

Interactive comment on “Using Horizontal to Vertical Spectral Ratios to construct shear-wave velocity profiles” by Janneke van Ginkel et al.

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Dear Authors,

The manuscript “Using Horizontal to Vertical Spectral Ratios to construct shear-wave velocity profiles” presents a method to improve a shear wave-velocity profile for the North Sea Group (NSG) sedimentary layer in the Groningen field, the Netherlands. The method is based on 5 teleseismic events recorded at each station location of the Groningen borehole network, which are then used in H/V body wave (HVBW) ratio analysis, and subsequently, velocity profiles for the lower part of the NSG are constructed. These velocity profiles are used as input for body- and surface-wave forward modeling and compared to the H/V spectral ratios of the ambient noise (HVAN). Also,

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the authors validate the new shear-wave velocity profiles by comparing HVAN curves to the theoretical Rayleigh-wave ellipticity curves in the band where Rayleigh waves dominate. Finally, the authors compare their results to the existing Vs model from Kruiver et al. (2017).

The manuscript is clear, interesting, and well written, the scientific methods and assumptions are valid and clearly outlined. This improved Vs model might be used consequently in microseismic event location and site effect estimation. The results are validated with forward modelling, and the two approaches for H/V curve calculations show similar peak frequencies. I think that the paper explains precisely different approaches to extract H/V curves, which might be reproduced and used in other studies.

I think that this manuscript can be published in SE after a few minor and technical corrections. I have only three specific comments and questions:

1. Do the authors think that the difference in amplitudes of the resonance peak for HVBW might be related to the characteristics of the near-surface, that might be different between 2017, 2018, and 2019? This was shown by Mordret et al. (2020) and Brenguier et al. (2020) that both the NSG and Chalk group can experience velocity variations due to the loading effect associated with rainfall events and atmospheric pressure variations. Could the authors comment on it?

2. I think that in general, it could be good to add these two papers to the list of references. Especially the one from Mordret et al. (2020), where they show the presence of the fundamental and the first higher mode of the Rayleigh waves in the Groningen field in the frequency bands that are coherent with the author's results presented on Figure 13.

3. I think that the Introduction could be slightly restructured. Some pieces of information are coming up too early before the aim of the study is introduced. Please, have a look at the marked manuscript.

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Other than that, I just put some minor technical comments in the attached manuscript, and I would like to congratulate the authors on a clear and well-written manuscript.

Best,

Małgorzata Chmiel

Please also note the supplement to this comment:

<https://se.copernicus.org/preprints/se-2020-86/se-2020-86-RC1-supplement.pdf>

Interactive comment on Solid Earth Discuss., <https://doi.org/10.5194/se-2020-86>, 2020.

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