

## **Monitoring diffuse volcanic degassing during volcanic unrests: the case of Campi Flegrei (Italy)**

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Hydrothermal activity at Solfatara of Pozzuoli (Campi Flegrei caldera, Italy) results on a large area of hot soils, diffuse CO<sub>2</sub> degassing and numerous fumaroles, releasing at the surface large amounts of gasses and thermal energy. Solfatara is one of the first sites of the world where the techniques for measuring and interpreting soil CO<sub>2</sub> diffuse degassing were developed during 1990's and, more recently, it has become a sort of natural laboratory for testing new types of measurements of the CO<sub>2</sub> fluxes from hydrothermal sites. The results of 30 diffuse CO<sub>2</sub> flux surveys performed at Solfatara from 1998 to 2016 are presented and discussed. CO<sub>2</sub> soil fluxes were measured over an area of about 1.2 [U+F0B4] 1.2 km including the Solfatara crater and the hydrothermal site of Pisciarelli using the accumulation chamber technique. Each survey consisted in a number of CO<sub>2</sub> flux measurements varying from 372 to 583 resulting in a total of 13158 measurements. This data set is one of the largest dataset ever made in the world on a single degassing volcanic-hydrothermal system. It is particularly relevant in the frame of volcanological sciences because it was acquired during a long period of unrest at Campi Flegrei caldera and because Solfatara release an amount of CO<sub>2</sub> comparable to that released by medium-large volcanic plumes. Statistical and geostatistical elaborations of CO<sub>2</sub> flux data allowed to characterise the sources of soil diffuse degassing, to define the extent of the area interested by the release of hydrothermal CO<sub>2</sub> (Solfatara DDS) and to quantify the total amount of released CO<sub>2</sub>. During the last eighteen years relevant variations affected Solfatara degassing, and in particular the "background" CO<sub>2</sub> emission, the extent of DDS and the total CO<sub>2</sub> output, that may reflect variations in the subterranean gas plume feeding the Solfatara and Pisciarelli emissions. In fact, the most relevant variations in Solfatara diffuse degassing well correlates with steam condensation and temperature increase affecting the Solfatara system resulting from repeated inputs of magmatic fluids into the hydrothermal systems as suggested by Chiodini et al., (2015; 2016; 2017) and show a long-term increase on the amount of released CO<sub>2</sub> that accompanies the ongoing unrest of Campi Flegrei caldera.