Reply to the comments of Reviewer No. 1

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March 31, 2018

The authors would like to thank the reviewer for his/her efforts and constructive comments. They are very much appreciated and incorporated into the revised manuscript.

In this document the comments given by the 1st reviewer are addressed consecutively. The following formatting is chosen:

- The reviewer comments are marked in blue and italic.
- The reply by the authors is in black color.
- A marked-up manuscript is added. Changed sections with regard to the comments by reviewer 1 are marked in yellow. Changed sections with regard to comments by both reviewers are marked in gray. Changes with regard to no comments but which serve a better understanding and an improvement of the submission are marked in green.

Some manuscripts, which were accepted during the review of this manuscript, are now published:
Fischer et al. 2016 is now referred under Fischer et al. 2018
Wendler et al. (2016) is now published.
Klein et al. (2017) is now referred under Klein et al. (2018)

Moreover, Jost (2017) and Klein (2017) are now replaced by Jost et al. (2018)
The display of the references were adopted in the reference list.

We would like to mention, that since the first submission of this manuscript in September 2017, two conference papers, which partly use the same data as in the present manuscript, were written, submitted and accepted for the AIAA 2018 Conference Series. As these papers reference on the present submission, they were not cited here.

Bartholomay, Sirko, et al. "Towards Active Flow Control on a Research Scale Wind Turbine Using PID controlled Trailing Edge Flaps." 2018 Wind Energy Symposium. 2018.

Marten, David, et al. "Numerical and Experimental Investigation of Trailing Edge Flap Performance on a Model Wind Turbine." 2018 Wind Energy Symposium. 2018.

General comments "G"

1. "*In general, I find the text not always clear, unstructured, and in many cases too vague. The lack of structure makes the text confusing to read, especially because the paper is investigation*

many different parameters, such as experiments, two different numerical codes, blockage effects and the effect of yaw misalignment."

The authors apologize for the inconvenience. In addition to the major and minor comments, the manuscript was completely revised and the authors improved the structure by putting subsection 2.5 into an extra section (Section 3), see **R1:G1** (page 13, line 280).

2. "*Although the results are very interesting, the discussion is not thorough enough and the conclusions oversimplified.*"

The discussion of the results (section 4) was detailed and more specific conclusions were drawn (section 5) in the revised manuscript. More detailed references can be found in the corresponding comments, e.g. Ma3.4, Ma4 or Ma10.

3. "*The differences between the experimental and numerical inflow conditions are neglected. However, the inflow conditions show a difference in the mean velocity of +- 10% compared to the simulation conditions, which seems not negligible. The authors should discuss the consequences of the different inflow conditions on the measurements in more detail.*"

Due to the wind tunnel, the inflow in the experiment is less uniform compared to the simulations and a difference of -10% occurs in a small region, compare **R1:G3** (page 18, line 396). But as the average inflow velocity is the same within the rotor area, the differences in the inflow are lower than $\pm 10\%$. Downstream of the rotor, the differences are bigger, especially in the wake of the nacelle and in the area of the tip vortices, compare Fig. 11. According to Major Comment Ma3.4 and Ma6, and to Major Comment Ma4 and Ma7 of reviewer 2, additional information were added and the consequences were discussed, for example in Table 5 and in Table 6.

4. "*Furthermore, it would be interesting to verify and discuss specifically which physics are modelled correctly by the codes, and which not. For example, one could verify this by estimating the angle of attack, on-blade velocity, and bending moment with a simple BEM method, to verify the benefits of the Lifting Line Free Vortex Wake code.*"

The authors didn't estimate the angle of attack, on-blade velocity, and bending moment with a simple BEM method but prefer to describe the advantages of the vortex codes over traditional BEM methods in the revised manuscript. Moreover, references about the advantages, especially in unsteady operating conditions, were added, compare **R1:G4** (page 9, line 200).
The modelled physics are mentioned with regard to Major Comment Ma10.

