General Comments

This is a very well written manuscript describing a new high-resolution 3D model of the shear wave velocities in the Bohemian Massif, based on ambient noise data. It contains an informative introduction, followed by short information about used data

(selected 24 258 station pairs for ambient noise processing) and detailed description of used methods (an iterative fast marching method resulting in shear velocity maps and a stochastic inversion of dispersion curves for a collection of multi-layered shear velocity models). Furter it describe the results with a large number of figures and useful supplements, resolution and sensitivity tests. The main content of the article is the discussion, that itself is a review of all important articles describing the structure of the Bohemian Massif and especially its lower crust.

The manuscript is long, but clearly describe data analysis, chosen assumptions and methods limitations. It is interesting as it presents the low shear wave velocity anomaly in the lower crust of the whole Bohemian Massif in contradiction to everything that was previously published, and explain that by anisotropy of seismic velocity. As an easy improvement, this manuscript could be shortened and even some figures (e.g. fig.5, 7, 8, 13) could be removed without harming the main message.

We shorten the paper by moving several figures, including the Figs. 5, 7and 13 into the supplement, but we keep the Fig.8 (Moho depth map) in the main text.

Specific comments

1. Reduction of shear wave velocities in the lower crust is a new and surprising result. No such effect was visible in previous P-wave velocity results from CSS experiments. It is, of course, possible that P and S waves have different characteristics, but would it be possible to verify S-wave velocities in the lower crust using existing CSS data? It would be less precise than P-waves, but still, such characteristics should be clearly visible.

It would be very interesting study, but such task is for specialists in CSS, having access to data and extremely large experience in CSS processing. The reduction of only v_S results in an increased of vp/vs to ~1.9, which is a value typical for mafic rocks.

The most surprising is the existence of those lower velocities in the whole area. As shown using P-wave CSS at profiles CEL09 (Hrubcova et al. 2005 JGR doi: 10.1029/2004JB003080), and S02, S03 (Majdanski et al. 2006 Tectonophysics doi: 10.1016/j.tecto.2005.10.042) anomalous P-wave velocities in form of layered lower crust were recognized in part of profiles, but not globally. Those areas were interpreter as remelting of the lower crust or magmatic underplating (Majdanski´ et al., Tectono-physics, doi: 10.1016/j.tecto.2007.02.015). Is it really a global feature of Vs of BM?

The ANT model shows systematically the low shear velocities for the majority of the BM. Moreover, the low velocities correlate with the tectonics of the BM (see Fig.10).

2. Despite the possible difference in P and S-waves velocities in the lower crust that are possible the boundary of the lower crust, both upper and lower (Moho) should match the P-wave models, at least in range of the uncertainty of used methods. As shown they are quite different. The argument of 3D modelling advantage over 2D CSS is valid, but this effect is not that strong, because in the Bohemian Massif horizontal variations are not that significant. The question is, what level of S-wave anisotropy in the upper and middle crust would be needed to match P-wave models boundaries? As shown by Sroda 2006 GRL doi:10.1029/2006GL027701, for P-wave 10% anisotropy was observed.

We presented in the ms. (Lines 491-491) that " the minimum strength of the lower crust anisotropy ranges from 3 to 9 % depending on the average v_S.

3. I strongly disagree that the results of CSS should be neglected as less precise comparing to ambient noise methods. From personal experience, I am convinced that controlled source seismic and P-waves analysis is the most precise method of studying the crustal structure. The second one is CSS with S-waves (as they are less precise to recognize because arrive later, are converted and mixed). The next in precision are receiver function methods, and the least precise the Surface waves (dispersion anal-ysis) methods. Authors refer to my paper (Majdanski´ and Polkowski, 2014 PAGEOPH doi 10.1007/s00024-014-0840-9) as weakness of CSS.

We have never claimed that the results of CSS should be neglected. We compare the BM models from different approaches, without giving a preference to any of them. We are aware the three methods are sensitive to different parameters. For example, receiver function is poorer for absolute velocities than ambient noise tomography, but approaches P wave CSS for discontinuities.

We reformulate L378: "Therefore, the ANT method can image 3-D structures of the crust in a more realistic way compared to the case when the 2-D CSS lines do not match at crossing points."

This paper shows the limitation of the layer-stripping approach. With previous paper (Majdanski´ Geophysics doi: 10.1190/GEO2012-0280.1) it proves that the uncertainty of layer-stripping approach grows as dv*sqrt(n), where n is the number of stripping iterations. The same is valid for presented layer-stripping ANT in the discussed paper. So what is the final uncertainty of the presented model?

The layer-stripping in trial-and-error CSS model building method is a completely different concept from the layer-stripping in the surface wave stochastic inversion, therefore, conclusions of Majdanski and Polkowski (2014) are not applicable to the layer-stripping technique performed in this study. See also the answers RC2.23, RC2.27 and Fig.6b vs.6d.

The vertical resolution of the ANT vs model is depth dependent. Statistics computed on the group of the best fitting models, particularly standard deviation and skewness, can serve as a rough guide of the depth resolution and as a confirmation, that the model space in the stochastic inversion is fully explored and that the constrains of the model space do not influence the outcome. We created the map of the standard deviation and skewness for LPC/UPC boundary and for Moho (RC_Fig8, for the supplement), it show that skewness coefficients are very small values mostly around zero and standard deviations are within the generally accepted accuracy of Moho depth estimate ~5km (Kästle et al., 2018).

Small technical corrections: *Corrected.*

The manuscript is partially written in the first person: "We picked", "We interpolate".
Should be in third person.

28: remove space

166: remove space

405: remove . .

I hope that my comments will help to improve this manuscript.