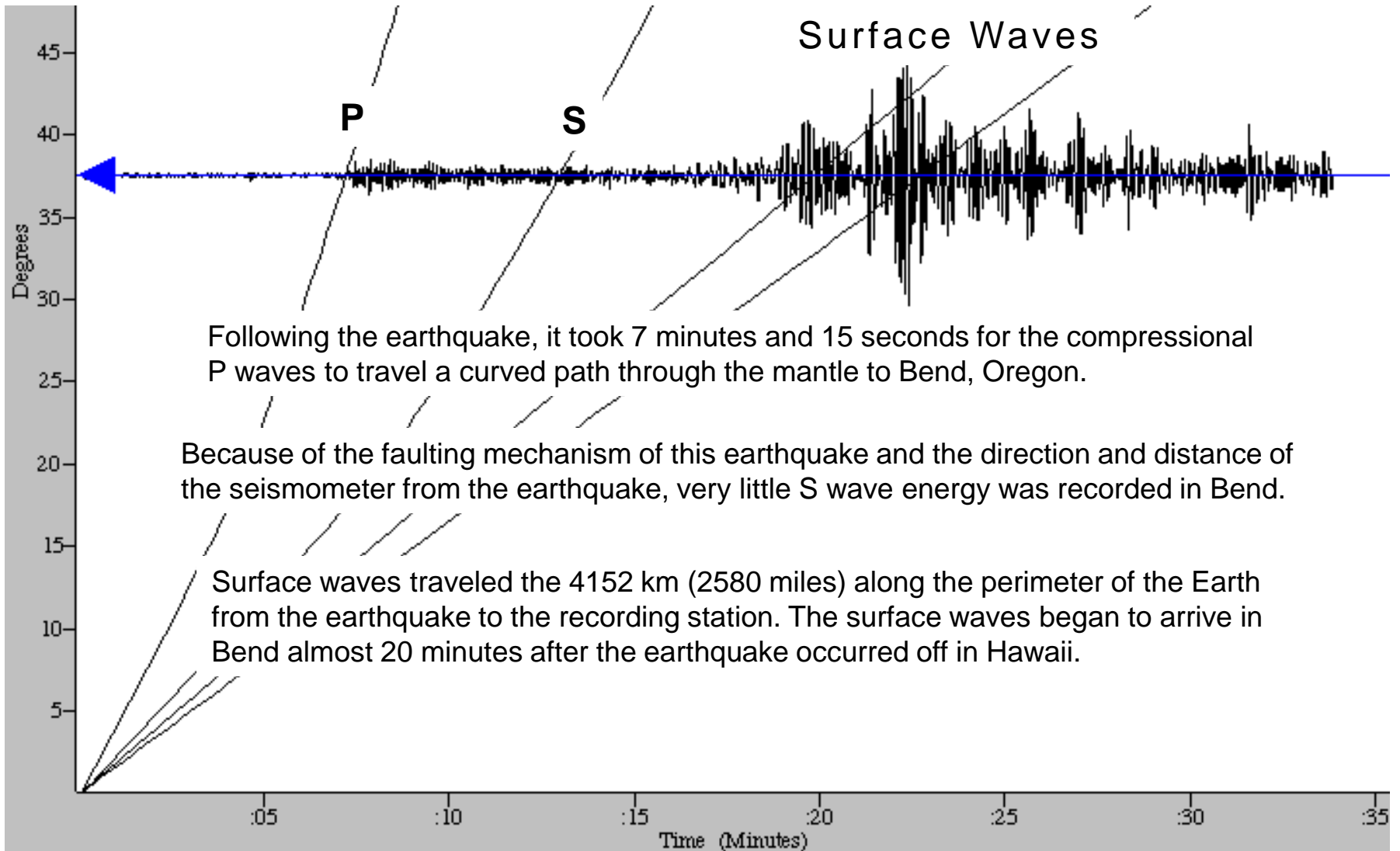


Ground motion visualization for the M 6.9 earthquake in Hawai'i as sensors in the continental states received the seismic signals.

# Magnitude 6.9 BIG ISLAND HAWAI'I

Friday, May 4, 2018 at 22:32:55 UTC

The record of the earthquake in Bend, Oregon (BNOR) is illustrated below. Bend is 4152 km (2580 miles,  $37.4^\circ$ ) from the location of this earthquake.



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