

Interactive comment on “On the scaling of wind turbine rotors” by Helena Canet et al.

Anonymous Referee #1

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General comments

It is a very well written paper and has good contribution to the scientific progress of wind energy. The authors have presented a very comprehensive methodologies, discussions and results on the aero-elastic scaling of the wind turbine rotor. It answered clearly the 3 common scientific questions mentioned in the very beginning of this paper regarding the scaling of a wind turbine rotor. The reviewer still has some specific comments to address in order to further improve the quality of the paper.

Specific comments

In the following, there are some more technical comments:

1. On page 1, line 24, “an alternative design approach”. What exactly is the design approach?

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2. On page 7, line 9, " Hence, non-dimensional deflections can always be matched, provided that the stiffness is adjusted as shown". But the stiffness can not always be adjusted as it needs easily due to the limitation on the material properties. The author should consider to strengthen this argument.
3. On page 11, line 5 "If the model is actuated (with generator, pitch and yaw), it becomes increasingly difficult if not altogether impossible to house these systems in the reduced dimensions of the model." It is difficult to understand this sentence. What does the author mean?
4. On page 16, line 1 "For instance, the standard blades of the V27 weigh 600 kg (Vestas, 1994); four times more than the gravo-aeroservoelastically scaled blades of the S-model." The author should consider or mention that the V27 blade was designed 15 years ago using relatively old technology, which should be heavier than a blade designed by newer technology.
5. On page 17, line 9 " as efficiency is still relatively high" What is your reference case for this statement?
6. On page 17, line 11 "the FFA-W3-241 airfoil behaves very poorly." Could you please show a figure here?
7. On page 17, line 12 "because its aerodynamic characteristics at the scaled Reynolds are in reasonable agreement with the ones of the original airfoil at its full-scale Reynolds." Could you show a figure to support your argument?
8. On page 19, line 3 "The third web of the full-scale blade is also extremely thin (less than 1 mm) and very close to the trailing edge." This sentence is misleading. If I understand correctly, should it be the blade of W-model or S-model?
9. On page 19, line 7 "For example, the outer shell requires an elasticity modulus of 6.6 GPa and a density of 1,845 " Is this statement made for which sub-scaled



10. On page 19, line 31 "matrices". What matrices? Could you please be more detailed?
11. On page 20, Figure 3. Too much information is provided in this figure. If you could remove some of the non-relevant info, you could improve the clarity of the figure.
12. On page 20, line 13-14. Why extreme loads are not considered?
13. On page 23, Figure 5. Could you explain more in detailed about the "reference" used in figure 5?
14. On page 24, line 7-8 "The proportional-integral-derivative gains used for the scaled models are obtained by scaling the ones of the full-scale machine." Why and how do you scale these PID gains? In my opinion, a good method is to re-tune them. Could you explain on why to you scale them instead of re-tune?
15. On page 24, line 22 "up-scaled". From my understanding, should this be down-scaled?
16. On page 24, section 5, The wake model used for calculate wake deficit is not mentioned. Could you briefly describe it?
17. On page 26, line 3-4, "The mismatch is due to a slightly higher sectional mass in the last 20
18. On page 26. What about the comparison of the natural frequencies? Could you please show one plot regarding the frequencies in this section?
19. On page 27, line 7-8, Which wake model is used?

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20. On page 27, line 13, The critical explanation of the results shown in figure 8 is missing.
21. In general, The results and conclusions reflect the outcome of this research work well. But some statement is missing, for example, it was not mentioned how the rated wind speed, rotor speed were selected during the sub-scaling design process?

Technical corrections

Some of the small grammar mistake and typos are found and listed from my side:

1. On page 3, line 34, "aeroelastically" -> aero- elastically
2. On page 19, line 14, on -> in
3. On page 19, line 29, composites -> composite; appear -> appears
4. On page 27, line 18, overestimation -> over estimation

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