Dear Anne Paul,

Thank you for your comments and remarks.

We decided to add another vertical profile slicing through the checkerboard tiles from W to E at 44.5°N as a supplement (Fig. 1 in this document). We do not think that a third resolution profile around 13.3°E (N-S) will add much valuable information, as the densest station coverage around SWATH-D is already included in profile R1, whereas the influence of the EASI experiment on our dataset is minor (due to its end in 2015).

There might be a little misunderstanding, as the crustal model does not reach down to only 77.5 km, but up to 99 km depth (which is the bottom boundary of Tobias Diehl's model). The transition between the 1D background model of Diehl and AK135 is at 77.5 km.

You will see in the updated Fig. 10 (Fig. 2 in this document) that a 90 km slice also partly slices through the a priori model. We do not think that the vertical resolution of our model between 80-130 km is too bad to show a horizontal slice at that depth. As far as we understood, the reviewer(s) wrongly assumed that the a priori crustal perturbations are artifacts of the checkerboard in the crust and concluded a severe resolution problem in this area. We created another resolution test with checkerboard perturbations also in the crustal domain (and without the a priori crustal model) to investigate vertical smearing in the uppermost mantle and crustal domain that we will also add as a supplement to the manuscript (Fig. 3 and 4 in this document). In this test we do not see a severe smearing problem in the depth range between 80-130 km. Along the N-S profile we can even resolve structures in the uppermost 40 km, north of 46°N, whereas south of 46°N and along the W-E profile the crustal domain is dominated by vertical smearing. However, the resolution in the uppermost mantle is still satisfactory along both profiles.

Regarding the original test that included the crustal a priori model we only see that there is more vertical smearing possible in the depth range between 80-130 km than for e.g., between 150 and 300 km depth, but we also see that e.g., for the 2x2x3 grid points checkerboard (Fig. 10) there is only moderate smearing of the underlying checkerboard anomalies (starting at 140 km depth) up to 120 km depth and no smearing above 100 km depth. A depth slice at 90 km depth through this test model would not be contaminated by the checkerboard perturbations below. Hence, the true depth of the anomalies in a 90 km depth slice might be less well determined than e.g., for the slices between 150 km and 300 km, but still acceptable for a meaningful interpretation.

