

Underwater noise emission from the NOAH's drilling operation at the narec site, Blyth, UK

Authors: Merin Broudic¹, Per Berggren², Simon Laing², Lysnay Blake², Federica Pace³, Silvana Neves³, Irene Voellmy⁴, Peter Dobbins⁴, Rick Brintjes^{6,7}, Steve Simpson⁶, Andy Radford⁵, Stephen Robinson⁸, Paul Lepper⁹

¹ Swansea University, ² Newcastle University, ³ Baker Consultants, ⁴ Ultra Electronics Sonar Systems, ⁵ Bristol University, ⁶ University of Exeter, ⁷ HR Wallingford, ⁸ National Physical Laboratory, ⁹ Loughborough University,

Summary

- ✓ In October 2012, the National Renewable Energy Centre (narec) conducted a series of drilling operations off the narec centre in the frame of the 3rd Round offshore wind demonstrator site (figure 1) [1].
- ✓ The Bio-Acoustic Research Consortium (BARC) undertook underwater acoustic measurements prior and during drilling operations (figure 2).
- ✓ Underwater background noise levels ranged between 30 dB re 1μPa_{rms}²/Hz (≈150kHz) and 110 dB re 1μPa_{rms}²/Hz (≈ 10Hz).
- ✓ Drilling operation occurred at 37m depth using the rotary drilling technique.
- ✓ Anthropogenic noise recorded at 500m from the source did not exceed 110 dB re 1μPa_{rms}²/Hz.
- ✓ Drilling noise did not exceed 30 dB re 1μPa_{rms}²/Hz above background noise level at 500m from the source.
- ✓ Rotary drilling operation occurring during the measurement seems to have very little impact in comparison with other techniques of fixed platform deployment (pile driving, large drilling) [2].
- ✓ From the results on figure 5 and 6, rotary drilling noise does not appear to propagate further than few nautical miles.
- ✓ This results will be used to study the impact of drilling noise on marine mammals.

1. Introduction

Underwater noise spreading resulting from offshore deployment is still a concern regarding the impact that such activities may have on marine life.

The acoustic impact highly depends on the environment and the deployment technique used.

The drilling operation at the narec sites consists of drilling a socket through the pile sleeve and into the bedrock [3].

The seabed is made of glacial till/sandy gravel up to 5m and hard rock underneath [3].

Underwater acoustic measurements were carried out from the surface using a drifting buoy. The sensor was positioned at 10 m depth the monitoring lasted 10 minutes at each location.

The data processing used a 312 kHz sampling rate and a 16 bit resolution. The post-processing used a Hanning windows and a 2¹⁶ Fast Fourier Transform (FFT) and each plot is based on a 2 minutes averaging period.

This poster presents the results of an investigation into the noise associated with drilling operation during the installation of the NOAH in Blyth, England at various locations of the narec sites and different period.

2. Spatio-temporal variation of Background Noise at the narec site

- Figure 3 and figure 4 highlight the background noise distribution at 5nm east and 3nm north from the borehole.
- Underwater background noise recordings were undertaken on a 25 square nautical miles area and over two years.
- Underwater background noise amplitudes ranged between 30 and 110 dB re 1μPa_{rms}²/Hz.
- Main temporal and spatial variations occur below 10kHz and can be attributed to wind, shipping traffic and surface agitation [4,5].

References:

[1] SeaRoc, 2012, Searoc charter MPI Adventure for Narec's Offshore Anemometry Hub Installation [Press release]. [2012] Available from:

http://www.google.co.uk/url?sa=t&rlz=1C1G8&source=web&cd=2&ved=0CDOQIAB&url=http%3A%2F%2Fwww.narec.co.uk%2Fnarec.co.uk%2Fdocuments%2Fcorporate%2Fsaroc_vesselAward_240812_finalS.pdf&ei=s8FfUJ4O8HgW6yQP&usq=AFOJCNH9YTMp_wgOxSI_V3hXmhVn2fsc1Q&hvm=by65397613_d_bSQ

[2] J. Nedwell, D. Howell, A review of offshore windfarm related underwater noise sources, Report No. 544 R 0308, Oct 2004, Cowrie.

[3] FoundOcean case study, Rock socket grouting for Narec's Offshore Anemometry Hub (2013), available at <http://www.foundocean.com/our-projects/case-studies/rock-socket-grouting-narec-offshore-anemometry-hub/>

[4]. Richardson WJ, Green Jnr C, Malme CI, Thomson DH. Marine mammals and noise. Virginia Press; 1995. 87e155.

