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Interactive comment on "A new model of the upper mantle structure beneath the western rim of the East European Craton" *by* M. Dec et al.

Anonymous Referee #2

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The authors present structural study which results in the 1-D seismic velocity model of the upper mantle beneath the western rim of the East European Craton in Poland. Their interpretation is based on recordings of natural seismic sources recorded by one seismic station located in Poland. The analysed seismic events are divided into four azimuthal groups modelled separately. For modelling the authors use forward ray-tracing and they fit the first and the second arrivals. This results in velocity distribution and also in detection of the upper mantle discontinuities. The paper is well written, concise, and with good English. However, in some parts it is too brief and some points need to be more discussed and explained. Also, the quality of figures must improve, since as they are now, there do not document what they should (see below).

Specific points: The 1-D model is derived for all azimuthally distributed events. But

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as according to Fig. 1 and epicentral distances, the places to which the model refers are not always close. Also, one or two azimuthal regions to which the velocity refers are not located directly in EEC. Are there any differences in the velocity distribution for different azimuths? Or for different tectonic units?

As the authors say, the velocity model of the crust and upper mantle down to ∼100 km depth is constrained from previous published results. But how is the velocity of LVZ below this depth constrained?

In structural modelling from such type of data, there is a trade of between velocities and depth of discontinuities. How can the change in velocity influence the depth of discontinuities? Such analysis superimposed on data (waveforms) would be instructive.

The quality of Figs. 4, 5, and 6 is poor and needs substantial improvement. Especially the seismic sections where the traces are hardly visible and do not document the fit of the data with calculated traveltimes. Also, it would be good to put there the interpreted arrivals to see the fit. In some parts the phases does not seem to be well constrained (only one or two waveforms show the phase arrivals – see e.g. 5b) and 5c) for phase P220 but similarly it seems to be for phase P440 at Fig. 4).

In error analysis, I cannot see the benefit in calculation of the S/N improvement after filtering. On the other hand it would be nice to discuss more the filtering, different band-pass filters and the accuracy of picking related to the filter applied. On page 564-565 the authors talk about tested range of band pass filter frequencies for displaying data and finally conclude that the best results were obtained for 0.5–2.0 Hz bandwidth. But how did they reach such conclusion? Would there be a change when different filters (e.g. 0.5-5 Hz or 0.5-8Hz) were applied? Discuss also how different filters would change the picking accuracy.

In Fig. 3 for both a) and b) subpanel mark the names of phases. Is the phase marked by green the P410P or later interpreted P440P phase? And from which sub-region?

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In Figs. caption 4-7 (and also Fig. 3) explain how the waveforms are displayed (band-pass filtered with 0.5-2 Hz or differently?).

The figures need to be organized according to how they are first referred to in the text. Fig. 7 is discussed before Figs. 5 and 6 are referred to.

Mark the names of sub-regions in Fig. 1. Also, be consistent in using either the abbreviations or full names of different sub-regions used in the study.

In Fig. 8 the authors say "...all analysed seismograms recorded at SUW station." The figure displays about 80 traces. But at page 564 the authors say there were 249 analyzed events in total. Which traces were selected for Fig. 8 and why?

Table 1. "List of seismic events shown in Fig. 1. Numbers from column 1 correspond to numbers of seismic records in Fig. 1. ... " But I cannot see any numbers in Fig. 1. Table 1 is not mentioned in the text.

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