Reviewer 1

I consider this to be a well-written and well-structured paper with a clear contribution. I have to say that I am not an aerodynamicist and therefore cannot asses every detail of this paper. I have some minor comments/questions/suggestions:
The authors appreciate the positive feedback and useful comments from the reviewer. The comments have been addressed below. All changes are marked in blue in the manuscript.

- It is not clear if this model replaces or extends the FLORIS model as defined in (Gebraad). The caption of Figure 9 states that they use the FLORIS model but with different features (Gaussian vs Curl)? It would be good to explain how the FLORIS model is extended with the Curled Wake model or the Gaussian model.

Response:

The model presented in this paper extends the use of the Floris frame-work. This is a wake model which is a new option inside of Floris. This explanation has been incorporated to the text:

"The model proposed in this work is a new wake model and it has been incorporated to the FLORIS framework. The model is used to compute the wake from each turbine in a wind farm. After computing the individual wakes, they are added using the sum of squares method (Katic et al., 1987)."

- On pg 11, "We observe that both models agree very well in terms of power production" How do we see that? Do we see that in Table 1? What is the added value of the 2 turbine simulation? The effects highlighted in the 2 turbine simulations should also be visible in the three turbine case.

Response:

We agree with the reviewer and the results presented in this section were unclear. This section has been edited as follows:

"Table 1 shows a comparison between the power predictions and performance of the Gaussian and curled wake models and simulations performed in SOWFA. 5 In the case of 2 turbines, both models agree very well in terms of power predictions. However, we notice that the power predictions from the curled wake over-predict results from LES in the case of 3 aligned turbines. This outcome is expected because the vortices resulting from curl do not decay as they travel downstream. Without a decay model, the spanwise velocities from the yawed turbine, would never decay. In reality, these vortices decay due to the turbulence in the atmosphere and in the wake."

- Table 1, 3 turbine case. It seems that the Curled model is as bad as the Gaussian model (if you compare with SOWFA). The authors argue that this has to do with the fact that there is no decay model. Adding a decay model would also influence the two turbine case. It would be good to add some kind of tuned decay model to really show the strength of the model.

Response:
Yes, we agree that the decay model is a much-needed capability for the model. This is part of ongoing/future work. A statement has been added to the conclusion to reassure this:

"Future work consists of improving the curled wake model with emphasis on implementing a robust decay model for the vortices and comparing the model to experimental data."

- In general, it is not clear how the different engineering models are tuned.

Response:
There is minimum tuning of the parameters in the curled wake model. Since the curled wake model solves a simplified version of the Navier-Stokes equations, most of the effects can be incorporated through physics models rather than tunable parameters. All of the tunable parameters included in the curled wake model are explained in the manuscript.

- Conclusions, the authors state that this work sets a foundation for a simplified wake steering model in a more wind farm control-oriented framework. I believe the authors are referring to an estimation step followed by an optimization step (they can make this more explicit). The authors also increase the complexity of the model which typically means more tuning variable and thus a more complex control problem. It would be good to add a discussion on how this model can be used with respect to the state-ofthe-art.

Response:
The model presented in the manuscript is only a wake model. This wake model can be incorporated into other optimization routines in a control-oriented framework such as Floris. We agree that the module is more computationally expensive than other models, but this is necessary to capture the curl physics. This model is a new option (under development) in the Floris frame-work.

- A literature overview with containing other control-oriented models is lacking.

Response:
An overview of Floris, and some of the wake models used has been added. A reference to a more complete review on wake models has also been added in the introduction:

"FLOw Redirection and Induction in Steady State (FLORIS) is a software framework used for wind plant performance optimization (Gebraad et al., 2016; Annoni et al., 2018). A wake model is used in FLORIS to compute the effect of wind turbine wakes on downstream turbines. Different models can be used inside of FLORIS to compute the wind turbine wakes, including the Jensen and Gaussian wake models (Bastankhah and Porté-Agel, 2016; Jensen, 1983). A review of control-oriented models can be found in Annoni et al. (2018)."

- In figure 3 and 4 it is not specified which quantity is plotted

Response:

The caption in the figures has been changed to:

“Comparison of streamwise velocity contours between a large-eddy simulation using an actuator line model under uniform inflow from \citet{howland2016} (top) and the proposed model (bottom). The streamlines show the spanwise velocity components.”

- I believe it is “an LES” instead of “a LES”

Response:

Yes, this has been changed accordingly.