Geophysical Research Abstracts
Vol. 13, EGU2011-4961, 2011
EGU General Assembly 2011


# Shear-wave velocity model of the European Upper Mantle

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An automated multimode inversion technique of partial waveform was applied to available data of broadband stations in Europe 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 1990 to 2007 from all permanent stations for which data were available via the data centers of ORFEUS, GEOFON and IRIS, and from others that build the Virtual European Seismological Network (VEBSN). In addition, we incorporated data from temporary experiments like SVEKALAPKO, TOR and the Eifel plume project as well as permanent stations in France. We were also able to add the data recorded by the temporary broadband EGELADOS network in the southern Aegean. In this way, a huge data set of about 500.000 seismograms came about from which about 70.000 seismograms provide 400.000 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.

Tests were performed on different parameters such as the grid spacing, the damping constrains and the smoothing factors to increase the resolution of the resulting inversion.

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 Europe and surroundings. Most prominent features are a narrow high velocity regions following the Hellenic arc and the Ionian trench toward the north. Even a high velocity zone beneath the Western alps can be imaged. Low velocity zones are found at depths around 130 km in the Pannonian basin, the back-arc of the Hellenic subduction zone, and the Middle East. At greater depths clear remnants of Tethyan subduction along the Eurasian-African plate boundary are observed.