Kilauea East Rift Zone Eruption Update

June 7, 2018

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https://volcanoes.usgs.gov/volcanoes/kilauea

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Topics to be covered include:

- Timeline of events spanning April 30- June 6, 2018 (what's happened)
- Hazards analysis
- USGS response
- Key Partners
- What's Next?
- Useful web sites for updated information

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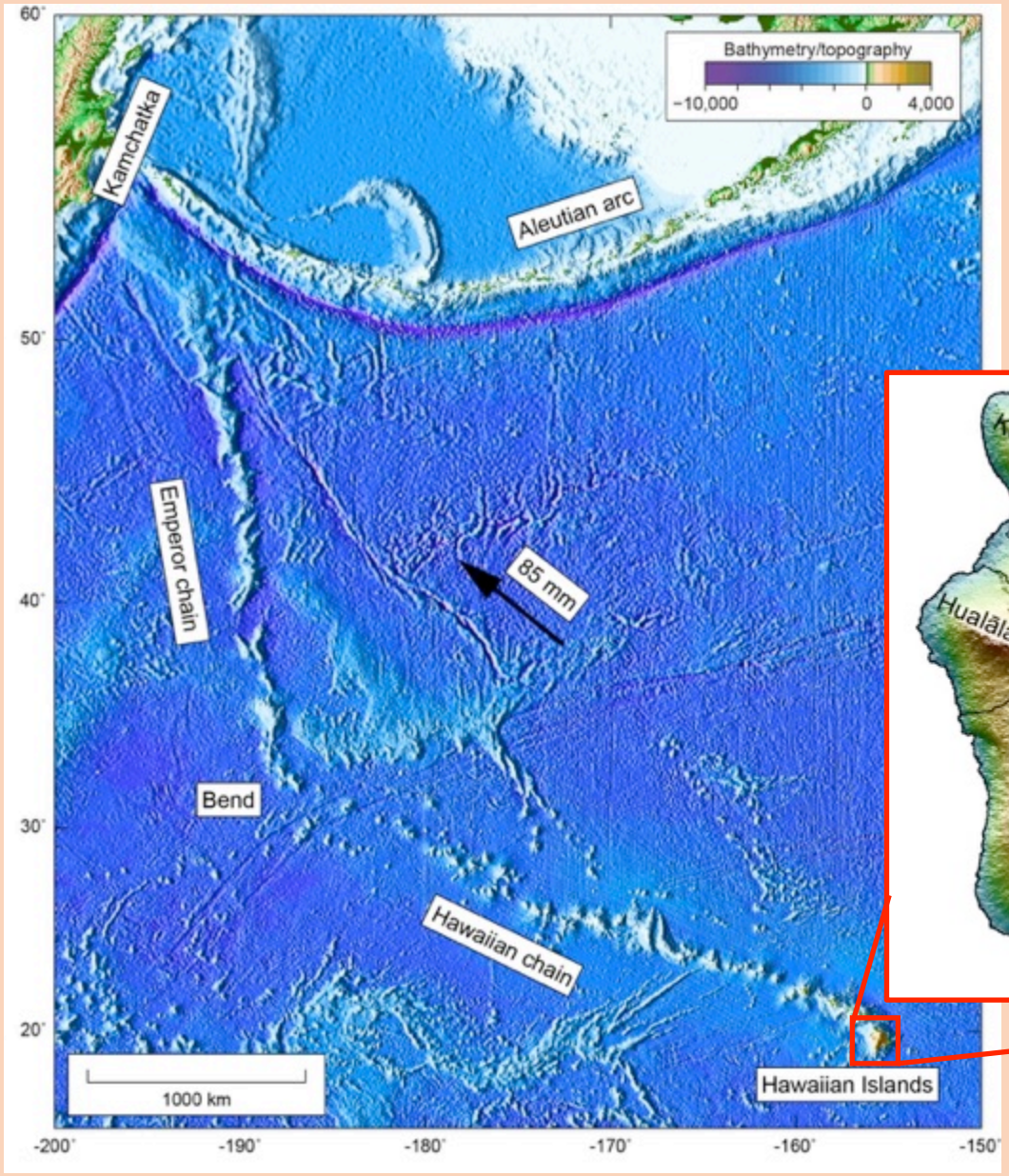
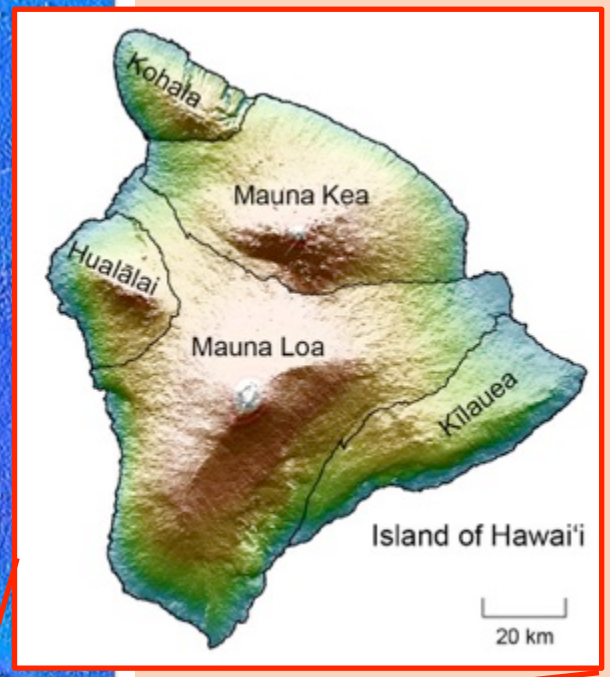
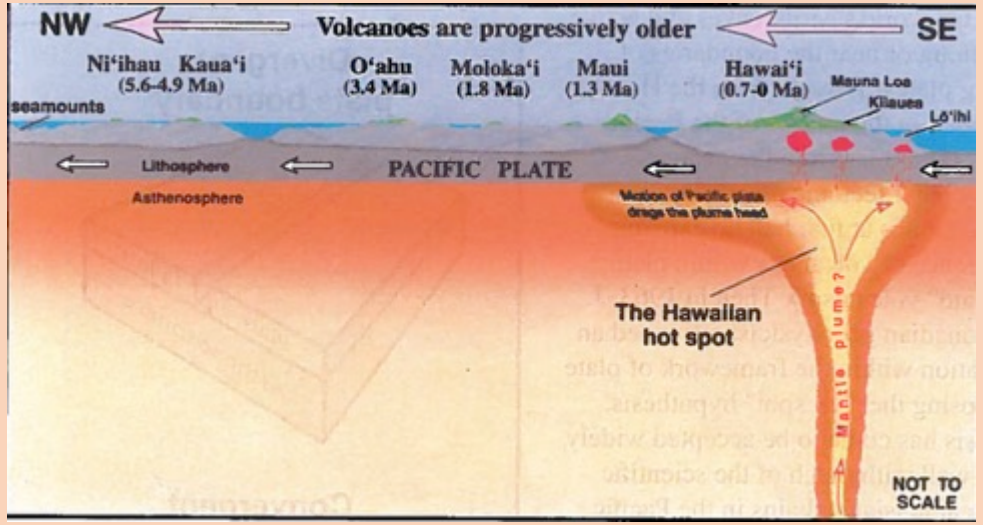
Hawaiian Island Chain originates from Hot Spot Volcanism







Pacific plate overrides a deep mantle hot spot and melting of hot mantle rocks in the plume generates basaltic magma that erupts to form a shield volcano. Kilauea is the youngest and most active.

