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Interactive comment on "Integrated wind farm layout and control optimization" *by* Mads M. Pedersen and Gunner C. Larsen

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Despite of successful field testing results of wake deflection (such as https://www.nrel.gov/docs/fy19osti/73991.pdf or https://www.wind-energ-sci.net/2/229/2017/), Pedersen and Larsen seem to come to the conclusion in their introduction that wake deflection is of smaller importance compared to wind turbine derating/axial induction based control. They refer to presentation slides from Andersen (2019) with LES studies, in addition to comparisons using low-fidelity models by Deshmukh. It seems to me however that in the slides by Andersen (2019), also the power of the combination of turbines cannot be increased through turbine derating, see slide 13/16?

The authors are referring to Gebraad, 2015 and mention that it is not taking into account the combination of pitch and TSR, thereby referring to Larsen's own work (Vitulli, 2019) where this was done. The combination of pitch and TSR is interesting, but it is questionable whether the linearized RANS modeling tool (FUGA) that was used by Vitulli can be used to compare results. The main points following out of Gebraad, 2015 and related publication (J. Annoni et al. Analysis of axial-induction-based wind plant control using an engineering and a high-order wind plant model. Wind Energy, 2015.), which was based on high-fidelity LES simulations using actuator-line rotors, are that when reducing thrust, also wake recovery is reduced because of reduced turbulence in the wake, limiting the potential of axial-induction based wake control. Secondly, when using pitch control in particular, the energy that is conserved in the wake is concentrated at the edge of the wake, so that most of that energy cannot be recovered at the downstream turbine. The linearized RANS modeling tool with actuator discs used in Vitulli's (and also now in Pedersen's work) might not be able to capture such effects?

This is not to say that there could not be benefits of axial induction control, but it might be only applicable in very tightly spaced wind farms, and probably smaller than expected by the model used in Pedersen and Larsen. A recent paper (Effects of axial induction control on wind farm energy production-A field test, van der Hoek, 2019) shows benefits of axial induction control to be present, but smaller than expected from a CFD model (FarmFlow). The row production increase in below-rated conditions is reported to be 3.3%, while the spacing is more tight than the Lillgrund row where 8% increase in AEP was predicted by Pedersen and Larsen. Perhaps by recreating the scenarios, Pedersen and Larsen could have a critical look at their model's predictions compared to field testing results.

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