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Interactive comment on “Mantle lithosphere transition from the East European Craton to the Variscan Bohemian Massif imaged by shear-wave splitting” by L. Vecsey et al.

Anonymous Referee #2

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Review

The authors present and discuss interesting results from SKS splitting measurements obtained at the PASSEQ array to study upper mantle anisotropy across the Trans-European Suture Zone. In the introduction, they provide an informative overview of the tectonic situation in the region covered by the extensive network of stations. My general impression is that the authors are very careful in the analysis of the measurements and in considering effects of possible sensor missorientations on the splitting measurements. However, the discussion of the results could be improved.

Specifically, the authors show significant back-azimuthal variations of splitting parame-

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ters but there is little effort to explain these observations by possible layered anisotropic structures. Much effort is put into delimiting different anisotropic domains and regional variability, but there is not much discussion on the relation between observed fast-axes and specific tectonic processes which may explain the observations. Possible effects of mantle flow in the asthenosphere and anisotropic effects of the crust are also not considered.

I do not agree with the authors' implication (p. 239) that Fresnel zones cannot be used estimate the depth of anisotropic domains from variable results at neighboring stations.

Generally, in the discussion, it is not always clear which statements are really supported by the data and the results given in this paper. For example, from the results and from the discussion it is not clear how the authors obtain information on the dip direction and how relevant this is.

Readability may be improved by shortening the discussion and by better highlighting the original contributions made here.

Furthermore, at the beginning of the discussion section, the authors explain the “two types of variations need to be followed”... “(1) changes of polarization parameters “... “(2) changes of apparent parameters “.. “The former leads to 3D modeling of the mantle domain fabrics”... .

What is the difference between “polarization parameters” and “apparent parameters”? It is not clear which data sets the authors have in mind. Do they refer to P-wave polarization and SKS shear wave splitting parameters? Or does this relate to SKS polarization and apparent splitting parameters? Please be more specific. I also did not find any further reference to the 3D modeling mentioned above.

Further on the authors state (p. 242): “Anisotropic signal can be detected if the SKS propagates through an anisotropic block of a sufficient thickness, i.e., at least of one wavelength thick (Plomerová et al., 2011).“

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This statement is not correct, as a thin but highly-anisotropic layer may also cause significant shear wave splitting. For example, a hypothetical 30 km thick, highly-anisotropic crustal layer may result in a delay time of 0.5 sec, the wavelength is not relevant here! The wavelength may matter in heterogeneous media, where effective anisotropy due to layering (of isotropic material) plays a role.

At several instances the authors mention the number of pairs of splitting parameters (1009). However, for how many stations did they obtain splitting parameters? What is the average number of splitting measurements per station?

I also have a number of minor suggestions that may help to improve the readability of the manuscript:

p. 231, line 9: controlled source line 19/20: lower lithosphere and the upper mantle below

p232, 14: Shear-wave splitting analysis provides a standard method to measure .. 27: .. dominant period of shear waves ranges between 8 – 10 s ...

p233, 6: only the main 8: at the temporary 9: In total we obtained 1009 11: are evaluated by minimizing the energy 20: bootstrap diagrams are used to evaluate the reliability of the measurements. The orientation p234. 23: We have tested the effect of

p236, 6: The location 9: and with a sufficient 18-20: may be a repetition from what is said earlier

p237, 4: SKS phases arriving at 9: The width 12: indicating minor anisotropy 15: The anisotropic signal 16: Unfortunately, the majority 21: evaluate a large number of 29: azimuths, even if

p238, 23: need to be considered:

p239, 3-4: delete “, allowing ... splitting,” 15: and the regional 28: select 1 or 2 representative self citations

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p242, 23: transitional zone between the two lithospheric segments of different ages.

p244. 11: that the lateral 12: than the extent 15-16: we suggest that the EEC mantle lithosphere penetrates into 25: array, even if evaluated

Interactive comment on Solid Earth Discuss., 6, 229, 2014.

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6, C385–C388, 2014

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