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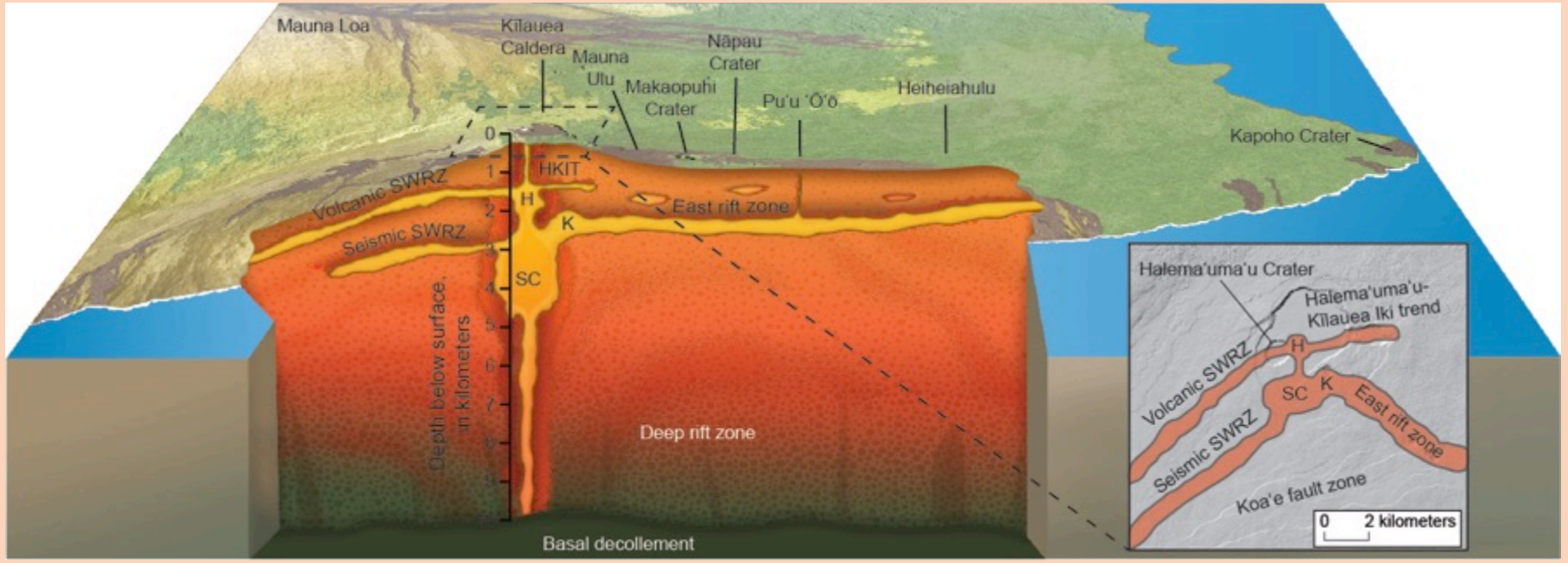
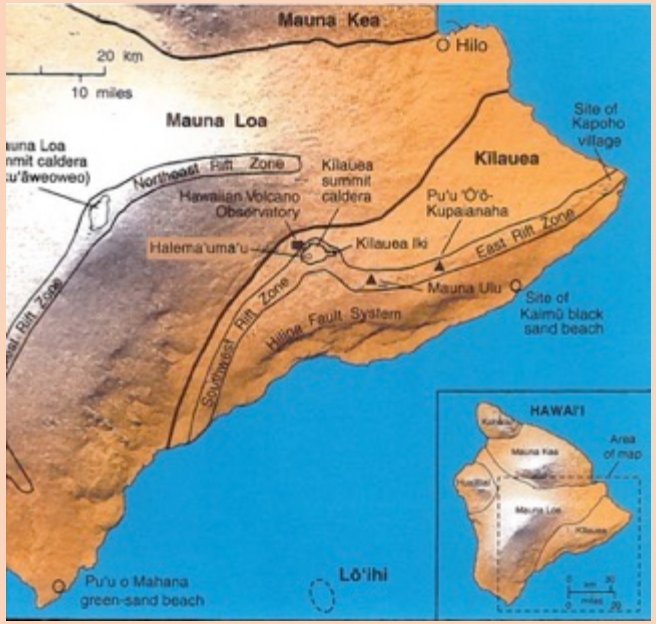
Cross section of Kilauea Volcano and East Rift Zone





Map View of Kilauea and East Rift Zone, and Pu'u 'O'o vent

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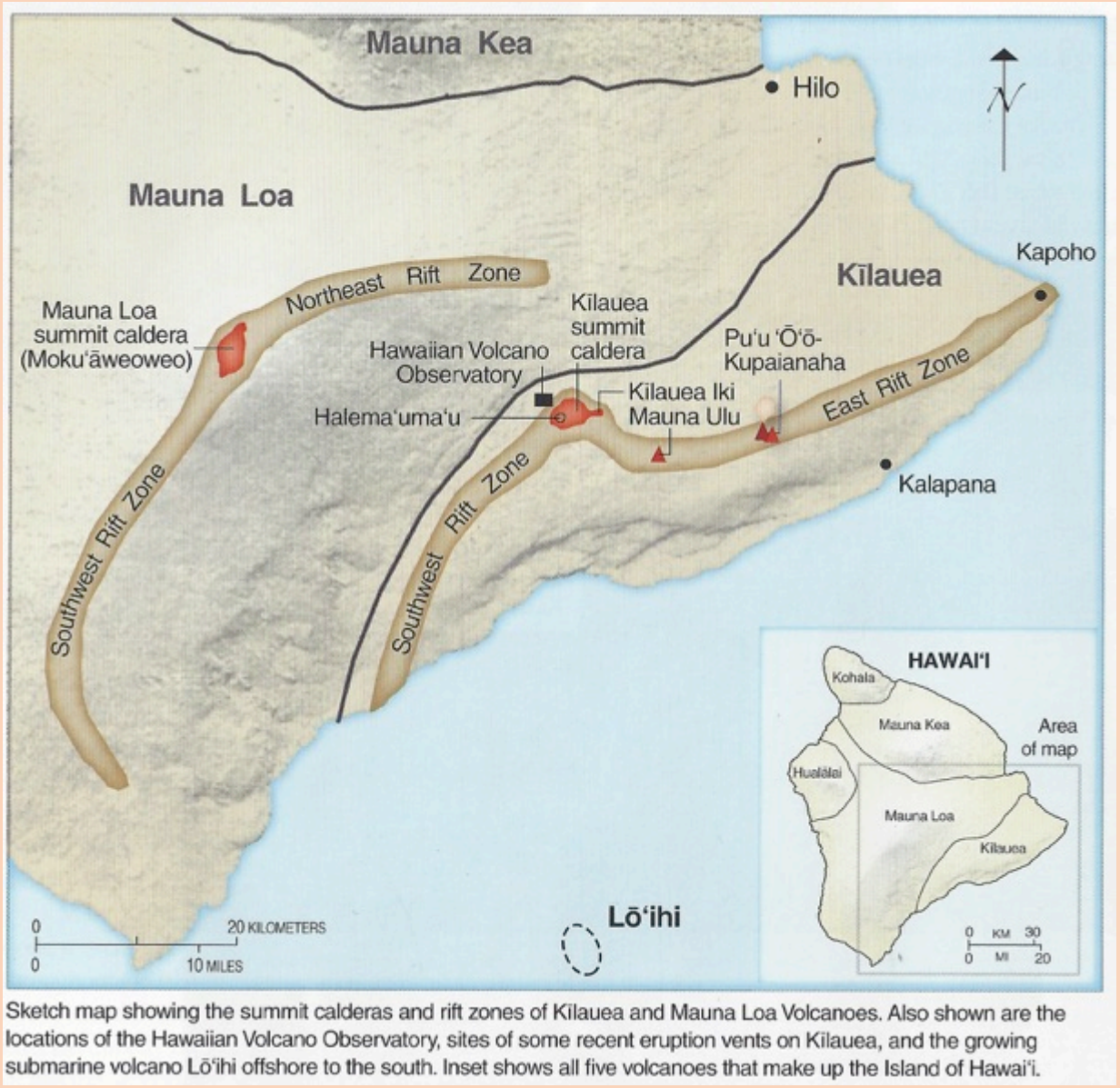
A bit of orientation first



