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DEWI GmbH –
German Wind Energy Institute

SITE ASSESSMENT . WIND TURBINE ASSESSMENT . GRID INTEGRATION . DUE DILIGENCE . KNOWLEDGE . CONSULTANCY

Long term underwater acoustic monitoring at FINO platforms

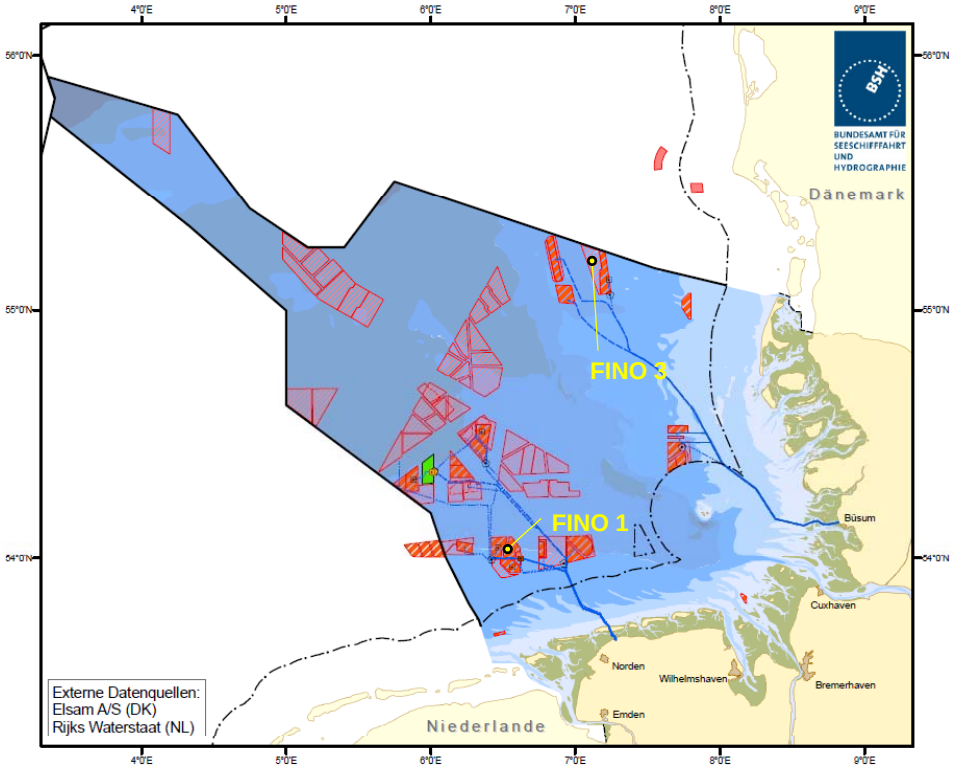
Contents

- **Motivation**
- **Underwater acoustic monitoring station**
- **Data and examples of pile driving noise**
- **Conclusions and outlook**

Motivation: Research project Hyprowind

- Marine fauna like harbour porpoises, seals, fish and fish larvae may be damaged by the intensive sound of pile driving
- Hydrosound scenarios based on forecast modeling and monitoring for the installation of offshore wind farms in the German North Sea

- Interference of pile driving noise of different offshore wind farms
- Development of noise maps
- Validation by measurements (FINO1, FINO3, autonomous system)



