Response to Reviewer 1's comments:

The revised manuscript is well presented and well structured. The authors' response covers all doubts and questions raised, and appropriate changes have been applied to the manuscript. However, I still have some minor scientific and technical comments which you can find here below.

The authors thank the reviewer for their kind comments and for their assistance in improving the manuscript.

Scientific comments/questions

1. Line 244: in the current work, the wind-farm start-up phase lasts for 20 minutes. Have you checked whether the selected time horizon suffices for reaching a fully-developed statistically steady-state flow in and around the farm? I believe that this is important since the SOWFA outputs are further compared against steady-state models.

The authors thank for the reviewer for their comment. We have not done statistical analysis on the fully-developed SOWFA flow, but chose the length of start-up time based on previous experience and an approximate calculation that is based on how long it would take a flow at freestream velocity to travel through the full domain. In this case, for a 10 km long domain, at 8.5 m/s freestream (just below all the average wind speeds of the precursors), it would take wakes 10 km / 8.5 m/s ≈ 1200 seconds to reach the end of the domain. Based on this, and the fact the precursors were run for 21,600 seconds to establish a steady-state freestream, the authors felt confident in taking an average over 2400 seconds of simulation to capture pseudo-steady-state turbine/flow data. Additional explanation has been added to the text, as shown below.

> Full wind farm simulations are run for a range of wind turbine yaw angles and lateral turbine locations, the latter to provide more realizations of the same flow for more converged flow statistics. In further analysis, the first ~~1,200~~ 1200 s of the simulation results are omitted because they relate to wake development and start-up effects. This value was chosen based on the calculation of approximately how long it would take the wake of a wind turbine to propagate at freestream velocity (approximately 8.5 m/s) through the entire domain (10km streamwise). The remaining simulation output is time-averaged over 2400 s to obtain a steady-state representation of the wind turbine and farm performance. Using the time-averaged cubed wind speed field (as

2. Line 264: Are the coefficients of the Crespo-Hernandez wake-added turbulence model the original ones? If not, I would suggest including them in the manuscript (for instance, as done in Doekemeijer et al. Table A1).

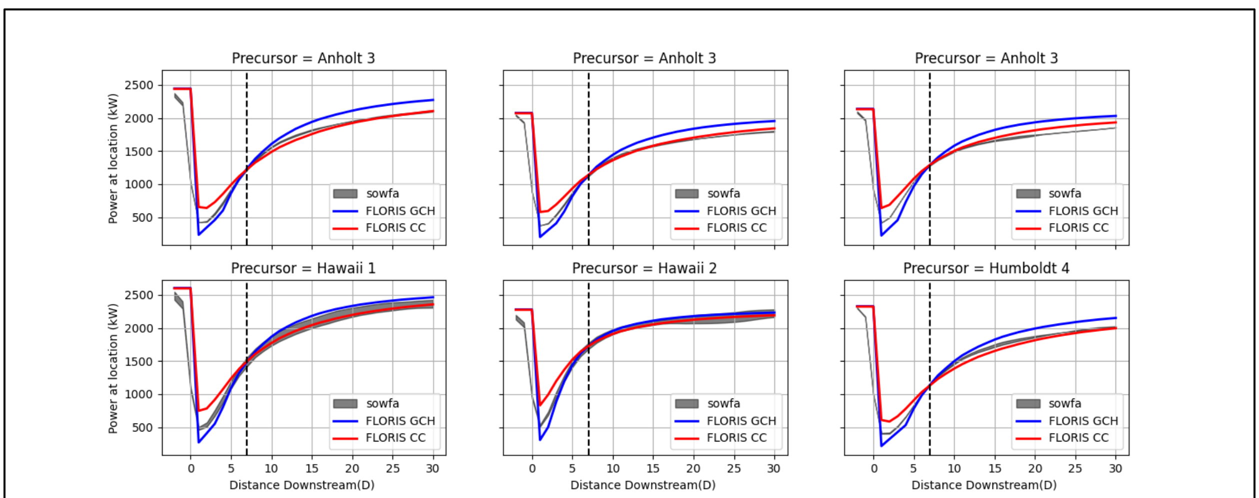
The authors appreciate the reviewer's feedback. The Crespo-Hernandez model coefficients used are the same as are defined in the example input file for the Cumulative Curl model in the FLORIS GitHub repository. For clarity and reference, those values have been added as shown below.

