

Application of the UK IOA AM Rating Method

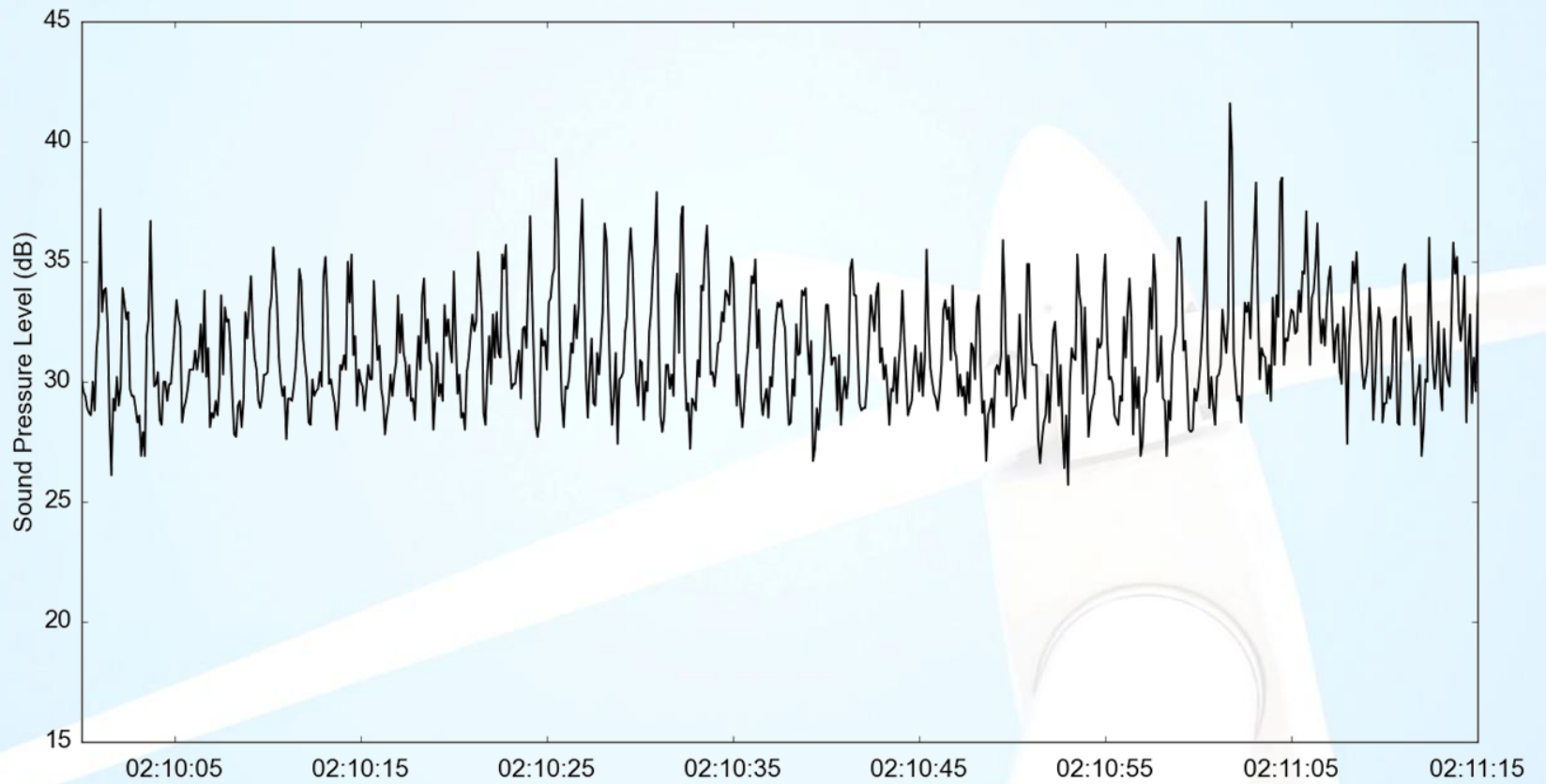
David Coles – 24 Acoustics Ltd

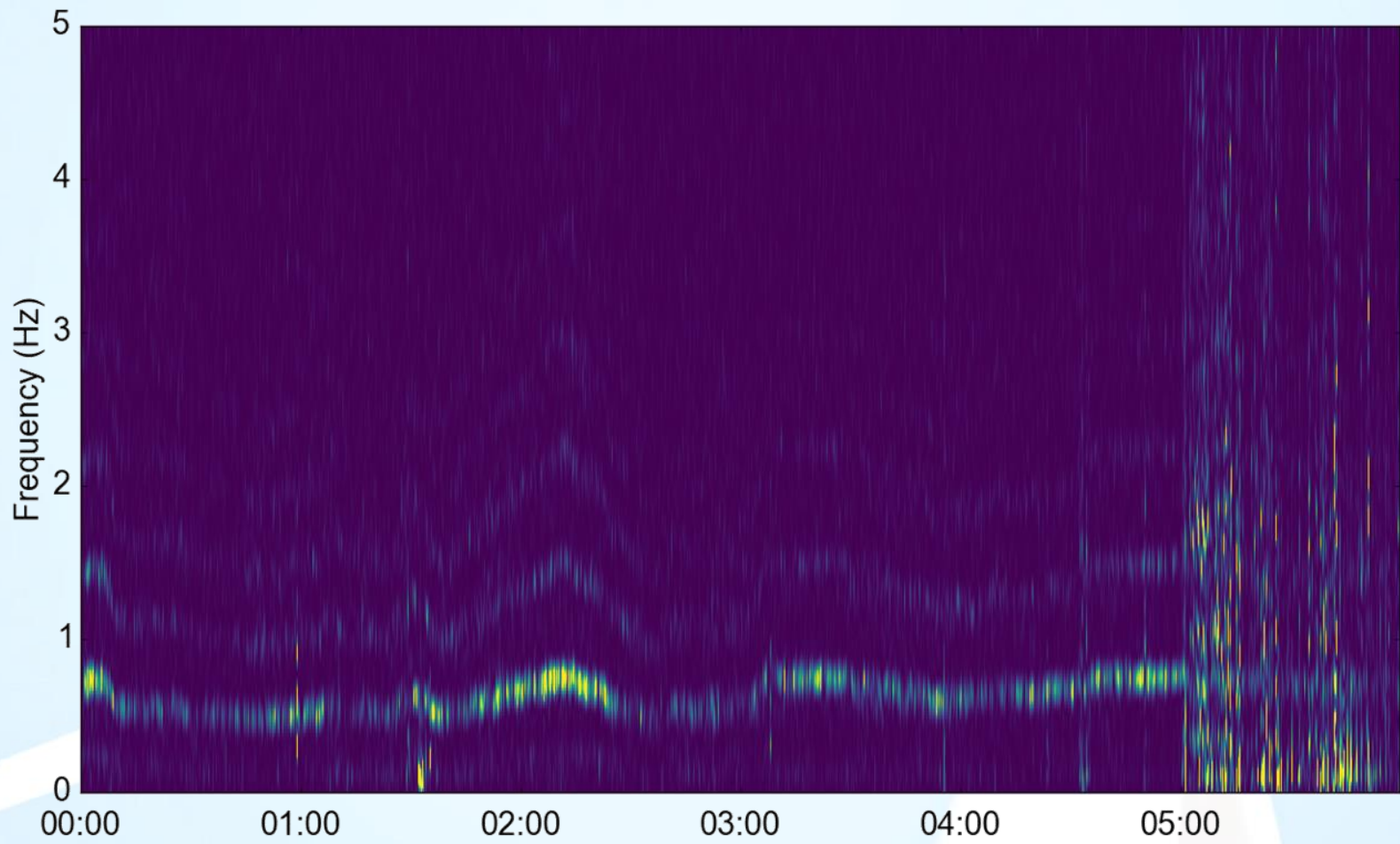
Matthew Cand – Hoare Lea

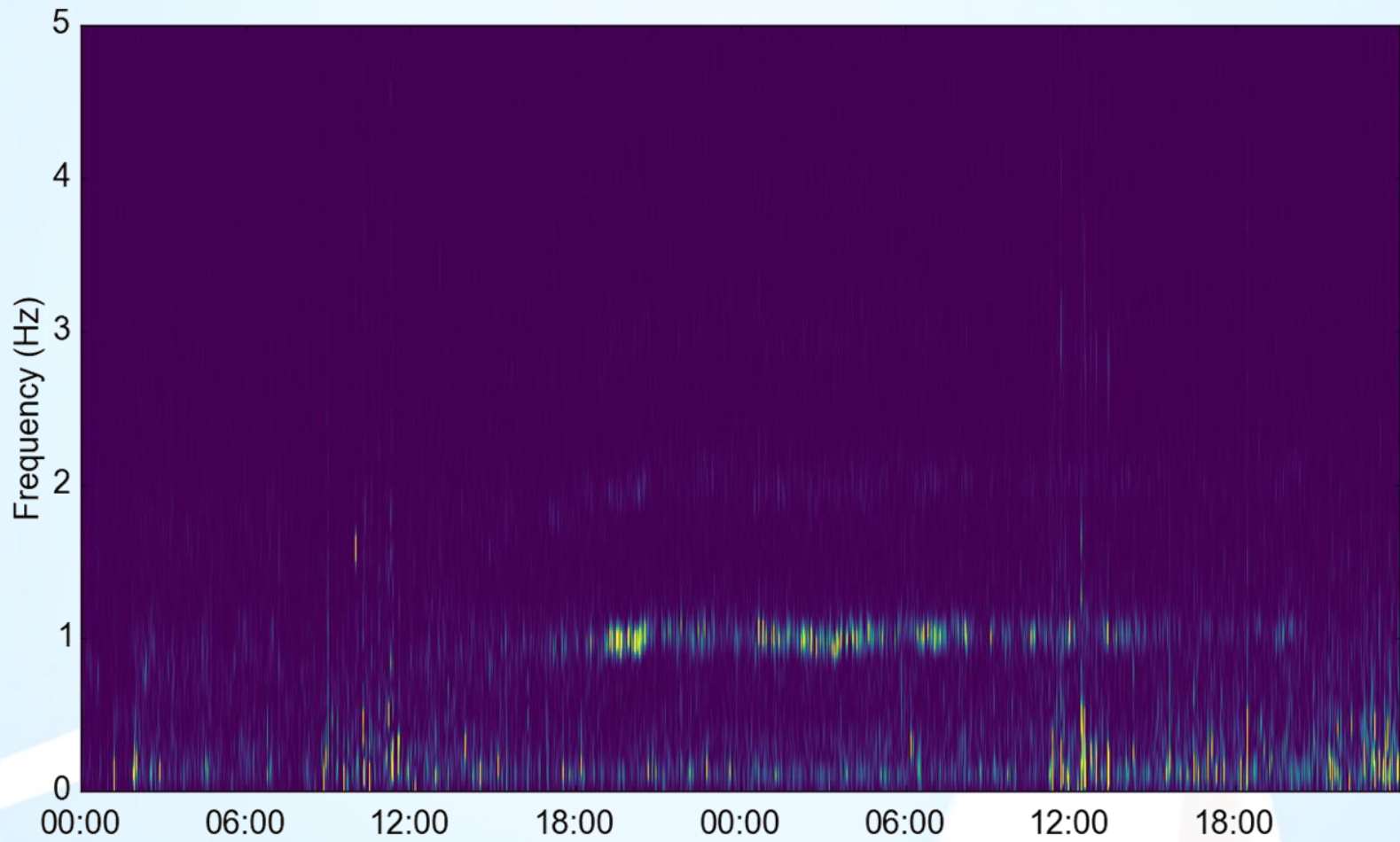
Tom Levelt – Hayes McKenzie Partnership Ltd

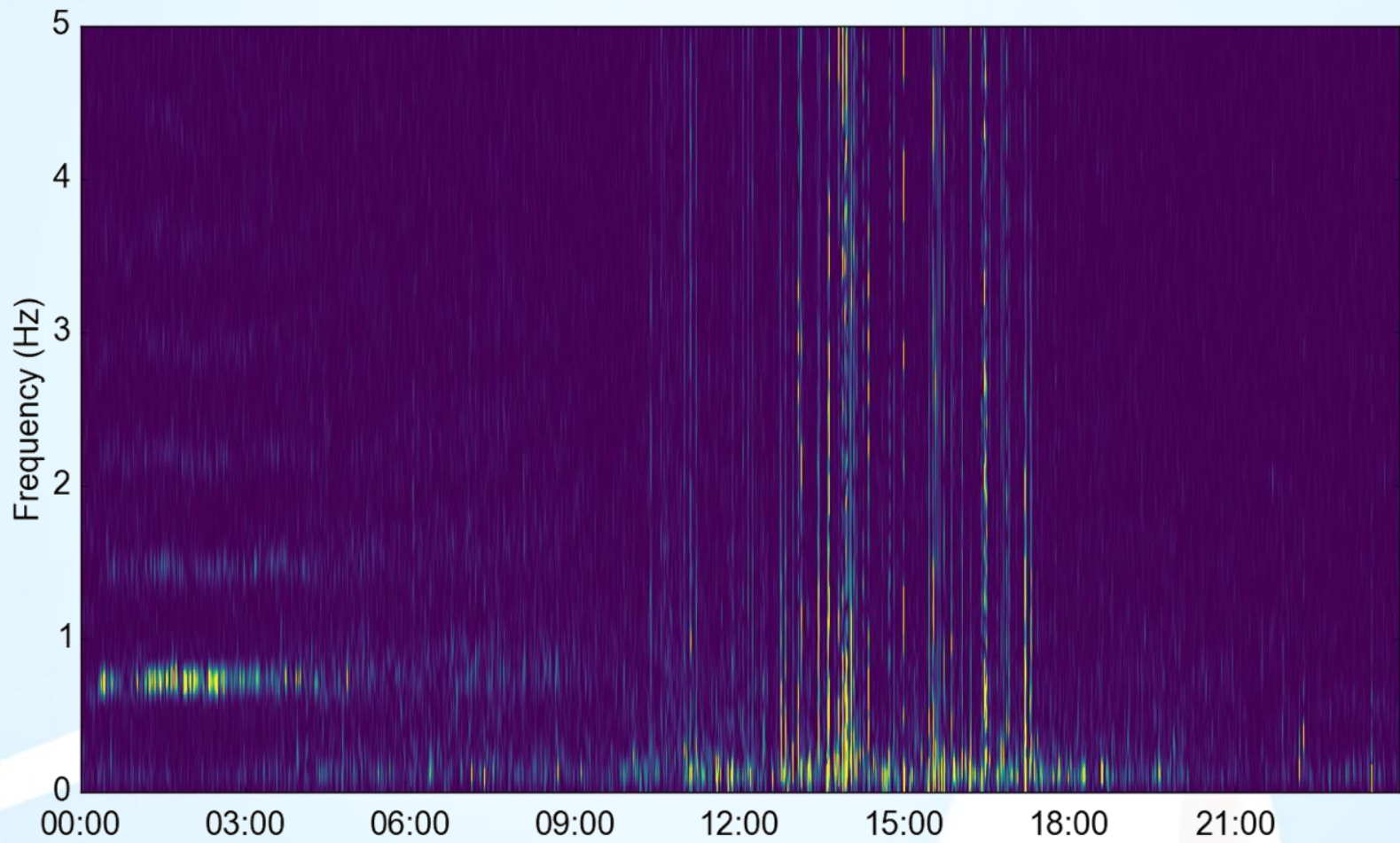


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Method Strengths

- Quantification of amplitude modulation
- Robust and repeatable
- Very little user input into algorithm
- Resistance to extraneous noise sources
- Meaningful results obtained quickly

