

The summit part of Mount Etna revealed by High Resolution DC Electrical Resistivity Tomography coupled with complementary geophysical and soil gas techniques

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Between 25 June and 13 July 2015 a very deep ERT profile (Pole-Dipole configuration, 40m spacing between electrodes and a remote electrode located at ~10km from the acquisition points) has been performed in the framework of the “MED-SUV” Project. Self-potential, soil gas concentrations (CO₂, ²²²Rn, ²²⁰Rn, He, H₂ and CH₄) and soil temperature measurements were coupled to the ERT profile with a spacing of 20m (except for Rn: 40m). The NE-SW profile crossed Etnas summit craters in the middle of the 5720m ERT total length. Six roll along protocols of ¼ of the dispositive (600m out of 2520m tot) have been carried out and, for the first time, a high resolution DC ERT profile reached the noticeable investigation depth of 900m b.g.l.. The results clearly evidence the central shallow hydrothermal system of Mt. Etna with large positive self-potential anomaly, high values of temperature, ²²²Rn, CO₂, He, H₂ and CH₄, in the areas where the conductive bodies reach the surface in correspondence of the summit craters and the 2014 eruptive vents (CO₂, ²²²Rn and temperature). Structural boundaries, such as the Elliptic Crater, were highlighted by a sharp decrease of the self-potential inside the Elliptic Crater. The high activity of ²²⁰Rn (Thoron) outside the Elliptic Crater highlights shallow gas source. The resistive body identified just below the NE crater is probably due to the over-heated plume rising from the top of the shallow feeding system towards the surface.