Methodology for floating offshore wind turbine Major Component Replacement (MCR) - Webinar

FLoating Offshore Wind Operations and Maintenance (FLOWTOM) project

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PARTNERSHIP:

FRANCE ENERGIES MARINES, EDF, Ifremer, IMT Atlantique Bretagne-Pays de la Loire École Mines-Télécom, INNOSEA Part of OWC, JIFMAR OFFSHORE SERVICES, SBM OFFSHORE, Shell, skyborn, SOFRESID ENGINEERING

With the financial support of:

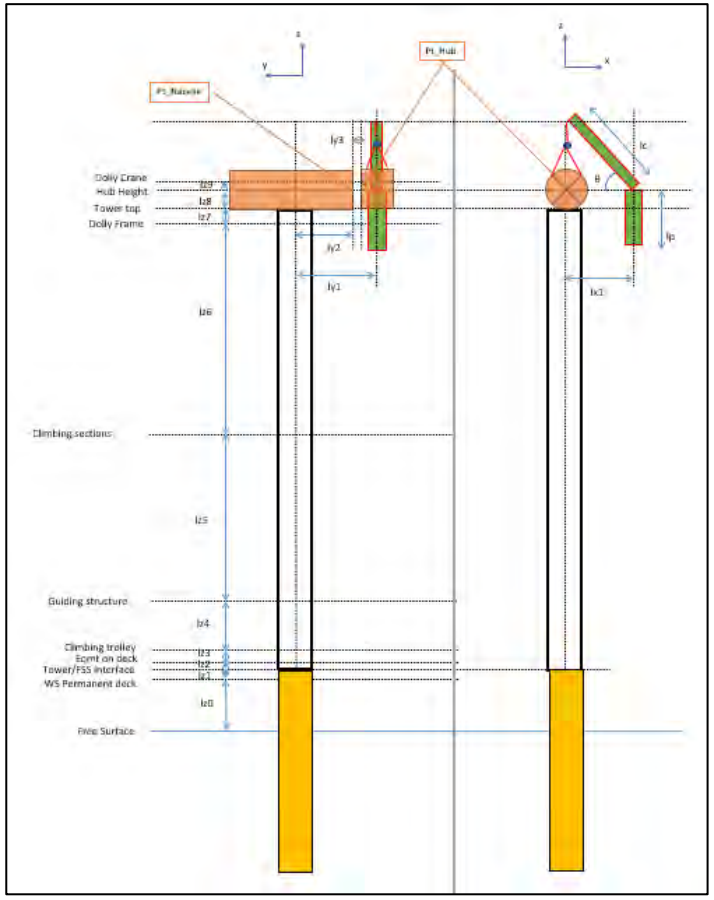
Région Bretagne

3. Case study : operability definition of MCR steps

Part III – Case of hub replacement at tower top of a floating offshore wind turbine

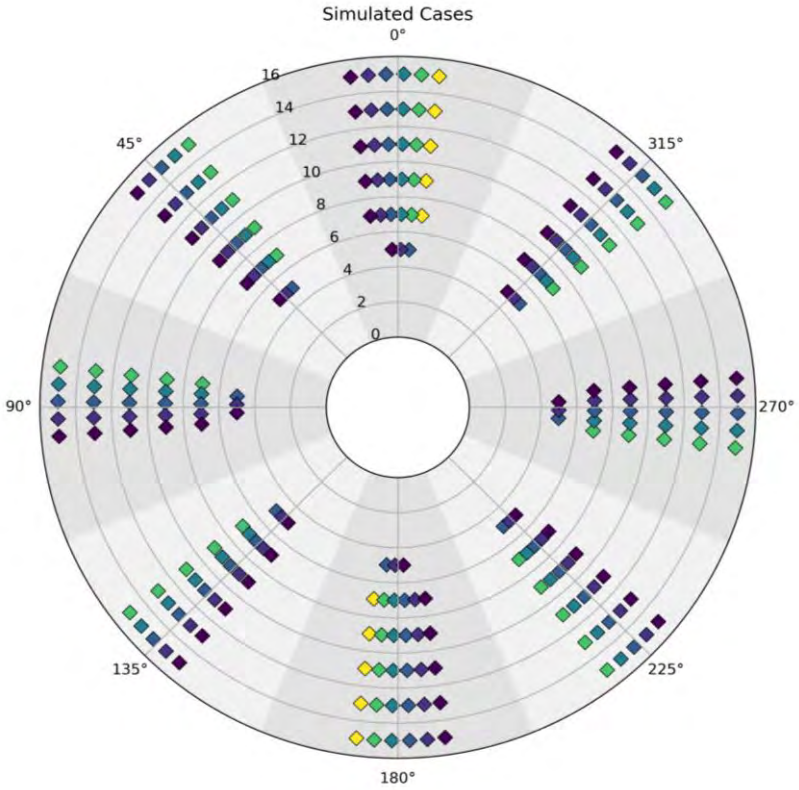
Pierre Alain Frémont, SBM Offshore

Case 3 : Hub replacement



FEM - VUS

SBM - F4W™



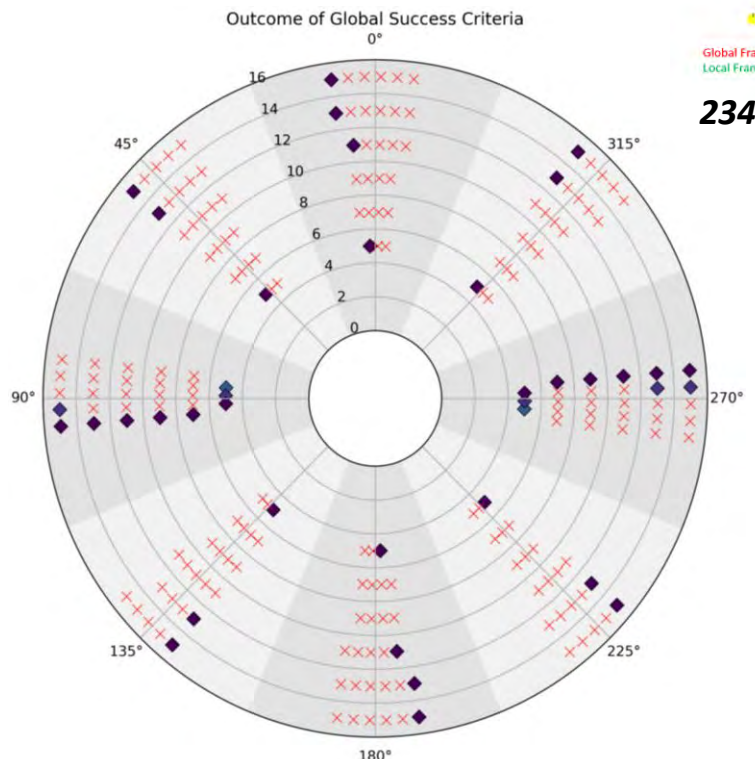
Case : 190 t lift weight, use of self hoisting crane

Model:

- Wind drag multiply by 2 due to the structure of the self hoisting crane and **No** 2nd order wave forces on FOWT