Best regards,

Marcel Paffrath and Wolfgang Friederich

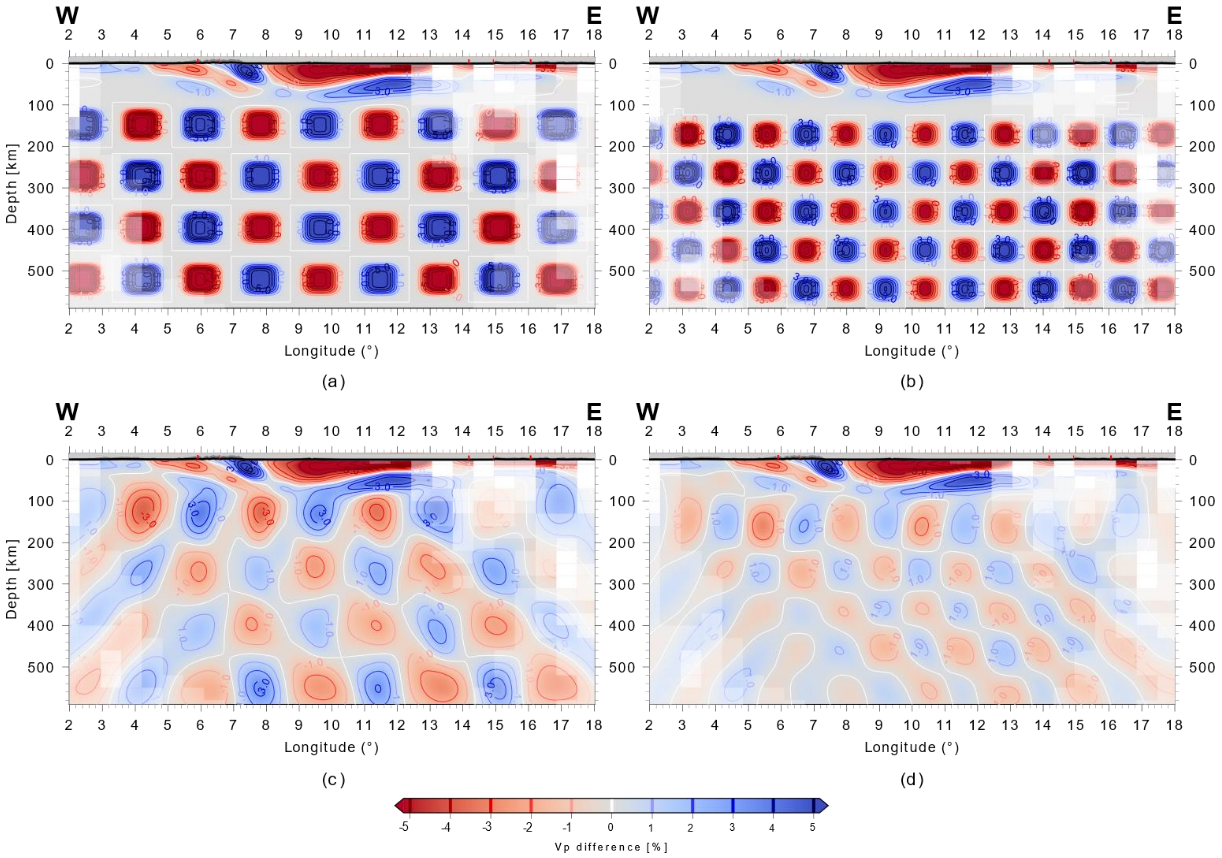

Figure 1 Checkerboard results at 44.5°E (through Ivrea body and Po-plain)

