UNIVERSITY OF BERGEN
EERA DeepWind Conference 2022

Underwater acoustic noise under the effects of varying oceanic and sea-state conditions: Modelling

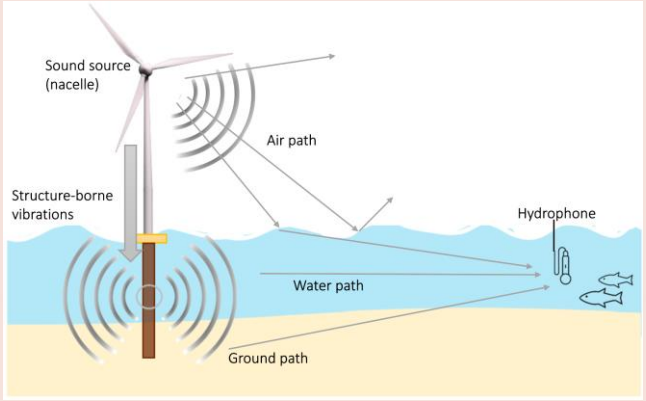
Tiril Konow, Master's student in Energy, Geophysical Institute University of Bergen
tiril.konow@uib.no

Mostafa Bakhoday-Paskyabi, Geophysical Institute University of Bergen, and Bergen Offshore Wind Centre,
mostafa.bakhoday-paskyabi@uib.no

UNIVERSITY OF BERGEN

Introduction

Important to determine the disturbances from the turbines, and how it affects the environment.



Approach

Observational data

Modelling

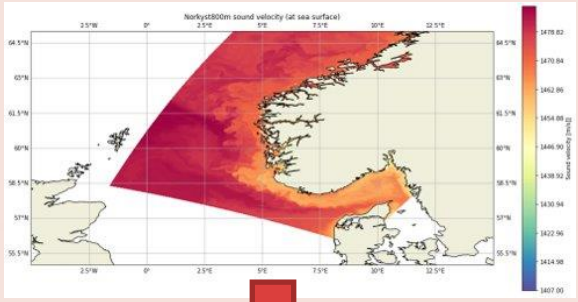
Inverse problem

Propagation model

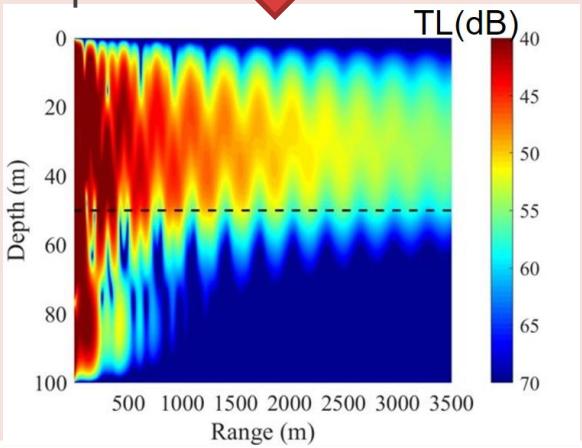
Normal modes model

Input:

- CTD-data
- ROMS
- Sound velocity
- Source freq. and depth

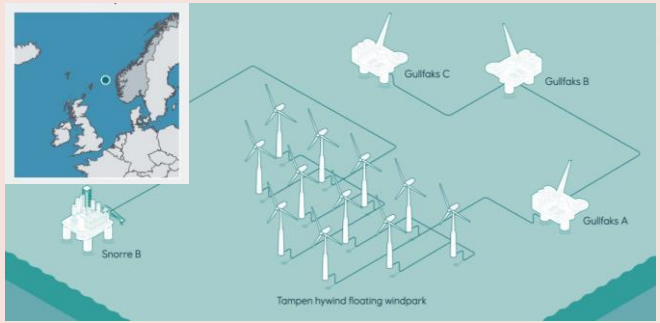


Output:



Example: Hywind Tampen

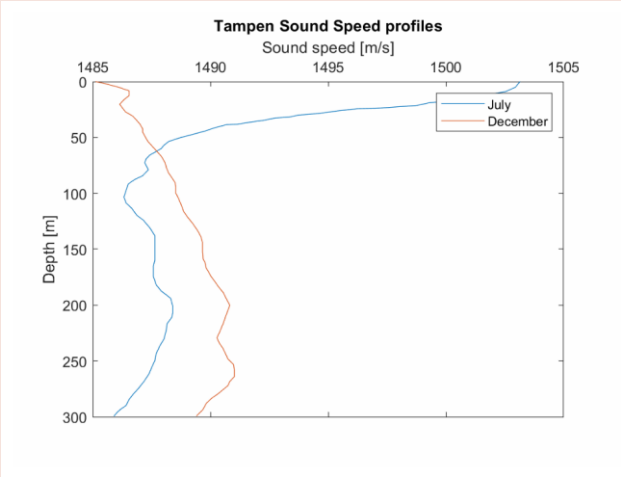
Oscillations from floating turbine influence noise



