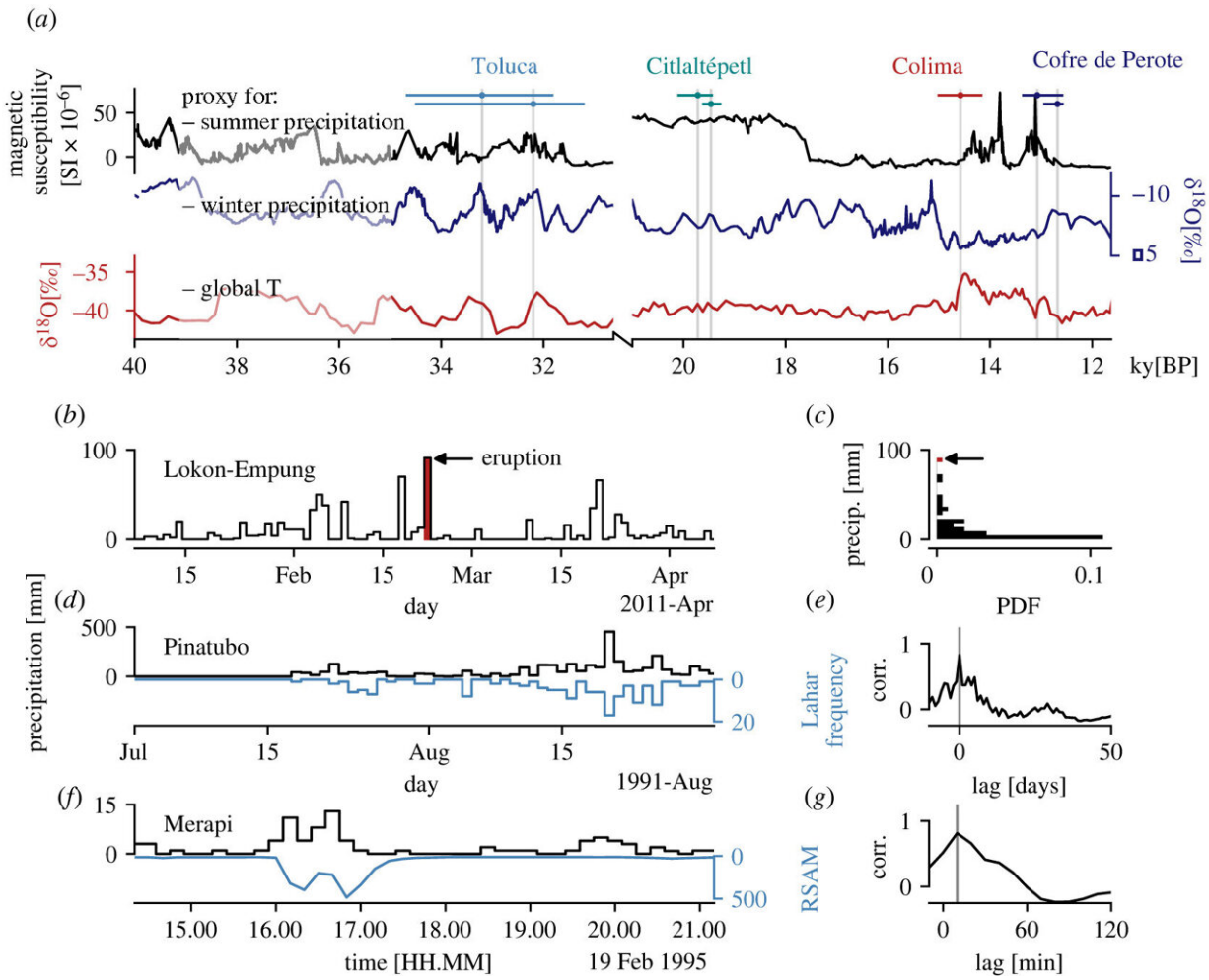
Climate model predicts more heavy rainfall events over active volcanoes as planet warms

July 27 2022, by Bob Yirka



Extreme rainfall as a driver of volcanic hazards. (a) Pleistocene volcanic sector collapses of Volcán de Colima, Nevado de Toluca, Citlaltépetl and Cofre de Perote (Mexico), reproduced after Capra et al. [39]. Climate proxy data are described in the Material and methods. For each of the seven collapses, horizontal date ranges are indicated, as well as a vertical line highlighting the

maximum probability collapse date. Note discontinuous x-axis. (b) The February 2011 eruption of Lokon-Empung is shown by a vertical line, alongside time series of local precipitation data. (c) Log-normal distribution of precipitation data from (b), with outlying value (corresponding to date of eruption) indicated. (d) Daily precipitation data (black) is plotted against the number of lahars per day (blue) observed at Pinatubo between July and September 1991. (e) Result of cross-correlation analysis of Pinatubo data shown in (d), shown as correlation coefficient (corr.) between daily precipitation and lahar frequency versus lag. (f) Precipitation in ten-minute bins at Merapi volcano, alongside the RSAM value at the same temporal resolution. RSAM maxima reflect peak lahar surges. (g) Result of cross-correlation analysis of Merapi data shown in (f), shown as correlation coefficient between ten-minute precipitation and RSAM value versus lag. Credit: *Royal Society Open Science* (2022). DOI: 10.1098/rsos.220275

A pair of researchers at the University of Miami has found evidence that suggests global warming could lead to more heavy rain events over volcanoes around the world leading to more eruptions and mudslides. In their paper published in the journal *Royal Society Open Science*, Falk Amelung and Jamie Farquharson, describe how they used climate models run under various scenarios to learn more about the probability of increased heavy rainfall events over active volcanoes.

Prior research has shown that rainfall events, particularly heavy ones, can lead to dangerous conditions on or near active volcanoes. The rainwater can seep into a dome leading to the creation of steam that builds up pressure until there is an explosion. Rainwater can also make the ground surrounding the dome unstable leading to mudslides. In this new effort, the researchers noted that prior research has suggested that global warming is likely to lead to more heavy rain events around the world and wondered if they may occur over or near active volcanoes. Such events, they note, would represent another threat posed by global warming—one that has not yet been addressed.

To find out if the increase in future heavy rainfall events is likely to involve volcanoes, the researchers first created a map of all known active volcanoes. They then ran a standard climate model that has been used to predict weather changes in the coming years and visualized specifically where increases in future heavy rainfall events might occur. They then compared the maps of volcanoes with the sites identified by the model.

The researchers ran the model under nine scenarios corresponding to various temperature and greenhouse gas emission estimates. In the worst-case scenario, the model showed more heavy rainfall events occurring over 716 active volcanos, most of which were located in the infamous Ring of Fire, the African Rift and several island chains in the Antarctic and Pacific oceans. Under the medium scenario, the number was 506. They also noted that approximately 100 volcanos would actually see fewer such events. The researchers suggest their findings indicate that officials in likely impacted areas should take note of the likely increase in dangerous events under their jurisdiction.

More information: Jamie I. Farquharson et al, Volcanic hazard exacerbated by future global warming-driven increase in heavy rainfall, *Royal Society Open Science* (2022). DOI: 10.1098/rsos.220275

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