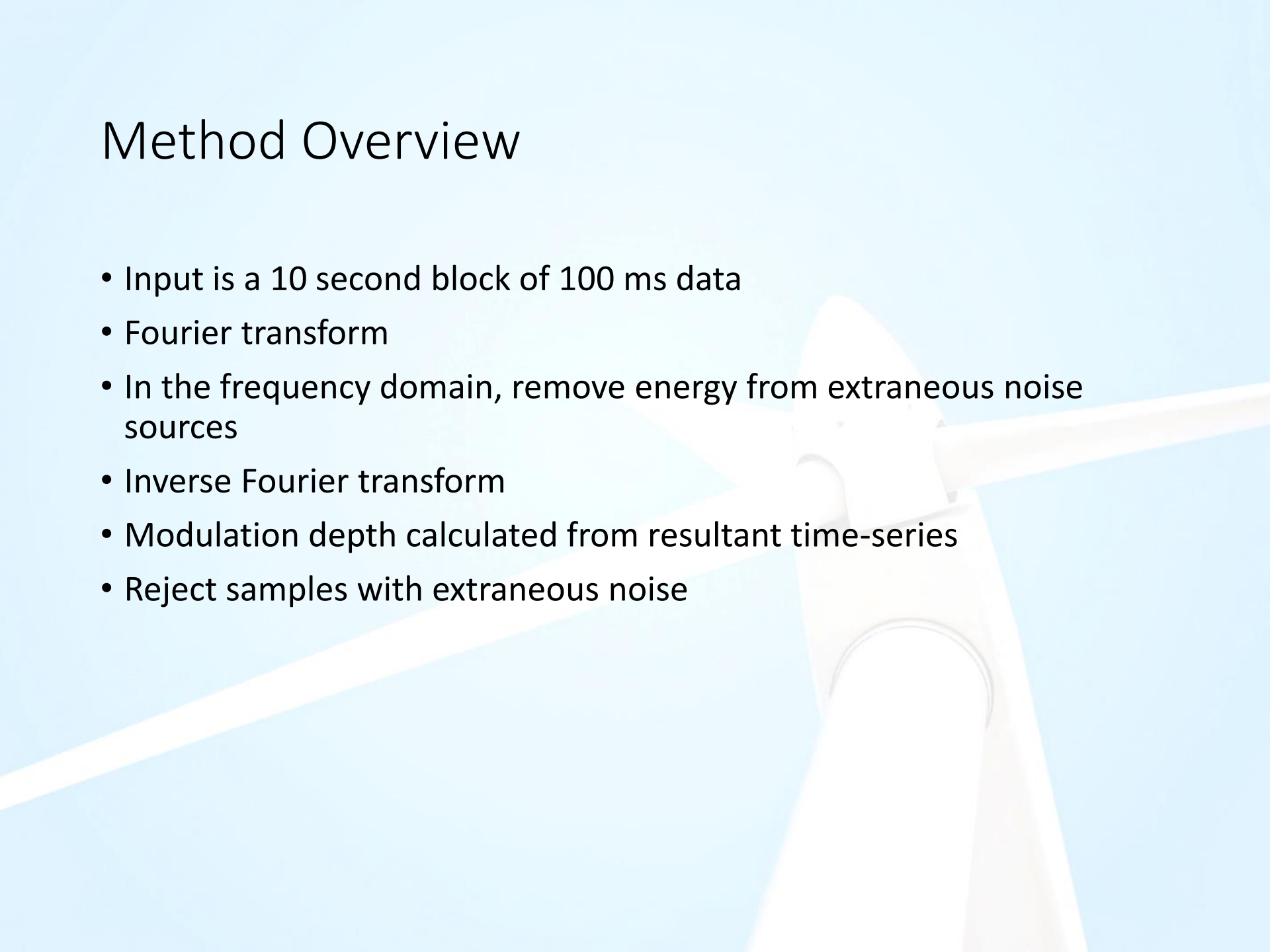
Judgement still required by the user

Method Overview

Final result is a series of 10 minute values representing modulation depth

10 minute values are calculated from a sequence of 10 second results

Method Overview

- Input is a 10 second block of 100 ms data
 - Fourier transform
 - In the frequency domain, remove energy from extraneous noise sources
 - Inverse Fourier transform
 - Modulation depth calculated from resultant time-series
 - Reject samples with extraneous noise
- 

Input data

Fourier Transform

Remove Unwanted
Energy

Inverse Fourier
Transform

Modulation Depth

- 10 second block of L_{eq} data
- 100 ms sample rate
- Band-filtered
 - Seven 1/3 octave bands
 - 100-400 Hz default range
 - 50-200 Hz & 200-800 Hz possible
- A-weighting applied

Fourier Transform

Power Spectrum



$$S = \frac{|F\{x\}|^2}{n^2}$$

$F\{x\}$ is output from Fourier transform
 n is length of input data

- 0.1 Hz frequency resolution (10 second input)
- Highest resolved frequency is 5 Hz ($F_s = 10$ Hz)
- Rectangular window