Source: BSH / DEWI - Status: 2011-02-11

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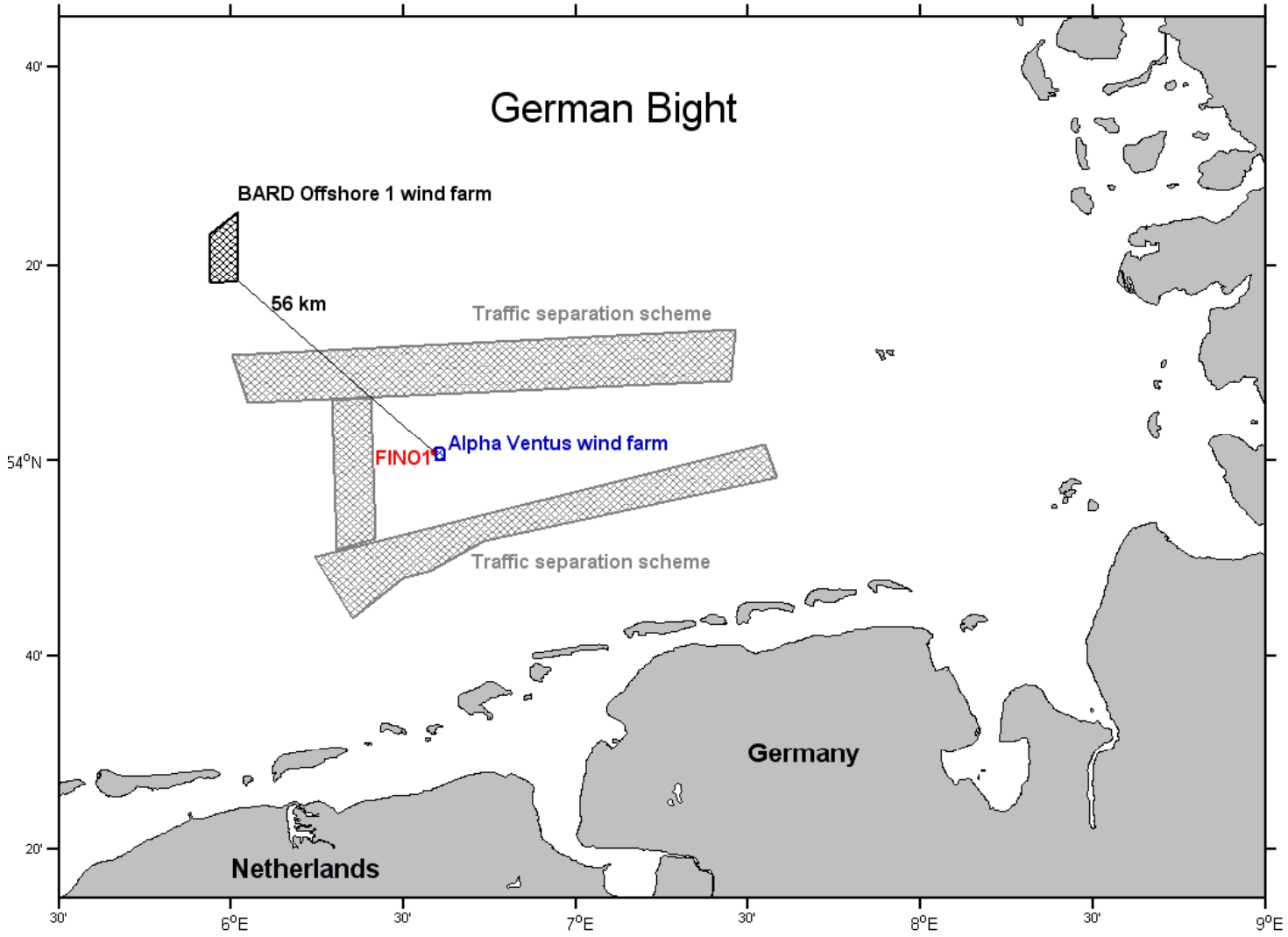
Site of Measurement System



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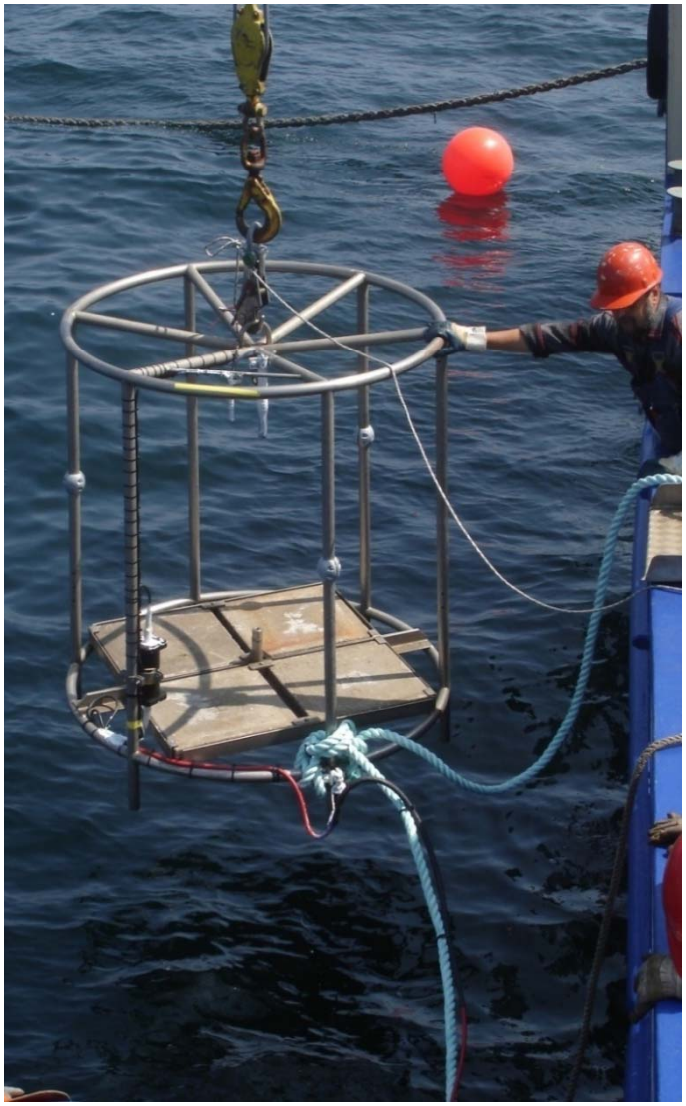
Underwater acoustic monitoring



