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Interactive comment on "A vortex-based tip/smearing correction for the actuator line" *by* Alexander Raul Meyer Forsting et al.

Anonymous Referee #1

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General Comments:

The paper presents an correction tot he Actuator Line (AL) model commonly employed for finite volume simulations of wake turbine aerodynamics. An idealized proof is provided showing that a smeared representation of the volume forces of the AL necessarily lead to a smearing of the velocity field, analogous to the effect of making use of a viscous core model in a lifting line (LL) code. The correction is clearly important, and leads to a necessary correction of the AL model, such that the forcing induced by the blade is more realistic, as realistic as a standard LL in fact.

The paper is structured quite well, and most results are easy to follow, some discrepancies in the results are seen and the proof is quite idealized, so the general application to a fully 3D, viscous flow certainly cannot be claimed. The model is presented clearly

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and allows the reader to follow the arguments made generally quite well.

Specific Comments: Page 1, Line 2: Would there really be any doubt that a smeared force distribution gives rise to a smeared velocity field? Page 2, Line 11: Why should the AL produce the same velocities as LL? The AL simulation will be generally viscous, as opposed to a lifting line, which (even with core model) really is based upon an inviscid external flow. Page 2, Line 19: Rephrase: "to exhibit the same viscous core behavior"... Page 3, Line 1: Perhaps more logical to use "tangential" velocity instead of vertical. Page 4, Line 1: The assumption that the spanwise flow is negligible is violated at the tip and the blade root, where one expect the largest gradients, hence this proof is only idealized really. Page 4, Line 2: Simply because the BL is not resolved does not necessarily imply that we can ignore viscous effects, especially not for large inflow shear gradients. Page 4, Line 3: Can the assumption of quasi-steadiness be demonstrated with some sort of simple example, perhaps an order of magnitude argument using the Strouhal number perhaps? Simply this statement seems open to attack, especially for situations with large gradients/ flow deflection. Page 4, Line 16: Here tangential velocity is referred to, as opposed to the previous page with "vertical velocity" Page 5, Line 9: Which grid size is referred to here? Are uniform grids generally used for this type of situation. Statement is ambiguous. Page 5, Line 17: Dirichlet and Neumann implies velocity and pressure? Or is there a reason to use the more general terms? Page 6, Line 29: Is there a reason to use a core size equal to the local chord? Otherwise this could appear to be a "tuning" parameter. Is this expected to produce the comparable velocities? Page 9, Line 21: It is stated that upon activation of the smearing correction, vortices are trailed in-between sections. Is this as the model is treated as being steady/converged, and hence should not have trailing vorticity? Page 9, Line 25: Equation appears to be erroneous: Suggest removing (2) from bracketed term in radical Page 15, Figure 10: Could the author please provide slightly more explanation as to why the differences at the root and tip are so drastic? Is the legend of Figure 9 the same as Figure 9? Page 16, Table 3: This results appears to be drastic as opposed to the AL. Shall the reader then assume that AL results using Ellypsis 3D thus far have

been out by such a factor? Page 16, Line 1: “for any section along the blade.” Is the correct color scheme used for these plots, as it appears that the trend is reversed in the tip region. Page 16, Line 3: This doesn’t appear to be true for the downwind section of the yawed turbine. Page 17, Line 4: Is this statement made as the “return” to F_inf results appears to set in quicker? Page 17, Line 6: If the physical effect of smearing is inspected, does one necessarily expect a large impact on dynamic response? Page 19, Figure 13: Check color scale again. Results appear to not coincide with text (or I have interpreted them wrong). Page 19, Line 5: Restatement of reviewers earlier statement regarding inviscid approach of LL. Page 20, Line 1: indendepent of

Technical Corrections: Page 1, Line 1: “prove,” not proof (repeated on Page 19, Line 2:) Page 1, Line 5: covers Page 1, Line 8: lifting Page 1, Line 21: over-predicted, meaning Page 5, Line 17: symmetry Page 7, Line 7: vorticity Page 8, Line 7: instead of |x| . . . Page 10, Line 9: inherits Page 11, Figure 5: Suggest plot color change/line style change. Bund trailed not differentiable.In general plot is also not necessarily well displayed like this. One plot for streamwise and one for spanwise would work better (reviewers opinion!) Page 11, Line 11: (ana)lytical? Page 12, Figure 6: Expand plot width and choose different line style/color style. Results can barely be differentiated. Page 12, Line 9: a /= are Page 12, Line 9: than

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