



Short-term variations of diffuse CO₂ and H₂S emission from the summit crater of Teide volcano, Tenerife, Canary Islands

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Tenerife (2034 km²) is the largest of the Canary Islands and hosts a central volcanic complex (Las Cañadas caldera). The twin stratovolcanoes Pico Viejo (3,103 m) and Teide (3,717 m) lie within the summit of Las Cañadas caldera and at the intersection of the three major volcanic rift-zones. Teide summit cone has been constructed during several phases and, although it shows a weak fumarolic system, volcanic gas emissions observed there are mainly controlled by high rates of diffuse CO₂ degassing. Previous diffuse CO₂ surveys have shown to be an important tool to detect early warnings of possible impending volcanic unrests at Tenerife Island (Melián et al., 2012; Pérez et al., 2013). During the summer of 2017, 11 diffuse CO₂ and H₂S degassing studies were performed at Teide Volcano crater (6,972 m²) in order to evaluate short-term variations in the degassing regime. Soil CO₂ and H₂S efflux were measured at 38 observation sites homogeneously distributed inside the summit crater according to the accumulation chamber method, using a non-dispersive infrared (NDIR) LICOR-820 CO₂ analyzer and a H₂S electrochemical cell H2S-BH, Alphasense. Soil CO₂ efflux values ranged between non-detectable values and 492 kg·m⁻²·d⁻¹, with an average of 216 kg·m⁻²·d⁻¹, while soil H₂S efflux values presented a range from non-detectable to 35 g·m⁻²·d⁻¹, with an average of 0.86 g·m⁻²·d⁻¹. Sequential Gaussian simulation (sGs) was used for mapping and estimating the volcanic CO₂ discharge. The highest diffuse CO₂ efflux values were measured at the East sector of the crater (>60 kg·m⁻²·d⁻¹). The zones with the highest diffuse CO₂ effluxes were also characterized by a relatively high soil temperature (>60°C) and intense hydrothermal alteration. The total amount of diffuse CO₂ discharged through the surface environment of the summit crater ranged between 76 and 159 t·d⁻¹ with an average of 115 t·d⁻¹. The observed variations of CO₂ diffuse emission during June-August 2017 are higher than those observed during the same period of 2016 (15.6-22.4 t·d⁻¹, with an average of 19.0 t·d⁻¹) and during 1999 to 2010 period (2.2-36.3 t·d⁻¹, with a mean value of 15.7 t·d⁻¹; Melián et al., 2012). This increase in the diffuse emission of CO₂ is well-correlated with an increase in the seismic activity recorded during 2017: INVOLCAN seismic network registered a total of 102, 73 and 38 seismic events for June, July and August, respectively, values higher than those registered by the Instituto Geográfico Nacional (IGN; <http://www.ign.es>) in the same period of 2016, with an average value of 10 seismic events per month. This change in the CO₂ emission ranges was probably due to the increase of fluid pressure in the hydrothermal-magmatic system of Tenerife. Periodic diffuse CO₂ and H₂S surveys will be a valuable to improve and optimize the detection of early warning signals of future volcanic unrest at Teide volcano.

References

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