

Flow corrections for met masts – wind tunnel validation of a CFD tool

Friedrich. Wilts*¹⁾, Thomas Neumann¹⁾, Ilona Bastigkeit²⁾

1) UL International GmbH (DEWI), Wilhelmshaven, Germany

2) Fraunhofer-Institut für Windenergie und Energiesystemtechnik IWES Nordwest, Bremerhaven, Germany

**) presenting author, f.wilts@dewi.de*

1.) Introduction

In offshore environments massive mast structures are commonly used to measure wind speeds. Due to logistic issues, offshore masts can't follow common IEC* regulations. Therefore mast shadows, partial or total, at certain inflow directions are an important source of error when dealing with offshore wind measurements. This error has to be investigated and corrected carefully. Within the FINO-Wind* research project different approaches have been used to investigate these mast effects.

One of the used methods was the application of a CFD (Computational Fluid Dynamics) model. To validate the results of the CFD corrections the flow around a simplified mast sample has been measured in a wind tunnel and compared against the results of the CFD tool.

2.) Approach

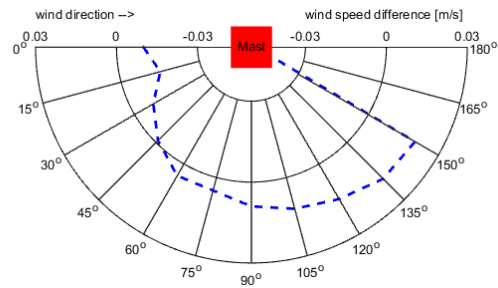
The following methods have been used to prepare this evaluation:

- Wind tunnel tests: A measurement campaign with a section of a squared mast model in a scale 1:8 was carried out in the wind tunnel of WindGuard in Bremerhaven. The flow around the mast model was measured in 15° steps at three distances to the mast center and in different inflow directions.
- CFD-Calculations: An OpenFOAM® CFD model was set up for the simplified mast sample that was used in the wind tunnel tests. All wind tunnel test set ups carried out with the squared mast model were calculated.
- All wind tunnel measurements were compared with the CFD results.

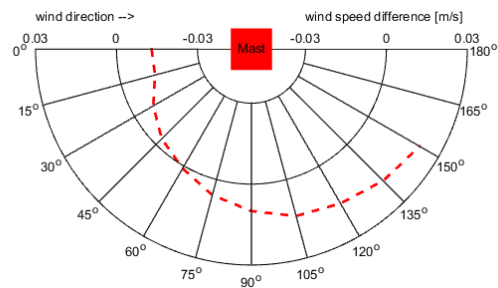
3.) Results

CFD results are in good accordance to the measured wind speed reductions. Figure 1 shows the differences between measured and calculated values for a non rotated inflow direction, which are with exception to the direct wake field well below +/- 0.03 m/s. At the observed points the overall range of calculated wind speeds are in a range between 9.8 m/s and 10.3 m/s.

Ratio of 1.9 between measuring distance to mast center and mast width



Ratio of 2.1 between measuring distance to mast center and mast width



Ratio of 2.3 between measuring distance to mast center and mast width

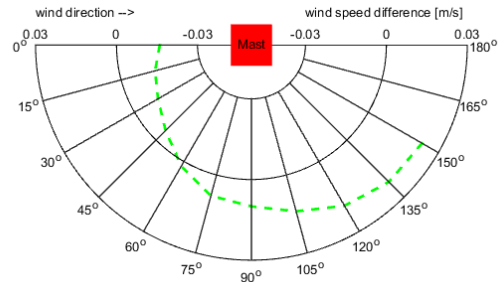


Figure 1: Wind speed differences between wind tunnel and CFD results for three different distances to the mast center

4.) Conclusion

The results of this study show, that the flow field around lattice masts could be understood with a CFD analysis in a good manner, hence CFD models are an appropriate tool to plan reasonable mast designs with the aim to minimize the wind speed errors or, for a given mast structure, can be used to derive the uncertainties that arise from the mast structure.