Sketch map showing the summit calderas and rift zones of Kīlauea and Mauna Loa Volcanoes. Also shown are the locations of the Hawaiian Volcano Observatory, sites of some recent eruption vents on Kīlauea, and the growing submarine volcano Lō'ihi offshore to the south. Inset shows all five volcanoes that make up the Island of Hawai'i.

All of the eruptive activity is originating from Kilauea, the the youngest of five volcanoes that comprise the Island of Hawai'i in ongoing eruption for 35 years

Most of the eruptive activity of the past month has taken place from new fissure vents that opened in the Lower East Rift Zone of Kilauea

Other points of eruption that have generated recent lava flows, or ash plumes include Pu'u 'Ō'ō vent and Halema'uma'u crater that lies within Kilauea's summit caldera

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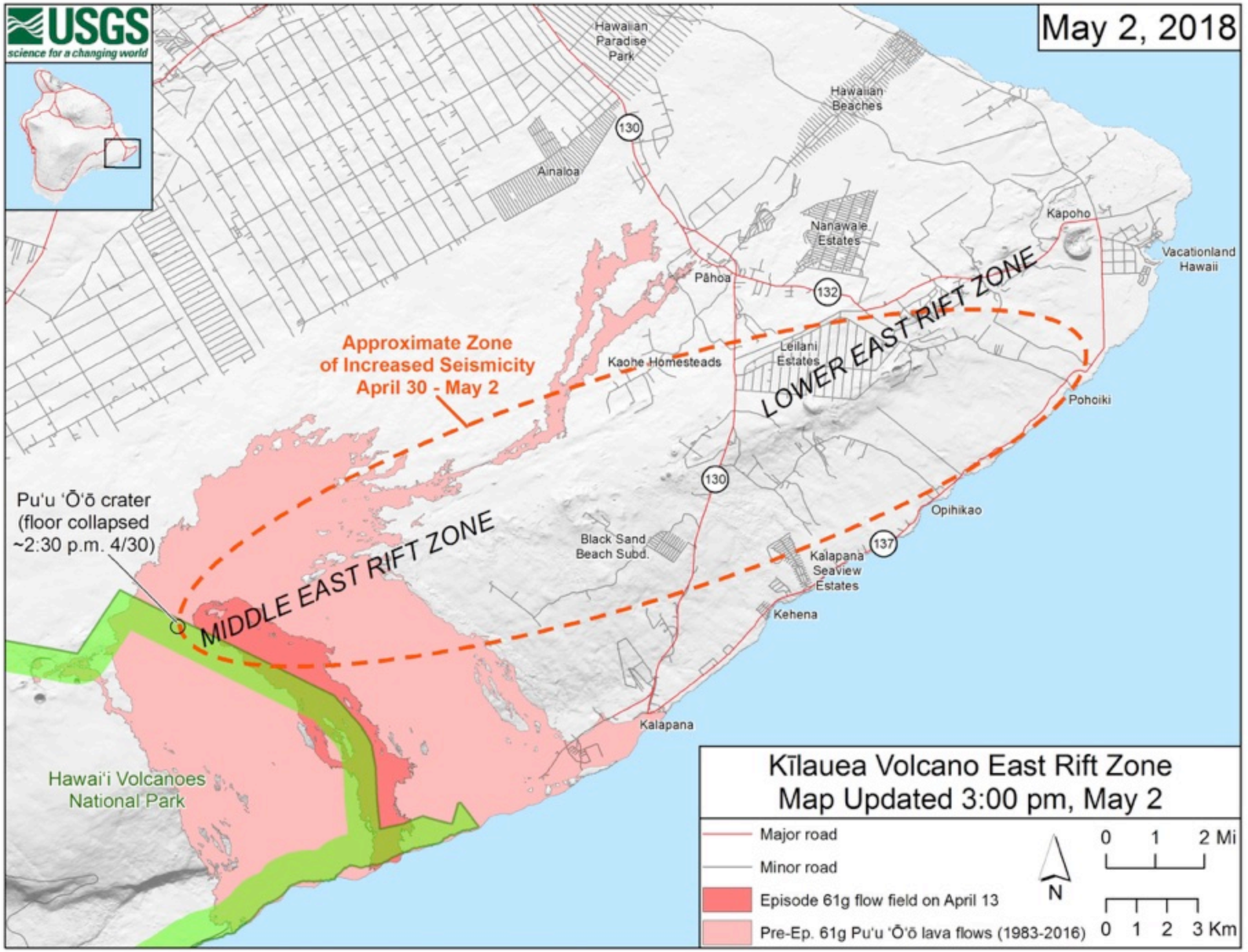
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May 2, 2018
Hawaiian Paradise Park
Hawaiian Beaches
Ainaloa
130
Kapoho
Nanawale Estates
Vacationland Hawaii
Pāhoa
132
Approximate Zone of Increased Seismicity April 30 - May 2
LOWER EAST RIFT ZONE
Kaohe Homesteads
Leilani Estates
Pohoiki
Pu'u 'Ō'ō crater (floor collapsed ~2:30 p.m. 4/30)
130
MIDDLE EAST RIFT ZONE
Opihikao
Black Sand Beach Subd.
137
Kalapana SeaView Estates
Kehena
Kalapana
Hawai'i Volcanoes National Park
Kīlauea Volcano East Rift Zone
Map Updated 3:00 pm, May 2
Major road
Minor road
Episode 61g flow field on April 13
Pre-Ep. 61g Pu'u 'Ō'ō lava flows (1983-2016)
N
0 1 2 Mi
0 1 2 3 Km

Active Fissures 1 - 4 on May 4th 2018, Leilani Estates subdivision

Large amounts of sulfur dioxide being emitted at fissure vents

Accumulation of lava spatter producing short runout lava flows of a few tens of meters from vent

