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Post-emplacement dynamics of andesitic lava flows at Volcán de Colima, Mexico, revealed by remote sensing data

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We use a combination of radar and optical remote sensing data to map, estimate the volume and measure the surface displacements of lava flows emplaced in the summit part of Volcán de Colima, Mexico, between late 2014 and early 2016. We perform deposits mapping and volume estimation by differencing two Digital Elevation Models derived from radar and optical images acquired, respectively, before and after the main peak of activity. Coherence information derived from the radar dataset add temporal constrains on the timing of various deposits emplacement. We thus estimate an extrusion rate around $1 - 2\mathrm{m}^3\mathrm{s}^{-1}$ between November 2014 and February 2015. An original approach is then proposed to reconstruct the 3D displacement field, taking advantage of images acquired by the same satellite, on both ascending and descending tracks, and using a physical a priori on the direction of horizontal displacements. Our results show that horizontal motion is still recorded on the SW lava flow a few months after its emplacement due to the high viscosity of the magma and the steep slope of the volcano. We model the lava flow thermal contraction based on a finite element numerical method and evidence that thermal contraction, flow motion and viscoelastic loading, all together, contribute significantly to the recorded displacement field.