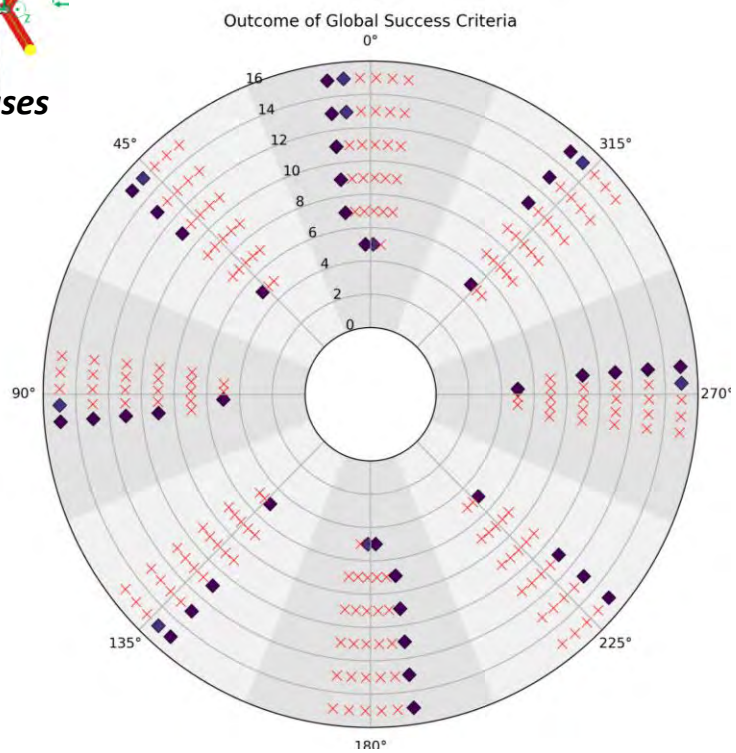
Case 3.1.2 : Hub replacement with tugger line

