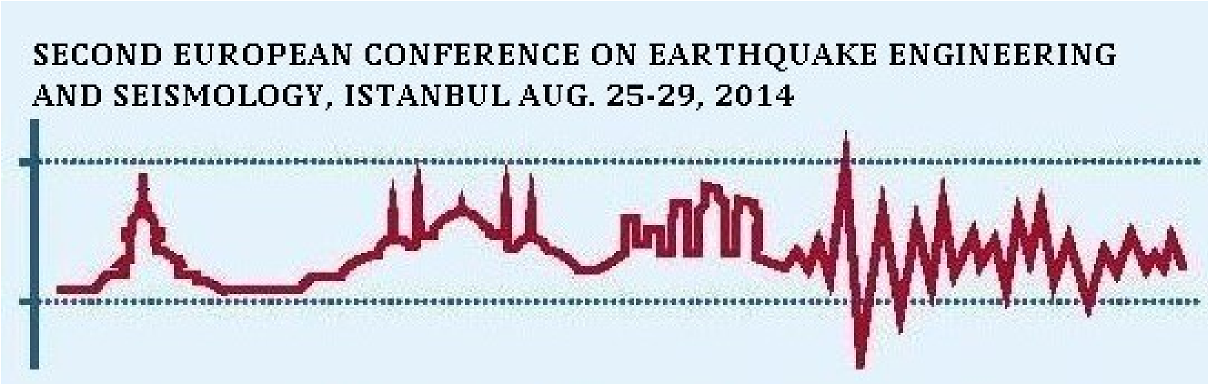

EXTRACTING NEAR SURFACE ATTENUATION FROM CORRELATION OF THE CODA OF THE CORRELATION (C^3) OF SEISMIC NOISE USING A LOCAL ARRAY

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Attenuation, or its inverse, quality factor Q, is an important parameter to describe the propagation of seismic waves in Earth's interior. Knowledge about the attenuation structure of the shallow subsurface is needed in order to give e.g. reliable ground-motion predictions in seismic hazard studies. Traditionally, seismic waves generated by earthquakes have been used to measure attenuation. Only recently, focus has been put on attenuation estimation from Empirical Green's functions (EGF's) that are derived from the cross-correlation of ambient seismic noise. While the extraction of seismic velocities from noise derived EGF's has been proven successful in many application, the retrieval of exact amplitude and attenuation information seems to be more difficult as noise source intensity tends to vary in space and time.

Stehly et al. (2008) tackled the problem of poorly constructed EGF's that arise from uneven noise source distributions by calculating the correlation of the coda of the correlation (C^3). The method is based on the idea that the coda of noise derived cross-correlations contains scattered energy and is therefore more diffuse than the original noise field. Cross-correlating the coda of noise EGF's then results in an EGF with improved time symmetry and less azimuthal dependence on the noise source distribution. Stehly et al. (2008) used the C^3 method to retrieve more robust travel time estimates. Zhang and Yang (2013) showed that the EGF's derived from C^3 can also successfully be applied for attenuation retrieval. Using data recorded by the USArray, the authors compared attenuation results obtained with C^3 with those estimated using earthquake data and proved that the retrieval of unbiased attenuation coefficients from noise is possible.

While Zhang and Yang (2013) extracted attenuation on a regional scale and for periods within the microseism band (6-25 s), we want to focus on a more local scale and higher frequencies (1-10 Hz) using a small circular array in the Mygdonia basin in Northern Greece which is situated about 30 km northeast of the city of Thessaloniki. The Mygdonia basin is a European Experiment test site (EUROSEISTEST) for integrated studies in earthquake engineering, engineering seismology, seismology and soil dynamics where multiple geophysical and geotechnical experiments have been conducted within the past years. We use data from an array experiment that was carried out in August and September 2011 in the northern part of the Mygdonia basin. The array consisted in total of 27 instruments from which 19 stations were placed on fixed positions on an outer circle with a diameter of approximately 1.8 km running for a period of two weeks. Eight mobile units were installed on an inner circle with a diameter of around 700 m. These stations were moved throughout investigation, running either for several hours during day or night time before being moved to a new position on the circle. Inter-station distances for the total array range from a few tens of meters to approximately 2 km.

Our goal is to use this local array to calculate C^3 correlation between all possible station pairs (also between stations that have not been operating during the same time periods) and try to infer the

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attenuation structure of the shallow subsurface. We decided to focus on the attenuation estimation for frequencies between 1 and 10 Hz because Hannemann et al. (2014) were able to determine group velocity maps for the same array within this frequency band. We will investigate how the chosen pre-processing, the rotation of stations to a different coordinate system, different stacking or station combinations can affect the attenuation retrieval. We will finally compare our results with the outcomes of other geophysical studies that were carried out in the Mygdonia basin.

REFERENCES

Hannemann K, Papazachos C, Ohrnberger M, Savvaidis A, Anthymidis M and Lontsi AM (2014) “3D shallow structure from high-frequency ambient noise tomography: New results for the northern Mygdonia basin – Euroseistest area, Northern Greece”, *Journal of Geophysical Research: Solid Earth*, under review

Stehly L, Campillo M, Froment B and Weaver RL (2008) “Reconstructing Green's function by correlation of the coda of the correlation (C^3) of ambient seismic noise”, *Journal of Geophysical Research: Solid Earth*, 113, *B11306*

Zhang J and Yang X (2013) “Extracting surface wave attenuation from seismic noise using correlation of the coda of correlation”, *Journal of Geophysical Research: Solid Earth*, 118(5):2191–2205