

Comment on wes-2022-44

Anonymous Referee #1

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-RC1>, 2022

The paper extends the recent wake superposition model proposed in Bastankhah et al. 2021 by using a super-Gaussian distribution to express wake velocity deficit profiles, instead of a Gaussian distribution. The former is expected to improve results in the near-wake region. As discussed in the manuscript, the integral form of the conservation of momentum deficit for a waked turbine cannot be solved analytically for a super-Gaussian profile. However, the author used a numerical method as well as two approximate analytical methods to compute the integral. Results are compared with the LES data for two wind farm layout configurations. Overall, the paper is well-written with clear figures and interesting and critical discussion of results. So I recommend the publication provided that my below comments (in no particular order of importance) are addressed:

- Equation 6: I think "n" should be replaced with "k". Please check!
- Equation 9: It is not clear how this equation is obtained. Please provide more clarification about how model coefficients (shown in Equation 9 and Table 1) are tuned.
- Line 93: "... are estimated using a local rotor element area ponderated average". Please clarify what this means and how it affects obtained results.

Line 100: "... lead to superimposed velocity deficit". I am not sure if I understood what this sentence means. Please paraphrase it and elaborate what you mean here.

Figure 2: It is shown that MC methods underpredicts the velocity deficit for the second turbine. Line 107 states that this is a consequence of the application of the "modified"

momentum conservation. So please add the results for the "original" momentum conservation as I think this would strengthen your argument and also would be interesting for the reader to see how they are compared with each other.

- The main contribution of this work is the inclusion of super-Gaussian profile. To more clearly show how significant this affects the results, please include original model predictions (using Gaussian profile) in both figures 2 and 3.