

A Compact Ultraviolet Spectrometer System (COMPUSS) for Monitoring Volcanic SO₂ Emission: Validation and Preliminary Observation.

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A compact and handy system for measuring SO₂ fluxes from volcanoes is newly built using a miniature UV spectrometer. This COMPACT Ultraviolet Spectrometer System (Hereafter referred as “COMPUSS”) is much smaller and lighter than a correlation spectrometer (COSPEC), which has been used for SO₂ flux measurements from volcanoes over 30 years. Validation of the COMPUSS was carried out comparing COMPUSS and COSPEC instruments at Sakurajima and Miyakejima volcanoes by car and heliborne traverse method, respectively. Our results show that agreement of the SO₂ flux between the COSPEC and the COMPUSS data is vouched for traverse measurements. The COMPUSS has much advantage compared to the COSPEC for volcanic SO₂ flux measurements, because of its portability and possibility for further improvement of the system.

Key words: SO₂ flux, DOAS, UV spectrometer and COSPEC

1. Introduction

For the last 30 years, correlation spectrometer (COSPEC) has been used as the only method for ground-based remote sensing to measure sulfur dioxide emission rate from volcanoes and had a prominent contribution on the progress in recent volcanology. The COSPEC was first designed for monitoring industrial emission of SO₂ and NO₂ in 1960's (Hoff and Millan, 1981) and later used for monitoring volcanic SO₂ emissions by various researchers (e.g., Moffat and Millan, 1971; Stoiber and Jepsen, 1973). Integrated COSPEC measurements showed that correspondence of SO₂ flux with magma discharge rates at Unzen volcano, Japan (Hirabayashi *et al.*, 1995) or with seismicity and ground deformation at Soufriere Hills volcano, Montserrat (Watson *et al.*, 2000).

In the beginning of this century, a remarkably small miniature ultraviolet spectrometer was introduced and used successfully to volcanic SO₂ flux measurements (Galle *et al.*, 2002). This compact and low-cost UV

spectrometer system offered a chance to carry out various kinds of new monitoring methods. Owing to its compactness and portability, the instrument enabled us to make walking traverse measurements (McGonigle *et al.*, 2002; Oppenheimer *et al.*, 2004). At Soufriere Hills volcano, continuous (day-time) measurements of SO₂ flux is carried out using two scanning systems with the miniature UV spectrometer (Edmonds *et al.*, 2003). Several groups developed new methods for measuring the plume speed, which has been always a fundamental problem for flux estimation, by the use of the miniature UV spectrometer (McGonigle *et al.*, 2005; William-Jones *et al.*, 2006). Under current situation, each researcher builds their own systems using the spectrometer (Galle *et al.*, 2002; Horton *et al.*, 2006; McGonigle *et al.*, 2002). In 2002, we started to develop a Japanese version of the miniature UV spectrometer system. The COMPUSS and its operating software are specially designed focusing on easy handling for measurements and on availabil-

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