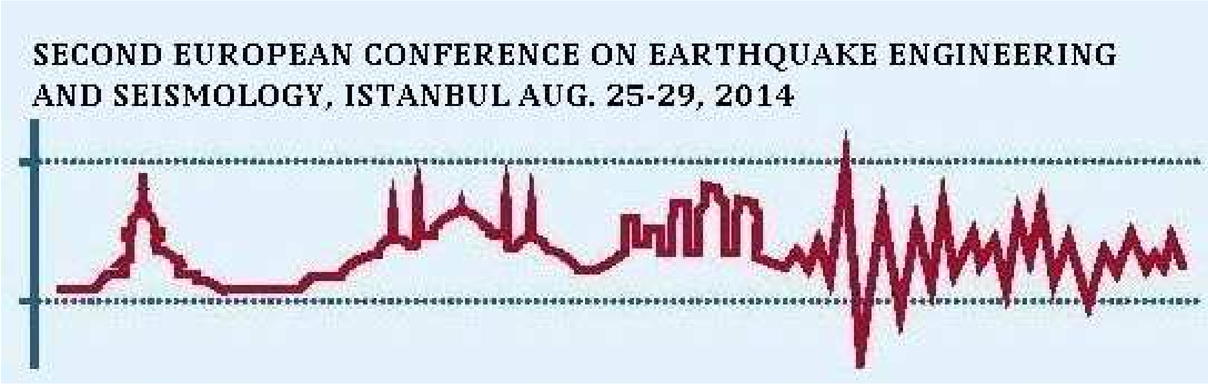

DIRECTIONAL AMPLIFICATIONS OF THE GROUND MOTION IN A SPREADING AREA: SOUTH ICELAND

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The Mid-Atlantic Rift crosses Iceland from southwest to northeast, with rifting and transform motion taking place at the plate boundary, leading to volcanic activity and earthquakes. In particular, the seismicity in South Iceland (SISZ) is well know and many major faults in the zone and on Reykjanes Peninsula (RP) have already been mapped from manifestations on the surface, as well as in the subsurface through high-precision earthquake relocations. In the SISZ the faults are predominantly N-S with right-lateral strike-slip motion, while the over-all motion is E-W oriented left-lateral motion. In the RP the N-S faults interact with the oblique rifting (109°E) in the rift zone. Geology of the studied area is mostly covered by alternating basaltic lava units and hyaloclastite formations, highly fractured by the presence of the well-developed fault system. In the area different distinct volcanic fissure swarms (Jakobsson et al., 1978; Clifton and Kattenhorn, 2006) with an average strike of N40°E are present.

The features of near surface geology as well as the morphologic setting play a key role in controlling ground motion. Spectral ratio techniques make it possible to underline, in the frequency domain, the modifications of the seismic input when it propagates from the bedrock to the surface through the shallower deposits. In several recent studies, amplified motions near faults were found to have a high angle to the fault strike, indicating a mechanism different from trapped waves (Di Giulio et al., 2009; Panzera et al., 2014; Pischiutta et al., 2014). Fault zones are anisotropic solids characterized by a highly fractured low-velocity zone bounded by higher-velocity undamaged rock. Under these conditions seismic shear-waves are split into two nearly-perpendicular polarisations, which travel at different velocities (Crampin, 1981). Pischiutta et al. (2014) observe that, in this condition, the shear-wave velocity is larger in the crack-parallel direction than in transversal one.

In the present study, we use fifteen seismic stations of the SIL network in South Iceland to study the wavefield polarization and seismic site response by using earthquakes and noise recordings. Directional effects were investigated by computing the horizontal to vertical spectral ratios (HVSR) after rotating the horizontal components of motion. However, in the presence of lateral and vertical heterogeneities or velocity inversions, the HVSR can be "non-informative" due to the occurrence of amplification on the vertical component of motion. Thus in this study we also apply the polarization analysis proposed by Jurkevics (1988). This technique can provide quite robust results, overcoming the bias that could be introduced by the denominator spectrum in the HVSR calculation.

We have found new evidence of ground motion polarization in Iceland on fault zones associated with the RP and SISZ fault system. Results from noise and earthquake analysis, although showing significant differences in amplitude, are comparable in frequency. Pronounced directional effects are mostly observed on stations located near fault zone, showing a high angle with the fault strike. In the same area, the fast S-wave direction studied by Volti and Crampin (2003) is parallel to the general trend of faults. In conclusion, in the study area wavefield polarization and fast S-wave direction tend to be orthogonal. The obtained results highlight that polarization and shear wave splitting are produced by the anisotropic medium represented by volcanic rocks with large fracture systems associated with rifting and transform motion that take place in south Iceland.

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