Earth Surface Dynamics Discussions

Earth Surf. Dynam. Discuss., referee comment RC2
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Comment on esurf-2021-43

Anonymous Referee #2

Referee comment on "Vibration of natural rock arches and towers excited by helicopter-sourced infrasound" by Riley Finnegan et al., Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2021-43-RC2, 2021

The authors present an interesting study associated with the vibration of rock arches and towers caused by helicopter-sourced infrasound. Both seismic and infrasound observations are carefully analyzed to evaluate the response of natural landforms to anthropogenic sources. The pieces of evidence and analyses are well organized and the paper is well written. However, there are a few aspects that need a further demonstration.

First, the authors mentioned 3D models of landforms were built to estimate the eigenfrequencies of the arches and towers using finite-element simulations. This is an important component of the analysis and can provide insightful discussion on this topic. Please consider, at least, adding a dedicated paragraph describing the details.

In addition, in L80-84, a couple of procedures and methods provided by the previous study have been cited without sufficient details. It is difficult for the audience to understand what has been done. Please add a sentence or two to briefly summarize these methods and procedures.

Further, in section 5.3, the author compared the maximum vibration velocities measured on landforms with the empirical levels of previous studies. Using vibration velocity is only a practical way to evaluate the damage. The damage should be determined by the stress perturbations and the structural strength. As the 3D finite-element model are available, it will be great to estimate the maximum stress/strain perturbations inside the landforms caused by the infrasound loading of helicopters. What’s the order of the stress perturbation when loading on a landform of ~10 Pa at its natural frequencies? The stress perturbation is a more direct parameter to compare with the rock strength. This should be the highlight of this paper and will cause an impact.

Last but not the least, when introducing new parameters, e.g., admittance, it is always

good to demonstrate what does it mean when the value is high and low.

Here are the detailed comments:

Figure 1. Can the authors also show the spectra of the infrasound records for comparison?

Table 2. Are the overtones always the multiples of blade pass frequency?

L80-81: Please briefly summarize the method performed to estimate the natural frequencies.

L82-85: Please consider adding a supplemental figure comparing the observed and modeled nature frequencies of the 4 arches and 3 towers analyzed in this study.

L97-99: Did the authors perform lowpass filtering before downsampling the records? Otherwise, there will be artifacts associated with aliasing.

L105: The authors mentioned the orientation of maximum vibration for arches is in the vertical. Can this be confirmed by the seismic observation? Please add a sentence or two to discuss.

L106: Are the dominant polarization azimuth associated with the geometry of hoodoos?

L108: "We plotted …" Is this referring to Figure 2 or Figure 3?