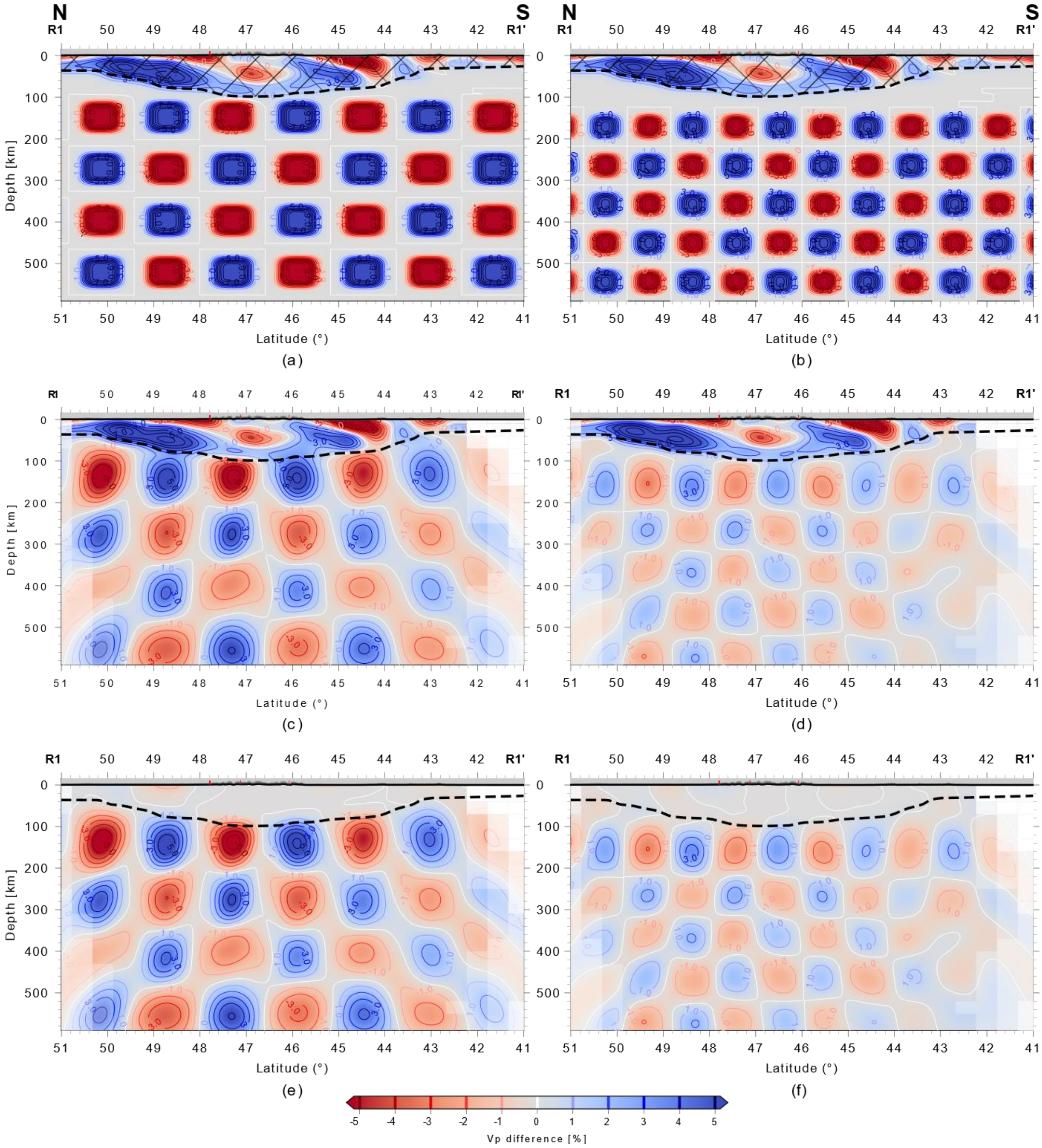

Figure 2 Updated Fig. 10: Vertical slices of profile R1 cutting through the checkerboard models at 11.5°E. Shown are perturbations of P-wave velocity relative to the 1D reference model. Top panel: Test model used to calculate synthetic data including a priori crustal model (crosshatched area). Middle panel: Recovered checkerboard model including slightly altered a priori model. Here we can analyse possible interactions between the resolved checkerboard perturbations and the overlying a priori model (e.g., connection of anomalies due to smearing). Bottom panel: Recovered checkerboard model with the a priori crustal model subtracted. Here we can analyse alterations of the crustal model (artifacts) due to mapping of the checkerboard anomalies into the crust.

