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Large eddy simulation of unsteady wind farm behavior using advanced actuator disk models[1] MAUD MOENS, MATTHIEU DUPONCHEEL, GREGOIRE WINCKELMANS, PHILIPPE CHATELAIN, Univ Catholique de Louvain — The present project aims at improving the level of fidelity of unsteady wind farm scale simulations through an effort on the representation and the modeling of the rotors. The chosen tool for the simulations is a Fourth Order Finite Difference code, developed at Universite catholique de Louvain; this solver implements Large Eddy Simulation (LES) approaches. The wind turbines are modeled as advanced actuator disks : these disks are coupled with the Blade Element Momentum method (BEM method) and also take into account the turbine dynamics and controller. A special effort is made here to reproduce the specific wake behaviors. Wake decay and expansion are indeed initially governed by vortex instabilities. This is an information that cannot be obtained from the BEM calculations. We thus aim at achieving this by matching the large scales of the actuator disk flow to high fidelity wake simulations produced using a Vortex Particle-Mesh method. It is obtained by adding a controlled excitation at the disk. We apply this tool to the investigation of atmospheric turbulence effects on the power production and on the wake behavior at a wind farm level. A turbulent velocity field is then used as inflow boundary condition for the simulations.

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