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Comparison of lava dome volume calculations at Nevado del Huila volcano employing geometric shapes and oblique photogrammetry

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Nevado del Huila volcano (5365 masl) is the highest mountain in the Colombian Andes. The volcano had its first historical eruption in February 2007, which produced a small lahar and a 2 km long crack on the summit glacier. In total, there were three eruptive episodes between 2007 and 2008. During the final episode that began in November 2008, a lava dome erupted on the south west flank of the Central Peak, piercing through the glacial ice cap. The growth of this dome can be divided into two phases: the first, from November 2008 to October 2009, and the second, from October 2009 to June 2010, when dome growth and associated seismicity ceased. This paper presents a comparison made between two methods employed to calculate the dome volume: the first method is based on the sum of partial volumes from geometric shapes obtained from a set of points taken in October 2010 using a FLIR camera. The second method is based on a set of oblique photographs captured in January 2011 using a Nikon D5000 camera and processed using photogrammetry software to create a DEM of the lava dome and GIS software for post processing and volume calculation. A DEM elaborated in 2016 was used to validate the obtained results. It was seen that volume calculations employing geometrical shapes were much larger than the volume obtained using oblique photogrammetry. In part, the difference in volumes can be attributed to the influence of the underlying topography, which is accounted for in the oblique photogrammetry approach. A comparison of the accuracy of both methods is made and a final dome volume and extrusion rate are reported.