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Presentation and validation of a simulation environment for floating lidar systems

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Motivation & simulation model description

A **model based simulation framework for floating lidar systems (FLS)** could be very beneficial to reduce trial costs and reduce measurement uncertainties → Within the german **Malibu** project such a model has been developed → Validation of the model and the simulation framework is mandatory

Simulation framework


Dynamic lidar simulation
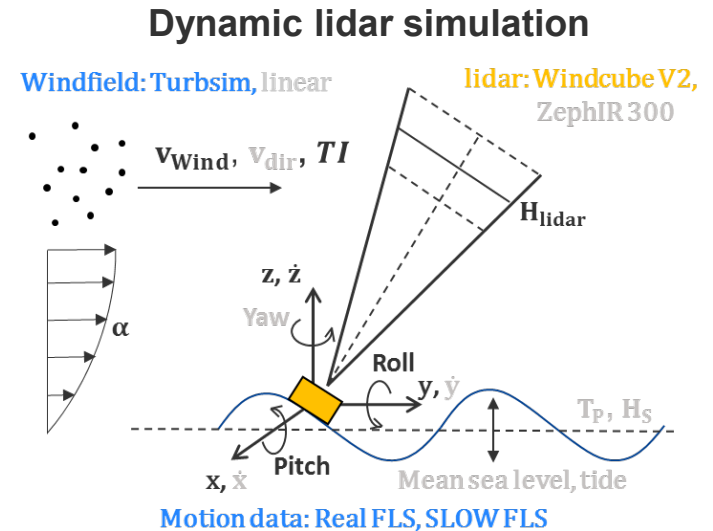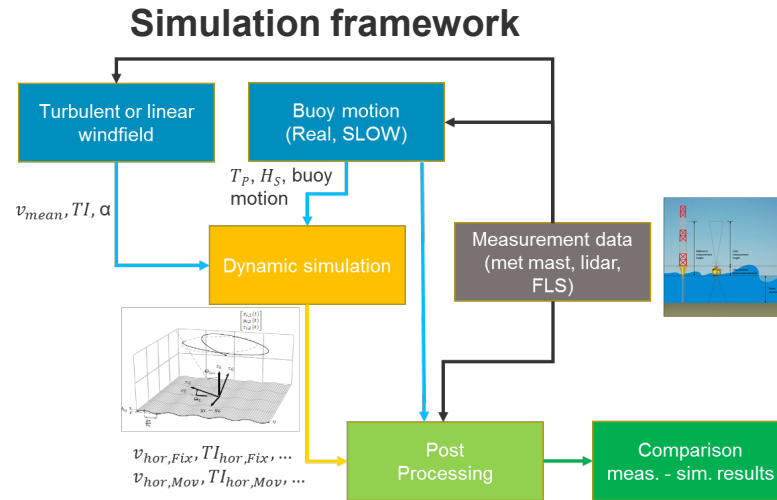
Measurement data for model validation

- Offshore met mast (german north sea) + fixed lidar (Windcube V2) on met mast platform
- FLS (Windcube V2) installed in short distance (~350 m} to met mast
- 6 months measurement data available (Nov. – Jun.), applied data filter → n = 3533 data sets

