The data presented here is only possible because of the long-term continuous monitoring and geologic mapping efforts at HVO.

Kudos to the dedicated personnel at HVO; past and present!
Uwēkahuna, incl. Kulanaokuaiki Tephra

Stratigraphically older than ash

Stratigraphically younger than ash

Lava flows—effusive activity dominant 40% of past 2500 y

Episodic explosive activity dominant 60% of past 2500 y
What’s happening at Mauna Loa during the same time frame?
500-200 BCE

Effusive activity at Kīlauea

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**Surface Area (SA) km²**: 288.3*

**SA km²/yr**: 0.96

**% of MLO area**: 1.3

**Vol km³**: 0.269

**Vol km³/yr**: 0.0009

**# of flows**: 12

**span in years**: 300

*Estimated SA
200 BCE – 1000 CE

Caldera formation and explosive activity at Kīlauea

Surface Area (SA) km² 1939.5
SA km²/yr 1.49
% of MLO area 38.0
Vol km³ 7.76
Vol km³/yr 0.006
# of flows 241
span in years 1300
Effusive activity at Kīlauea

1,000 – 1,500 CE

Surface Area (SA) km$^2$ 491.0
SA km$^2$/yr 0.98
% of MLO area 9.6
Vol km$^3$ 1.96
Vol km$^3$/yr 0.004
# of flows 102
span in years 500
1,500 – 1,800 CE

Caldera formation and explosive activity

- Surface Area (SA) km$^2$: 482.3
- SA km$^2$/yr: 1.61
- % of MLO area: 9.5
- Vol km$^3$: 1.93
- Vol km$^3$/yr: 0.006
- # of flows: 48
- span in years: 300
Last 200 years

Effusive activity at Kīlauea

Surface Area (SA) km² 734.4
SA km²/yr 3.67
% of MLO area 14.4
Vol km³ 2.94
Vol km³/yr 0.015
# of flows 33
span in years 200
Summary

- From the geologic record
  1. When Kilauea was in effusive eruption style
     - Mauna Loa showed modest activity
  2. When Kilauea was in recovery from episodic explosive activity
     - Mauna Loa activity was more robust.
GPS velocities from 2008-Present

GPS measures ground motion
How long has this asymmetrical style of deformation been occurring on MLO?

- For that we will look at Mauna Loa’s summit caldera
Profile across summit caldera and flow ages
A Current View of Mauna Loa Caldera

View of photo is from NE to SW

Note the eastern rim is lower than the western
Profile across summit caldera and flow ages

Legend:
- 600-500 CE
- 700-600 CE
- 800-700 CE
- 900-800 CE
- 1000-900 CE

130 m

A A'

West

East

2x Vert Exag.
Asymmetry in caldera wall height

- Since 1000 CE eastern portion of the caldera has subsided.
- From the prehistoric record asymmetric deformation appears to have occurred and continues to be an on-going process.
Mauna Loa
Seismicity: 2002-2005

Inflation began in 2002

June 2004 to April 2005
2 cm/yr
INSAR image of Ground Deformation 2005-2007
Summit caldera inflating

Radial deformation pattern
Impact to summit storage due to E flank movement

Reduced pressure
When Magma Supply is High
it overcomes flank motion (dilation)
Eruptions at Kīlauea and Mauna Loa are not affected
Kīlauea Summit: Explosive activity

- MS is recovering from devastation (Swanson 2011)
- FM is null

Mauna Loa: Eruptions not impacted

MS = Magma Supply
FM = Flank Motion
Kīlauea Summit with a Lava Lake

MS = modest
FM = is minimal in order to sustain the lava lake or high stand.

Mauna Loa: Eruptions not impacted
Eruptions from 1832 to 1950

Kīlauea Summit: Period dominated by Lava lake activity (black bars)
- MS is modest
- FM is null (Negligible)

Mauna Loa:
MS High = Eruptions not impacted
Kīlauea: Period dominated by **East Rift zone activity** and now in addition summit activity

- MS is high-moderate
- FM moderate to high
- Due to dike push

Mauna Loa:

- MS modest = Eruptions not occurring
- FM Moderate to low
Eruptive activity along Kīlauea’s rift zones drives the south flank
In turn Mauna Loa’s flank moves.  FM > MS = NO eruptions
Summary

✅ Asymmetrical deformation of the volcano is an ongoing process and centuries old

❖ From the geologic record there appears to be an inverse correlation of activity levels at the 2 volcanoes: Kīlauea and Mauna Loa

❖ When is Mauna Loa going to erupt?
  • When Kīlauea’s rift activity stops (no Flank Motion) and/or
  • There is an increase in magma supply to Mauna Loa to overcome the flank motion
Profile across summit caldera and flow ages

- >500 yrs flank motion Null
- <500 yrs flank motion is toward Kīlauea
Profile across summit caldera and flow ages

East-West profile across the summit of Mauna Loa

- >500 yrs flank motion Null
- <500 yrs flank motion is toward Kīlauea
Profile across summit caldera and flow ages