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Interactive comment on "The Explicit Wake Parametrisation V1.0: a wind farm parametrisation in the mesoscale model WRF" *by* P. J. H. Volker et al.

Anonymous Referee #2

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In the article, the authors introduce a wind-farm parameterization in the mesoscale model WRF. The new model uses classical wake theory to describe the unresolved wake expansion. The authors compared the results from the new model with the filtered in situ measurements and also with the results obtained from current wind-farm parameterization proposed by Fitch et al. (2012).

The reviewer believes that there are fundamental issues in both model derivation and model validation.

1. in Section e 2.2.2, equation 7, the authors assume that the growth rate of the wake is proportional to xˆ1/2. This assumption is not correct, as the both numerical

and experimental studies of wind turbine wake under the atmospheric conditions show that the wake growth rate has a linear proportionality with x. As a result, the model derivation starts with an assumption that is basically wrong. (It should be noted that this assumption is only valid for the plane wake under laminar inflow condition.)

2. The authors mention that the definition of TKE in their model is different from the one in Fitch et. al. (2012). If this is the case (the definition of TKE is different in different schemes), how the authors compare their results with the ones obtained from WRF-WF scheme?

3. In comparison with the field data, the authors only validate their model only for the mean velocity, without any comments for the prediction of the added TKE. The author should comment on this issue that which model (EWP or WRF-WF) could provide better estimation for the added TKE inside a wind farm, since the TKE in the wake is responsible for the wake recovery and has significant effects on the power output from downwind turbines.

4. In section 2.2, the authors mention that "The expression for Pt can be found by multiplying the Navier–Stokes equations with the velocity fluctuation and then applying Reynolds averaging." However, in equation 4, a negative sign is missing (F_Di has a negative sign). As a result, the equation 4 is always negative and cannot predict the augmentation of turbulence due to the presence of the turbines.

It should be noted that, inside a grid cell, the heterogeneity of the flow is not resolved. It means that we cannot resolve the velocity inside the gird as shown in Fig.1a, and what we have is the averaged one over the grid cell (Fig. 1b). Therefore, all the heterogeneity inside the grid cell must be taken into account in the parametrization in order to estimate the added TKE by the turbines. Otherwise, as shown in Eq (4) (with a negative sign), this formulation only predicts the reduction of turbulence inside the farm, which is not correct.

In summary, the reviewer believes that there are fundamental issues in the proposed

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model that need to be addressed carefully before the paper consider for the publication.

Interactive comment on Geosci. Model Dev. Discuss., 8, 3481, 2015.