

ENERGY – RENEWABLES CERTIFICATION

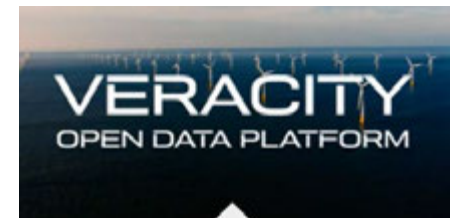
Presentation of JIP – Validation of Turbulence Models - 4th Workshop on Systems Engineering for Wind Energy

Sept 2017, Copenhagen

DNV GL Renewables Certification

Motivation

- Large variations are seen in the **fatigue loads** used for the design of wind turbines and wind farms based on internal investigations. The variations occur because the methods used for the establishment of the turbulent wind field allow a **number of choices** to be made which can lead to **differences of up to 20-30%** in the calculated fatigue loads.
- We set up a **Joint Industry Project (JIP)** – various different partners, with different contribution and all have the same target!
<https://www.dnvgl.com/news/dnv-gl-brings-wind-industry-leaders-together-in-validation-of-turbulence-models--77607>
- References
 - “BICEPS - testing of leading edge erosion protection systems
 - “Bolted connections”
 - “Coupled analysis of floating wind turbines”
 - EU Project on Floating wind turbines LIFES50+



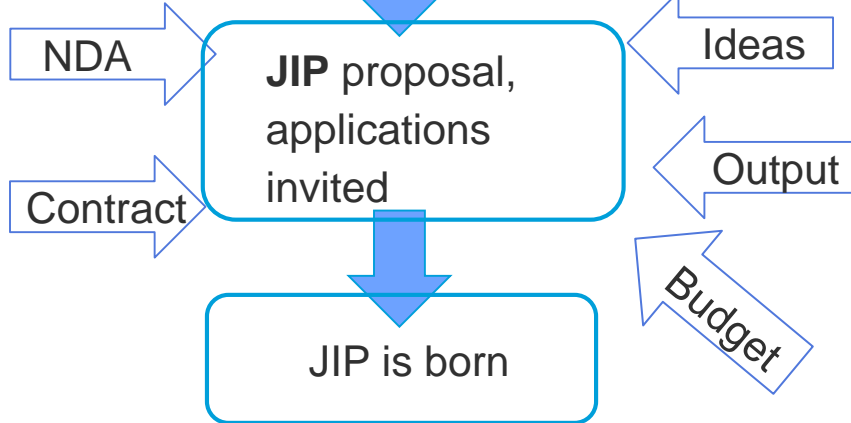
JIP Overview



JIP „Validation of turbulence models“

- 1. Collect the data*
- 2. Process the data*
- 3. Run sensitivity studies*
- 4. Recommendations for application*

Alignment on



Private and confidential

GIP – Global Innovation Project

Challenges

Get the Data!

Many site measurement exists, in different format, in different quality, owned by different parties

14+ sites (onshore/offshore) / > 300GB of data

Align on the methods how to process the data!

Data processed by different partners on different levels

Get the same results with the same data → round robin

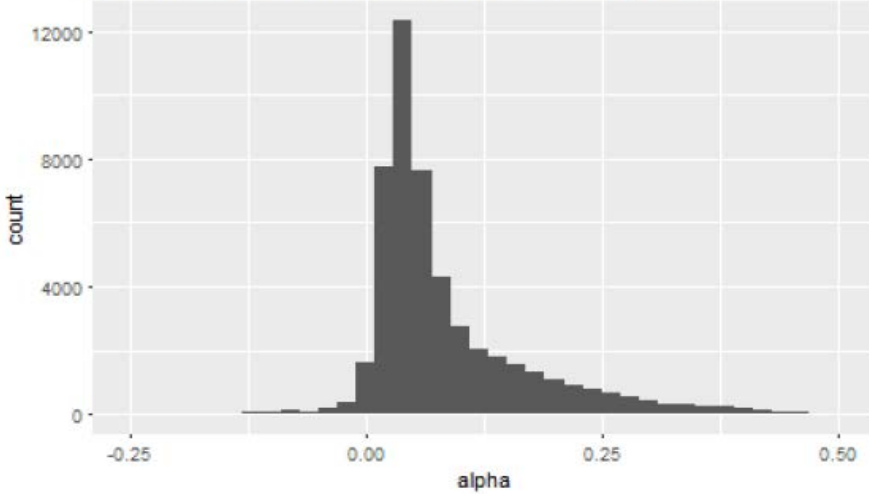
What to look at, within a limited budget!

