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High temporal resolution SO_2 flux measurements at Mt. Erebus, Antarctica

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The measurement of SO_2 flux from volcanoes is of major importance for monitoring and hazard assessment purposes, and for evaluation of the environmental impact of volcanic emissions. We propose here a novel technique for accurate and high time resolution estimations of the gas flux. This method involves the combination of two wide field of view UV spectrometers which are capable of collecting, instantaneously, light from cross sections of the whole gas plume. The two instrument fields of view are separated by a small angle which enables tracking of inhomogeneities in the gas cloud from which accurate evaluation of the plume velocity can be made by correlation analysis. The method has been successfully applied on Mt. Erebus volcano (Antarctica). It yields rigorous estimations of the plume velocity and gas flux at unprecedented time resolution (1 Hz) and high accuracy (uncertainty of 25%). During a $\sim$2 h experiment at Erebus on 26 December 2006, SO_2 flux varied between 0.17 and 0.89 $\pm$ 0.1 kg s^{-1} with a vertical plume velocity varying between 1 and 2.5$\pm$0.1 m s^{-1}. These measurements provide insight into the short-term variations of the volcanic degassing of this volcano renowned for its active lava lake. A cyclicity in the flux, ranging from 11-22 min, is evident and associated to the passive release of large amounts of gas at the lake surface. Smaller gas puffs, associated with flux fluctuations on timescales of a few minutes, are also observed intermittently. The dual-wide field of view DOAS technique promises better integration of geochemical and geophysical observations and new insights into gas and magma dynamics, as well as processes of magma storage and gas segregation at active volcanoes.