S023-06
Crustal-Scale Passive Seismic Imaging of the North Anatolian Fault: A Matrix Framework for Aberrations Correction

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Virtual

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Abstract:
The geometry of faults extending in the mid to lower crust and upper mantle are key elements to understand how fault systems work. Imaging the crustal structure in fault zones is challenging because of the diversity of geological units and the intensity of the damage zones. To probe such media, we rely on the reflected wave-field that contains information about the structure of the medium, that is the velocity distribution and the location of the reflectors. Recently, passive imaging has been adopted as an alternative of active sources. We use cross correlations of ambient noise to estimate the medium response between two receivers. We interpret the body wave part of the responses using an imaging technique inspired by a matrix approach derived from previous works in optics and acoustics and already applied in seismology ([2], [3]). We perform focusing operations at emission and reception to obtain the reflection matrix at depth [2].

However, the complexity of the medium and the rapid velocity variations in the shallow crust result in phase distortions. Phase distortions prevent the retrieval of the true reflectivity of the crust and therefore limit the imaging process. To overcome these issues, we introduce a novel operator: the distortion matrix. It contains the deviations from the ideal reflected wavefront emitted by a virtual source inside the medium in the absence of heterogeneities. A time-reversal analysis of the distortion matrix allows to correct for high-order aberrations [3].

We apply our method to study the structure of the western part of the NAFZ. The data used has been recorded during the DANA (Dense Array of North Anatolia) experiment[1]. Our approach allows to reveal the crustal-scale 3D-structure of the North Anatolian Fault with optimal resolution and contrast.

[1] DANA. Dense array for north anatolia. International Federation of Digital Seismograph Networks doi:10.7914/SN/YH2012, 2012

[2] Blondel, T., Chaput, J., Derode, A., Campillo, M., & Aubry, A., 2018.Matrix approach of seismic imaging: application to the erebus volcano,antarctica,J. Geophys. Res.: Solid Earth,123(12), 10,936–10,950

[3] Touma, R., Blondel, T., Derode, A., Campillo, M., & Aubry, A., A Distortion matrix framework for high-resolution passive seismic imaging of san jacinto fault zone, California, submitted to Geophys. J. Int

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