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Diffuse CO₂ degassing monitoring of the Tenerife North–South Rift Zone (NSRZ) volcano, Canary Islands

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Tenerife (2,034 km²) is the largest of the Canary Islands and the North South Rift Zone (NSRZ) is one of the three active volcanic rift-zones of the island. The NSRZ (325 km²) is characterized mainly by effusive activity of basaltic lavas forming spatter and cinder cones and comprises 139 monogenetic cones representing the most common eruptive activity occurred on the island during the last 1 Ma. In order to provide a multidisciplinary approach to monitor potential volcanic activity changes at the NSRZ volcano, diffuse CO₂ emission surveys have been undertaken since 2002. This study shows the results of the last soil CO₂ efflux survey undertaken in summer 2019, with 600 soil gas sampling sites homogeneously distributed in the study area. Soil CO₂ efflux measurements were performed at the surface environment by means of a portable non-dispersive infrared spectrophotometer (NDIR) LICOR Li820 following the accumulation chamber method. Soil CO₂ efflux values ranged from non-detectable (≤ 0.5 g m⁻² d⁻¹) up to 30 g m⁻² d⁻¹, with an average value of 2.6 g m⁻² d⁻¹. In order to distinguish the existence of different geochemical populations on the soil CO₂ efflux data, a Sinclair graphical analysis was done. The average value of background population was 2.1 g m⁻² d⁻¹ and that of peak population was 18.5 g m⁻² d⁻¹, representing the 97% and the 1% of the total data, respectively. To quantify the total CO₂ emission rate from the NSRZ volcano a sequential Gaussian simulation (sGs) was used as interpolation method. The diffuse CO₂ emission rate for the studied area was estimated in 2019 in 819 ± 18 t d⁻¹, ranging from 466 to 819 t d⁻¹ between 2002 and 2019, with the highest value measured in 2015 (707 t d⁻¹). The temporal evolution of diffuse CO₂ emission at the NSRZ shows a clear relationship with the volcano seismic activity in and around Tenerife Island, which started to taking place from the end of 2016. This study demonstrates the importance of studies of soil CO₂ efflux at the NSRZ volcano of Tenerife island as an effective volcanic monitoring tool, especially in areas where there is no visible degassing (fumaroles, etc.)