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Measuring lava eruption temperatures with a digital camcorder at Kilauea volcano, Hawaii, USA

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The rise in capability of consumer-grade equipment has yielded a new level of remote sensing of active volcanism. We report measurements of temperatures of skylights and lava flows at the active Kilauea basaltic lava flow field that were obtained using a consumer Sony Handycam with a digital CCD and spectral range from the visible through the near-infrared. This camera was calibrated to produce images that were processed using the Thermoshot software, developed by Saito et al. (2005, EPS 57, e5-e8), which converts a grayscale bitmap image into a thermal image. In this manner, the Sony camcorder can be used as a radiation thermometer.

A skylight and a surface flow at Kilauea were photographed at a range of 5-10 m with our Sony HDR-HC1 camcorder. We simultaneously measured lava temperatures by thermocouple and close-range surface temperatures by optical pyrometer. The Sony digital images were imported to Thermoshot, which produced individual pixel brightness temperatures of 600-1200˚C for the skylight, and 500-900˚C for the surface flow. The temperatures correlated with actual surface temperatures of individual flow features as measured by thermocouple and pyrometer to within +/- 50˚C.

The thermal images created in Thermoshot are useful for obtaining information on the temperature distribution of flow features. Remarkable details of the internal thermal structure of skylights and the surface morphology of lava flows can be seen. Cooler soda straws and flow bands are visible in the skylight, and evidence of inflation can be seen in the flow in a uniformly hotter base to flow lobes. The ease of obtaining thermal data at short wavelengths is of great value in providing another level of close-range remote sensing monitoring of active, basaltic, volcanic features.