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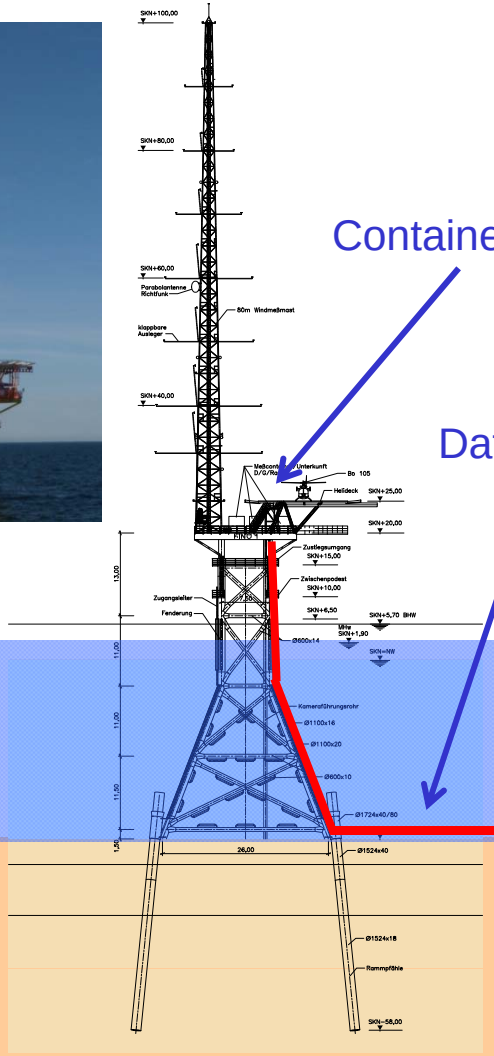
Underwater acoustic monitoring station

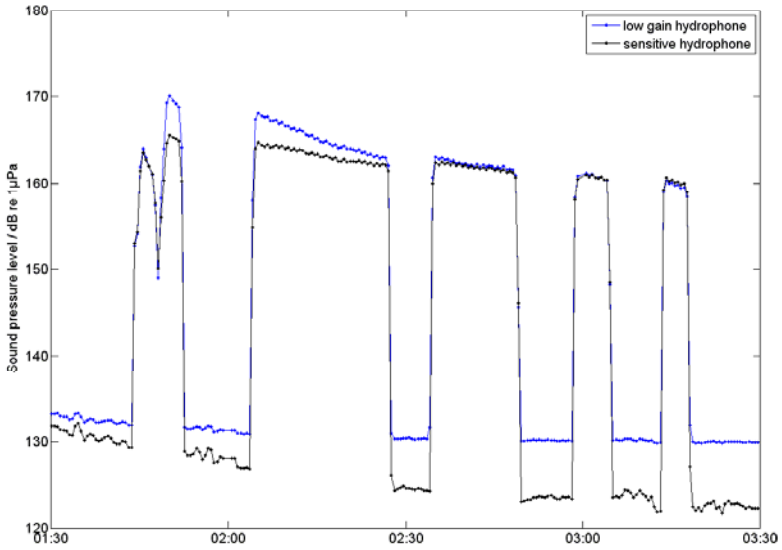


- Set up in July 2009
- Distance of 80 m to research platform FINO1
- 2 different hydrophones: a sensitive and a low gain one
- Resolution 24 Bit
- Sampling rate 48000 Hz
- Equipped with external hard drives for data storage

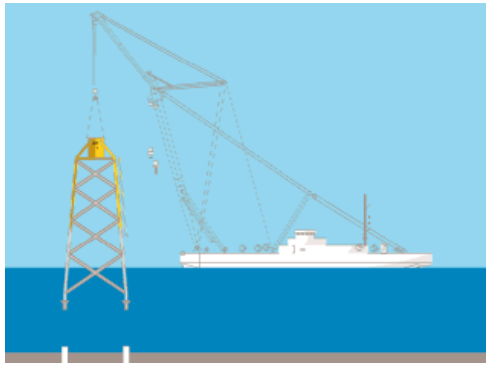
Examples of pile driving

Nearby pile driving

(August 9th, 2009, distance 1200 m)