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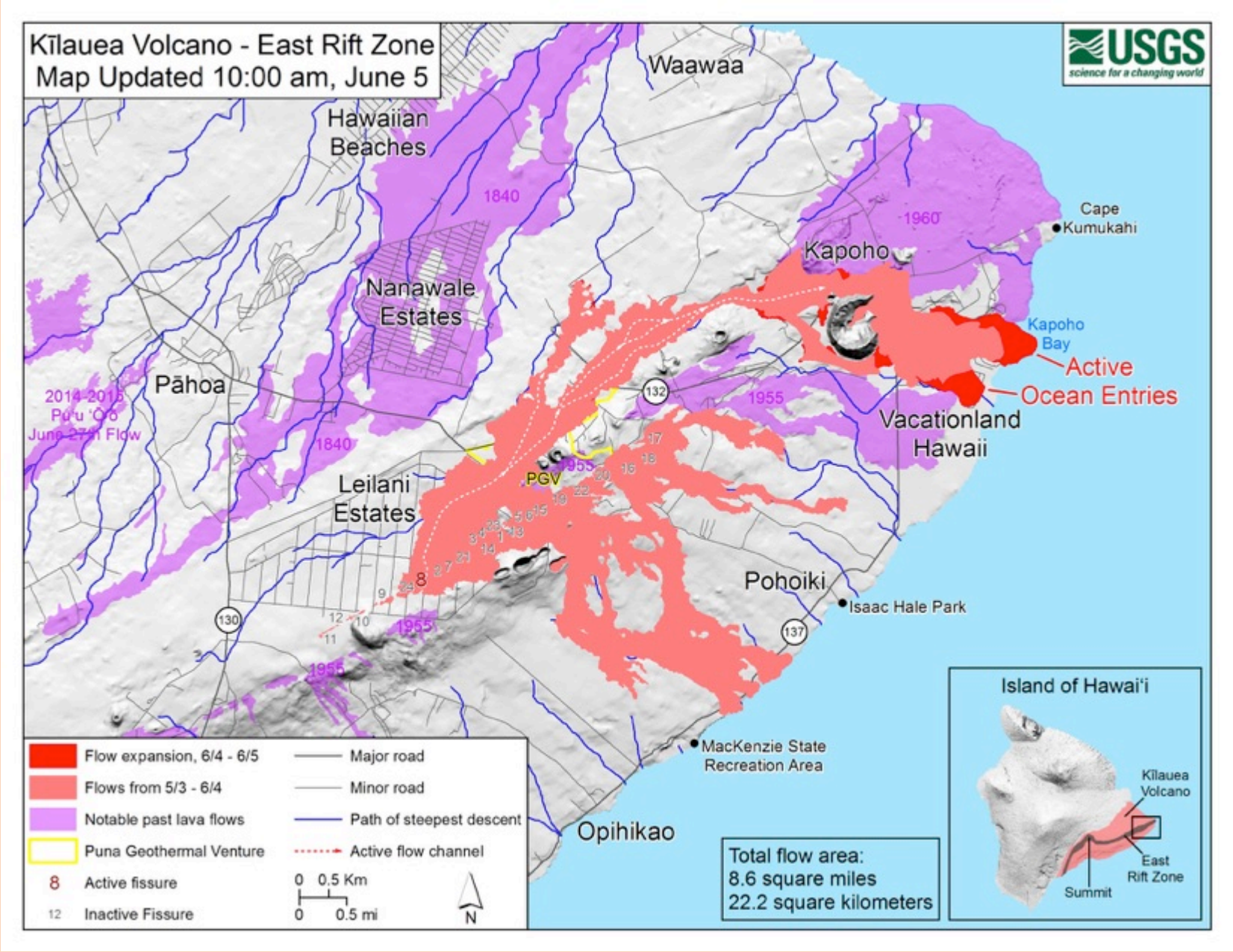
After 1 month of eruptive activity in Lower East Rift Zone

Now 24 Fissures some combining during eruption

Hotter and more fluid lava now being erupted

Lava flows moving several miles from vent

Lava flows have reached the ocean 4 times



Vigorous reactivation of older fissures

Other flow lobes may reach the ocean in days ahead

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Fissure 8 lava flow entering Kapoho Bay June 4, 2018

Flow entrance to Kapoho Bay produced vigorous **laze** plume that drifted inland, but dissipated quickly. **Laze is a corrosive mixture of steam, hydrochloric acid and volcanic glass particles** that irritates the skin, eyes, and throat and makes breathing difficult. Kapoho Bay is now mostly filled with lava.

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At Kilauea's summit potential for explosive ash forming eruptions

On May 15, HVO issued a Volcano Observatory Notice for Aviation and raised color code from Orange to Red due to increased intensity of ash emission from Overlook Crater within Halema'uma'u.

Photo of Kilauea's Halema'uma'u crater in eruption May 18, 1924. Photo from northwest rim of Kilauea summit **present site of HVO**

Ash-rich plume on May 16

At 4:15 am HST on May 17 an explosion of a few minutes from Overlook Crater within Halema'uma'u produced an ash plume to **30,000 fee**t confirmed by **NOAA/NWS NEXRAD radar.**

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Current Volcanic Hazards from Kilauea Eruptions

East Rift Zone (Puʻu ʻŌʻō) vents and lava flow field

- Near-vent areas could erupt or collapse without warning, ejecting spatter and/or ash that can be carried downwind within the gas plume.
- Advancing lava erupted at 1150°C (2100°F), igniting everything in its path
- Potentially lethal concentrations of sulfur dioxide gas may be present within 1 km downwind of vent. Formation of vog downwind.
- Active lava flows within forested areas can produce methane blasts capable of propelling boulder-sized rocks and other debris into the air.

Summit (Halemaʼumaʼu) vent

- Tephra including volcanic ash and Pele's hair, can be carried several kilometers downwind of the summit vent within Halemaʼumaʼu (Overlook Crater)
- Potentially lethal concentrations of sulfur dioxide can be present within 1 km (0.6 mi) downwind of the summit vent. Formation of vog downwind
- Explosive eruptions in the summit of Kilauea can throw fragments of rocks and molten lava up to 2 m (6.5 ft) in diameter on to rim of Halemaʼumaʼu Crater, an area that has been closed to the public since early 2008 due to volcanic hazards.

Earthquake Hazards Lower East Rift Zone and island wide

- Large magnitude M6.9 earthquake on May 4, and associated aftershocks in next few weeks

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Lava flow threat to Puna Geothermal Venture Plant

