

Volcanoes cool the tropics, say researchers

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This is Mount Bromo, an active volcano in East Java, Indonesia. Credit: Paul Krusic, Lamont-Doherty Earth Observatory

Climate researchers have shown that big volcanic eruptions over the past 450 years have temporarily cooled weather in the tropics—but suggest that such effects may have been masked in the 20th century by rising global temperatures. Their paper, which shows that higher latitudes can be even more sensitive to volcanism, appears in the current issue of *Nature Geoscience*.

Scientists already agree that large eruptions have lowered temperatures at higher latitudes in recent centuries, because volcanic particles reflect sunlight back into space. For instance, 1816, the year following the massive Tambora eruption in Indonesia, became known as "The Year Without a Summer," after low temperatures caused crop failures in northern Europe and eastern North America.



More extensive evidence comes in part from tree rings, which tend to grow thinner in years when temperatures go down. This is one of the first such studies to show how the tropics have responded, said lead author Rosanne D'Arrigo, a scientist at the Tree Ring Lab at Columbia University's Lamont-Doherty Earth Observatory. "This is significant because it gives us more information about how tropical climate responds to forces that alter the effects solar radiation," said D'Arrigo. The other authors were Rob Wilson of Lamont and the University of St. Andrews, Scotland; and Alexander Tudhope of the University of Edinburgh, Scotland.

Along with tree rings, the researchers analyzed ice cores from alpine glaciers, and corals, taken from a wide area of the tropics. When things cool, not only do trees tend to grow less, but isotopes of oxygen in corals and glacial ice may shift. All showed that low-latitude temperatures declined for several years after major tropical eruptions. The samples, spanning 1546 to 1998, were taken from Nepal down through Indonesia and across the Indian and Pacific oceans; the ice cores came from the Peruvian Andes. The researchers used materials they collected themselves, as well as samples from the archives of other scientists.

The data show that the most sustained cooling followed two events: an 1809 eruption that probably took place in the tropics, but whose exact location remains unknown; and the 1815 Tambora eruption, one of the most powerful recorded in human history. Following Tambora, between 1815 and 1818, tropical temperatures dropped as much as 0.84 degrees C (1.5 degrees F) below the mean. A slightly bigger one-year drop came in 1731--0.90 degrees C (1.6 degrees F). The researchers say this may be connected to eruptions at the Canary Islands' Lanzarote volcano, and Ecuador's Sangay around this time.

D'Arrigo says that the study shows also that higher latitudes may generally be even more sensitive than the tropics. Some corresponding



drops in northern regions following volcanism were up to three times greater. D'Arrigo said higher latitudes' greater sensitivity appears to come from complex feedback mechanisms that make them vulnerable to temperature shifts. This goes along with growing evidence from other researchers that, as the globe warms, the most dramatic effects are being seen with rapid melting of glaciers, sea ice and tundra at high latitudes. The authors say that, overall, eruptions in the 20th century have exerted fewer obvious effects in the tropics. They said this could be because there were fewer major events in that century--but they noted it could also be "because of the damping effect of large-scale 20th-century warming."

"Particularly warm decades may have partially overridden the cooling effect of some volcanic events," said D'Arrigo. Noting that few reliable instrumental records exist from before this time, she said, "This study provides some of the first comprehensive information about how the tropical climate system responded to volcanism prior to the instrumental period."

The paper, "The impact of volcanic forcing on tropical temperatures during the last four centuries," is available at: www.nature.com/ngeo/journal/v2 ... n1/full/ngeo393.html .

Source: The Earth Institute at Columbia University

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