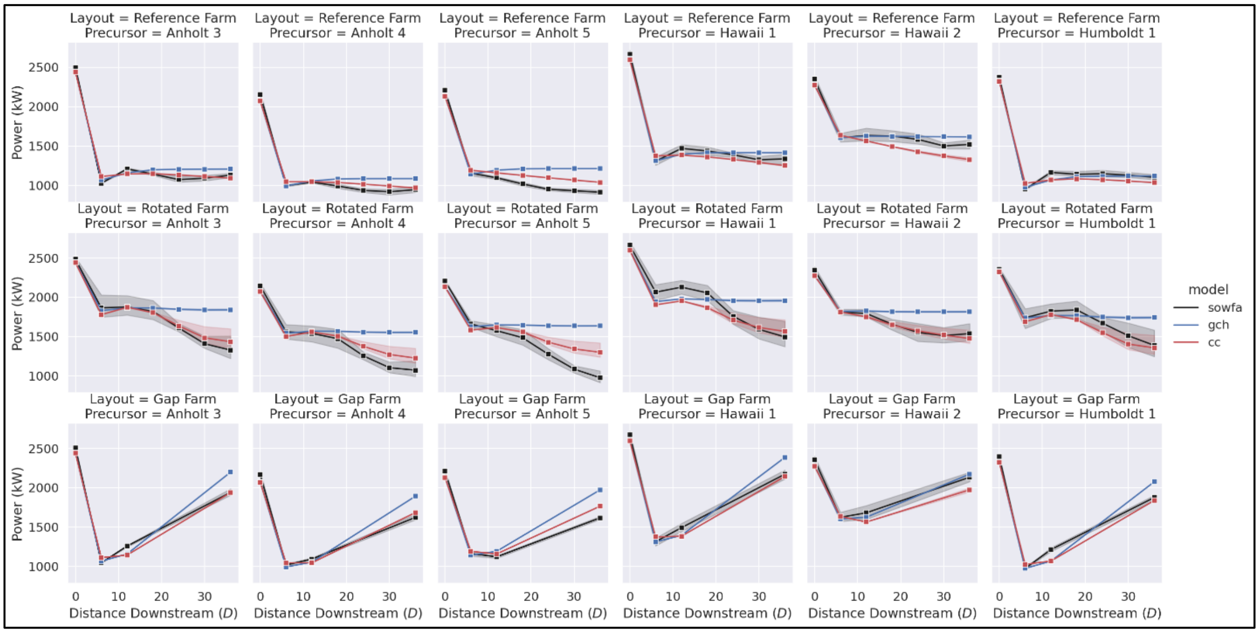
> $5D$ and $10D$. The $7D$ value was chosen to show that the new model's predictions are improved overall at other distances compared to the old model. The default wake-added turbulence model in FLORIS, Crespo-Hernandez, is used for the FLORIS simulations, with tuned parameter values as defined in the cumulative-curl input file in the FLORIS examples folders. For reference, those values are $ti\_initital = 0.01$, $ti\_constant = 0.9$, $ti\_ai = 0.83$, and $ti\_downstream = -0.25$. A log-law approximation of shear was applied to the background inflow using the default settings in FLORIS to approximate the shear

