First lightship-based wind lidar measurement in the North Sea

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Summary

Within the WIPAFF* (WInd PArk Far Field) project, a work package shall generate validation data from offshore sites that are several ten kilometers away from existing offshore wind farms. To this aim a vertical wind lidar system has been installed at a lightship moored in the German bight (North Sea). After more than eight month of continuous measurement, system set-up as well as ship-motion effects on wind data will be presented.

1. Introduction

For the monitoring and operation of offshore wind farms new observational platforms are

Fig. 1: Wind lidar mounted on the roof of the Lightship deckplatform.

required. In the last years a high reliability and acceptance of wind lidar technology has been proven. Its deployment on offshore floating platforms seems to be a cost-effective and flexible alternative to conventional fixed meteorological masts. Within the WIPAFF (Wind PArk Far Field) project, a work package has the aim to produce validation data from offshore sites that are several ten kilometres away from existing offshore wind farms. Wind lidar measurements from moving and/or fixed positions are one of the few options that allow the study of 3D wind profiles in order to validate flight measurements as well as model simulations.

In this project we have made use of a lightship, which is operated by the Wasser und Schiffahrtsamt (WSA) Wilhelmshaven and is also used by the Federal Maritime Agency (BSH) as a part of the Marnet monitoring network [1]. It is located on a strategic favourable location about 28km west of the Helgoland Island in the North see) in the far wake of several wind farm clusters for certain wind directions. We have equipped the lightship with a vertical Doppler wind lidar together with an inertial sensor to account for the ship movements. Moreover, a dual GPS is used to track the ship heading and therefore to estimate the current wind direction.

Besides data delivery for the project it will be a general outcome of the campaign, in how far existing platforms can be used for continuous monitoring of the marine boundary layer as supplement to existing fixed e.g. the FINO platforms.

Therefore, an important part of the experiment is not only to verify the quality of the derived data but also to check the stability of the measurement itself.

Furthermore we identify operational aspects of the system which could be optimized to reduce maintenance.

2. Results

In this work measurement data including system set-up and stability will be presented. Communication issues and performance in different weather situations to qualify the system as a long term measurement option will be discussed. First data analysis dealing with the effects of the dynamic ocean conditions on the lidar measurements will be shown as well as comparisons between the floating lidar and an onshore wind lidar deployed on the island of Helgoland with and without application of the motion compensation algorithm to minimize the effects of ship-motion motion on wind lidar measurements.

3. References

[1] http://www.bsh.de/en/Marine_data/Observations/MARNET_monitoring_network/index.jsp.

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