

## ***Interactive comment on “Power curve and wake analyses of the Vestas multi-rotor demonstrator” by Maarten Paul van der Laan et al.***

**Jamieson (Referee)**

peter.jamieson@strath.ac.uk

Received and published: 30 January 2019

I think this paper reflects excellent experimental work.

My main concerns are with the introduction as a key aspect of the work is not recorded. The results of this paper are the first experimental corroboration in real wind operation (validation as yet would be too strong a word as the results give in effect only one data point for 4 closely spaced turbines) of power gains previously predicted by purely computational methods associated with the interaction of numbers of rotors and spacing. The main problem is that references are not up-to-date with the most substantial piece of work (Innwind task 1.33 Report of 2015) missing and papers on power enhancement from multiple turbine blockage - Nishino (2015) and others - missing.

[Printer-friendly version](#)

[Discussion paper](#)



Results from 2015 are;

35% power gain from an infinite array (70 actuator discs) at optimum spacing for a large array  $\sim 1$  radius (Nishino 2015); 8% from 45 rotors at minimal spacings 5% and 2.5% diameter (Innwind, Chasapogiannis, 2015); 3% from 7 rotors (cited Chasapogiannis 2014) at 5% diameter spacing.

So the 4R-V29 result of 2% from 4 rotors closely spaced fits well with the above but it is really great that it comes from real turbines operating in real turbulent wind!

The sentence starting in line 15 "it is.." etc is a misunderstanding and needs deletion or amendment. BEM of course cannot be used in any present form for interacting rotors and all data regarding rotor interaction comes from CFD or vortex models as in Chasapogiannis. There are power gains of the Innwind 45 multi-rotor array from two separate influences - response to turbulent wind compared to a single large turbine (which does not depend on interactions - simply the faster response of small turbines modelled in BEM with structural and control system dynamics) and rotor interaction. Also the dominant effect on structure loads comparing multi and single (at least for large numbers of turbines) has nothing to do with rotor interactions but with averaging effects of many turbines.

In 5 Conclusions, p 25, line 22, a wake recovery distance of 4R-V29 of 1.03 to 1.44 Deq is "shorter" than for a single equivalent rotor. Why not approximately quantify the relevant distance for the single rotor?

Overall I think the paper should be improved by inclusion of the missing references and something like the story above regarding power gains discussed.

---

Interactive comment on Wind Energ. Sci. Discuss., <https://doi.org/10.5194/wes-2018-77>, 2019.

Printer-friendly version

Discussion paper

