Solid Earth Discuss., 7, C1640–C1656, 2015
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Interactive comment on "POLENET/LAPNET teleseismic P-wave traveltime tomography model of the upper mantle beneath northern Fennoscandia" *by* H. Silvennoinen et al.

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We thank J.R.R. Ritter for valuable and constructive comments on our manuscript. Please find our answers below. Hanna Silvennoinen would like to apologise the very late answers. She defended her PhD thesis mid-December and has been swamped with tasks related to that. Additionally a small error was found in the data file during the revision process, which did not significantly alter the results but took some time to ascertain there were no other problems.

The presentation and description of resolution and results of tomography inversion have been rewritten and a new figure 8 has been build to better visualise the process

used to define the fairly well defined part of the inversion results. The new resolution figures that combine ray coverage, RDE information and some synthetic test results for each layer of the model volume. Layers at the depths of 120 km and 360 km are used as examples in a new version of the manuscript and the rest will be included as supplementary material. These figures have been used to help establish more detailed analysis of the tomography results. Former Chapter 5 has been divided into Chapters 5 and 6 as suggested and figures have been gone through to cover missing annotations.

P6, L12-16: The relative travel time residual datasets of POLENET/LAPNET and SVEKALAPKO data were both build from the picked traveltime data for this work. Hence, the process of calculating the theoretical travel times through iasp91 reference model were done identically for both datasets, though 2 different persons did the picking of the P-wave arrivals. To ascertain this causes no discrepancy between the datasets, we compared the residual distribution over distance and back-azimuth at 4 sites were we had both POLENET/LAPNET and SVEKALAPKO station running. These stations are permanent seismic station OUL, MSF and SGF and a temporary station LP13. The comparison figures will be added as supplementary material.

P10, L23-28 and Fig. 8: After careful consideration we have plotted the new “fair” resolution regions based mainly on RDE value 0.3. The regions may have slight deviations from the RDE based on contracting information in ray-coverage and synthetic tests.

Section 4, Following section 4.2 (Crustal correction model): A short analysis of the residuals at the stations used as examples in Figures 4 and 7 is added to the end of chapter 4.3.

Section 5 Results and Discussion: comment on layer-wise relativity of the tomography results has been taken into careful consideration when rewriting Chapter 5. Also the suggested method of numbering anomalies was adopted.

Fig. 9: Input anomalies are now marked on the checkerboard test figures. The anomalies are only slightly underestimated in the recovered results as can now be seen better

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with new color scale that has a stable color around +/-2%.

Fig. 12. The “fair resolution” lines have been added to the figure.

Comments from annotated manuscript:

Terms “array” have been have been edited to “network”

Terms “IASP91” have been edited to “iasp91”

A few words have been added to Introduction about BB sensor bandwidth

In Chapter 2 there is a comment about “Karelian Craton” title missing from Figure 1. In the text Karelian Craton (or the part of it in our study area) is described to consist of Kola and Karelian Provinces that are both marked on the map. It was decided that the map stays clearer in Karelian Craton text is not added there.

In Chapter 2, the origin of all the juvenile material is not certain, but there is some evidence it is mostly of crustal origin. A sentence to state this has been added to the text with references. There was also a question whether just crustal material or whole lithosphere was deformed during the orogenies. While one could assume whole lithosphere was affected, the lithosphere in the area is not well known and I could not find previous results on the upper mantle state. Hence the term “crust” was changed to “material” in the text to emphasize the missing information

In Chapter 4.1 unit of damping value have been added.

In Chapter 4.3 there was a question about why there is less events recorded by western part of the network. As the stations in Sweden included into POLENET/LAPNET network are all part of the permanent SNSN network, which was being updated during the POLENET/LAPNET data acquisition period, there are data gaps in that part of the data causing significantly less recorded events.

In Chapter 4.3 there was also a question about the extent of the leaked anomalies in synthetic tests in km. Generally the leakage extended only one the layer above or

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below the synthetic anomalous body and with smaller amplitude. With our horizontal gridding of 60 km this would correspond to maximum leakage of the anomalies to be 60 km.

