

Interactive comment on “Wind speed deviations in complex terrain” by Christian Ingenhorst et al.

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We want to thank Anonymous Referee #2 for the extensive feedback, and we are sure, that the comments will further improve the scientific quality of the paper.

General comments:

“While results of the field studies are reasonably well presented, further work is required to interpret the results in the context of the state of the art, including comparisons to other research efforts. More emphasis should be placed on describing how this work contributes to overcoming existing knowledge gaps. Recommendation is for reconsideration after significant revision - Spelling and grammar should be reviewed - some suggestions are provided below but manuscript would benefit from thorough proof-reading.”

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A comparison to other research efforts, especially CFD and LIDAR with their advantages and disadvantages, has been performed in a qualitative manner throughout the paper. A quantitative in-depth analysis is not yet possible due to the status of our project, but it is planned for future publications.

For the final paper, a more detailed insight on research of measuring wind speed distributions above complex terrain will be given. Additionally, we will explain, that the current project is still ongoing and the paper contains results of the proof-of-concept phase. We will discuss in more detail, which further steps are necessary to raise the UAV's full potential to overcome the presented disadvantages of LIDAR and CFD based wind analysis.

Specific comments

“You indicate that limitations of the current measurement strategy are too significant to be considered valid (Line 258). It would be useful to describe what criteria are being used to evaluate the validity of the measurement strategy, and to provide additional details on what advancements are believed to be necessary to overcome this issue.”

The limitations of the current measurement strategy are too significant to be considered valid in general. During an ongoing simulation campaign, several measurement strategies, in particular the presented approach, have been evaluated concerning their performance. This is done by virtual test flights within a simulated wind field and shall be part of a future publication. One result is, that the used prototype strategy (single flying measurement system plus single stationary sensor) depends on a reference, which is representative for the area-wide wind situation. We assume this to be the case in the described situation because of the good correlation between normalised wind speeds of the mobile and the stationary system (Fig. 22). In other experimental cases, with differently positioned stationary references and at other wind conditions, we have seen higher variations. The particular strategy therefore is not capable to deliver a plausible wind field without a careful choice of the location of the stationary

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reference.

For the final paper, this context will be described. Because simulations are still ongoing, more detailed results are not available yet.

”Further to the above comment, you mention in Line 32 the notion of bankable site assessments for regions of complex terrain - can you comment on the extent to which UAV-based measurements need to be further developed to meet this benchmark? Is this a desired research outcome? Where do IEC standards fit in with respect to UAV measurements?”

At the moment, a single airborne measurement can only deliver a “snapshot” of a specific weather situation in terms of wind speed and direction. The results are planned to be used for site assessment in the same way as a single CFD calculation (but without the corresponding modelling uncertainties). However, necessary long-term statistics for a complete UAV-based site assessment can only be realised by a fully autonomous operation, which is not only a technical issue, but also a legal issue in Europe and therefore a mid-term objective.

”Line 201: If possible, it would be useful to indicate the elevation gain from the base of the hill to the peak, as this would give additional context in relation to the measurement plane height of 100m above ground level. It would also be valuable to supply the geographic co-ordinates of the test sites, and the source for the 3D terrain model if applicable. “ The elevation gain is roughly 200 m, the 3D model is based on open data from the county of North Rhine-Westphalia. Within the final paper, geographic coordinates and more of the surrounding landscape will be added for additional context. “Title of the manuscript could be improved to be more reflective of content, e.g. "Detecting wind speed deviations in complex terrain through airborne measurement" or similar. ”

The authors agree. For the final paper, it shall be changed to “Method for airborne

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measurement of the spatial wind speed distribution above complex terrain”.

”It would be useful to compare the UAV measurements against CFD and LIDAR studies of the same site; this could possibly be suggested as an area of further work”

Depending on the LIDAR system, such study usually does not allow to gain insight into the spatial distribution of wind speeds. This specific problem shall be addressed by the UAV based measurement approach. A CFD study nevertheless would be a suitable method for a more in-depth validation of the airborne measurement method, but is not yet in scope due to the status of the project. This shall be addressed in future publications.

Figures and tables

Figure titles will be combined, and the location of the ultrasonic anemometer will be added to Fig. 19.

Typos and spelling/grammar

We want to thank Anonymous Referee #2 for his/her suggestions and take them into account for the final paper.

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