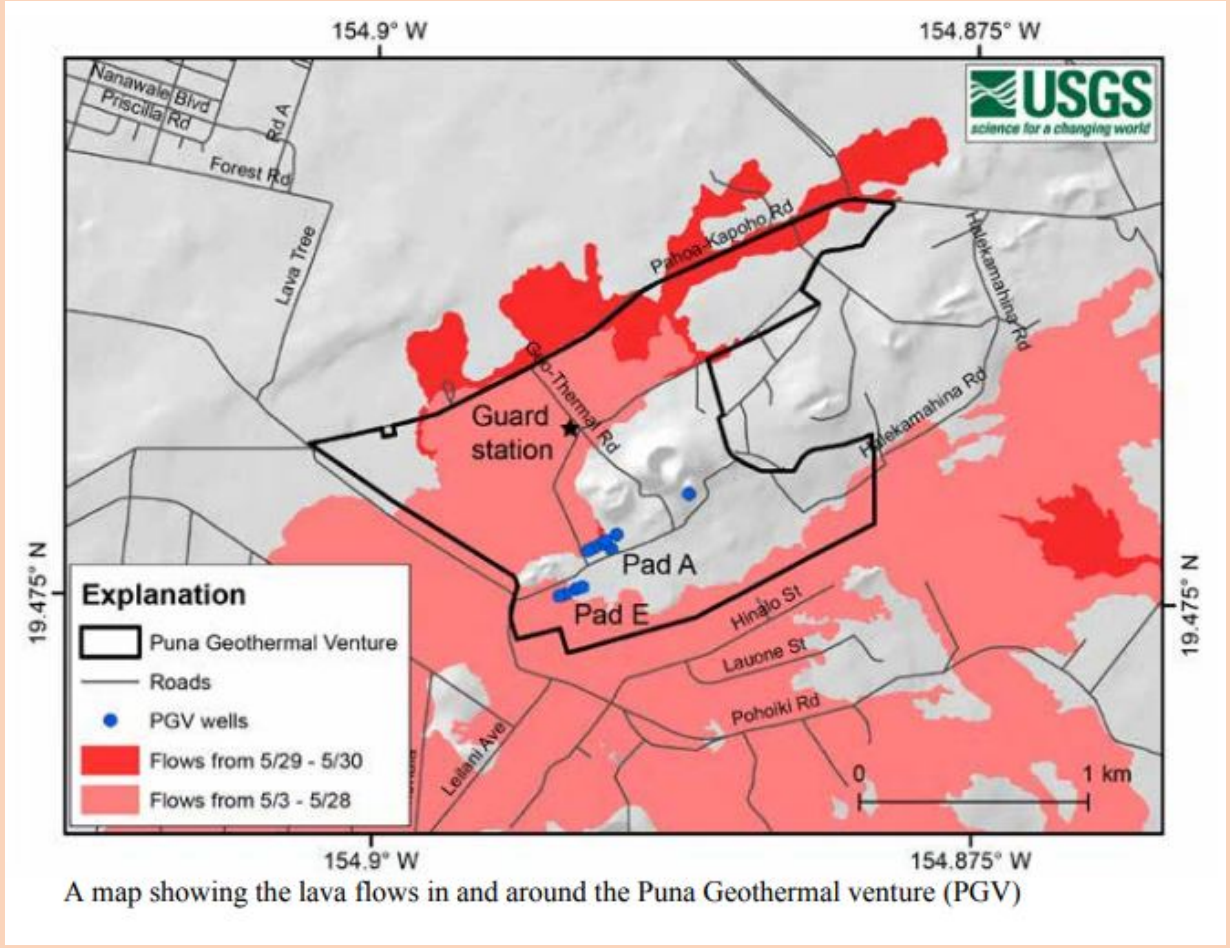
Governor Ige convened task force of experts led by Hawaii Emergency Management Agency to take mitigation measures including:

Shutdown of plant at start of LERZ eruption

Removal of 60,000 gal. of pentane from site -transport to Hilo

Flushing of pentane turbine system with nitrogen gas to ensure no residual pentane vapor

Removal of external pipes to well heads, closure of shut off valves, master valves buried in cinder and disconnected from above ground valves, wells quenched with cold water, metal bridge plugs inserted at depth and cemented.



A map showing the lava flows in and around the Puna Geothermal venture (PGV)

Ormat, the PGV operator, expanded H_2S monitoring around site. No release of toxic H_2S thus far

Lava flows have now encroached on PGV lands and now have covered parts of well Pad E and wells KS-5 and KS-6 and the entrance road to PGV

Of future concern: Fate of well heads buried under lava

Release of toxic H_2S

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USGS Response

- The USGS Hawaiian Volcano Observatory is working closely with Hawai‘i County Civil Defense, Hawai‘i State Emergency Management, the National Park Service, FEMA and others to prepare for continued outbreak of lava threatening people and developed areas.
- USGS has 24/7 presence in the lava flow areas where USGS geologists and a USGS-OAS Unmanned Aircraft System Team track fissure activity and the advancement of lava flows.
- Sixteen USGS scientists from the other USGS volcano observatories and other USGS centers are on site in Hawaii assisting the Hawaiian Volcano Observatory (HVO).
- Using data from real-time networks of seismometers, tiltmeters, GPS and other instruments, data from satellite, UAS, and field observations, USGS scientists at HVO closely monitor activity for signs that hazardous conditions have increased, or may increase.
- Staff at other USGS volcano observatories are assisting in the response with public affairs, operations, and scientific interpretation. Other USGS staff and resources such as satellite data acquisition, Office of Communications, and supercomputing are assisting.
- USGS has a scientist 24/7 at the County Emergency Operations Center in Hilo. USGS has a mission-assigned subject matter expert to the FEMA Incident Management Assistance Team in Hilo. A second USGS scientist is splitting time between the County’s emergency response team and the IMAT. A third scientist is embedded with the County Emergency Operations Center on Oahu.
- The USGS, Hawai’I Volcanoes National Park, and Hawaii County Civil Defense have scheduled daily media briefings. The local, national, and international media interest remains high.
- HVO is communicating with the public concerning the on-going situation through media, fielding direct inquiries, through its website and cooperation with Civil Defense.
    - https://volcanoes.usgs.gov/observatories/hvo/

Key Partners

Hawai‘i County Civil Defense, Hawai‘i State Emergency Management, the National Park Service, FEMA, NOAA/National Weather Service, NASA, U.S. Army Corps of Engineers

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Pahala Town Hall Meeting on Ash Fall and Vog

Tina Neal, Scientist-in-Charge of HVO and David Damby of USGS

Talmadge Magno, Hawaii County Civil Defense Administrator, Wendy Stovall of USGS Cascades Volcano Observatory

USGS scientists working with Hawaii County Civil Defense Emergency responders to give the public the information and resources they need to protect themselves from ash fall and vog hazards.

