



**Asia-Pacific
Economic Cooperation**

2018/SOM3/EPWG/015

Agenda Item: 10.17

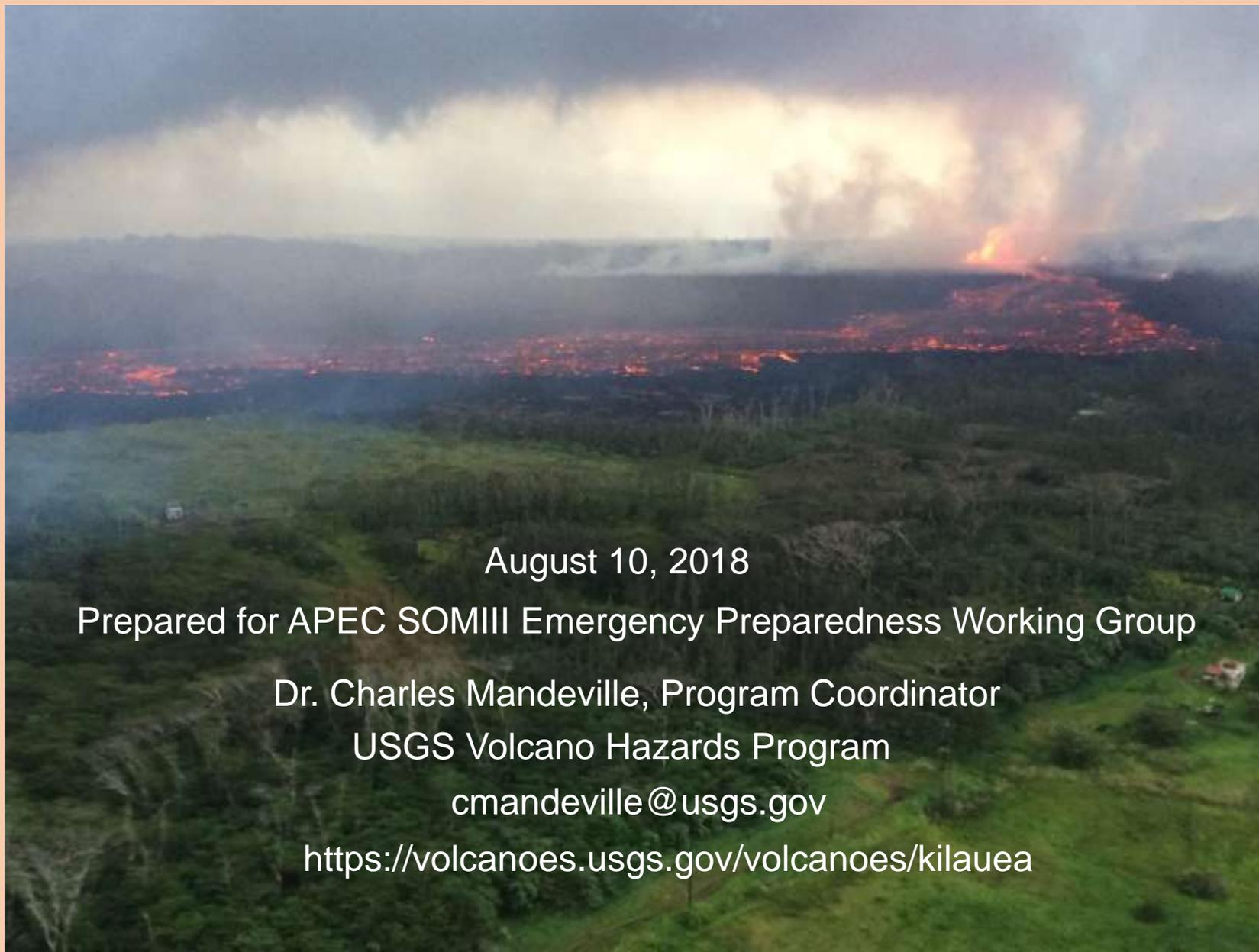
Kilauea Summit and East Rift Zone Eruption Update