In Chapter 4.3 there was a question about the recovery rate of the synthetic tests. We have updated the figures to show tests with anomalies at varying depths to help estimate the recovery rate at different depths. Two depths, 120 km and 360 km are shown in the revised manuscript while the rest of the layers are added to the supplementary material. From these results one may notice that quite commonly the anomalous bodies are recovered with relatively high "over-swinging" effects surrounding them, possible leakage to the layer above or below of the anomalous body. But especially within the yellow line marking the fairly well resolved part of the study area, the recovery is reasonably good.

Also in Chapter 4.3 there was a question about resolution west of 23 degrees. The yellow line marking the fairly well resolved part of the study area extends at its westernmost to roughly 21 degrees but only in central latitudes of our study area and most of the western part of our study area is poorly resolved. Despite this, the anomalies shown in Figure 11 were a stable feature in the results, when testing different inversion parameters and the lateral velocities at 120 km depth start to clearly increase (roughly 3%) already within the fairly well resolved part.

Also many small language errors were corrected as suggested.

Please also note the supplement to this comment:
http://www.solid-earth-discuss.net/7/C1640/2015/sed-7-C1640-2015-supplement.zip

Interactive comment on Solid Earth Discuss., 7, 2527, 2015.

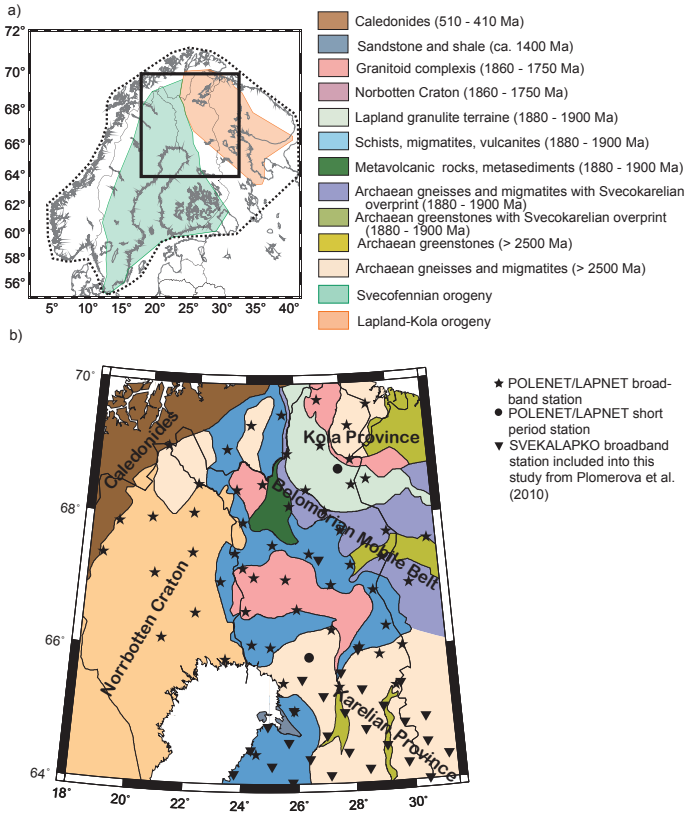

Fig. 1. Revised Fig. 1

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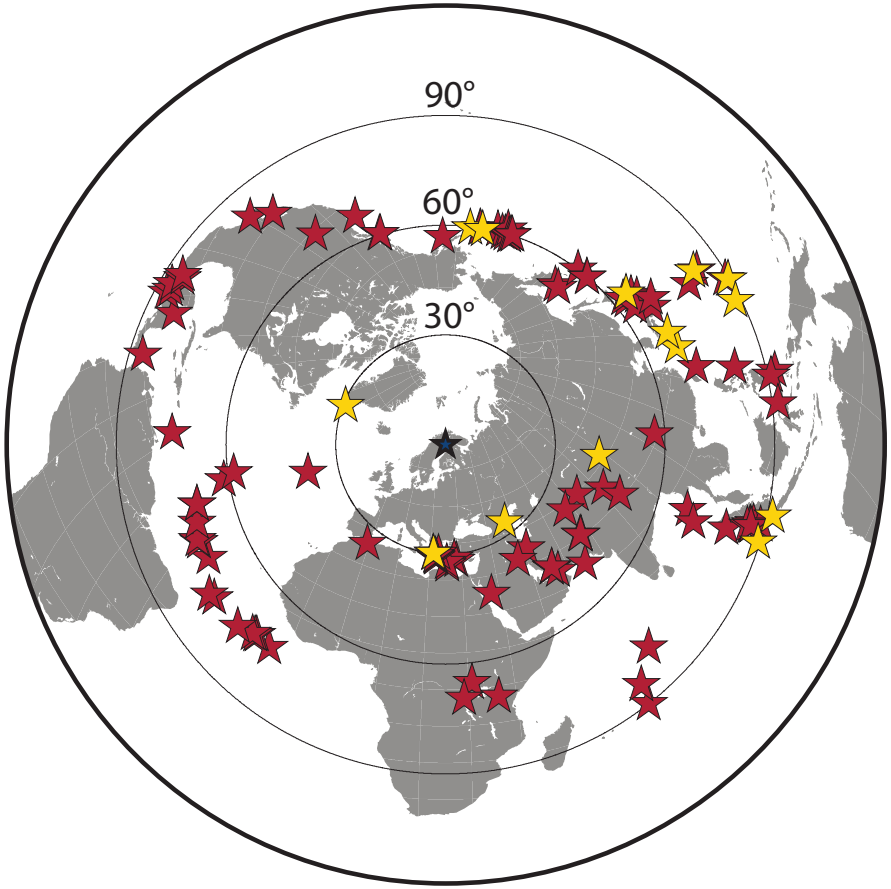

Fig. 2. Revised Fig. 2

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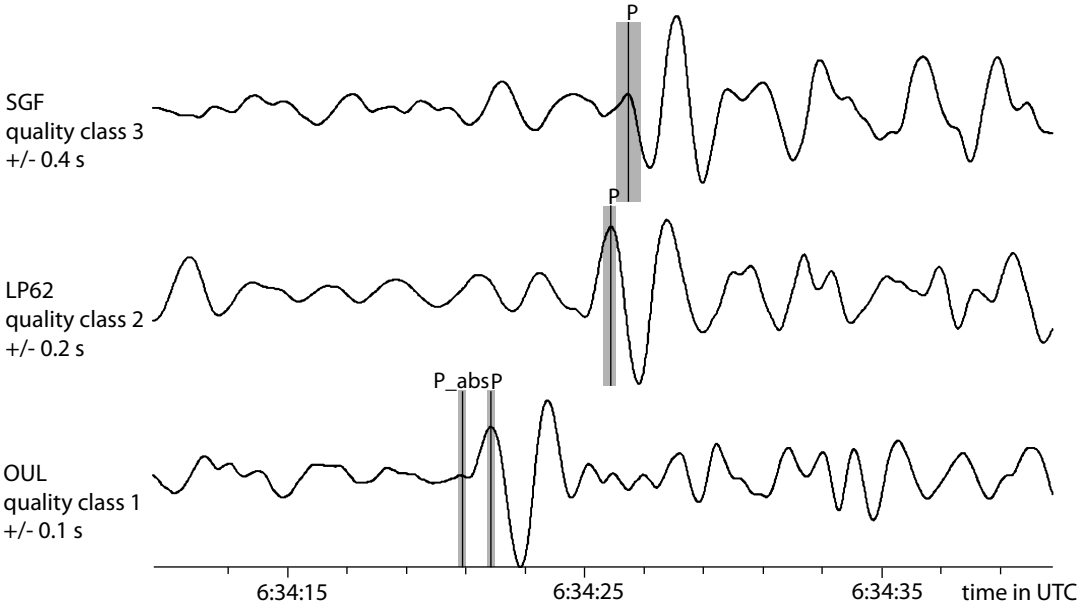