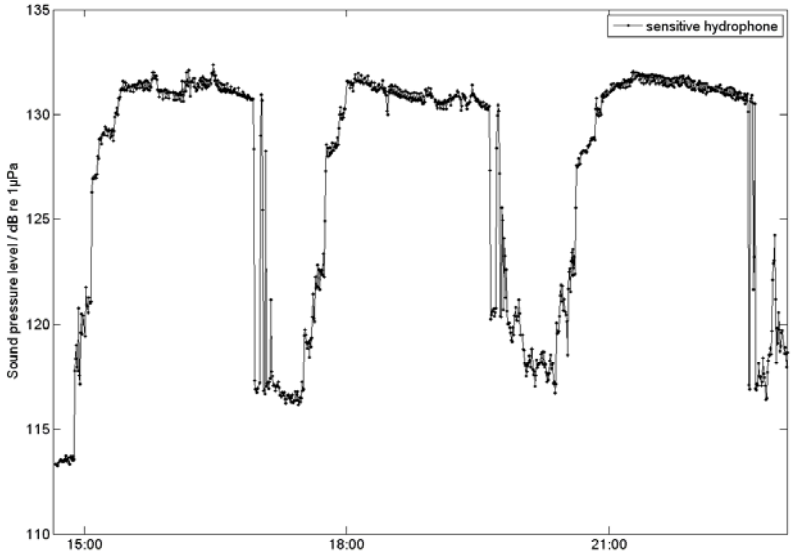


Hammering of a pile of a jacket construction



Distant pile driving

(December 22nd, 2010, distance 56 km)



Hammering of 3 piles of a tripile construction

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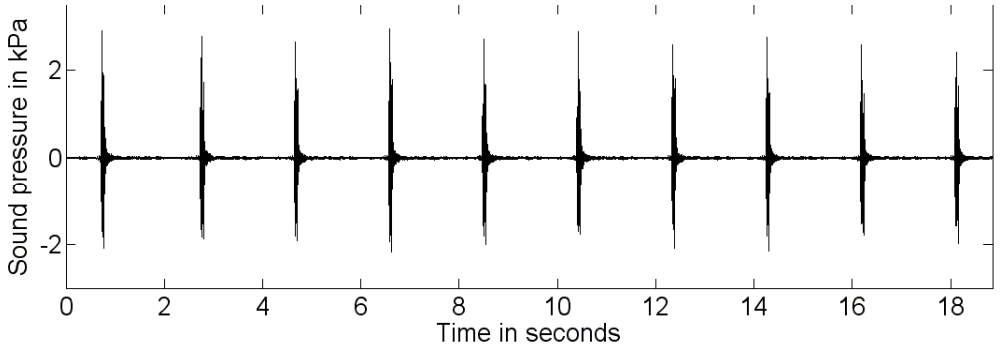
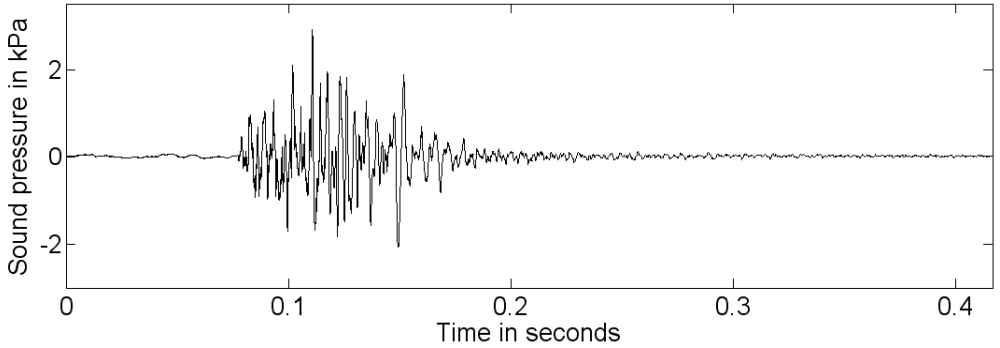
Examples of pile driving noise

