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Post-eruptive topographic changes at Chaiten, as constrained from Lidar, UAV and InSAR measurements

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Volcano domes are volatile poor and highly viscous extrusions of magma that develop at many volcanoes, often associated with highly energetic eruptions, pyroclastic flows, block and ash deposition and associated hazards. While volcano dome growth and destabilization have been extensively investigated, there is little knowledge about the post-emplacement dynamics, cooling and structural architecture of domes. Chaiten volcano, Chile, developed a major dome in 2008-2009, associated with a ash laden eruption that disrupted the air space of large parts of the southern hemisphere. Following the emplacement of the dome, topography has changed significantly, as our study shows. We compare digital elevation models acquired years after emplacement of the dome in 2010 and 2016. While the former was acquired by air borne LiDAR campaign, the second was acquired by multiple drone overflights and Structure from Motion (SfM) image processing. Results reveal that broad and localized subsidence occurs on meter scale. To further test this large amount of deformation, we analyse high resolution InSAR data acquired by the German satellite TerraSAR-X in strip mode. Results confirm the presence and persistence of pronounced displacements. To further analyse the nature of the displacements, we develop numerical models that consider cooling and loading of the substratum, allowing to further investigate complexities in the local deformation trend. This study highlights the volcano-tectonic processes acting at dome building volcanoes, being persistent even years after emplacement.