5. "*However, the comparison for the bending moment, which is a result of the former two parameters, shows a surprisingly large difference. It would be interesting to discuss the possible causes for this difference in more detail.*"

The authors agree that a discussion of possible causes would be interesting. However, according to the suggestion of reviewer 2 (Ma2), the measured bending moments were removed from the present manuscript because of the large fluctuations and the need of strong filtering, which influenced the bending moments considerably. See also Major Comment Ma8.

Major comments "Ma"

1. "*The introduction does not clearly motivate the research objectives with a literature overview. For instance on page 2, lines 13-15, it is mentioned that earlier studies already verified the effect of wind tunnel walls and blockage effects with simulations. What where the conclusions? From the introduction it is thus unclear what this paper will contribute to the study of wind tunnel blockage effects.*"

The introduction was completely revised.
The objective concerning the influence of the walls on the results was reformulated in the abstract, see **R1:Ma1-b** (page 1, line 3) and in the introduction, compare **R1:Ma1-e** (page 3, line 65)). As the reviewer noted, the effect of the wind tunnel walls were already verified and estimated in other papers (Fischer et al. (2018), Klein et al. (2017)). The conclusions of these papers were now added in the present manuscript, see **R1:Ma1-a** (page 3, line 58). However, the published papers concerning the blockage effect present pure numerical results. No comparisons with experimental data to validate the simulated effect were done, see **R1:Ma1-c** (page 3, line 62). So in the present submission, the gain in knowledge is on the one hand the estimation of the influence assessed with FLOWer, see **R1:Ma1-e** (page 3, line 65). On the other hand, in QBlade, the walls were not taken into account. Therefore, after the validation of the influence of the wind tunnel walls in FLOWer, these simulations can be used for a comparison with FLOWer far field simulations to estimate the effect of the walls, see **R1:Ma1-d** (page 33, line 618). Afterwards, a comparison with the QBlade results can be done. Without the link with FLOWer, a comparison of the experimental results and the simulated QBlade results would not be that meaningful. But with the influence of the wind tunnel estimated, the different results can be compared and interpreted.
Moreover, the literature overview was extended. As suggested by reviewer 2, articles from research groups from JHU, EPFL and KU-Leuven have been taken into account. References about hot-wire measurement to investigate the wake under different operating conditions like yaw misalignment can be found at **R1:Ma1-j** (page 1, line 22). Further information about the measurement of mean velocity and turbulence intensity was integrated at **R1:Ma1-f** (page 2, line 25). References about further applications and benefits of wind tunnels can now be found at **R1:Ma1-g** (page 2, line 31). References about the investigation of the blockage ratio were added at **R1:Ma1-h** (page 2, line 43) and **R1:Ma1-i** (page 2, line 49).

2. "*When a comparison with measurements is done, it is important to consider the measurement uncertainty. Add an estimation of the measurement uncertainty.*"

The velocity planes are measured with hot-wire probes. These probes were calibrated using a KIMO L-type pitot tube with an error of 1% corresponding to 0.1 m/s at the maximum calibrated velocity. The dynamic pressure was measured using a Baratron (pressure sensor) with an error of 0.15% of the pressure reading. The latter corresponds to a velocity error of 0.07% = 0.0075 m/s at the maximum calibrated velocity. Therefore, the error due to the calibration error is 0.1075 m/s. In order to assess the bias error between the probes, in all measurements of the campaign, a set of 20 measurement positions was measured by each probe. Thereby, the bias between the probes was determined. The maximum bias of the probes was determined from the entire dataset as 0.33 m/s, corresponding to 3.3% in reference to maximum calibrated velocity of 10m/s. This is in good agreement to the error estimation shown in the Dantec User Guide, Finn (2002), where the velocity error is calculated to 3%. Summarizing, the error due to calibration and the hot-wire measurement chain is 4.37%, corresponding to 0.44 m/s.
This information is now added in the manuscript, see **R1:Ma2-b** (page 14, line 297).
Moreover, the simulated and measured averaged standard deviation for the velocity planes can now be found in Table 5 and Table 6 and values are now mentioned and discussed in the text, see **R1:Ma2-i** (page 17, line 387) and **R1:Ma2-j** (page 19, line 423).
The on-blade velocity and angle of attack are measured by three-hole probes on the rotor blade. In order to assess the error of these measurements, the measurement chain was analyzed. The three-hole probes were separately (detached from the rotor blade) calibrated in a calibration-setup. The relative error for the velocity measurement amounts 1% in reference to the maximum speed of 22 m/s, which corresponds to 0.22 m/s. In a range of -30deg to +30deg,

