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Interactive comment

Interactive comment on "On the impact of non-Gaussian wind statistics on wind turbines – an experimental approach" *by* Jannik Schottler et al.

Anonymous Referee #1

Received and published: 4 September 2016

The manuscript entitled "On the impact of non-Gaussian wind statistics on wind turbines – an experimental approach" deals with the experimental observation that the turbulent properties as the intermittency that characterize the flow impacting a wind turbine are transmitted to its operating properties, even for sub-rotor scales.

The manuscript content is of great interest for the wind energy sector since the outcomes can have a direct impact of the way of designing wind turbines in order to improve their robustness and durability. The obtained results were already observed through numerical simulations but it is an additional step to prove this overall transmission of intermittency at the lab scale.

On the other hand, some questions that arise through the present study on the cut-off frequency of this transmission is not enough deeply discussed (see major comments).

Consequently, I recommend the publication of the article, considering that major corrections will be made according to the recommendations given below.

Major comments:

- P3, l10-11, Eq 5 : a space average is applied to the incoming flow measurements, arguing that “This approach is more appropriate to describe the wind speed affecting the rotor than a single point measurement”. Please elaborate your argumentation.

- If this approach is more appropriate, why is it not used in the following part of the study?

- §3.2 : please show PSD for all signals and discuss them

- Fig 5 : the coherence functions for power and torque are not continuous, but show regular peaks. Why? Don’t we expect continuous functions? Please elaborate an explanation.

- Wind turbine data sets are low-pass filtered with a cut-off frequency of 15Hz for thrust and 45Hz for power and torque data. These cut-off frequencies are very close to the frequencies related to the time scales of interest, 13 and 40Hz.One can therefore expect that the signal distortion due to filtering (magnitude damping and phase shift) affects the wind turbine signals at the frequencies of interest, and so their unsteady properties, including intermittency. In other words, how confident can one be in the increment PDFs obtained for the thrust with tau = 0.067s, whereas the signal is low-pass filtered at 15Hz; and for the power and torque with tau = 0.025s, whereas the signals are low-pass filtered at 45Hz?

- Fig12 : PDFs show strong asymmetric distributions for power and torque. Please add the skewness and flatness values for all signals and for both inflow conditions and comment them

Minor comments:

- P2, l7: “Rainflow distribution” instead of “Rain flow distribution”. Please explain briefly what it is.

- P2, l8: describe FAST at the first time of appearance in the manuscript (aeroelastic tool)

- P2, l20: “we contribute THROUGH wind experiments to. . .”

- P3, Eq 4: add “<uˆ2_tau> = “ to the equation

- P3, l19: write the relationship between the second-order structure function and the autocorrelation function.

- P3, l25: define sigma_tau (formula)

- P4, l7 : “As shown in Tab.1 and Fig. 1,. . .” : remove Tab.1

- Figures 1, 9 to 12: you choose in Fig 1 to sort the plots (top to bottom) according to a decreasing time scales. You choose the opposite for other plots. Please make all plots consistent.

- P5, l6-7: it is not clear at which downstream distance from the rotor the measurements are performed. Is it 1D?

- Eq 7 : write “R_sh” instead of “0.1 Ohm”

- P6, l21-22: please indicate the velocity rotation, the rpm and the associated frequency of the wind turbine model.

- P8, l17 : “autospectra” instead of autospectrum”

- P10, l7 and Tab.2: “turbine dimensions” instead of “turbine lengths”?

- Tab. 2 : “time scale tau” instead of “time”

- Tab 2 : if I compute the frequency related to the time scale 0.08s, I obtain 12 instead of 13Hz

- Fig. 11: use solid lines for the inflow for both plots

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Discussion paper