PO050

# Validation of LiDAR Availability-improving Algorithms

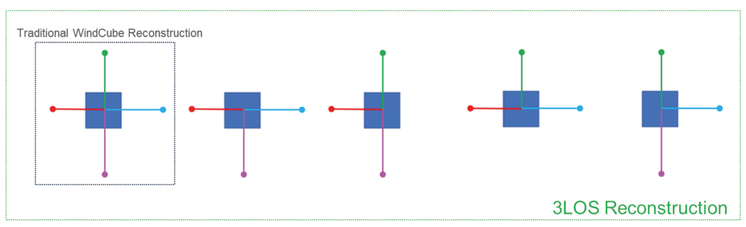
**Markus Sommerfeld, Martin Richter-Rose, Annika Baltzer , Frédéric Delbos, Hazem Rabhi, Pierre Allain**
Pavana GmbH, Vaisala France SAS

# 3 line-of-sight and range boosting algorithms increase WindCube LiDAR data availability without artificially generating data

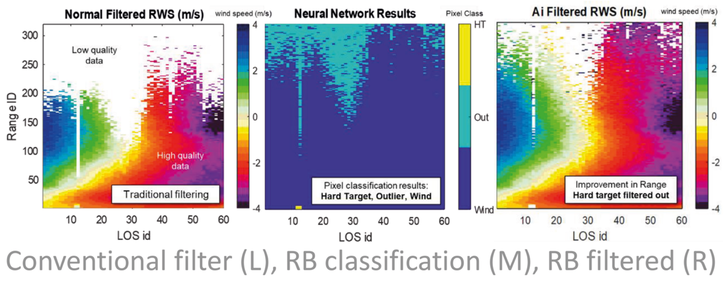
## Motivation

The purpose of this study is to verify the measurement accuracy of two newly developed, availability-enhancing algorithms by Vaisala (3LOS and RB) that can be applied to high resolution WindCube LiDAR data. Pavana GmbH investigated LiDAR measurements up to 200 m a.g.l. from 16 Vaisala WindCube V2.1 devices against the the IEC 61400-50-1 compliant reference met mast close to Janneby in northern Germany.

10-minute mean ensemble datasets with conventional and enhanced filtering were synthesized from the 16 high-resolution datasets. We compare wind speed and direction from reconstructed and conventionally filtered LiDAR data to measurements from a meteorological mast.




Conventional and 3LOS reconstruction



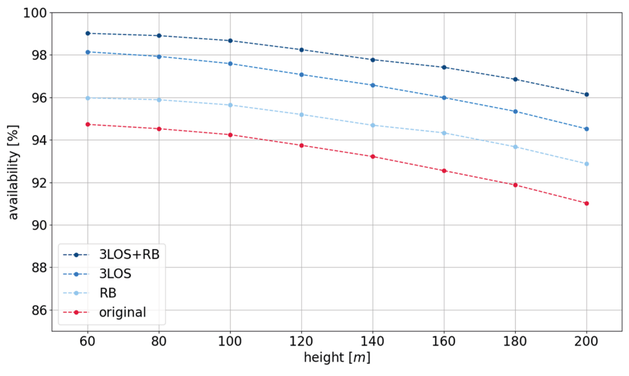

Conventional filter (L), RB classification (M), RB filtered (R)

## Data processing

The three line-of-sight (3LOS) and range-boosting (RB) post-processing algorithms, designed to enhance availability, can be applied to high resolution 1Hz wind data individually or in combination with each other to increase data availability.

The 3LOS algorithm allows WindCube LiDAR devices to perform wind field reconstruction as long as any three out of the four inclined laser beams are above the set CNR threshold. The algorithm dynamically switches, when necessary, between the conventional four-beam and the new three-beam reconstruction methods to compute the 10-minute mean wind velocity.

The deep-learning RB algorithm is trained to detect outliers, noise, hard target and valid wind data in high resolution line-of-sight measurements. Valid wind measurements that were filtered out (false negatives) are recovered by lowering the CNR threshold, without introducing artificially generated data.

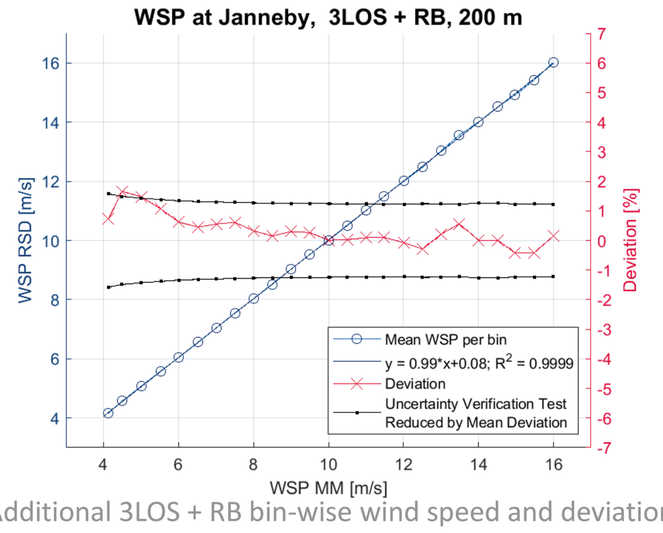



LiDAR data availability comparison

## Results

For the here investigated location and period, the 3LOS algorithm recovered more data at all heights than the RB algorithm. A combination of both algorithms shows the best results and an increase in availability by approximately 5% at all heights whilst maintaining data integrity. Results may vary depending on season and location and could be more pronounced in measurement campaigns with generally lower data availability.

The additional measurements, recovered by the algorithms, show no systematic deviation. The recovered wind speed and wind direction data correlate very well with the met mast data at all wind speeds and measurement heights ($R^2 > 0.985$ above 100 m).




Additional 3LOS + RB bin-wise wind speed and deviation

Watch this presentation

Download the poster

Wind EUROPE TECHNOLOGY WORKSHOP 2025 19-20 JUNE ISTANBUL

windeurope.org/tech2025
#WindTech25