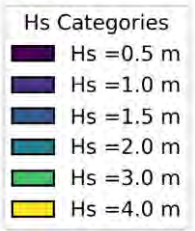
FEM - VUS

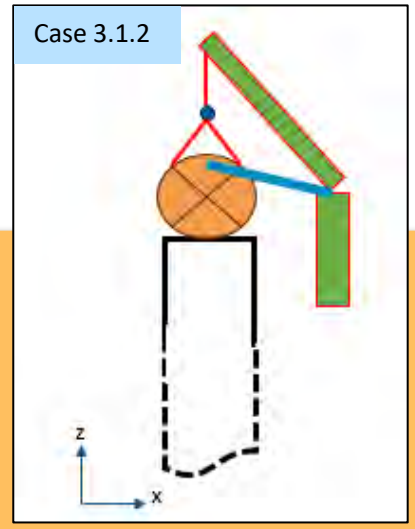


234 cases

SBM - F4W™



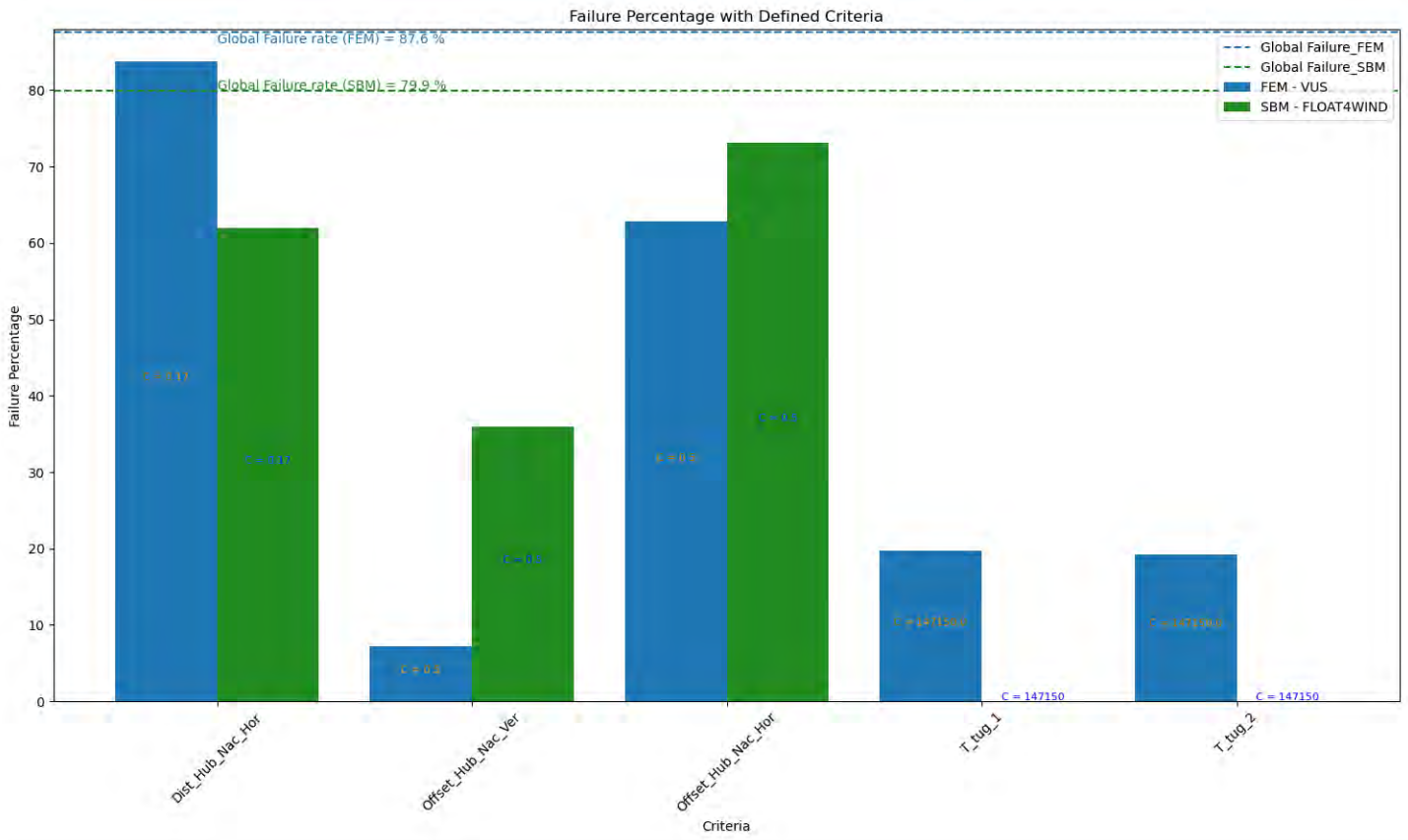


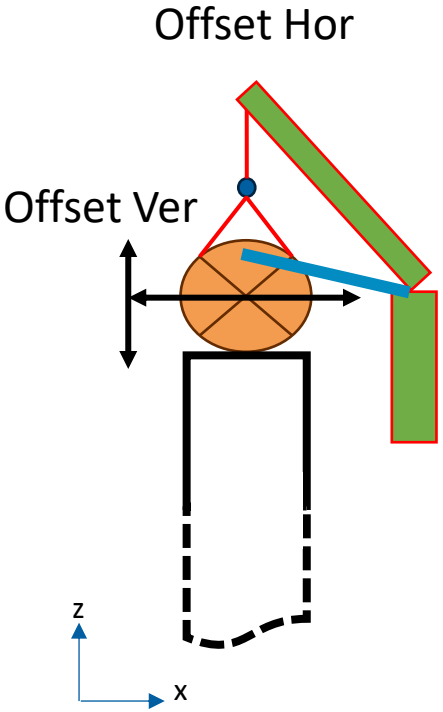


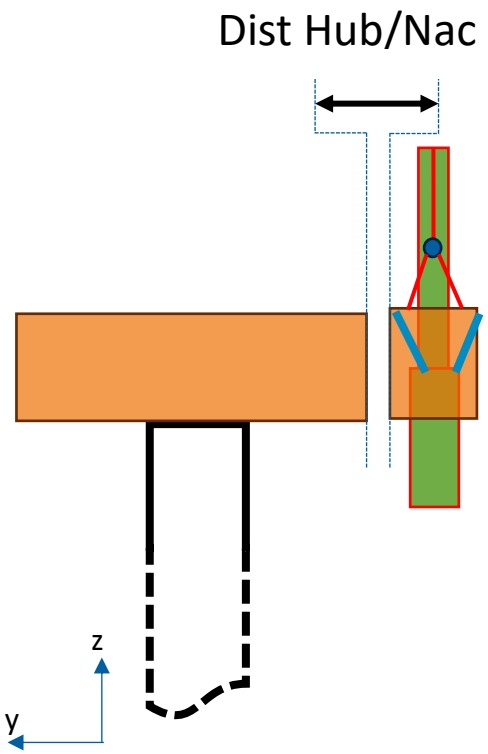
- **No preferential direction**
- **FEM: line control increases pack motions**
- **Low success near pendulum natural period (=7s)**
- Differences between floaters to be further investigated

Case 3.1.2 : Hub replacement with tugger line

234 cases







- **Hub horizontal offset and the distance between the nacelle and the hub are the main limiting criteria**

3. Case 3.1 : Hub replacement

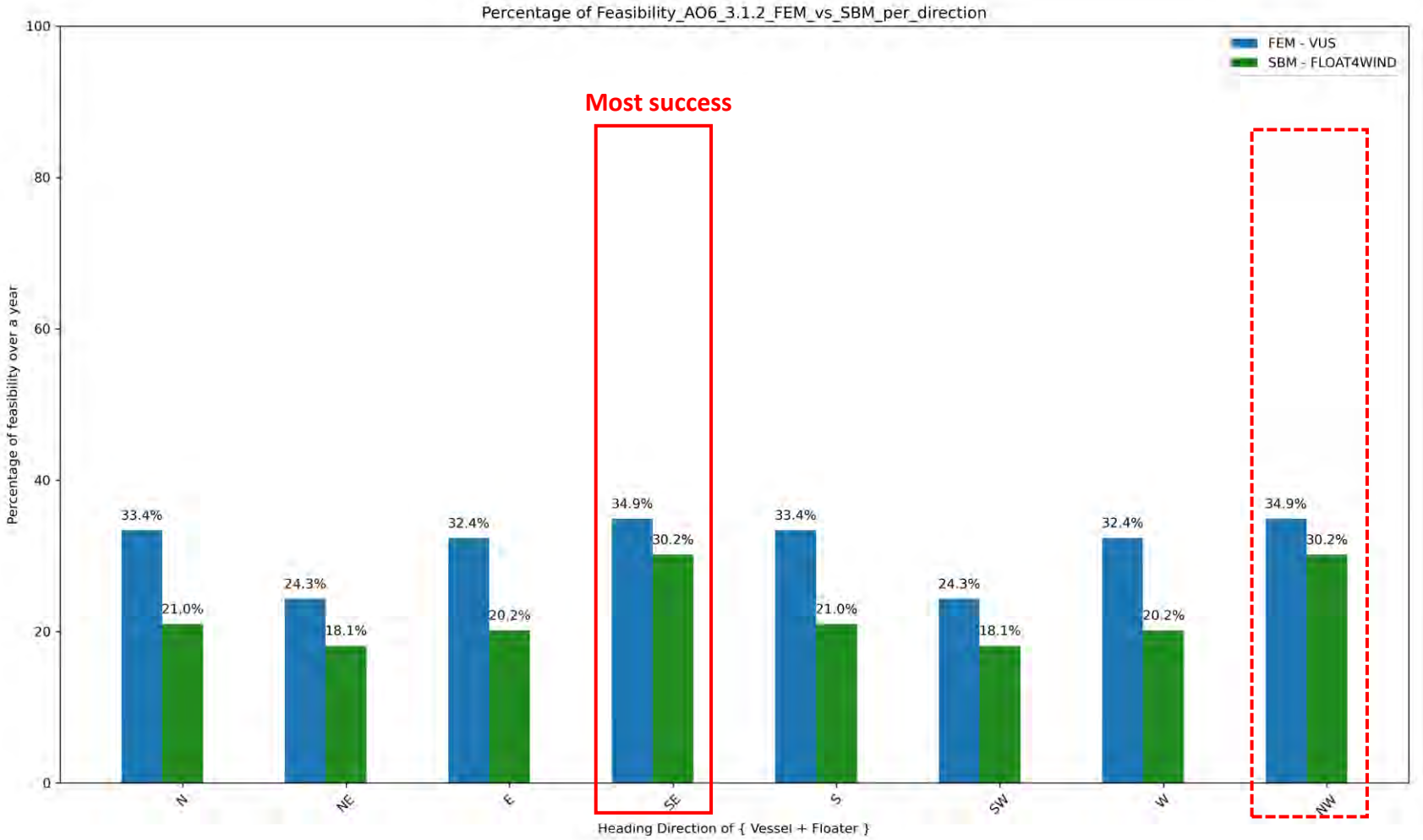
Global rate of success (% of simulations run : out of 234 cases)

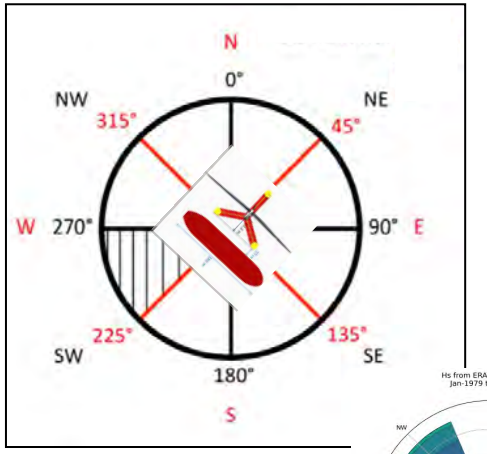
Cases	VUS	F4W
Hub replacement without tugger line	17 %	10 %
Hub replacement with tugger line	12 %	20%

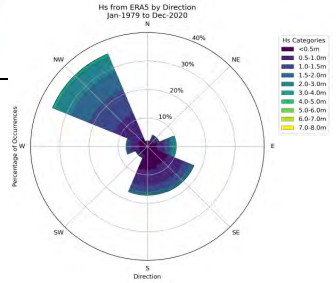
- **Using tugger lines improve the results for F4W floater** but not the case for the VUS (tugger modelling issue)
- **Levers for improvement** : design of tugger line (friction damping function for example), guiding system, operational limitations definition

Case 3.1.2 : Hub replacement with tugger line

/!\ operation duration not included in this operability analysis – default duration : 3h simulation