Purpose: Information
Submitted by: United States



**14th Emergency Preparedness Working
Group Meeting
Port Moresby, Papua New Guinea
10–11 August 2018**

Kilauea Summit and East Rift Zone Eruption Update



August 10, 2018

Prepared for APEC SOMIII Emergency Preparedness Working Group

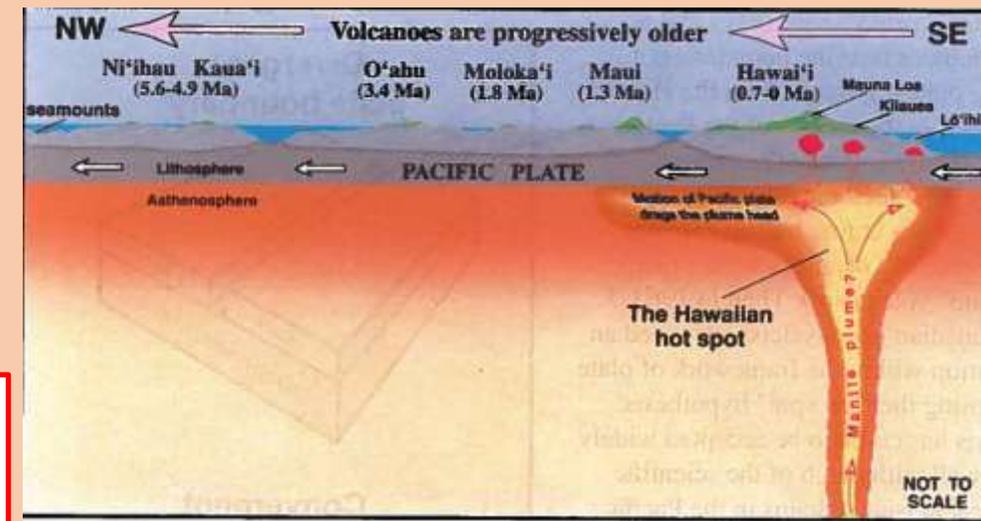
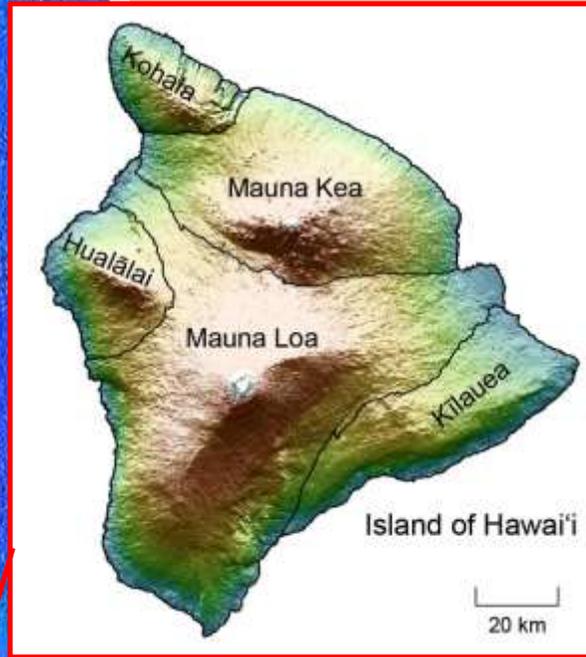
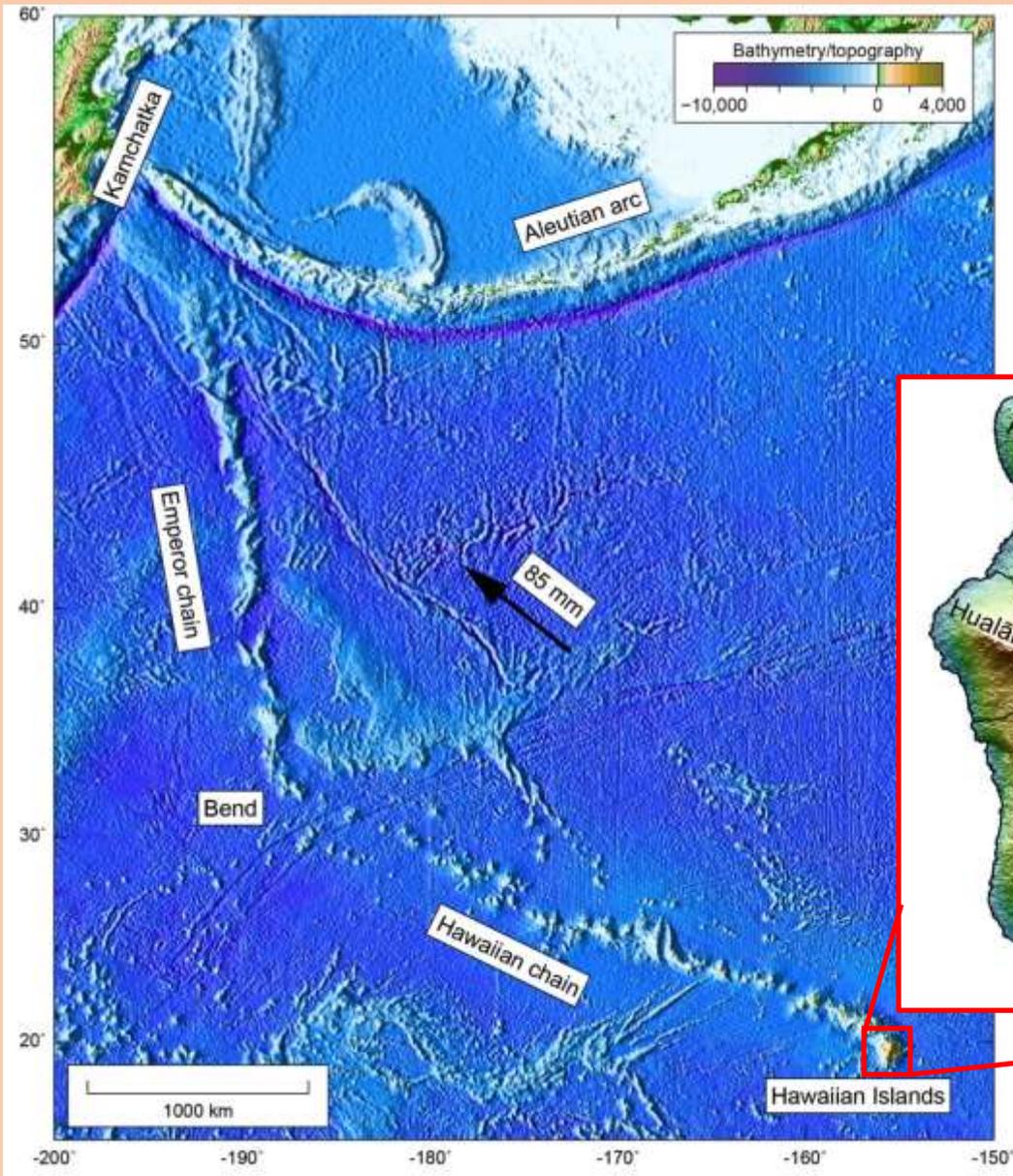
Dr. Charles Mandeville, Program Coordinator