the maximum error (bias) for the AoA is 1.6%/Fullscale, which corresponds to 0.48deg for the considered velocity range. To assess the error of the induction correction, the probe was installed in a 2d-wing setup, which ist mounted on a turn table. Thereby, the velocity was compared also to the inflow velocity, that was measured by a differential pressure measurement along the duct section upstream of the test-section. An error of 2%-2.7% is present in the linear region, corresponding to an error of 0.3 to 0.4 m/s. The calculated AoA are compared to the AoA that is set by the turn-table. Within the linear attached flow region, the error of the AoA measurement remains below 2% in reference to the 40deg pitched airfoil, which corresponds to 0.8deg. As the error for the induction correction includes the error which is created by a 'pure' three-hole probe setup, the maximal errors of the velocity and AoA measurement can be summarized for the linear attached flow region as $\Delta AoA = 0.8deg$ and $\Delta v = 0.4m/s$.
This information is now added in the manuscript, see **R1:Ma2-a** (page 15, line 329).
Moreover, information about the average standard deviation of the measured on-blade velocity is now mentioned in the text, see **R1:Ma2-c** (page 21, line 451), **R1:Ma2-d** (page 22, line 476) and **R1:Ma2-e** (page 24, line 493). The averaged standard deviation for the measured AoA was added as well, see **R1:Ma2-f** (page 25, line 512), **R1:Ma2-g** (page 26, line 542) and **R1:Ma2-h** (page 29, line 562).

3. "*Section 2 about the 'methodology and setups' is badly organized and needs a significant improvement.*"

The manuscript was reorganized to improve the structure. About the methodology and setups, the general information about the setups were now placed at the beginning, see **R1:Ma3-a** (page 4, line 90). Afterwards, the different setups are described, starting with the experimental setup. Thereby, the order was from big (wind tunnel) over turbine to small (blade). The description of the two numerical codes starts with information about the code, which is in each case followed by the description of the numerical setup used for the present submission. Afterwards, the data acquisition is introduced with Fig. 6, see **R1:Ma3-b** (page 13, line 281).

3.1 "*Each section and sub-section needs an introduction.*"

An overall introduction for the whole section as well as short descriptions of the content of each subsection were added, see **R1:Ma3.1-a** (page 3, line 86), **R1:Ma3.1-b** (page 4, line 90), **R1:Ma3.1-c** (page 5, line 106), **R1:Ma3.1-d** (page 8, line 176), **R1:Ma3.1-e** (page 10, line 223) and **R1:Ma3.1-f** (page 13, line 280).

3.2 "*The section about the wind tunnel is too short and brief.*"

The section about the wind tunnel is now more detailed. The authors added more information about the wind tunnel and the composition of the test section which could be helpful to understand the present setup, see **R1:Ma3.2-a** (page 5, line 111) and **R1:Ma3.2-b** (page 5, line 115). Further information about the inflow was added in the course of the consideration of Ma3.4.

3.3 "*It is not necessary to mention the top-speed for the wind tunnel test section which is not used in this paper.*"

The information was removed, see **R1:Ma3.3-a** (page 5, line 111) and **R1:Ma3.3-b** (page 5, line 116).