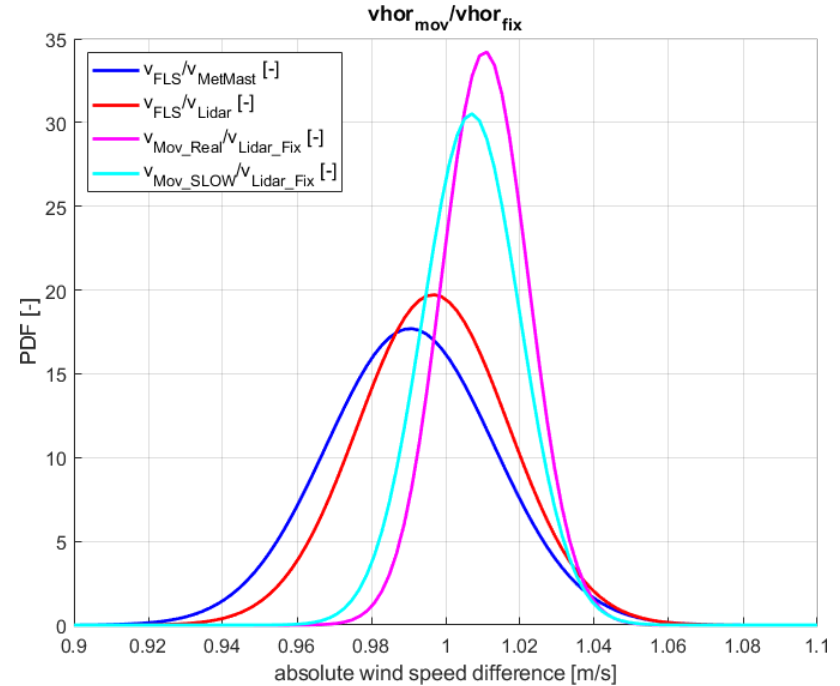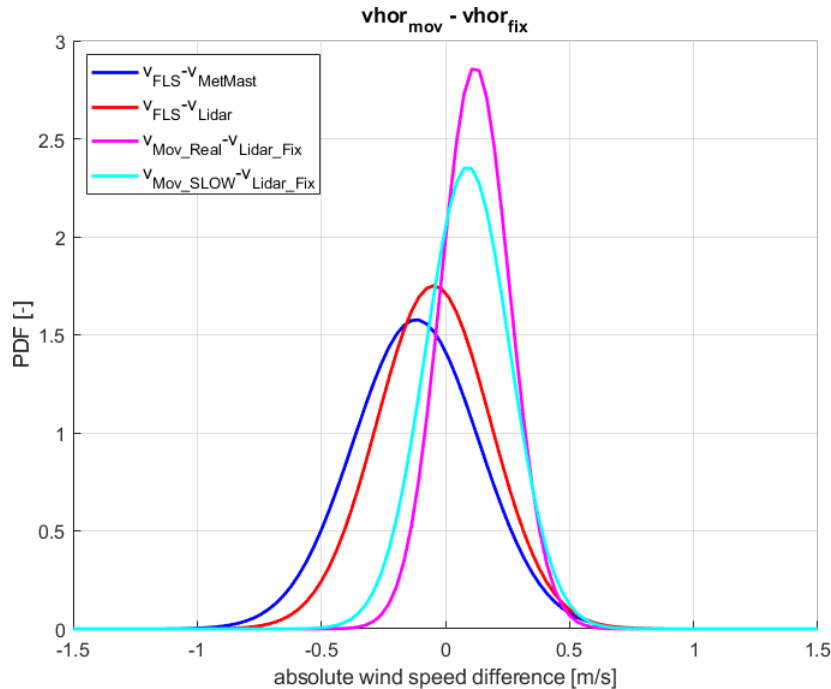# **Comparison of measurement data and simulation results** (Scatterplots)

- Only raw data sets of FLS have been analysed **(no motion correction for customers)**
- Simulation input: measured buoy motions and TurbSim wind fields based on met mast measurements)

