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Towards a high-resolution 3D S-wave velocity model of the European upper mantle

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In spite of remarkable research efforts our knowledge of the distribution of seismic velocities and attenuation in the European upper mantle can still be considered as insufficient. As a consequence, answers to various questions regarding the role of the upper mantle in European tectonics are still open. This particularly applies to the Cenozoic volcanism in Europe, the Atlantic passive margin, the Mediterranean and the plumes in the European upper mantle.

Methods predestined to investigate these questions are certainly the receiver function method by which the depth of transition from lithosphere to asthenosphere and the depth of the mantle discontinuities can be mapped. Body wave and surface wave tomographies give further constraints on the geometry of the lithosphere-asthenosphere transition but are also able to fill in the 3D variations of the seismic velocities and attenuation in the upper mantle and are thus indispensable for creating a European Reference Model. Such a model and all other future high-resolution models of the European mantle will be limited by four factors: (1) the geographical distribution of seismic broadband stations in Europe, (2) open access to the data, (3) the availability of automatic schemes for quality control, processing and inversion and (4) the validity of forward schemes used to model seismic wave propagation in inversions which are still mostly based on ray theory.

We discuss the current state of the European broadband network - which data are available, where are data missing. We indicate some new ways to efficiently control the quality of large amounts of data needed for high-resolution models by displaying waveform stacks and snapshots of the wavefields propagating over the network. New approaches to automatic processing from event detection to localization are mentioned. We then discuss efforts to overcome the limitations of ray theory using scat-

tering theory and waveform sensitivity kernels and show some examples. Finally, first results of ongoing research aimed at a high-resolution model of the European mantle using large amounts of data and applying an automatic waveform inversion method are shown.