Numerical Simulations of Wake Interactions in Axial-Flow Turbines

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To understand the dynamics of the turbulent wakes past marine hydrokinetic (MHK) devices, we simulate arrays of axial-flow turbines. Using hybrid turbulence models that combine Reynolds-averaged Navier-Stokes equations and large-eddy simulations (URANS/LES), we compute flows downstream of three-bladed turbines with different arrangements, to investigate the mean velocity field, turbulence statistics, and the instantaneous dynamics of the wakes. Results show the consequences of wake interactions on the mean flow and the turbulent kinetic energy. This approach provides a consistent framework to characterize the impacts of MHK devices in natural tidal channels, and it can help to improve the arrangement design, by obtaining quantitative data on the interactions among turbines in realistic conditions.