Referee #1 (Liu)

The first concern is that there is a lack of an in-depth investigation of complex anisotropy, which is characterized by systematic azimuthal variations of the splitting parameters (Silver and Savage, 1994). Although the azimuthal coverage is not ideal, one can still plot the measurements against the azimuths (or their modulo-90 or modulo-180 degree) to see if the variations are systematic or not, and if there are systematic variations, are the periodicity 90 (indicating multiple layer of anisotropy with a horizontal axis of symmetry) or 180 (tilting axis) degrees? It seems that some stations do display such variations (e.g., the two stations to the NE of the TESZ in the central profile).

More than two-decade research of shear-wave splitting has been carried out up to now in tectonically different regions and by different authors. It is clear from the research that anisotropic structure of the upper mantle is much more complex than it was assumed at the early stage of shear-wave splitting evaluation. This led to more complex view on the structure and forced us to leave the simple assumption of the upper mantle as one anisotropic layer with horizontal symmetry axis. Particularly, variations of the splitting parameters with back azimuth and/or incidence angle, a search for a model explaining independent observations of anisotropy (e.g., with directional dependences of P-wave travel time residuals and shear-wave splitting) and regionalization of the results, require a 3D view on the target with adequate changes in presentations of the results.

Unfortunately, azimuthal coverage for SKS waves in central Europe is far from being ideal and cannot be improved, because it reflects distribution of earthquake foci on the Earth. As an example we plot the back-azimuth dependence of splitting parameters evaluated at station JAVC (Fig.1 below), having measurements for all 15 events (see Table S1 of the originally submitted ms). Plotting shear-wave splitting parameters at modulo-90 or modulo-180 degree improves the coverage only artificially and moreover, doing that one implements an assumption of horizontal symmetry axes. We often observe and show that splitting parameters of waves arriving from opposite back-azimuths, i.e., from φ° and φ+180°, differ. To demonstrate this we have prepared a figure (Fig. 2 below) with synthetic splitting for a model with tilting axis exhibiting the clear 360° periodicity and due to a presence of noise offering a tendency of 90° periodicity (EGU 2011-3164, Geophysical Research Abstracts 13, 2011), which can be misinterpreted as a double-layer model.

My second concern is related to the display of the splitting results. The arrows plotted in Figure 6 and several similar figures start at the ray-piercing point at 80 km deep, and point to the fast direction. I was confused by the statement of "point in down-dip directions". I do not think it is necessary to plot the results with arrows. Instead, it is easier to understand if the bars are centered at (not start from) the ray-piercing point. The location of the ray-piercing point relative to the station gives the back-azimuth.

Working with splitting parameters in 3D, i.e., evaluating them in the LQT coordinate system, we prefer to visualize them as vectors from a station or piercing point, to emphasize inclination of the QT plane. Prior to requested redrawing our results in the standard (horizontal plane) way, i.e., as bars centered in the points, we show Figure 6 of the ms. plotted in the two ways – the original (Fig. 6 – original) and a standard ones (Fig. 6-replotted), to consider their meaning and clarity. The latter figure loses one dimension, is less understandable and dominated more by polarizations plotted as the last ones.

Moreover, we show (Fig. 3 below) synthetic pairs of splitting for a pair of stations situated above a mantle with different anisotropic structures. The standard way of plotting - bars

centered at the stations (right part of the figure) - does not indicate any structural change, though the models differ significantly. On the other hand, showing the fast S polarization azimuths as arrows indicates the structural change of the models with divergently dipping fast symmetry axes. To keep clarity of figures with a lot of individual measurements and not to mask boundaries between blocks with differently oriented anisotropy in 3D, we prefer using arrows.

The third main concern is about the interpretation of the results. The authors attribute all the observed anisotropy to the lithosphere, and did not discuss the possibility of a significant asthenospheric contribution at all. The spatially slow variation of the splitting parameters suggests a deep source, although the actual depth cannot be determined confidently. The authors should discuss this possibility by comparing the observed fast directions and splitting times with various APM models and with results of geodynamic modeling of mantle flow (e.g., Conrad and Behn, 2009).

We concentrate on variable component of the splitting parameters which we associate with the lithosphere structure. The southern part of the PASSEQ array covers the Bohemian Massif (BM, central Europe), where very detailed and intensive research of anisotropic structure of the lithosphere has been carried out. Joint inversion of anisotropic parameters of body-waves (shear-wave splitting and P-wave travel residuals (P-spheres)) resulted in retrieving several domains of mantle lithosphere with different anisotropic structure forming the massif (Babuska and Plomerova, 2013, for review). North of the BM regional changes of anisotropic signal are smooth and less distinct. European plate moves very slowly without a clear direction (e.g., Gripp and Gordon, 2002). Also recent geodynamic models of mantle flow (Conrad and Behn, 2010) gives very slow flow, if any, in the mantle beneath whole Europe. Therefore, similarly to the BM lithosphere, we associate a substantial component of the evaluated anisotropy with the lithosphere structure.

Finally, the current **discussion** section is not structured and hard to read. I would like to suggest that the authors reorganize the materials into a few sections with subtitles.

As suggested, we structure the discussion and add subheadings into the revised version to make this section easier to read.