TOPOGRAPHIC AND THERMAL INVESTIGATIONS OF ACTIVE PAHOEHOE LAVA FLOWS USING COUPLED LiDAR/FLIR DATASETS

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Study Locations: Active Pahoehoe Flows, Kilauea Volcano

Instrumentation for Field Investigations of Active Pahoehoe Flows

Digital Photography:
- DSLR Cameras (12.1 megapixels)
- HD Video

Thermography - FLIR SC 645
- Object Temperature Range: −20° to +2000°C
- Accuracy: ±2°C
- Field of View: 15° × 11°
- Spatial Resolution: 0.41 mrad

LiDAR – RiegGl 1000 Laser Scanner
- Range: up to 600 m
- Measurement Rate: up to 122,000 points/sec
- Precision: ±3 mm
- Field of View: 360° horizontal, 100° vertical

GPS - Global Navigation Satellite System Base and Rover Receiver

RTK surveying system used to provide precise location of scan position and geometry LiDAR point cloud to real-world coordinates.

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References

To display the LiDAR point cloud as a DEM and slope map derived from the LiDAR data, the following processes are applied: LiDAR point cloud collection at a given time interval can be used to document the morphometric characteristics of advancing pahoehoe lobes and to directly link quantitative morphometric measurements to other flow characteristics (e.g., flow morphology, temperature). The LiDAR point cloud collected of a pahoehoe lobe can be easily manipulated and displayed at different scales for postural and thermal analysis. In the text, we use the term “channel” to describe subaerial pathways through which lava is emitted from the lava front (center left) initially by a spreading pahoehoe toe, which accumulates and overflows into a batholithic lava channel; c) cycles of inflation and breakout across the flow front (right), which produce a new pahoehoe toe network that inundates the previously active lobe field, and d) cycles of inflation and breakout across the flow front (right) that produce a new pahoehoe toe network that inundates the previously active lobe field.

May 2010 Observations of Pahoehoe Flows: Active Pahoehoe Network Mapping using FLIR Images

On May 18, 2010, we acquired ~2.5 hours of mostly continuous visible and thermal video footage along the front of advancing pahoehoe flows (T). Analysis shows that pahoehoe lava flow includes: 1) spreading of a generally multifingered flow front in a trapezoidal shape (translatory lava flow); 2) palaeo- lava (in the same general location) that is currently active along the flow front; and 3) a stage where the flow is highly folded and contains a variety of inflating lava channels and breccias across the active flow field that extends beyond a zone of confinement and allows continued spreading.

Comparison of raw LiDAR scan for advancing pahoehoe flow in March 2012. The scan shows the change in flow surface height over 24 hours using 3D images of active flow advance and subsequent incision at center to −30 m.