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Crustal tomography of the Aegean-Anatolian domain using noise cross-correlations

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Data of more than 150 temporary and permanent broadband seismological stations deployed in the Aegean-Anatolian domain between May 2007 and May 2009 are grouped in the SIMBAAD (Seismic Imaging of the Mantle Across the Anatolian Domain) dataset. We compute noise cross-correlations between all station pairs on a 1.5-yr duration. We obtain more than 11.000 correlations for each component of the cross-correlation tensor. We apply a MFA (Multiple Filter Analysis) method to measure group velocity dispersion curves of Rayleigh waves on 4 components of the correlation tensor (ZZ, ZR, RZ, RR) and of Love waves on the TT component, both in positive and negative times. According to the theory, a noise cross-correlation converges to the Green function if noise sources are randomly distributed around the station pair. If this condition is fulfilled, the cross-correlation should be symmetrical in time. We compare group velocity measurements between positive and negative times to evaluate the convergence of each cross-correlation to the Green function. The quality of the symmetry is used to weight the time measurements in the inversion for group velocity maps. In the last step, Rayleigh wave group velocity data are inverted for a 3-D model of S-wave velocity. This processing gives an image of the crustal structure in the area [37-41°N ; 23-33°E] with a horizontal resolution of 60 to 200 km depending on depth and station coverage. The shallowest layers clearly display the present-day thick sedimentary basins (Axios, Thrace, Marmara, Bay of Antalya, ...) and older sedimentary nappes (Lycian nappes, Miocene sediments in the Kirsehir block) as strong low velocity anomalies. At larger depth, Southwestern Anatolia is characterized by a broad low velocity anomaly which contrasts with the higher velocities of the Aegean Sea. We clearly image a West to East increase of Moho depth from 20-25 km in the Aegean Sea to 35 km in the Anatolian plateau. This increase located between 27°E and 28°E can be linked to a lateral change in the amount of North-South extension measured by GPS.

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