Response to Reviewer 2, round 2:

Dear Referee #2,

thank you for your review of our manuscript in this second round. Please find our answers to your comments (black) below in red and changes made to the manuscript in blue.

In the revised manuscript the authors made significant modification to the figures and the text, in particular the presentation of results and the conclusion. In general, these modifications resulted in improvement of the manuscript. The authors adequately addressed all my minor comments; however, they dismissed the major comments related to the overprediction of power because of the "butterfly effect" after performing a longer-term simulation and justified using unreasonable wind turbine density as demonstrating scaling of the implemented induction modification. However, as can be seen in the Figure 2 b) on average the simulation with the induction modification results in larger power than the reference simulation, for the range of wind speeds between 4 m/s and approximately 11 m/s. It is not clear how can this be attributed to the "butterfly effect," i.e. dependence on initial conditions, especially since the result is based on five-day simulation, and time average should converge to an ensemble average. Furthermore, because of the over prediction, this unrealistic simulation with 22 MW turbines does not really demonstrate scalability. The question is what is the cause of this over prediction? The authors should provide a more convincing explanation before the manuscript can be accepted for publication.

We appreciate the critical evaluation of this part of the manuscript. It becomes clear to us that while such artifacts are well-known in the WRF community, it does make sense to add clarifications for the reader of the manuscript.
The presence of the turbines initially disturbs the flow only locally, but when solving for the momentum equations this local disturbance also affects the flow in the rest of the domain, also upstream of the turbines which further in the simulation then again affects the wind speed experienced by the turbines. This results in a decorrelation of the wind speed between the simulations with and without turbines. Even though this effect is small, it is noticeable in short simulations, like the 12h simulations we showed in the first iteration of the manuscript. For longer simulations this effect will vanish. We aimed to demonstrate this with a 5-day long simulation in the second iteration of the manuscript, but evidently this is still too short to fully eliminate this effect, illustrated by the small overestimation of power compared to the reference in Figure 2c. Not that this difference is only 0.32 % or 38.3 W per turbine, which even at the shallowest part of region 2 of the power curve could be caused by a wind speed difference as small as 0.056 m/s.
Focusing on Figure 2b specifically, as referenced by the reviewer, it should be reiterated that the wind speed used here on the x-axis is derived from the reference simulation without turbines. Between 5 m/s and 11 m/s both positive and negative ΔP can be found that cancel each other out, with values in the order of 10% caused by the decorrelation of wind speed between the two separate simulations. More intriguing is the apparent systematic positive bias between 3 and 5 m/s, which can be explained as follows. A deviation (due to decorrelation) of the wind speed in the simulation with turbines from the reference simulation without turbines results in large differences in ΔP. This can be because the wind speed drops below cut-in (resulting in ΔP = -100%, not shown in this plot) or because the reference

power is very small (resulting in large positive values of ΔP because the value in the denominator is small). This is again an artifact decorrelation of wind speeds between simulations.

To shortly clarify this in the manuscript, the following has been added at the end of section 3:
"The slightly positive $\overline{\Delta P}$ in Figure 2c is an artifact of the decorrelation of wind speed between the simulations with and without turbines caused by the presence of the turbines. A longer simulation time would effectively eliminate this artifact and therefore does not affect AEP estimates from year-long simulations."