3.4 "*The measurements are performed in the settling chamber which has as purpose to condition the non-homogeneous and turbulent flow from the wind tunnel fan before it enters the test section. As figure 9 indicates, there is a significant mean shear over the cross section in the settling chamber, and the turbulence intensity is not negligible. It is important to provide* *a motivation for this configuration, provide a characterization of the inflow and turbulence properties, and discuss the effects it may have on the results."*

A motivation for this configuration was added, see **R1:Ma3.4-a** (page 5, line 111). Information about the velocity plane and the occurring inequality were investigated by Bartholomay et al., 2017, and were addressed in Subsection 4.1, see **R1:Ma3.4-c** (page 16, line 373). More information about the distribution of the turbulence intensity were added, see **R1:Ma3.4-b** (page 5, line 118).
Additionally, the authors included tables with the streamwise mean velocity, the standard deviation of the streamwise velocity as well as the global turbulence intensity in x-y-direction for both locations, see Table 5 **R1:Ma3.4-f** (page 17, line 383) and Table 6 **R1:Ma3.4-g** (page 19, line 418). Moreover, the mean differences between measurement and simulation were determined and mentioned in the text, see **R1:Ma3.4-h** (page 18, line 395) and **R1:Ma3.4-i** (page 20, line 430).
An overview on the influence of the turbulent inflow on the results was added, see **R1:Ma3.4-d** (page 5, line 122) and was already given in Section 4, see **R1:Ma3.4-j** (page 19, line 406), **R1:Ma3.4-k** (page 19, line 410) and **R1:Ma3.4-l** (page 21, line 445). The authors want to remark, that for the present investigations, which are a basis for the subsequent investigations of the wind turbine including flaps, the focus was not on the exact reproduction of the unsteady inflow conditions. This will be done in future investigations and is now mentioned in the manuscript, see **R1:Ma3.4-e** (page 18, line 392).

3.5 "*Section 2.1 'Experimental setup' does not describe the velocity measurement setup.*"

The velocity measurement setup was already described in sub-subsection 3.1 together with the description of the approach for the FLOWer simulations, see **R1:Ma3.5** (page 13, line 286). The authors preferred to put the descriptions of the data acquisition for experiment and simulations in one subsection rather than divide them into different subsections.

3.6 "*Mention the specific acquisition devices, and not just the name of the manufacturer.*"

Specific acquisition devices can now be found at **R1:Ma3.6-a** (page 8, line 150), **R1:Ma3.6-b** (page 8, line 151) and **R1:Ma3.6-c** (page 8, line 162).

4. "*P5 Figure 3: The actuators for the flaps and the 3-hole probes + air tubes on the smart blade look like they will influence the airflow around the blade. The presence and impact of this blockage should be discussed.*"

Information about the influence of the probes, their holder and the tubing was added, see **R1:Ma4-a** (page 8, line 164). Moreover, a reason for the neglect in the simulation was added, too, see **R1:Ma4-b** (page 13, line 271).

5. "*P10 L3: An acquisition time of 16 seconds is short for velocity measurements. Please motivate, e.g. based on the integral time scale, that this is sufficiently long for good statistics.*"

The time is assumed to be long enough for good statistics for the current setting as the measured integral length scale is $\leq 0.15m$. With the inflow velocity of 6.5m/s as convective velocity, an integral time of t = 0.15m / 6.5m/s = 0.023s is achieved, which is considerably smaller than the acquisition time of 16s. This information was added in the manuscript, see **R1:Ma5** (page 14, line 289).

6. "*P15 L5: I don't agree with the statement that the error is small. The error in figure 12 is higher than 10% in a large part of the wake: shear region and center.*"

Fig. 12 in the first submission corresponds to Fig. 11 in the present submission.
The authors agree and reformulated the sentence see **R1:Ma6-a** (page 20, line 429). Moreover, the wording "quite good" was replaced with "acceptable", see **R1:Ma6-b** (page 21, line 436). Additionally, as already mentioned in relation to Major Comment Ma3.4, the mean differences between measurement and simulation were determined and mentioned in the text, see **R1:Ma3.4-h** (page 18, line 395) and **R1:Ma3.4-i** (page 20, line 430).

7. "*Figure 18: The experiments show a significant dip around 90 degrees. This is not visible in the simulations. Is there a reason for this effect? Is this also due to the traverse? Explain the situation.*"

This effect is also due to the traverse, which was located upstream of the rotor during all measurements. The influence of the traverse is now mentioned for CaseYAW15, see **R1:Ma7-a** (page 26, line 537), and CaseYAW30, too, see **R1:Ma7-b** (page 28, line 554).

