American Geophysical Union 2018

The 2018 Kilauea Eruption along the East Rift Zone Is Becoming Voluminous Enough to Cause Substantial Global Warming Just Like Other Extensive, Effusive, Sub-aerial, Basaltic Lava Flows Found Worldwide

Peter L. Ward, US Geological Survey retired

Throughout Earth history, extensive, sub-aerial, basaltic lava flows associated with continental rifting and hot spots have been contemporaneous with major global warming—the more extensive the flows, the longer the period of eruption, and the greater the warming of air and oceans. Around 251 Ma, basalts covered an area in Siberia of 5 million km^2 probably within 670,000 years, causing equatorial oceans to become highly acidic with temperatures >40°C. Approximately 96% of all marine species and 70% of all terrestrial vertebrate species went extinct in an environmental crisis mapped globally as the end of the Paleozoic. The Deccan basalts covered an area of 0.5 million km^2 around 66 Ma causing warming and extinctions that formed the end of the Mesozoic. Around 56 Ma, rifting of Norway from Greenland extruded as much basalt as 3000 km^3 per km of rift per million years, forming the Paleocene Eocene Thermal Maximum. Hundreds of smaller basalt eruptions punctuate the geologic time scale ending geologic eras, periods, epochs, and even ages.

In historic time, the Great Þjórsá Lava, covering 970 km^2 of Iceland, led to major warming around 8600 BP. The King's Bowl and Wapi lava fields covered 700 km^2 of the Snake River Plain in southern Idaho around 2250 BP during the Roman Warm Period. The basaltic volcano Eldgjá covered 800 km^2 of Iceland around 939 AD, associated with the Medieval Warm Period. The much smaller volcano Bárðarbunga erupted 85 km^2 of basalt in 6 months starting in 2014, the largest basalt flow since 1783, contemporaneous with sudden warming in the northern hemisphere of 0.47ºC from 2014 to 2016. The rate of flood-basalt areal coverage was 0.5 km^2 per day. The Kona eruption has been extruding basalts covering 0.6 to 0.4 km^2 per day from May 3 through July 27. If this eruption continues for 6 months, it could affect climate as much as Bárðarbunga.

Warming appears caused by ozone depletion, allowing more UV-B than usual to reach Earth. UV-B radiation is hot enough to burn skin and is 48 times hotter than infrared radiation absorbed strongly by CO_2. Basaltic eruptions emit especially high volumes of chlorine and bromine, which are observed to cause ozone depletion. The exact chemical path is not yet well understood. Heat waves during the summer of 2018 are associated with a "sharply kinked" jet stream often thought caused by ozone depletion.

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Large basaltic lava flows covering areas from tens to millions of square kilometers have been observed throughout Earth history to be accompanied by sudden increases in global temperature. Basaltic lava erupted this year from the East Rift Zone of Kilauea volcano has been flowing out over land at a rate of 0.5 km^2 per day from May 3 to July 27, when this abstract was written. This high rate of lava flow is similar to the 2014 to 2015 eruption of Bárðarbunga volcano in Iceland, the largest basaltic eruption since 1783. Bárðarbunga extruded lava for six months covering an area of 85 km^2 at a rate of 0.5 km^2 per day. Average temperatures throughout the northern hemisphere, which had remained relatively constant from 1998 through 2013, a period described extensively in the literature as the Global Warming Hiatus, began rising suddenly in 2014, reaching a peak that was 0.5^oC hotter in 2016, cooling slightly in 2017. If the Kilauea eruption continues for another four months, it could have a similar effect on average northern-hemisphere temperatures.

Submission:

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Abstract Text:

Throughout Earth history, extensive, sub-aerial, basaltic lava flows associated with continental rifting and hot spots have been contemporaneous with major global warming—the more extensive the flows, the longer the period of eruption, and the greater the warming of air and oceans. Around 251 Ma, basalts covered an area in Siberia of 5 million km2 probably within 670,000 years, causing equatorial oceans to become highly acidic with temperatures >40°C. Approximately 96% of all marine species and 70% of all terrestrial vertebrate species went extinct in an environmental crisis mapped globally as the end of the Paleozoic. The Deccan basalts covered an area of 0.5 million km2 around 66 Ma causing warming and extinctions that formed the end of the Mesozoic. Around 56 Ma, rifting of Norway from Greenland extruded as much basalt as 3000 km3 per km of rift per million years, forming the Paleocene Eocene Thermal Maximum. Hundreds of smaller basalt eruptions punctuate the geologic time scale ending geologic eras, periods, epochs, and even ages.

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Plain-Language Summary:

Large basaltic lava flows covering areas from tens to millions of square kilometers have been observed throughout Earth history to be accompanied by sudden increases in global temperature. Basaltic lava erupted this year from the East Rift Zone of Kilauea volcano has been flowing out over land at a rate of 0.5 km2 per day from May 3 to July 27, when this abstract was written. This high rate of lava flow is similar to the 2014 to 2015 eruption of Bárðarbunga volcano in Iceland, the largest basaltic eruption since 1783. Bárðarbunga extruded lava for six months covering an area of 85 km2 at a rate of 0.5 km2 per day. Average temperatures throughout the northern hemisphere, which had remained relatively constant from 1998 through 2013, a period described extensively in the literature as the Global Warming Hiatus, began rising suddenly in 2014, reaching a peak that was 0.5oC hotter in 2016, cooling slightly in 2017. If the Kilauea eruption continues for another four months, it could have a similar effect on average northern-hemisphere temperatures.

Session Selection:

The 2018 Eruptions of Kilauea Volcano, Hawaii and Fernandina and Sierra Negra Volcanoes, Galápagos

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Abstract Title:

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Requested Presentation Type:

Assigned by Program Committee (oral or Poster)

Previously Published?:

No

AGU On-Demand:

Yes

Abstract Payment:

Paid (agu-fm18-384402-0664-6539-7512-2715)

For non-students only: I do not want to be involved in OSPA or the mentoring program.

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