USGS Volcano Hazards Program

cmandeville@usgs.gov

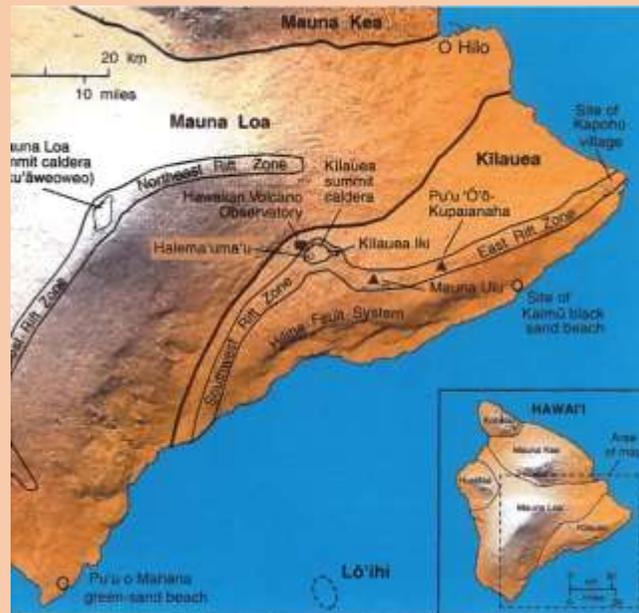
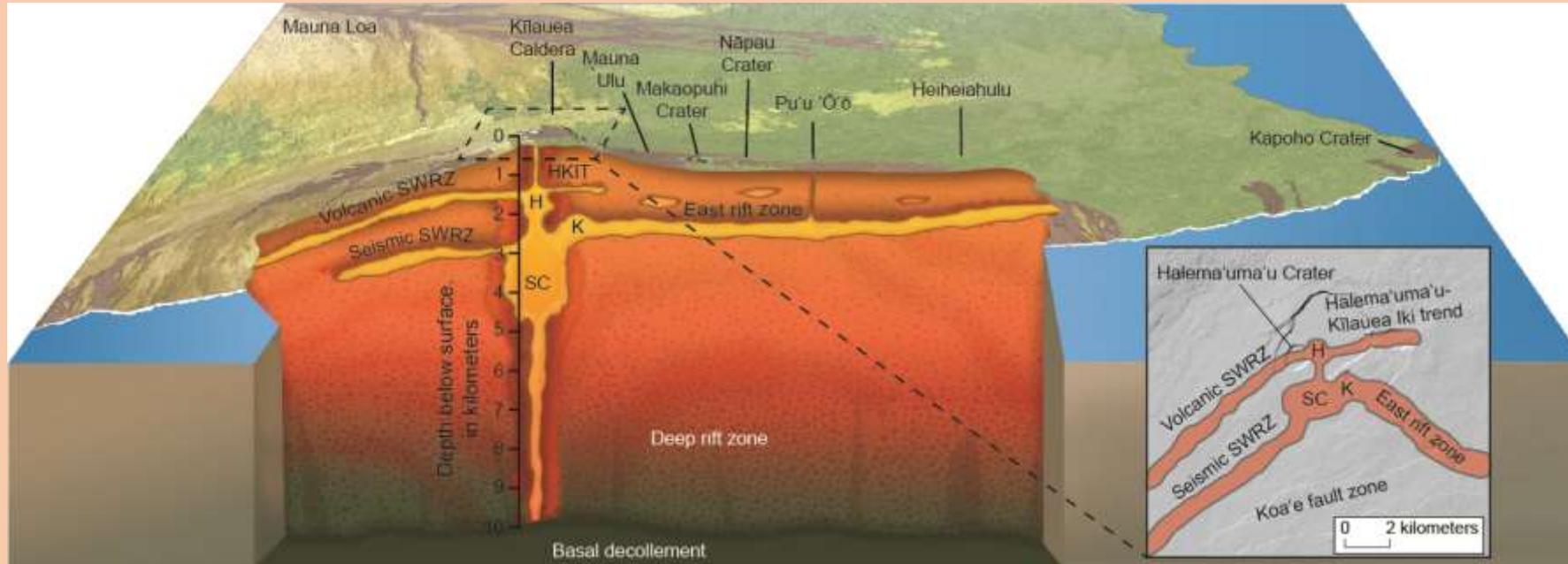
<https://volcanoes.usgs.gov/volcanoes/kilauea>

