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Upper-mantle shear-wave structure under Asia from Automated Multimode Inversion of waveforms

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An automated multimode inversion technique of partial waveform was applied to available data of broadband stations in Asia and surrounding regions.

It performs a fitting of the complete waveform starting from the S-wave onset to the surface wave. Assuming the location and focal mechanism of a considered earthquake as known, the first basic step is to consider each available seismogram separately and to find the velocity perturbations that can explain the filtered seismogram

best. In a second step, each velocity perturbations serves as a linear constraint in an inversion for a 3D S-wave velocity model of the upper mantle.

We collected data for the years from 1977 to 2012 from all permanent stations as well as temporary experiments for which data were available.

In this way, a huge data set of about 12 million seismograms came about from which about 2.3 million seismograms provide 8 million linear constrains for the resulting 3D model.

The frequency content of the data associated with the sensitivity kernels as well as the path density in the considered region allows us to perform a high resolution tomography at a continental scale.

The resulting models exhibit an overwhelming detail in relation to the size of the region considered in the inversion. They are to our knowledge the most detailed models of shear wave velocity currently available for Asia and surroundings. Most prominent features are a details on the morpholoogy of the Tibetan Plateau and its extent at depth that are properly mapped.

The vertical extent of its lithosphere as well as other cratonic lithosphere could be imaged at depths greater than 200 km. Orogenic volcanism is almost exclusively found in regions of shallow asthenosphere and in areas where the depth of the LAB changes significantly, along the passive margins.

Keywords: Tomography, Asia, Surface-waves