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UAS-based tracking of the Santiaguito Lava Dome, Guatemala

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Imaging growing lava domes has remained a great challenge in volcanology due to their inaccessibility and the severe hazard of collapse or explosion. Changes in surface movement, temperature or lava viscosity are indicators for the current state of the activity and are thus considered crucial for hazard assessments at active lava domes. Here, we present results from a series of repeat survey flights with optical and thermal cameras at the Caliente lava dome at Santiaguito volcano, Guatemala, using an Unoccupied Aircraft System (UAS) to create topography data and orthophotos of the lava dome. This enables us to delineate the 2D deformation field and calculate flow velocity, strain components, and apparent lava viscosity. We find that the lava dome displays motions on two separate timescales, firstly a narrow and fast-moving lava extrusion and secondly a slower radial expansion of the dome. Both processes also produce distinctive fracture sets detectable with surface motion and the lava extrusion shows associated thermal anomalies. Our results highlight that motion patterns at lava domes control the structural and thermal architecture and different timescales should be considered to better characterize surface motions during dome growth to improve the assessment of volcanic hazards.

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