Comparion of Infrasound Wind Noise Reduction Systems for Use in Temporary Deployments

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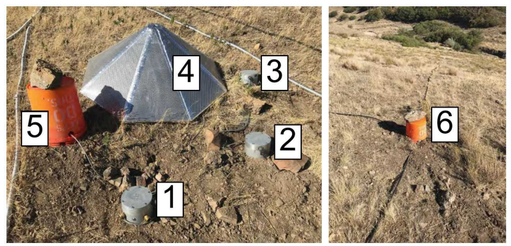
Introduction

- Turbulence within the atmosphere (wind) generates noise
- Wind noise can dominate low signal-to-noise ratio waveforms
-Spectral methods cannot be used to reduce noise as it falls within the frequency band of interest for infrasound research (0.01 - 20 Hz)
-Extensive studies have evaluated the performance of robust wind noise reduction systems (rosette pipe filters[2], wind fences[1], fabric domes[4])
-Many researchers choose wind noise reduction systems for tempo- rary deployments based on anectdotal evidence
-**Motivation**: we are updating the regional infrasound array network in the state of Utah and need to use the best low-cost wind noise re- duction system

Experiment Design



1. Reference (open ports)
2. Hyperion High Frequency (HF) shroud
3. HF Shroud
4. HF Shroud + 1.1m Metal Mesh Dome
5. HF Shroud + 5-gallon bucket with hole
6. Hyperion Garden Hose Shroud + 4 porous hoses

- Weather data collected from a station ~11 km away

Methods

- Data partitioned corresponding to wind speeds (1 m/s intervals up to 5 m/s, then 5-10 m/s)
-Power spectral density (PSD) calculated for 20 s windows with 50 % overlap[3]
- Average PSD calculated for each wind speed interval
- Noise reduction calculated from reference

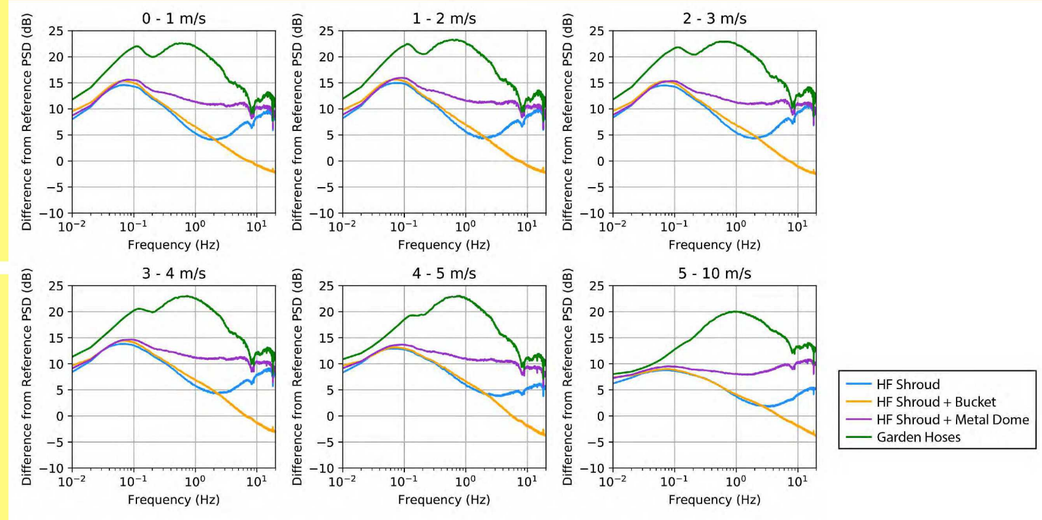
Results and Discussion

- Garden Hoses reduce noise the most, but also attenuate the signal.
-HF Shroud + Dome does well at reducing noise and does not affect the signal.
- Placing a bucket over the HF shroud causes an increase in noise over ~8 Hz.
-The HF shroud contains holes around its circumference that work to average the noise.
-Placing a bucket (with a single hole) over the shroud effectively sam- ples the wind at one point rather than averaging around the circum- ference, causing an increase in noise.

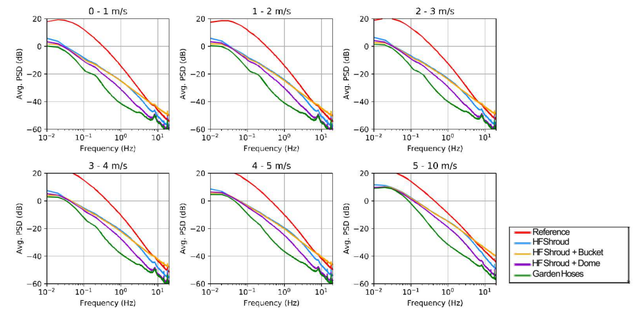
Conclusions

- The HF Shroud + Dome configuration should be used when possi- ble.
-A bucket should never be placed over the HF shroud unless only low frequency signals are of interest.
-While the garden hoses reduce noise the most, they show consider- able

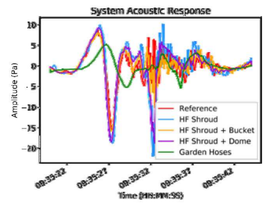
Metal mesh **domes perform best** at reducing wind noise; placing **a bucket** over the sensor **increases wind noise**.



PSDs During Night Only



Acoustic Response



HF Shroud vs. Bucket

Wind is averaged over inlets surrouding the circumference of the HF shroud.

Placing a bucket over the top effectively reduces the sampling to one inlet.

References

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