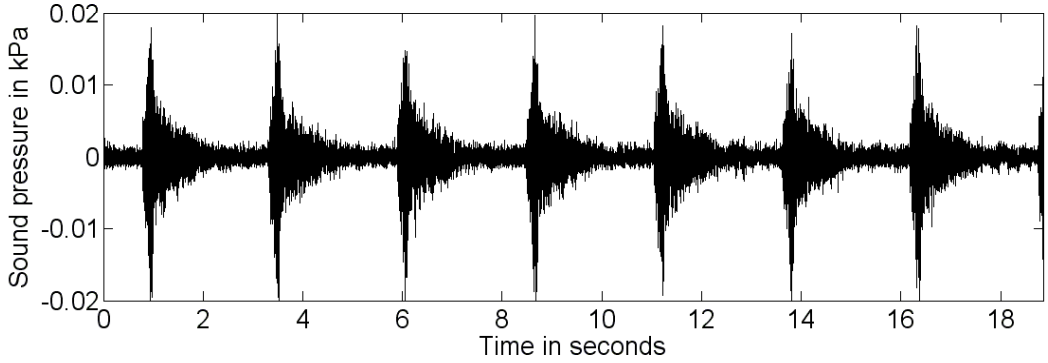
Nearby pile driving

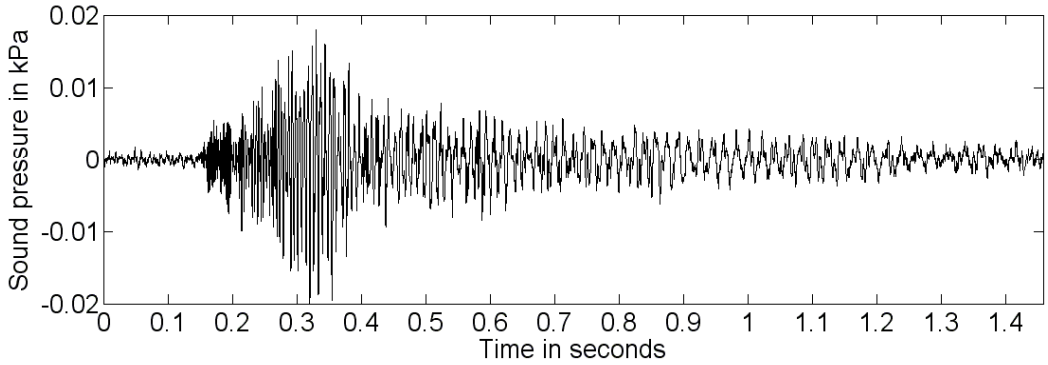




Amplitude and frequency of strokes of nearby pile driving on July 14th, 2009

Distant pile driving





Amplitude and frequency of strokes for far distant pile driving on May 9th, 2010

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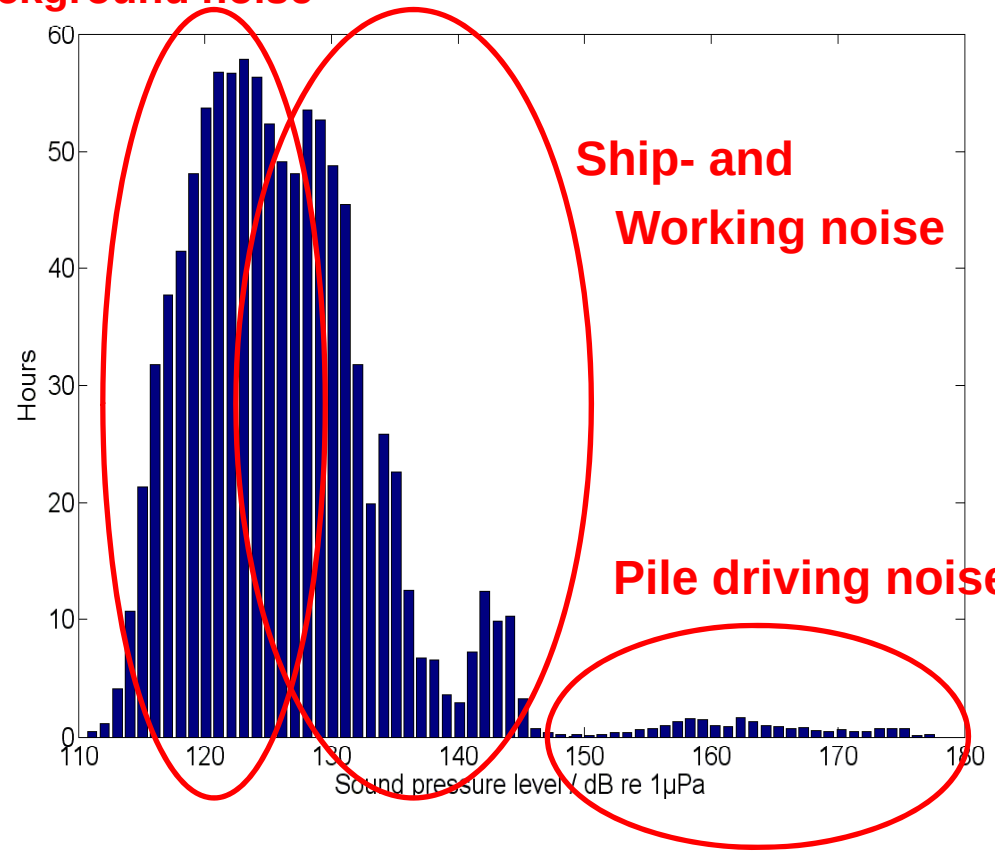
Long term sound pressure level distribution

