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Volcanic Lightning in Eruptions of Sakurajima Volcano

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In May 2015 a field program was undertaken to study volcanic lightning at the Sakurajima volcano in southern Japan. One of the main goals of the study was to gain a better understanding of small electrical discharges in volcanic eruptions, expanding on our earlier studies of volcanic lightning at Augustine and Redoubt volcanoes in Alaska, USA, and Eyjafjallajökull in Iceland.

In typical volcanic eruptions, electrical activity occurs at the onset of an eruption as a near-continual production of VHF emissions at or near to the volcanic vent. These emissions can occur at rates of up to tens of thousands of emissions per second, and are referred to as continuous RF. As the ash cloud expands, small-scale lightning flashes of several hundred meters length begin to occur while the continuous RF ceases. Later on during the eruption larger-scale lightning flashes may occur within the ash cloud that are reminiscent of regular atmospheric lightning. Whereas volcanic lightning flashes are readily observed and reasonably well understood, the nature and morphology of the events producing continuous RF are unknown.

During the 2015 field program we deployed a comprehensive set of instrumentation, including a 10-station 3-D Lightning Mapping Array (LMA) that operated in 10 μs high time resolution mode, slow and fast ΔE antennas, a VHF flat-plate antenna operating in the 20-80 MHz band, log-RF waveforms within the 60-66 MHz band, an infra-red video camera, a high-sensitivity Watec video camera, two high-speed video cameras, and still cameras.

We give an overview of the Sakurajima field program and present preliminary results using correlated LMA, waveforms, photographs and video recordings of volcanic lightning at Sakurajima volcano.