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Wind Energy Science Discussion

Date: July 27, 2022
Subject: WES-2022-36 Final Response

Dear Referees,

Thank you for taking the time to revise our manuscript, for the corrections and for the valuable feedbacks.

The article has been revised following your suggestions. The attached document answers your comments.

On behalf of all Authors,
yours sincerely,

Alessandro Fontanella

Attached documents:

- Response to Anonymous Referee #1
- Response to Anonymous Referee #2

Response to Anonymous Referee #1

Dear Referee,

Thank you for your additional suggestions. We implemented them in the paper, and you can find below some feedbacks from our side.

- L280: Thanks for the effort in improving the paper here. However, it is not clear to me if the rotor speed experienced small variations in operation due to the pitch motion, leading to the inertial effects on rotor torque that we are discussing about, or if the rotor was slipping in the fixed tests without wind. Maybe I would rephrase, attributing the lack of inertia removal to "the inability to completely lock the rotor in the tests without wind". Stating that this depends on the controller is confusing in my opinion, since this way one would assume that a torque controller was used in the tests with wind, while from my understanding the rotor speed is simply held fixed.

  Thank you for pointing this out. The lack of inertia removal is indeed due to "the inability to completely lock the rotor in the tests without wind". We think this is the best way to express what we meant, so we included the sentence in this way:

  "*The large amplitude of torque variations, which is not matched by thrust, and their phase shift suggest the torque response is mostly due to mechanical inertia which could not be removed by the force post-processing. This is due to the inability to completely lock the rotor in the tests without wind, which resulted in small oscillations of the rotor of less than 10° of amplitude.*"

- Figure 9: I understand this new figure was prompted from the requests of reviewer #2 (and partially from my own). I am not used to analyzing such figures, however despite my best efforts I find this figure extremely difficult to interpret. I will list the points I am struggling with so authors can judge how to possibly improve the figure

  1. I am not 100% sure what the color map refers to. In the sense that: we are looking at average variation with respect to? The mean velocity in each point? Or the mean velocity in a certain point of the phase-Y plane?

     The figure shows the space-time evolution of phase-averaged velocities, and in particular their variation with respect to the mean velocity in each point. We included this information in the caption of Fig. 9. Moreover, we in the text (lines 411-416) a brief explanation of how we obtained the results of Fig. 9.

  2. We are looking at maps derived for oscillations at the wave frequency, correct? Perhaps include this in the legend.

     Yes, it is correct. We included this information in the figure caption.

  3. Does the rotor-frequency have anything to do with the results we are seeing? Particularly for the results in sway and roll, if no significant meandering can be noted, can the interaction between root and tip vortices of the blades be the cause of the oscillations in the various parts of the wake?

Thank you for this comment. We agree this hypothesis is interesting and deserves to be further investigated in future research. We included this sentence in the comment to Fig. 9 at lines 434-436:

"*Since no significant meandering is detected, the velocity oscillations in the central portion of the wake can be the result of the interaction of root vortices that are generated when the turbine operates in WC2*."

And, at lines 444-445 (where results with yaw motion are discussed):

"*As for sway and roll motion, the velocity oscillations in the center of the wake suggest a possible interaction between the root vortices.*"

We also included a sentence in the conclusion (lines 488-490):

"*No significant motion of the wake core is detected, so the velocity oscillation in the center of the wake that are seen with sway, roll, and yaw may be the result of the interaction between root vortices. Further research is needed to confirm this hypothesis and, in general, to explain the velocity fluctuations caused by platform motion.*"

Response to Anonymous Referee #2

Dear Referee,

Thank you for your comments and corrections. We fixed the errors at lines 118 and 286, and we updated the caption of Fig. 9 as you suggest.

Finally, concerning the comment:

Line 551 : what is confidential in the Dante calibration procedure? everything is explained in their userguide.

Our answer is that the calibration procedure and the data acquisition system were developed in house and are different from those provided by Dantec (only their LabVIEW drivers are used). This was done by our research group that works on hot-wire probes to improve the performance of the measurement system. The methodology is not published in any paper because it is used also for commercial applications. We briefly explained this in the Appendix B with this text:

"*The calibration procedure and the data acquisition software were developed in house and are confidential.*"