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On the evaluation of Taylor's frozen-flow hypothesis in modeling the meandering of turbine wakes XIAOLEI YANG, GUOWEI HE, Institute of Mechanics, Chinese Academy of Sciences — Fast and accurately predicting the meandering motion of turbine wakes is crucial to the design and control of large wind farms. Engineering wake models developed for the mean velocity deficit and the turbulence intensity cannot predict the meandering motion of turbine wakes. Large-eddy simulation (LES), which is able to predict the energetic coherent structures of turbine wakes, on the other hand, cannot be directly applied to the design of wind farms because of its high computational cost. To fast predict the meandering motion of turbine wakes, the dynamic wake meandering (DWM) model has been developed in the literature (Risø National Laboratory Technical Report, 2007, Risø-R-1607). In the DWM model, the meandering motion is taken into account by modeling wakes as passive scalars based on Taylor's frozen-flow hypothesis. To the best of our knowledge, the validity of Taylor's frozen-flow hypothesis for modeling wake meandering has not been fully evaluated. In this work, we evaluate Taylor's frozen-flow hypothesis using the LES data of turbine wakes. The space-time correlations are examined. The predictions from a simplified DWM model are compared with the LES results.

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