Automatic semi-continuous accumulation chamber for diffuse gas emissions monitoring in volcanic and non-volcanic areas

Matteo Lelli (1), Brunella Raco (1), Francesco Norelli (1), Giorgio Virgili (2), and Davide Continanza (2)

(1) Institute of Geosciences and Earth Resources, Pisa, Italy (m.lelli@igg.cnr.it), (2) West Systems s.r.l., Pontedera, Italy (g.virgili@westsystems.com)

Since various decades the accumulation chamber method is intensively used in monitoring activities of diffuse gas emissions in volcanic areas. Although some improvements have been performed in terms of sensitivity and reproducibility of the detectors, the equipment used for measurement of gas emissions temporal variation usually requires expensive and bulky equipment. The unit described in this work is a low cost, easy to install-and-manage instrument that will make possible the creation of low-cost monitoring networks. The Non-Dispersive Infrared detector used has a concentration range of 0-5% CO_2, but the substitution with other detector (range 0-5000 ppm) is possible and very easy. Power supply unit has a 12V, 7Ah battery, which is recharged by a 35W solar panel (equipped with charge regulator). The control unit contains a custom programmed CPU and the remote transmission is assured by a GPRS modem. The chamber is activated by DataLogger unit, using a linear actuator between the closed position (sampling) and closed position (idle). A probe for the measure of soil temperature, soil electrical conductivity, soil volumetric water content, air pressure and air temperature is assembled on the device, which is already arranged for the connection of others external sensors, including an automatic weather station. The automatic station has been tested on the field at Lipari island (Sicily, Italy) during a period of three months, performing CO_2 flux measurement (and also weather parameters), each 1 hour. The possibility to measure in semi-continuous mode, and at the same time, the gas fluxes from soil and many external parameters, helps the time series analysis aimed to the identification of gas flux anomalies due to variations in deep system (e.g. onset of volcanic crises) from those triggered by external conditions.