

Fumarolic and diffuse soil CO₂ output from Furnas Volcano (Azores)

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Introduction

Carbon dioxide diffuse degassing structures and fumarolic fields at Furnas volcano (São Miguel Island, Azores) are the surface expression of rising hydrothermal steam. Soil CO₂ surveys, started in the early nineties, initially demonstrated the existence of a significant CO₂ degassing area in Furnas caldera. Here, we report the results of a study (performed in August 2014) in which soil CO₂ degassing surveys (via accumulation chamber) were combined, for the first time, with measurement of the fumarolic CO₂ flux, using a GasFinder 2.0 tunable diode laser.

Results and Discussion

At each site, we used an ad-hoc designed measurement geometry, using a TDL (a GasFinder unit) and several differently positioned retroreflectors (mirrors), to scan the fumaroles' plume from different angles and distances. From post-processing of the data, we derived contour maps of CO₂ mixing ratios in the plume and, by integration and combination with plume transport speed, we inferred the CO₂ flux directly. Simultaneously, the accumulation chamber equipped with a LICOR LI-800 infrared CO₂ detector that measures CO₂ concentrations in the range 0 – 2 vol.% was used. The soil CO₂ flux contribution from both fields (9.2 t/d) represented a minor (10-15%) contribution to the total CO₂ output (60.5 t/d), which was therefore dominated by fumaroles. The CO₂ emitted by the fumaroles is far lower than the total hydrothermal diffuse degassing flux of ~ 968 t/d. This observation supports the conclusions that, although fumaroles are the most visible surface manifestations of thermalism, they may contribute relatively little to the total CO₂ output from a quiescent, hydrothermal volcano, although exceptions may do exist.