Reply to comments by Reviewer 2

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

In the present document the comments given by the 2nd 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 section with regard to the comments by reviewer 2 are marked in cyan. Changed sections with regard to comments by both reviewers are marked in green. Highlighting in gray denotes passages that have been changed by the authors in order to improve the clarity or the argumentation but which are not related to specific reviewer comments.

General comments

1. "*In the introduction, it would be useful to mention other techniques that can be used to improve aerodynamic efficiency in the root region with flatback airfoil, such as flow control devices (splitter, cavity, flap...), and to show how the authors' solutions can stand out.* "

This point has been added to the introduction in section **R2:G1-a** (page 3, line 81) by mentioning measures to increase the efficiency of conventional root sections and root sections with flatback airfoils. For the cylinder like sections active and passive flow control technologies such as VGs, or blowing/plasma actuators might be utilized in future applications. For flatback airfoil sections the causes of the base drag are briefly described and possible solutions are listed such as Gourney flaps, splitter plates, or cavities. The relevant literature describing all these measures is given. In addition, a clearer distinction of the scope of the present work from these efficiency boosting technologies is given in section 1.5. **R2:G1-b** (page 4, line 97)

2. "*With no validation of the model and without a grid independency study, how can you be sure about the results accuracy?*"

This point was also argued by Reviewer#1, so that a critical examination of this has been conducted. The authors agree that an assessment of the accuracy of numerical predictions is very important, particularly if there is no reference data available to validate the results. The grids in the present study are based on experiences gained during many national (AssiST, DFG-PAK780, LARS, TremAc, OWEALoads) and international research projects (MexNext, AVATAR, Innwind) and are based on the recommendations for the cell spacings and growth rates made during the NASA drag prediction work shops. In order to check for the influence of the grid on the solution in the present study a very fine grid has been employed for comparison which is planned to be used for future DES simulation. The trend on the sectional load distribution shows that there is only a very small grid influence. The sectional thrust curves more or less collapse completely. For the sectional driving force, very small deviations are visible in the radial distribution. Interestingly, the differences in the integral driving force is one order of magnitude smaller compared to the differences in the integral thrust. For this reason a classical grid convergence study (GCI) can be sometimes misleading, since local effects might be caught up by error compensation. However, these local effects are particularly important the present case where a detailed analyses of three-dimensional features are studied. Probably, a "bad" grid in the root region with for example large skew angles, aspect ratios or under-resolved boundary layers would not allow allow for a detailed evaluation of the relevant flow features, but on the other hand would also not be reflected in a global GCI.

Although, the general impact of the grid on the solution seems to be very small, it must be noted that for the lower wind speeds the local effects of the aerodynamic modifications on the overall blade performance can come into the same order of magnitude as the accuracy of the CFD framework. This fact is analyzed in the newly introduced section 4.6.

Regarding the grid dependency analysis, the paper has been modified in **R2:G2-a** (page 7, line 181) and **R2:G2-b** (page 10, line 224).

3. "*Are there any manufacturing constraints for the proposed solutions to increase aerodynamic efficiency?*"

This study is based on results of the research project AssiSt which was a cooperation with industry. The purpose was to get a better understanding of the basic nacelle parameters and the root aerodynamics of the root region of a wind turbine being equipped with flatback airfoils. At first instance the study neglected any other engineering disciplines. Therefore, no strict geometric constraints were imposed. Some considerations, like the lateral blade shifting, would impose a fundamental re-engineering of the engine construction.

Other modifications, primarily the blade root fairing, would easily be applicable from an engineering point of view since the blade connectors are fixed to the spinner. However, this leaves aside any economic deliberation.

An overview on the project results can be found in

Kühn, Timo, et al. "Results of the research project AssiSt." Journal of Physics: Conference Series. Vol. 1037. No. 2. IOP Publishing, 2018.

4. "*The proposed nacelle modifications and their impacts locally, on the root flow have been shown in detail. However, it would be interesting to quantify the impact of these solutions on a global parameter performance, such as the total power produced of the turbine*"

This comment is off course very important, since the crucial parameter that counts is the amount of energy extracted from the wind! Whenever it was possible, the relative improvements or degradations of the rotor efficiency have been added in the text for each of the analyzed modifications:

- regarding the difference of the baseline geometry to the isolated rotor **R2:G4-a** (page 18, line 385)
- regarding the impact of the nacelle thickness **R2:G4-b** (page 22, line 454)
- regarding the relative movement of the blade relative to the nacelle **R2:G4-c** (page 28, line 540)

- In section 4.6 the global assessment of the fairing type modification has been analyzed. Additional wind speeds have been considered that mimic off-design conditions. While the benefits obtained at low wind speeds are very small, they are considerable at higher wind speeds, where additionally a favorable effect can be expected for future investigations that take into account high levels of atmospheric turbulence. **R2:G4-d** (page 33, line 602) and **R2:G4-e** (page 38, line 684)