Fig. 3. Revised Fig. 3

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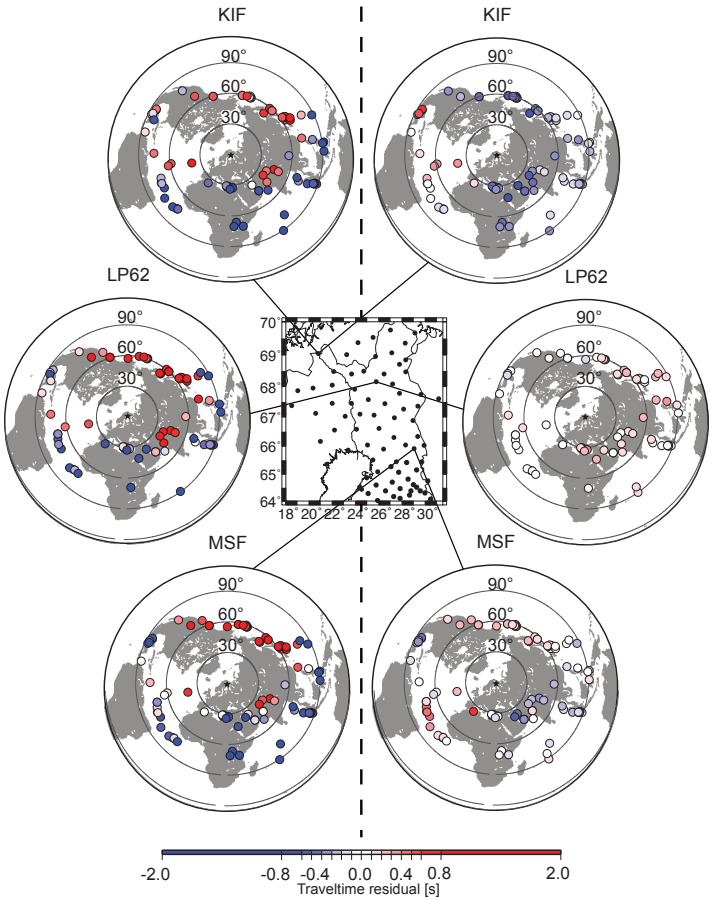

Fig. 4. Revised Fig. 4

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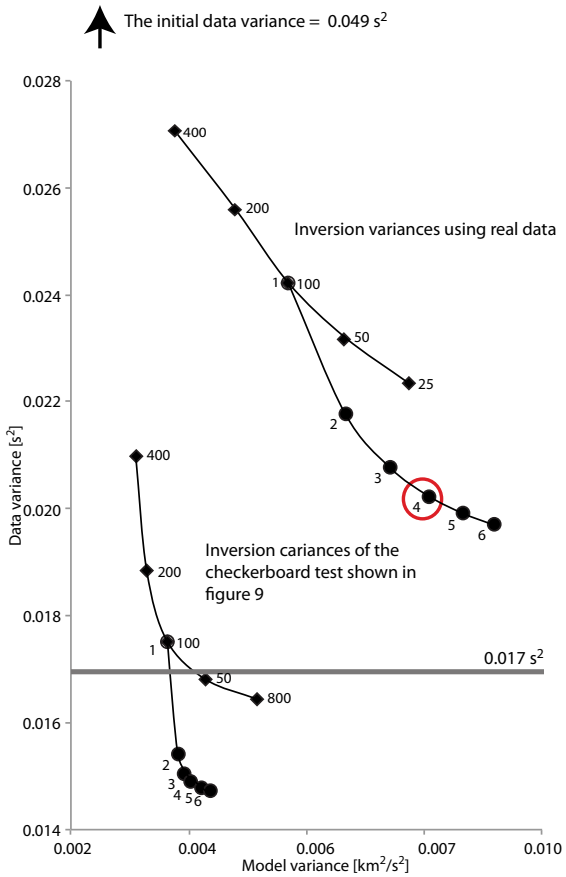

