Diffuse CO$_2$ emission from the NE volcanic rift-zone of Tenerife (Canary Islands, Spain): a 15 years geochemical monitoring

Germán Padilla (1,2), Mar Alonso (1), Trevor Shoemaker (3), Ariane Loisel (4), Eleazar Padrón (1,2), Pedro A. Hernández (1,2), Nemesio M. Pérez (1,2)

(1) Instituto Volcánologico de Canarias (INVOLCAN), 38400, Puerto de la Cruz, Santa Cruz de Tenerife, Canary Islands, Spain, (2) Environmental Research Division, Instituto Tecnológico y de Energías Renovables (ITER), 38611, Granadilla de Abona, Santa Cruz de Tenerife, Canary Islands, Spain, (3) Department of Geology, College of Wooster, Ohio, 44691, United States of America, (4) Department of Earth Sciences, University College London, London, WC1E 6BT, United Kingdom

The North East Rift (NER) volcanic zone of Tenerife Island is one of the three volcanic rift-zones of the island (210 km$^2$). The most recent eruptive activity along the NER volcanic zone took place in the 1704-1705 period with the volcanic eruptions of Siete Fuentes, Fasnia and Arafo volcanoes. The aim of this study was to report the results of a soil CO$_2$ efflux survey undertaken in June 2015, with approximately 580 measuring sites. In-situ measurements of CO$_2$ efflux from the surface environment of NER volcanic zone were performed by means of a portable non-dispersive infrared spectrophotometer (NDIR) model LICOR Li800 following the accumulation chamber method. To quantify the total CO$_2$ emission from NER volcanic zone, soil CO$_2$ efflux contour maps were constructed using sequential Gaussian simulation (sGs) as interpolation method. The total diffuse CO$_2$ emission rate was estimated in 1209 t d$^{-1}$, with CO$_2$ efflux values ranging from non-detectable (∼0.5 g m$^{-2}$ d$^{-1}$) up to 123 g m$^{-2}$ d$^{-1}$, with an average value of 5.9 g m$^{-2}$ d$^{-1}$. If we compare these results with those obtained in previous surveys developed in a yearly basis, they reveal slight variations from 2006 to 2015, with to pulses in the CO$_2$ emission observed in 2007 and 2014. The main temporal variation in the total CO$_2$ output does not seem to be masked by external variations. First peak precedes the anomalous seismicity registered in and around Tenerife Island between 2009 and 2011, suggesting stress-strain changes at depth as a possible cause for the observed changes in the total output of diffuse CO$_2$ emission. Second peak could be related with futures changes in the seismicity. This study demonstrates the importance of performing soil CO$_2$ efflux surveys as an effective surveillance volcanic tool.