8. "*The differences between the measured and simulated bending moments in figures 20 and 21 are significant. It is not ok to say that this is a good agreement. The experimental curves follow a different pattern, especially for CaseBase. Is there an explanation for this?*"

The authors agree, that the differences between the measured and simulated bending moments are significant.
Strong fluctuations are visible in the raw data of the measured bending moments and heavy filtering was necessary to obtain the distributions shown in the first version of this manuscript. The resulting data should only be used for qualitative comparison to numerical results but cannot be considered as valid basis for quantitative comparisons and code validation purposes. We therefore decided, based on Major Comment Ma2 for reviewer 2, to discard all measured bending moments in the revised version of the manuscript.
The reason for the removal is given at **R1:Ma8-a** (page 16, line 351) and the text was adopted and the corresponding passages were removed, see **R1:Ma8-b** (page 1, line 12), **R1:Ma8-c** (page 1, line 13), **R1:Ma8-d** (page 3, line 80), **R1:Ma8-e** (page 29, line 569), **R1:Ma8-f** (page 30, line 582), **R1:Ma8-g** (page 31, line 590), **R1:Ma8-h** (page 33, line 639), **R1:Ma8-i** (page 33, line 644) and **R1:Ma8-j** (page 33, line 646). The corresponding figures (Fig. 19 and Fig. 20) were adopted, too.
As one of the objectives is the comparison of a medium and a high fidelity code, we consider a comparison of the bending moments calculated with the two numerical methods important.
However, the QBlade results were revised and improved in the course of another paper (Marten et al. 2018). They were replaced in the present manuscript, too, to provide the latest results. In this concerning paper, the present manuscript was cited.
In the former QBlade simulations, the size of the vortex was estimated too large. Instead of the time offset, the parameter "initial vortex core size" is used now in the vortex evolution equation. This parameter is more common in literature and better defined. In the present investigation, approximately 10% midspan chord are used for this parameter, leading to a 50% smaller vortex core. The relevant parameters for the QBlade simulation are now listed in Table 3.
The corresponding Figures (Fig. 19 and Fig.20) were adopted.

9. "*The authors should be careful with copyrights. For instance figure 1a, figure 2, figure 3b and figure 8 can be found identically in the paper 'Reproducible inflow modifications for a wind tunnel mounted research HAWT' by Bartholomay S., et al. 2017.*"

Thanks a lot for this information. The authors are in contact with ASME concerning the copyright. But as the pictures show setups and approaches and no result graphs, it should not

cause an infringement. However, Fig. 3 (former Fig.2) was replaced and Fig. 4 (former Fig. 3b) is slightly changed, to have less identical pictures.
If needed, the pictures can also be completely replaced.

10. "*P24 L26: The main conclusion of this paper is too strong. The experiments have too many differences (e.g. vertical shear and turbulence) to make this statement. Furthermore, the agreement for the bending moment is not good at all. Instead make conclusions on what can be estimated correctly, what not, and which physics are modelled correctly.*"

The conclusion was completely revised and the authors tried to make the conclusion less strong, see **R1:Ma10-a** (page 33, line 623), **R1:Ma10-c** (page 33, line 624), **R1:Ma10-e** (page 33, line 626) and **R1:Ma10-n** (page 33, line 648).
Additionally, we extended the conclusions to quantify the differences between simulation and measurement, see **R1:Ma10-b** (page 33, line 624), **R1:Ma10-d** (page 33, line 625), **R1:Ma10-i** (page 33, line 633) and **R1:Ma10-j** (page 33, line 635) in order to find out, how good the parameters can be estimated.
Moreover, the according reasons for the differences were added, see **R1:Ma10-g** (page 33, line 626) and **R1:Ma10-s** (page 34, line 658)
Furthermore, information about the modelled physics are extended and added, see **R1:Ma10-t** (page 32, line 611), and **R1:Ma10-u** (page 32, line 613) as well as **R1:Ma10-h** (page 33, line 641) and **R1:Ma10-o** (page 33, line 649).

