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'Understanding volcanoes and society: the key for risk mitigation'



Unusual seismic activity at Chiles and Cerro Negro volcanoes on the Colombia-Ecuador border

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The region of Chiles and Cerro Negro volcanoes, located on the border of Colombia-Ecuador, has experienced an unusual increment of seismicity beginning in August 2013. A cooperative broadband monitoring network was installed by the Servicio Geológico Colombiano (Colombia) and the Instituto Geofísico of the Escuela Politécnica Nacional (Ecuador). Since November, 2013 more than 555,000 earthquakes were recorded; although since May 2015 the seismicity has decreased significantly to an average of 70 earthquakes per day except June 14, 2015, and March 19 and July 31, 2016 when more than 500 earthquakes per day were totalized. The major earthquake swarms with increasing energy occurred in August-October 2013, March-May 2014, and September-December 2014. By the end of 2014, roughly 400 earthquakes greater than M 3 have occurred with a maximum rate of 8,000 earthquakes per day. The largest earthquake was a 5.6 ML on 20 October 2014. This event produced an InSAR coseismic deformation of ~23 cm. Most events are typical VT earthquakes located in a cluster beneath the southern flank of Chiles extending 8 km southwest of volcano, with depths between 1.5 and 10 km. Relative earthquake relocations reveal a structure consistent with mapped regional faults. Some events are low-frequency (LF, ~0.5 Hz) and very-low-frequency (VLF). Using particle motion a VLF on October 15, 2014 was located south of Chiles Volcano, near the InSAR source, while the VLF registered on February 14, 2015 was likely located very close to summit of Chiles. No degassing or changes in the hydrothermal system have been detected. We infer that magma intrusion and resulting fluid exsolution at depths greater than 5 km are driving seismicity in the Chiles-



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Cerro Negro region. However, earthquakes are failing in a manner consistent with regional tectonics. Thus seismicity is likely controlled by an interaction of magmatic and tectonic processes.