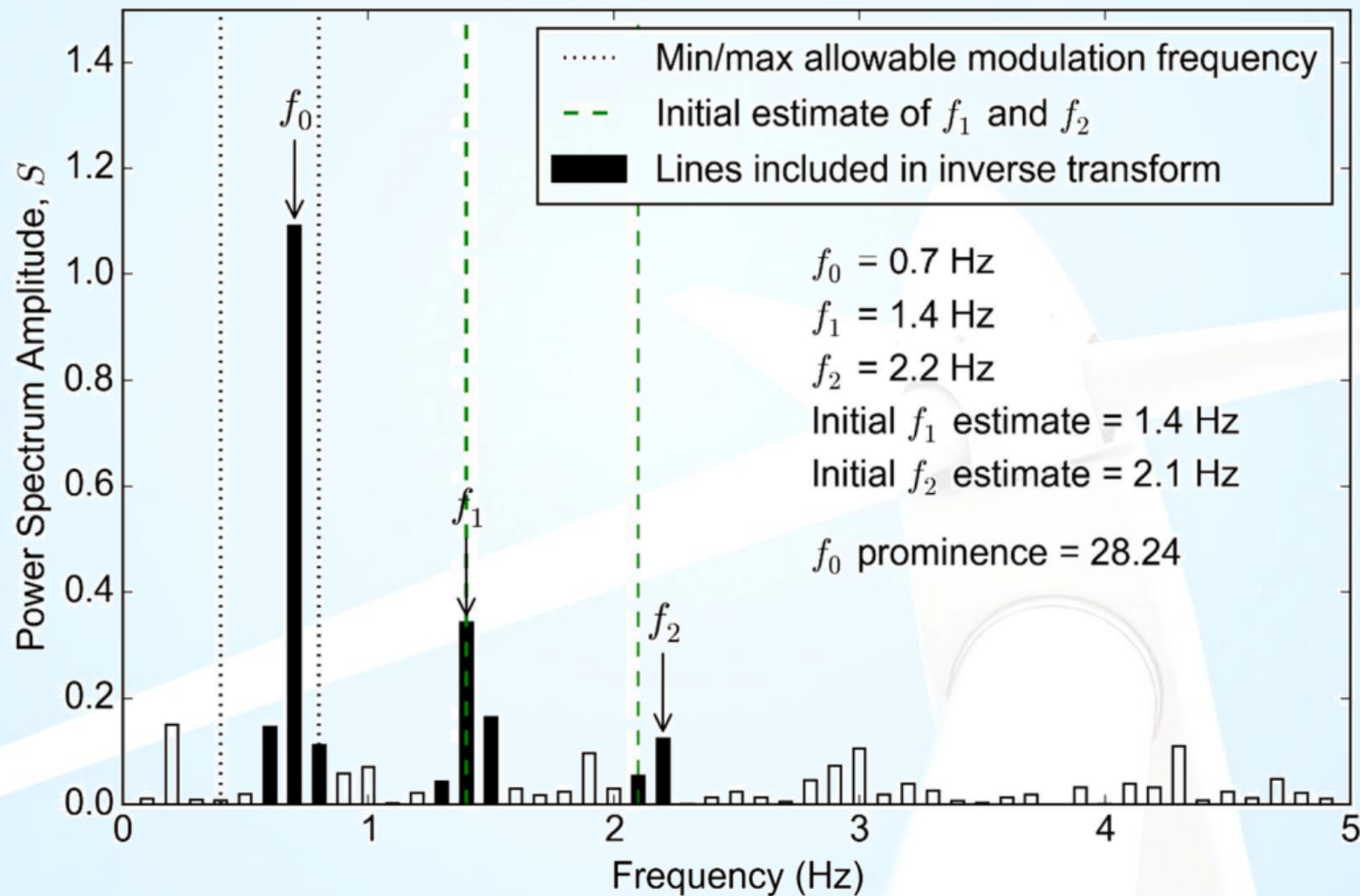
Input data

Fourier Transform

Remove Unwanted Energy

Inverse Fourier Transform

Modulation Depth



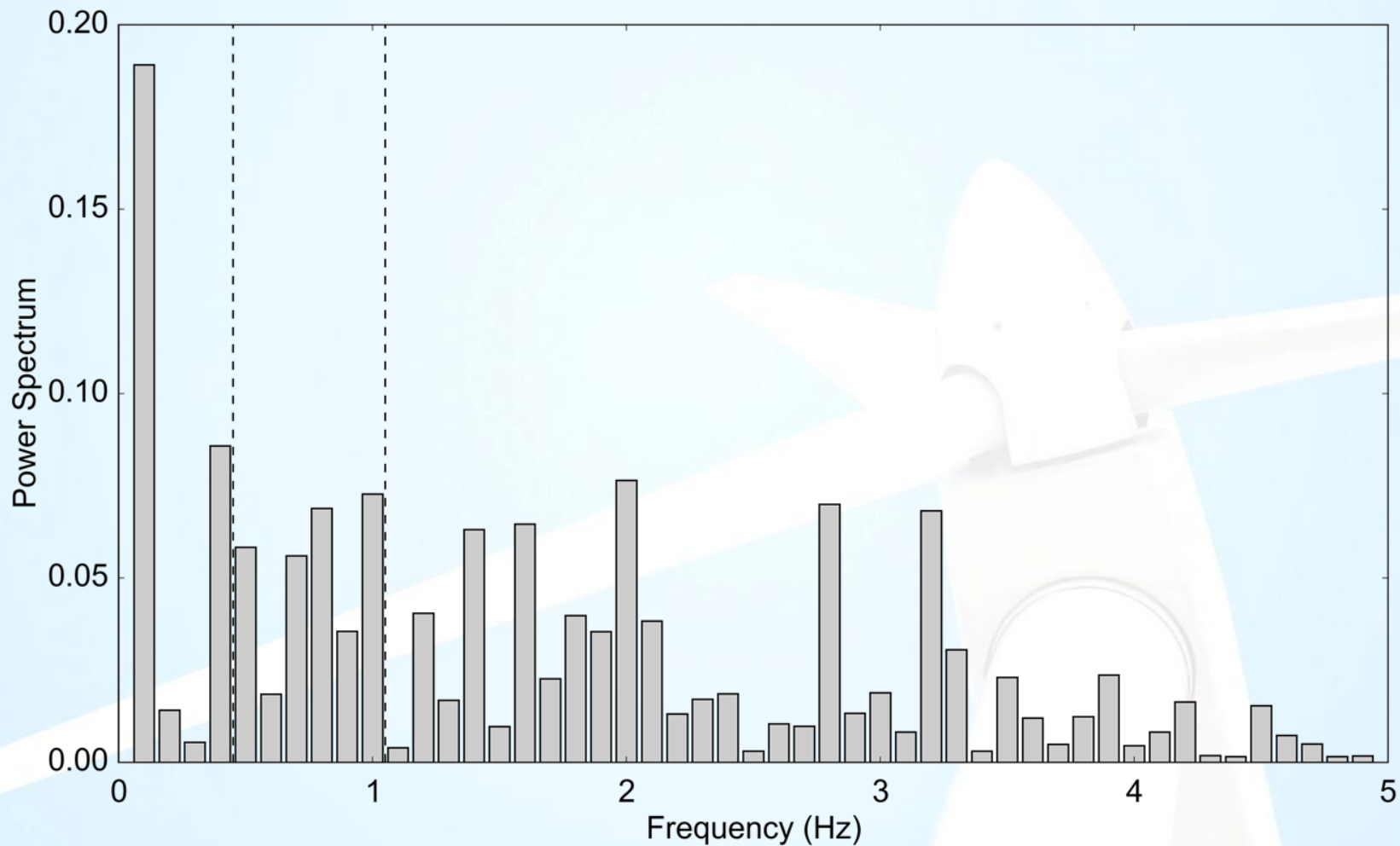
Input data

Fourier Transform

**Remove Unwanted
Energy**

Inverse Fourier
Transform

Modulation Depth



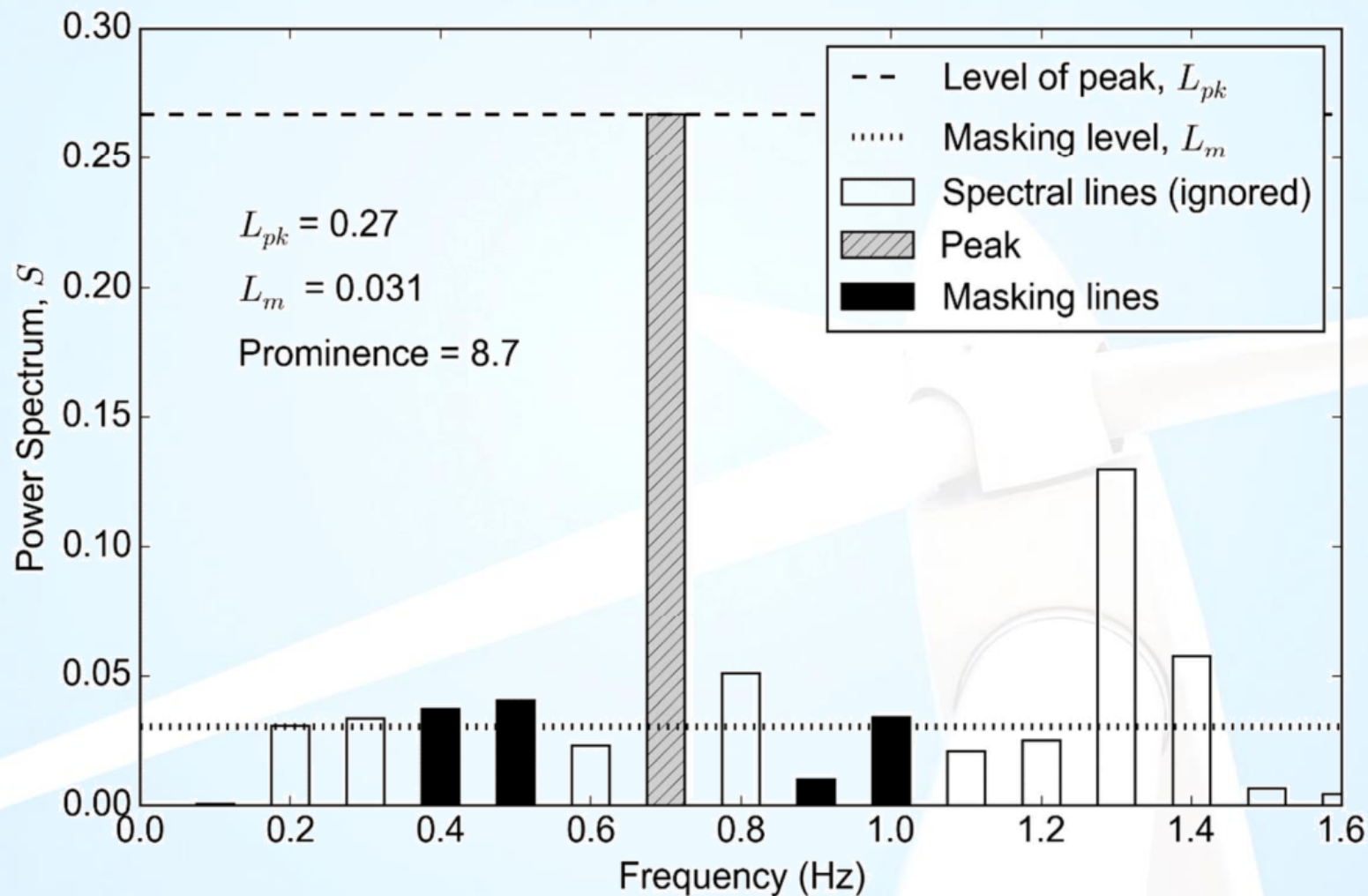
Input data

Fourier Transform

Remove Unwanted
Energy

Inverse Fourier
Transform

Modulation Depth



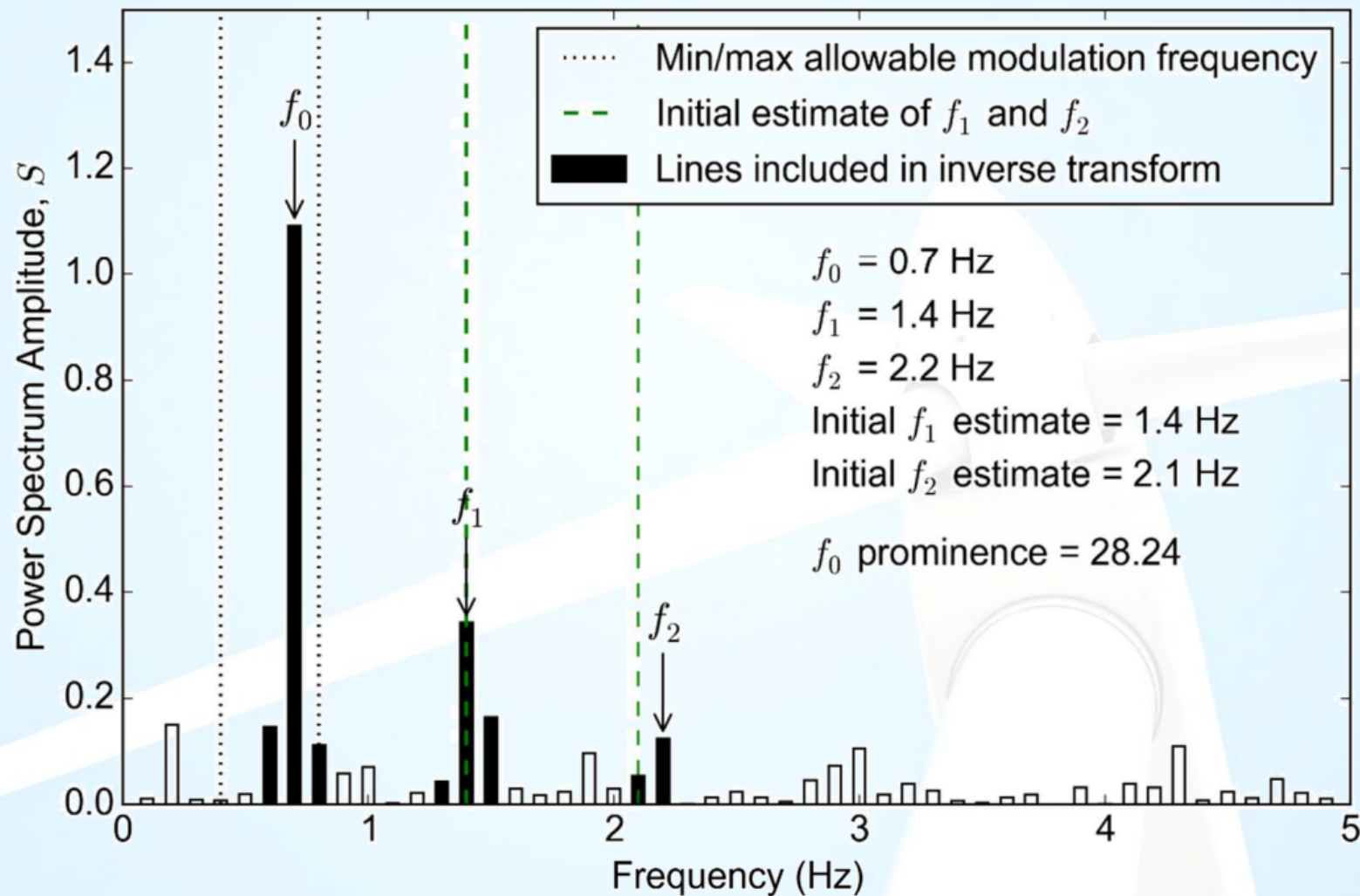
Input data

Fourier Transform

Remove Unwanted Energy

Inverse Fourier Transform

Modulation Depth



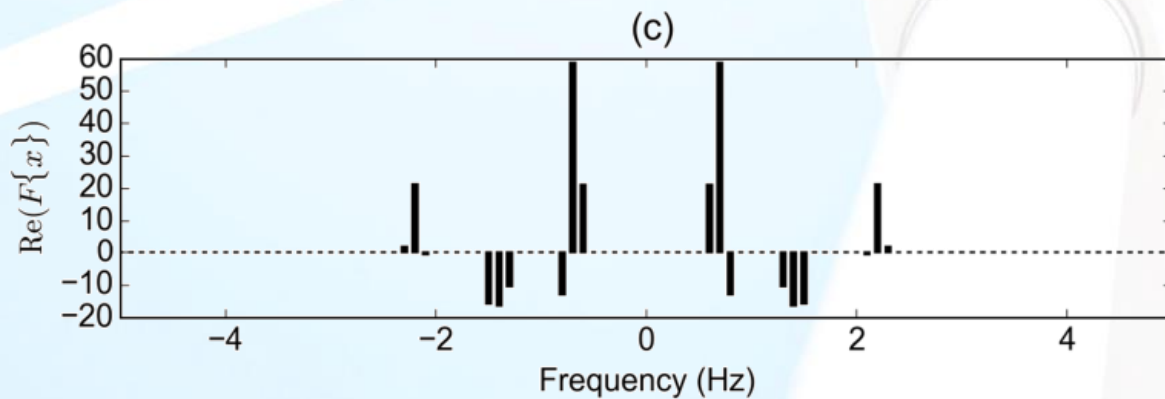
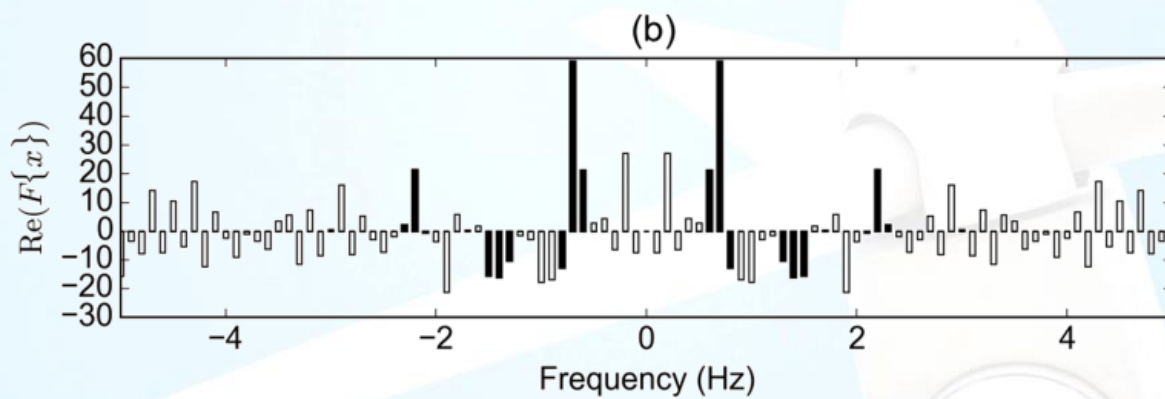
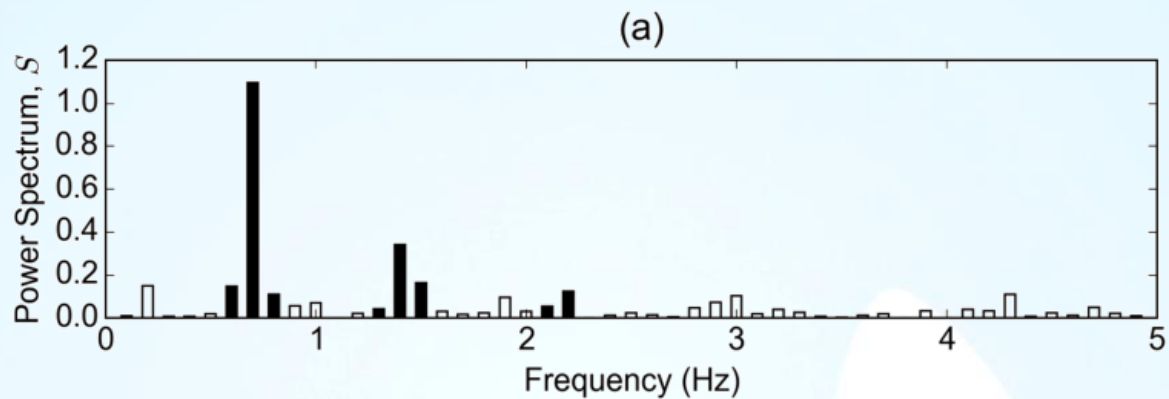
Input data

Fourier Transform

Remove Unwanted
Energy

**Inverse Fourier
Transform**

Modulation Depth



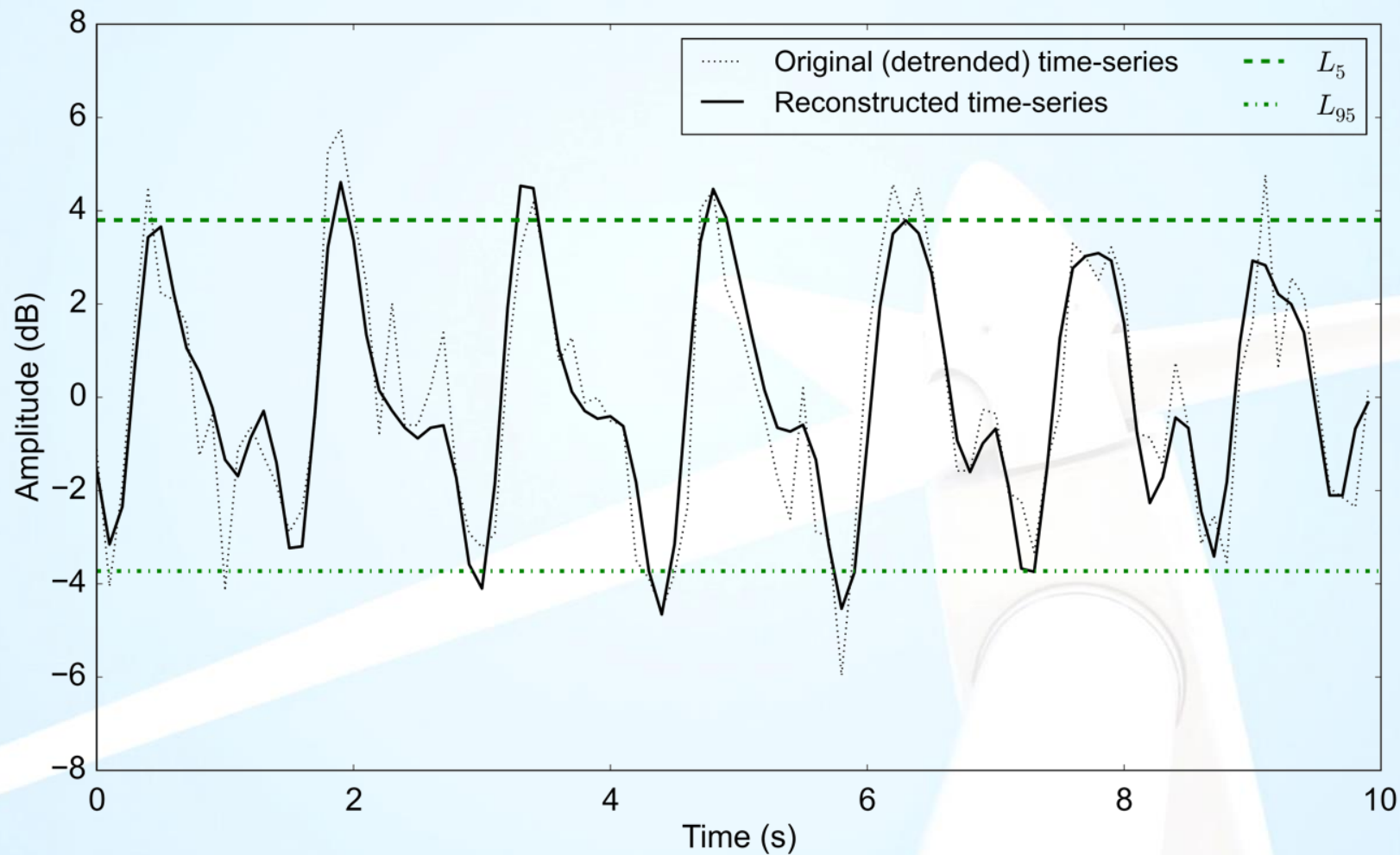
Input data

Fourier Transform

Remove Unwanted
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Inverse Fourier
Transform

Modulation Depth



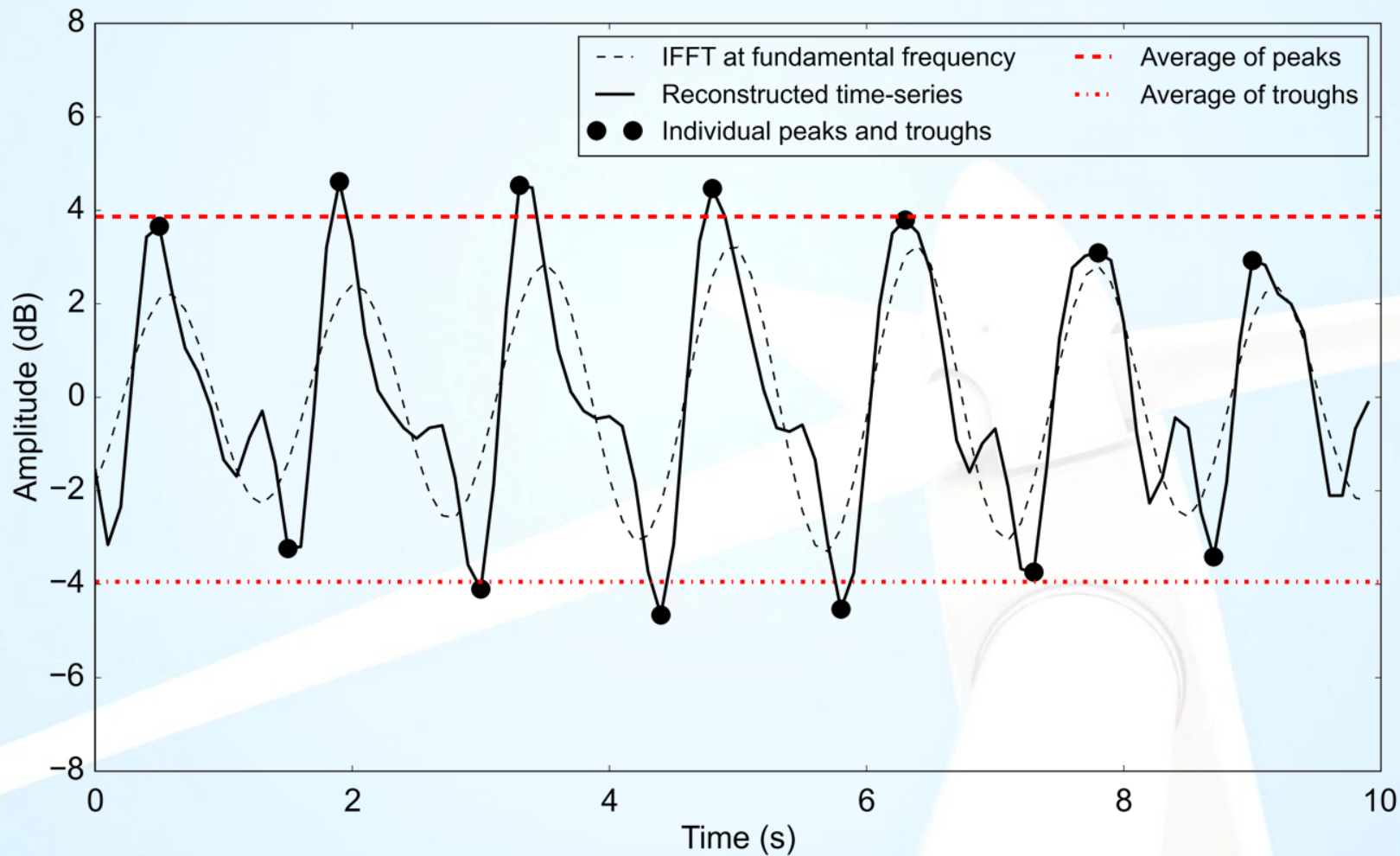
Input data

Fourier Transform

Remove Unwanted
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Inverse Fourier
Transform