Fig. 5. Revised Fig. 5

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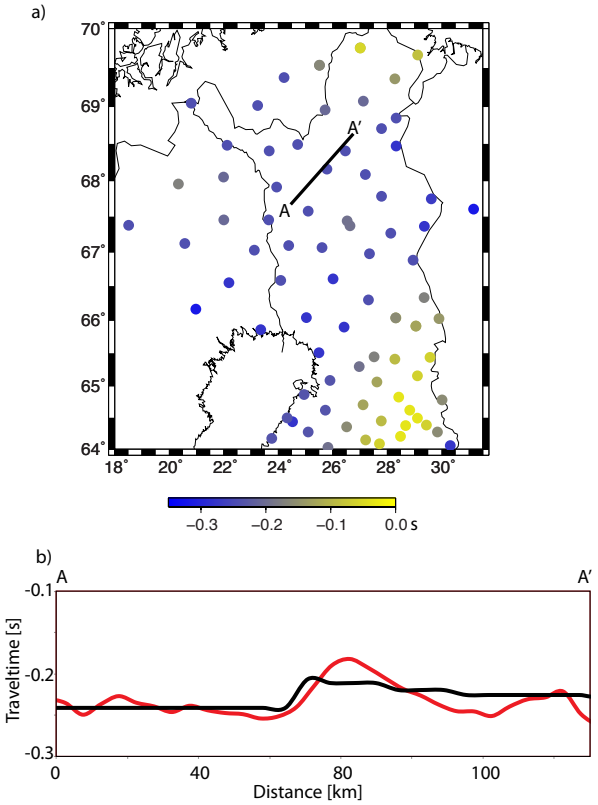

Fig. 6. Revised Fig. 6

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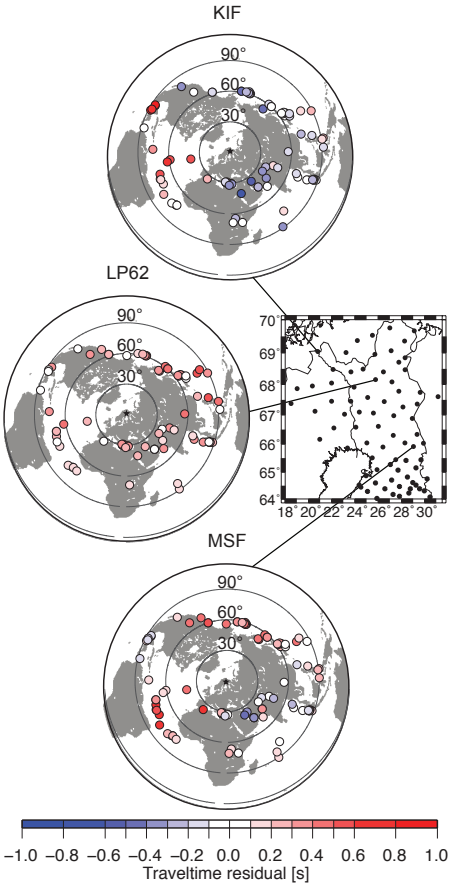

