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Sulfur dioxide emissions from Alaskan volcanoes quantified using an ultraviolet SO_2 camera

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Alaskan volcanoes are difficult targets for direct gas measurements as they are extremely remote and their peaks are mostly covered in ice and snow throughout the year. This makes access extremely difficult. In 2015, we were able to make use of an ultraviolet SO_2 camera to quantify the SO_2 emissions from Augustine Volcano, Redoubt Volcano, Mount Cleveland and Shishaldin Volcano in the Aleutian Arc.

An airborne gas survey performed at Augustine Volcano in April 2015 found that the SO_2 emission rate from the summit area was below 10 tonnes per day (t/d). SO_2 camera measurements were performed two months later (June 2015) from a snow-free area just 100 meters from the fumarole on the south side of Augustine's summit dome to maximize camera sensitivity. Though the visible appearance of the plume emanating from the fumarole was opaque, the SO_2 emissions were only slightly above the 40 ppm·m detection limit of the SO_2 camera. Still, SO_2 could be detected and compared to coincident MultiGAS measurements of SO_2, CO_2 and H_2S.

At Redoubt Volcano, SO_2 camera measurements were conducted on 13 June 2015 from a location 2 km to the north of the final $72x10^6$ m^3 dome extruded during the 2009 eruption. Imagery was collected of the plume visibly emanating from the top of the dome. Preliminary evaluation of the imagery and comparison with a coincident, helicopter-based DOAS survey showed that SO_2 emission rates had dropped below 100 t/d (down from 180 t/d measured in April 2014).

Mount Cleveland and Shishaldin Volcano were visited in August 2015 as part of an NSF-funded ship-based research expedition in the Central Aleutian Arc. At Mount Cleveland, inclement weather prohibited the collection of a lengthy time-series of SO_2 camera imagery, but the limited data that was collected shows an emission rate of several hundred t/d. At Shishaldin, several hours of continuous imagery was acquired from a location 5 km east of the summit vent. The time series shows an SO_2 emission rate of several hundred t/d as well as short-term ($<$5 min.) variations that could provide insights into shallow degassing mechanisms at this highly active volcanic center.

Our presentation will include a brief description of our SO_2 camera, a system we designed and built for rapid deployment at active volcanoes, and the results of the measurements will be discussed. These results will be compared to other available monitoring data and interpreted with regard to their importance for assessing the current level of activity of these remote Alaskan volcanoes.