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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Laminar-turbulent transition characteristics of a 3-D wind turbine rotor blade based on experiments and computations" *by* Özge Sinem Özçakmak et al.

Anonymous Referee #2

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The paper addresses the laminar-turbulent transition in boundary-layers over surface of wind turbine blades. The investigation includes analysis of field and wind tunnel measurements as well as evaluation of the transition prediction based on the commonly used methods.

The work is focused on effects of free-stream turbulence on laminar-turbulent transition and capability of empirical methods to predict it.

The topic of the work is of importance and necessary for correct prediction of the wind turbine energy production. The analysis of measured data is performed in an adequate manner trying to extract information as much as possible from the available data. Field

measurements of the kind reported here are difficult to perform and available data are usually limited.

I can recommend the paper for publication. However, there are some issues which should be addressed before the final acceptance:

1. Page 2, line 33: Bertolotti et al., J. Fluid Mech. (1992), vol. 242, pp. 441-474, is the first paper published on PSE, please use this instead of Herbert 1997.

2. Page 2, line 34-35: It is said 'the eN method is commonly used since it can predict the transition position accurately'. As authors mention later eN method requires calibration and cannot predict transition for a general flow condition. The correct sentence should be ' the eN method is commonly used since it can predict the trends in variation of transition position correctly'.

3. Page 3, line 15: The dimension of x-derivative of pressure level should be 'dB/m' instead of 'dB'.

4. Page 8, line 3: A reference to 'transient computation' is made. What is it meant with 'transient' here?

5. Page 9, line 5: Due to acceleration of flow, value of U varies in the wall-normal direction even outside of the boundary layer. How is the value of 'Ue' chosen at a given x/c location?

6. Page 9, line 10-11: How do the profiles obtained from von Karman boundary-layer equations compare to those given by CFD for cases studied here?

7. Page 9, line 24-25: Authors write 'In order to ensure that the entire stagnation line is found at each time step, Hiemenz flow across the stagnation line and Blasius flow along the stagnation line are assumed'. Please explain that further.

8. Page 11, line 4: It is said that eN method accurately predict transition for Tu up to 2%. One should be aware that the transition can be dominated by streak breakdown for

cases with Tu≈0.65%. See e.g. Suder, K., O'Brien, J. and Reshotko, E., Experimental study of bypass transition in a boundary layer. NASA TM 100913 (1988).

9. The pressure signals shown in figure 5a show a periodicity in x direction. Is there any physical explanation for that or it's just due to different sensitivity of microphones? It would be good to mark location of microphones in figure 4 and 5 and also to keep the same colorbar scaling in figures 5a and 5b.

10. Figure 9: I suggest to plot CFD data as vertical bars at the azimuthal positions corresponding to flow condition in simulation. I believe it will improve visualization of data. 11. Is there any flow conditions in present investigation at which transition is caused by flow separation?

12. Mention transition-prediction parameters for results in figure 13a-c. 13. Plots given in figure 14 are very difficult to read. Improv them by either dividing these plots to group of 2D relative 3D cases or using fix colors for 2D and 3D cases respectively.

14. Would be possible to perform a simulation allowing for modelling variation of FST level during one rotation by introducing time dependent transition N factor. Alternatively performing simple analysis by using for example Xfoil with input data (AoA, Re and FST level) from figure 6.

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