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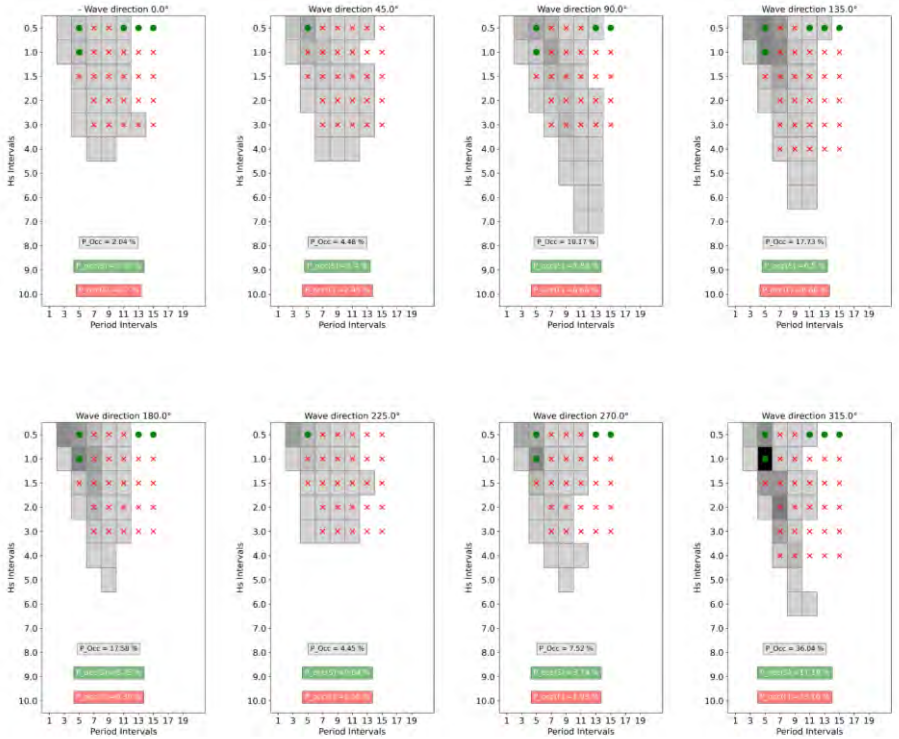
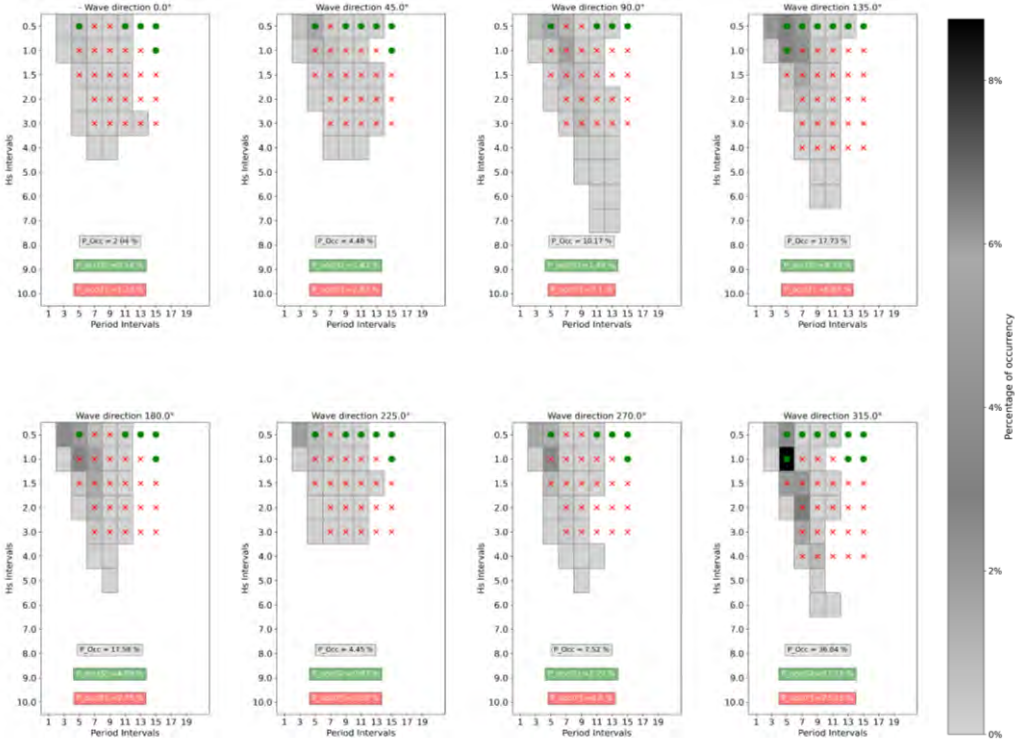
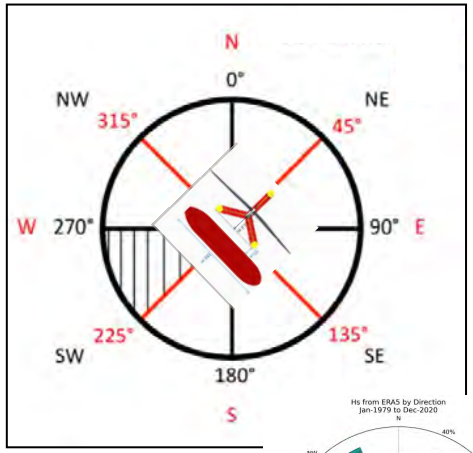
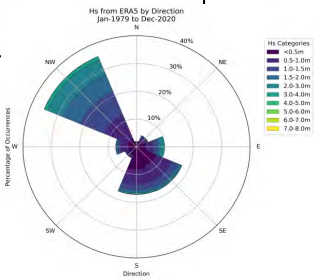
FEM - VUS



SBM - F4W™







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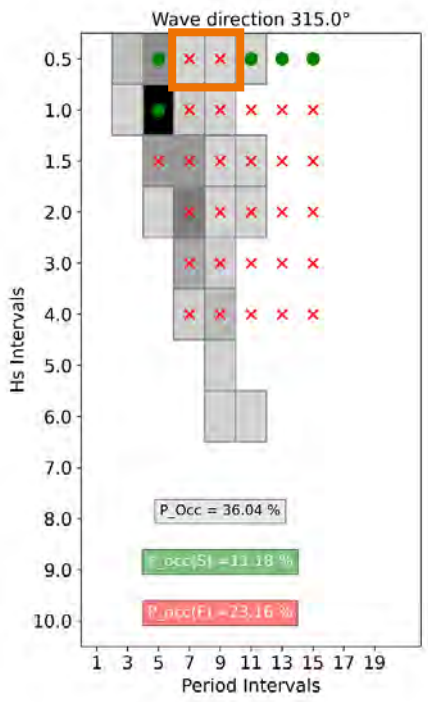
EDF - VUS