11×8MW floating wind turbines

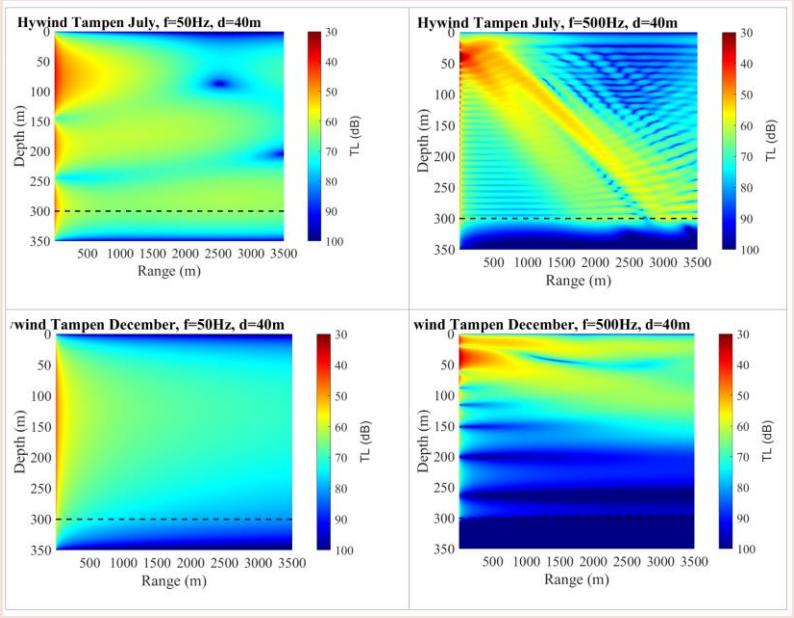
In operation third quarter of 2022

Environmental conditions at this area ⟶ sound speed

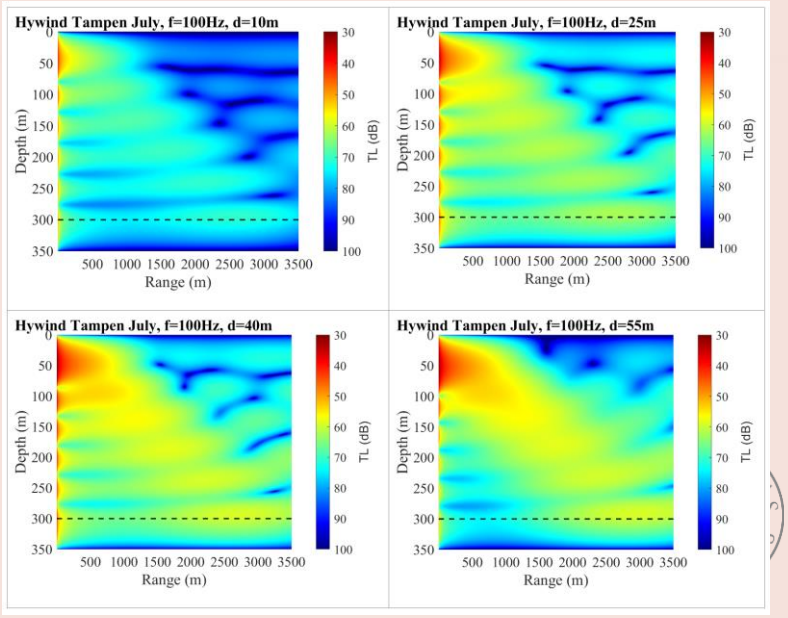


Example: Hywind Tampen

Modelling for different source frequencies and seasons



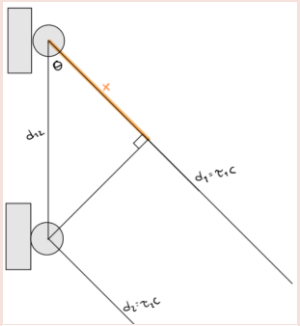
Modelling for changing source depth



Future work

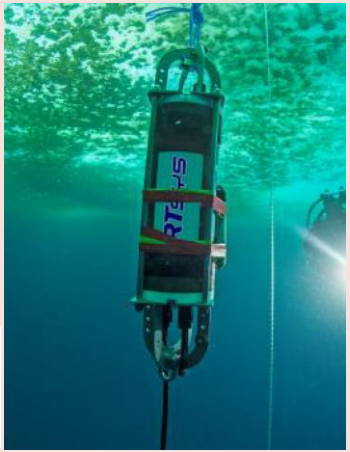
Inverse problem

- Sensor deployment
- Complete beamforming/DOA



the direction of arrival;

$$\theta = \cos^{-1}\left(\frac{\Delta_\varphi \lambda}{2\pi d_{12}}\right)$$



Pre-construction noise

- RAVE – FINO1
- Signal processing

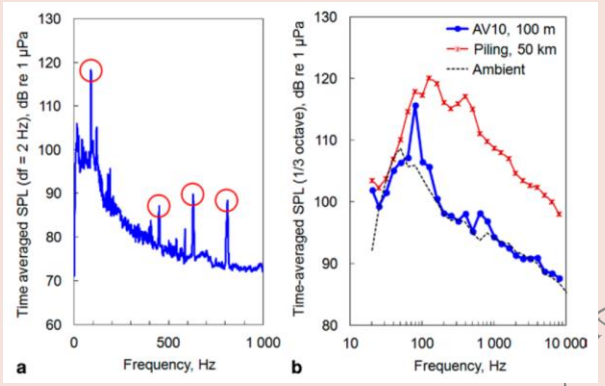


Figure from *Ecological Research at Alpha Ventus* (2014)
a): Narrowband spectrum from turbine (AV10) at rated power
b): 1/3 octave spectrum, Ambient curve was recorded in 2008 before the turbines were installed

References

BSH & BMU (2014). Ecological Research at the Offshore Windfarm alpha ventus – Challenges, Results and Perspectives. Federal Maritime and Hydrographic Agency (BSH), Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Springer Spektrum. 201 pp.

FINO1 - Research Platform in the North and Baltic Seas No. 1
https://www.fino1.de/en/

Tu, H., Wang, Y., Lan, Q., Liu, W., Xiao, W., & Ma, S. (2021). A Chebyshev-Tau spectral method for normal modes of underwater sound propagation with a layered marine environment. *Journal of Sound and Vibration*, *492*. https://doi.org/10.1016/j.jsv.2020.115784

Equinor. (2019). *Noise Impact Assessment Hywind Tampen*. Retrieved from www.equinor.com

Thank you!

email: tiril.konow@uib.no