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Interactive comment on "Updating BEM models with 3D rotor CFD data" *by* Marc S. Schneider et al.

Anonymous Referee #2

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General comments

This paper is very relevant because it discusses the validity of the widely used BEM model and its input. Polars have been extracted from 3D CFD computations and compared to 2D polars from e.g. 2D CFD computations.

However, some important information is missing. We need to know whether the solver includes free transition and how big the CFD domain is. Furthermore, it is assumed that the 3D CFD computations are correct and represents the "truth". Couldn't this be questioned? My experience is that (3D) CFD does not capture stall correctly. So do we believe in the stations where we have separated flow? And forces can be too high if the domain is too small and the flow has been pushed through the rotor because of the boundaries of the domain. The domain boundaries probably have to be 10 to 20 rotor diameters away. Furthermore, the extraction of the data can also be questioned. Was the radial component extracted? Also, there is something with the values where force

distributions are shown. They are about 10 times too high if the forces are Newton per meter.

Finally, the conclusions are not really conclusions but self-fulfilling statements since it is obvious that data based on 3D CFD compares better to 3D CFD.

Since the overall aim of our research is to provide data and methods for the further development of wind turbines, we have to wear the perspective of the wind turbine manufacturers. Would I as a manufacturer blindly believe the 3D CFD computations? I think not. Therefore, I do not think that the advice should be to extract polars directly from 3D CFD. However, I think it could be more interesting to discuss why we see these differences between 2D and 3D. Why do we see this AOA shift for different pitch angles? I am left with the feeling that you (and we) are overlooking something. How do we interpret the abstraction of AOA in 3D flow?

I propose the following should be considered in the paper: * look into the values of the forces, where I think there is an error * describe the CFD setup in more details (domain size, free transition etc) and * analyse where we see differences to 2D data and why you observe the shifts in angle-of-attack * change the conclusions so that it is not self-fulfilling statements. I do not think that you should propose to use polars extracted directly from 3D CFD, because you then make the assumption that 3D CFD is correct.

Specific comments

Abstract Line 8: "…the the…"

Chapter "Introduction" * I think you are missing one of the first attempts to make such airfoil characteristics from CFD: – Bak, C., Fuglsang, P., Sørensen, N. N., Aagaard Madsen, H., Shen, W. Z., & Sørensen, J. N. (1999). Airfoil characteristics for wind turbines. (Denmark. Forskningscenter Risoe. Risoe-R; No. 1065(EN)).

Section "Inverse BEM" Last sentence: I do not really understand…

Section “RANS setup” How big is the domain? How far upstream? Downstream? And in radial direction? If the domain is small this can influence the result. . .

Section “Influence of pitch angle” Figure 5: Title of plot is not clear.

Section “Comparison between Rans,. . .” Fig 7: What does the forces represent? N/m? If so: An integration of the tangential forces result in a power delivered by the blade of around 30MW – and for 3 blade 90MW. . .. Can this be right? A factor of 10? And the same is the case for the axial loading. . .

You extract axial and tangential induction. What about radial? Couldn’t this explain some of the AOA shifts?? Or what explains the AOA shift for different pitch angles?

Section “Conclusion” * First finding: – It is obvious that polar data obtained from 3D CFD agrees better to 3D CFD than data not obtained from 3D CFD. So that is not really a conclusion. It have to be so – otherwise you have been inconsistent.

* Second finding: – This is also obvious because you use the inverse BEM. So this is not either a conclusion

* Third finding: – I would actually like to know WHY the polars change with pitch angle. Please consider a bit more.

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