Fig. 7. Revised Fig. 7

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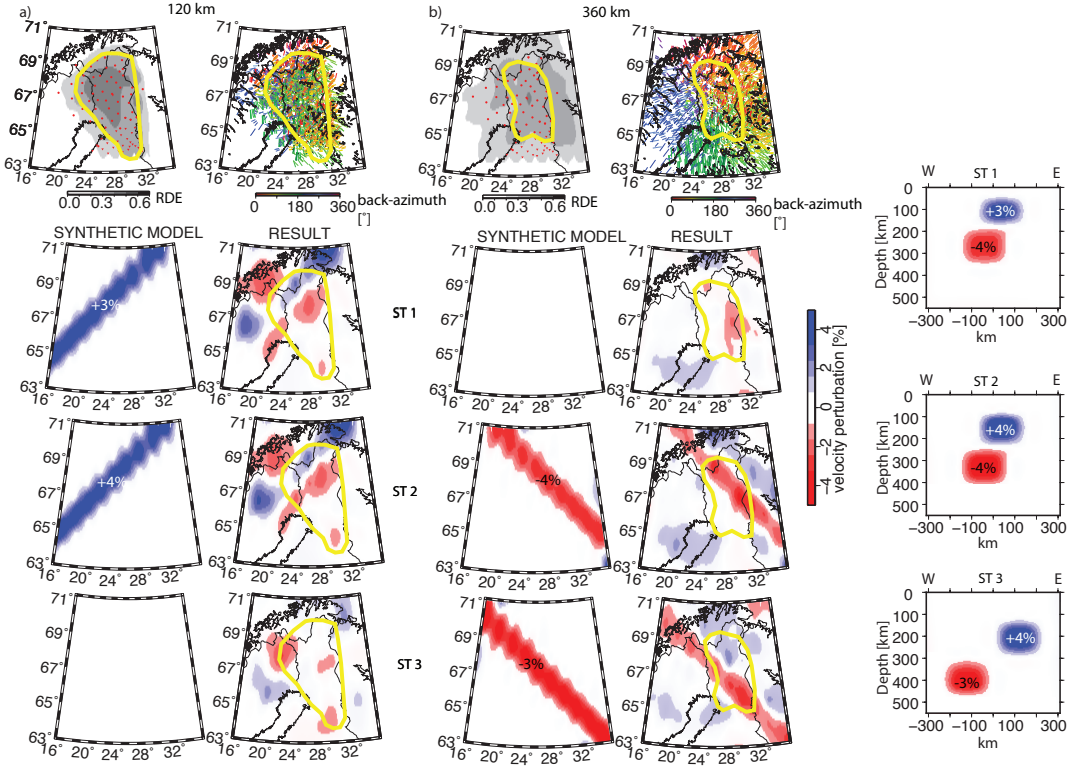

Fig. 8. Revised figure 8 that is a combination of old figure 8 and 10

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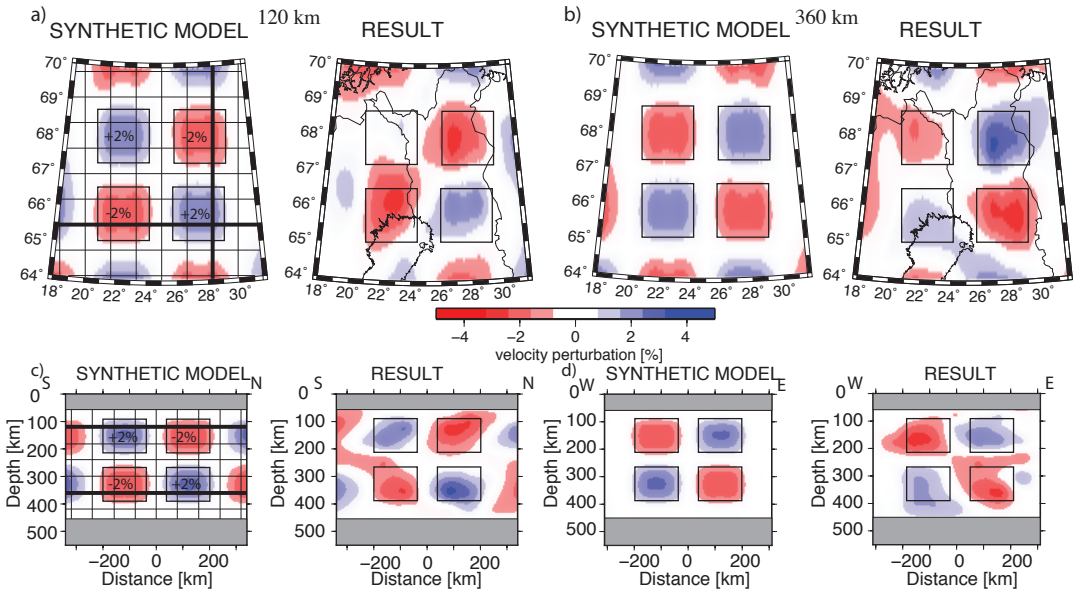