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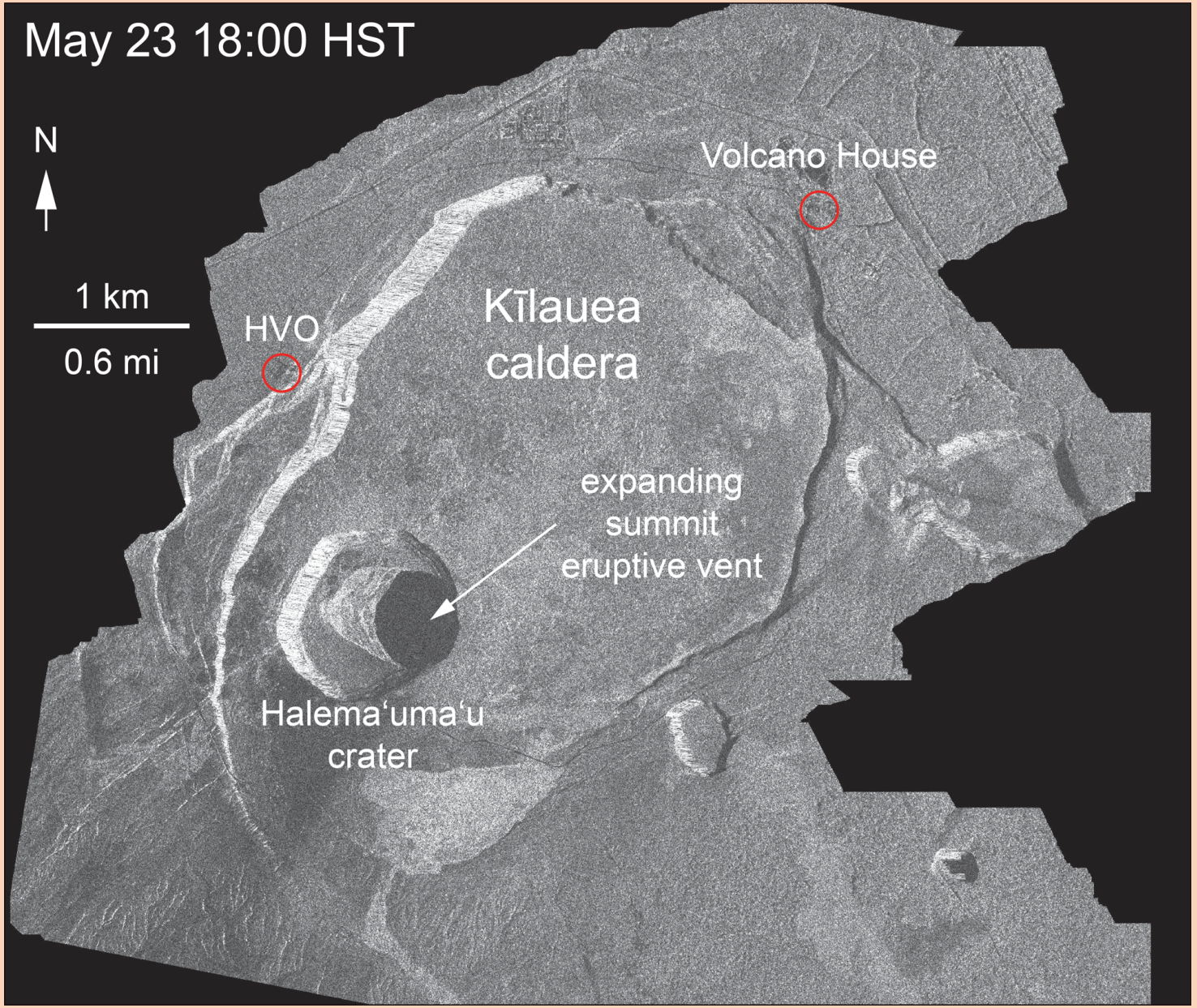
Remote Sensing data is critical for situational awareness



Cosmo SkyMed SAR images (ASI) reveal major changes in Halema'uma'u crater in Kilauea's summit

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UAS flight provides spectacular view inside Halema’uma’u crater

Intense steaming from new collapse pit to north

New cracks and faults reflect ongoing subsidence

Footage shows rubble covered floor from recent wall collapse

Video image May 31, 2018 from USGS UAS OAS Dept. of Interior

Special Thanks to NASA Ames for engineering live video streaming on USGS-OAS UAS

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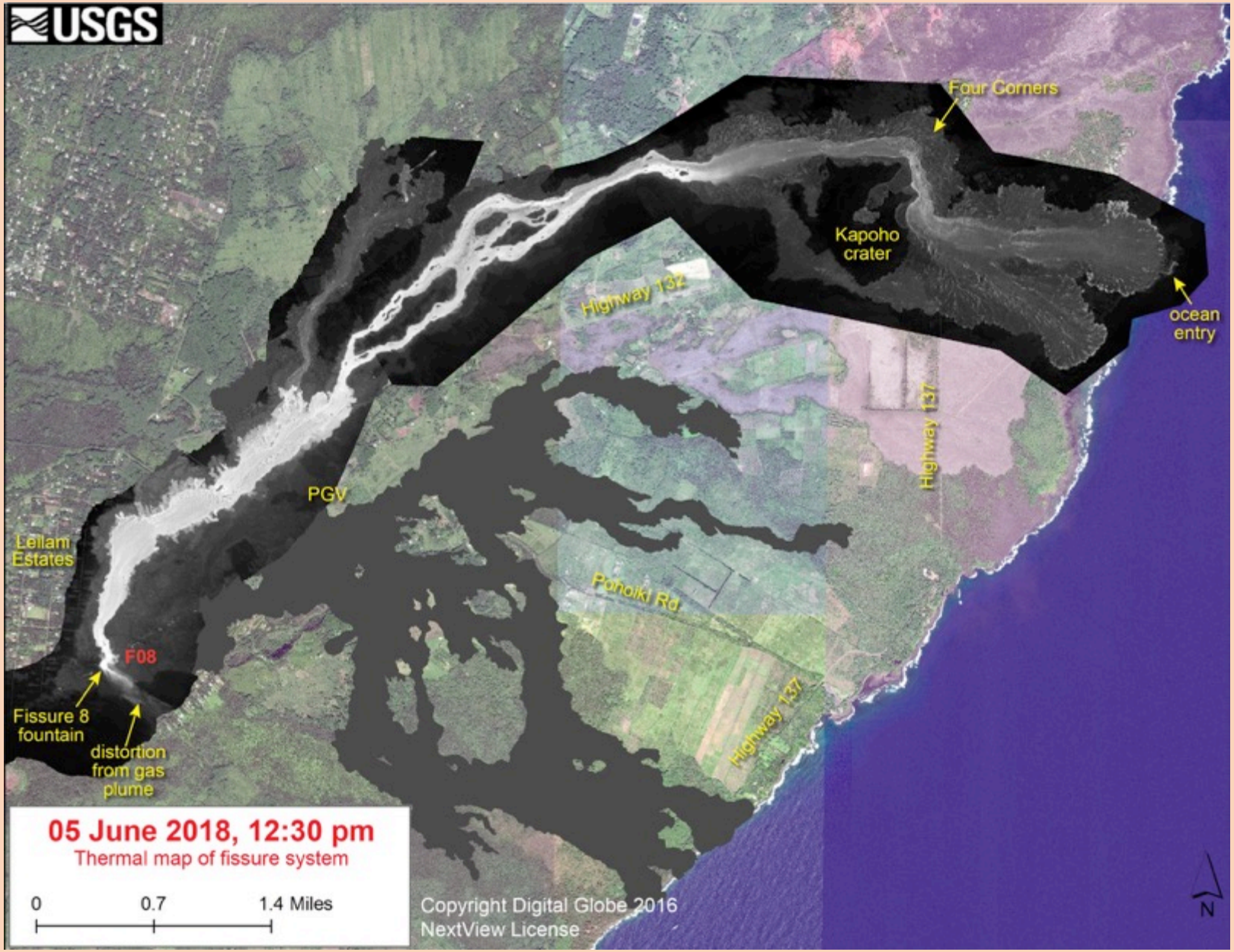
Thermal camera map of channelized Fissure 8 lava flow

Fissure 8 fed lava flow cuts Hwy132 and Hwy137 and enters ocean at Kapoho Bay



Flow extends 750 yds into Kapoho Bay

Vacationland and Kapoho Beach Lots no longer accessible by roads

Many more homes destroyed past 24 hours

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What Comes Next ?

- Monitoring data are consistent with continued accumulation of magma within the East Rift Zone. It is unknown whether the flows will continue to advance, or stop, and new lava flows are likely given the rate of activity seen at the rift zone. Additional outbreaks of lava are expected. It is not possible at this time to say when and where new vents may occur. Existing fissures may also be reactivated.
- Lava entrance to the ocean will continue to cause laze plumes (a corrosive mixture of steam, hydrochloric acid and volcanic glass particles) that can irritate the skin eyes, and lungs and make breathing difficult. These plumes need to be avoided at shore and at sea.
- At any time, activity at Kīlauea's summit may again become more explosive, increasing the intensity of ash production and producing ballistic projectiles very near the vent. Communities downwind should be prepared for ashfall as long as this activity continues. Ash could reach altitudes greater than 20,000 ft above sea level and pose a threat to aviation.
- Earthquakes in the summit area continue, as does deflation of the summit region. The earthquakes and ash explosions are occurring as the summit area subsides and adjusts to the withdrawal of magma from the summit.