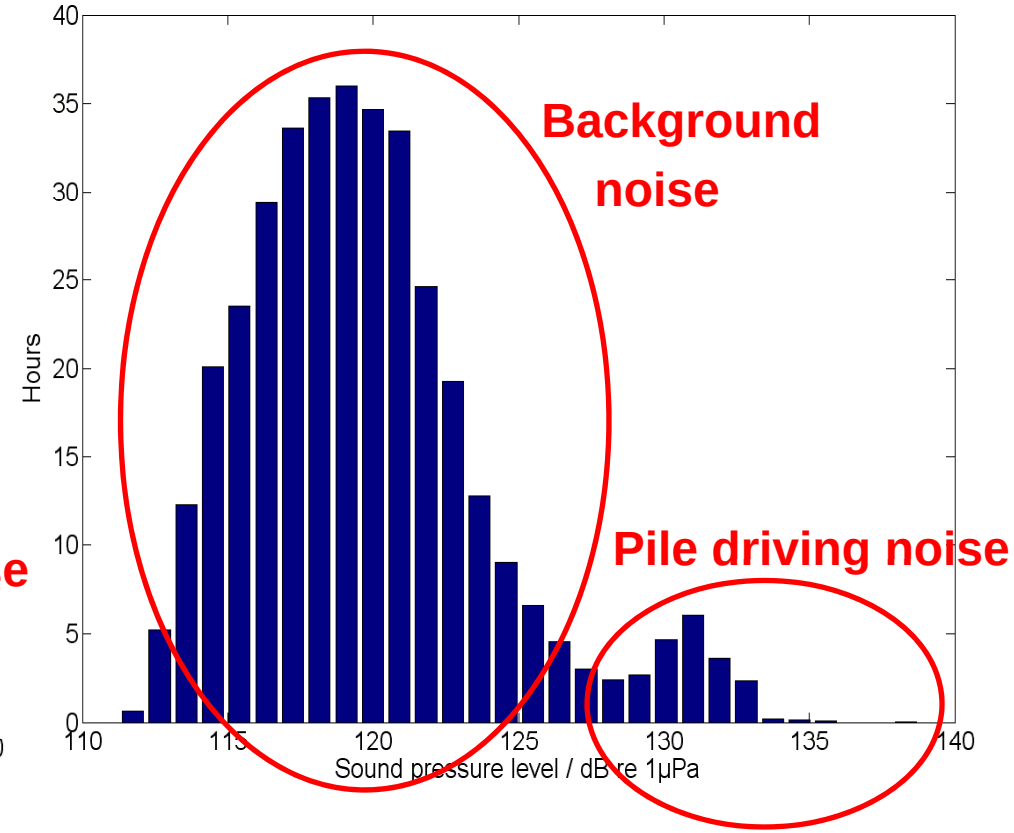
Nearby pile driving

Background noise



Distribution of L_{eq}
July 7th to August 26th, 2009

Distant pile driving



Distribution of L_{eq}
