Handling the Heat: New Ways to Study Nature’s Steamy, Ashy, Fiery Phenomenons

Approximately 1,511 volcanoes around the world are considered to be active, and about 50-60 volcanoes erupt each year. Known for their tremendous heat, fire plumes, and blizzards of ash, volcanoes can cause significant devastation. The deadliest eruption occurred in 1815 on the Tambora volcano in Indonesia when 92,000 people died, mostly from the ensuing tsunami, flying volcanic debris, and starvation. As recently as 1985, the Ruiz volcano in Colombia caused 25,000 deaths, mostly because of mudflows. While volcanoes of this violent nature are far less common than the ones emitting a bit of steam and ash, their destruction is too great to ignore. Sparking tsunamis, widespread disease, and architectural collapse, volcanoes have long caused geologists and other scientists to search for ways to improve our understanding of their warning signs.

In Miami, far out of reach from lava flow and volcanic ash, Rosenstiel School scientists are working to learn more about volcanoes and help keep more people out of harm’s way.

Eye in the sky
UM’s Rosenstiel School is fortunate to have the only facility in the United States that receives and analyzes satellite data for near-real-time environmental monitoring from the southeastern United States to northern South America. Its Center for Southeastern Tropical Advanced Remote Sensing (CSTARS) is advancing our understanding of active volcanoes and is well-located to watch over the 200 potentially active volcanoes in this region—40 of which have been active since 1960.

For these volcanoes, CSTARS can receive direct-broadcast imagery acquired during a satellite’s flight over the volcanoes. Using a special technique to take earth measurements called Interferometric Synthetic Aperture Radar (InSAR), scientists can take multiple images acquired at different times and combine them to measure changes in distance between the ground and the satellite that occurred during the time periods between the image acquisitions. Scientists can then detect ground displacements of even less than a centimeter.

GPS to the rescue
To supplement the InSAR information, Rosenstiel School scientists also employ GPS to provide more frequent readings, especially when monitoring an active volcano becomes more critical. Rosenstiel School has placed GPS receivers in Ecuador, Peru, Costa Rica, Nicaragua, and Mexico to provide real-time volcano hazard assessments.

Ultimately, the information these scientists glean from GPS and InSAR will further explain how to measure volcanic deformations better so that we can turn this information into more helpful hazard estimates.

Looking for answers deep within
Instead of looking from the outside in, other Rosenstiel volcanologists are studying the origin of the volatile gases inside. By measuring carbon dioxide and water dissolved in glassy lava formed by rapidly quenching magma as it erupts under the sea, they can better understand the important implications for the explosivity of eruptions and help mitigate volcanic hazards. These scientists will use dredges, manned submersibles or remotely operated vehicles to collect submarine lava at mid-ocean ridges and ocean islands. Further lab work helps extrapolate this data to understand the areas that can’t be reached to get a complete picture.

It’s this approach to volcanology study – looking at the issue from inside and out – that will allow Rosenstiel School researchers to help people who live with the uncertainty of whether the next eruption will be a life-threatening one.