Submarine volcanoes add to ocean soundscape

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A steam plume rises from Bogoslof volcano as hot lava heats the seawater during an eruption in August 2017. Credit: Dave Withrow (NOAA/Fisheries)

Most volcanoes erupt beneath the ocean, but scientists know little about them compared to what they know about volcanoes that eject their lava

on dry land. Gabrielle Tepp of the Alaska Volcano Observatory and the U.S. Geological Survey thinks that with improved monitoring, scientists can learn more about these submarine eruptions, which threaten travel and alter the ocean soundscape.

During the 174th Meeting of the Acoustical Society of America, held Dec. 4-8, 2017, in New Orleans, Louisiana, Tepp will discuss the challenges and benefits of remote monitoring and what it can teach us about submarine volcanoes.

"It's very difficult to study underwater volcanoes because it's hard to put instruments in the water, especially long-term," Tepp said.

Depending on the size and depth of an underwater eruption, gas and ash may never break the ocean surface, or the gas and ash could create a volcanic plume with the potential to interfere with air travel. "The ocean is a big place so it's pretty unlikely that you're going to have a situation where a ship haphazardly wanders over an eruption, but there are a few that have come close," Tepp said. These unpredictable eruptions may also create a floating blanket of rocks, called a pumice raft, which can clog harbors and damage boats.

Tepp is presenting observations from two submarine volcanoes: Ahyi, a seamount in the Northern Mariana Islands in the Pacific Ocean, and Bogoslof, a shallow submarine volcano in the Aleutian Islands. The volcanoes made very different sounds, suggesting that different processes occurred during eruption. In 2014, Ahyi erupted for two weeks, with short, repetitive gunshotlike explosions every few minutes. In 2016 and 2017, Bogoslof had more sustained eruptions, lasting minutes to hours, which occurred every few days.

Evidence of these eruptions showed up on distant seismometers, which measure waves passing through the ground to record earthquakes, and

hydrophone arrays that pick up underwater sound to detect covert nuclear detonations. When volcanoes erupt directly into the water, the sounds can travel for thousands of miles before dissipating.

Questions remain, however, such as if seismometers are sufficient for remote monitoring or if the more accurate information provided by cabled hydrophone arrays is worth the greater expense. Researchers are also interested in how the movement of waves from water into rock, and vice versa, affects signal detection.

Tepp and colleagues at National Oceanic and Atmospheric Administration and USGS recently deployed a hydrophone array in the Northern Mariana Islands. They will collect the data next summer and hope to determine where and how often local volcanoes erupt to see if the area needs better hazard monitoring.

Due to the long distances that eruption signals travel, they likely show up as anomalies on far-off monitoring devices used to study earthquakes, land-based volcanoes or even whale songs.

"Eruptions that create a loud enough sound, in the right location, can travel pretty far, even from one ocean to another," Tepp said. "It makes you wonder, how many of these signals have we seen on distant instruments where nobody knew what they were, and it's a submarine volcano from halfway around the world?"

More information: Abstract: 1aAO5: "The Sounds of Submarine Volcanoes," by Gabrielle Tepp, Matthew Haney, John Lyons, Robert Dziak, Joe Haxel, Del Bohnenstiehl and William Chadwick, Monday, Dec. 4, 2017, in Salon F/G/H in the New Orleans Marriott. asa2017fall.abstractcentral.com/s/u/OajXUcch9zc