We have many options and directions

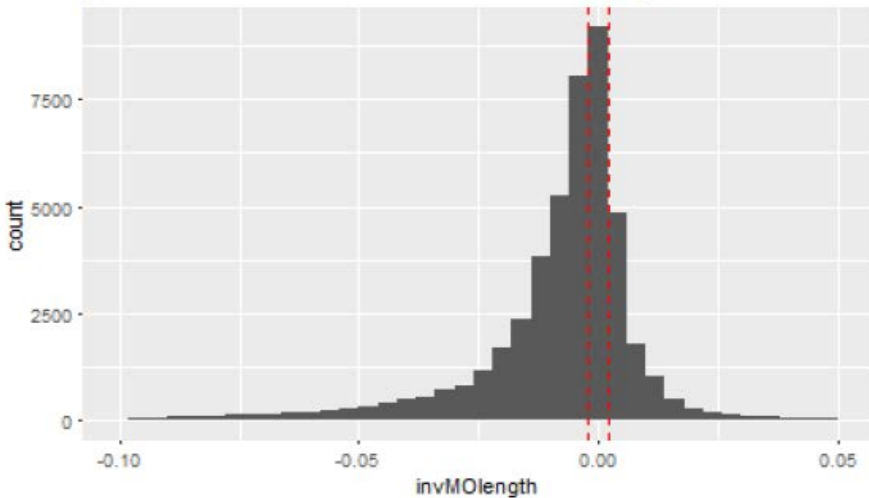
Communication & Sharing of Information

JIP Turbulence Models – Results

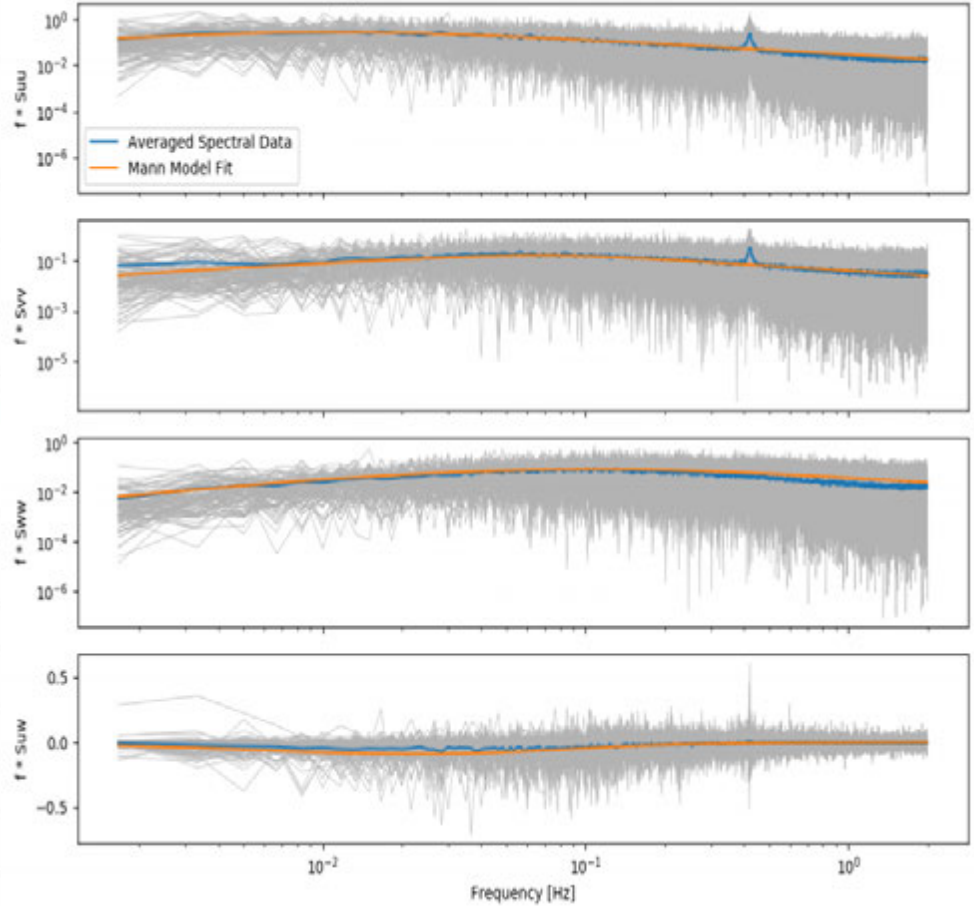
Ijmuiden Tower - distribution of wind shear exponent



Ijmuiden Tower - distribution of inverse MO Length



Stability: neutral Wind Speed Bin: 14.0 - 16.0 m/s 108 files
 $ae^{(2/3)} = 4.364e-02$ $L = 4.352e+01$ $G = 3.711e+00$



Thank you!

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