The MALIBU project: Developing a simulation environment for floating lidar systems

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Summary
Floating lidar systems (FLS) provide a flexible and cost-effective approach to assess the wind resources at offshore sites. However, buoy motions usually have an impact on the lidar wind field measurement. Therefore the understanding of the occurring measurement uncertainties for different wind, current and wave climates due to these motions is necessary to apply the technology at a fully commercial level. Nevertheless it is still very difficult to predict measurement uncertainties of FLS for untested metocean conditions especially if there is no nearby reference measurement available.
The MALIBU project focusses on closing this gap by developing and providing a simulation environment for different lidar and buoy types in realistic offshore conditions. This work will present the latest findings and the roadmap to develop such a simulation environment.

1. Introduction

Due to the emerging offshore wind energy market, there is a large need for accurate wind resource assessment measurements for potential offshore wind farm projects. Floating lidar systems (FLS) have been developed with the goal to provide a flexible and cost-effective tool to provide such wind measurements. Nowadays, there is a variety of different FLS designs/realisations available, varying in size, buoy type and lidar type among others, which are currently used for wind resource assessment purposes [1]. However there are still a number of open questions regarding the application of FLS and the measurement uncertainty of wind measurements carried out with FLS. Therefore it is already recommended practice to monitor external influences in parallel to a FLS measurement campaign and relate these values to the measurement performance of the system. This is due to the fact that especially the measurement uncertainty is very difficult to predict before the installation and operation of a FLS in different metocean conditions than encountered in earlier measurement campaigns.

2. The MALIBU project and the FLS simulation model

In order to provide a better estimation of the measurement uncertainty already before conducting a FLS measurement campaign, an accurate simulation tool would be very helpful. The goal of the MALIBU project consists in developing such a validated simulation environment for FLS. The planned simulation model consists of a reduced hydrodynamic buoy model and a simulation model for a motion affected lidar system including a wind field reconstruction algorithm. Both models will be validated with measurement data from various FLS measurement campaigns carried out with the Fraunhofer IWES Wind LiDAR buoy. In a final step both models will be coupled in order to realize a FLS simulation model to carry out a wide range of parameter studies with limited computational effort. An approach for uncertainty assessment with FLS will be integrated to complete the model-based approach for the simulation of FLS wind potential measurements. The overall model shall be used to estimate and forecast measurement uncertainties for FLS at arbitrary offshore sites. Also new buoy designs shall be simulated taking into account wave probability tables and uncertainty information such as sensitivities and classifications of a FLS.
We will present the results and current findings from the first project year and give an outlook for the coming two years.

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References

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