Minor comments "Mi"

1. "*Define abbreviations at first use in the main text. Don't define abbreviations in the abstract, and limit the use of abbreviations in the abstract. For example CFD, LLFVW, URANS, ..*"
The abbrevations are removed from the abstract and inserted at the first use in the main text, see **R1:Mi1-a** (page 1, line 7), **R1:Mi1-b** (page 1, line 8), **R1:Mi1-c** (page 1, line 10), **R1:Mi1-e** (page 1, line 11), **R1:Mi1-f** (page 1, line 11), **R1:Mi1-g** (page 1, line 13), **R1:Mi1-h** (page 2, line 37), **R1:Mi1-i** (page 3, line 72) and **R1:Mi1-j** (page 2, line 54).

2. "*Throughout the text, several sentences are unnecessarily long, or have a structure where the subject is placed at the end, which can be confusing. Improving these sentences will benefit the clarity of the text.*"

The complete manuscript was revised to make the wording more concise.

"*Some examples are:*"
2.1 "*P1, L1*"

The syntax was changed, see **R1:Mi2.1** (page 1, line 1)

2.2 "*P1, L2: This is a long sentence and not entirely clear. For instance 'methods of different fidelity' is too vague.*"

The sentence was cut into several short sentences, see **R1:Mi2.2-a** (page 1, line 2), **R1:Mi2.2-b** (page 1, line 2), **R1:Mi2.2-d** (page 1, line 4) and **R1:Mi2.2-e** (page 1, line 3). Moreover, 'methods of different fidelity' is more specified, see **R1:Mi2.2-c** (page 1, line 5)

2.3 "*P1, L5: Is it relevant where the code was run?*"

The information was inserted to make clear, which part of the data was created at which institution and can therefore be assigned to the authors. We therefore prefer to keep this information.

2.4 "*P2, L3: long sentence.*"

The sentence was reformulated and split into two sentences, compare **R1:Mi2.4-a** (page 3, line 68) and **R1:Mi2.4-c** (page 3, line 69).

3. "*P2 L11: It is not clear what 'a one third model' is + this is a long sentence.*"

Information about the one third model is added and the sentence is splitted into two sentences, see **R1:Mi3-a** (page 2, line 55).

4. "*P2 L17: The yaw angle is negative. Does this matter? The orientation is not mentioned.*"

Due to the revision of the introduction, the sentence was omitted.
However, the word "clockwise" was added at the description of the yaw cases, see **R1:Mi4** (page 4, line 95). In the experiment, the door to the settling chamber would have been blocked if the turbine would have been rotated counter clockwise.

5. "*P2 L19: 'the flow around the rotor' is too vague.*"

Due to the revision of the introduction, the sentence was omitted.

6. "*Define the term 'far field conditions'.*"

A short explanation of what is meant by 'far field condition' is added, see **R1:Mi6** (page 11, line 239).

7. "*Units need to be formatted correctly.*"

The format of the units were changed throughout the whole manuscript. For reasons of simplicity, it is only marked with **R1:Mi7-a** (page 5, line 117) and **R1:Mi7-b** (page 13, line 286) exemplary.

8. "*The first sentence of the introduction is too vague and unnecessary.*"

The first sentence was deleted and the following sentence was adjusted, see **R1:Mi8** (page 1, line 18).

9. "*P1 L17: You mention 'simulations' but the referenced paper presents experimental results.*"

That was an infelicitous wording. The mentioned paper was only a reference for the MEXICO project and not for the simulations of the MEXICO rotor in particular. The authors apologize for the confusion. The sentence was adopted and an exemplary reference for the simulation of the MEXICO experiments was added, see **R1:Mi9-a** (page 2, line 34) and **R1:Mi9-b** (page 2, line 38).

10. "*P2 L16: Instead of 'three different states', it would be more clear to mention 'Three different yaw-misalignment cases'.*"

The sentence was changed, see **R1:Mi10** (page 3, line 76).

11. "*P2 L23: This sentence is very long, consider breaking it up in several more clear and well defined sentences.*"

The sentence was revised and split up in shorter sentences, see **R1:Mi11-a** (page 3, line 64), **R1:Mi11-c** (page 3, line 66) and **R1:Ma1-e** (page 3, line 65).

