Icelandic volcano caused historic famine in Egypt, study says

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An environmental drama played out on the world stage in the late 18th century when a volcano killed 9,000 Icelanders and brought a famine to Egypt that reduced the population of the Nile valley by a sixth.

A study by three scientists from Rutgers, The State University of New Jersey, and a collaborator from the University of Edinburgh, Scotland, demonstrates a connection between these two widely separated events. The research, funded by the National Science Foundation and the National Aeronautics and Space Administration (NASA), is the latest addition to NASA's Life on Earth series of Web features.

The investigators used a computer model developed by NASA's Goddard Institute for Space Studies to trace atmospheric changes that followed the 1783 eruption of Laki in southern Iceland back to their point of origin. The study is the first to conclusively establish the linkage between high-latitude eruptions and the water supply in North Africa.

"Our findings may help us improve predictions of climate response following the next strong high-latitude eruption, specifically concerning changes in temperature and precipitation," said Rutgers researcher Luke Oman, first author on the study. "Given the sensitivity of these arid regions to reductions in rainfall, our predictions may ultimately allow society time to plan for the consequences and save lives."

Eruptions of volcanoes in the tropics are known to produce warmer winters in the northern hemisphere; however, the new study shows that

volcanic influences also can flow north to south, generating an array of repercussions, including both hot and cold weather.

The authors present "new, strong evidence, from both observations and climate model simulations" that high-latitude eruptions have altered northern hemisphere atmospheric
circulation in the summer following, with impacts extending deep into the tropics.

Oman, Alan Robock and Georgiy Stenchikov of Rutgers' department of environmental sciences in New Brunswick/Piscataway, and Thorvaldur Thordarson at the University of Edinburgh, published their Sept. 30 study in Geophysical Research Letters, now featured online by NASA.

In June 1783, the Laki volcano began a series of eruptions, regarded as the largest at high-latitude in the last 1,000 years. The eruptions produced three cubic miles of lava and more than 100 million tons of sulfur dioxide and toxic gases, killing vegetation, livestock and people.

These eruptions were followed by a drought in a swath across northern Africa, producing a very low flow in the Nile. Laki's far-flung effects were chronicled by the French scholar Constantin Volney and his friend Benjamin Franklin.

"The [annual Nile] inundation of 1783 was not sufficient, great part of the lands therefore could not be sown for want of being watered, and another part was in the same predicament for want of seed. In 1784, the Nile again did not rise to the favorable height, and the dearth immediately became excessive. Soon after the end of November, the famine carried off, at Cairo, nearly as many as the plague," wrote Volney as reported by Oman and his colleagues.

In the northern hemisphere, the summer of 1783 was chilly – the coldest

in at least 500 years in some locations, according to tree ring data. Sulfate aerosols in the atmosphere kept the warmth of the sun from the Earth's surface.

While the computer linked these reduced northern hemisphere temperatures to Laki, it also connected the dots to a weak monsoon – the seasonal winds that bring the annual rains to southern Asia and northern Africa. The unusual cold in the North lessened the temperature contrast between the land and the oceans, upon which the monsoon winds rely for their development and strength.

The modeling showed significant warming that occurred in the region west to east across Africa to the southern Arabian Peninsula and on to India during the summer of 1783. With little or no monsoon, there were no clouds to bring rain for the rivers or shield the surface from evaporation. Little or no rain, no irrigating floods, no crops and no food – all conspired to bring about the situation Volney described, and all were traceable back to Laki.

Source: Rutgers, the State University of New Jersey