EGUsphere, referee comment RC2
https://doi.org/10.5194/egusphere-2022-108-RC2, 2022

Comment on egusphere-2022-108

Anonymous Referee #2

Referee comment on "Ground motion emissions due to wind turbines: observations, acoustic coupling, and attenuation relationships" by Laura Gaßner and Joachim Ritter, EGUsphere, https://doi.org/10.5194/egusphere-2022-108-RC2, 2022

The authors present the results of an experiment aimed at registering and analyzing seismic and acoustic emissions from wind turbines. While the applied methods are not new, the results provide important insights into the seismic and accoustic emissions of wind turbines, especially with regard to the desired expansion of renewable energy sources. The manuscript is clearly structured and presents the measurements as well as the derived results in a comprehensible way. I recommend its publication after minor revisions which take account for following remarks.

Seismic stations were placed in the vicinity of two wind farms in southern Germany. Additional infrasound sensors were installed at selected locations to register the accoustic emissions simultaneously. Using PSD spectra, the authors first analyze the characteristics of the registered seismic signals close to the sources (i.e., wind turbines). They identify frequency-independent signals that are assigned to the natural oscillations of the wind turbines, as well as highfrequency components that correlate with the rotation rate of the wind blades or the generator. The results are presented in an understandable way and are convincingly documented by the illustrations.

In the following section ("Signals at place of immission"), the authors discuss signals which have been recorded in the village of Kuchen, in about 1 km distance from the closest windfarm. Obviously, some residents feel disturbed by the wind farm and one of the project goals lies on how residents experience the WT emissions. Unfortunately, it then turns out that the recordings in Kuchen cannot be evaluated, because here the wind turbine signals are completely covered by the vibrations of a nearby and heavily frequented railroad line. Therefore, I would shorten this section significantly and also remove Fig. 8 since, in my opinion, it does not contribute anything to the targeted questions.

Another aspect that has not been addressed as often as seismic emissions is the measurement of infrasound signals in the vicinity of wind farms. At a few sites, both,

seismometers and acoustic sensors were installed, and the authors compare the registered ground motion with the infrasound signal. For certain frequencies, the PSDs of ground motion and infrasound exhibit an astonishing agreement, so that the same sources (blade passing, generator rotation) are supposed for both signal types .

From the amplitude ratio of infrasound and ground motion, the authors derive the so-called coupling transfer coefficient at different frequencies. The results are well documented by text and figures, however, I miss the discussion of the significance of this parameter, which is not very common in seismology. How is the mechanism of the transmission of airborne sound to ground motion, are there any insights on this? Or, which information can be derived from this parameter, what does this coupling factor depend on, e.g. properties of the subsurface? This section should be expanded accordingly.

One of the most important results of this manuscript is the presentation of the b-values describing the spatial decay of the seismic wind turbine emissions. There are already numerous publications on this topic, but the results vary quite strongly depending on e.g. the number of wind turbines, wind farm geometry, or geological conditions. I think each further experiment can help to bring systematics into the results and to better understand the emitted seismic wave field of a wind farm. Table 3 gives a nice compilation of published b-values. However I would also like to see a graphical representation, which enables a better and quick overview.

To calculate the b-values, the authors use both, absolute PSD amplitudes and relative PSD values. The comparison shows that the relative PSD method results in somewhat more stable and more reliable b-values, particularly if the registration of wind turbine emissions is superimposed by transient noise. I would appreciate if this aspect would be discussed in more detail, as it could leed to unified measurement rules with which comparable b-values can be obtained in future.

In the discussion section there are some statements, which are not proofed by the presented results, concerning the range of the emitted wind turbine signals. At page 17, line 289 the authors write that the signals can be observed "over distances of several kilometers". However, no PSD recorded at several km distance from a wind turbine is shown in this manuscript.

some technical comments:

Fig. 1: at WF Lauterstein there are 3 white WT symbols which means that these WTs were "not studied".
How is it possible to exclude them from the measuments?

page 12, line 182: ... The closest recording station (IW02F, 20m distance) ...

due to Fig.1 and Fig.8 the closest station is IW02G, IW02F is at 80m distance to the railroad track

Fig.8: I would sort the legend entries by distance

page 12, line 183: you should use just one unit for the PSD amplitudes throughout the manuscript (same in text and figures): either dB relative to 1 (m/s)**2/Hz or dB relative to 1 (micrometer/s)**2/Hz

page 13, lines 192, 193: I think ground motions and acoustics were registered only at 2 resident sites simultaneously (IMC-B1 and IMC-B2)

page 13, lines 199, 200; "Both, ground motion and acoustic, spectra contain clear signals ..."
move the comma to "Both, ground motion and acoustic spectra, contain clear signals ..."

page 13, lines 217, 218: please add the appropriate unit to the C_{AS} values

page 14, Fig.10, caption: "Signals with frequencies 32×BPF can be observed in all three data sets."
Please mark the addressed signals as you did in Fig. 9.

page 17, line 286: "At sites with 150 m to 1900 m distance to the nearest WT ..."
Obviously you are talking about WF Lauterstein. You should name it here.

page 18, line 287: "Measurements at different wind farms ...", the same as above. This is WF Tegelfeld.

page 22, lines 329 330: "Thus, recordings with seismometers and high sampling rates may be used in the future to monitor infrasound signals in the near-field of WTs."
You cannot monitor infrasound with seismometers, can you?