May 1st to 31th, 2010

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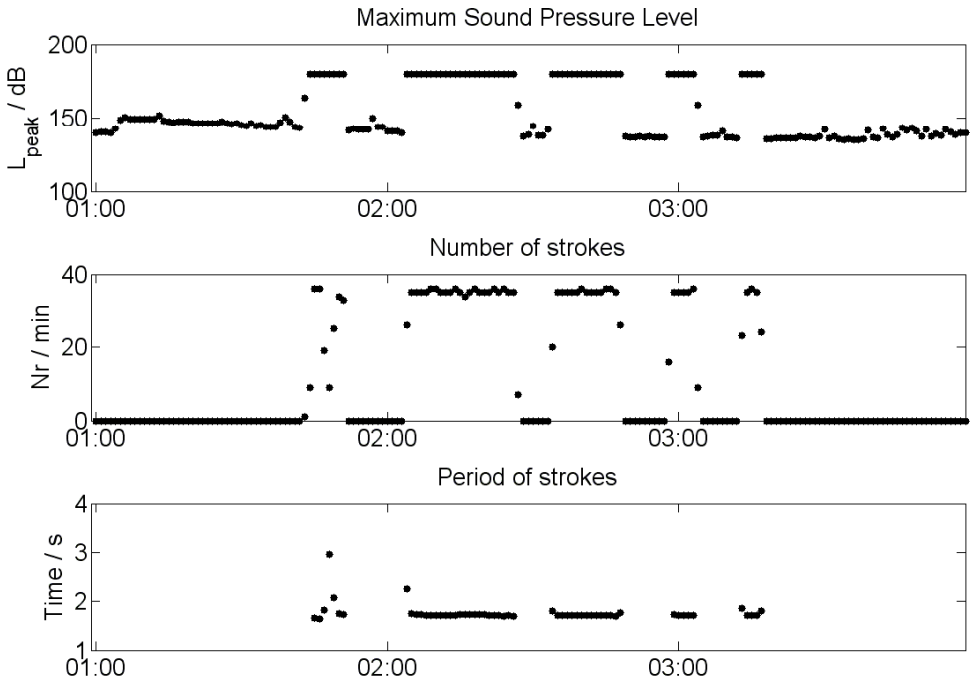
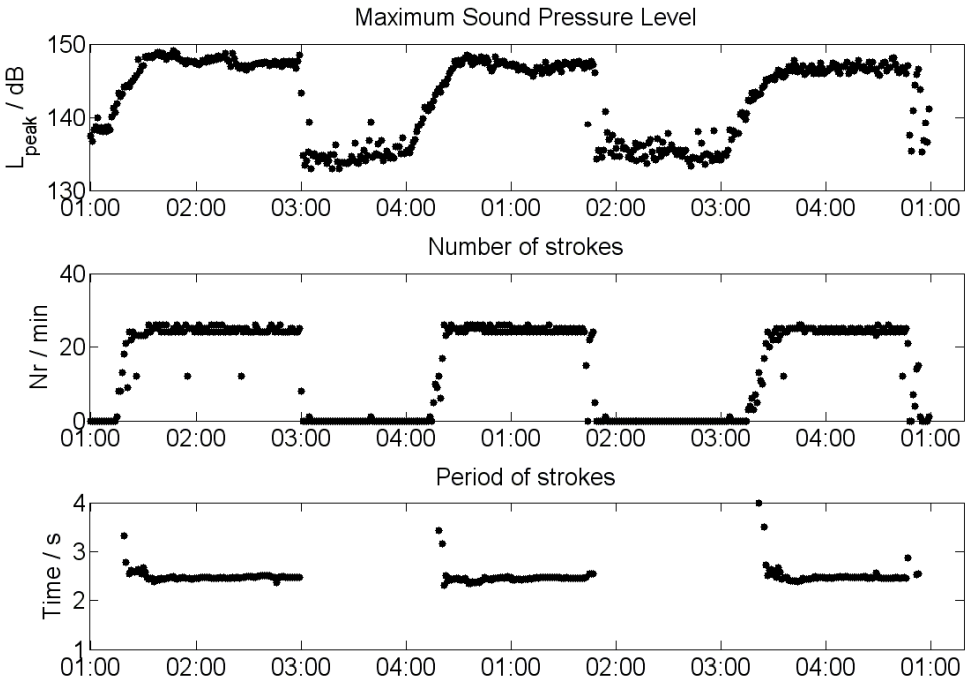
Automatic pile driving detection algorithm