Fig. 9. Revised Fig. 9

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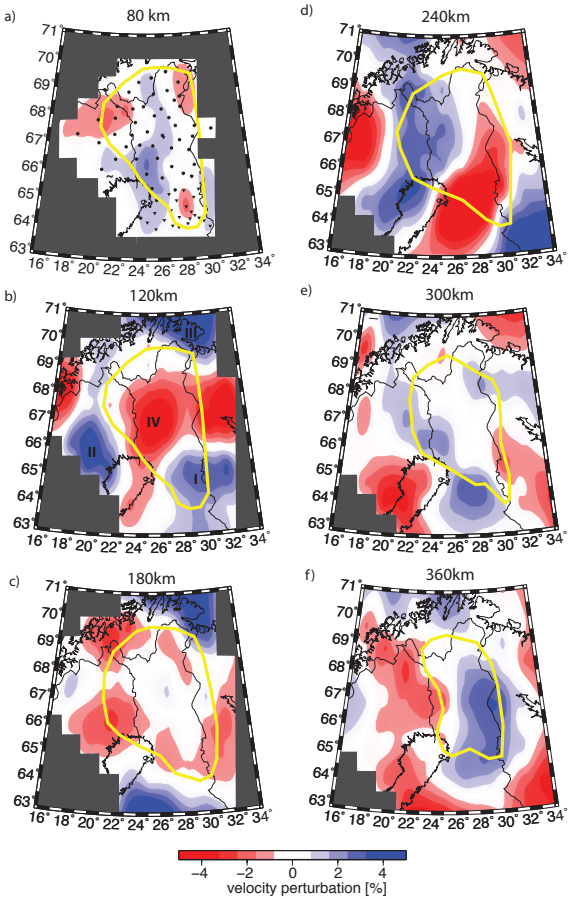

Fig. 10. Revised Fig. 11

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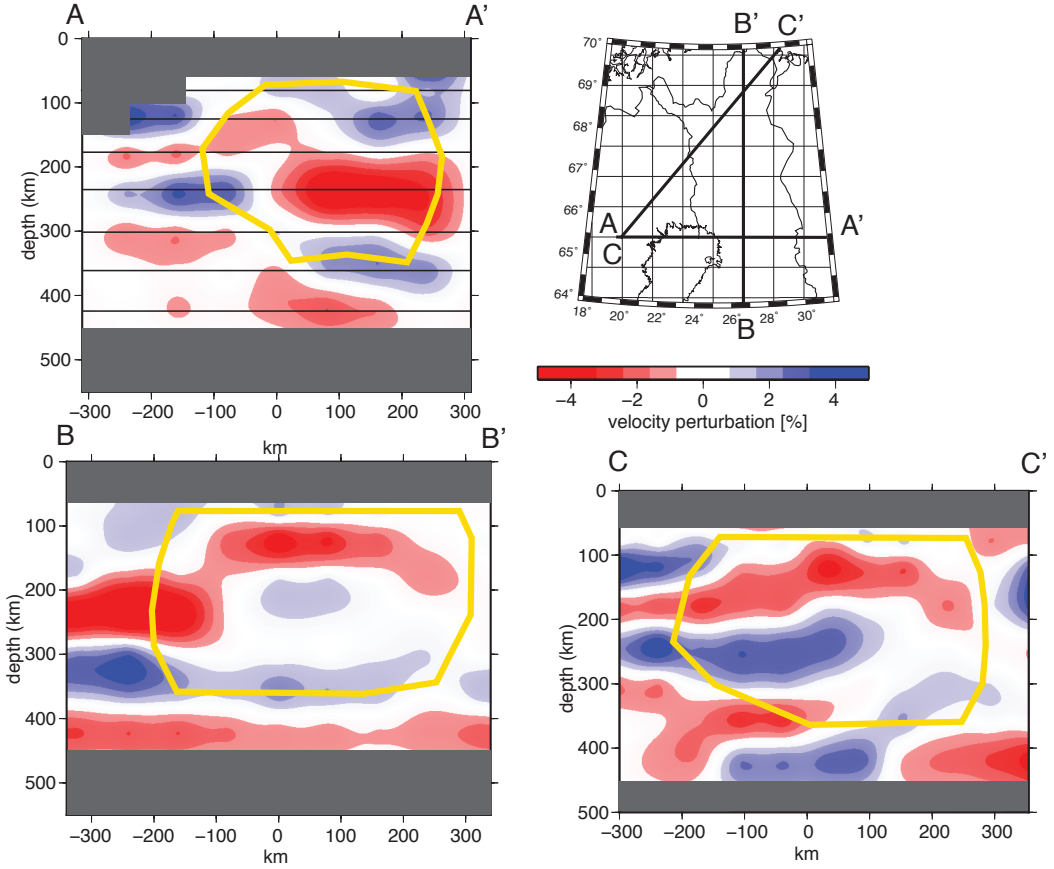

