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Adjoint tomography reveals structure of the European Upper Mantle

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We use spectral-element and adjoint methods to iteratively improve crustal and upper mantle images of Europe and the Mid-Atlantic Ridge. 159 earthquakes with magnitudes from 5 to 6.5 recorded at 338 stations are used in the iterative preconditioned conjugate-gradient inversion. Crustal model EPcrust1.0 combined with mantle model S362ANI comprise the initial 3D model EU00. Before the iterative structure inversion, earthquake source parameters (i.e, Centroid moment tensor and location), are recalculated based on 3D Green's functions and Fr\'{e}chet derivatives. Since we concentrate on upper mantle structures which involve significant anisotropy in the Asthenosphere, transversely isotropic (frequency-dependent) traveltime sensitivity kernels are employed in the structure inversion. Long-period surface waves and short-period body waves are combined to constrain shallow and deep structures simultaneously. With each subsequent iteration, higher frequency signals are added to the inversion. Statistical assessments of traveltime anomalies and point-spread functions enable us to assess the inverted source and structure models. Current model EU25 reveals many interesting features. For instance, slabs underneath the Hellenic, Vrancea and Calabria arcs, slab detachment underneath the Central Apennines, mantle upwelling associated with the Eifel hotspot, slow wavespeed structures in several back-arc basins, e.g., the Ponnonian basin and Tyrrhenian sea, the sharp transition of the Teisseyre-Tornquist suture zone between central Europe and the East European platform.