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OPEN-ACCESS SIMULATION DATASET

FLOATING WIND TURBINE DEEPCWIND OC4 SEMI-SUBMERSIBLE IN WIND AND WAVES

1. Introduction

Global simulation results of a reference floating offshore wind turbine (FOWT) platform are made publicly available as part of the Energy Transition Fund (ETF) BEL-Float project.

With a total of 1152 simulation cases, the dataset is also used by other BEL-Float researchers for further research and the development of various numerical tools corresponding to simulating an FOWT platform.

2. Methodology

An open-source aero-servo-hydro-elastic software, namely OpenFAST (v3.5.3) is used to perform the global numerical analysis of a reference FOWT. The code is adapted to include more simulation outputs of the Morison drag force. The combinations of the variables are shown in Table 1 and Table 2. This research uses the DeepCwind OC4 semi-submersible platform paired with the NREL 5-MW turbine, both are provided by NREL as an open-source OpenFAST numerical model. The mooring layout is shown in Figure 1 and Figure 2.

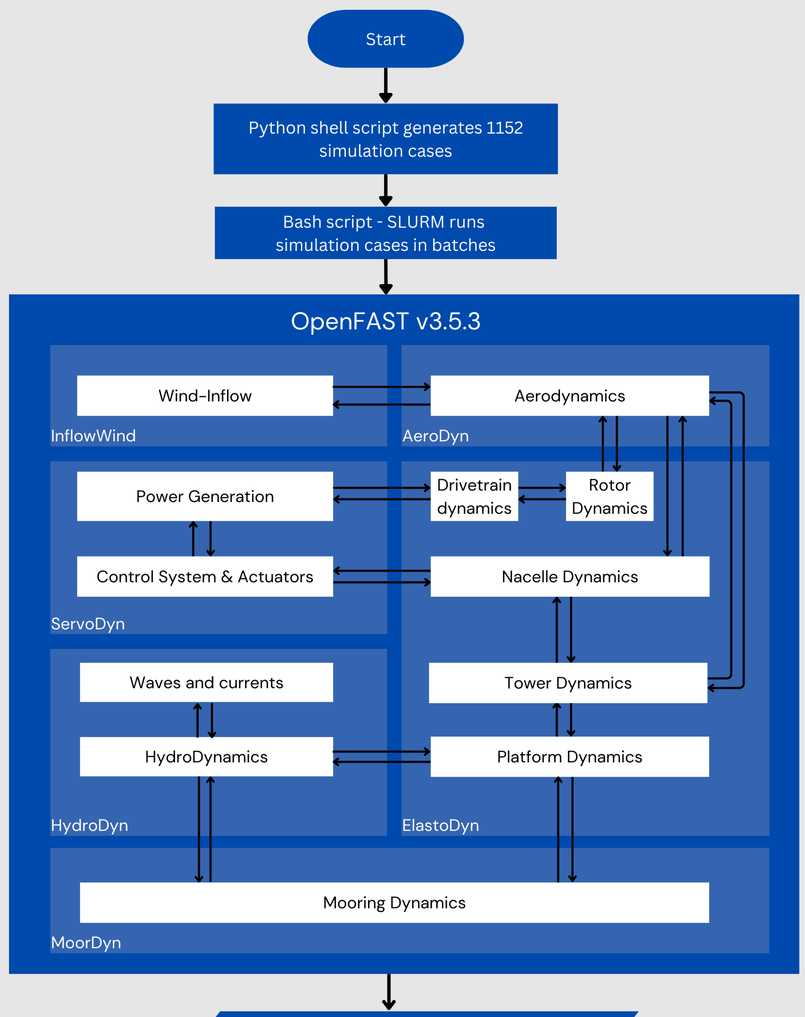


Table 1. Simulation matrix for the irregular wave cases. All the combinations of variables makes up a total of 768 simulation cases.

Significant wave height	Wave peak period	Wind speed	Wind type	Damaged scenario	Wind direction
[m]	[s]	[m/s]	[-]	[-]	[deg]
1.5	8	8	Steady	Operational	0
3	10	11	Turbulent	Fairlead 1 loss	30
4.5	12	13			45
6	20	20			

Table 2. Simulation matrix for the regular wave cases. All the combinations of variables makes up a total of 384 simulation cases.

