Measurement campaign of a large rotor wind turbine

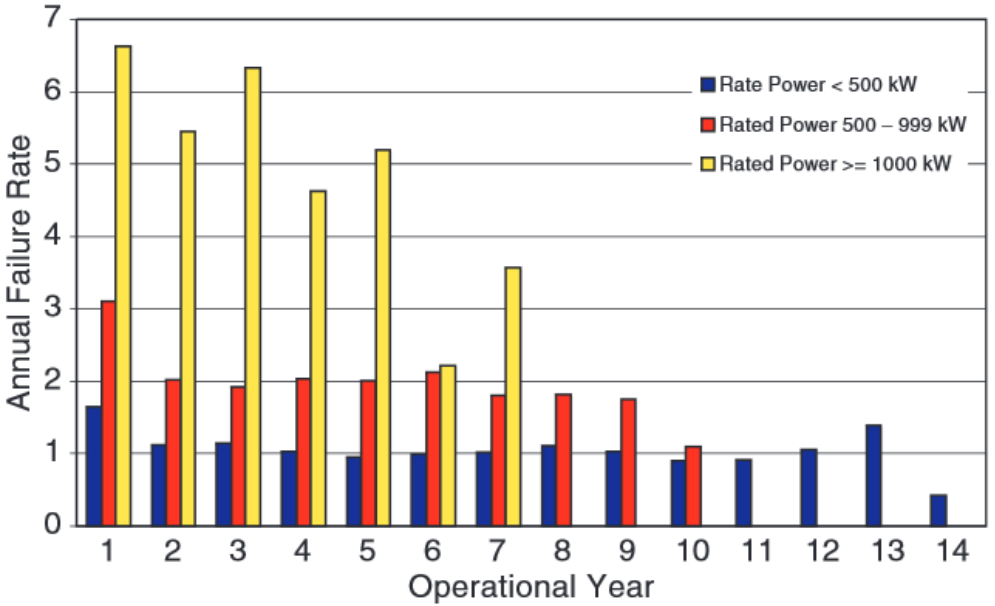
Lene Eliassen[a], Jørgen Krokstad[a,b], Eivind Sæta[b]

[a]NTNU, Department of Marine Technology,

[b]Statkraft

Norwegian University of Science and Technology

Motivation



From (Hahn, Durstewitz et al. 2007)

Motivation

- Sheringham Shoal (40 %)
  - Operators
- Dudgeon (30%)
  - Comission end of 2017
- Dogger Bank
  - Planning for developer role

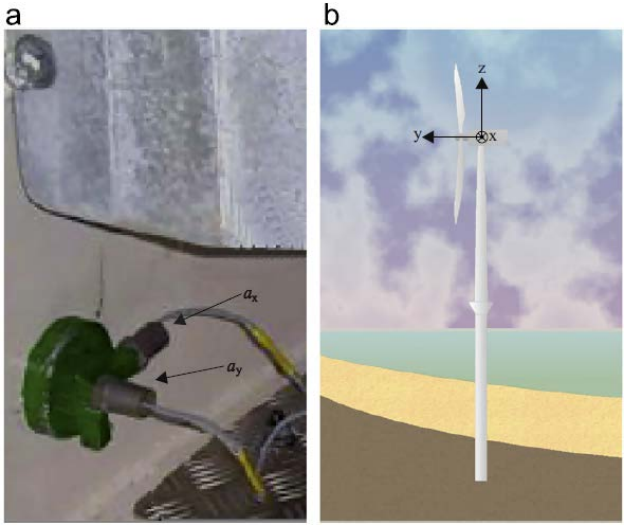
Smøla test turbine

Generator size:	6-8 MW
Hub height:	100-130 m
Rotor diameter:	140-180 m

NTNU

Methods - measurement

Strain gauge



Accelerometer (Damgaard, Ibsen et al. 2013)

