

Velocity structure of Nevado del Ruiz volcano (Colombia) and a model for its seismic activity

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A local tomography study was done for Nevado del Ruiz Volcano. Low-velocity zones for both P and S waves were identified. Two large low Vp zones were found, one at depth 0-4km located to the NW of the volcano and another at depth 6-8km located to the NW and beneath the active crater. A high velocity zone for both P and S waves was found at shallow depths. Moreover a low Vs zone beneath the crater at 2-4km was detected. we suggest a model for the seismic activity of the NRV. VT earthquakes occurred very often as swarms-like pattern, and are located in several cluster around the volcano. The VT swarm located at the west of the volcano, sometimes occur simultaneously with a VT swarm located at the active crater. When this seismic pattern occurs, it seems to increase the volcanic activity.

A local tomography study by using the method of Zhao et al (1992) was done for Nevado del Ruiz Volcano (NRV). Low-velocity zones for both P and S waves were identified. Two large low Vp zones ($>-5\%$) were found, one at depth 0-4km located to the NW of the volcano and another at depth 6-8km located to the NW and beneath the active crater. A high velocity zone ($>5\%$) for both P and S waves was found at shallow depths (0-2km). Moreover a low Vs zone beneath the crater at 2-4km was detected. The shallow low Vs zone beneath the crater is supposed to be related with the conduit and a reservoir of gas. The two low Vp zones are believed to be the location of magma reservoirs in melting stage. The shallow high Vp and Vs zone is interpreted as the location of an old, degassing and cooling magma body which is in close relationship with the hydrothermal system of the volcano. Based on the data obtained with the tomography and analyses of the seismicity, we suggest a model for the seismic activity of the NRV. VT earthquakes occurred very often as swarms-like pattern, and are located in several cluster around the volcano. The VT swarm located at the west of the volcano, sometimes occur simultaneously with a VT swarm located at the active crater. When this seismic pattern occurs, it seems to increase the volcanic activity (ash emission, eruption, steam column, etc). On the other hand, LP swarms are located mainly near the active crater and supposedly at shallow depths. This LP swarms seem to be in close relationship too with the previous pattern mentioned. It seems to be the response to the previous VT activity. Temporal changes in Coda Q were detected before the most important volcanic crises and were related with changes in gas accumulation beneath the volcano. All this facts suggest that the main activity of the NRV is produced by a degassing process going on at the present and located at shallow depth. In addition, it seems that there is no magma supply at the present, but the possible existence of two magma reservoirs at depth ($>7\text{km}$) found from tomographic study, insinuate that is plausible in the future a magmatic injection at shallower depths.