



Crustal structure of the north-western Turkey around the North Anatolian Fault Zone (NAFZ) resolved from the high-resolution Ambient Seismic Noise Tomography

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Turkey poses a complex crustal structure as a result of the convergence of the Arabian and African plates. The North Anatolian Fault Zone (NAFZ) represents 1600 km long active right-lateral strike-slip fault system of the country that has caused several destructive earthquakes. Location of historical earthquakes indicates that the activity on the fault tends to migrate westward. In the western part of NAFZ, there is a seismic gap inside the Sea of Marmara. Reliable knowledge of physical properties of the crustal structure of the unruptured segment within the Sea of Marmara is crucial for proper seismic hazard assessments considering that the megacity Istanbul with its millions of habitants, is closely located to this seismic gap.

In this study, ambient seismic noise tomography, for the first time, has been applied to obtain a high-resolution image of the crustal structure of northwestern Turkey. For forward estimation of traveltimes, we employed the Fast Marching Method. A Bayesian framework was utilized to invert traveltimes residuals extracted from Green's functions for the Rayleigh wave group velocity models at various frequencies. Besides the Transdimensional Bayesian tomography imaging, we also applied a rather simple and computationally fast 2-D nonlinear tomography scheme on the same data-set to gain a rough idea on group velocity variation in the regions.

Our high-resolution tomographic images included group velocities of Rayleigh waves resolved between 1 and 20 s. Lateral variation of group velocities successfully revealed the basin structures such as Çınarcık, Tekirdağ, and Adapazarı Basins between periods 1 and 10 s that are characterized by typically low group velocities with low uncertainties. The low-velocity zones appear to mark well weakness zones along the NAFZ in the crust and the complex structure due to the active tectonics of the Anatolia. Finally, different tectonic units, in particular, to the east were identified from each other as our maps highlight Istanbul-Zonguldak Zone from Armutlu-Almacik Block with a sharp high to low-velocity change in N-S direction.