

Monitoring of CO₂ soil diffuse degassing at Izu-Oshima volcano, Japan

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Izu-Oshima is a 15x9 km active volcanic island located around 100 km SSW of Tokyo. The centre of the island is occupied by a caldera complex with a diameter of 3 km. A large post-caldera cone known as Mt. Mihara is located at the south-western quadrant of the caldera. Izu-Oshima has erupted 74 times, consisting mainly in fissure eruptions, both inside and outside of the caldera. The last eruption of Izu-Oshima occurred in 1986. Since 2007, four soil gas surveys have been carried out to investigate the spatial and temporal evolution of diffuse CO₂ emission from this volcanic system and to identify those structures controlling the degassing process: (i) March 2007, when a soil gas survey was performed at both the entire island (91 Km²) and the central caldera, and (ii) August 2010, July 2011 and July 2012, when soil gas surveys were performed only at the summit area of Mt Mihara. Diffuse CO₂ emission surveys were carried out following the accumulation chamber method. The location of the CO₂ anomalies showed a close relationship with the structural characteristics of the volcano, with most of the gas discharged from the rim of the summit crater and the fissures of the 1986 eruption out of the caldera. As part of the volcanic surveillance program of the island and to improve the knowledge of CO₂ and H₂S diffuse emission dynamics in Izu-Oshima, an automatic geochemical station was installed in March 25, 2008 inside summit crater of Mt. Mihara. Soil CO₂ and H₂S efflux and several meteorological and soil physical variables have been measured in an hourly basis until present. Soil CO₂ efflux ranged from non detectable values up to 94.5 g m⁻² d⁻¹, whereas soil H₂S has been not always detected reaching efflux values up to 14 mg m⁻² d⁻¹. Soil CO₂ efflux time series has shown a stable behaviour with variations due to external variables (environmental parameters) during monitoring period. In the other hand, temporal evolution of diffuse CO₂ emission rate from Mt. Mihara has shown a drastic decrease during the last six years, from 27 t d⁻¹ in March 2007 to 2.2 t d⁻¹ in July 2012. The observed behaviour on the CO₂ emission rate for the 4 surveys could be related to short-term meteorological variations and/or changes on the gas pressure at depth. Future work at Izu-Oshima volcano will include soil helium measurements since helium can play an important role in the prediction of volcanic events. Therefore to perform regularly soil CO₂ and He efflux surveys seems to be an effective geochemical surveillance tool for Izu-Oshima volcano in order to detect a change in the tendency of the gas emission rates in case of future episodes of volcanic unrest.