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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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In the framework of the EC FP7 project "MEDiterranean SUpersite Volcanoes", one profile coupling DC electrical resistivity tomography (Pole-Dipole configuration with a remote electrode located between 8-10 km from the middle of the different acquisitions, 64 electrodes and 40 m spacing between the electrodes), self-potential, soil CO_2 degassing, Radon measurements and sub-surface (30cm depth) temperature have been performed between June 25th and July 13th 2015.
This profile, NE-SW direction, crossed the summit part of Mount Etna. A total 5720m of profile was performed, with a roll along protocol of 1/4 of the dispositive, for each new acquisitions. A total of 6 acquisitions was made to complete the entire profile.
For the first time in the world, a multi-electrodes DC ERT profile, of high resolution (40 m of spacing between the electrodes) reached, thanks to a pole-dipole configuration, 900m for the depth of investigation.
The ERT profile clearly evidences the hydrothermal system of Mount Etna: the lowest resistivity values are associated with a large scale positive self-potential anomaly, and smaller wavelength anomalies for temperature, CO_2 concentration and Radon, in the area where the electrical conductor reach the surface.
Structural discontinuities such as the Elliptic crater, was clearly evidenced by a sharp decrease of the self-potential values in the inner part of this crater.
The striking result of this profile is the presence of a resistive body located just below the NE crater. This structure displays the highest degassing values of the entire profile. We interpret this resistive body as a consequence of the thermic over-heated plume rising from the top of the shallow feeding system. Indeed, above several hundred of degrees Celsuis, it is impossible to consider rain water infiltration and the presence of a wet hydrothermal system. The consequence would be therefore to obtain this resistive body, centred on the area of main heat transfer.
Above this resistive body, we clearly note a preferential hydrothermal fluid flow, associated with maximum of self-potential anomaly, temperature and radon, and reaching the surface on the highest elevation area along the profile.