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Interactive comment on "Upper mantle structure around the Trans-European Suture Zone obtained by teleseismic tomography" *by* I. Janutyte et al.

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We thank Dr. Andreas Fichtner for the useful and constructive comments. Kindly find our reply below.

(1) In Chapter 7 we note that the teleseismic tomography inversion result depends on many factors. We also mention that "distortions on the full raypaths outside the velocity model" has influence to the amplitudes of velocity variations. This effect strongly depends on the depth and region where the earthquake (EQ) originated. The travel times (TT) recorded from shallower EQs experience more distortions as the rays propagate through the heterogeneous upper layers. We do not want to speculate about the specific value, but we estimate the effect could reach (to be on the safe side) up to 0.5 % of velocity variations.

(2) In pg. 1727 we present several practical definitions of the LAB regarding different physical properties and geophysical techniques. We use definition of the seismic LAB according to Eaton et al. (2009) which defines the seismic LAB as transition between the solid outer layer of the Earth, which is characterized by higher seismic velocity values, and its low-viscous interior, which is characterized by lower seismic velocity values. That is right that we use transition from fast to slow velocities to define the seismic LAB. As the reference velocity model we use IASP91 model, thus, the obtained results are presented compared to this reference model.

(3) We agree with the Reviewer. The synthetic model was compiled in order to find out whether our dataset with current station configuration is capable to resolve large scale synthetic structures. We chose it to be something like "geologically possible“ (based on other studies), because we would like to see if the resolved image is similar to the one obtained with the real dataset in order to have base for speculation for the interpretation.

(4) That is true that the seismic velocities deep in the Earth depend on many various parameters, thus, there is no unambiguous relation between viscosity and seismic velocity. The base for this statement was that asthenosphere is more plastic, thus, low-viscous, and the seismic velocities are lower compared to those in elastic materials.

(5) We may consider to rephrase the sentence.

(6) The smoothing constrains provide more stability to the system. Several values of smoothing have been tested, with limited influence on the final results. The value of 50 km was selected as a default value corresponding to the spacing between the grid nodes. The damping parameter determines how much noise present in the data is mapped in the resolved model. Underestimation of damping would result in noise fitting and overestimation would reduce lateral velocity variations. We investigated the trade-off curve between the data variance and model variance and selected the value which was close to optimal and conservative.

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(7) The thickness is derived from the tomographic results. The accuracy of the measure of the thickness of the lithosphere is bound by the parameterization which is 50 km. For Western-Central Europe where the clear boundary between the lower and the higher seismic velocities was observed and the seismic LAB determined, we consider this boundary as the bottom of the lithosphere. Below the craton we find no indications of such a boundary, thus, we assume that the lithosphere in this part is thick or the boundary is not so well expressed. We observe the higher velocities below the craton down to 300 km and more which might be an effect due to the vertical smearing, which is intrinsic to all tomographic resuls. On the other hand, some other studies (e.g. Koulakov et al., 2009) also indicate higher velocities beneath the craton going deeper than 300 km.

Interactive comment on Solid Earth Discuss., 6, 1723, 2014.