Hawaiian Island Chain originates from Hot Spot Volcanism



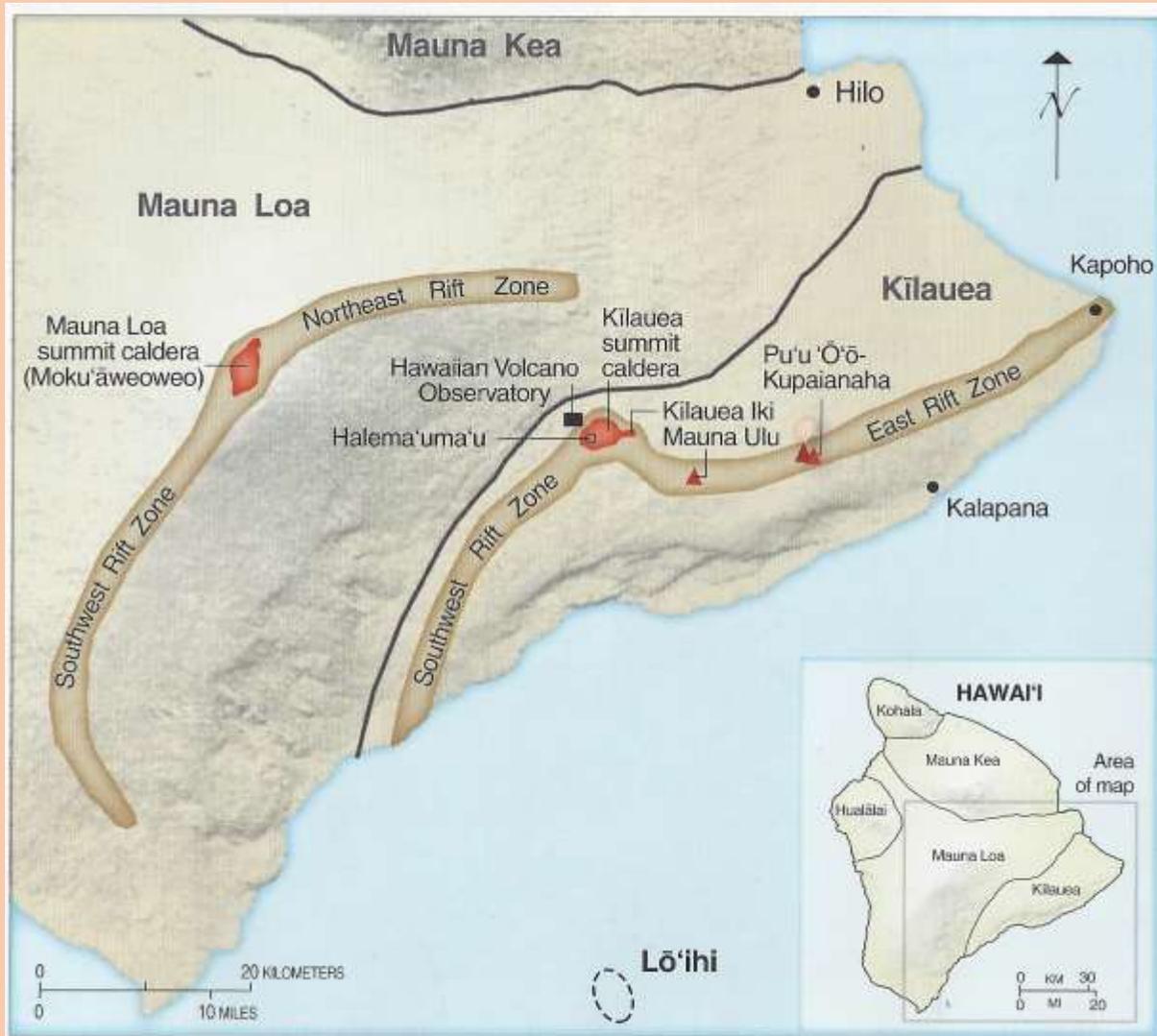
Pacific plate overrides a deep mantle hot spot and melting of hot mantle rocks in the plume generates basaltic magma that erupts to form a shield volcano. Kilauea is the youngest and most active.