Sampling rates		
Damgaard et al, 2013	nacelle	10 Hz
Damgaard et al, 2013	Tower	200 Hz
Koukoura, 2014	Foundation	20 Hz
Koukoura, 2014	Tower, shaft & blades	35 Hz
Hansen et al, 2006	Tower,blade root, nacelles	25 Hz
Kühnel et al	Alpha Ventus	50 Hz

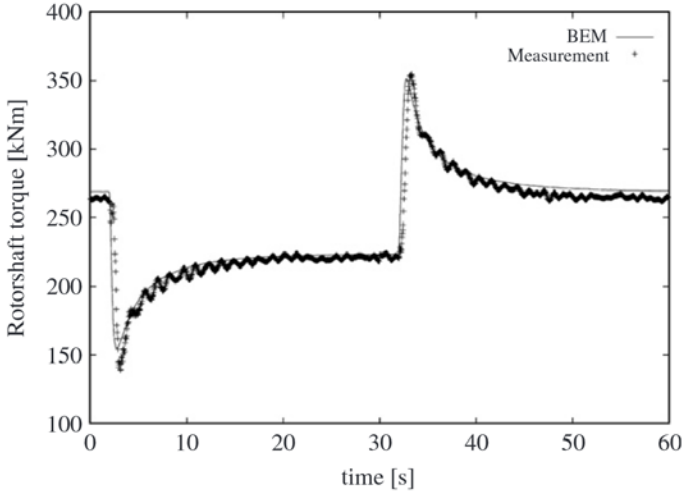
Wind measurement

Nacelle mounted cup anemometer and wind vanes

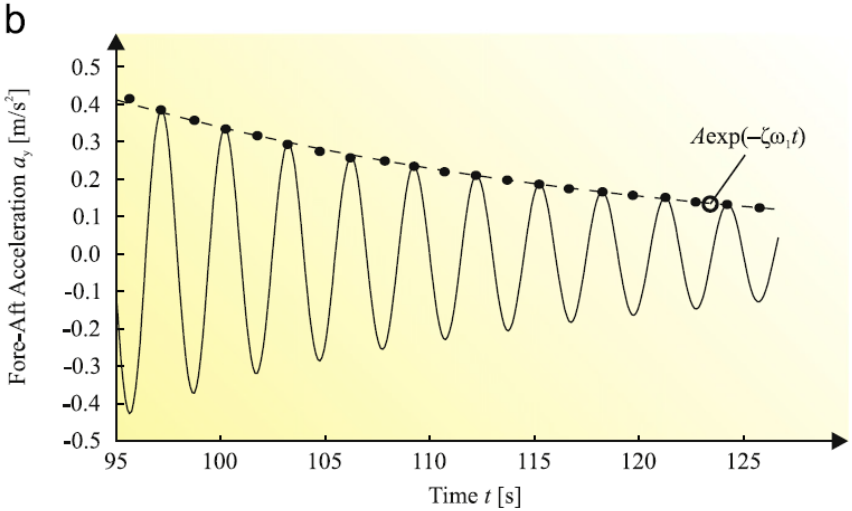
Meterological masts with wind sensors

Lidar measurements

What can measurements be used for?