Modulation Depth



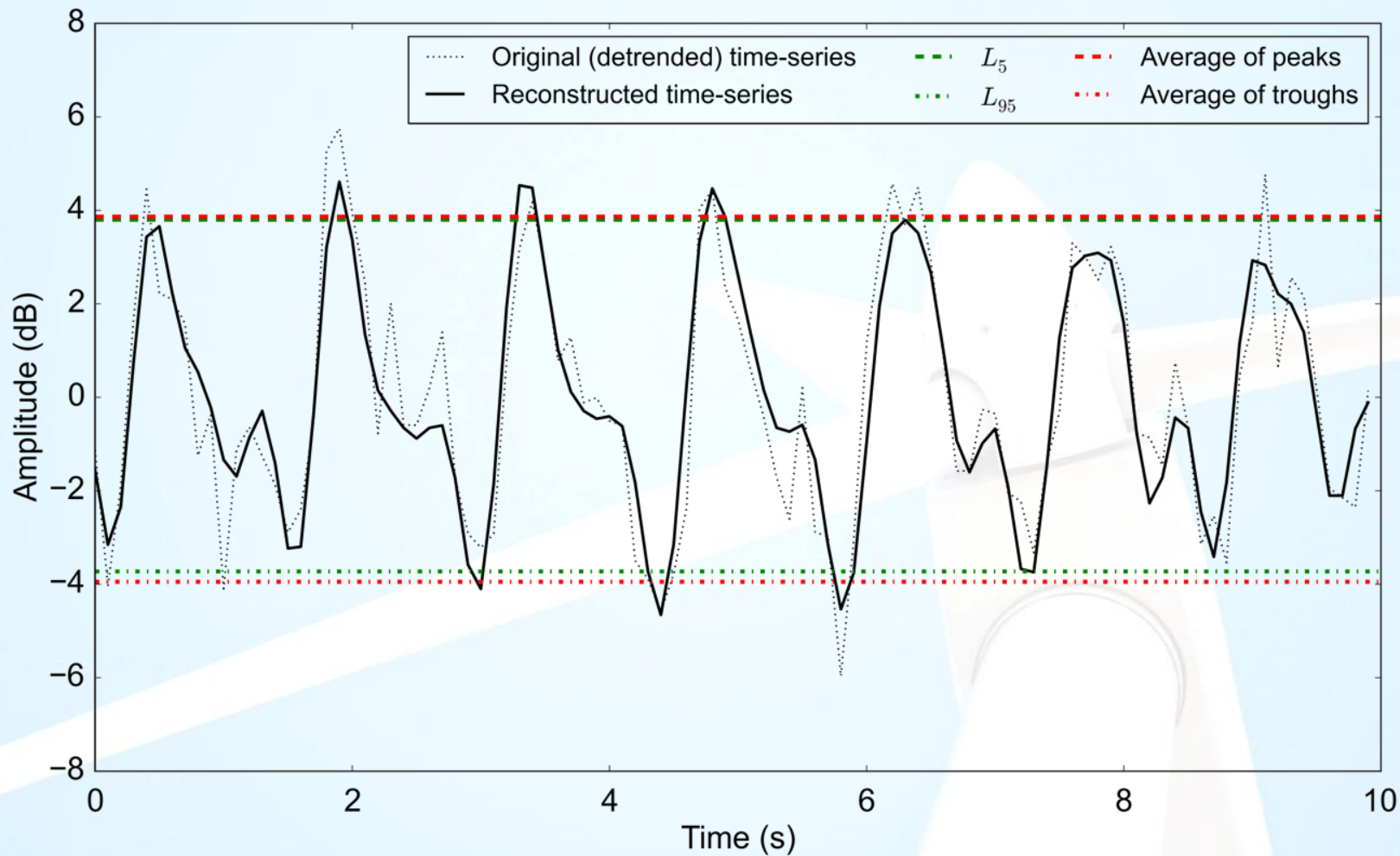
Input data

Fourier Transform

Remove Unwanted
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Inverse Fourier
Transform

Modulation Depth



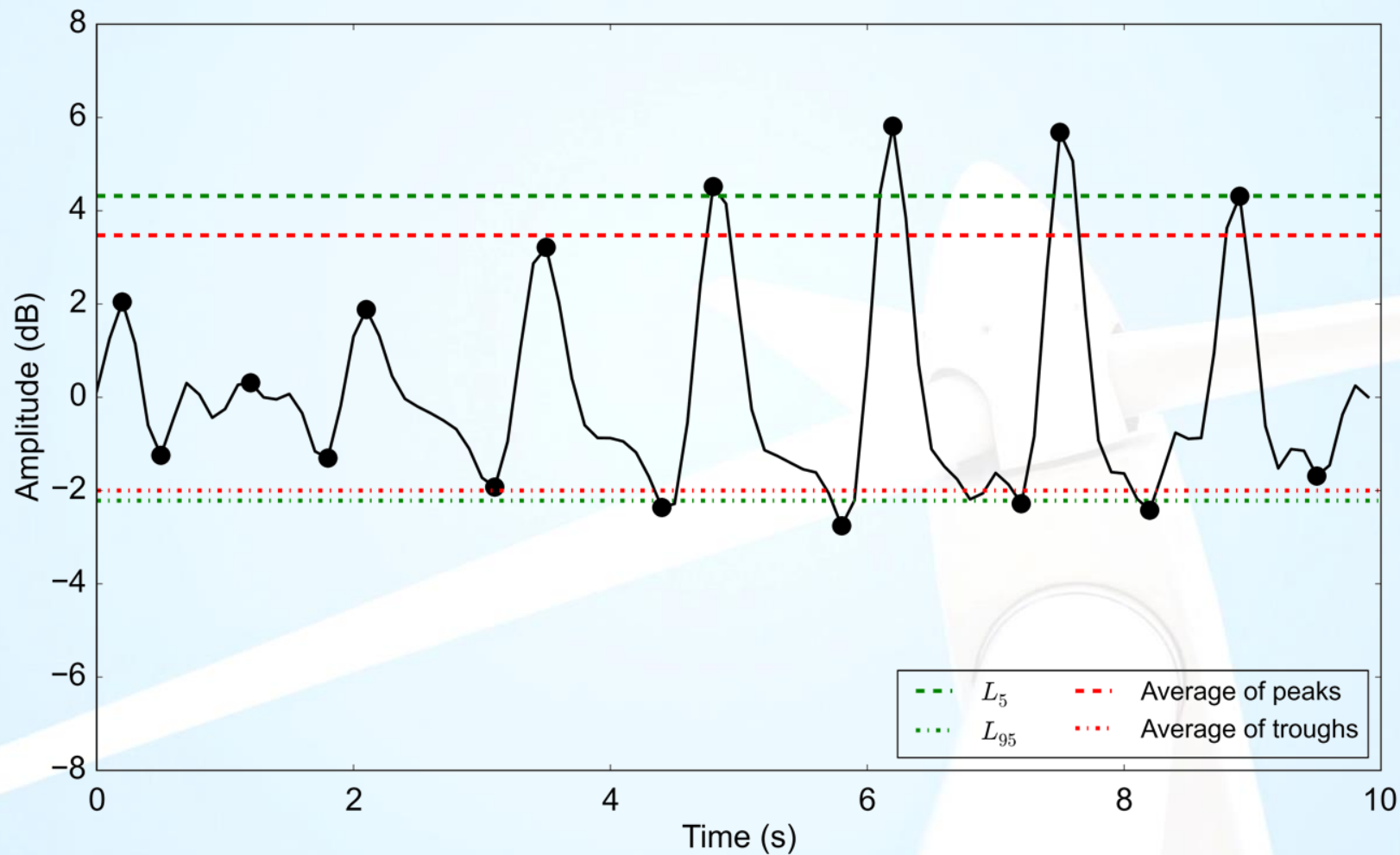
Input data

Fourier Transform

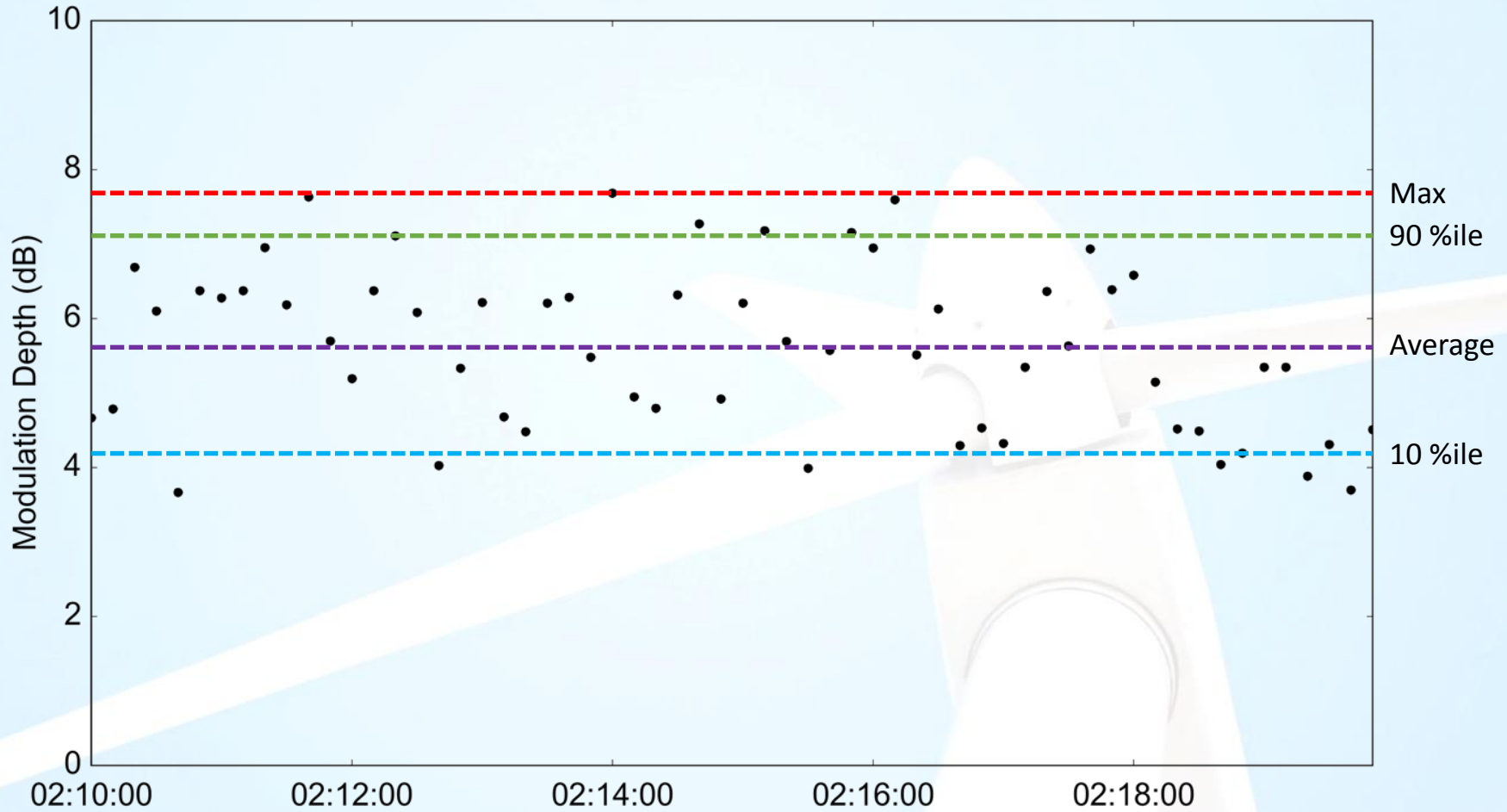
Remove Unwanted
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Inverse Fourier
Transform

