



Short-term variations of diffuse He and H₂ at the summit crater of Teide volcano, Tenerife, Canary Islands

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Tenerife (2034 km²), the largest island of the Canarian archipelago, hosts three volcanic rifts and a central volcanic complex, Las Cañadas, which is characterized by eruptions of differentiated magmas. Lying inside Las Cañadas and at the intersection of the three volcanic rifts, a twin stratovolcano system, Pico Viejo-Teide, has been developed. 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 all around the summit cone of Teide (Pérez et al., 2013). During summer 2018, 14 soil gas surveys have been performed at the summit crater of Teide volcano to determine the diffuse He and H₂ emission rates and to evaluate the temporal variations and their relationships with the seismic–volcanic activity. In each survey a total number of 38 sites were sampled homogeneously distributed within an area of 6,972 m² inside the summit crater. Soil gases were sampled at 40 cm depth using a metallic probe with a 60 cc hypodermic syringe and stored in 10 cc glass vials for later laboratory analysis. Diffusive and convective emission components of He and H₂ were estimated at each sampling site following the Fick and Darcy's laws, respectively. In order to compute the diffuse He and H₂ emissions at the studied area, spatial distribution maps were constructed using sequential Gaussian simulations. The zones with the highest diffuse He and H₂ emission were also characterized by high CO₂ effluxes and relatively high soil temperature (>60 °C) as well as intense hydrothermal alteration. Temporal evolution shows a range from 0.03 to 4.1 kg•d⁻¹ and from 5.2 to 15 kg•d⁻¹, with an average values of 0.5 kg•d⁻¹ and 9 kg d⁻¹ for He and H₂, respectively, with maximum values measured on June 13th survey. The observed increases on both gases are well-correlated with an increase in the seismic activity recorded during 2018. INVOLCAN seismic network registered a total of 114, 175 and 67 seismic events for April, May and June, respectively. These changes in the He and H₂ emission rates were probably due to the increase of fluid pressure in the hydrothermal-magmatic system of Tenerife. Periodic diffuse He and H₂ emission surveys will be a valuable to improve and optimize the detection of early warning signals of future volcanic unrest at Teide volcano.

References

Pérez et al., 2013. *J. Geol. Soc.*, DOI: 10.1144/jgs2012-125.