Technical comments

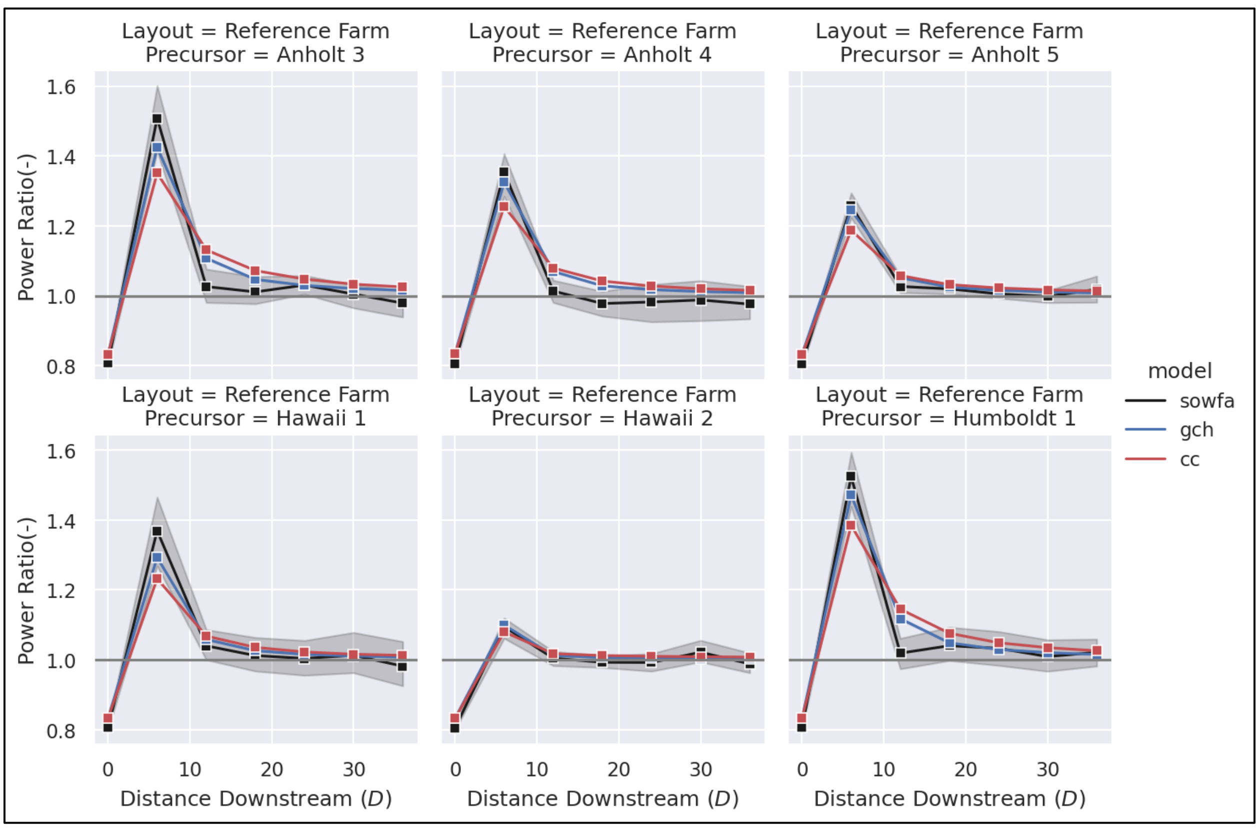
1. Throughout the manuscript, the precursor simulations are labelled with wind-farm names (see Tables 1 and 2). However, these precursor simulations are then used to drive the flow across idealized farm layouts (i.e. reference, rotated and gap farm). This creates confusion, especially while looking at Figs. 5, 6 and 7, where in the title of each subplot there are two wind-farm names. Hence, I would suggest labelling the precursor simulations differently.

The authors thank the reviewer for their feedback. Figures 1, 5, 6, and 7 have been more clearly labeled to indicate what precursor and layout are being used, as shown below.

