Wind Energ. Sci. Discuss., referee comment RC4
https://doi.org/10.5194/wes-2021-52-RC4, 2021
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Comment on wes-2021-52

Emmanuel Branlard (Referee)

Referee comment on "Some effects of flow expansion on the aerodynamics of horizontal-axis wind turbines" by David H. Wood and Eric J. Limacher, Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2021-52-RC4, 2021

The authors present expression of the "general" momentum theory of an actuator disk (including the pressure terms acting on the control volume surfaces, and without assuming that the pressure is recovered in the far wake). In their analyses, they relate the contribution of the pressure term to an integral over the axial and radial momentum in the radial direction. The formulae are presented in integral and differential form. The authors then proceed to studying a finitely bladed rotor with expanding wake but constant pitch.

The work is highly relevant and thorough. I have several general comments that I hope can improve the paper:

- I would advise to split this paper into two. The actuator disc and finite number of blades part are somewhat related, but each part could very well be put into separate, shorter papers. Mixing disc and finitely-bladed rotors adds in complexity and can confuse the reader.

- The paper contains a lot of maths and is not easy to follow without a definite engagement from the reader. I would recommend to guide the reader more between equations: stating what equations are used, adding intermediate steps and definitions, translating definitions into maths, etc. I think it would help the reader, if going from one equation to the next is straightforward. I've added specific comments in the pdf for equations that in my opinion need more guidance.

I enclose some specific comments in the pdf attached to this review. I'd like to congratulate the authors for their interesting work. I'll be looking forward to review a revised version of this paper.

Emmanuel

Please also note the supplement to this comment:
https://wes.copernicus.org/preprints/wes-2021-52/wes-2021-52-RC4-supplement.pdf