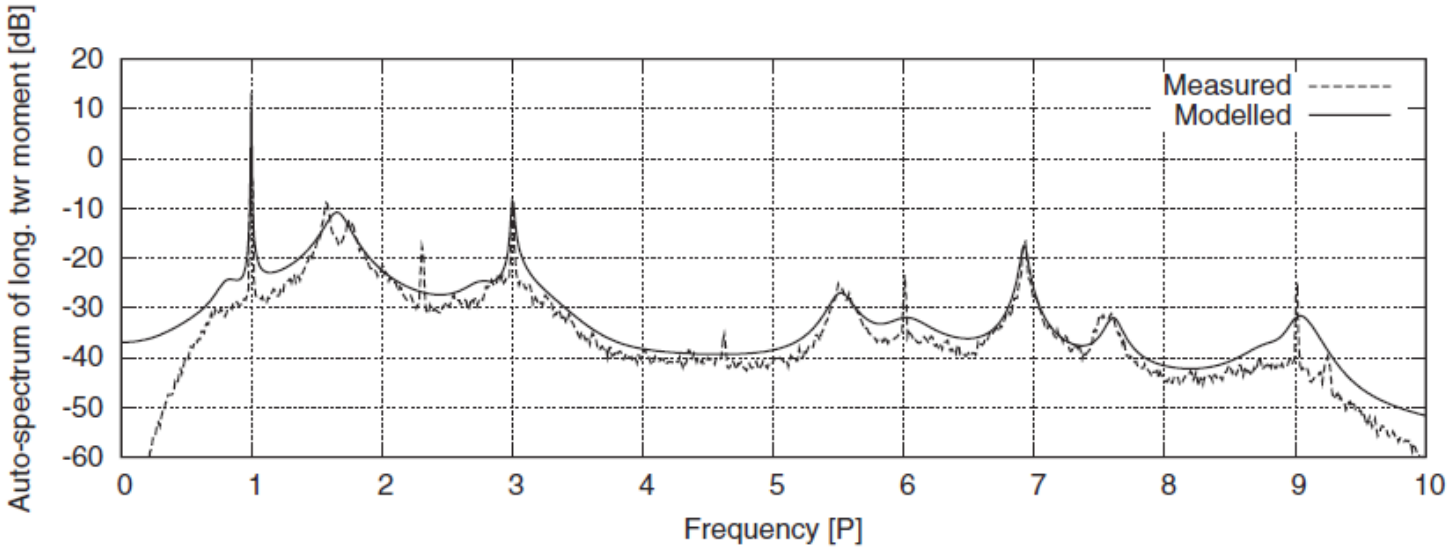


Validation, (Hansen, Sørensen et al. 2006)



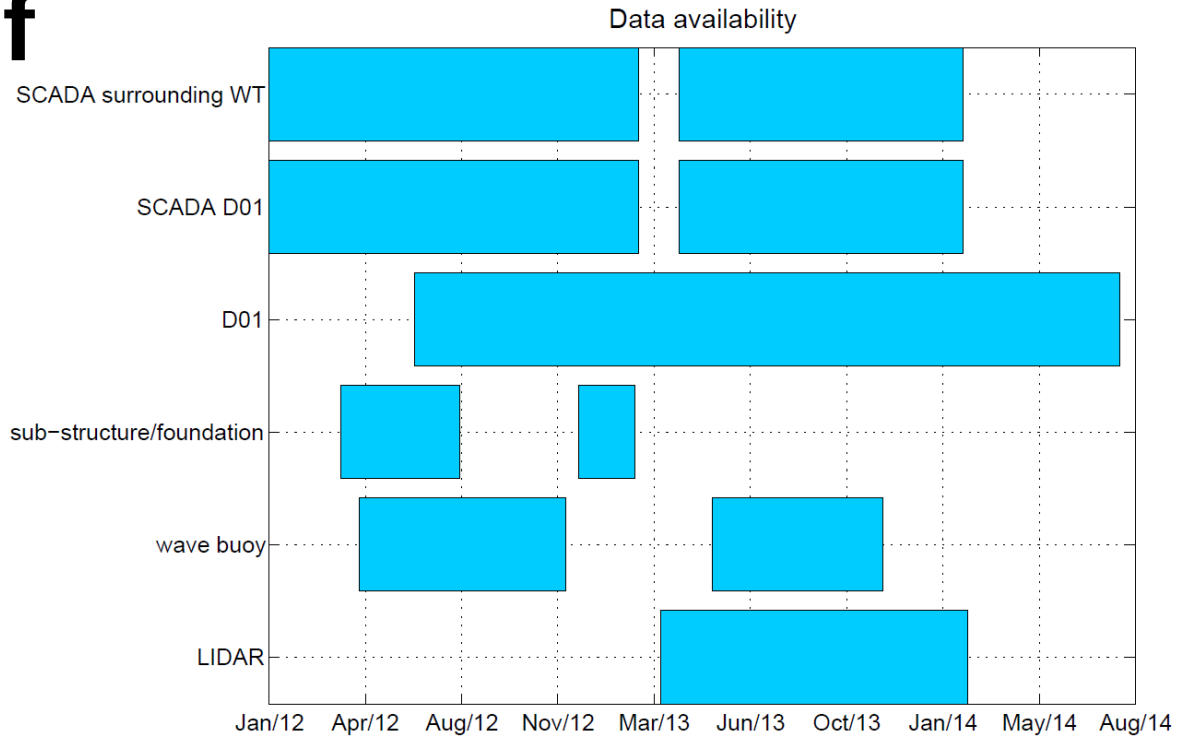
Estimate modal parameters (Damgaard, Ibsen et al. 2013)

