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Geochemical monitoring of El Hierro volcano (Canary Islands) by means of diffuse CO_2 degassing surveys

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El Hierro, the smallest, youngest and westernmost island of the Canarian archipelago, with an area of 278 Km2, is settled on an ocean floor 3.5 km deep and reaches 1.5 km above sea level. The island was constructed by rapid constructive and destructive processes in $\sim$ 1.12 Ma. From October 2011 to March 2012 a submarine eruption took place about 2 km south of the small village of La Restinga in the southernmost part of the island. The eruptive process has been the second longest and the second largest volume discharged in the historical volcanic activity of the Canaries (in the last 500 years) and was the first one to be monitored from the beginning. One of the most useful geochemical tools to monitor the volcanic activity of El Hierro is the diffuse degassing studies, since visible volcanic emissions are absent at the surface of El Hierro. Diffuse CO_2 emissions have been monitored at El Hierro Island since 1998 in a yearly basis, with higher frequency during the pre and eruptive periods. At each survey, 600 sampling sites are studied and measurements of soil CO_2 efflux were performed in situ following the accumulation chamber method (Parkinson, 1981). During pre-eruptive and eruptive periods, the diffuse CO_2 emission released by the whole island experienced significant increases before the onset of the submarine eruption and the most energetic seismic events of the volcanic-seismic unrest. In the last survey, performed in the 2018 summer period, soil CO_2 efflux values ranged from non-detectable to 31 g•m−2•d^{-1}. Statistical-graphical analysis of the data show three different geochemical populations, background (B), intermediate (I) and peak (P), represented by 90.9%, 7.8 % and 1.3% of the total data respectively, with geometric means of 1.1, 12 and 22 g•m−2•d^{-1}, respectively. To quantify the diffuse CO_2 emission for the 2018 survey, 100 sequential Gaussian simulations (sGs) were performed as interpolation method. The estimated 2018 diffuse CO_2 output released to atmosphere by El Hierro was at 654 $\pm$ 26 t•d-1, value higher than the background average of CO_2 emission estimated in 422 t•d-1. The data presented here demonstrate that discrete surveys of diffuse CO_2 emission offer important information to optimize the early warning system in volcano monitoring programs and to monitor the evolution of an on-going volcanic eruption.