R&D Webinar - OROWSHI Project Outcomes

Towards new standards for the design of the offshore wind turbines exposed to topical cyclones

With the financial support of:

Feedback from the industry on the project outcomes

Who we are:
EDF Power Solutions

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Existing EDF Power Solutions' offshore wind farm projects

https://parc-eolien-en-mer-manche-normandie.fr/les-acteurs-du-projet-2/

Making the new electric world possible, for everyone, in all our geographies.

- A subsidiary of EDF
- Active in over 25 countries
- Contributing to EDF Group's ambition:
  - Contribute to the decarbonization and global performance of electrical systems
- 8000 employees worldwide
- €7 billion in revenue
- 71 TWh gross of electricity produced

Multi-technology experts

EDF UK R&D

EDF power solutions

Who we are:
EDF R&D and UK R&D

R&D THROUGHOUT THE WORLD

With 3 centres in France and 6 abroad, EDF conducts research both nationally and at international level.

Within EDF UK R&D, we lead a MetOcean work package in convention with EDF Power Solutions, within which we participate in FEM OROWSHI.

What is EDF UK R&D?

- Local R&D entity of EDF in the UK, supporting all EDF UK families, EDF R&D and EDF Group entities since 2012.
- A well-established R&D Centre part of EDF Group R&D wider community

How do we help the business?

- Contribute to strong operational performance and change
- Support future growth and business development, incubate new opportunities
- Leverage the local ecosystem of Research and Innovation to promote EDF UK's views and contribute to EDF reputation
- Enhance synergies between the 5 families of EDF UK and with EDF Group entities

Motivation for participation

Why is EDF PS interested in better characterising wind and waves?

EDF Power Solutions are multi-technology experts, delivering solutions across the entire value chain:

- Early-stage project development
- Development
- Engineering & Construction
- Asset management
- Operation & Maintenance

Extreme wind and waves have an impact at each stage this value chain.

Design basis

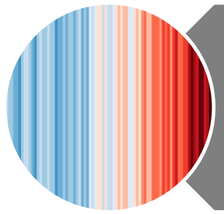
- e.g. foundation and floater type choice, material quantities, cables, etc…

Construction planning

- e.g. vessel selection, assembly timing

Operation & Maintenance

- e.g. wear and tear, replacement, scheduling, turbine control



Climate Change

- Long-term resilience planning
- Updating present-climate assumptions

Use cases for OROWSHI model in EDF

Extreme wave characterisation for design basis

- It is important for us to understand how extreme winds and waves can become during powerful typhoon conditions.
- We cannot always rely on single timeseries from buoys and met masts, since they may not have been deployed for long enough or may need to capture the whole area not just one point.

Adhering to standards:

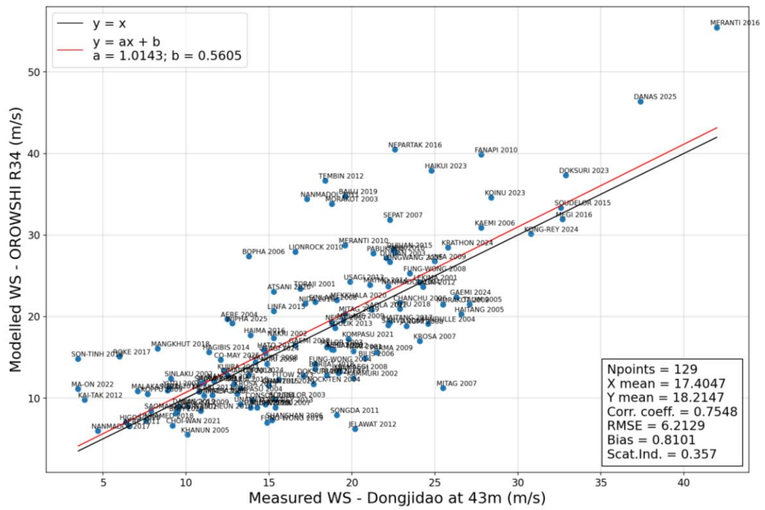
- IEC 61400-1 Annex J
- IEC 61400-3-1 Annex I
- IEC 61400-3-2 Annex I
- DNV-ST-0437 Section 3.5.20 & 21
  - Need for 500-year return levels
  - Recommendation to rely on Monte Carlo approach (focus on winds, clarity needed on waves)

Example of application:
Comparison of model output against observations at Dongji Island

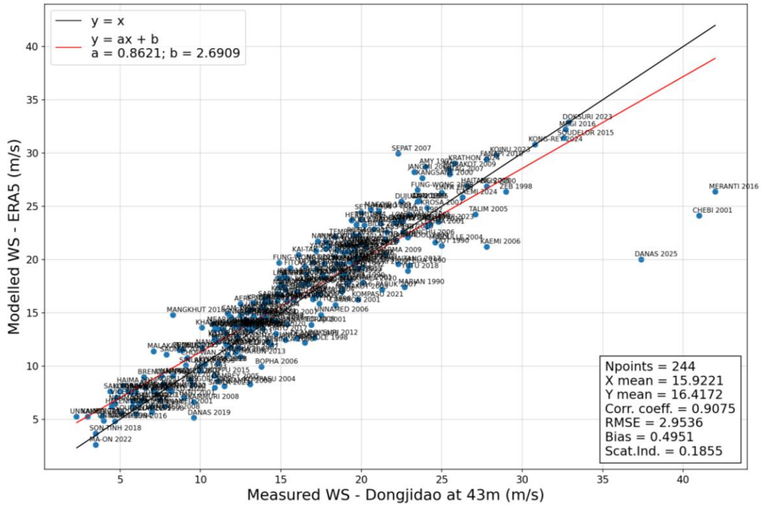
Good correlation, with some systematic overestimation in windspeeds in OROWSHI parametric model.