[5] X. Lurton, An Introduction to Underwater Acoustics, Principle and Applications, 2010, Springer.



Figure 1: Background noise at 5nm east from the anemometry hub location - 03/10/12



Figure 2: The Bio-Acoustic Research Consortium on board of the Princess Royal

3. Operational drilling noise

Drilling operation noise was monitored at 500m east and 3nm north from the borehole.

Figure 5 and 6 highlight the noise distribution signature of the drilling operation at 500m east and 3nm north from the source.

Underwater noise amplitudes recorded during drilling operation at 500m ranges between 40 and 105 dB re 1μPa_{rms}²/Hz.

Underwater noise amplitudes recorded during drilling operation at 500m ranges between 35 and 100 dB re 1μPa_{rms}²/Hz.

Drilling noise amplitudes (figure 3&4) are 10 to 30 dB re 1μPa_{rms}²/Hz higher than the background noise levels (figure 5&6).

Drilling operation noise at 3nm north away from the source is comparable to the background noise levels.

Higher drilling noise amplitude occurs between 100Hz and 50kHz and reaches up to 100 dB re 1μPa_{rms}²/Hz.

The results show that the noise signature of the drilling operations was particularly low in comparison with the levels expected [2].

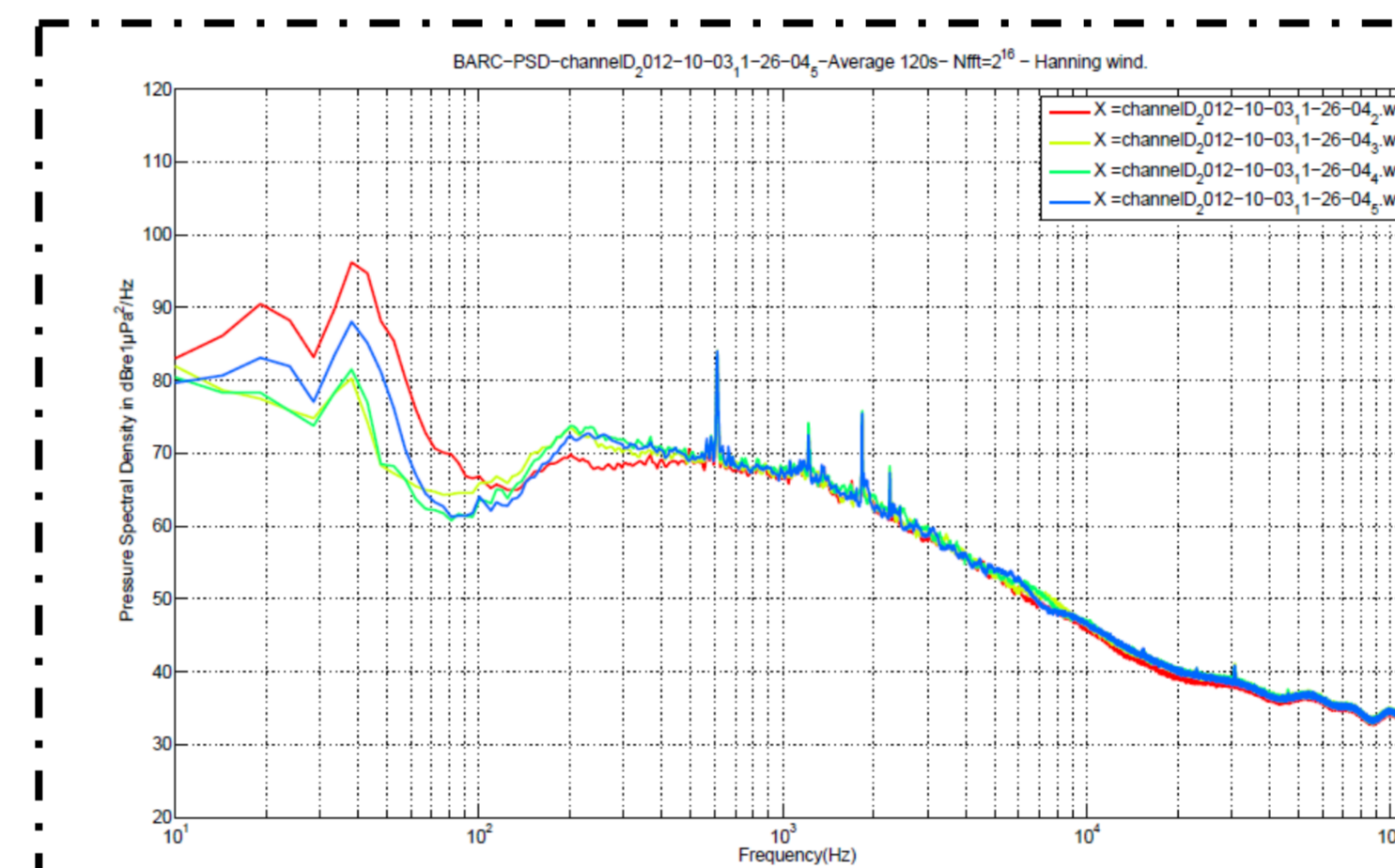


Figure 3: Background noise at 5nm east from the anemometry hub location - 03/10/12

