

# ***Review: Introduction of the Virtual Center of Wind Pressure for correlating large-scale turbulent structures and wind turbine loads***

## **General Comments**

The study considers two sets of observations from vertical towers in the presence of wind turbines to compare the loads generated from observations versus simulated wind fields generated using the IEC standards. The paper argues that “bumps” in the loads are the major contributors to the Damage Equivalent Load (DEL) and that these bumps are not found in the loads produced from the simulated wind field (not shown). The only analysis of the wind field is a calculation of the virtual center of wind pressure and it is shown that this metric correlates well with the simulated tilt moments.

Overall, the writing quality of this paper is good, but there remains a glaring omission from the paper that the actual wind field is not shown in any way. The calculated and simulated loads are compared, but the data with which they were calculated is omitted. It is difficult to believe in any of the findings when the wind field comparisons are missing. Due to this and other major revisions listed below, I recommend the paper be reconsidered after major revisions are completed.

## **Major Revisions**

- The paper compares the calculated loads which are a function of either the observed or simulated wind fields, but doesn't show results from the actual wind fields. Without seeing how these wind fields compare, it's tough to believe that the differences in the loads are not caused by some major discrepancy in the wind fields. By showing that the simulated wind field is reasonably close to that of the observed winds, readers can be more confident in trusting the analysis. If the modeled wind field is not a time series, but just a PDF, for example, then a comparison of PDFs would be fine. Additionally, discussion of the differences between the simulated and observed wind fields would allow for the authors to generate hypotheses about what the differences in the loads may look like, and/or attribute the differences in the loads to aspects of the differences between simulated and observed wind fields more clearly.

One of your conclusions states, “[t]he bumps were not observed within simulated loads from standard wind fields, which reinforces the need for a more comprehensive understanding of the turbulent structures and the improvement of the synthetic wind fields,” I don't see where in the paper this is shown. If the “bumps” are inherently not in the time series due to the simulated wind field being a statistically-generated field, then explain that (and, show the simulated wind field that was used to create the time series).

- Section 4 - what is the DEL when there is no “bump” in the artificial signal? It’s argued that these “bumps” are the main drivers of DEL but there is nothing showing the DEL before the bump is introduced.
- Section 5.2 - it is lost on me which data are being used to calculate these variables (Ts,tilt, Tv,tilt, Tm,tilt, etc.). It seems like from the text the “simulated” moments are from the observed GROWIAN data, the “virtual” moments are using an equation (but is it from simulated data or observed?), but then the “measured” moments are never shown. This section is very unorganized and difficult to follow. Additionally, the lack of clearly showing a direct comparison between observations and simulations truly hurts the credibility of the research.
- I don’t understand the “bump” event correlation to “large structures” in the wind field. The load is a function of the wind field; so if there is a signal in the load, there is a signal from the wind field, no? This, again, would benefit from showing the wind field.

## Minor Revisions

- In Figures 1 and 2 (possibly others), you show data for either the simulated or observed wind field, but not both at the same time. Is it not possible to plot the same metrics for both simulated and observed? If you want to drive home the comparison, it seems like it would be beneficial to plot both of these together to convince the reader that the simulated data is or isn’t comparable to the observed data.

## Technical Suggestions

- Writing and figure quality are good - no suggestions.