Understanding Volcanic Processes Using UV Camera Measurements of Sulfur Dioxide and Coincident Infrasound and Seismicity

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ABSTRACT

The exsolution of volatiles from magma maintains an important control on volcanic eruption styles. The nucleation, growth, and connectivity of bubbles during magma ascent provide the driving force behind eruptions, and the rate, volume, and ease of gas exsolution can affect eruptive activity. Volcanic plumes are the observable consequence of this magmatic degassing, and remote sensing techniques allow us to quantify changes in gas exsolution. However, until recently the methods used to measure volcanic plumes did not have the capability of detecting rapid changes in degassing on the scale of standard geophysical observations. The advent of the UV camera now makes high sample rate gas measurements possible. This type of dataset can then be compared to other volcanic observations to provide an in depth picture of degassing mechanisms in the shallow conduit. The goals of this research are to develop a robust methodology for UV camera field measurements of volcanic plumes, and utilize this data in conjunction with seismoaoustic records to illuminate degassing processes. Field and laboratory experiments were conducted to determine the effects of imaging conditions, vignetting, exposure time, calibration technique, and filter usage on the UV camera sulfur dioxide measurements. Using the best practices determined from these studies, a field campaign was undertaken at Volcán de Pacaya, Guatemala. Coincident plume sulfur dioxide measurements, acoustic recordings, and seismic observations were collected and analyzed jointly. The results provide insight into the small explosive features, variations in degassing rate, and plumbing system of this complex volcanic system. This research provides useful information for determining volcanic hazard at Pacaya, and demonstrates the potential of the UV camera in multiparameter studies.