Comparison of wind turbine wake properties in non-sheared inflow predicted by different computational fluid dynamics rotor models

The wake of the 5MW reference wind turbine designed by the National Renewable Energy Laboratory (NREL) is simulated using computational fluid dynamics with a fully resolved rotor geometry, an actuator line method and an actuator disc method, respectively. Simulations are carried out prescribing both uniform and turbulent inflows, and the wake properties predicted by the three models are compared. In uniform inflow, the wake properties predicted by the actuator disc and line methods are found to be in very close agreement but differ significantly from the wake of the fully resolved rotor, which is characterized by much higher turbulence levels. In the simulations with turbulent inflow, the wake characteristics predicted by the three methods are in close agreement, indicating that the differences observed in uniform inflow do not play an important role if the inflow is turbulent. Copyright © 2014 John Wiley & Sons, Ltd.