**Review for "Potentials and pitfalls of permafrost active layer monitoring using the HVSR method: A case study in Svalbard" by Andreas Köhler and Christian Weidle**

The authors propose an interesting article about potentials and pitfalls of using the H/V method to monitor permafrost layers.
Obviously, the first pitfall is to use a correct definition of the H/V ratio. This is the main problem of the paper and it needs to be corrected before the scientific significance of the results can be assessed:
The authors use the geometric mean of the spectra of the northern and eastern component to calculate the H/V curves, which is not what is generally used for H/V calculations:

$$\frac{H}{V}(f) = \frac{\sqrt{|N(f)|^2 + |E(f)|^2}}{|Z(f)|}.$$

This formula has a physical meaning, i.e. the energies on both horizontal components are summed together and the resulting amplitude is taken for the H/V computation. In this way, waves from all azimuths are treated in the same way and a wave from any direction will always have the same H/V ratio.
I do not see a physical meaning in the formula used by the authors. For perfectly isotropic wave fields, both formulas might give the same result (with a sqrt(2) factor missing), but the authors especially state that the wave field is not isotropic here. Using the formula with the geometric mean, if the wave field was composed by a single Rayleigh wave, the resulting H/V curve would actually depend on the azimuth of the wave. Arriving from the direct north or east, one of the components would have a zero spectrum and therefore the so calculated H/V would be zero. Arriving from the northeast, both components would have the same amplitude and the H/V curve would be the correct one (except for a sqrt(2) factor).
For a real wave field, the case is more complex, and the spectra of the north and east components are sums of all wave contributions. Therefore, each wave will have a cos(alpha)*sin(alpha)*amplitude^2 contribution in the product N*E, plus the cross-terms between north and east components of the different waves. If the wave field is not isotropic, these cross-terms will in general not correct for the misestimation. Therefore, the basic definition for the H/V ratio used in this paper introduces a bias based on the main azimuths of the wave field. As the wave field in the area is not isotropic and changes with the seasons, this bias will result in a change of the H/V curve.
The real data H/V curves should be recalculated using the correct formula and the results should then be reinterpreted accordingly.

Apart from that, the study makes sense and is well described and performed. The identification of the tremor source is reasonable and sound. For the assessment of the variability of the Rayleigh wave ellipticity and the discussion section, the reinterpreted results might change the conclusions, so that it is difficult to comment on this issue at this time.
In any case, the study has or will have a high scientific value and be of great interest to the community.

Here are some other comments the authors might want to take into account:

Fig. 1 Maybe a photo of one or several of the stations would be helpful. The reader is curious to see how you install sensors in such an environment.

Fig. 2 and similar figures: The plots are nice, but it is actually not that easy to see differences in the amplitudes in these plots. I would suggest adding the real H/V curves for comparison reasons.
5 HVSRs from a repeating seismic tremor:
I cannot follow the reasoning here. KBS sits at 2.5 m depth in a shelter. However, the wave field recorded by the station will still include the waves travelling through the frozen or not frozen layers. Waves with v=100 m/s at 20 Hz have a wavelength of 5 m, which are of course sensed by the station. Higher velocities result in larger wavelengths, so the station should be able to detect changes in the frozen layer in any case.

Appendix C and D are necessary for the understanding of the main text and are also cited so often in that text that they should be incorporated in the main document.

The verb “allow” usually requires a direct object (e.g.: “allows us to do …”, “allows the determination of …”; instead of “allows to do …”).