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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on “Remote surface damage detection on rotor blades of operating wind turbines by means of infrared thermography” *by* Dominik Traphan et al.

Anonymous Referee #2

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General: A good paper with some interesting results from IR-measurements and it is clearly shown that the method is useful in visualising the effects of roughness on blades. However, I think you promise more in the introduction than you "deliver" in the paper: On p.4 l.2 you mention that you can assess the effective power loss but on p.14 l.17 you state that no significant change in the performance is detected (this is probably true for the turbulators you have placed). But I think it could be interesting to see if you can predict degradation in power (e.g. by adding more turbulators at the tip part so a larger part of the blade is affected). You are testing at a relatively low Re-number compare to full scale. Can you comment on this?

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An idea for a further study: Check the rule of thumb that a defect with a roughness height Re less than 680 doesn't disturb the flow (von Doenhoff, Albert E. and Horton, Elmer A. "A Low-Speed Experimental Investigation of the Effect of a Sandpaper type roughness on Boundary-Layer Transition", NACA report 1349, 1958).

p.2 line 10: It is true that a systematic approach has not been found, but there are some groups looking into this: Sandia National Laboratories (e.g. the report SAND2017-10669) or Christian Bak et al. "What is the critical height of leading edge roughness for aerodynamics?", Journal of Physics: Conference Series, vol. 753, no. 2, 2016.

p.6 l.21: You have decided to use five turbulators, but have you checked what happens if you use more? In principle the turbulators introduce 3D flow effects and you are measuring 2D Cl and Cd, so one can argue that the flow from the turbulators should also be 2D, hence there should be much more turbulators.

p.7 top: Why aren't you using the same Re in IR and lift measurements? I think you need to comment on that.

Fig 7: Could you compare to the standard turbulent-spot wedge angle ?

Fig. 8: Caption text and legend doesn't match. What is delta sigma?

p.12 l.3: I am not sure that turbulence easily exceeds stall. Normally you try to avoid that by having a sufficient margin to max Cl.

p.12 l.12: I don't think the comment about the increased fluctuations in post stall is relevant, as the airfoil will probably not operate at such high angle of attack.

Fig. 9: Is it possible to include a zoom of one of the wedges so it is easier to see the vorticity direction?

p.14 l.3: You reference to Section 3.2, for the subcritical, critical and super critical Re numbers. But they are not defined explicitly. I think it would be good to do that, either in Sec. 3.2 or in the caption of Table 1.

p.14 l.14: I don't fully understand the comment about the missing laminar to turbulent transition on the blade. Unless the Re number is very low you should always see transition on the blade. It is probably further aft because of the lower AoA and the thinner profile, but it should be there. Or is the flow tripped already at the LE (is the flow turbulent?). Comparison with Fig. 7 shows that the wedge is much less visible in the turbulent region of the flow. So Fig. 11 suggests that the transition is closer to the LE on the inner part?

p.14 l.17ff: Can you show some more data about the performance of the wind turbine with and w/o turbulators. Perhaps plot the radial contribution to power with and w/o the turbulators? Can you extract the Cl and Cd changes for the section with roughness and w/o? Could be interesting to see the effect on the turbine?

Table 1: Can you give the chord Re numbers as well?

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