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Questions?

For more information

Updates on activity will be posted on the HVO website at https://volcanoes.usgs.gov/volcanoes/kilauea/status.html

You can receive these updates by email through a free subscription service: https://volcanoes.usgs.gov/vns2/

Fissures #2 and #7 in eruption on 5/5/18

Resource on volcanic ash hazards: https://volcanoes.usgs.gov/volcanic_ash/

Resource on vog: https://vog.ivhhn.org/

Hawai‘i County Civil Defense will issue its own hazard notices should that become necessary: http://www.hawaiicounty.gov/active-alerts/

Hawai‘i Volcanoes National Park status is posted on their web page: https://www.nps.gov/havo/index.htm

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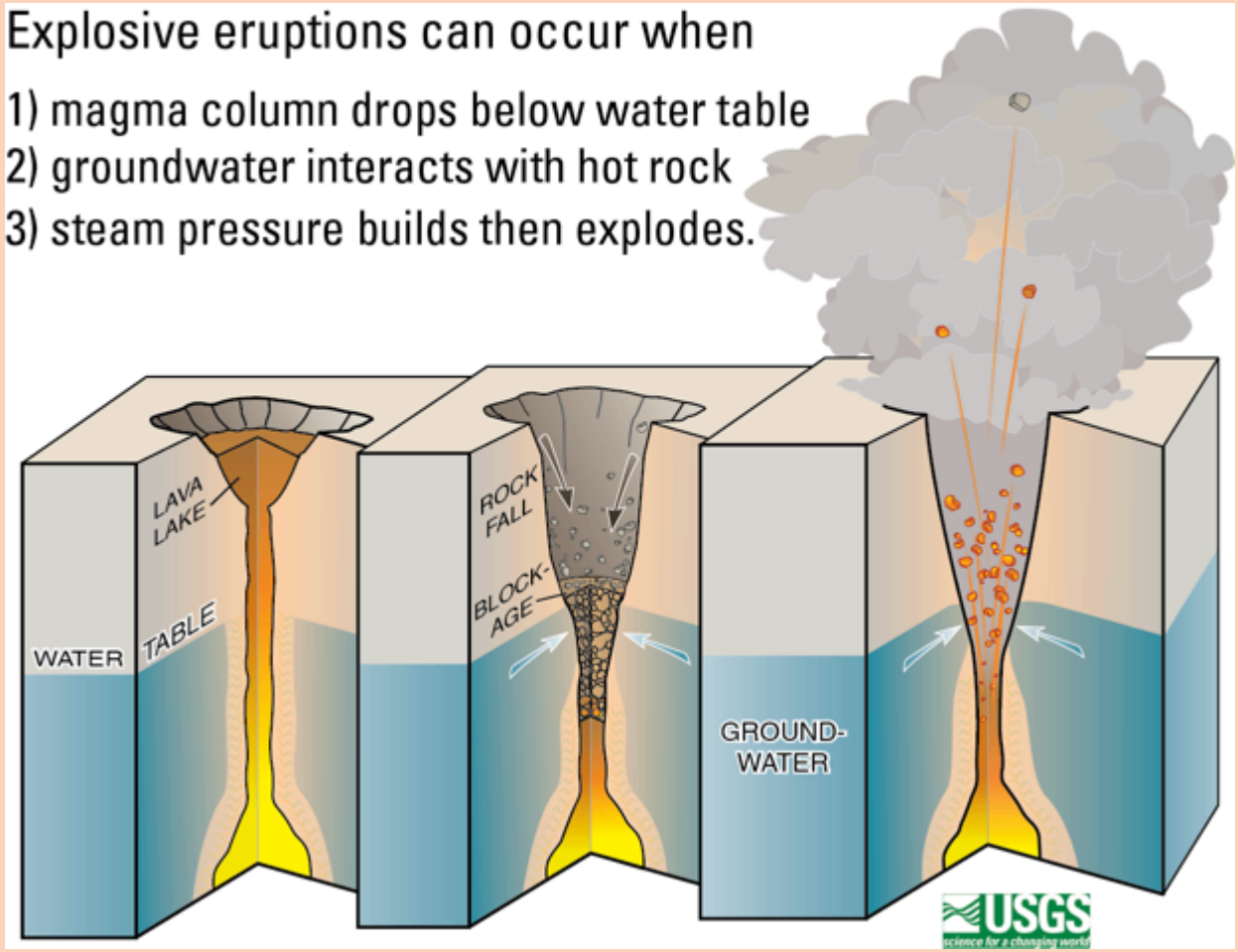
Potential Ballistics and Ash Hazards, and Mechanisms



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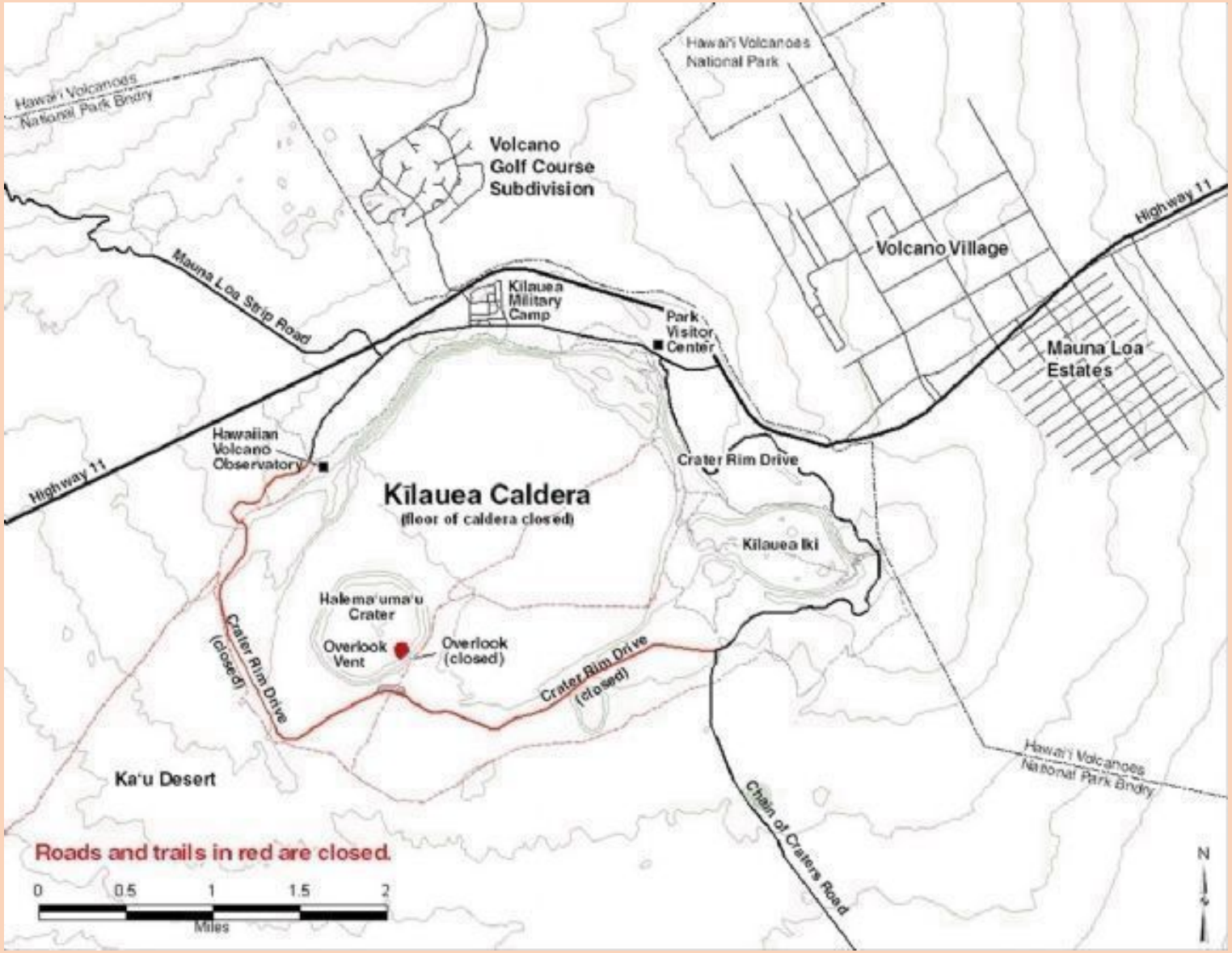
Kilauea Summit in detail map



