Abstract Submitted
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**Large eddy simulation of turbine wakes using higher-order methods** GEORGIOS DESKOS, Department of Earth Science and Engineering, Imperial College London, London SW7 2AZ, UK, SYLVAIN LAIZET, Department of Aeronautics, Imperial College London, London SW7 2AZ, UK, MATTHEW D. PIGGOTT, Department of Earth Science and Engineering, Imperial College London, London SW7 2AZ, UK, SPENCER SHERWIN, Department of Aeronautics, Imperial College London, London SW7 2AZ, UK — Large eddy simulations (LES) of a horizontal-axis turbine wake are presented using the well-known actuator line (AL) model. The fluid flow is resolved by employing higher-order numerical schemes on a 3D Cartesian mesh combined with a 2D Domain Decomposition strategy for an efficient use of supercomputers. In order to simulate flows at relatively high Reynolds numbers for a reasonable computational cost, a novel strategy is used to introduce controlled numerical dissipation to a selected range of small scales. The idea is to mimic the contribution of the unresolved small-scales by imposing a targeted numerical dissipation at small scales when evaluating the viscous term of the Navier-Stokes equations. The numerical technique is shown to behave similarly to the traditional eddy viscosity sub-filter scale models such as the classic or the dynamic Smagorinsky models. The results from the simulations are compared to experimental data for a Reynolds number scaled by the diameter equal to $Re_D$=1,000,000 and both the time-averaged stream wise velocity and turbulent kinetic energy (TKE) are showing a good overall agreement. At the end, suggestions for the amount of numerical dissipation required by our approach are made for the particular case of horizontal-axis turbine wakes.

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