Wind Energ. Sci. Discuss., referee comment RC2
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Comment on wes-2022-44

Anonymous Referee #2

Referee comment on "Brief communication: A momentum-conserving superposition method applied to the super-Gaussian wind turbine wake model" by Frédéric Blondel, Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2022-44-RC2, 2022

The proposed manuscript extends previous superposition-based wake models to super-Gaussian profiles. While such approach results in an integral with no analytical solution, the author proposes different approximations (numerical and analytical) that are evaluated against the LES results from Bastankhah et al. (2021). It is found that both approximations have a satisfactory agreement with the numerical data.

I consider the proposed model of interest for the community and the results sound. In consequence, I think the paper is suitable for publication on WES. Nevertheless, I have several remarks that should be addressed prior to publication:

- As also proposed by another anonymous reviewer, figure 3 should also show the Gaussian and numerical models. This would support the conclusions drawn by the author.
- Also, both in figures 2 and 3 the agreement between different models and the LES should be quantified to show the overall performance of them.
- Which is the influence of the rotor disk discretization (line 93) in the results? The author states a 12x12 polar grid has been used but this number is not discussed.
- I am not convinced about the relevance of figure 1. It is not expected that an approximated super-Gaussian profile will perform better than a Gaussian one? Also, the maximal relative error for the kEquiv model still seems to be high. I propose the author gives such value in the main text. Furthermore, on the same topic, which are the values of kEq used in figures 2 and 3?
- I find section 3 too short. For instance, the parameter a_f is not defined and its relevance never explained. Also, can the author be more specific about the poor performance previously exhibited by the super-Gaussian model?
- This is just a suggestion, but it would help the reader to add a diagram, maybe as an inset in a figure, where the layout of the farm and the parameters n and i are shown.
- The caption of figure 2 should give more details. For instance, where are the turbines placed? Also, before the streamwise distance 5x/d_0 all models collapse? And why the velocity deficit increases after x/d_0=2?

- The manuscript has some typos and problems with definitions. In line 43 should say ‘interestingly’ instead of interesting. In line 45 and equation 4 the velocity U is not defined and shown alternatively with and without capital letters. In line 65 it is not clear if the characteristic widths are or not normalized.