Modulation Depth

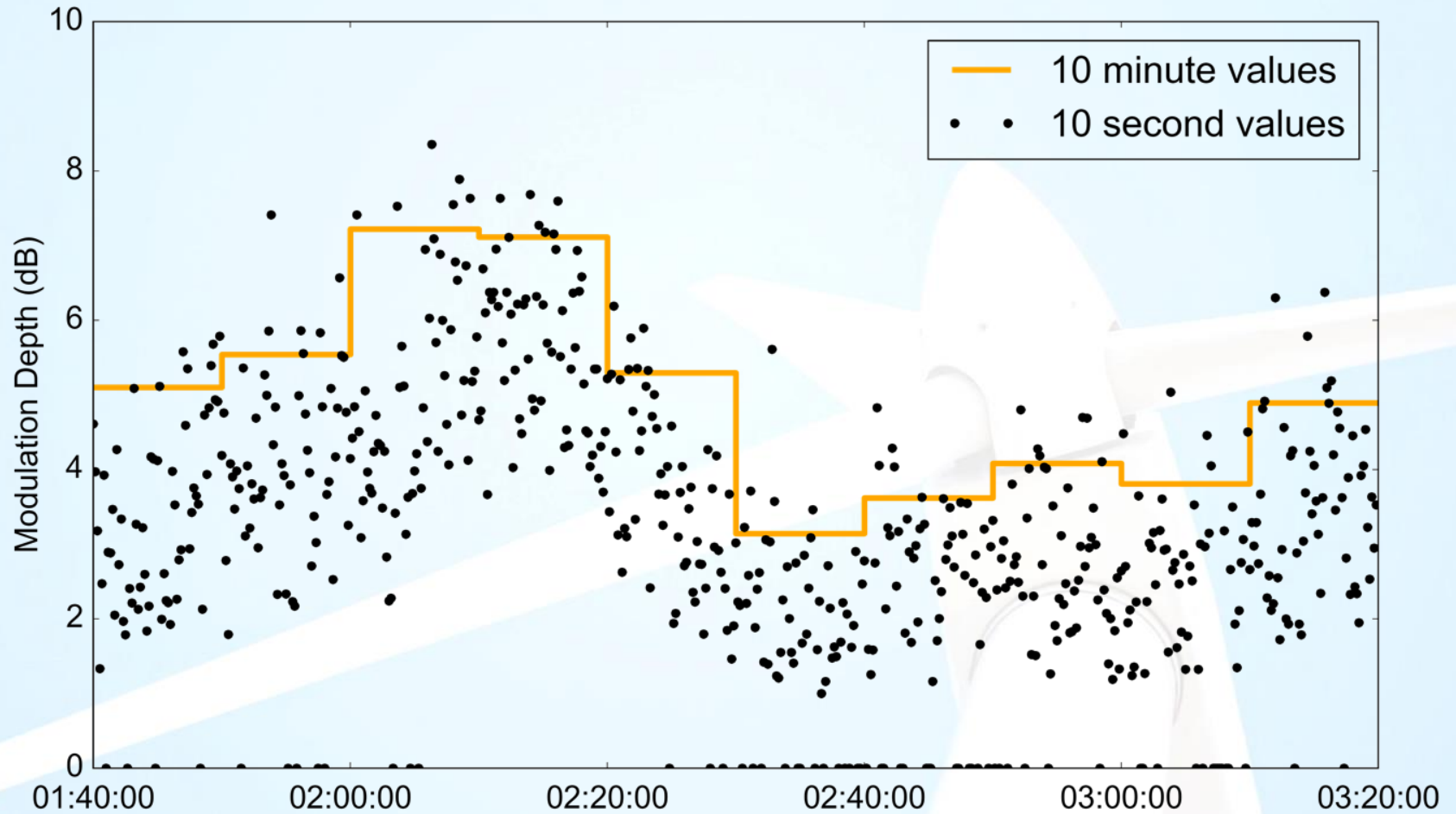


10 minute result



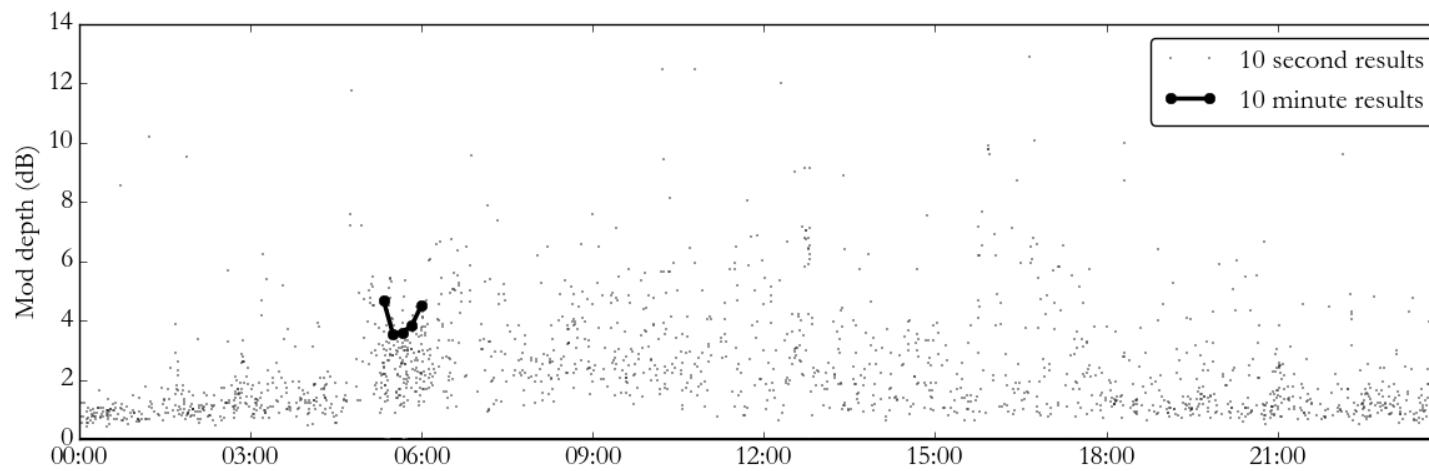
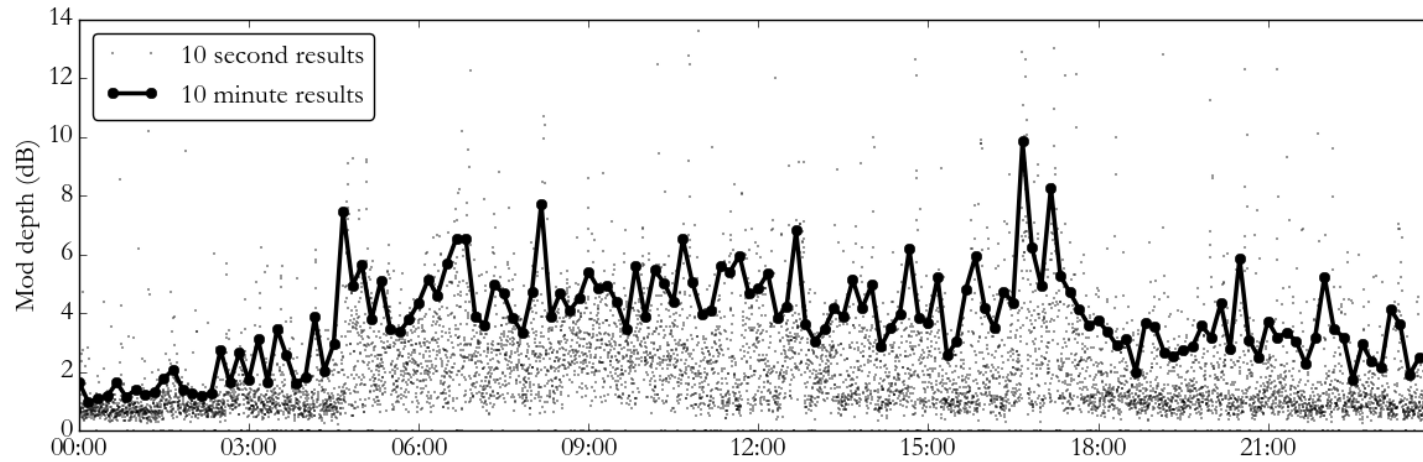
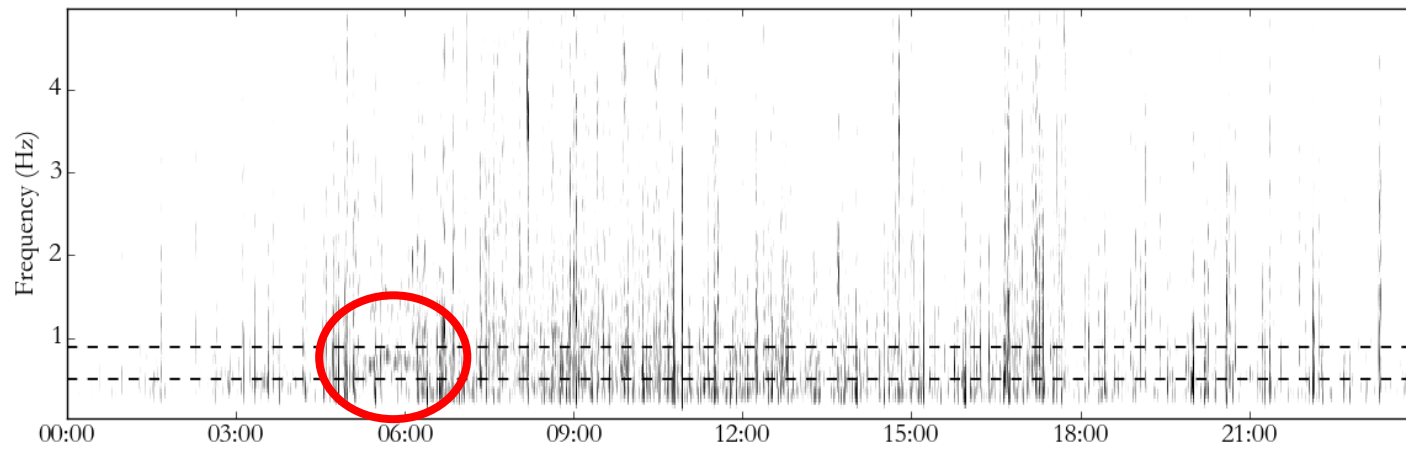
...**IF** there are 30 or more valid samples in the 10 minute period

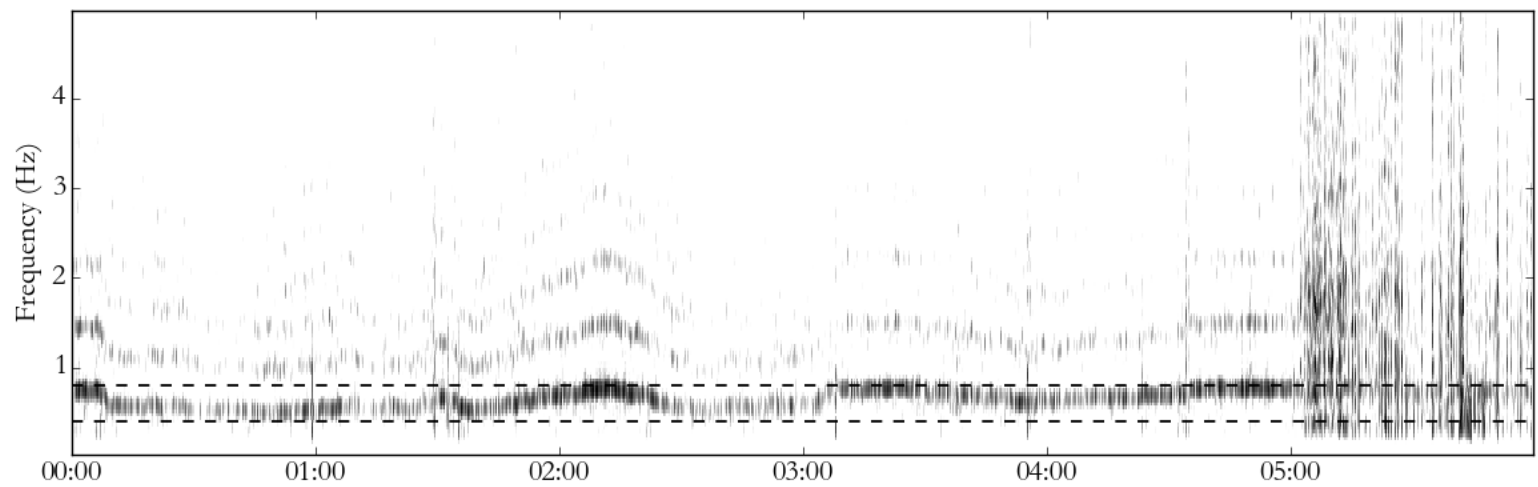
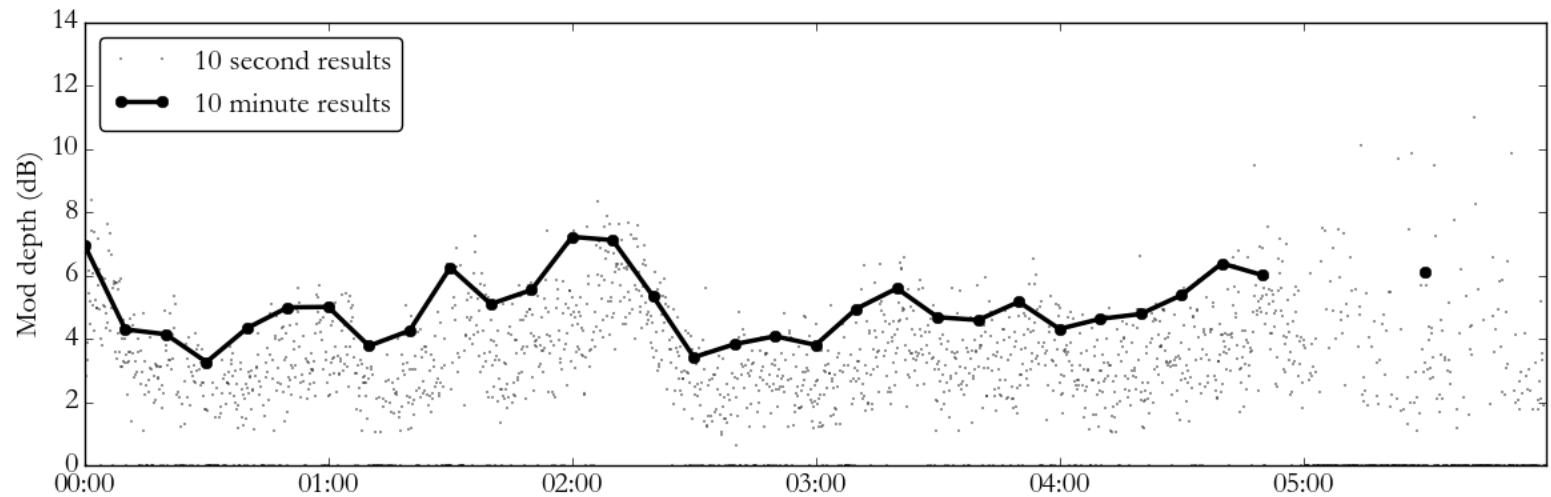
10 minute result