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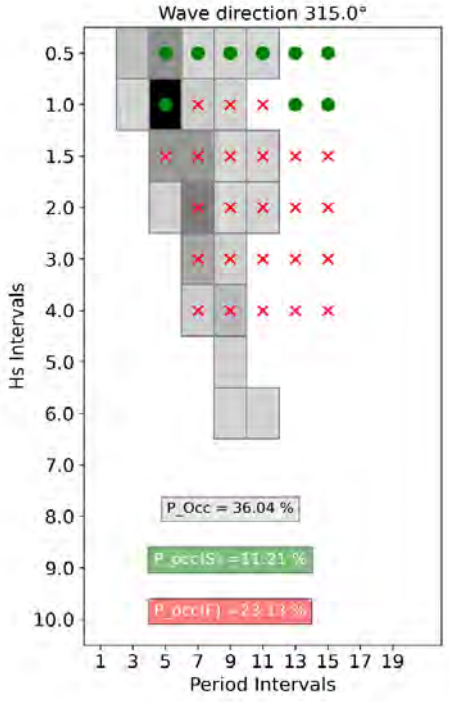

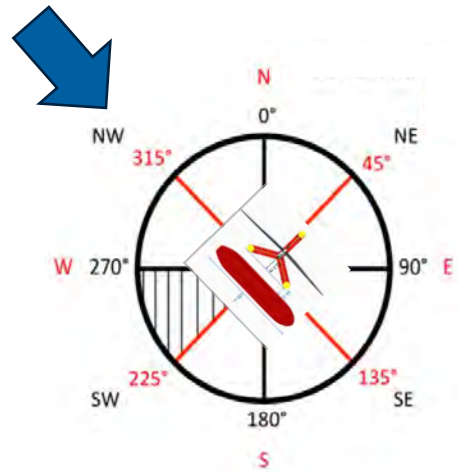

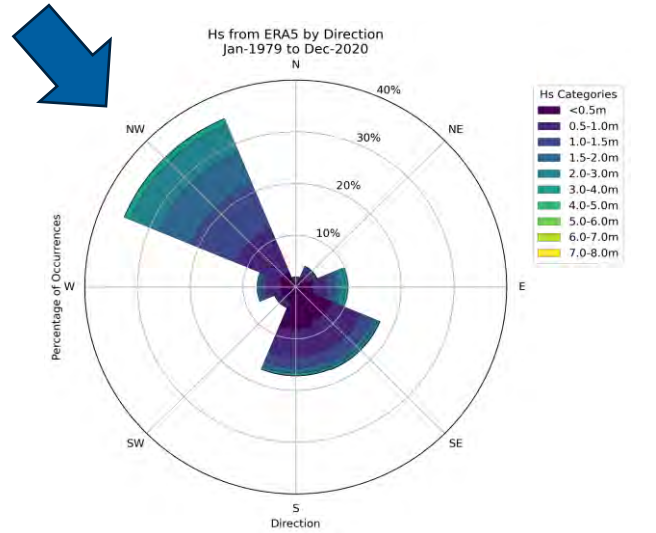

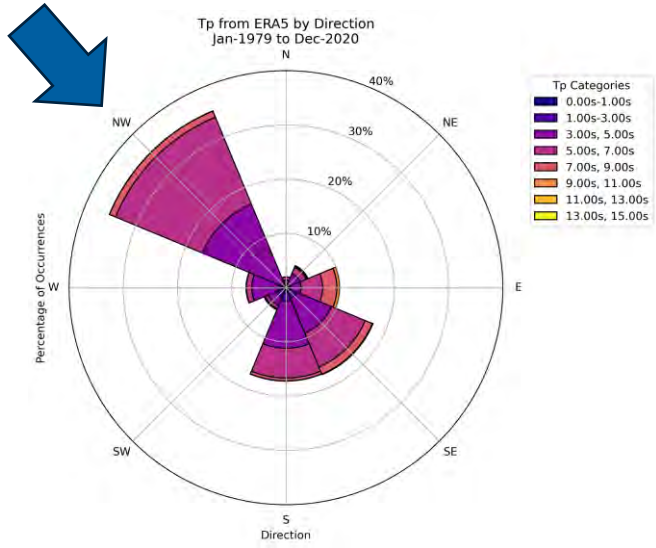

Case 3.1.2 : Hub replacement with tugger line

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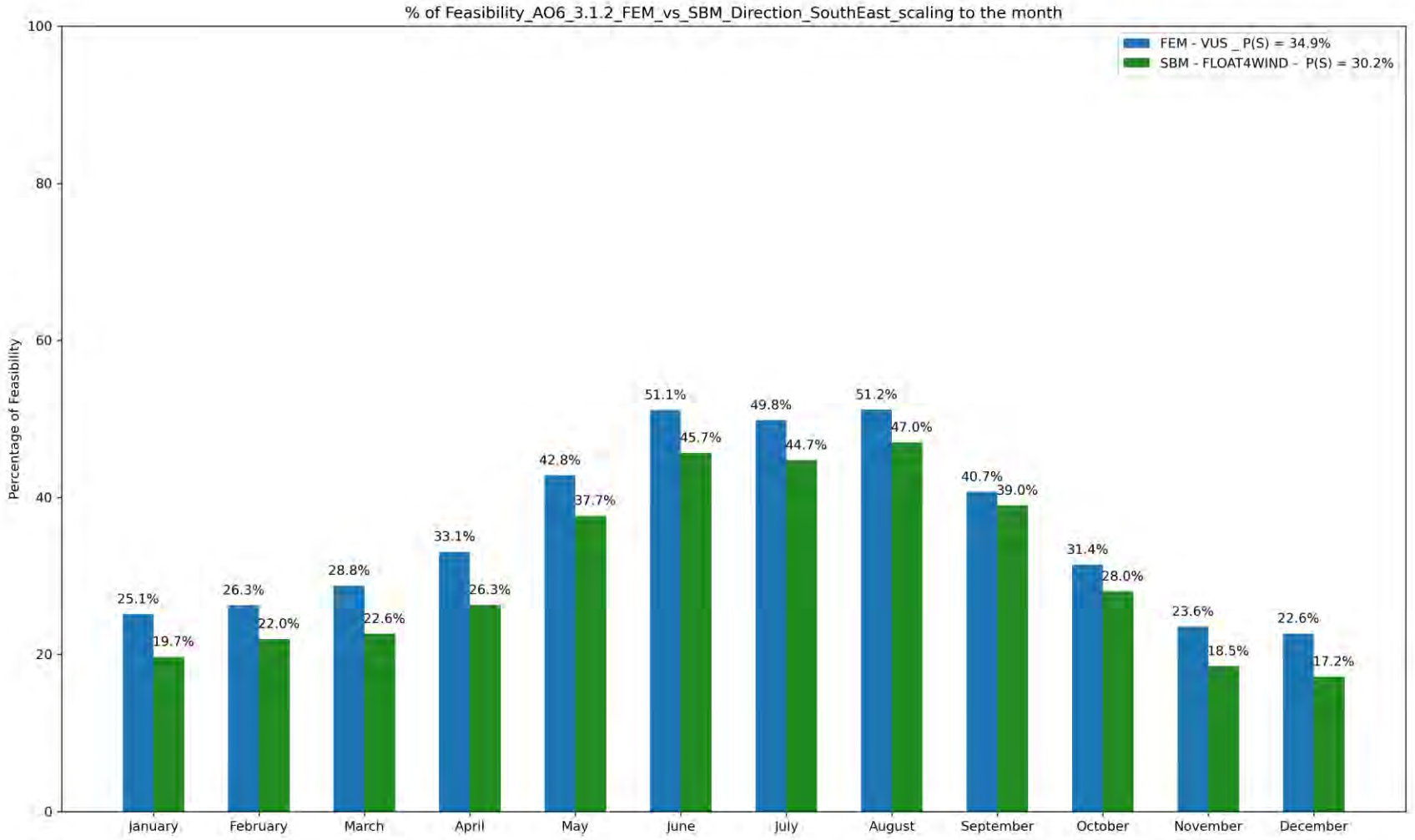

