



Cities on Volcanoes 9
November 20-25, 2016
Puerto Varas, Chile

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



Deep source model and dome growth analysis for Nevado del Ruiz Volcano, Colombia, constrained by interferometric synthetic aperture radar and in-situ observations

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Keywords: Nevado del Ruiz, InSAR, lava dome, source model

Nevado del Ruiz (NRV) is part of a large volcano complex in the northern Andes of Colombia with a large glacier that erupted in 1985, generating a lahar killing over 23,000 people in the city of Armero and 2,000 people in the town of Chinchina. NRV is the most active volcano in Colombia and since 2012 has generated small eruptions, with no casualties, and constant gas and ash emissions. Interferometric synthetic aperture radar (InSAR) observations from ascending and descending track RADARSAT-2 data show a large (>20 km) wide inflation pattern apparently starting in late 2011 to early 2012 and continuing to the time of this study in early 2015 at a LOS rate of over 3-4 cm/yr. Volcano pressure volume models for both a point source (Mogi) and a spheroidal (Yang) source find solutions over 14 km beneath the surface, or 10 km below sea level, and centered 10 km to the SW of Nevado del Ruiz volcano. The spheroidal source has a roughly horizontal long axis oriented parallel to the Santa Isabel – Nevado del Ruiz volcanic line and perpendicular to the ambient compressive stress direction. Its solution provides a statistically significant improvement in fit compared to the point source, though consideration of spatially correlated noise sources may diminish this significance. Stress change computations do not favor one model over the other but show that propagating dikes would become trapped in sills, leading to a more complex pathway to the surface and possibly explaining the significant lateral distance between the modeled sources and Nevado del Ruiz volcano. Since September 2015 COSMO-SkyMed (CSK) data track the dome growth in the summit crater. We present a preliminary analysis of this dome growth and contemporaneous in-situ volcanic activity observations that will guide future volcano system analysis of Nevado del Ruiz.