12. "*P3 L6: The text mentions 'low Reynolds numbers'. Please describe the Reynolds numbers at which the experiments are run, and motivate if the experiments scale realistically.*"

The main goal of the turbine is to deliver data for the comparison to simulations and to test and analyze flow control devices and not to compare the overall performance to a turbine in the free field. Therefore, a low Reynolds airfoil was selected as it provides attached flow in the root region of the turbine, which is better for the comparability of experiment and simulation. Over the whole blade span, the Reynolds number ranges from Re=170000 at 15%R over Re=276000 at 50%R to Re=162000 at 98%R. The Reynolds numbers at 15%R and 75%R are now provided, see **R1:Mi12-c** (page 6, line 133) and Table 2.
The load alleviation concepts will be investigated in future studies and this submission serves as a basis. In the manuscript, additional information concerning the airfoil see **R1:Mi12-a** (page 6, line 132), **R1:Mi12-b** (page 6, line 132) and the motivation of the scaling, see **R1:Mi12-d** (page 6, line 140), were added.

13. "*P3 L9: How is the boundary layer thickness estimated? Is it possible to indicate the tape on figure 3?*"

That was a mistake the authors want to apologize for. The turbulator heights for the model wind turbine were adopted to the Reynolds number, which changes with blade radius. It was estimated with the help of an additional 2D experiment. Thereby, the Reynolds number over the whole blade radius was determined and reproduced in the Model Wind Tunnel (MWT) of the IAG, University of Stuttgart. With the help of a stethoscope, the state of the flow was investigated behind zig-zag tapes with different heights. Based on these investigations, the turbulator heights for the BeRT turbine were estimated in order to get a defined transition position and to avoid overtripping. The sentence was adopted and a short remark, that the heights were estimated experimentally was added in the submission, see **R1:Mi13** (page 6, line 136).
The tape position is now indicated in the corresponding figure (Fig. 4, former Fig. 3).

14. "*P3 L15: It is confusing to mention at this point in the text the overall goal of the research project, as it is different from the objectives of this paper.*"

The sentences was reformulated and refers now to the aims of the manuscript rather than the aims of the overall project, see **R1:Mi14** (page 6, line 145).

15. "*P5 L2: What is meant with 'trailing edge deployment'?*"

The smart blade has trailing edge flaps. The actuators are used to deflect the flaps and the sensors to monitor the deflection. So the word 'flap' was missing and is now added, see **R1:Mi15** (page 8, line 158).

16. "*Table 2: What are the units for the wake length?*"

The wake length is measured in rotor revolutions after release of the respective wake elements. A wake length of two means that a wake element is removed from the domain after the rotor completes two full revolutions after it has been released from the blades trailing edge. Additional information was added in the text, see **R1:Mi16** (page 10, line 216).

17. "*P6 L14: 21 panels are mentioned in the text, but in Table 2 15 panels are mentioned. Which one is correct?*"

The final calculations have been carried out with 21 blade panels. It was corrected in the table, see Table 3 (former Table 2).

18. "*P7 l3: It is not entirely clear what is meant with 'overlapped using the CHIMERA technique', overlapping several grids?*"

The sentence was extended, see **R1:Mi18** (page 11, line 232). And yes, several grids overlapp, as each component of the wind turbine has a separate grid. Afterwards, the single components are put together and the grids are overlapped. The flow of information between the single meshes is handled with the help of the so called Chimera technique. More information about the technique can be found in the corresponding reference. The most important advantages of the technique are the possibility to adopt the mesh for every body to the corresponding requirements of the body and the possibility to move the grids against each other.

19. "*P7 L7: Don't use double brackets '(())'.*"

The double brackets were removed, see **R1:Mi19** (page 11, line 236).

20. "*Table 3: I suppose the units are millions of cells?*"

Yes, that is correct. The information can be found in the table header, but it was now added in first column of Table 4, (former Table 3), too.

21. "*P 8 L6-7: This is a repetition.*"

The sentence was deleted and some of the information are placed in the next sentence, see **R1:Mi21** (page 12, line 248).

