Solid Earth Discuss.,
https://doi.org/10.5194/se-2018-100-RC2, 2018

Solid Earth Discussions
Open Access
EGU

Interactive comment on "Near surface structure of the North Anatolian Fault Zone from Rayleigh and Love wave tomography using ambient seismic noise" *by* George Taylor et al.

Anonymous Referee #2

Received and published: 8 November 2018

I think that the need for the present work is indisputable given that the high seismic hazardous potential of the study area has, but I got an impression that this work lacks some very interesting points which can justify the quality of the work when reading it. In that respect authors seem to take some critical issues explained below quite superficially. I think this work requires a major revision prior to possible publication in the journal of Solid Earth. At this stage I strongly suggest authors seriously consider following issues listed below.

General Comments

Although they emphasize the importance of good and reliable knowledge on crustal

Printer-friendly version

Discussion paper

structures along the continental shear deformation zones at the very beginning in the introduction, and since this is one of the primary task for taking all such efforts in the region, I am very upset why they avoid to interpret their results mainly around this target which could be vitally important for future studies that aim at a decent seismic scenario for the region.

There have been numbers of recent geophysical model and observations in a region including the study area and further west dealing with the branch of the NAFZ beneath the Sea of Marmara. However, introduction significantly lacks of a compilation of previous studies and their findings including the DANA experiment.

Isotropic velocity In the present work, inversion results for shear wave velocity for deeper sections at 3.5 and 5.5 km do not provide profound velocity contrasts among three tectonic zones, namely, Istanbul, Armutlu-Almacik, and Sakarya Zones (see Fig. 6) whereas using the same network and teleseismic P-and S arrivals Papaleo et al. (2017, 2018) were showing clear separation reflected as relatively high wave speeds beneath Istanbul Zone to the north, and low beneath Sakarya Zone to the south that is mostly likely due to the lithological differences down to, at least, the depth of 20 km.

Only for the first 1.5 depth range, resolution is sufficient to resolve shear zones along the northern branch. There down to the depth of 1.5 km major difference is claimed by the authors to be associated with low S-wave velocity to the north of the NAFZ, associated with faulted marine clastic sediments near Izmit (Akbayram et al., 2016) and with the Adapazari sedimentary basin. I think a detailed introduction with more geological constraint as well as other geophysical data to support this and further velocity variations at this depth range is missing. Such introduction is crucial since below this range velocity variation does not show high resolution details.

It seems there is an effect of N-S elongated azimuth of station pairs on resolved images. This effect can be investigated using sensitivity analysis, i.e., checkerboard test results. I am aware that authors have already added materials in Supplementary but

Printer-friendly version

Discussion paper

I believe it is much better if given within the Sensitivity Analysis section of the main text. In this way, later they can use this by putting quantitative arguments when they describe the results (reliability of various features which will be potentially examined in the Discussion).

I would like to see the ray-paths of periods and their checkerboard results in supplementary file to be able to see the influence of dominance of N-S orientation of station-pairs in your data set.

Extraction of surface wave velocities

→ According to my recollection, in some studies dealing with ambient noise inversions in the literature, group velocities and related time information are used for further inversion process. Here authors are using phase velocities. Perhaps this has to be addressed in the text.

→ Figure 2 is interesting. One of the first things that is prominent on this figure is the zero-offset energy. What might be the major source for that? Needs to be clarified.

Azimuthal anisotropy Large scatter azimuthal variations of phase velocities (see Fig. 8 & S13) under the presence of N-S dominating azimuth of station-pairs. Thus long period behavior of directional dependent phase velocities is doubtful. And thus, a frequency varying fast velocity directions (with increasing uncertainties as period increases) is also not too convincing.

This work examines anisotropy issue with a superficial discussion regarding early constraints on seismic anisotropy in the region. Authors appear to take the discussion regarding seismic anisotropy only using a single SKS splitting study (Biryol et al., 2010), which has been informative for upper mantle anisotropy. However, there are a few earlier studies performed along the NAFZ (central and western NAFZ) with direct observation of crustal anisotropy. No specific discussion in the light of earlier works revealing upper crustal anisotropic structure mainly based on shear wave splitting structure (e.g.

Peng and Ben-Zion, 2004-2005; Hurd and Bohnhoff, 2012) or entire crust from RFs analyses (Vinnink et al., 2015; Licciardi et al. 2018).

The question on what part(s) of the area may indicate structure-induced, and what part(s) stress-induced anisotropy is still ambiguous. Moreover, a single model for such a complicated tectonic setting with significant lateral heterogeneities cannot be represented a single-smooth depth-varying model with very consistent SKS orientations (see e.g. Peng and Ben-Zion, 2004-2005; Hurd and Bohnhoff, 2012; Vinnink et al., 2016). At least early shear wave splitting and RFs data suggests the opposite what the current work says.

Another thing I could not figure out is that authors do not provide any clue regarding radial anisotropy? If they are already able to invert both love and Rayleigh wave wouldn't it be possible to visualize radial and tangential shear wave speed variations at various depth?

More importantly, I am seriously wonder why they have not gone for a detailed harmonic analysis that can provide depth variation of fast polarization azimuths on a finer spatial resolution using on available data set.

I would omit this part unless it is supported with a more convincing and detailed analysis of the data set.

Figures For Figs. 1, 3, 4, and 6, values of latitude and longitude is strange.

References

Two references of Şengör (Şengör and YÄślmaz, 1981; Şengör et al., 2005) are not listed in the alphabetical order.

Interactive comment on Solid Earth Discuss., https://doi.org/10.5194/se-2018-100, 2018.