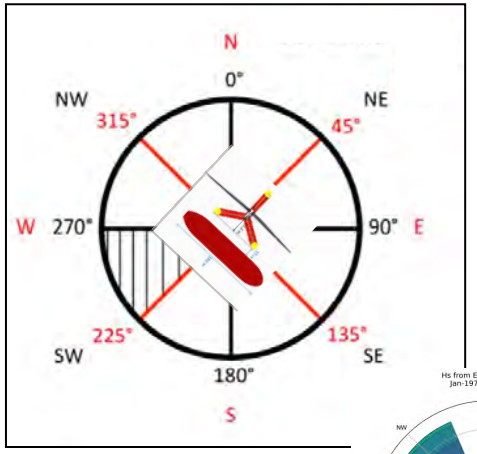

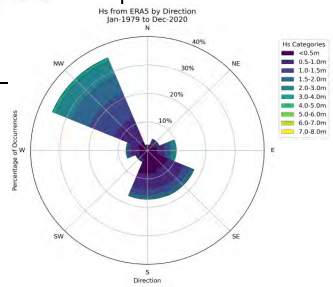

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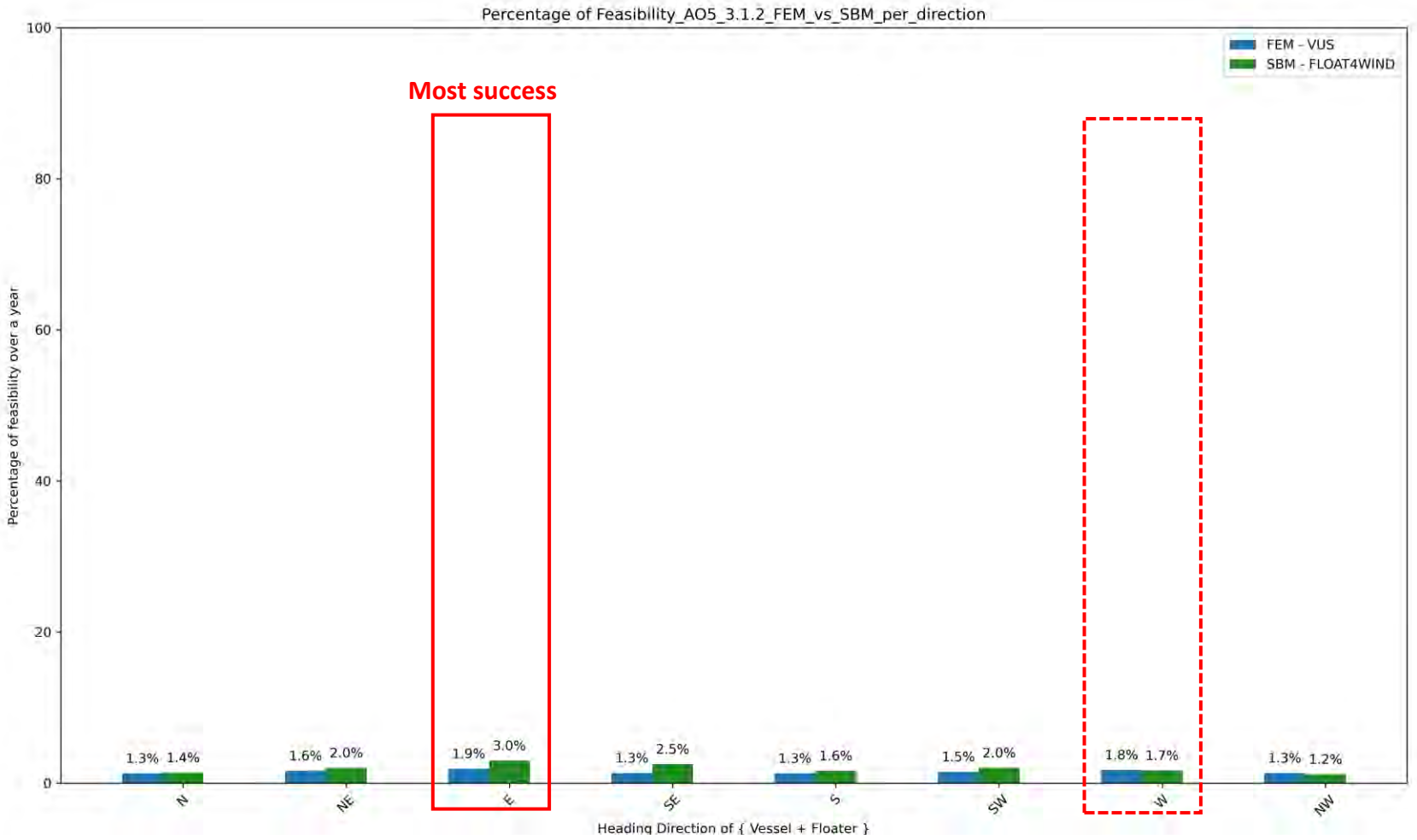

