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Surface Wave Tomography of the European Upper Mantle and its Relationship to Tectonics

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We have constructed a new surface-wave shear velocity model of Europe based on the inversion of fundamental and higher-mode Rayleigh waveforms for over 39,000 paths. One-dimensional path average models are calculated from the seismograms, using the linearized inversion technique of Cara and Lévêque, and the average models are used as the input to a tomographic inversion using the continuous regionalization method of Debayle and Sambridge. The tomographic maps and profiles from this analysis provide images of the European mantle down to the top of the mantle transition zone with a horizontal resolution of about 500 km.

Our model shows a number of features which can be related to the tectonics of the region. A clear distinction can be seen between the Baltic Shield/Russian platform, with high shear wave velocities in the upper mantle, and the rest of Europe, which has lower shear wave velocities. This feature follows the Tornquist line. Low V_s in eastern Spain is consistent with the high elevation of this region, while low V_s in southern Greece and across Turkey suggests a warm mantle which is consistent with basaltic volcanism in the region. Finally, a high V_s in the Aegean may be related to the low-angle subduction under the Hellenic arc.