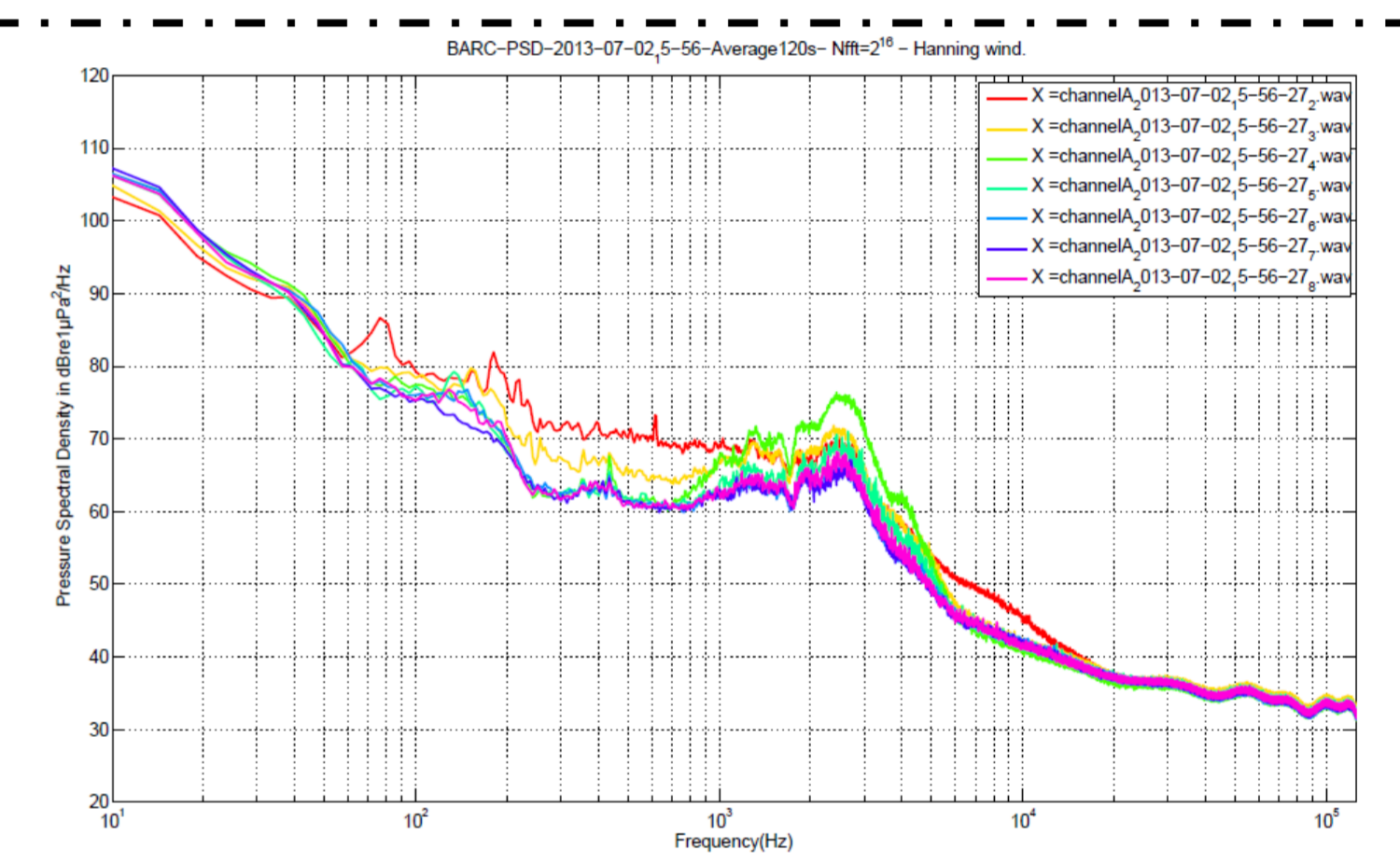


Figure 4: Background noise at 3nm North from the anemometry hub location - 02/07/13