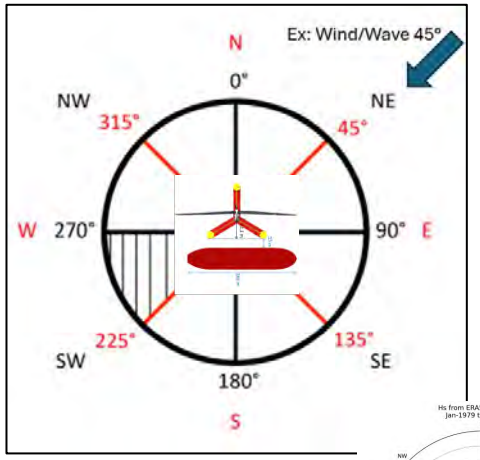

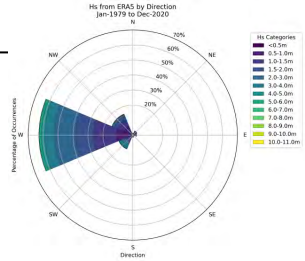

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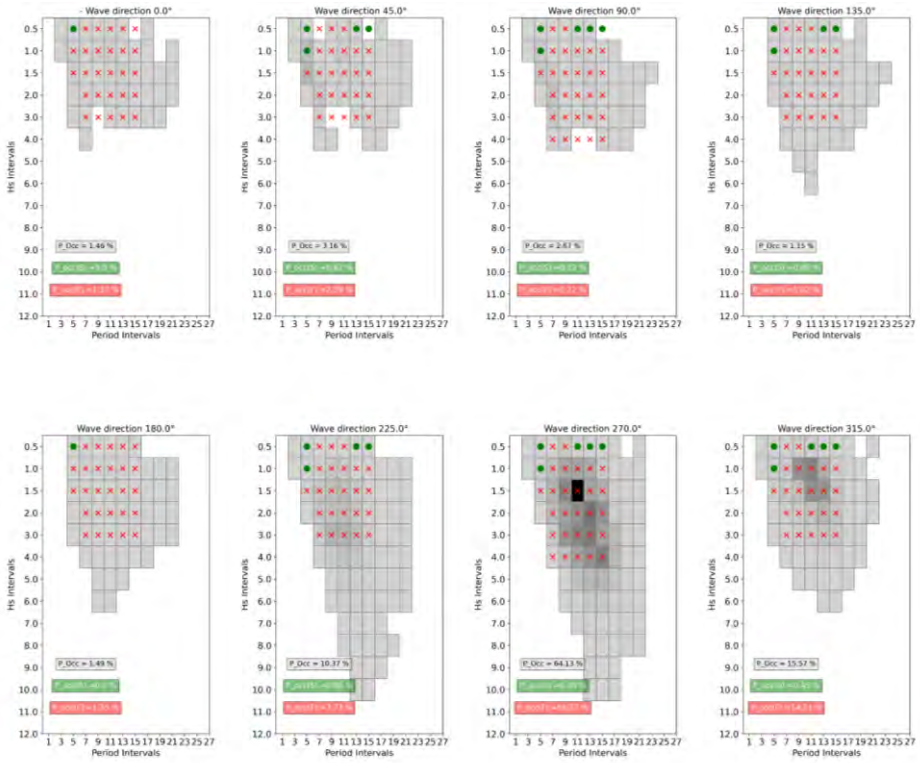
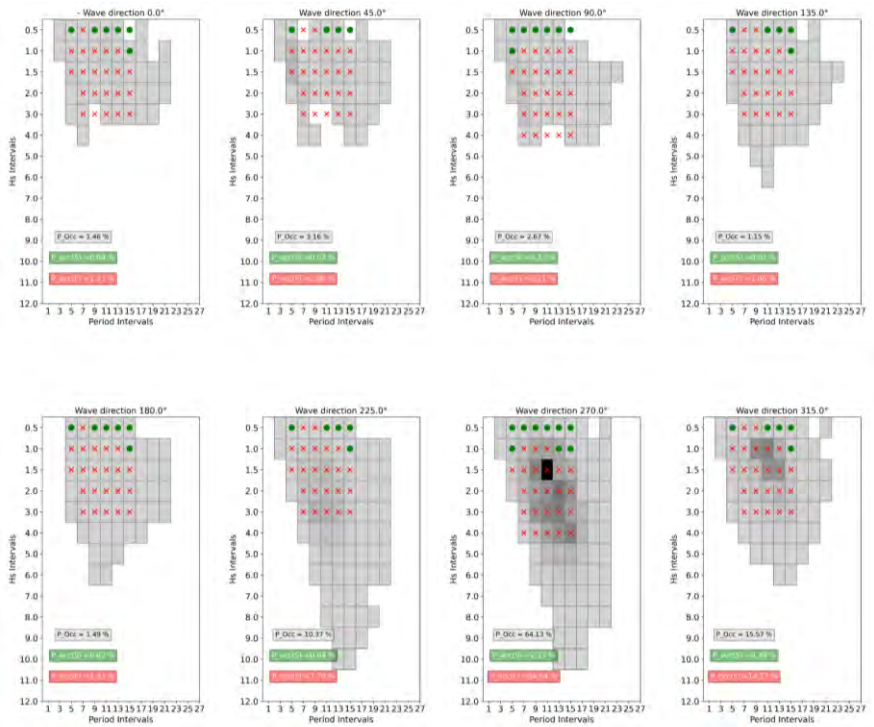
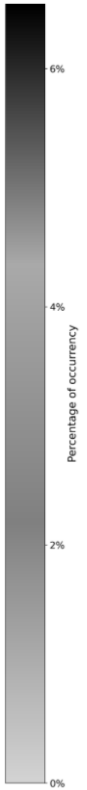
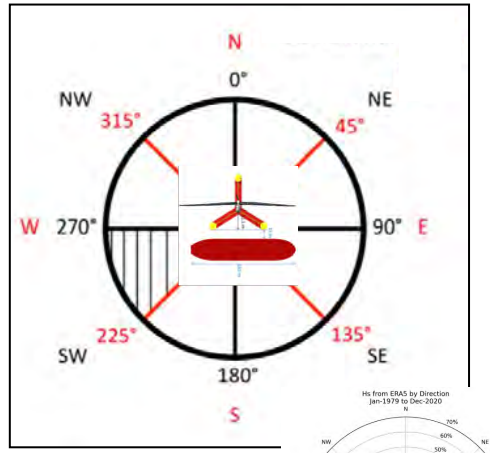
FEM - VUS

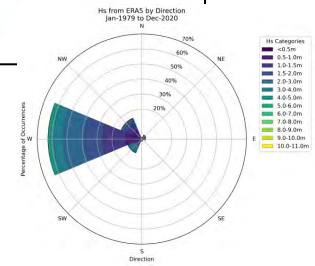


SBM - F4W™









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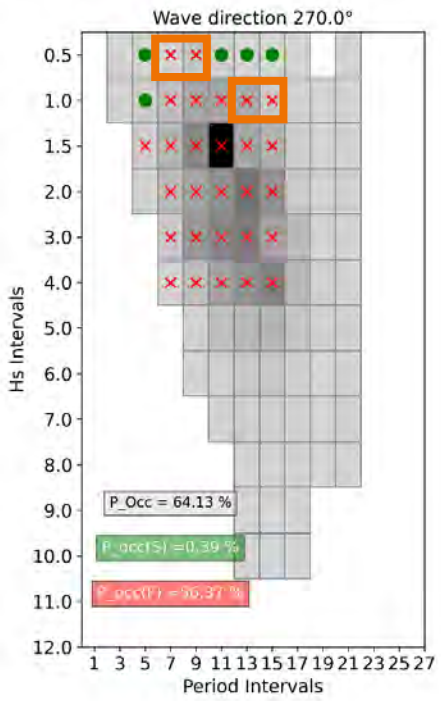
EDF - VUS



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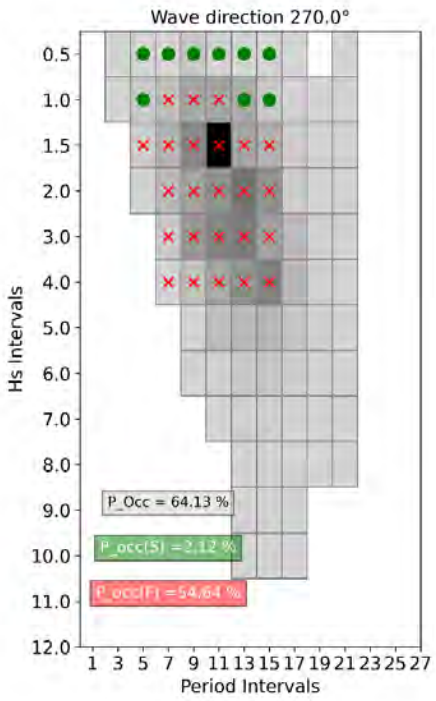