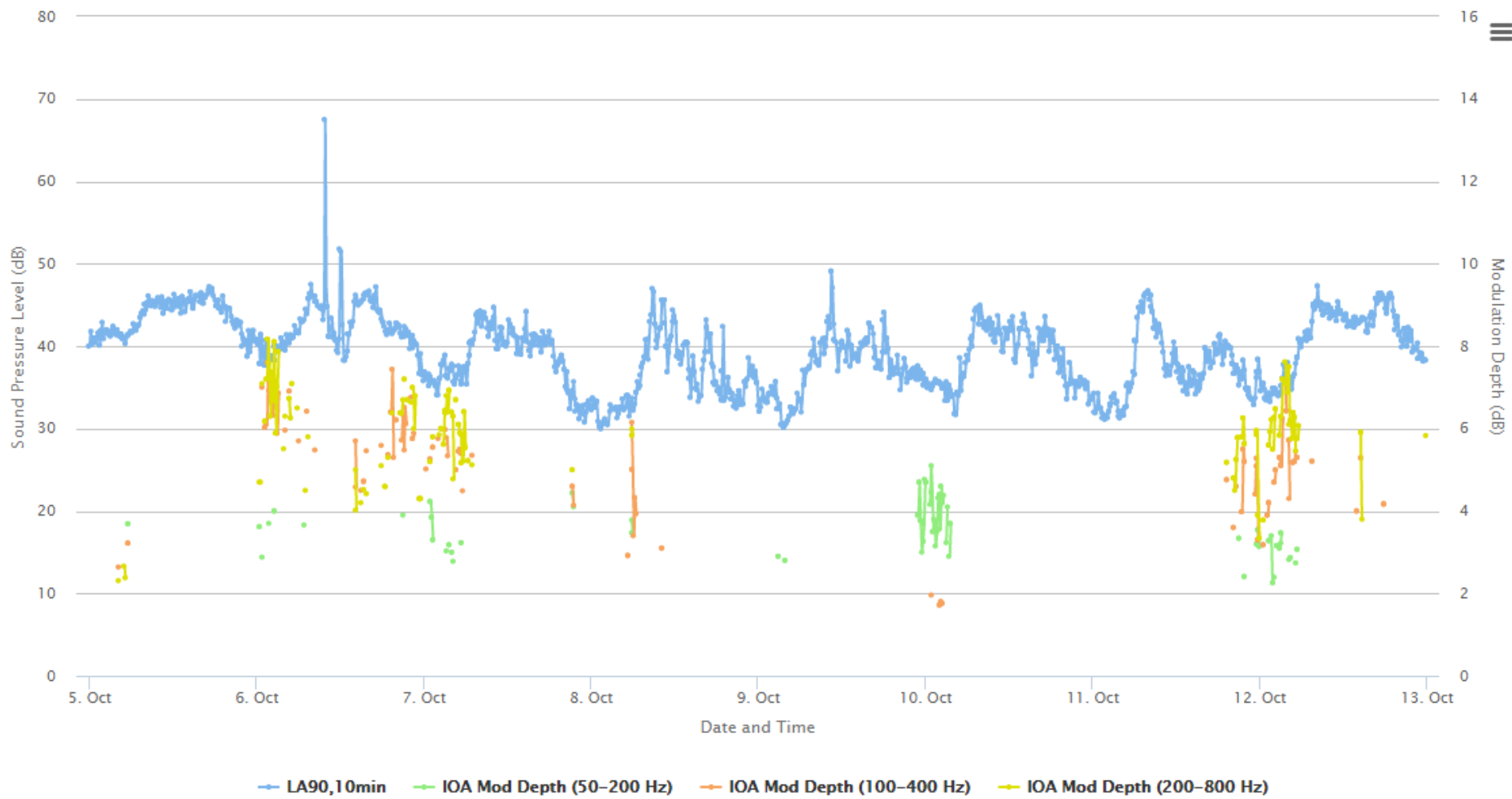


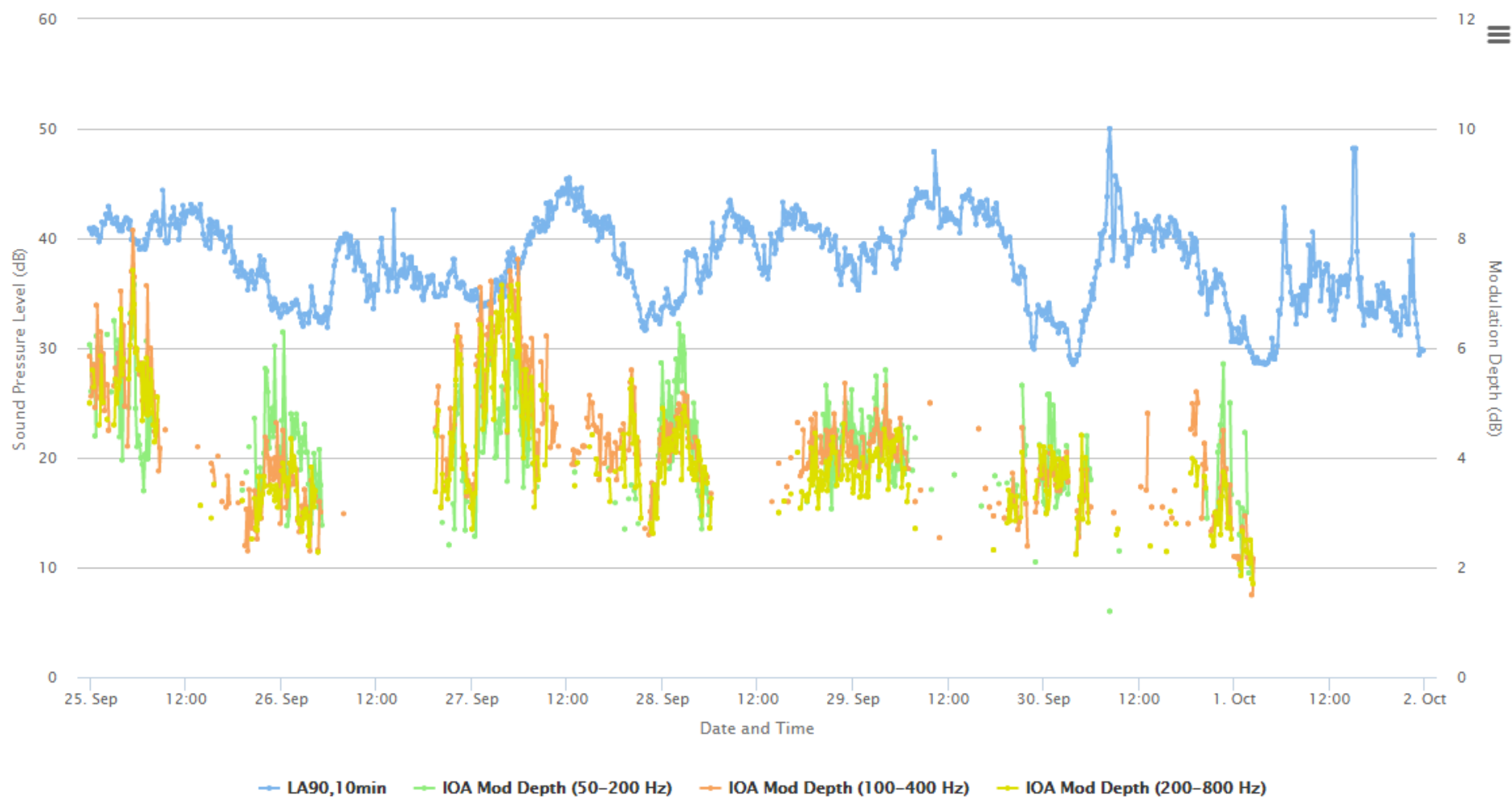


Application to Real Site Data

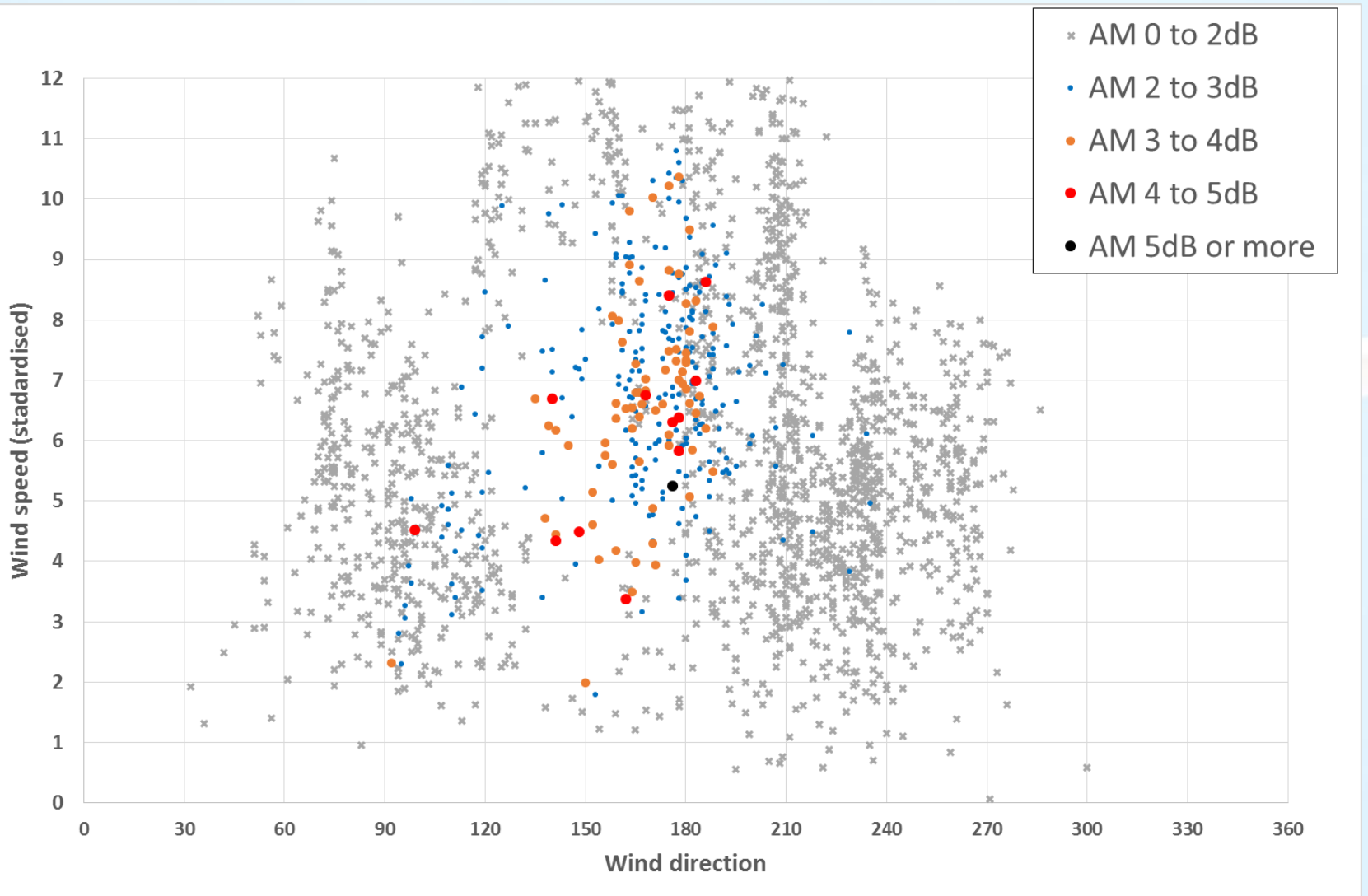


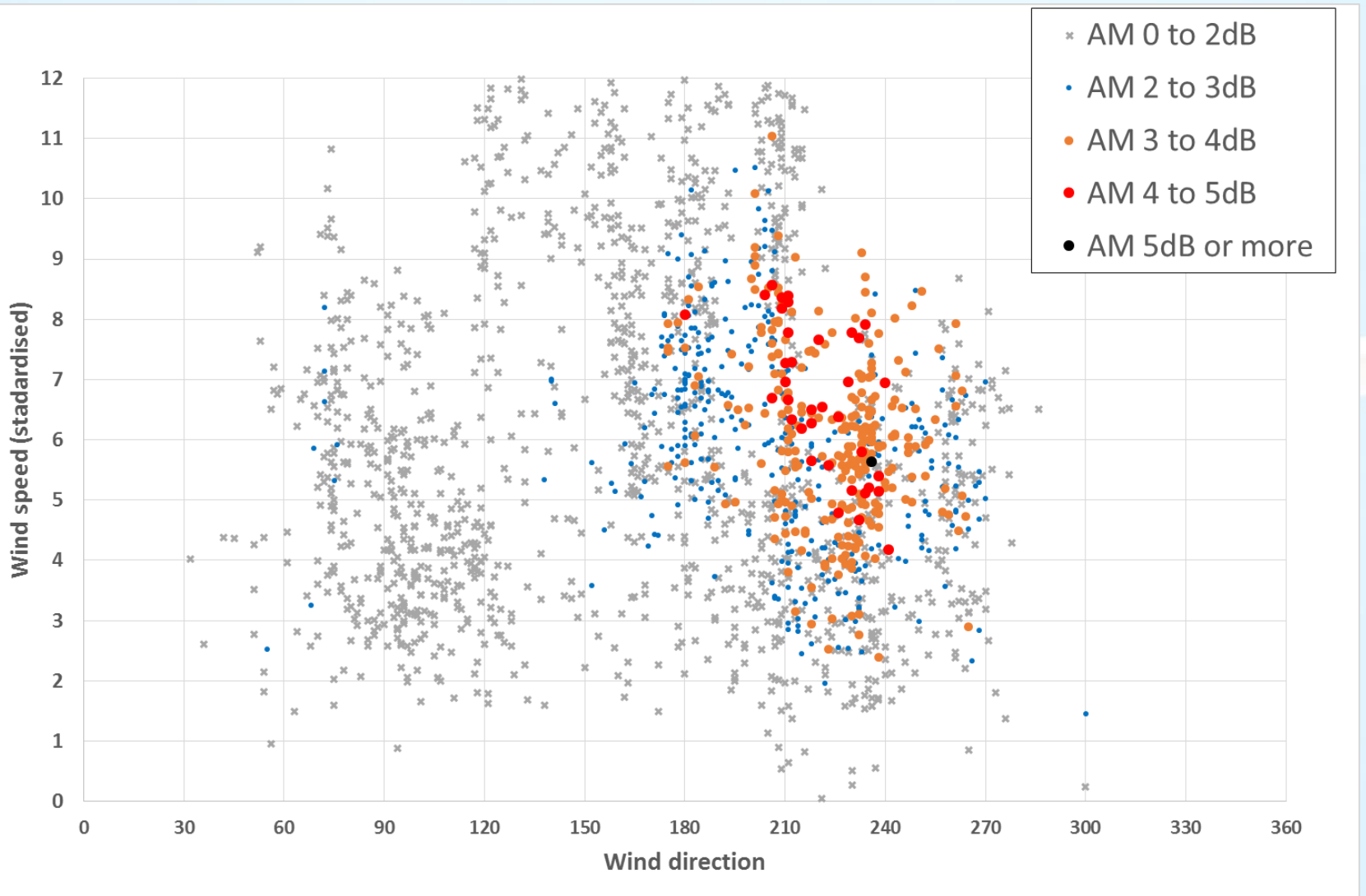






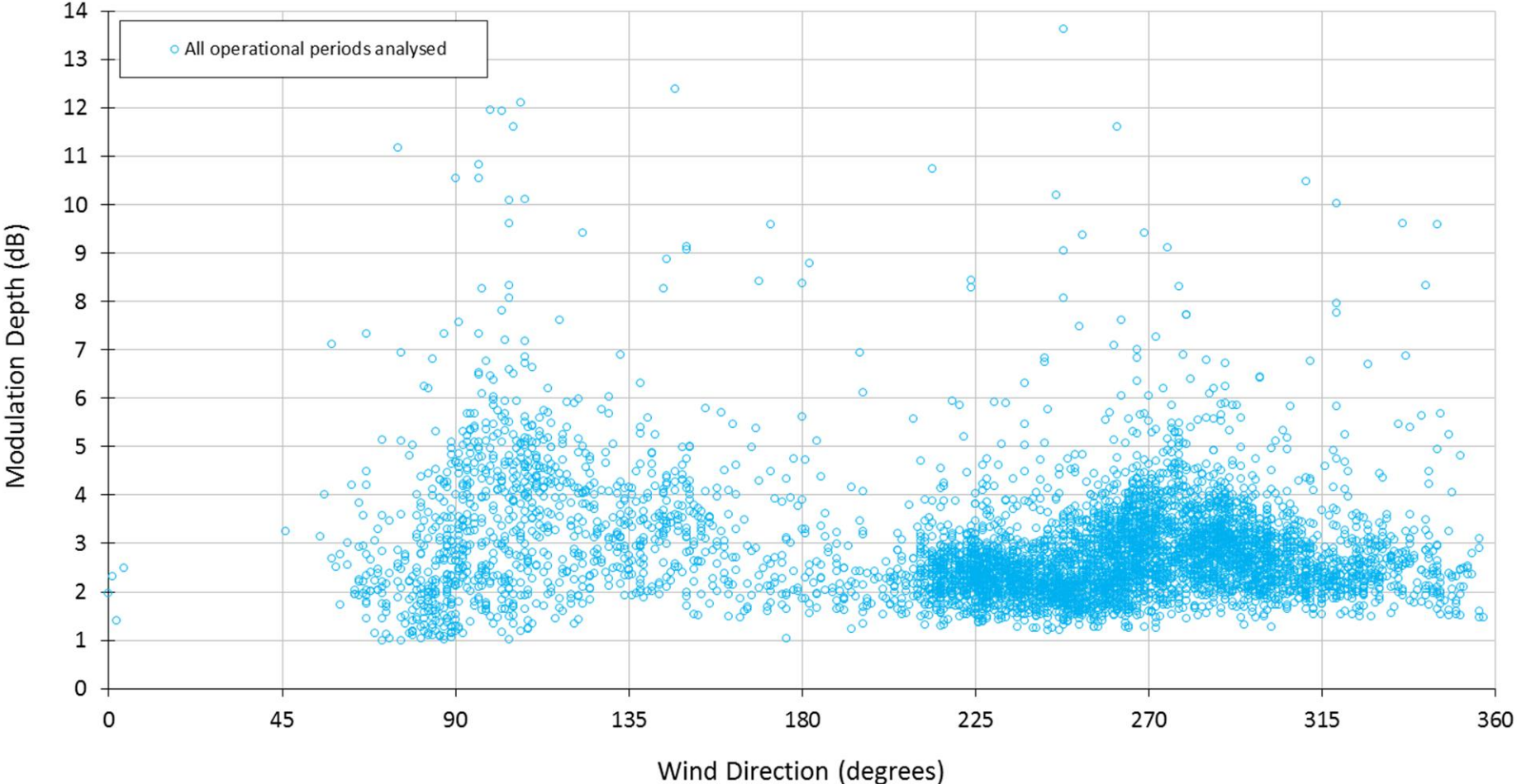
— LA90,10min — IOA Mod Depth (50–200 Hz) — IOA Mod Depth (100–400 Hz) — IOA Mod Depth (200–800 Hz)





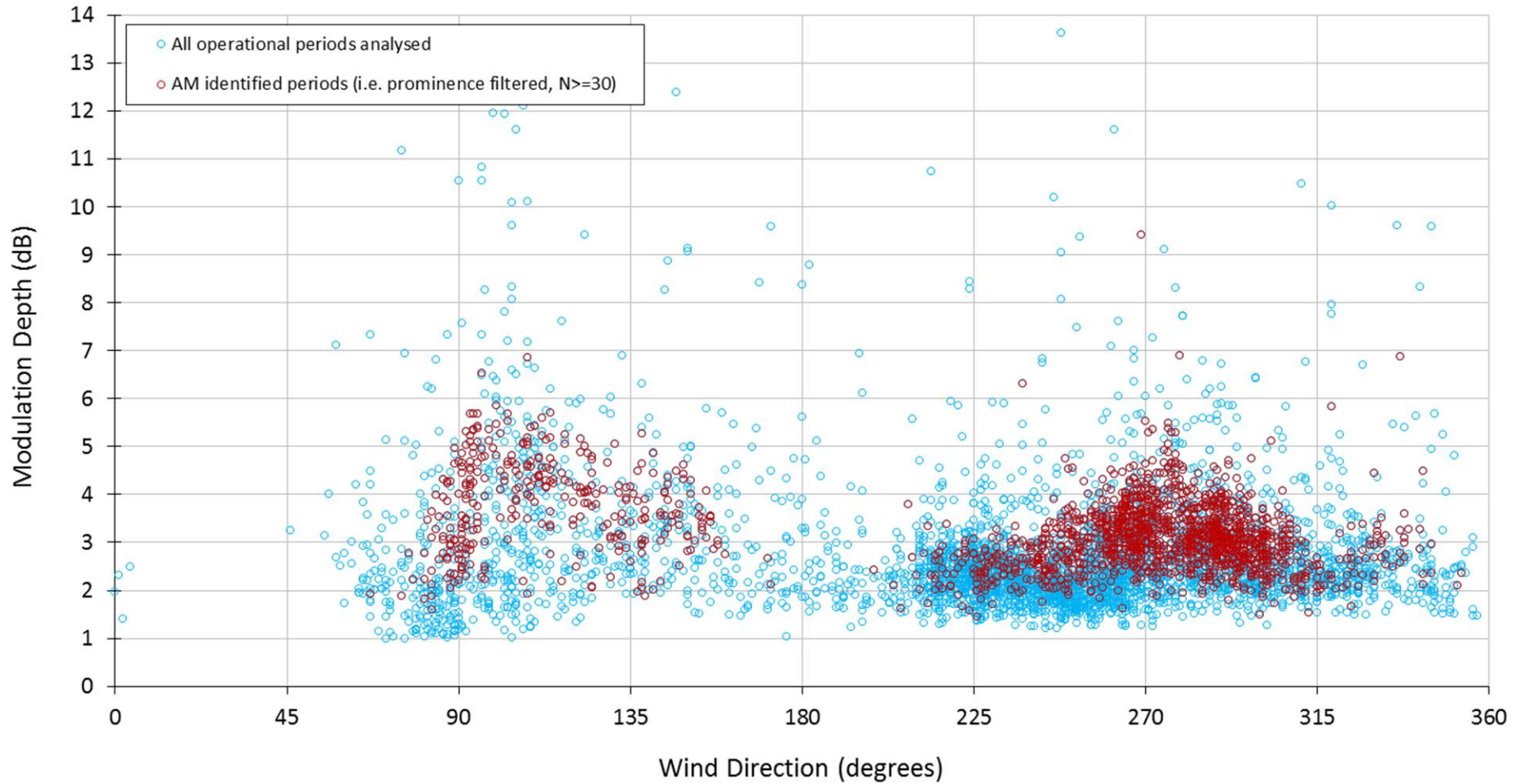
Wind Conditions of Identified AM Periods (100-400Hz result)

House 1 (Operation)



