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# $CO_2$ soil flux permanent stations in S. Miguel Island (Azores archipelago) – time series analysis

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Furnas and Fogo volcanoes are two of the three active central volcanoes of S. Miguel Island where a variety of hydrothermal manifestations, namely fumarolic fields, thermal and $CO_2$ cold springs and soil diffuse degassing areas can be found. This work reports the continuous gas geochemical monitoring network currently in progress in S. Miguel Island for seismovolcanic surveillance and for public health risk assessment purposes.

The soil flux continuous programme started in October 2001 when the first permanent $CO_2$ soil flux station was installed in Furnas Volcano. Presently four stations are running in S. Miguel Island, two in Furnas and two in Fogo volcanoes. These stations perform measurements by the accumulation chamber method and the $CO_2$ soil flux averages vary between 6 and 600 $gm^{-2}d^{-1}$ depending on the monitoring site. Data on meteorological variables are simultaneously acquired by sensors coupled to the stations. Statistical approaches (multiple regression analysis) applied to the raw data allowed observing that the external monitored variables may influence more than 30% of the gas flux oscillations. Additionally it was noticed that meteorological variables (mainly barometric pressure, rainfall, soil water content and wind speed) show different control on gas flux depending on the selected monitoring site and may cause significant short-term (spike-like) oscillations. The recognition of those influences becomes important in order to distinguish external sources from gas anomalies related with deep processes. Differences among the monitoring sites may be mainly explained by the soil permeability and porosity, topographic effects and different exposure to the weather conditions. Seasonal variations were also possible to be identified in the five

years monitoring data. These long-term variations are characterized by higher $CO_2$ soil flux values during winter time and lower values in summer time.

The filtered data from the external variables allows the definition of a baseline for the gas flux oscillations for each monitoring site that will help in the recognition of variations that can potentially be related with deep processes. During the analysed time period several low magnitude seismic swarms ($M_L < 4.3$) have occurred in the area between both mentioned volcanic systems but no significant $CO_2$ soil flux changes were possible to correlate with the seismovolcanic activity.