Comment on “Wind turbine load dynamics in the context of turbulence intermittency”

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Addressing the non-gaussian behavior of small-scale turbulence upon wind turbine fatigue loads (through an aero-servo-elastic wind turbine model) are investigated with a simple Continuous-time-random walk model. The focus is on spatial correlations which are added through idealized prescribed correlations. The focus of the paper is clear (except the part explaining the spatial correlation – see below) and the methodology by Berg et al. 2016 in which the small-scale non-gaussian behavior (as defined though velocity increments) was isolated is to a large degree followed. The paper thus successfully bridges the more classical approach by using continuous-time-random walk models without spatial correlations (see papers in reference list mainly from the Oldenburg group by J. Peinke) and the work by Berg et al. The literature in the field is nicely reviewed and strength and weaknesses in both approaches are highlighted. The conclusions that the effect of intermittency decreases as spatial correlations increases is indeed interesting and worth investigating even further. This is therefore also my main critic of the paper – exactly how is this correlation constructed? and how is the associated coherence related to atmospheric turbulence.

I have added specific comments below for the authors to correct / answer / reflect on.

1. P1,l3-6: which two types? You just say two types of wind fields. Please specify
2. P1,l3. In IEC – the Kaimal model must be accompanied by a coherence model to account for the spatial correlation – much in connection to your work.
3. P6,l25. Can you say something about the physical time scales in the wind model (here defined with constants of physical units). How does for example the integral timescale compare to characteristic time scales of velocity fluctuations in the atmospheric boundary layer like ~10min.
4. P7,l5. 1% error in standard deviations of the wind velocity leads to approx. 1% in fatigus loads . Can you please elaborate – or add reference. So a linear response? – and for all load channels?
5. P7,l13. In principle also in the third moment (zero in gaussian stat).
6. P8,l1. In general, for most figures (fig 1b and 2b, 3 and 4) – if you want to compare two curves, in this case two pdf of velocity, u’(t), then plot the curves in the same coordinate system. Makes it much easier to observe any likely differences.
7. Figure 5a. Is it possible to get the numbers on the x-axis as a function of standard deviations (\sigma_{\tau}). That makes it easier to judge how much non-gaussian the velocity increments at the different time delays are.

8. Section 2.1.3: Main question: How are the delta correlated and 3*3 block correlated cases constructed? A 2-3-line description is not enough. For example, what is the block size in physical units and hence the derived integral length scale? Also how does the Coherence (based on the cross spectrum) look and how does it compare to atmospheric numbers and for example the Davidson model (exponential decay)? Both text, formulas and Figures are required. This is a vital information since the novel-ness of this paper is exactly the including of spatial correlation to the already introduced and utilized Continuous-time-random walk model.

9. Figure 14 caption: “vertically” should be “Horizontally”

10. Figure 7-12. How many ensemble members is used (difficult to count the number of boxes in the plots) and what is the size in space and time of these turbulence boxes.

11. A discussion of your results in terms of turbine safety factors would make the significance of the results more useful.