

Review for manuscript I. Janutyte et al. 2014 „Upper mantle structure around the Trans-European Suture Zone obtained by teleseismic tomography“.

This is a well-written paper regarding a topic of wide interest among geologists and geophysicists.

The manuscript provides a very nice overview on tectonics and lithosphere structure of the TESZ and adjacent region. It would, however, be nice to have a more informative Figure 1 showing all the mentioned features. Current Fig. 1a is not very informative and Fig. 1b is just showing the tectonic entities of within the study region. The tectonic overview presented in the introduction –for good reason, considering the variations along the TESZ- encompasses a much larger region than shown in Fig. 1.

It remains unclear why the review of the crustal structure across the TESZ is limited to the study region only while the review of the lithosphere mantle structure –as before the tectonics- encompasses all of TESZ. By the way, probably the first good tomography representation of the TESZ lithosphere structure was presented by Ziehlhuis & Nolet 1994. This reference is missing.

Data: I assume you picked all absolute arrival times?

Method: You apply a procedure (3D apriori crustal corrections combined with relative teleseismic tomography) first proposed and applied by Arlitt et al. 1999 and executed in much similar way and domain by Sandoval et al. 2003 and 2004 –see their discussion about crustal effects). A comparison with their procedure and results would be appropriate!

Please describe more clearly the specific assumptions of the inversion method you apply as there exists a non-linear teleseismic tomography code TELINV that predates Voss et al. 2006 by several years. Furthermore, the references provided do not „explain the method in details“ (Thompson&Gubbins 1982, Thurber 1983, Menke 1984, Koch 1985, Aki et al. 1997) but refer to very basic individual steps in the overall inversion procedure and some refer to local earthquake tomography rather than teleseismic tomography. The teleseismic tomography method you apply is based on an original idea by Aki et al. 1976 – known as the ACH method.

Crustal corrections, Fig. 6 and Fig. 7. Considering that due to lithologies and physics we expect and know from other regions lateral variations of velocity within the crust to be of significantly larger amplitude and shorter wave lengths than in the mantle, it is difficult to follow the reasoning of the authors preferring crustal corrections (Fig. 7c) that yield short wave length variations with many single cell anomalies very similar to the results using no crustal corrections! Compare your results with those by Sandoval et al. 2003 and consider their results of synthetic testing crustal effects.

Resolution. Fig. 8. Please plot part a and b of Figure in same color scale! What data error was added to the synthetic data before inversion? Please mark cell size or 3D grid.

Fig. 9. Quantify what denotes „poorly and well resolved areas“. You show one value (RDE?) per cell but certainly not „horizontal and vertical slices of resolution matrix“. How do you explain the seemingly „fair resolution“ (it is medium dark grey, whatever this might mean) outside your station network, f.e., along the border of the study region near $x=-500$ and $-200 < y < +250$ or the dark grey seemingly „very good“ resolution all along the profile $y=0$ at depth below 300km? You are not really deriving conclusions from your resolution testing. In the end what the reader needs to know is WHERE within your study region TO WHAT DEGREE you believe your results can be trusted/interpreted.

Results. Fig. 10. There is a significant difference in length scale and amplitudes between your results (Fig. 10c) and the synthetic testing input model (Fig. 10a) and the recovered model (Fig. 10b). If you want to make believe that anomalies of size and amplitudes like 3,4,5,6,7 are real, you need to do much synthetic tests with similar characteristics in model.

Comparing input and recovery of the synthetic test (Fig. 10 a and b) a systematic difference in average velocity (denoting 0 in your color scale) is evident. Do you imply the results (Fig. 10c) to be interpreted where red remains red (reduced velocity to fixed reference velocity) as in Fig. 10b or should we interpret it as light blue (slightly higher velocity relative to reference velocity) as in Fig. 10a? Note that in your results you obtained the same strength of reddish in layer 350km as in the layers above, while in Figure 10a, red is only present in layer 350km while all layers above are in blue.

In Summary: This paper is worth reading because of the reviews and discussions on geology and tectonics and also about previous knowledge and questions regarding crustal and lithosphere structure. Based on experiment setup and presented description, the data set is certainly good but at present, the here presented tomographic results in my view do not yield any new information that can be trusted. As a reader I may not distinguish between artefacts of various sorts and real structure and I urge the authors to clarify.