

**VolcLab: A balloon-borne  
instrument package to measure ash,  
gas, electrical, and turbulence  
properties of volcanic plumes**

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Release of volcanic ash into the atmosphere poses a significant hazard to air traffic. Exposure to appreciable concentrations ( $\geq 4 \text{ mg m}^{-3}$ ) of ash can result in engine shutdown, air data system loss, and airframe damage, with sustained lower concentrations potentially causing other long-term detrimental effects [1]. Disruption to flights also has a societal impact. For example, the closure of European airspace following the 2010 eruption of Eyjafjallajökull resulted in global airline industry losses of order £100 million daily and disruption to 10 million passengers. Accurate and effective measurement of the mass of ash in a volcanic plume can be used in combination with plume dispersion modelling, remote sensing, and more sophisticated flight ban thresholds to mitigate the impact of future events.

VolcLab is a disposable instrument package, attached to a standard commercial radiosonde, for rapid emergency deployment on a weather balloon platform. The payload includes a newly developed gravimetric sensor using the oscillating microbalance principle to measure mass directly without assumptions about particles' optical properties. The package also includes an SO<sub>2</sub> gas detector, an optical sensor to detect ash and cloud backscatter from an LED source [2], a charge sensor to characterise electrical properties of the plume [3], and an accelerometer to measure in-plume turbulence [4]. VolcLab uses the established PANDORA interface [5], to provide data exchange and power from the radiosonde. In addition to the VolcLab measurements, the radiosonde provides standard meteorological data of temperature, pressure, and relative humidity, and GPS location. Simultaneous collection of these datasets in multiple locations, and in real time, will provide in situ plume characteristics for airspace risk management planning as well as providing valuable scientific information on plume dynamics.

**References**

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