

In general, the manuscript is written with care. The math and statistics presented in the manuscript seem to be correct. However, this reviewer has the following comments

1). It is not clear throughout the manuscript what wind speed the authors are referring to. Is it the time-averaged “10-min mean wind speed” or “3-s gust mean wind speed?”. The clarification throughout the manuscript. In the introduction, it is stated (Lines 35-40) “... focused on the probability distribution of wind speed standard deviation  $[\sigma_u]$  conditional on the mean wind speed ( $u$ ), whereas it is required that the joint distribution of  $[\sigma_u]$  and  $u$  is properly modeled” Does  $u$  denote the “10-min mean wind speed” or the mean of “10-min mean wind speed”? This reviewer has a difficult time deciphering which is which. Clarification of this could significantly help this reviewer.

For clarity, in the following  $x_{10}$  will be used to refer to “10-min mean wind speed”.

2). The term modeling “wind turbulence”, “extreme wind turbulence” and “probability distribution of wind turbulence” are employed. However, the physical meaning of wind turbulence is unclear. Does it refer to  $x_{10}$ , the standard deviation of  $x_{10}$ , or the mean of  $x_{10}$ ?

In fact, the term “50-year turbulence levels” is not clear. Since often in wind engineering we speak 50-year return period value of annual maximum 10-min mean (or hourly mean) wind speed.

3) It is stated that “For modeling extreme turbulence accurately, the tail of the joint probability distribution of  $[\sigma_u]$  and  $u$ , must be accurately represented to small exceedance probabilities of the order of  $10^{-7}$ .” Again, accurate representation of  $x_{10}$ , mean of  $x_{10}$ , or standard deviation of  $x_{10}$ ?

4) The use of GMM is interesting. However, from a Bayesian point of view, if  $x$  is normally distributed, by considering its mean and/or its standard deviation are uncertain (due to small sample size effects), its posterior distribution which is obtained as a “weighted” Gaussian distribution is still Gaussian. This aspect needs to be discussed and contrasted with the GMM considered in the submitted manuscript.

5) Line 170. It was stated  $k$  is set equal to 4. It is not clear to this reviewer why  $k=4$  is considered.

Based on the above, this reviewer is not in the position to recommend its publication. Once the physical meaning of the terms is clearly defined, a re-review is necessary to examine the details. New queries are likely to be raised.