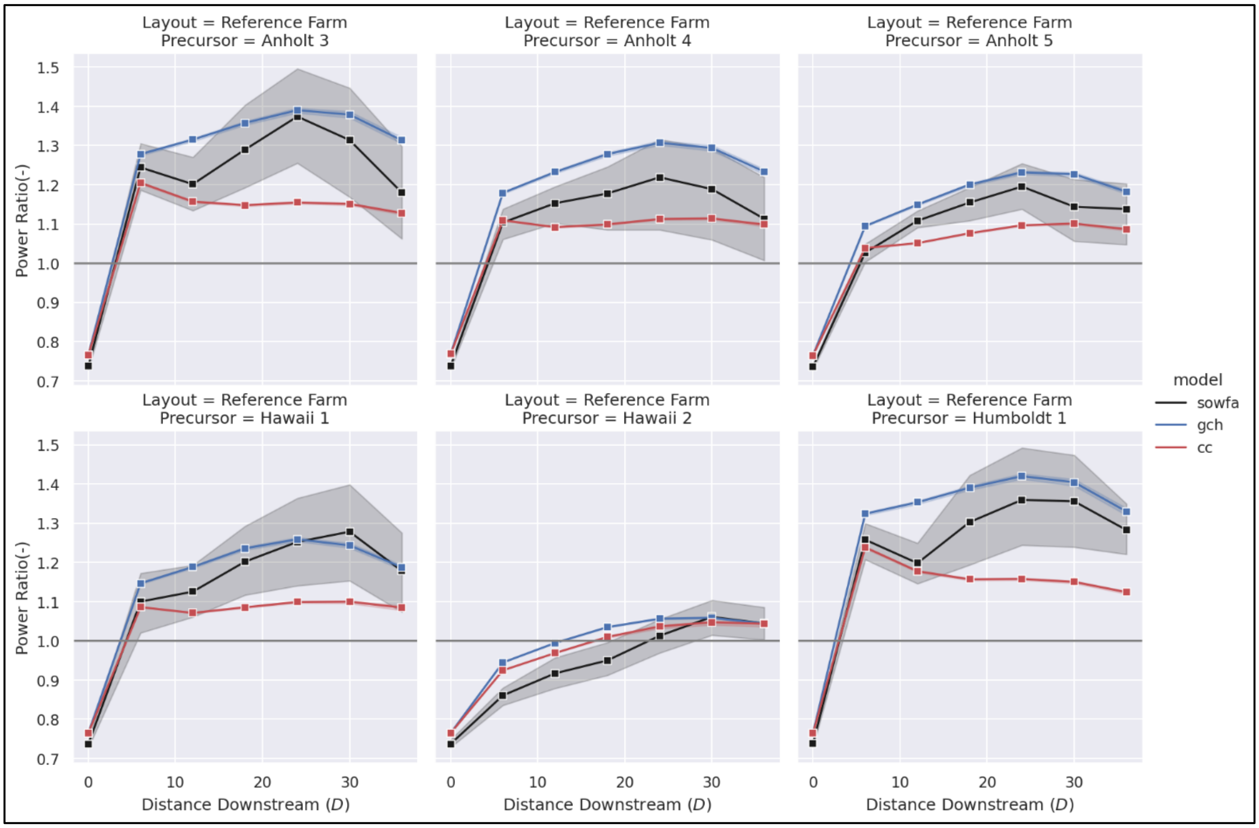




Layout = Reference Farm
Precursor = Anholt 3
Layout = Reference Farm
Precursor = Anholt 4
Layout = Reference Farm
Precursor = Anholt 5
Layout = Reference Farm
Precursor = Hawaii 1
Layout = Reference Farm
Precursor = Hawaii 2
Layout = Reference Farm
Precursor = Humboldt 1
Layout = Rotated Farm
Layout = Gap Farm
Power (kW)
Distance Downstream (D)
model
sowfa
gch
cc



Layout = Reference Farm
Precursor = Anholt 3
Layout = Reference Farm
Precursor = Anholt 4
Layout = Reference Farm
Precursor = Anholt 5
Layout = Reference Farm
Precursor = Hawaii 1
Layout = Reference Farm
Precursor = Hawaii 2
Layout = Reference Farm
Precursor = Humboldt 1
Power Ratio(-)
Distance Downstream (D)
model
sowfa
gch
cc



2.

There are no references to Table 1 throughout the manuscript. This might be a typo.

The authors thank the reviewer for pointing this out. We have corrected the table references as shown below. Note that latexdiff did not pickup the update of the table number.

Table 1 presents a subset of the 23 precursor simulations that were performed. In the table TI represents the ambient turbulence intensity as estimated via equation 11 using the TKE from WRF/NEWA. WD STD represents the standard deviation of the ambient wind direction impinging the wind farm in degrees. Note that wind direction is not exactly 270° (left to right) at the

the precursors, the wind direction can vary slightly at heights other than 120 m. The Wind Direction column in Table 1 captures this variation at 90 m (the hub height of the NREL 5 MW turbine), and is accounted for in the simulations.

3.2 Single wake analysis

The first set of wind farm simulations in SOWFA analyze the wake of a single turbine. For each SOWFA precursor simulation in Table 1, wind farm simulations of a single NREL 5 MW reference turbine are run (Jonkman et al., 2009).

3.2.1 Wake recovery

3. Line 179: typo a -> as

The authors thank the reviewer for pointing this out. The typo has been corrected.

Simulations are run in two stages. In the first stage, often termed ~~a~~ as "precursor", the computational domain (roughly 10 km × 5 km horizontally and 3 km tall with 10 m resolution in each direction within the boundary layer) is laterally periodic