- Comparing large catalogue of typhoons
- Good correlation with observations.
- **Some systematic overestimation in windspeeds in OROWSHI parametric model**, with higher variance than when comparing ERA5 with observations.

Wind speed – OROWSHI R34 vs observations (Dongjidao)



Wind speed – ERA5 vs observations (Dongjidao)



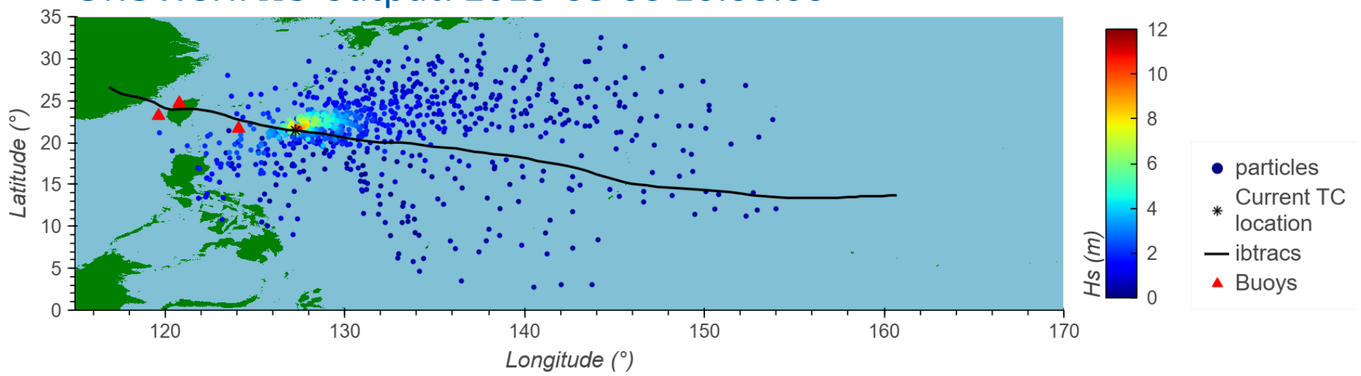
Observation location

Examples of use:
Characterisation of Typhoon Soudelor (2015)

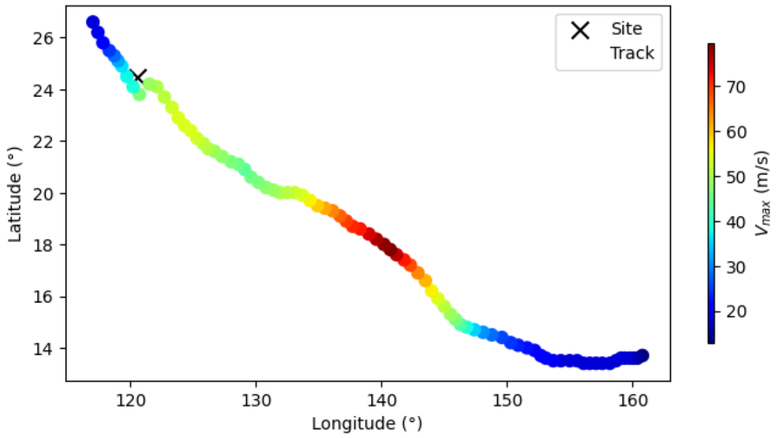
(Ongoing) We have been using the OROWSHI model to generate a large amount of synthetic data to compare to observations and hydrodynamic modelling of Typhoon Soudelor (2015) in the Taiwan Strait.

- Soudelor was one of the most powerful typhoons on record, and swept through the Taiwan Strait in 2015.
  - It provides a suitable extreme test case.
- Wind source: iBTrACS
- This work has so far identified key differences between our modelling techniques, and use cases for each, including the OROWSHI app.
- Adjacent data point values can vary considerably raising questions when making comparison to in-situ observations.

OROWSHI Hs-output: 2015-08-06 16:00:00



V_{max} along storm track



Looking forward:
Development and refinement priorities

Current performance

- The model currently performs well in offshore environments, with accuracy decreasing closer to the coast.
- A portion of existing methodology is already aligned with IEC and DNV standards, which is important for developers and end-users.

Future directions

- Strengthen confidence in using model for near-shore applications.
  - With improved implementation of **coastal topography**.
- Build on promising results from Phase 1 as the next phase progresses.

We are excited and grateful to have been a part of this project.

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Thank you for your attention!