Nearby pile driving

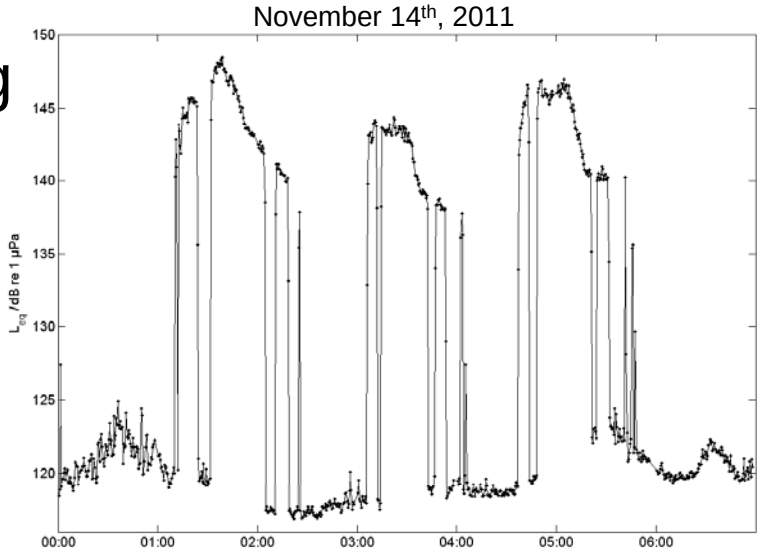


Distant pile driving

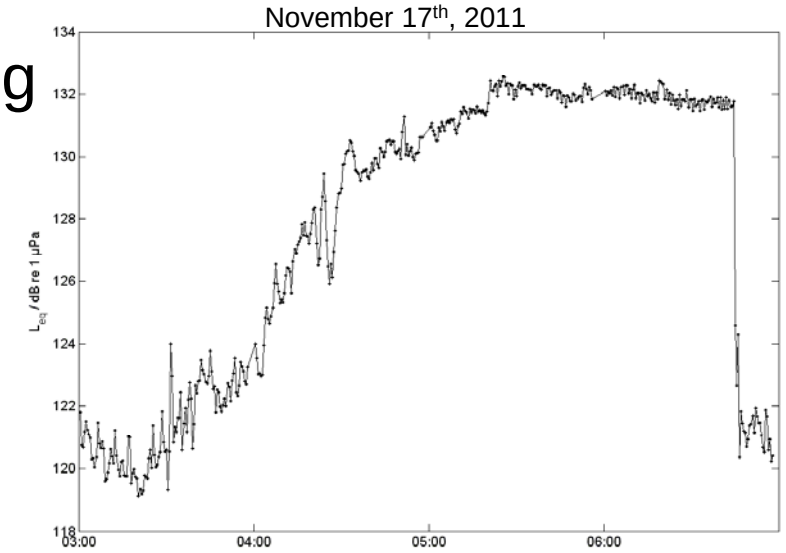


Outlook: cumulative effects

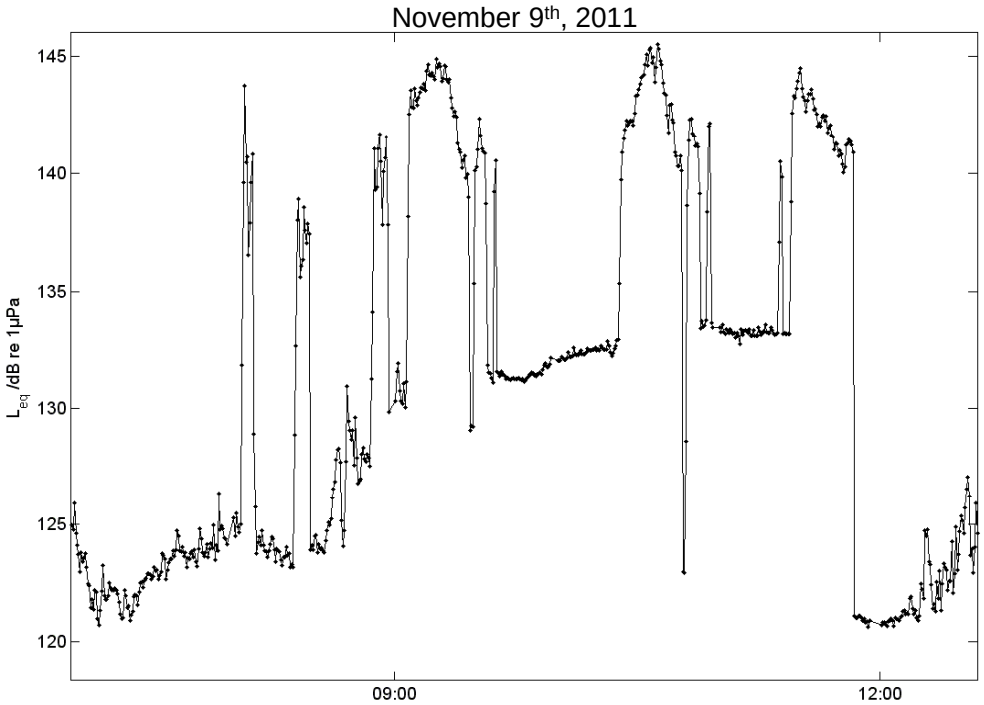
Nearby pile driving



Distant pile driving



Interference



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Conclusions and outlook

- About 3 successful years of long term underwater sound monitoring
- Focus on detection of pile driving noise in a high dynamical range
- Successful development of an automatic pile driving detection algorithm
- Investigation of cumulative effects
- Installation of second underwater acoustic monitoring station in the North of the German Bight near research platform FINO3
- Development of an autonomous system

Thank you
for your attention !