Cross section of Kilauea Volcano and East Rift Zone



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

A bit of orientation first

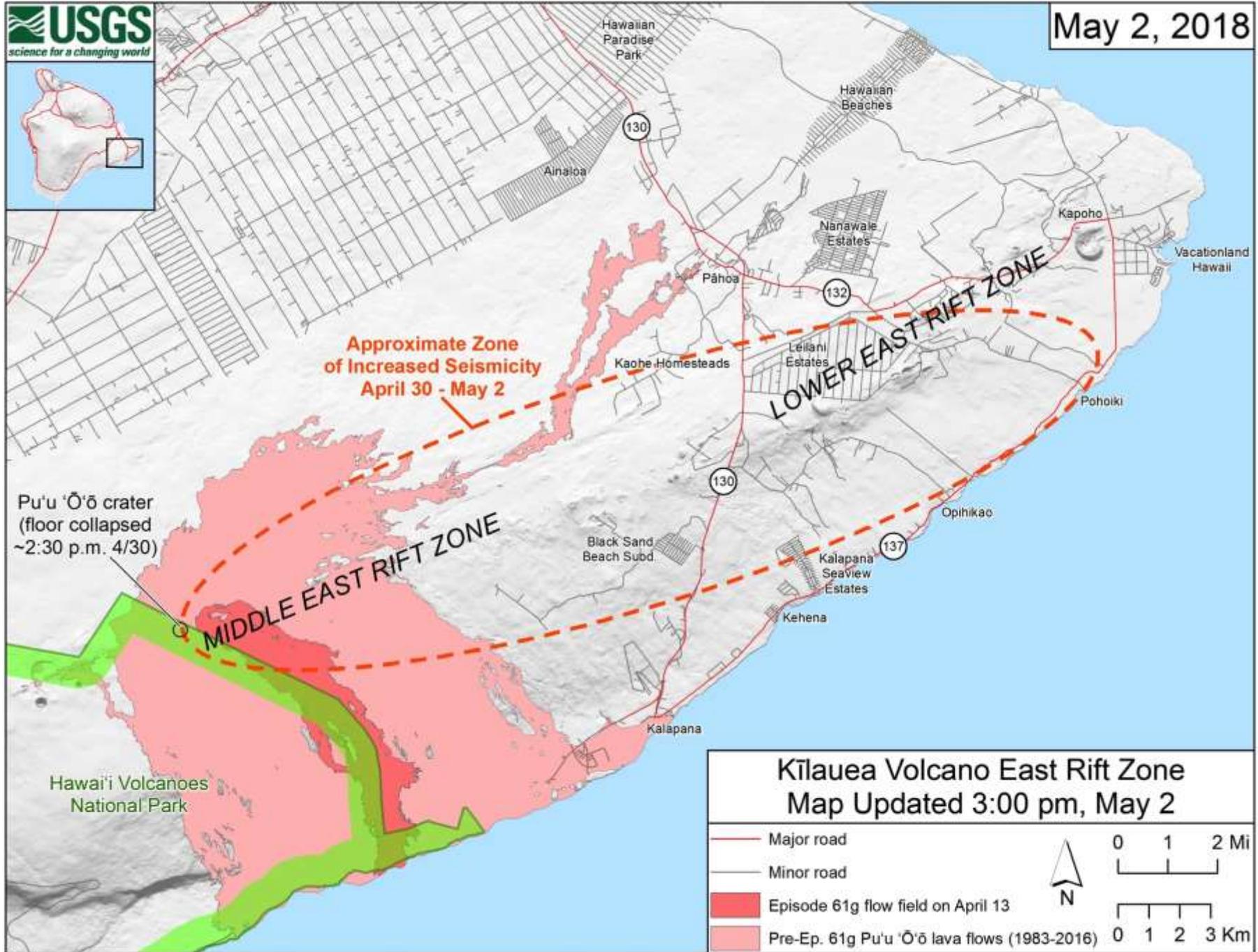


Sketch map showing the summit calderas and rift zones of Kilauea and Mauna Loa Volcanoes. Also shown are the locations of the Hawaiian Volcano Observatory, sites of some recent eruption vents on Kilauea, and the growing submarine volcano Lō'ihi offshore to the south. Inset shows all five volcanoes that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



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**

USGS photo by T. Neal

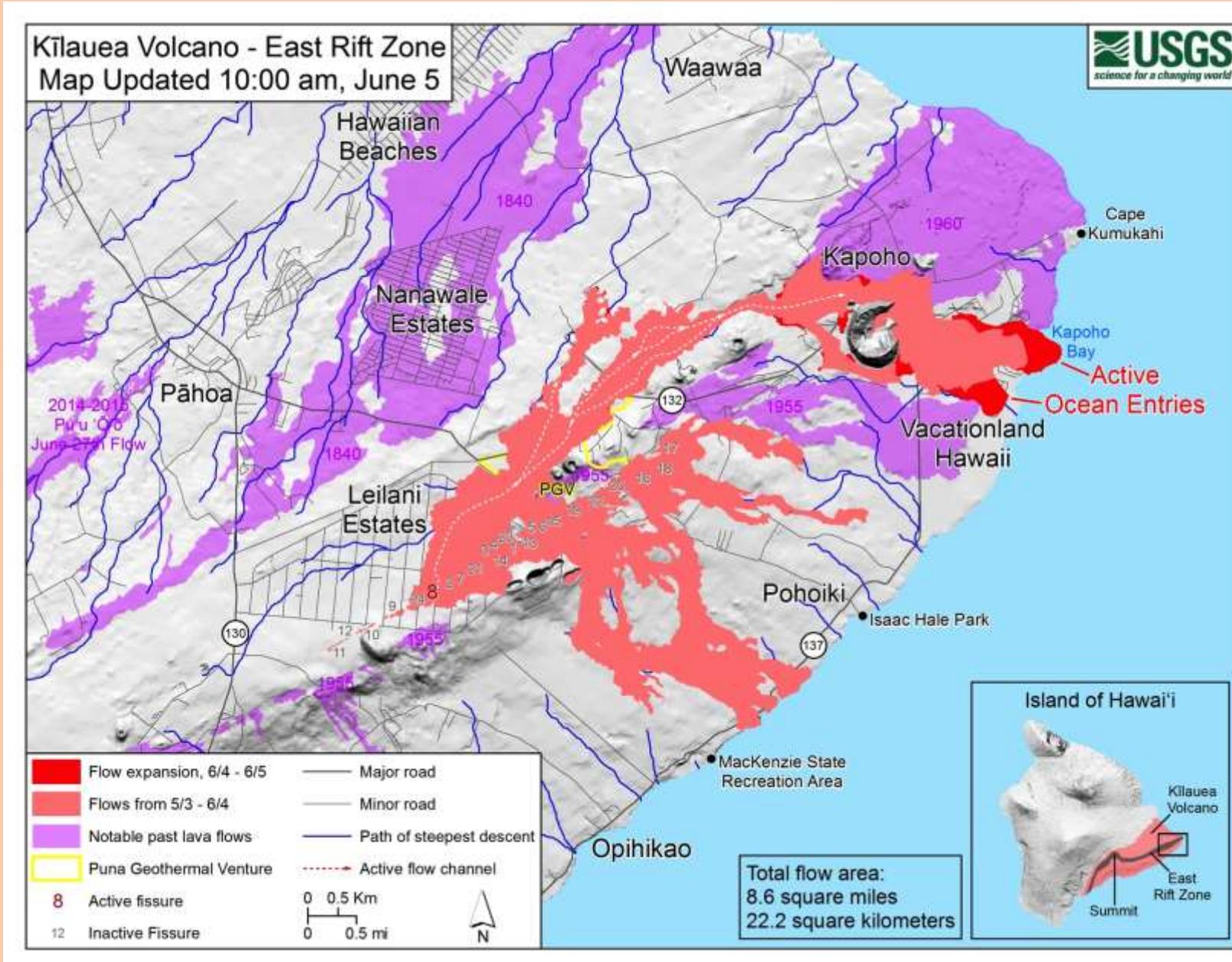
After 1 Month of Eruptive Activity in Lower East Rift Zone

