Wind Energ. Sci. Discuss.,
doi:10.5194/wes-2015-1-RC2, 2016

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Interactive comment on "Detailed Analysis of the Blade Root Flow of a Horizontal Axis Wind Turbine" *by* I. Herráez et al.

Anonymous Referee #2

Received and published: 22 April 2016

Review of paper WES doi:10.5194/wes-2015-1

Title: Detailed Analysis of the Blade Root Flow of a Horizontal Axis Wind Turbine Authors: I. Herraez et al.

The manuscript deals with an important area in wind turbine aerodynamics, i.e. rotational augmentation along the inboard blade sections of horizontal-axis wind turbine blades. The authors completed a very detailed PIV study of sectional- and blade-flow characteristics and compared against companying RANS analyses. Overall, good agreement is achieved between experimental and computational data. The manuscript merits publication in WES pending some comments given below.

General comments:

This is a good quality manuscript, and both results and interpretation appear to be correct. The reviewer enjoyed reading about the gamma (chordwise vorticity) distribution and its effect on the root vortex. Reading the abstract, though, there is not a single piece of information that is not already known to the wind energy community. In fact, a counter-rotating vortex has been documented for the NREL Phase VI rotor, resulting in a number of (also) computational studies that are not included in the manuscript.

- A sketch on a global coordinate system would be extremely helpful. The authors talk about radial, axial, and azimuthal but a clear sketch is missing. Then the equation about the chordwise vorticity distribution includes dx ?

- In reference to the previous comment, the authors may consider looking at a fairly recent paper by Dumitrache (AIAA J. Aircraft ?) that includes a very informative sketch (and coordinate definition) about rotational augmentation and the effects of both spanwise pressure gradients and centrifugal pumping.

- The authors need to address the scaling issue of rotational augmentation effects. In the end, this work, though very detailed for 1 operating case of 1 small-scale rotor, cannot be generalized, and this should be stated. Recent work by Lindenburg (ECN, Ph.D.) and Dowler and Schmitz (Wind Energy paper on BEM solution-based stall delay) identified a dimensionless parameter (ratio of centrifugal to Coriolis forces) that can help in quantifying the degree of rotational augmentation for this particular model rotor. It's very easy to add and would improve the paper.

- Also, the discussion on spanwise pressure gradient versus centrifugal pumping can be supported by, for example, the work of Du & Selig who did quite a nice analysis and provide the standard model still in use today in NREL codes. At least, the authors should mention this in the context of the discussion on pages 9-10.

- Check for typos, comma placement, etc.

Specific comments:

Page 4, Line 1: The rapid vortex diffusion could also be due to the low Reynolds numbers. Some discussion would be good.

Page 4, Line 24: Wording "... focus is put ..."

Page 5, Line 3: "The origin of the root vortex". (This is not Darwin's 'Origin of Species') Maybe something similar to "Root vortex formation in the presence of rotational augmentation"

Page 5, Line 14: Wording "... airfoil types"

Page 5, Lines 20-25: Here a clear sketch of the experimental setup is absolutely mandatory.

Page 6, Line 4-7: A figure showing baseline airfoil data (Re < 1x10ˆ5) would be helpful. Again, it is unclear how results obtained are relevant to larger turbines. Look at the scaling parameter of centrifugal over Coriolis forces in recent works.

Page 6, Line 21: Add a full reference to Pointwise.

Page 7, 1st paragraph: For the RANS computations, wouldn't laminar-turbulent transition be of importance? At least it has to be addressed.

Page 7, Line 22: "excellent" is too strong of a statement without further justification and quantification.

Page 8, Line 12: Why? Laminar-turbulent transition?

Page 9, Line 3: Probably not the only source of uncertainty, others should be (at least) mentioned.

Page 9: Do the RANS computations include the blade hub ? I think this is potentially important.

Interactive comment on Wind Energ. Sci. Discuss., doi:10.5194/wes-2015-1, 2016.