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Discussions

# *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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## GENERAL COMMENTS

This manuscript describes a tomographic study of the Trans-European Suture Zone (TESZ) using teleseismic P wave tomography. Following a review of the tectonic setting of the study area and of previous seismic experiments, the authors describe their dataset of around 6000 manually picked traveltimes. Sections 3 to 6 cover technical issues, including the inversion method, parameterization, crustal corrections and resolution analysis. Finally, the authors discuss their tomographic model in the context of the lithosphere-asthenosphere boundary (LAB) debate.

The manuscript is well written and interesting from both the technical and the geologic

perspective. Possible improvements include (1) a more detailed analysis of the impact of 3D Earth structure outside the study area, (2) the precise definition of the LAB and its identification in the tomographic images, and (3) the resolution analysis using synthetic inversions. Please find more details in the specific comments below.

## SPECIFIC COMMENTS

Major comments:

(1) While the authors carefully correct for crustal structure, apparently no attention is payed to 3D structure outside the study region, which can significantly bias the inversion results. Maybe the authors could provide an estimate of these biases or even include 3D long-wavelength structure in the computation of traveltime residuals.

(2) The manuscript stands in the context of the LAB debate, which also seems to arise – at least to some extent - from conflicting definitions of what exactly the LAB is. Such a definition is also missing in this manuscript. It seems that the authors take the transition from fast to slow velocity anomalies as an indicator. This, however, would strongly depend on the reference model. This issue needs some clarification.

(3) In figure 10, the authors provide images of recovered input structures that are "geologically plausible". What exactly is the purpose of this exercise, and what does it teach us? There is no need to show that there are synthetic input structures that produce output structures similar to the actual tomographic image. It is clear that this is possible because the tomographic model is in the range of the imaging operator. What would need to be shown is that there are no completely different input strutures that produce a similar output.

Minor comments:

(4) On page 1727 the authors make a relation between viscosity and lower seismic velocities. What exactly is the relation between viscosity and seismic velocities? Is there really a clear relation between these two parameters – given that seismic velocities

depend on so many other factors as well? And what means "lower"?

(5) I cannot agree with the author's statement on page 1731 that "the spacing between grid nodes determines resolution of the inversion". Resolution is primarily determined by the data. Maybe it would be better to say that the parameterisation should be fine enough to capture structure that can be resolved, meaning that it should be finer than the resolution length.

(6) On page 1731 the authors mention that "the smoothing was set to 50" and a "damping value of 120" was used. Maybe it would be good to explain what exactly these numbers really mean. For this, some equations would be very helpful.

(7) On page 1735 the authors write about lithospheric thickness. How exactly is this measured?

I hope that my comments help to improve this manuscript.

With kind regards

Andreas Fichtner