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Roofing over a lava channel: applications of thermal imaging

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Thermal images are a useful tools to map the temperature distribution on the surface of active lava flows. In some conditions the temperature of the surface can be considered as dependent from the cooling history that is the time since the surface has been exposed to the atmosphere. By knowing the appropriate cooling rate of the flowing lava, the thermal images can be converted into images representing the ages of the surface. We apply this method over a chanallised lava surface coming out from a growing lava tube and we show the temperature and the age distributions. These data allowed as to infer surface velocity distribution of the flowing lava stream as well as to estimate roof accretion mechanism and rate. Accretion occur in the boundary condition between flowing and stationary lava, when surface velocities are slower than 0.2 m/s and the lava surface is cooler than 1080 °C. In these conditions the rheological behaviour of the boundary layer is able to resist to the dragging force of the underflowing lava stream thus favouring the growing of the roof by accretion. By using equations proposed by Hon et al. (1998) for Hawaiian basalts, we modelled the growth of the viscoelastic layer and the rigid crust over the lava stream. Moreover we show how temperature data can be converted into a series of surface parameters (age, speed, viscosity) characterised by different trends. Finally the spectral analysis of the thermal signal (temperature profile) reveals a dominant spatial frequency related to the regular formation of festoons on the surface, resulting from strain rate - viscosity relationships.