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Instrumental system for the quick relief of surface temperatures in fumaroles fields and steam heated soils

Iole Diliberto, Santo Cappuzzo, Salvatore Inguaggiato, and Paolo Cosenza
Isitituto Nazionale di Geofisica e Vulcanologia, Sezione di Palermo, Italy

We present an instrumental system to measure and to map the space variation of the surface temperature in volcanic fields. The system is called Pirogips, its essential components are a Pyrometer and a Global Position System but also other devices useful to obtain a good performance of the operating system have been included.
In the framework of investigation to define and interpret volcanic scenarios, the long-term monitoring of gas geochemistry can improve the resolution of the scientific approaches by other specific disciplines. Indeed the fluid phase is released on a continuous mode from any natural system which produces energy in excess respect to its geological boundaries. This is the case of seismic or magmatic active areas where the long-term geochemical monitoring is able to highlight, and to follow in real time, changes in the rate of energy release and/or in the feeding sources of fluids, thus contributing to define the actual behaviour of the investigated systems (e.g. Paonita el al., 2013; 2002; Taran, 2011; Zettwood and Tazieff, 1973).
The demand of pirogips starts from the personal experience in long term monitoring of gas geochemistry (e.g. Diliberto I.S, 2013; 2011; et al., 2002; Inguaggiato et al.,2012a, 2012b). Both space and time variation of surface temperature highlight change of energy and mass release from the deep active system, they reveal the upraise of deep and hot fluid and can be easily detected. Moreover a detailed map of surface temperature can be very useful for establishing a network of sampling points or installing a new site for geochemical monitoring. Water is commonly the main component of magmatic or hydrothermal fluid release and it can reach the ground surface in the form of steam, as in the high and low temperature fumaroles fields, or it can even condense just below the ground surface. In this second case the water disperses in pores or circulates in the permeable layers while the un-condensable gases reach the surface (e.g. in mofettes and diffuse degassing areas). The occurrence of thermal anomalies at the surface often reveals that a process of steam condensation is occurring below the ground and that CO_2 fluxes are being released on the surface. A thermal map of steam heated grounds therefore highlights boundaries of underground steam advection and also the more suitable sites for geochemical monitoring.
Pirogips has been assembled for the quick acquisition of surface parameters related to the exhaling activity of volcanic systems. It has been formerly tested in a controlled environment, after in the well known fumaroles areas of Vulcano island, and then in the volcanic system El Machin (Colombia) for the field survey preliminary to the installation of new monitoring stations.
The preliminary test and the first field experiences confirmed that pirogips acquires the surface temperatures quickly and with good detail. The combination of sensors supplies the advantage of in situ methods (i.e. accuracy of the direct measurement by thermocouple) and those of ground-based remote sensing techniques (i.e. quickness of measurement process), at the same time reducing the main disadvantages of each method. A home-made data-logger combines the acquired parameters and returns a data-string allowing an easy visualization of acquired data on geo-referenced maps. The string of data returns the position of acquisition (lat, long, WGS84), surface temperature (either derived by the pyrometer and by thermocouple), ambient temperature, barometric pressure and air moisture.
-References
-Diliberto I.S., Gurrieri S., Valenza M. (2002) Relationships between diffuse CO_2 emissions and volcanic activity on the island of Vulcano (Aeolian Islands, Italy) during the period 1984-1994 Bulletin of Volcanology vol 64: 219-228.
-Diliberto I.S., (2013) Time series analysis of high temperature fumaroles monitored on the island of Vulcano (Aeolian Archipelago, italy). Journal of Volcanology and Geothermal Research Manuscript Number: doi: 10.1016/j.jvolgeores.2013.08.003.
Inguaggiato, S., Mazot, A., Diliberto, I.S., Inguaggiato, C., Madonia, P., Rouwet, D., Vita, F., (2012a) Total CO_2 output from Vulcano island (Aeolian Islands, Italy). Geochem. Geophys. Geosyst., 13, 2 ‘, Q02012, DOI 10.1029/2011GC003920.
-Inguaggiato, S., Calderone, L., Inguaggiato, C., Mazot, A., Morici, S., Vita F. (2012b) Long time variation of

soil CO_2 fluxes at the summit crater of Vulcano (Italy). Bull Volcanol, 74:1859–1863, DOI 10.1007/s00445-012-0637-6.
-Paonita, A., Favara, R., Nuccio, P. M., Sortino, F. (2002). Genesis of fumarolic emissions as inferred by isotope mass balances: CO_2 and water at Vulcano Island, Italy. Geochim. Cosmochim. Acta, 66, 759–772, doi:10.1016/S0016-7037(01)00814-6.
-Paonita A., C. Federico, P. Bonfanti, G. Capasso, S. Inguaggiato, F. Italiano, P. Madonia, G. Pecoraino, F. Sortino (2013) The episodic and abrupt geochemical changes at La Fossa fumaroles (Vulcano Island, Italy) and related constraints on the dynamics, structure, and compositions of the magmatic system. Geochimica et Cosmochimica Acta 120, 158–178.
Taran Y. A. (2011). N2, Ar, and He as a tool for discriminating sources of volcanic fluids with application to Vulcano, Italy. Bulletin of volcanology, 73, 395-408, doi: 10.1007/s00445-011-0448-1.
-Zettwood, P., Tazieff, H. (1973). Instrumentation for measuring and recording mass and energy transfer from volcanoes to the atmosphere. Bulletin of Volcanology 36, 1-19.