Background Noise

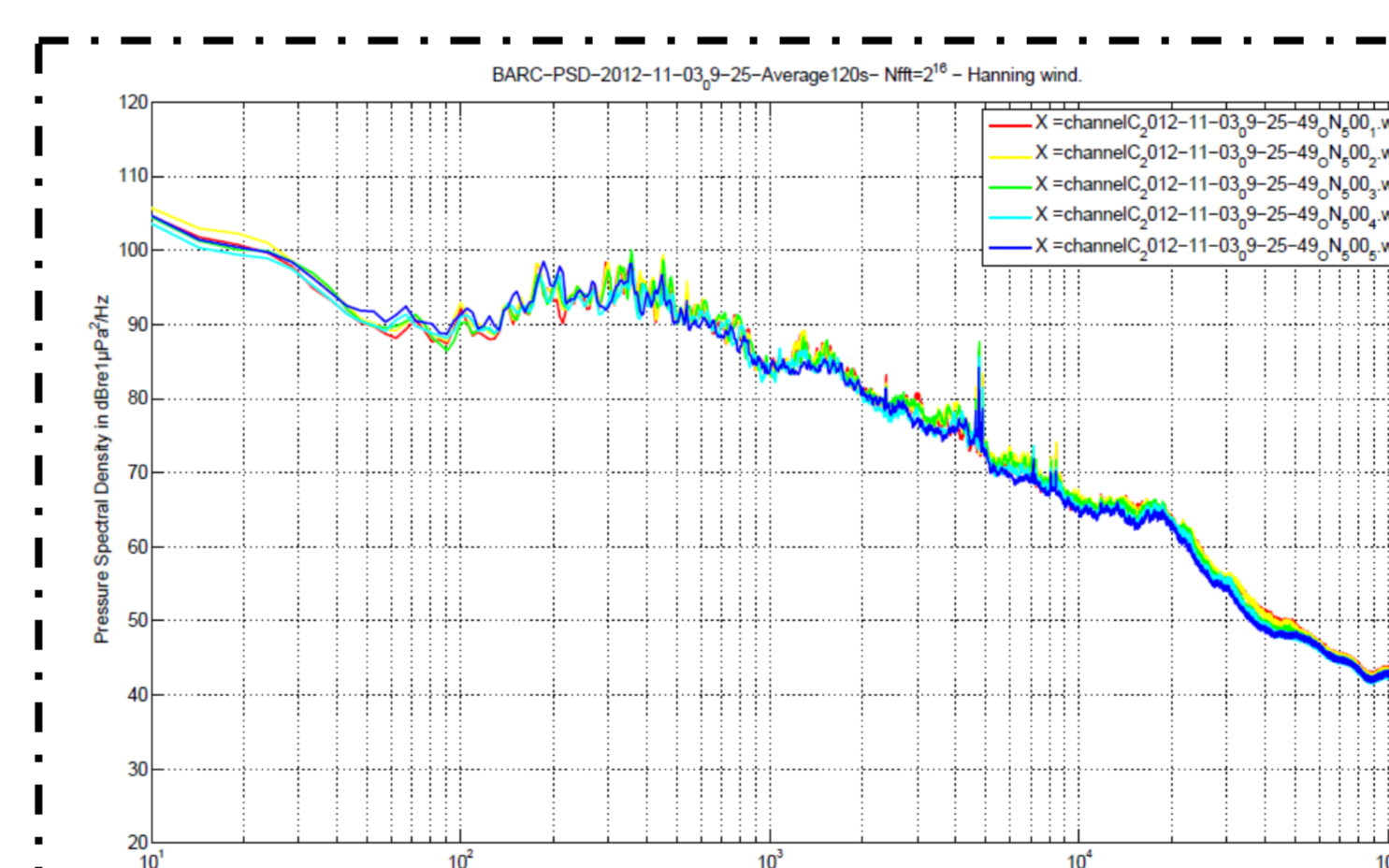


Figure 4: Background noise at 5nm east from the anemometry hub location - 03/11/12