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HVO Status as of May 18th, 2018

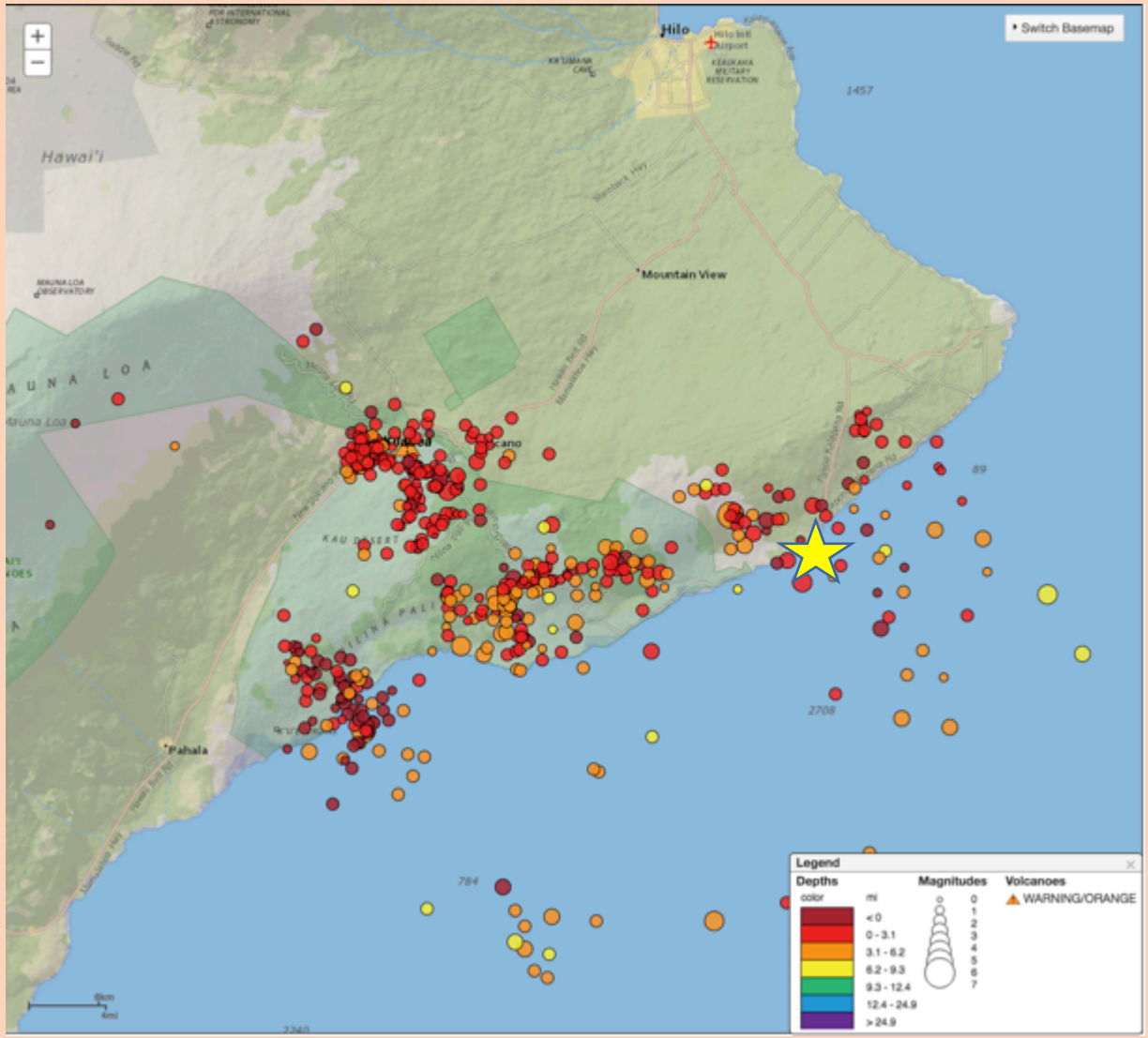
- HVO building is serving as an unattended data hub at present with power and secure internet connectivity
- All HVO staff are working from alternate site at UH-Hilo campus .
- Space for USGS staff at UH-Hilo is available and currently operational. At this time secured DOINET communications have been established.
- Power and communications lines to HVO are buried within the park boundaries.
- HVO can maintain current monitoring capabilities from HVO data hub and offsite U HI Hilo location.
- If our access to the HVO facility and the power to the existing monitoring hardware is lost, our monitoring capabilities will be severely deprecated. To restore monitoring capabilities a major realignment of the monitoring network will be required.

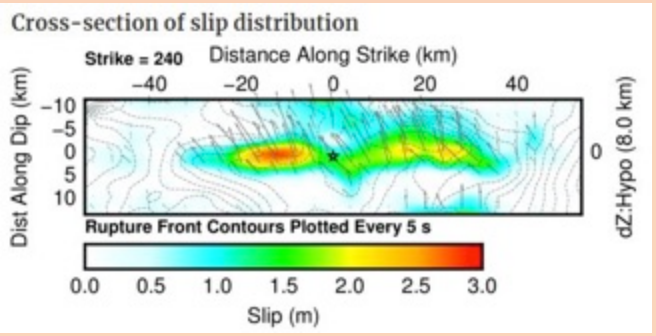
Crack in flooring in HVO


New crack in HVO parking lot

Map of Earthquakes located by HVO by May 5th, 2018

Between noon on May 4 to noon May 5, 2018, 500 earthquakes had been located by HVO. The M6.9 at 12:32 pm on Friday May 4th was preceded by two foreshocks M5.4 and M4.4 at 11:32 and 11:38, respectively. Moderate to strong aftershocks should be expected for weeks to months to come. The earthquakes are related to magma intrusion into the East Rift Zone and reflect adjustments beneath the south flank of the volcano.





Current GPS data do not support slip along Hillina Pali and Holei Pali