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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Brief communication: A double Gaussian wake model" *by* Johannes Schreiber et al.

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This is a manuscript for a short article describing a new engineering wake model that uses a double-Gaussian formulation rather than the more common single-Gaussian formulation. This is a useful addition to wake modeling because wake deficit profiles appear double-Gaussian in the near wake. Such a model as this increases the range of distances over which the wake model can be accurate. Often, proposed wake models include text stating that they are not designed to be accurate in the near wake.

The manuscript is well written. I enjoyed reading it. I have some minor comments outlined below that are meant to strengthen the paper. I would like the authors to consider these comments, and I recommend this manuscript for publication.

Minor Items:

- Page 1, line 25: Is the statement "Nowadays, onshore wind farms tend to be closely packed, and turbine spacing often reaches values below 3D," really true? I realize you are using this for motivation of having accurate near-wake behavior, but I cannot think of a wind farm with such tight spacing. Lillgrund is a tightly packed farm, and it is just above 3D in one of the directions.
- Page 2, line 31: You say "This is due to the presence of two peaks in the speed profiles close to the rotor disk." Please be precise with how you word this. Make sure to say that they are **peaks** in the **velocity deficit profiles** or **minima** in the **velocity profiles**.
- Page 3, equation 3: I find it confusing to label momentum as p when there is pressure in the full momentum equation and also we speak of power a lot with wind turbines.
- Page 6, section 3.1: Just to be clear, there is no vertical shear in the inflow wind profile, correct? Therefore, U_∞ in your equations is just a single constant–it is not dependent on y, right?
- Page 7, line 144: The word "aeroservoelastic" is misspelled.
- Page 7, line 145: I think you mean to say "non-uniformity", and not "non-uniformly."
- Page 9, figure 4: The single Gaussian and double Gaussian RMSE become nearly equal at 9D. You should comment on what you think may happen further downstream beyond 9D. Do you think that because the double Gaussian model is at its core two Gaussians, it would do a worse job than the single Gaussian far downstream where real data appears more single Gaussian, or do you think the

blend of the two Gaussians is sufficient? I ask because although typical larger spacings are around $9D$, the wake of the most upstream turbine continues on past the second row to the third, fouth, and so on.

- General comment: I like this idea of the double Gaussian very much. In our LES of turbines in sheared inflow, we notice that both the spanwise and vertical wake profiles are double Gaussian, but where the amplitude of each Gaussian is different. This makes sense vertically because of the vertical shear. Horizontally, we conjecture that the vertical asymmetry gets rotated to a horizontal asymmetry due to the wake rotation in the near wake. Would you ever incorporate something like this into your model? This seems important if people are to use it to predict wakes in real sheared atmospheric flow.
- General comment: I know this is just a short paper, but do you have plans to tune this to more data to come up with a constant k^* that is dependent on background turbulence intensity? Also, the location of the peaks of the Gaussians relative to centerline seems very dependent on the loading profile of the rotor. Can you somehow fit to enough data to make k_r tuning-free for the user?

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