Regular wave height	Regular wave period	Wind speed	Wind type	Damaged scenario	Wind direction
[m]	[s]	[m/s]	[-]	[-]	[deg]
3	8	8	Steady	Operational	0
6	10	13	Turbulent	Fairlead 1 loss	30
9	12				45
12	20				

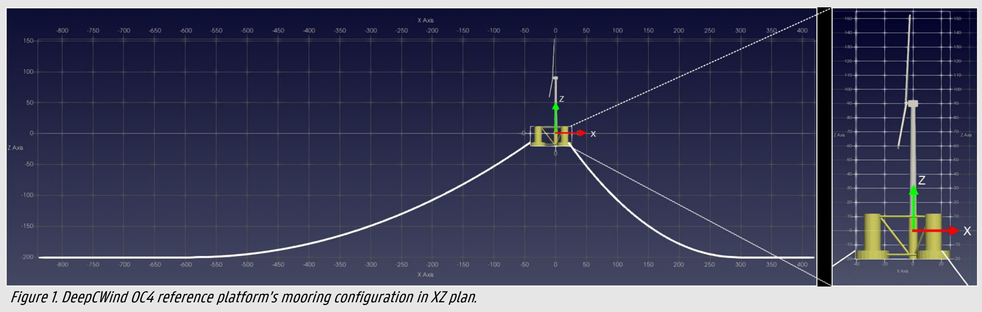


Figure 1. DeepCWind OC4 reference platform's mooring configuration in XZ plan.

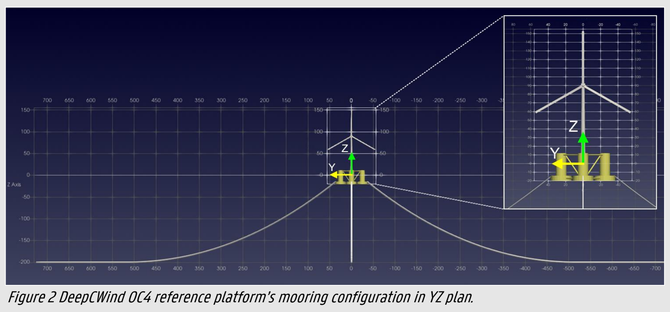


Figure 2 DeepCWind OC4 reference platform's mooring configuration in YZ plan.

3. Selective results and discussions

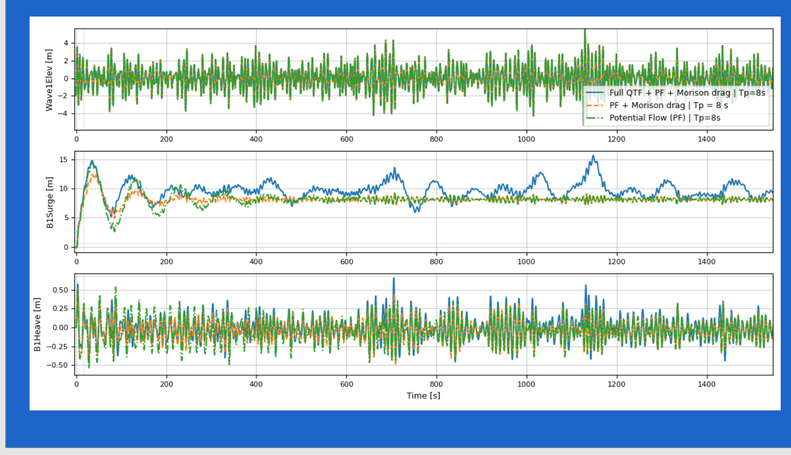
3.1 Influence of Second Order Wave Forces (QTF)

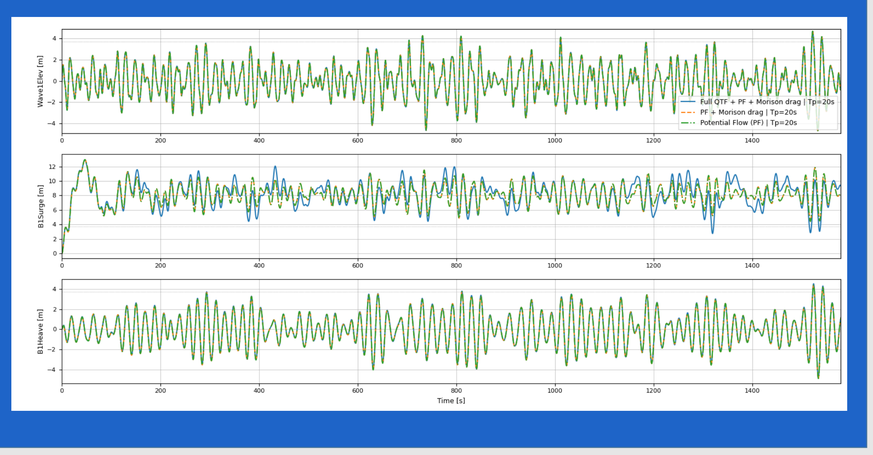
Significant wave height	Wave peak period	Wind speed	Wind type	Damaged scenario	Wind direction
[m]	[s]	[m/s]	[-]	[-]	[deg]
6.0	8.0, 20.0	11.0	Steady	Operational	0

- **Wave Peak Period of 8.0 s:**
  - Surge motion shows significant drift with QTF modeled.
  - Morison drag dampened transient responses.
  - Fairlead tensions increased due to the inclusion of QTF.