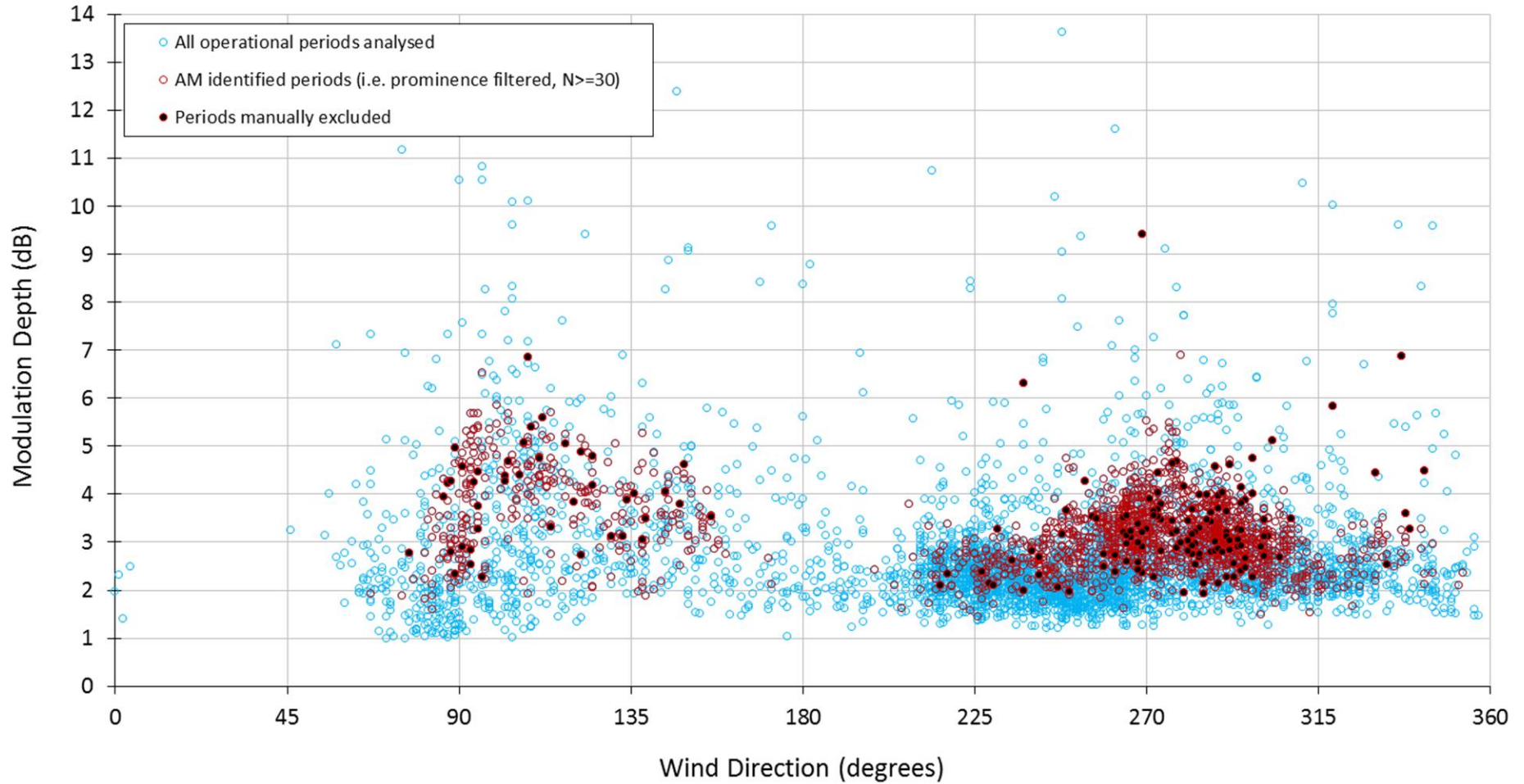
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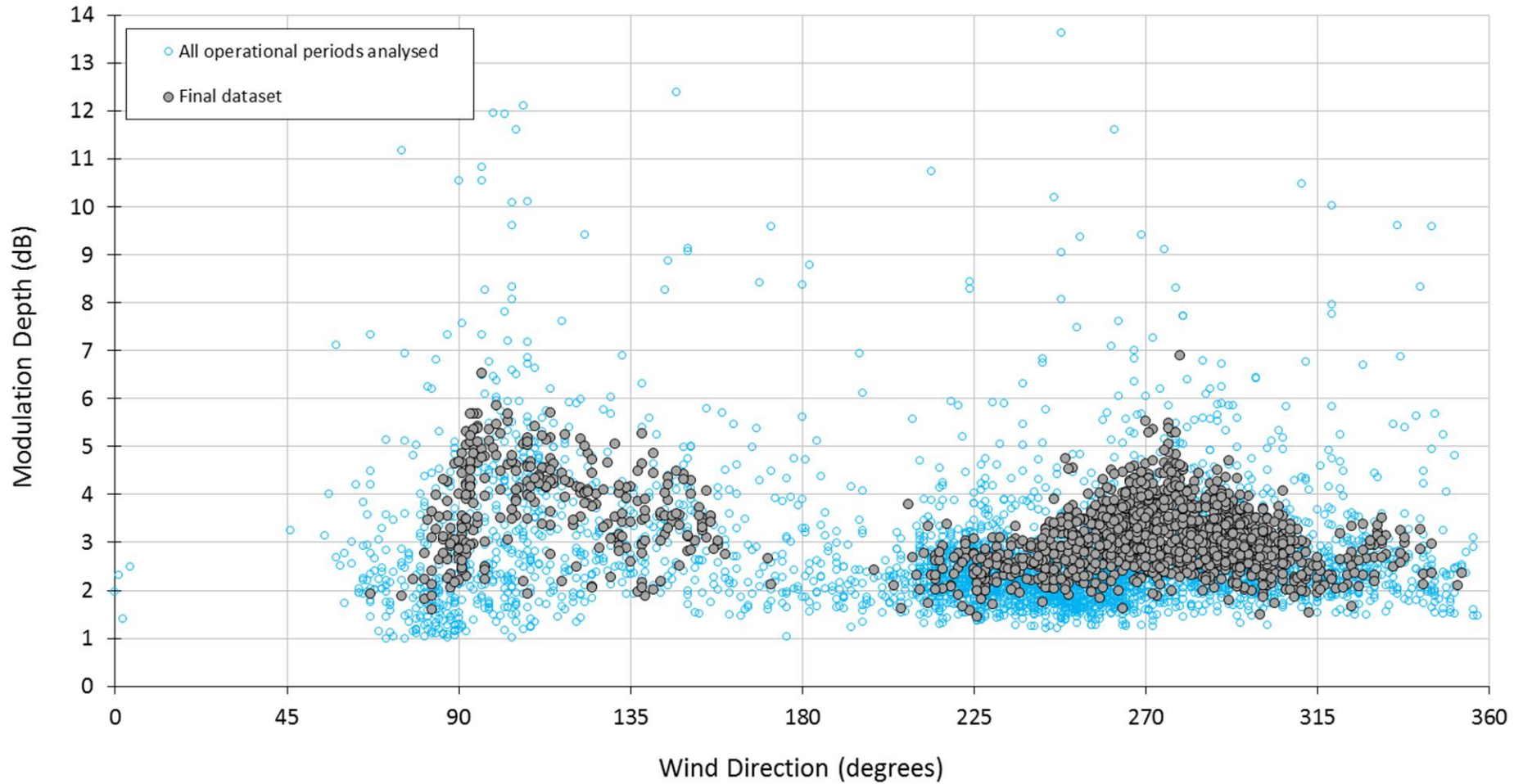
Wind Conditions of Identified AM Periods (100-400Hz result)

House 1 (Operation)



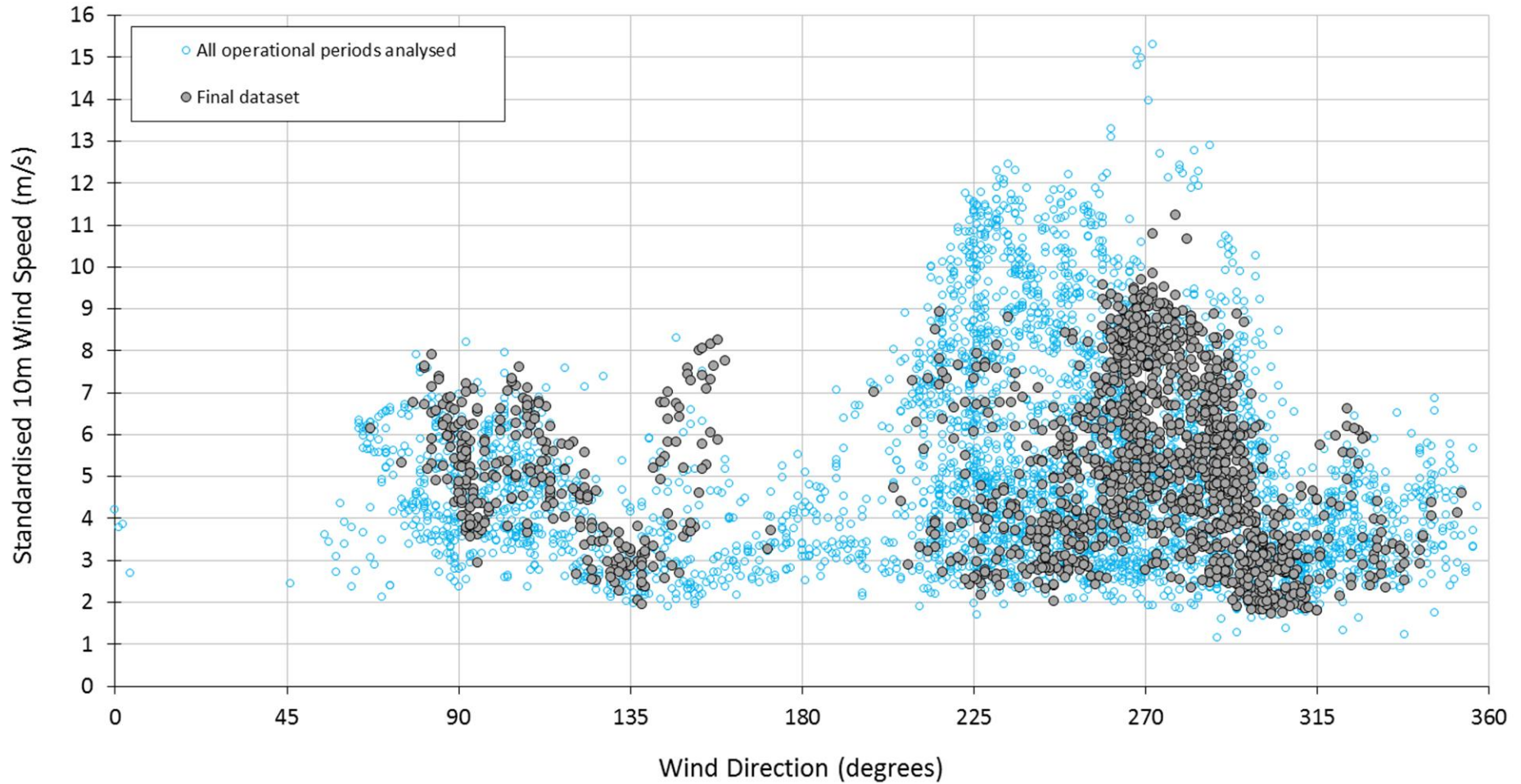
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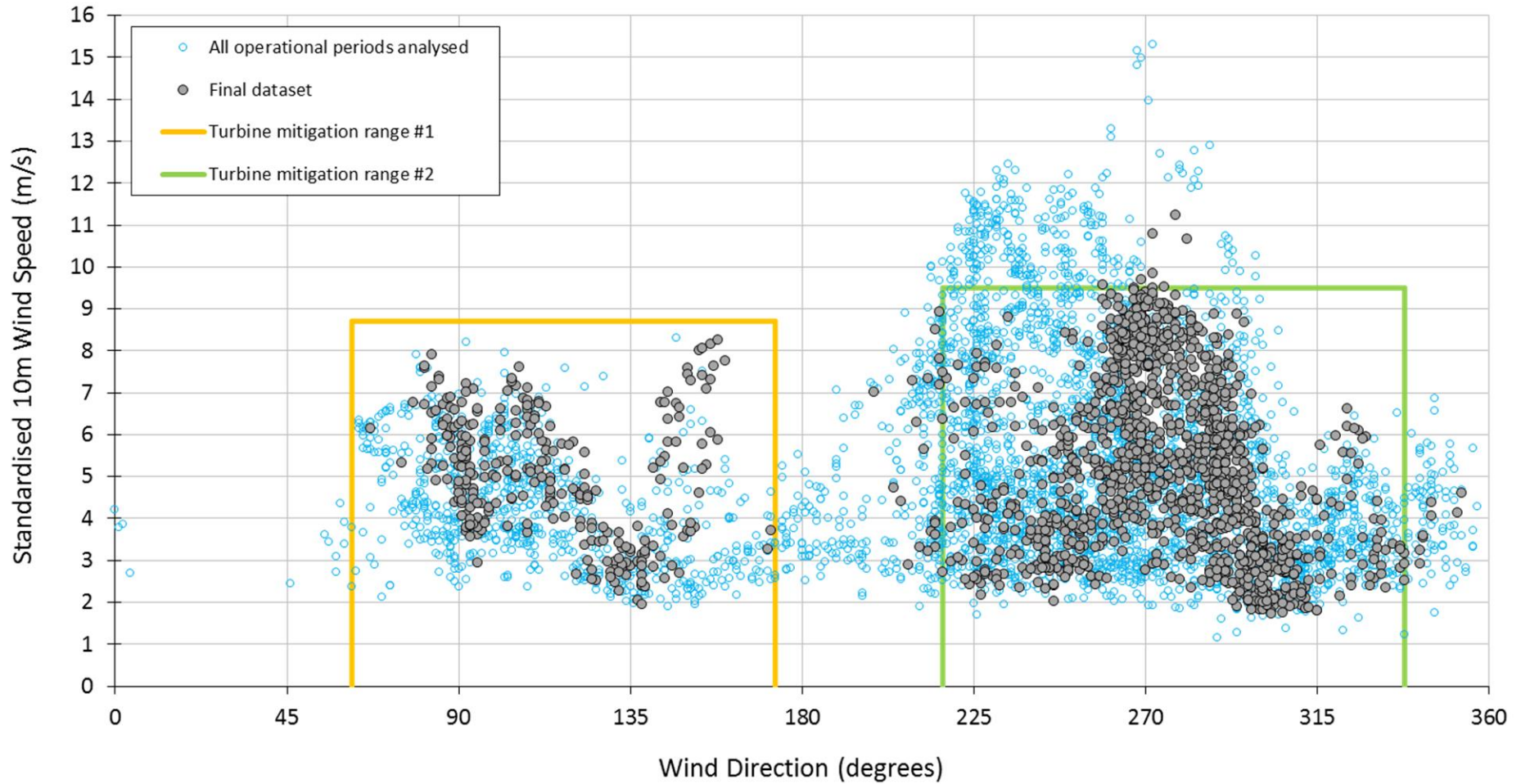
Wind Conditions of Identified AM Periods (100-400Hz result)

House 1 (Operation)



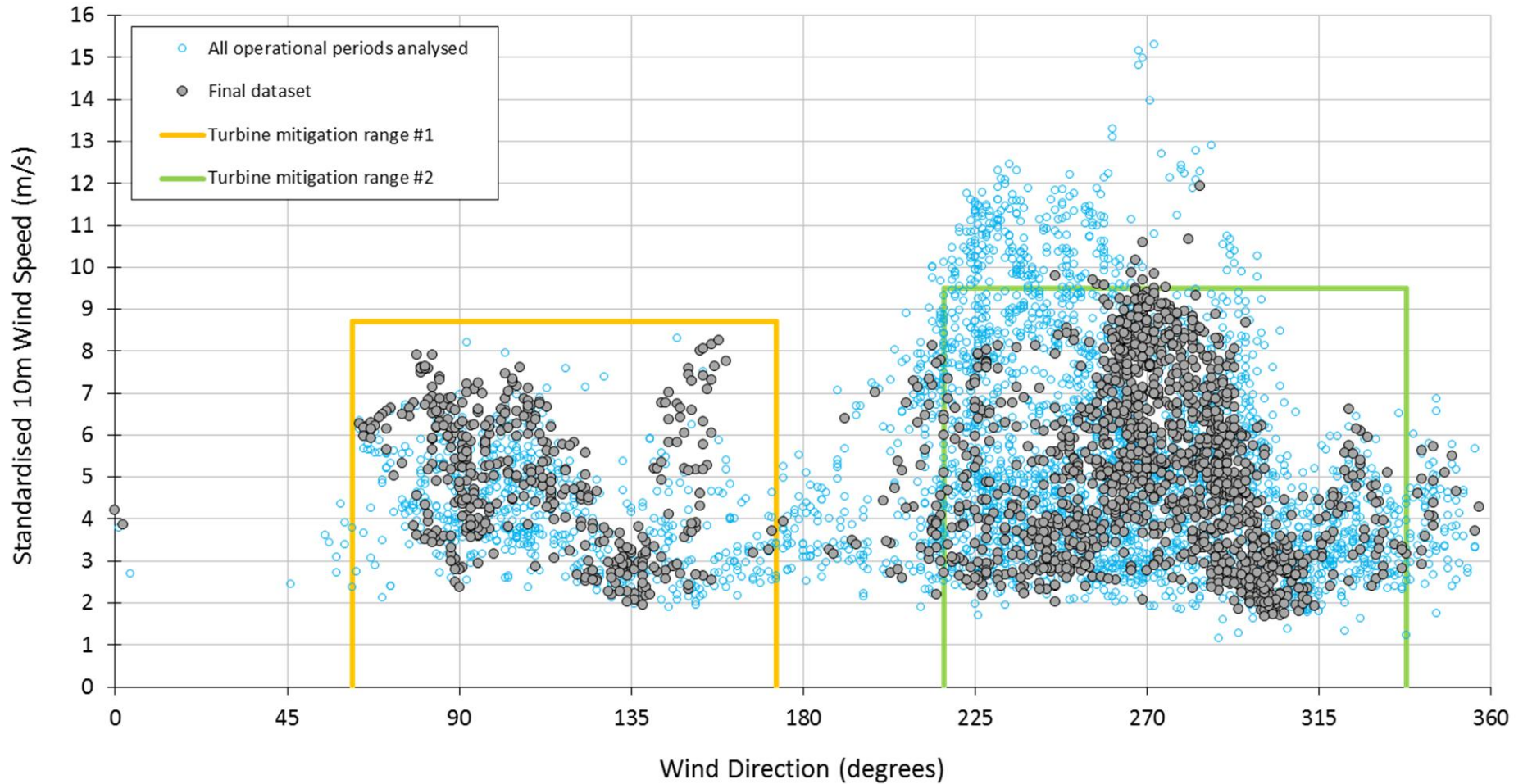
Wind Conditions of Identified AM Periods (100-400Hz result)

