

EVIDENCE OF DIRECTIONAL SITE EFFECTS ON FAULT ZONES: OBSERVATIONS FROM SOUTH-EASTERN SICILY AND MALTA

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It is well known that faults are generally characterized by a highly fractured low-velocity zone bounded by higher-velocity undamaged rock that behaves as a wave guide trapping incident seismic energy and therefore causing local amplifications (e.g. Li *et al.*, 2000). The local seismic response in the vicinity of fault zones was recently studied in the Etnean area (e.g. Di Giulio *et al.*, 2009). A systematic polarization of horizontal ground motion was observed near the investigated faults. The observation of a similar behaviour when using both earthquake and ambient noise recordings suggests the use of microtremors for investigating ground motion polarization properties across the main faults in the volcanic area, as well in SE Sicily and Malta. Noise measurements were performed along transects perpendicular to the fault strike, at increasing distance from it. Time series of ambient noise, having a total duration of thirty minutes, were processed through HVNR technique. Directional site effects were analyzed both by rotating the horizontal components of motion and computing the horizontal to vertical spectral ratio, as well as through a direct estimate of the polarization angle using the covariance matrix method.

Near all the investigated faults, the results show a stable polarization of the horizontal motion, in the frequency band 1.0-5.0 Hz, with directions that, only in a few cases are parallel to the fault strike. Generally, polarization directions make an angle of about 60° with the fault strike. It is that polarization angles parallel to the fault strike were observed only in one structure (Piedimonte fault) characterized by a predominant pure dip-slip motion, whereas all the other investigated faults show extensional oblique slip movements. Measurements at increasing distances from the fault lines indicate that polarization directions from both rotated spectral ratios and rose diagrams tend to become randomly distributed and/or uniformly scattered as the distance from the faults increases.

The evidence that directional effects are almost always not parallel to the fault strike is not consistent with the explanation of fault-trapped waves in a narrow low velocity zone between harder wall rocks. A possible explanation for this behavior could be given by a comparison with results from studies about stress directions and fractures orientation, in the presence of faults Studies by Tron and

Brun (1991) and Richard *et al.* (1994) show that a wide field of secondary fractures, with angles from 50 to 70°, with the strike of the main tectonic line can be correlated with changing values of the stretching vector angle, becoming more and more *en echelon* as the strike slip component increases.

References

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