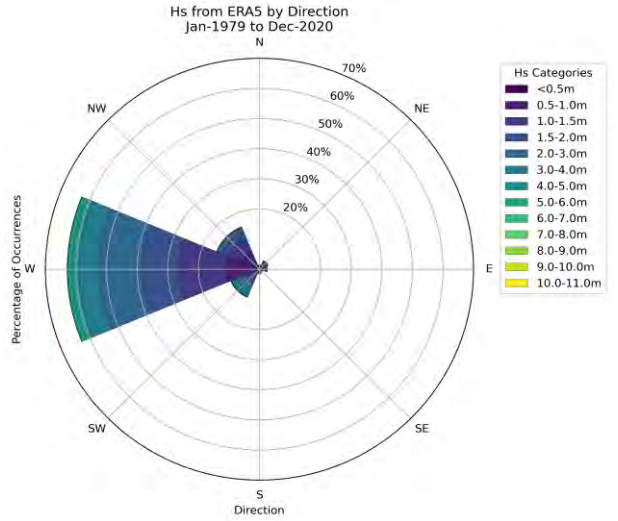

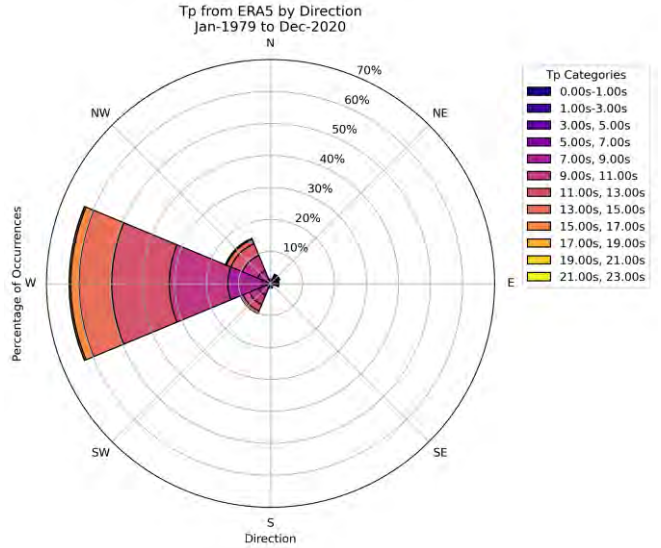

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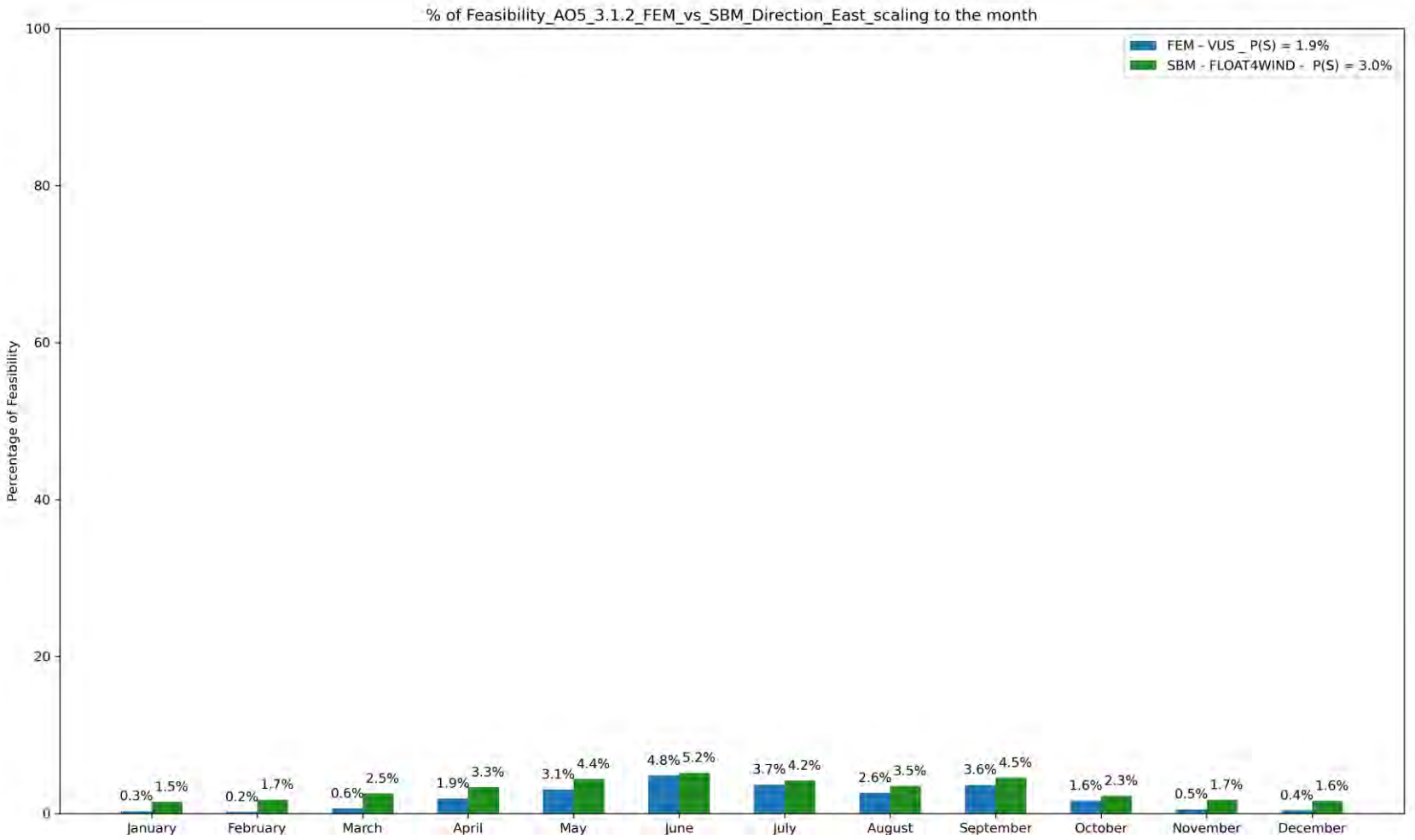

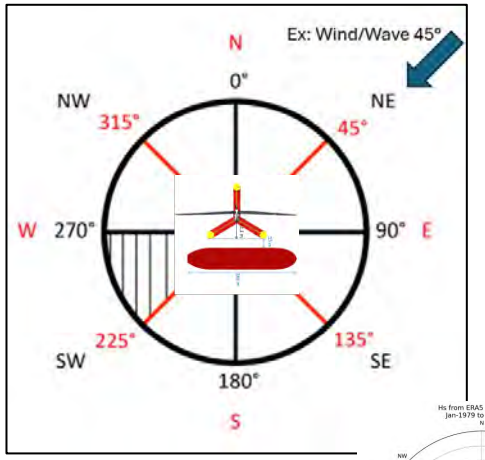

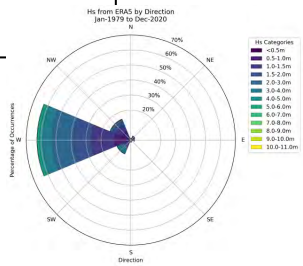

Case 3.1 : Hub replacement conclusions

Methodolody adaptation

- Input more precise operational limitations would result in finer rate of success
- The current simulations post treatment [3h + average on 10min windows] is not adapted to contact operations where a transitory state is reached.

→ **Way forward** : a criteria could be the stabilization time + post treatment on shorter time windows