Wave Peak Period of 20.0 s:

- Lesser impact of second-order forces.
- Slight increase in fairlead tension and pitch moment with QTF.

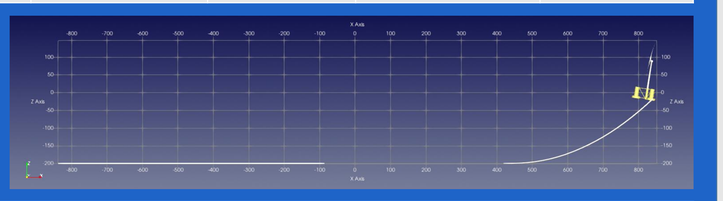


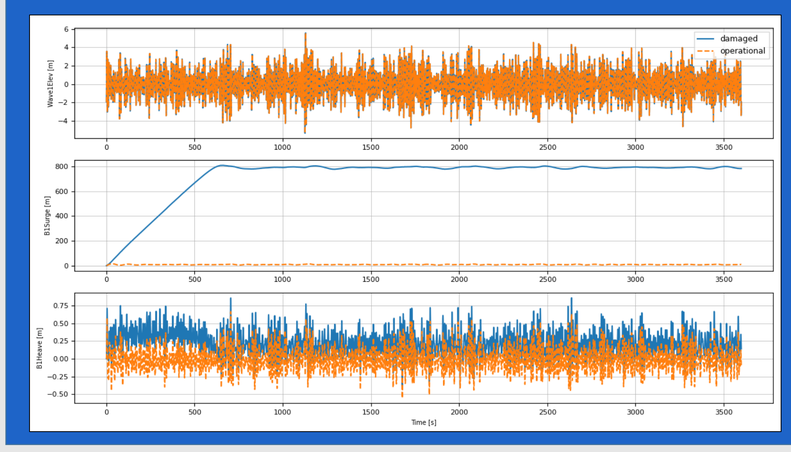


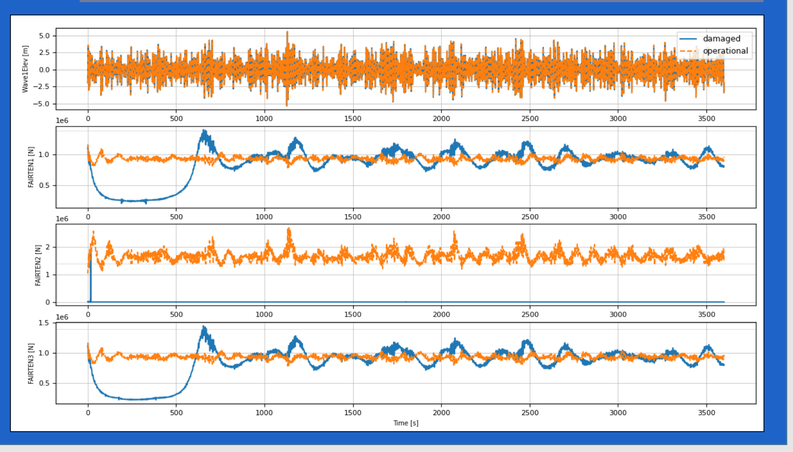
3.2 Damaged Scenario (Loss of Mooring Line)

Significant wave height	Wave peak period	Wind speed	Wind type	Damaged scenario	Wind direction
[m]	[s]	[m/s]	[-]	[-]	[deg]
6	8	13	Steady	Operational	0

- Platform drifts significantly (+800 m).
- Pitch amplitude increased by two-fold compared to intact mooring.
- Increased low-frequency loads in remaining mooring lines.







Scan to watch the simulation!

Scan to download the datasets!

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Partners: GHENT UNIVERSITY, VUB, PARK WIND JERA GROUP, 24SEA, MARLINKS decreasing cable risks

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BEL-Float Catalyzing the Belgian industrial expertise in floating wind through academic innovation

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