Reference case 1: FLS - Cup met mast

Reference case 2: FLS - lidar met mast
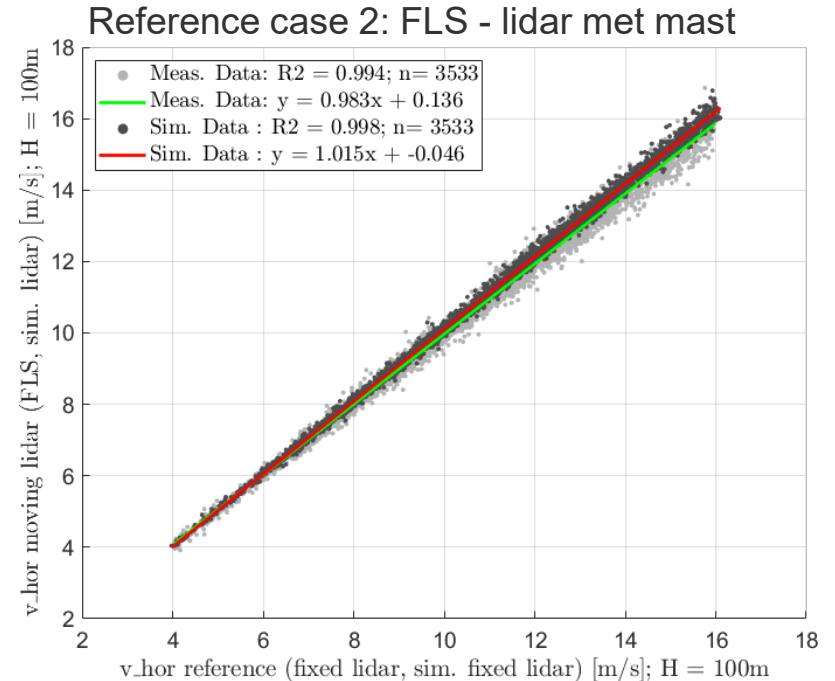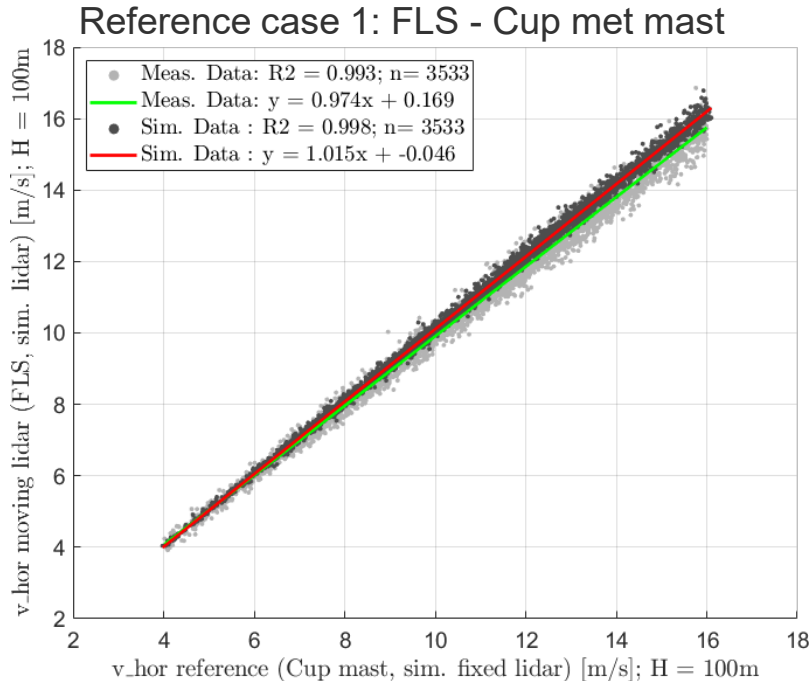
- Minor overestimation of horizontal wind speed for both reference cases (met mast / fixed lidar)
- Measurement data is slightly more scattered than simulation results

Comparison of measurement data and simulation results (PDF)

- Simulation input: Measured buoy motions + synthetic SLOW buoy motions and TurbSim wind fields based on met mast measurements)

- Slightly higher biases and uncertainties between measurement data and simulations
- Simulation with synthetic motion data of coupled SLOW model shows slightly better agreement

Conclusion & Outlook

- **Framework** for simulation of FLS based on [1] **has been created and is usable**

- Various FLS simulation studies based on measured buoy motions and synthetic buoy motions [2] have been prepared and compared to measurement results for **tool validation**

- Considering the fact that the simulation environment is limited to certain measurement parameters the **results are very promising and show the capabilities of the tool**

- Based on the collected validation results, **the tool will be extended and additional simulation parameters will be included**

Thank you!

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[1] D. Schlipf, et al., Model Based Wind Vector Field Reconstruction from Lidar Data, German Wind Energy Conference (DEWEK), Bremen, Germany, November 2012, http://dx.doi.org/10.18419/opus-8136

[2] Wei Yu, Oliver Bischoff, Po Wen Cheng, Gerrit Wolken-Moehlmann and Julia Gottschall. Validation of a Simplified LiDAR-Buoy Model Using Open Sea Measurements. ASME 2018, San Francisco, California, USA https://doi.org/10.1115/IOWTC2018-1086