

Enhancing monitoring capabilities at Nevado del Ruiz volcano, Colombia, and its magma system inferred from seismic waveform analyses

*Hiroyuki Kumagai¹, Yuta Maeda¹, Makario Londono², Cristian Lopez²

1. Graduate School of Environmental Studies, Nagoya University, 2. Colombian Geological Survey

Nevado del Ruiz volcano located in the Colombian Andes continues its eruptive activity. To enhance monitoring capabilities at this volcano, broadband seismometers and other equipment were installed by the Science and Technology Research Partnership for Sustainable Development (SATREPS) project in Colombia. Using waveform data from the seismic network, source locations of volcano-tectonic (VT) earthquakes, very-long-period (VLP) events, and tremor were systematically determined by the automated amplitude source location (ASL) system. We also performed tomographic inversion of *P* and *S*-wave arrival times and waveform inversion of VLP events. In this paper, we describe the seismic network and monitoring system at Nevado del Ruiz. We then discuss the magma system beneath this volcano based on our estimated source location distributions, tomographic images of *P* and *S*-wave velocities, and source mechanisms of VLP events.

At Nevado del Ruiz volcano, 12 broadband and 3 short-period seismic stations are maintained. Realtime waveform data are retrieved by the seedlink system. We use an automated event trigger system using seismic amplitudes in a low-frequency band of 0.3-1 Hz. Source locations of triggered events and tremor are automatically determined by the ASL system using high-frequency (5-10 Hz) seismic amplitudes. The estimated source information is accessible through a web system, and manual ASL analysis can be performed by this web system.

Our ASL results indicated that VT earthquakes occurred beneath the northern and southern flanks and the sources of tremor and VLP events were distributed from the summit crater (5311 m) to a depth of about sea level in the NW direction. We found that some tremor episodes showed moving sources along the tremor and VLP source region. Our waveform inversion of VLP signals points to tensile cracks dipping toward the NW direction. Tomographic inversion images displayed that the tremor and VLP source region corresponds to the region with high V_p/V_s ratios, implying the existence of fluids in this region. These results suggest that this source region represents an active crack-like conduit, in which tremor and VLP events were triggered by magma fragmentation processes.