Hydraulic Relief

conditions are used in CRSS, the combined storage could decrease by 10.3 cubic kilometers (21%, equivalent to 3.2 million acre-feet).

These water elevation changes are not due solely to inflow hydrology. Lake Powell and Lake Mead are operated according to prescribed operational guidelines that include the coordinated operation of the reservoirs [Reservoir of Reclamation, 2007]. The presence of those guidelines, along with the differences in streamflow response above and below Lake Powell, are partial explanations as to why Lake Powell has a larger increase in water elevation.

What Will This Do El Nino Be Like?

El Niño is one of the more pronounced climate drivers for the United States. As the current El Niño event progresses, water managers are encouraged to consider these projections related to reservoir supply and impacts to reservoir operations. It appears that expected changes should become evident to water managers and the public.

However, one El Niño event similar to those historically observed will not be enough to fully replenish large reservoirs such as Lake Powell and Lake Mead.

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Powell and Lake Mead.

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Active-Source Seismic Experiment Confirms the Magma Pathway of Mount Asama, Japan

Large volcanic eruptions result from the ejection of magma transported from depth. How the magma is transported to the surface is thus one of the fundamental questions in understanding how a volcano works. A way to address this question is to explore the seismic structures of volcanoes. One volcano that is well surveyed and instrumented through a variety of global positioning system and seismic networks is Japan’s Mount Asama. Because of this, scientists were able to conduct an active-source seismic experiment on this volcano, with the goal of mapping volcanic conduits.

Asama’s Eruptive History

Asama is known to have erupted explosively in 1188 and 1707, both with Volcanic Explosivity Indexes (VEI) of about 5 according to models of tephas output based on stratigraphic studies. Recent eruptions of Asama include moderately sized events with VEI of 2 in 1973, 1982, 1983, and 2004 and minor events with VEI of 1 in 2008 and 2009. Trace ashfall in Tokyo, about 180 kilometers from the volcano, due to the minor 2009 eruption suggests that at least 20 million people are at risk of volcanic hazards from Asama during future larger eruptions.

Because Asama is a well-instrumented volcano, scientists have already gained some insights into its magma pathways from geophysical observations [Toda et al., 2001]. These data show that during the 2004 eruptions, magma branched from the main conduit and traveled 4 kilometers west to a depth of 1.5 meters below sea level. The intruded magma then migrated horizontally to right beneath the summit and migrated upward to the surface. Such data suggest that a complex network of dikes and vents supports Asama’s volcanic activity.

Active-Source Seismic Experiment

The activity observed in 2004 raises several questions: Why was the dike offset from the summit? What controls the magma pathway beneath Asama? To address these questions, an active-source seismic experiment was conducted on Asama in October 2006 [Jako et al., 2007]. Using active-source seismic means that scientists can “engineer” locations and origins of otherwise indistinct seismic events. Successful active seismic studies have revealed the sub-surface structures of several volcanoes such as Italy’s Vesuvius.

Mount Asama

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Fig. 1. (a) Location of active sources (blue stars) and temporarily deployed L22-D seismometers with a natural frequency of 2 hertz (black dots). The red triangle represents the location of the summit of Asama. The black rectangle represents the area shown in Figures 1b (b) Location of densely deployed 622-D seismometers with a natural frequency of 4.5 hertz (black dots). The black circle indicates the location of the base station. The yellow circle indicates the location of the source.

Mount Asama

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shows a high-velocity zone around the area of interest. Note that the high-velocity zone resulting from repeated dike intrusions is formed by the solidification of magma after repeated intrusions. (Figures 2a and 2c). These inter- plications fit well with observations (Figures 2a and 2c), endorsing the idea that the high-velocity structure is reliable.

Combining these results with natural-earthquake locations and the electromagnetic signature measured through resistivity tests of Asama suggests that the intruded magma is blocked by a cap of stiff rocks but then finds a way to reach the surface at the present location of the volcano’s summit (Figure 2d).

Data from this active-source seismic experiment are available at www.eri.u-tokyo.ac.jp/asyokou/Asama2006/ or upon e-mail request to Yosuke Aoki (yackoi@eri.u-tokyo.ac.jp).

References

The Center for Transformative Environmental Monitoring Programs (CTEMPs) is a joint initiative of Oregon State University and the University of Nevada, Reno, to provide research and dissemination of technology that would help 4 times better spatial resolution and 10 times better temporal resolution than currently available monitoring systems. CTEMPS is testing a suite of other sensing systems, including fiber-optic distributed strain and acoustic sensing, and a spectrum of low-cost and high-precision point-sensing systems suitable for traditional and wireless networked sensing systems.

CTEMPs also is offering a series of 1-day introductory short courses and 4-day hands-on workshops to train researchers and students on the leading edge of distributed sensing.

For more information about the center and its short courses, and to apply to use the field-deployable DTS systems, visit http://www.ctemps.org or contact Susan Atkisson at Susan.Atkisson@oregonstate.edu.
Reference

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