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Correlation between resistivity and seismicity at Etna volcano (Italy)

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A great number of studies concerning the existence of instability phenomena as eastward sliding movements, in the eastern flank of Etna (Italy) have been performed. Actually, although the existence of these phenomena is overt, clear results about the presence in depth of décollement surfaces are still lacking. Multi-disciplinary information must be put together in order to better constrain modeling. A magnetotelluric (MT) derived 2D resistivity models recovered along two profiles (N-S and NW-SE-striking) located in the eastern flank of Etna and a well-localized seismicity data set belonging to the period July 2001- December 2006 are herein jointly analysed. The comparison between the seismicity data set and the MT results, both strike analysis and the resistivity models, was performed.

Detailed MT strike and dimensionality analyses reveal consistent, but period dependent, strike directions, indicating a change in the geoelectrical strike with period, that means, giving their direct proportionality, with depth. In the period ranges 0.01-1 s and 4-100 s the geoelectric strike angle is oriented W-E and almost SW-NE, respectively. A comparison with seismological data indicates that shallower MT strike is consistent with the EW clustered seismicity along the Pernicana Fault System.

Projection of the seismic activity located within a $\pm$ 2 km wide band, centered on the two MT resistivity models, strengths the existence of two different processes affecting the eastern flank at the same time, but at different depth ranges. The boundary between them, is marked by a resistivity increasing, that is interpreted as the top of the Etna basement. Within the second depth range (3-7 km bsl) along the MT profile, a detailed analysis of the relative seismic events recovered a low seismicity level at 4.5 $\pm$ 0.3 km b.s.l.. A 3D inspection of the seismic dataset shows that this level of reduced seismicity clearly originates from the northern wall of VdB and extends to NE.

This result suggests that the deeper rupture process characterizing the north-eastern flank of Etna may occurs on multiple planes and the level of reduced seismicity could play a key role in the instability processes involving the eastern flank of the volcano.