In the dynamic wake meandering (DWM) [1] model the meandering of the velocity deficit is the basic mechanism behind the increased loading in wake operation and likewise the main cause of the decrease in power. The computation of the deficit is thus a crucial part of the model. So far the velocity deficit has been computed using an axis-symmetric boundary layer equation (AS-BLE) model with the wake initial deficit derived from the blade element momentum (BEM) solution for the rotor induction. Within this framework of the axis-symmetric BLE formulation it is possible to compute a single velocity deficit as well as merging deficits for a row of turbines when the wind is aligned with the row. Model results for such cases have shown good correlation with measured row efficiency distributions. However, it is obviously important to extend the model complex to also handle arbitrary inflow directions to the row as well as interactions between different rows. The basic concept in the proposed model is to use a 2D BLE model in a horizontal plane and an AS-BLE model in a vertical plane for each deficit where the initial deficit as in the present model is derived from the BEM model induction. Merging of the wakes is implicitly modelled with the 2D BLE model where the computation can be extended over an arbitrary number of rows. For each deficit the 2D solution is locally coupled with the solution for the deficit in vertical direction computed with the axis-symmetric model. The coupling is done by enforcing a similar velocity from the two solutions at the centre of the released deficit using a coupling coefficient on the viscosity term in each of the two models.

A coupled axis-symmetric and 2D boundary layer equation model (AS2D BLE) model is being developed. The basic procedure to compute the initial deficit and expand the deficit is principally the same as already used in the dynamic wake meandering (DWM) model. The two BLE models (AS and 2D) used for the vertical and the horizontal deficit, respectively, are coupled together on the hub centerline, using a coupling factor on the eddy viscosity in each of the models. The model will be integrated in the optimization software, developed within the TOPFARM project, for optimization of wind farm layout.

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References