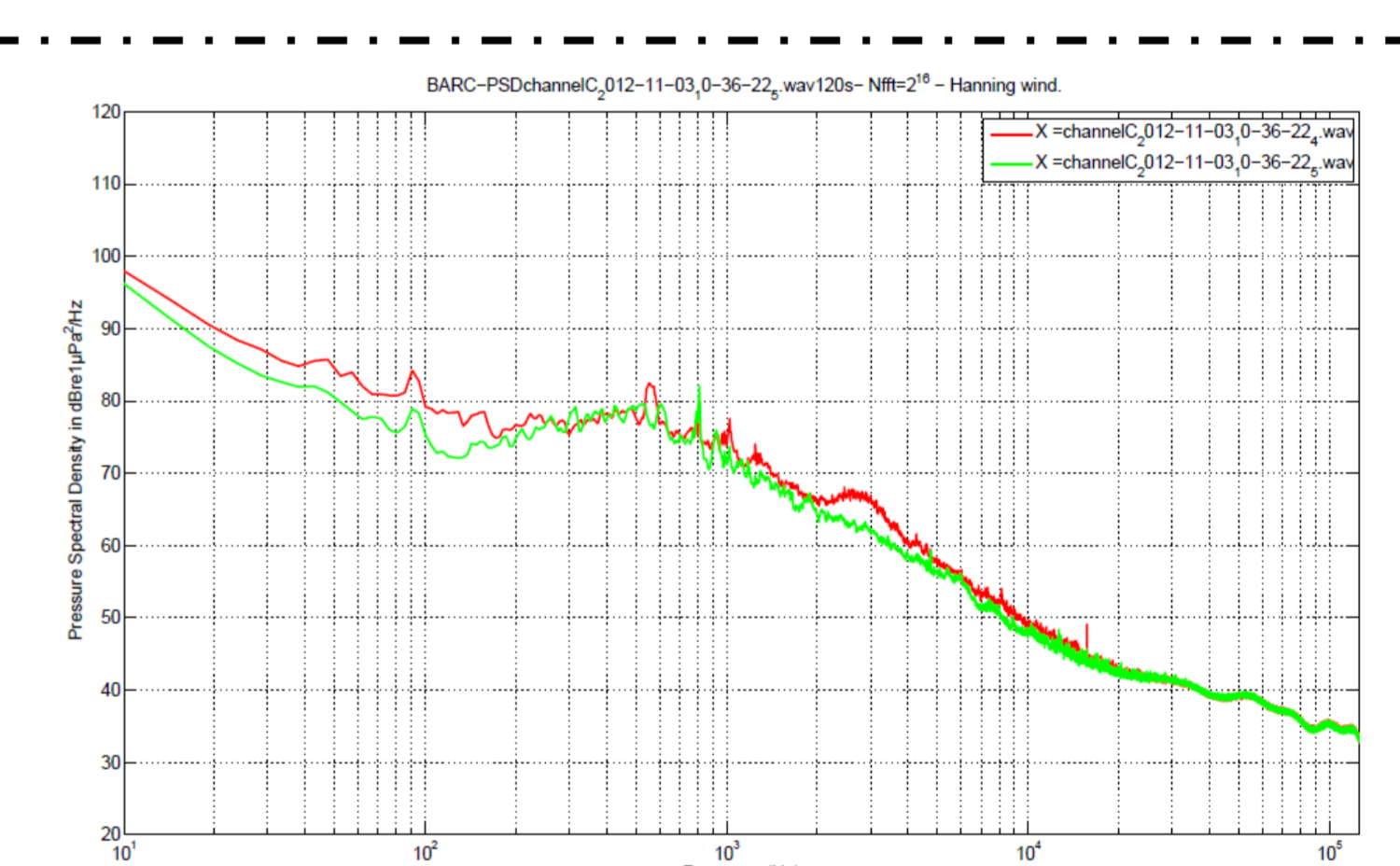


Figure 5: Background noise at 3 nm north from the anemometry hub location - 03/11/12

Drilling operation Noise