Operational Modal Analysis (OMA)



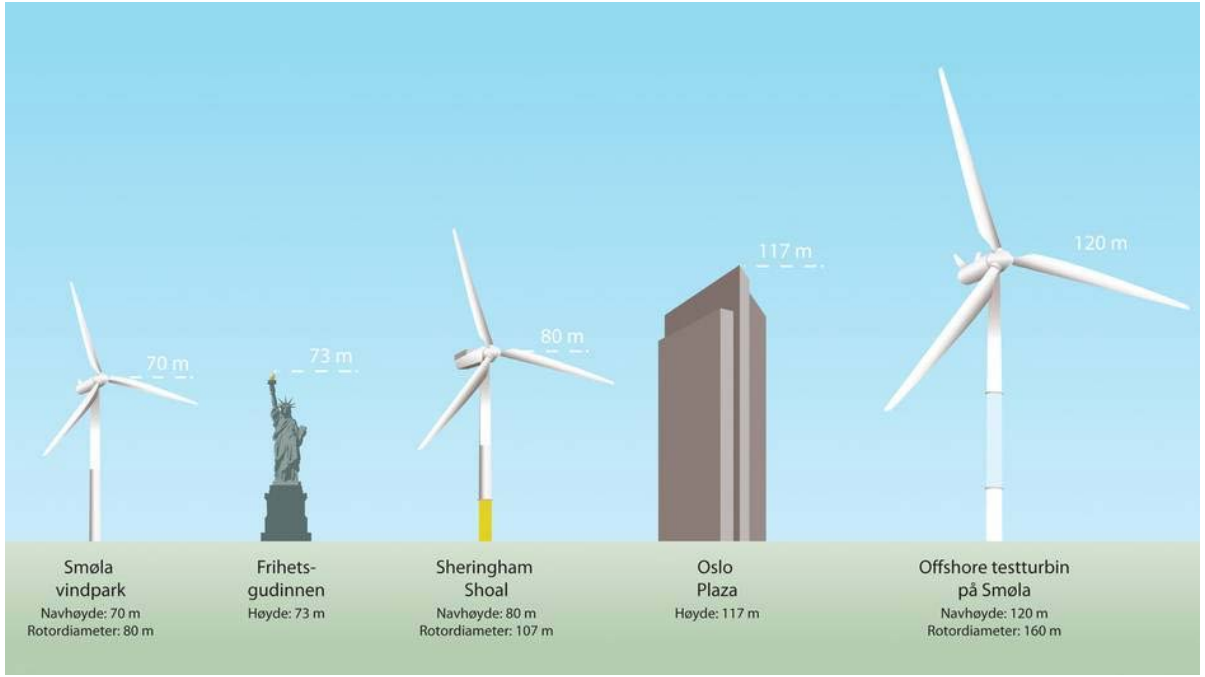
Measured and modeled auto-spectra for the longitudinal tower bending moment. The frequency axis is scaled with the mean rotor speed of 17.3 rpm. (Hansen, Thomsen et al. 2006)

Availability of instruments



From (Koukoura 2014)

Smøla test turbine



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Questions??