# Wind farm flow control: prospects and challenges — Reply to Reviewer 1

**Reviewer:** *A very thorough and comprehensive review of the current status of wind farm flow control. Some sections are perhaps a bit wordy, and there will always be scope to include a few more references. Just a very few small and specific comments:*
**Response:** We thank the reviewer for his/her very supportive comments, and have readily addressed the issues raised by the reviewer in the revised manuscript (see below for details)

1. **Reviewer:** *Line 142-3: "While these types of precise implementation details can matter, e.g., for turbine loading" - these details can be more significant than this implies; the exact means by which a particular wake change is achieved can affect power output as well as loads.*
   **Response:** Thank you, this is indeed a good point. We have improved the discussion on this part as follows

   "However, when discussing wind farm control, very often collective effects on the flow physics that result from turbine actuation are straightaway considered as a control input, without directly considering the precise actuation at the turbine level. The most common example is induction control, in which the axial induction set-point of the turbine is changed to affect the wake and its downstream interactions. This may be achieved in various ways, i.e. by changing the generator-torque set point (thus changing the ~~rotational speed~~ tip-speed ratio), the collective blade pitch angles, or combinations thereof. We should note that, although these details do not matter much for the effective wake-flow development, they do matter in terms of loads and power, and should be included in the overall control optimization. For instance, derating the turbine without pitching the blades is sub optimal in terms of power extraction, i.e. given a thrust set-point, there is a unique pitch–tip-speed-ratio combination that maximizes power. When considering yaw control, changes in the yaw set-point can lead to changes in the trust set-point as well, which need to be properly captured for correct wake behavior. Again, these changes can include changes in generator-torque or blade-pitch set-points, and precise details can matter a lot for the effective power output and turbine loads. Finally, we note that, given a selected thrust and yaw set point, the effective turbine torque (and related power set-point) will have a subtle effect on the amount of wake rotation induced by the turbine, but these effects are small, given that modern turbines operate at high tip speed ratios."

2. **Reviewer:** *Line 182: wake steering combined with overinductive induction control: this could further exacerbate loading; whereas the option to combine wake steering with 'normal' induction control (not necessarily simultaneously on a particular turbine but depending on turbine position and wind condition) should also me mentioned (and referenced) in this paragraph - it's one option for achieving a suitable compromise between energy production and loading.*
   **Response:** This is a good point. We changed the discussion in the

manuscript as follows
“ Yawing a turbine to redirect its wake, increases the turbine loading. Combining yaw control with derating (underinduction) of the turbine can be used to find a trade off between energy extraction and load reduction at the level of the farm (Bossanyi, 2018; Debusscher et al., 2022). Another track that has received some attention is the combination of yaw control and overinduction. ... ”

3. **Reviewer:** *Line 210: "resort under" - do you mean "result in", or something implying "be equivalent to"?*
   **Response:** We changed the formulation into “an approach that could technically be categorized as ‘static’ wake redirection ”

4. **Reviewer:** *Line 444: typo "leveraged"*
   **Response:** Thank you, has been corrected.

5. **Reviewer:** *Line 950: "reliability of the facility"*
   **Response:** Corrected.