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Interactive comment on "Near wake analysis of actuator line method immersed in turbulent flow using large-eddy simulations" *by* Jörn Nathan et al.

Anonymous Referee #2

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The manuscript entitled "Near wake analysis of actuator line method immersed in turbulent flow using large-eddy simulations" deals with numerical computations of a modelled wind turbine embedded in LES computations. Several types of inflow turbulence are implemented in order to study its effect on the near wake development. The spectral content of the wake flow is then used as indicator of modifications. The present study is of interest for the wind energy community ad gives valuable insights on the near wake extent depending on turbulence intensities and types. On the other hand, the manuscript needs several improvements before to be accepted for publications.

- In general, the figure captions are poor and lack of essential information. The reader

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should be able to understand the figure content just be reading the caption. Some axes are wrong. Some figures are not consistent with each other

- The manuscript should be self-consistent. Please remind the main parameters of the MEXICO / NEW MEXICO experiments: rotor dimensions, tip speed ratio, hub size, Reynolds number based on chord length, etc.

- What are the properties of the generated turbulence in term s of scales: integral length scale, ratio between this scale and the rotor radius? Since the authors present some turbulence spectra without wind turbines, it would be worth to develop a better description of the generated turbulence.

- The PhD thesis of the 1st author is cited regularly, whereas the reference is not precise enough to ensure that the reader will find it easily on the web. Additionally, this reference is sometimes cited for results which are not specifically a new outcome of this thesis. So please cite more relevant sources when possible.

Major comments:

- P2, lines 22-24: the spectra are also based on statistics. I do not see why it would be less sensitive than second-order statistics to the convergence issue, since the spectra is a frequency distribution of the variance.

- P3, line 10-12 : this data was obtained from wind tunnel experiments and therefore it does not include the stall delay due to boundary layer stabilizing effects such a Coriolis and centrifugal forcing which enhance the lift of the airfoil". These types of effects can be reproduced in a wind tunnel. Do you mean 2D experiment? Without rotation?

- Page 5, lines 4-6. Give some details about the synthetic turbulence fields: what are the turbulent length scales ? it seems that the turbulence does not dissipate with the axial distance. That is not so common, as explained later on in the manuscript. Some comments should be already mentioned here.

- Figure 5 : improve the caption and give details about the experimental configuration

used as reference here : power coefficient, thrust coefficient, TSR, etc

- Page 10, line 15-17 : this part is confusing : it seems that a relative decrease of turbulence is given (48% and 44%), whereas the 4% stands for a decrease of turbulence from 15% to 11%. This would correspond to a relative decrease of 25%... please rephrase this part.

- Page 16, lines 11-15. Please elaborate more on the discrepancies between sheared and un-sheared conditions

- Conclusion: there is not discussion about the relative size of the inflow turbulent structures compared to the wake turbulent structures (rotor size, blade size, tip vortex size, shear layer size?). It is indeed a very important parameter to justify the observations mentioned in page 17, lines 16-23.

Minor comments:

- P1, l24 : “to to”

- Figure 2 : if it the midplane at y/R = 0, the plot should be dependant of z/R and x/R

- P3, line 8 : one parenthesis is missing

- P4, line 2 : “Kernel function”

- P4, line 3: please give the definition of sigma and Delta x.

- Figure 8 is too small. Additionally, it is difficult to differentiate the experimental and numerical results

- Page 10, line 2: The Reynolds number is based on the circulation: Please explain why you use this definition and not another one.

- Pge 10, line 7 : remove “here”

- Figure 10 : the caption is wrong

- Figure 11: the caption is poor and the authors should also better explain in the body text what this figure is for. Which computation solver is used here?

- Page 12, line 8 : ". . . should be at least twice as big" means dx/Delta x >2 ?.

- Figures 12 and 13 : Captions are not consistent with each other

- Figures 14 and 19: make both captions consistent. Spectra of what? Measured where? - Page 15, line 1: "determining the near wake" limit or boundary?

- Page 15, line 3: "reveals"

- Figure 18 : Y axis is not consistent with the caption

- Conclusion: remind in the conclusion the used method to generate the turbulent inflow

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