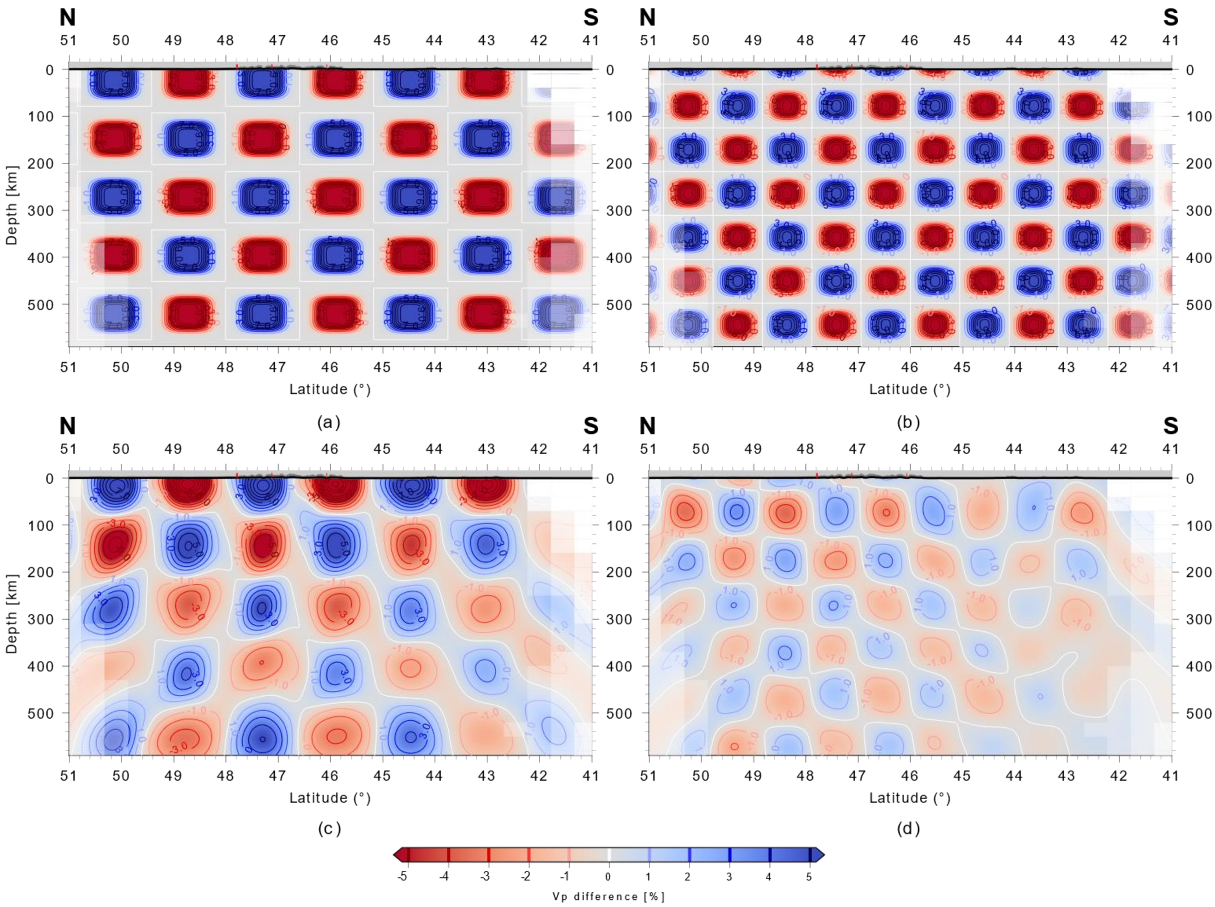

Figure 3 Slice R1 at 11.5°E through checkerboard model without a priori crustal model

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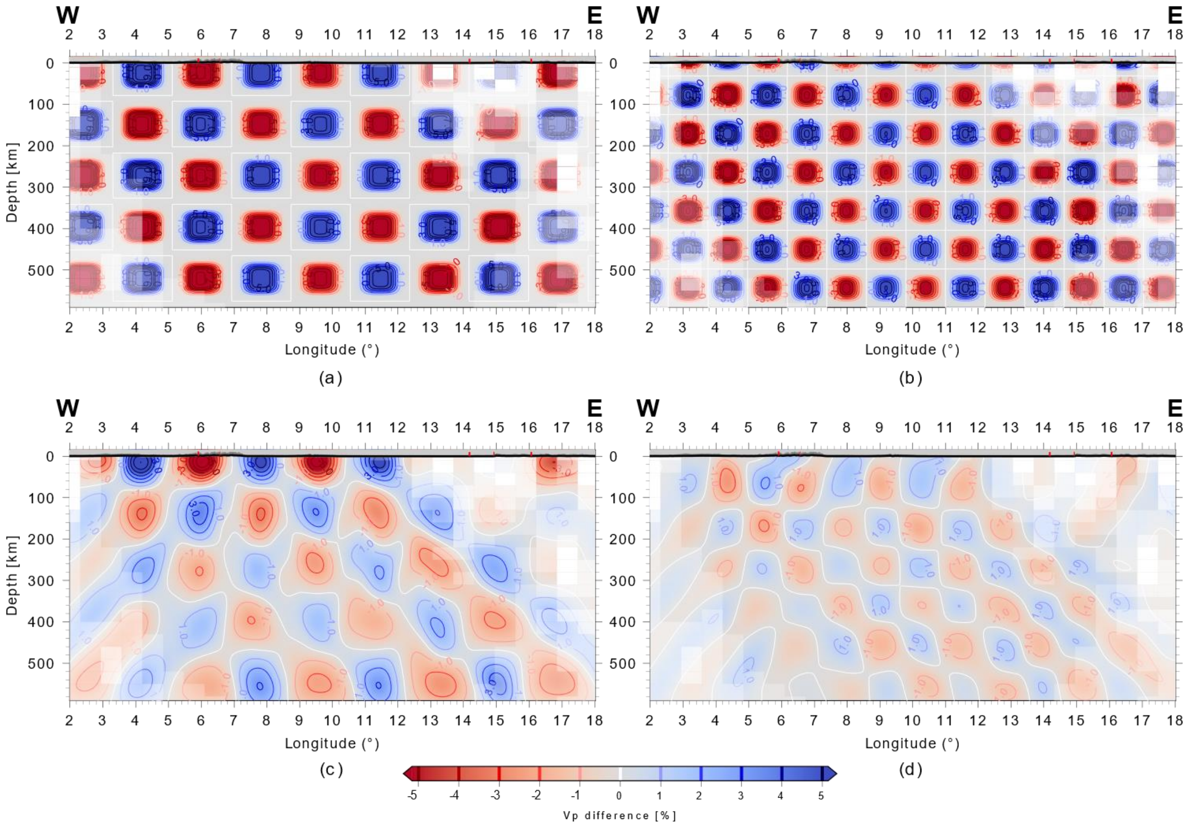

Figure 4 Slice R3 at 44.5°N through checkerboard model without a priori crustal model