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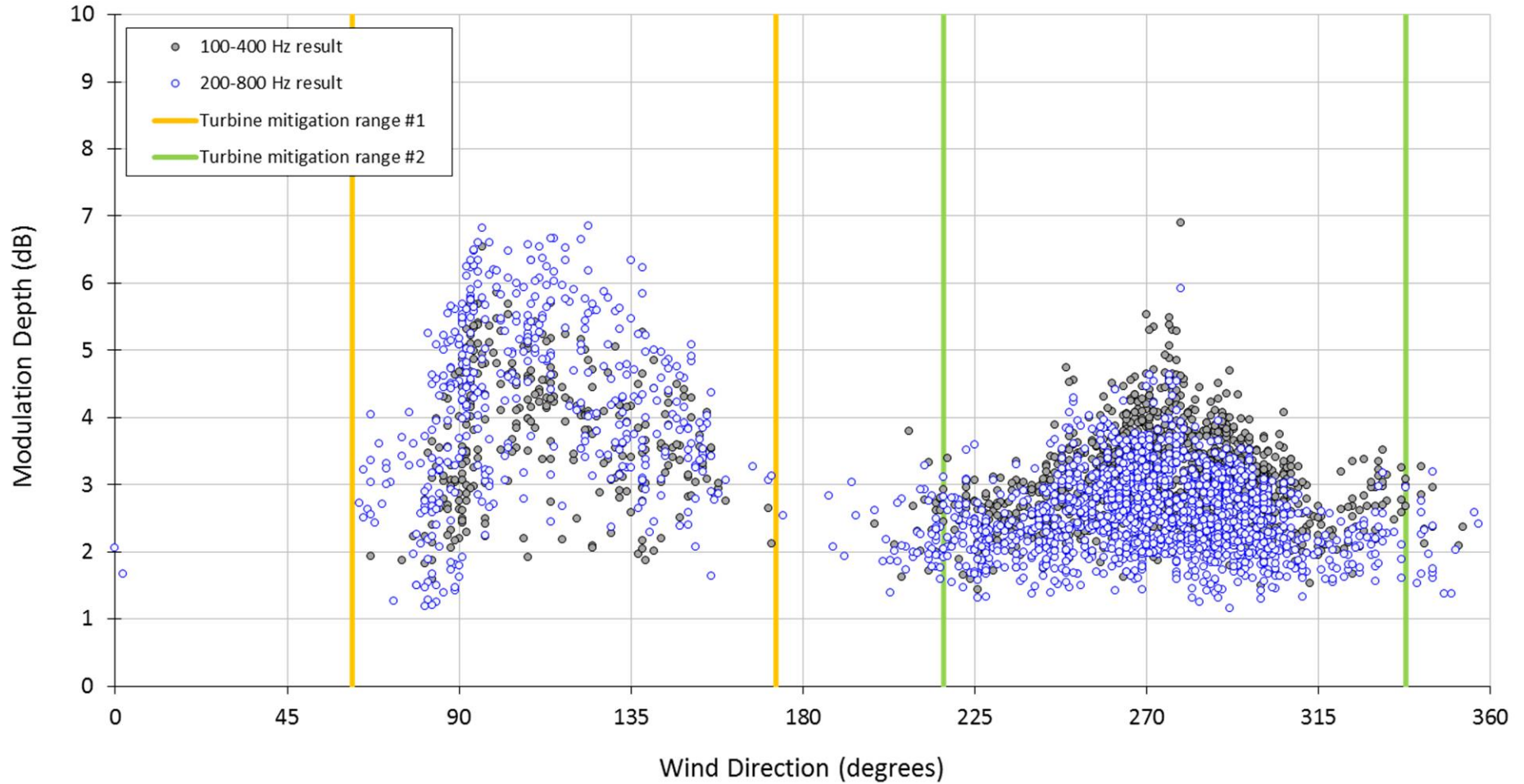
Wind Conditions of Identified AM Periods (200-800Hz result)

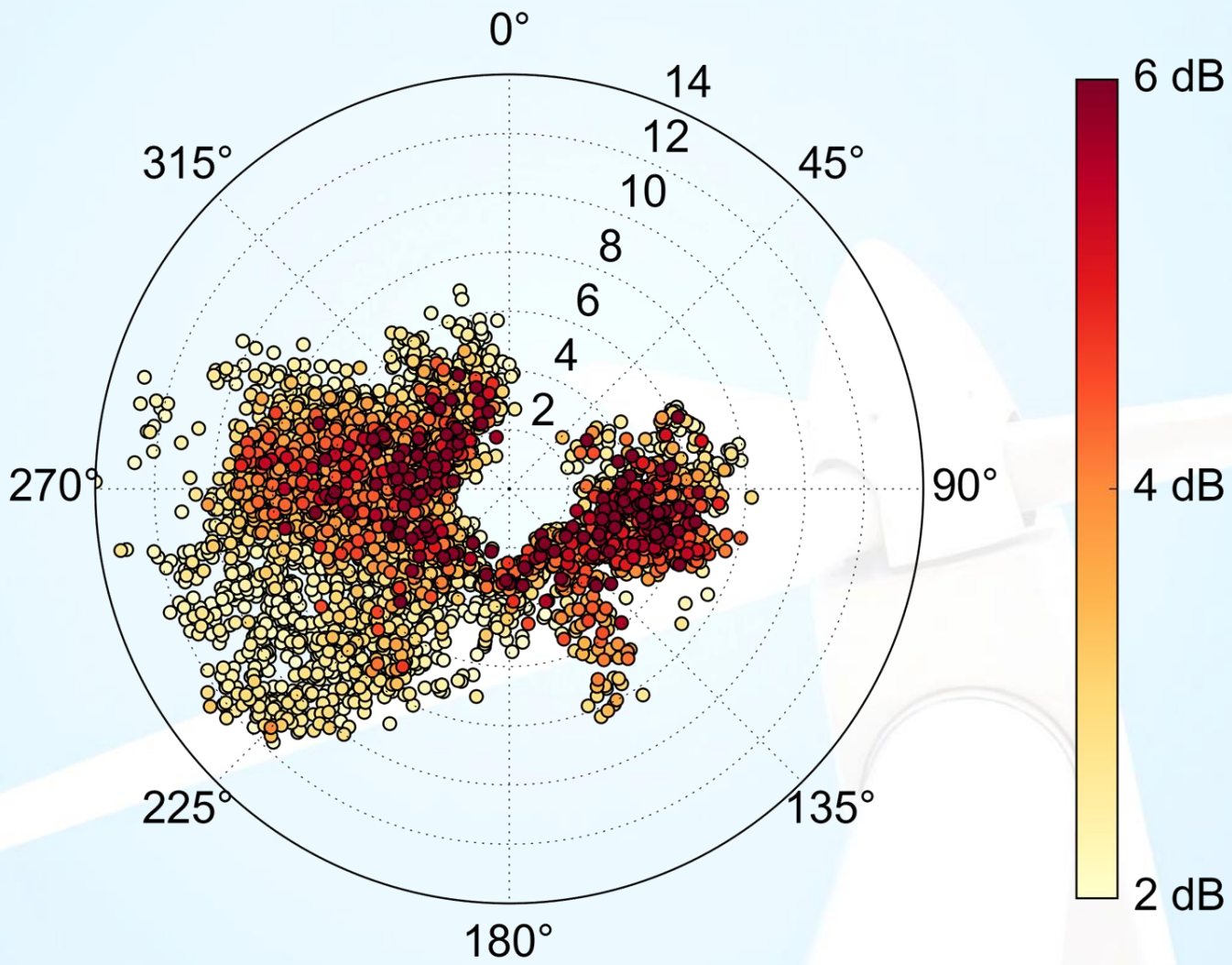
House 1 (Operation)

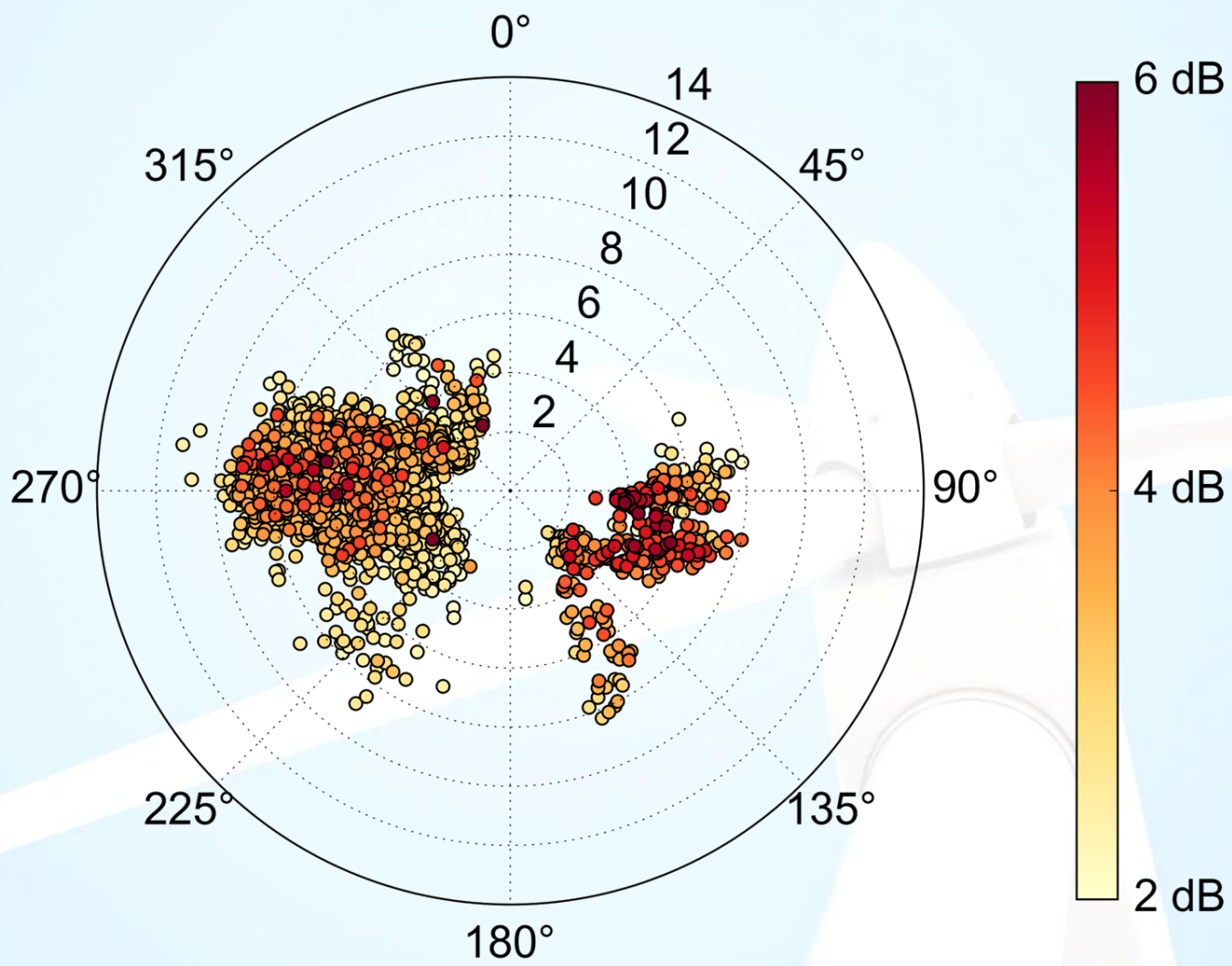


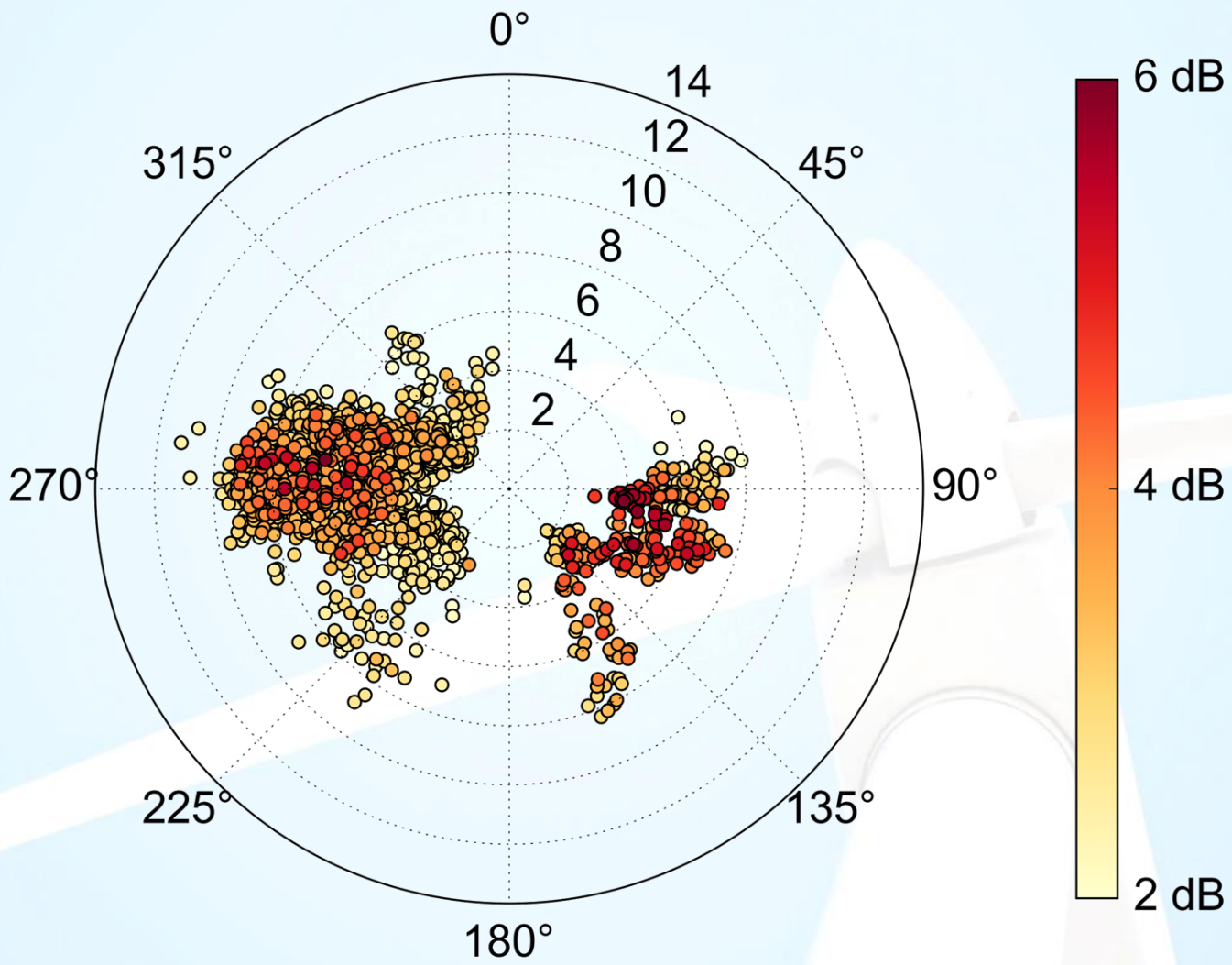
Wind Conditions of Identified AM Periods

House 1 (Operation)









Thank you for your attention



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