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Topographic changes of Volcán de Colima, Mexico, revealed by bistatic SAR interferometry

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The German TanDEM-X (TerraSAR-X add-on for Digital Elevation Measurement) mission consists of two nearly identical synthetic aperture radar (SAR) satellites that build a large interferometer in space. The two satellites simultaneously acquire images of the Earth surface from slightly different positions. Since temporal phase terms do not affect the interferometric phase, digital elevation models (DEMs) can be generated during every fly-over of the satellites, which is 11 days, or multiples of this. The developed TanDEM-X DEM differencing approach is applied here to study lava dome changes at Volcán de Colima in Mexico. While being a stratovolcano, Volcán de Colima's activity is characterized by long phases of dome growth intermitted by small explosions and culminating in complete dome destructions. The recent eruptive activity was characterized by several phases of dome growth, i.e., from 2007 to 2011, that ended with an explosion in June 2011. Since May 2014, the volcano has been permanently active. TanDEM-X DEMs from data acquired during different times of the volcanic activity are analyzed to reveal the topographic and volumetric changes in the summit area of the volcano. The data are exceptional useful since DEM differencing can reveal topographic changes of the Earth surface with an accuracy of only a few meters. The analysis at Volcán de Colima and at other (dome-building) volcanoes shows TanDEM-X is an innovative and reliable technique to study topographic changes caused by active volcanism. The generated DEMs and derived results are especially important to assess the activity of Volcán de Colima's lava dome, and can give exceptional insights into the magmatic system of the volcano. The importance of up-to-date topographic data for generation of flow modeling software which can be used to assist in evacuation procedures during eruptions shows the high impact of the present study.