

Analysis of volume changes at Santiaguito volcano, Guatemala, using TanDEM-X data

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The Santiaguito volcanic dome complex, Guatemala, has been continuously active since its formation in 1922 at the flank of Santa Maria's eruption crater. Over time, four volcanic domes formed of which only the oldest one, Caliente, is still active today. Santiaguito's, or more precisely Caliente's, eruptive behavior is characterized by several eruptions a day with varying frequency and rockfalls, pyroclastic flows and lava flows are common. The lava is blocky and the length of the lava flows varies between tens of meters and almost 4km. Santiaguito volcano has been focus of scientific studies for years and the work presented here follows in the footsteps of Ebmeier et. al (2012) who used InSAR (Interferometric Synthetic Aperture Radar) to estimate, amongst other things, lava thickness and flow shape between 2000 and 2009.

In the present work, we use TanDEM-X satellite data, between September 2011 and April 2019, to generate digital elevation models of Santiaguito to determine elevation changes and perform associated volume estimates of lava flows. The digital elevation models are created using the software DORIS (Delft Object-oriented Radar Interferometric Software) and have a high spatial resolution of approximately 6m in azimuth and 4-6m in range direction. TanDEM-X is very well suited for volcanic areas, as both satellites acquire data simultaneously and therefore atmospheric and ionospheric disturbances, temporal decorrelation and decorrelation due to deformation are negligible. Here, we focus on the southern flank of the volcano as well as its crater. Comparing the elevation from different years shows that significant elevation changes of up to several tens of meters occur both on the flank and crater during the observation period, even only within a few months. The biggest observed elevation changes took place between September 2011 and January 2016. Between January 2016 and April 2019, there has hardly been any change in elevation at the southern flank of the volcano. Between 2013 and 2016, a decrease in elevation of the crater of approximately 20m is observed, followed by a strong increase of up to 36m between 2016 and 2019. Our elevation measurements are well aligned with ground-based instrumental and visual observations and we are now focusing on determining flow shape and volume changes of lava flows within our observation period.

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