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

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.

Current Volcanic Hazards from Kilauea Eruptions

East Rift Zone (Pu'u 'Ō'ō) 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 (Halema'uma'u) vent

- Tephra including volcanic ash and Pele's hair, can be carried several kilometers downwind of the summit vent within Halema'uma'u (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 Halema'uma'u 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

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 feet** confirmed by **NOAA/NWS NEXRAD** radar.

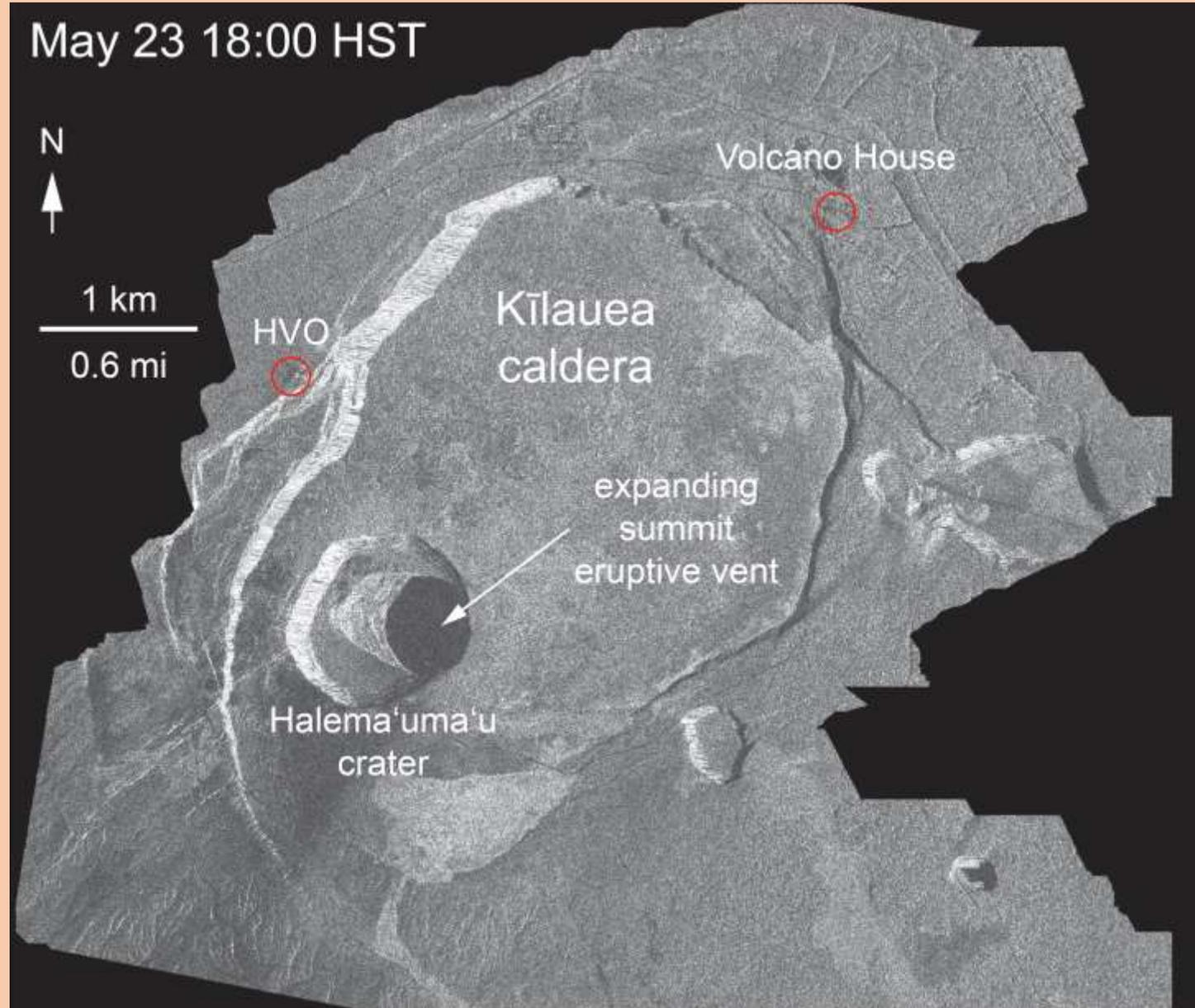
USGS Response

- 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

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

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

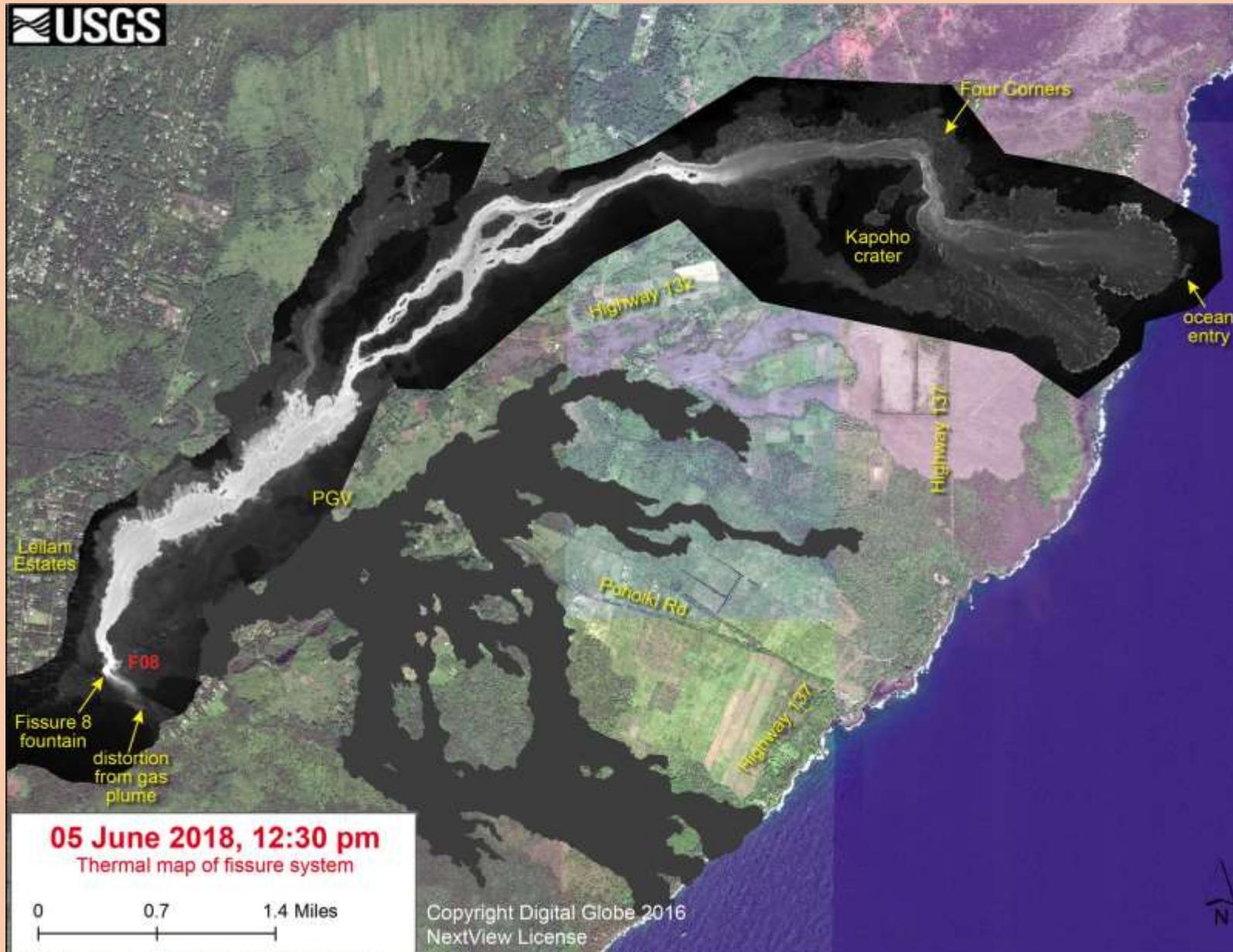
Footage shows rubble covered floor from recent wall collapse

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

Thermal camera map of channelized Fissure 8 lava flow on June 5th, 2018

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

What Comes Next ? (as of 6-7-2018)



- 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.