22. "*Table 4 is an important table. Maybe it can be discussed earlier in the text.*"

Indeed, the table is important and helps to clarify the different cases. Therefore, the whole subsection including Table (Table 1, former Table 4) is now placed at the beginning of the section, see **R1:Mi22-a** (page 4, line 90) and **R1:Mi22-b** (page 4, line 103). Moreover, the title of the section was changed so its content is more obvious and information about the position of the nozzle were added.

23. "*P10 L3: Which probe was taken as the reference then? How are the hot-wire probes calibrated?*"

The mean value of all four probes was calculated and used as reference for each measurement position. Additional information about the offset correction and the calibration of the probes were added, see **R1:Mi23** (page 14, line 292).

24. "*Figure 7 is unnecessary.*"

The figure was deleted.

25. "*P11 L15: How much are these corrections typically? Maybe indicate in figure 16.*"

The sentence was reformulated in order to make it more understandable. Moreover, an approximated linear equation for the conversion of the local flow angle at the probe to the actual AoA, which is valid in the linear regime, was added, see **R1:Mi25** (page 15, line 323) and equation 1.
The authors preferred this way of displaying the conversion instead of the indication in a figure. Regarding Ma2, additional information about error was added in the revised manuscript, see **R1:Ma2-a** (page 15, line 329).

26. "*P12: The description of the strain gauge setups should be done in the experimental setup section.*"

The strain gauge is now mentioned in the section 2.1.3 , see **R1:Mi26** (page 8, line 168), but no more detailed description is present, as the measured bending moments are no longer part of the submission.

27. "*P9 L17 The text mentions measurements at 1.05d , while P13 L3 doesn't mention measurements at 1.05D. Be consistent, also with the unit of 'D'.*"

All positions are now designated with a lower-case "d", according to Fig. 2.
The measurements were performed at three positions. Therefore, for reasons of completeness, the authors mentioned in the manuscript. But because of space reasons, only two locations were analyzed in the submission. Moreover, the additional position at 1.05d would not have brought further benefit for the manuscript.
An additional sentence which explains this fact is added, see **R1:Mi27** (page 16, line 364).

28. "*P13 L15 'More information about this topic can be found in..' is too vague.*"

It is now more specified what can be found in the provided reference, see **R1:Mi28** (page 17, line 381).

29. "*P14 L6: 'Some aspects' is too vague.*"

The aspects are now more specified, see **R1:Mi29** (page 18, line 401).

30. "*P14 L10-15: Conclusions on wake comparison are not clear, which of the two simulations is discussed?*"

A sentence is added in subsection 3.1 to make clear, that only the velocity planes from the simulation including wind tunnel are taken into account in the whole submission, see **R1:Mi30-a** (page 14, line 302). Moreover, in the text where the comparison is made, it is also mentioned that the comparison to the simulation including wind tunnel is drawn, see **R1:Mi30-b** (page 19, line 406).

31. "*P15 L12: What does this mean for the measurement blade: isn't 100% the maximal radial position?*"

You are right, 100% is the maximal radial position of the blade, which corresponds to 1.5m and represents the tip. Consequently, 0% corresponds to the center of the rotor. This information is now added, compare **R1:Mi31-a** (page 21, line 441) and **R1:Mi31-b** (page 21, line 442).

32. "*P17 L8-10: 'More information about..' is too vague.*"

The intention of the authors to mention this reference was to give the reader a possible reference, where they can find detailed information about all the effects which occur under yawed inflow. The sentence is now changed, see **R1:Mi32** (page 23, line 488).

33. "*P18 L10: 'More information about..' is too vague.*"

The authors could not explain all the details about the different methods to extract the on-blade velocity and the angle of attack. However we wanted to give information about further literature. The authors now changed the way the reference is mentioned in the text, see **R1:Mi33** (page 26, line 518).

34. "*P18 L13-L16: This should be mentioned in the introduction.*"

The sentences were move in the introduction, see **R1:Mi34-a** (page 2, line 47) and **R1:Mi34-b** (page 2, line 42)