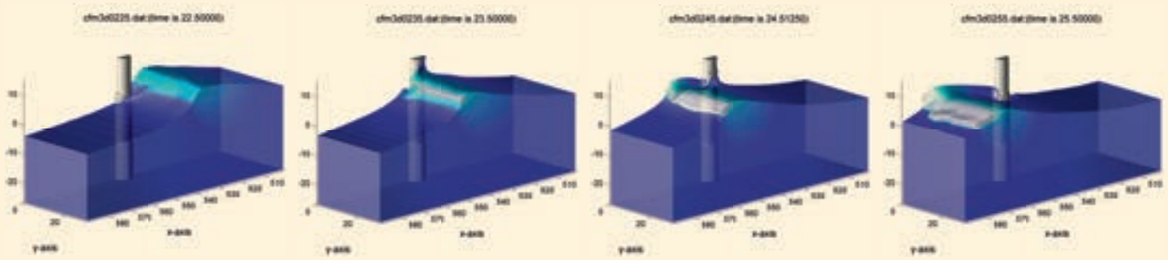
MARIN spearheads advanced wave impact modelling initiatives

Due to the complexity of wave impact modelling, MARIN is starting several new research initiatives.



Wave impact on fixed offshore wind turbine, simulated with ComFLOW

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The realistic modelling of wave impact loading requires a closer look into all the different aspects involved. Hydro-elastic responses of the structure, an appropriate wave kinematics model and wave-structure interactions during the wave impact all need to be addressed when modelling either numerically or experimentally. If you are interested in joining any of these initiatives, please contact the JIP person indicated or visit www.marin.nl/JIPs- Networks for additional information.

Short-crested wave impact on a fixed platform deck as measured during the ShorTCresT JIP

WiFi: the impact of steep (and breaking) waves on fixed turbines

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BreaKin BreaKin is a new joint research initiative addressing the occurrence of wave breaking with a focus on deep-water conditions. The objective of the BreaKin JIP is to determine the occurrence of breaking waves, to model the associated water particle kinematics and to describe the different types of wave loading that results. The overall purpose is to provide improved predictions of the breaking wave loads acting on offshore structures, including scale effects and to define the probability of occurrence.

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ComMotion The new ComMotion JIP aims to further increase computational accuracy and efficiency of the ComFLOW Code when it comes to wave impact loading. The effects of structural response on impact loading will be addressed by including hydro-elastic models, and simulations with interactive moving bodies will be possible. Additionally, because any reliable wave impact simulation starts with a realistic modelling of the incoming wave, algorithms for accurate, steep, irregular wave generation will be further developed. As part of the project deliverables, an extensive validation and benchmarking study of the new functionality will be performed. ComFLOW will be made available to all participants of ComMotion, including developments that were made in previous JIPs.

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MOONPOOL MODEL TESTS

ComFLOW-3 To numerically predict extreme wave loads on offshore structures, MARIN has been working together with the universities of Groningen and Delft in the development of the CFD method ComFLOW. Over the last few years many aspects have been addressed such as sloshing, air entrapment ("cushioning"), wave run up and deck impacts. In the most recent Joint Industry Project ComFLOW-3, MARIN's dynamic mooring line modules were incorporated, making it possible to realistically simulate the response of a complete floating structure during wave impact or mooring line failure.

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WiFi Another running JIP that deals with wave impacts is the WiFi JIP (see separate article on page 20). The objective of this JIP is to improve the way effects of steep and breaking waves are taken into account in the design methodology of fixed offshore wind turbines. For most offshore wind locations, the water depth is such that breaking or near-breaking waves can occur, causing impulsive excitation of the foundation and considerable stresses and displacements in the tower and turbine. In the WiFi JIP a methodology will be devised to take extreme waves into account during the design process based on extensive model testing, numerical simulation and full-scale measurements.

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ShorTCresT Recently, the ShorTCresT JIP was concluded, answering questions on extreme wave statistics, directional waves and the related wave impacts on offshore structures. The project included wave crest distributions beyond second order due to short-crestedness and wave steepness of the underlying wave spectrum, maximum crest heights under a deck area, the related global and local loading and typical loading levels on a platform deck in short-crested waves, as well as recommendations for analysis procedures involving short-crestedness in platform design.

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