After 3 Months of Kilauea Eruptive Activity in the Lower East Rift Zone

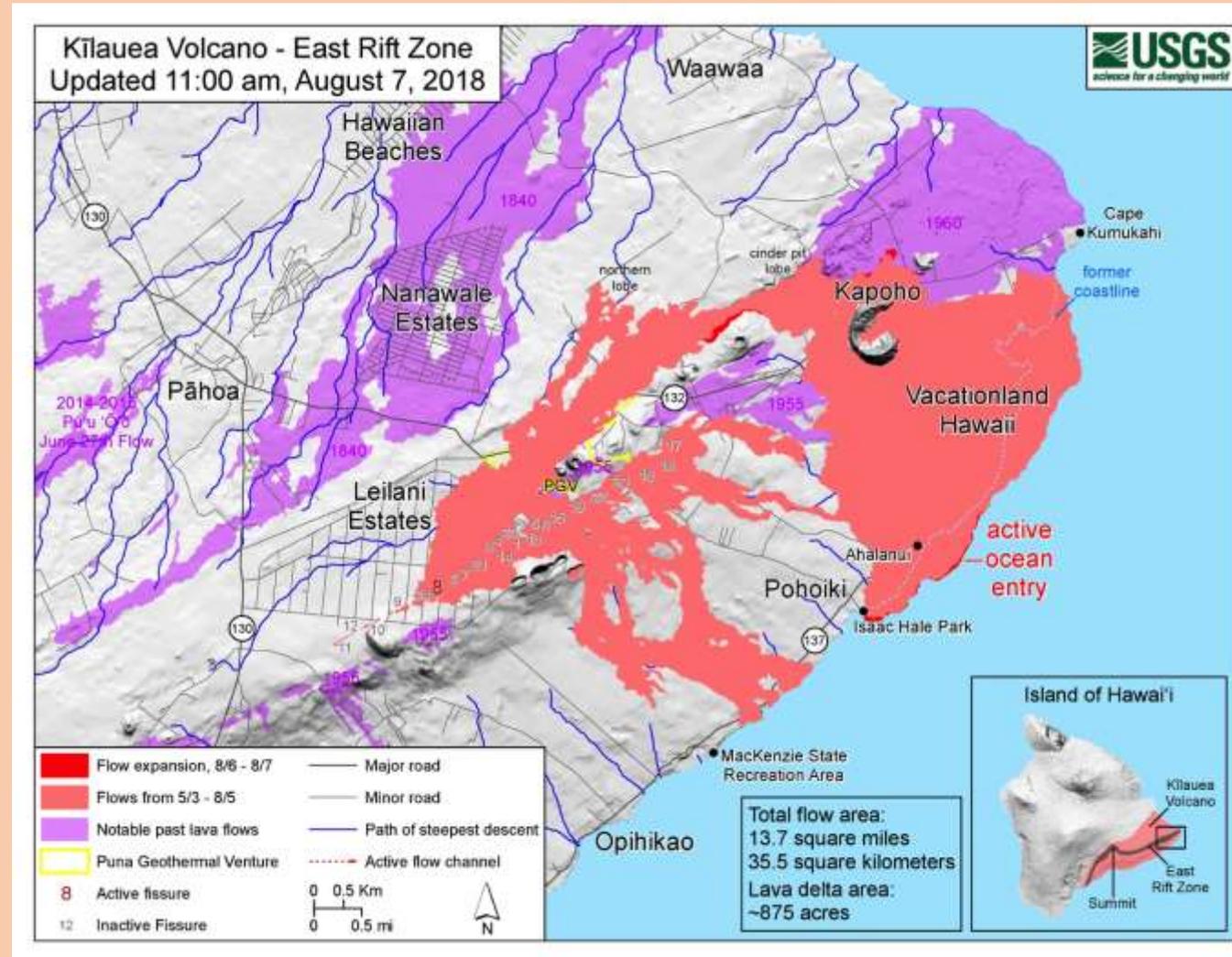
Fissure 8 lava flow dominated the activity since June 6th

As of July 19, 2018, several thousand people evacuated

Slowly moving lava flow front is only 70 meters from the Boat Ramp at Isaac Hale Park

A highly fluid lava flow from Fissure 8 travelled 8.5 miles to the ocean and completely filled Kapoho Bay

More than 700 structures damaged or destroyed



Changes in Kilauea's Eruption since Saturday, August 4, 2018

Magma leaving Kilauea's summit to feed Fissure 8 in the Lower East Rift Zone has significantly decreased



Stoppage of lava fountaining at Fissure 8, now only a small lava pond present as of August 4th, 2018.



Fissure 8 flow is largely crusted over, only minor oozing along flow fronts at the coast.

Eruption is not over, but may wax and wane for longer period

At Kilauea's summit as of August 6th, 2018

Profound changes in Kilauea's summit in the past three months

Magma supply from Kilauea's summit to LERZ has led to widespread subsidence of hundreds of meters



Collapse-explosion events have the energy equivalence M5.2 to M5.5 earthquakes

Halema'uma'u Crater within Kilauea's summit caldera has more than doubled in diameter and more than tripled in depth since May 16, 2018.

Seismicity through most of May, June, and July was elevated and cyclic, with periods of 25-40 events per hour, leading up to collapse-explosions, then a drop in events, followed by 24 to 50 hours of ramp up to next collapse-explosion.

Over 60 collapse-explosion events have taken place on a nearly daily basis since early June

Seismicity, deformation and collapse events have decreased significantly following the last collapse event on August 2, 11:55 am HST. Deformation as measured on tiltmeters and GPS instruments has slowed since August 4th

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/>



Resource on volcanic ash hazards: https://volcanoes.usgs.gov/volcanic_ash/ Fissures #2 and #7 in eruption on 5/5/18

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>