How a change in slope affects lava flows

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When exposed to the elements, flowing lava will form a crust at its surface. Credit: Scott Rowland

As soon as lava flows from a volcano, exposure to air and wind causes it to start to cool and harden. Rather than hardening evenly, the energy exchange tends to take place primarily at the surface. The cooling causes a crust to form on the outer edges of the lava flow, insulating the molten lava within. This hardened lava shell allows a lava flow to travel much further than it would otherwise, while cracks in the lava's crust can cause it to draw up short.

When there is a break in the terrain—a sharp change in slope, a valley, or a rock wall, for example—the smooth lava flow is disrupted. Pulses in

flow volume or the formation of turbulent eddies caused by these topographic features can make the hard lava shell crack. Using observations from historical eruptions and a simple mechanical model, Glaze et al. studied how changes in slope can affect lava flows. This was featured in a recent study in the *Journal of Geophysical Research: Solid Earth*.

The increase in flow velocity from a steepening slope is often quite minor, as most of the energy goes into vertical rotation of the lava, just as with a rock rolling down a hill. The authors' model considers factors such as temperature, depth and flow velocity, along with the effect of lava viscosity, to calculate how a change in slope affects the formation of vertical eddies created by tumbling lava. The authors' model allowed them to determine how far downstream the turbulence persists before the lava returns to a more streamlined flow.

More information: Glaze, L. S., S. M. Baloga, S. A. Fagents, and R. Wright (2014), The influence of slope breaks on lava flow surface disruption, *J. Geophys. Res. Solid Earth*, 119, 1837, DOI: 10.1002/2013JB010696

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