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Coupling high resolution electric resistivity tomography, temperature and soil gas emission to solve the ambiguities in interpreting self-potential signal on Stromboli volcano

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Six profiles of several kilometres long combining self-potential (SP) with high resolution Electrical Resistivity Tomography (ERT), soil CO2 flux and concentration and temperature (T) measurements, covering large part of Stromboli island, have been performed in May 2004 and April 2005. ERT (electrode spacing 20 meters, with a depth of penetration of 215 meters) allowed to identify the main structural boundaries and associated fluid flow structuring the shallow architecture of Stromboli island. The summit hydrothermal system have been clearly identified with very low values of the electrical resistivity ($<$ 50 Ohm.m) associated with strong positive SP, soil T and gas anomalies. Outside of the summit hydrothermal system, the dynamics of SP signal in the northern part of the island could be interpreted in different ways. Thanks to ERT, the surrounding rocks of the summit hydrothermal have been characterized by very resistive values ($>$ 2000 Ohm.m) except just on the North-East flank of the volcano where an aquifer have been detected at about 80 m depth (resistivity in the range 70-300 Ohm.m). This area revealed the presence of a giant old collapse structure, with a succession of listric faults. The geometry of this electric conductor at depth allowed in better understanding the significance of SP signal variations, in this part of the island. In the summit part of the island, a detailed correlation between SP, ERT, T and soil

gas emission clearly identified the relationships between lateral permeability changes and variations in SP gradients. Our first results obtained on Stromboli volcano, using ERT for the first time through an entire volcanic edifice, reveals the very high potentiality of the method to image with high resolution the inner structure of a volcano. Moreover, the complementarities of the four methods, allowed to better interpret in term of permeability and related fluid flow the inner structure of the volcano, and also the significance of SP signal variation on a active volcano.