Geophysical Research Abstracts
Vol. 14, EGU2012-8903-1, 2012
EGU General Assembly 2012

Spatial and temporal variations of soil CO_2 degassing rate at El Hierro volcanic system and relation to the 2011 submarine eruption

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El Hierro Island (278 km2) is the youngest and the SW-most of the Canary Islands. On July 16, 2011, a seismic-volcanic crisis started with the occurrence of more than 11,900 seismic events. On October 10, 2011, the seismic activity changed behaviour and produced a harmonic tremor due to magma movement suggesting the initial stage of an eruption. The purpose of this study is to investigate the spatial and temporal variations of soil CO_2 degassing rates at El Hierro volcanic system and its relation with the 2011 El Hierro volcanic unrest. Since 1998, diffuse CO_2 emission has been investigated at El Hierro volcanic system in a yearly basis during the summer periods with approximately 600 observation sites. From 2004 to 2009, a diffuse CO_2 emission rate decreasing trend from 1434 to 358 t•d-1 (equivalent to background values) was observed, and this tendency changed from 2009 to 2010 reaching a diffuse CO_2 emission rate of 970 t•d-1. Because of this observed tendency change on the diffuse CO_2 emission rate is possible to think that the preliminary stages of the 2011 volcanic unrest at El Hierro did start by the middle of 2010 with aseismic magma rising in the upper mantle beneath El Hierro. Since July 2011 and due to the start of the seismic-volcanic crisis at El Hierro, 16 diffuse CO_2 emission surveys have been undertaken until January 2012. Diffuse CO_2 emission measurements were performed by means of portable NDIR sensors according to the accumulation chamber method. Observed soil CO_2 efflux values for all the 2011-12 surveys have ranged from negligible values to 398 g•m-2•d-1. The diffuse CO_2 output released to atmosphere for the 2011-12 surveys was estimated between 138 and 2,143 t•d-1. On October 6, 2011, an increase tendency of diffuse CO_2 emission rate from 380 to 990 t•d-1 was observed prior the occurrence of the first 4 magnitude type earthquake on October 8, 2011, and El Hierro submarine eruption on October 12, 2011. From October 15, 2011, an increase trend on the diffuse CO_2 emission rate had been observed reaching a maximum value of 2,143 t•d-1 on November 27, 2011, and followed by a decrease trend until present. Movement of magma beneath El Hierro volcanic edifice and changes on the gas pressure at depth can explain the observed temporal variations on the diffuse CO_2 emission rate. Performing regularly soil CO_2 efflux surveys seem to be an effective geochemical surveillance tool for El Hierro volcanic system