Fig. 11. Revised Fig. 12

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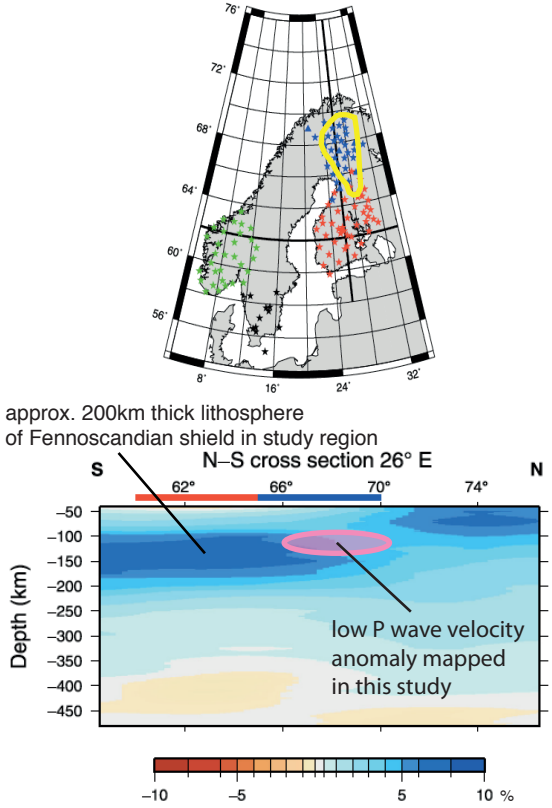

Fig. 12. Revised Fig. 13

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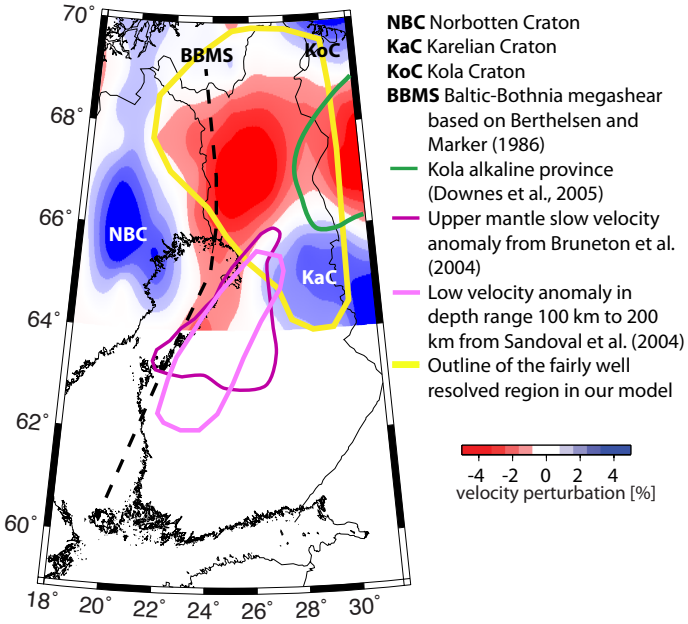

Fig. 13. Revised Fig. 14

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