



Surface diffuse degassing monitoring of the Tenerife Northwestern Rift Zone (NWRZ) volcano, Canary Islands

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Tenerife (2034.38 km²), the largest island of the Canarian archipelago, is characterized by three volcanic rifts oriented NW-SE, NE-SW and N-S with a central volcanic structure, Las Cañadas Caldera, hosting Teide-Pico Viejo volcanic complex. The North-West Rift-Zone (NWRZ) is one of the youngest and most active volcanic systems of the island, where three historical eruptions (Boca Cangrejo S.XVI, Arenas Negras 1706 and Chinyero 1909) have occurred. In order to study the activity of this zone, diffuse degassing studies have been taking place since 2000, covering an area of 72 km² with 345 sampling sites homogeneously distributed. Measurements were carried out according to the accumulation chamber method, using a portable non-dispersive infrared CO₂ analyzer system. During this period, soil CO₂ efflux values have ranged from non-detectable up to 141 g•m⁻²•d⁻¹, with the highest values measured in May 2005 whereas total CO₂ output ranged between 52 and 867 t•d⁻¹. Long-term variations in the total CO₂ output have shown a temporal correlation with the onsets of seismic activity at Tenerife, supporting unrest of the volcanic system, as is also suggested by anomalous seismic activity recorded in the studied area during April 22-29, 2004 and also during October 2-3, 2016 (Hernández et al., 2017). Soil CO₂ efflux values for the 2018 survey ranged between non-detectable values and 122 g•m⁻²•d⁻¹, with an average value of 8 g•m⁻²•d⁻¹. In 2017 values ranged between non-detectable and 47 g•m⁻²•d⁻¹, three times less than in the last survey in 2018. The probability plot technique applied to the data allowed to distinguish different geochemical populations. Background represented 96.6% of the total data with a mean value of 4.4 g•m⁻²•d⁻¹, and a peak population representing 0.6% and with a mean value of 79 g•m⁻²•d⁻¹. To construct a CO₂ efflux spatial distribution map, 100 sequential Gaussian simulations was used as interpolation method, resulting in an diffuse emission rate of 523 ± 22 t•d⁻¹, with the highest values located in the northeast slope of the rift. Monitoring the diffuse CO₂ emission contributes to detect early warning signals of volcanic unrest, especially in areas where visible degassing is non-existent as in the Tenerife North-West Rift-Zone.

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