Spatial distribution of the anisotropy coefficient in the European upper mantle

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Abstract The radial (transversal) anisotropy of the Earth's upper mantle was found by comparing the velocity sections of transverse waves obtained by inverse of the dispersion curves of Rayleigh and Love waves. Information on variations in anisotropy with depth was obtained from dispersion curves on fairly uniform oceanic paths. In the oceanic mantle the SH wave velocities obtained from the Love wave data is greater than the SV wave velocities determined from Rayleigh waves, so that the anisotropy coefficient is positive and is about 4 % under the Moho boundary and decreases to zero at a depth of about 200 km. The information about the anisotropy of the continents is much more scarce and often contradictory due to a strong lateral inhomogeneity of the crust and upper mantle of the continents. In the European region some authors reveal the zones where $V_{SV}>V_{SH}$ in the upper mantle, whereas some others confirm $V_{SH}>V_{SV}$ to be everywhere. The uncertainty in the observed values of the anisotropy coefficient is explained by the fact that it was always determined from the results of the Rayleigh and Love wave velocity tomography carried out on the basis of different samples of paths. Accordingly, the values of the SH and SV wave velocities turned out to be averaged over different regions, which led to errors in the estimates of the anisotropy coefficient. To reduce these errors, we proposed an alternative method for estimating the spatial distribution of the anisotropy coefficient: to estimate the anisotropy coefficient in the beginning at each path and then to fulfill the tomographic inversion for this coefficient. Preliminary results on the distribution of the anisotropy coefficient in the upper mantle of Europe were presented according to earthquake and seismic noise. However analysis of the anisotropy coefficient values obtained from the earthquake data and seismic noise have shown that those obtained from noise are usually underestimated. Therefore, in the present study we used only the data obtained from earthquakes. It was shown that the anisotropy coefficient under the continental part of the European region is close to zero but two areas where $V_{SV}>V_{SH}$ are detected - in central part of EEP and in the southern Italy. In both cases the negative values of the anisotropy coefficient are observed within the interval of ~60-100 km depth.

Keywords anisotropy, Rayleigh and Love waves, upper mantle, seismic tomography, Europe.

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