Abstract Submitted
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Application of the attached eddy hypothesis for turbulence characterization in marine boundary layer flows[1] DACHUAN FENG, The Hong Kong University of Science and Technology, VIKRANT GUPTA, MINPING WAN, Southern University of Science and Technology, LARRY K.B. LI, The Hong Kong University of Science and Technology — Tidal current turbines usually operate in moderate to high current marine boundary layer (MBL) flows. Whereas the mean flow speed largely determines the average power extraction, it is the higher-order turbulence statistics that determine the structural load on turbines (required for device design) and the wake length behind them (required for array design). We propose to use Townsend's attached eddy hypothesis to characterize the turbulence in MBL flows. To this end, we perform large-eddy simulations of high-Reynolds-number MBL flows with seabed roughness varying from the transitional to the fully rough regime. We find that, within the log-layer, the horizontally-averaged spanwise turbulence intensity follows a log-linear law while the wall-normal component remains nearly constant. These findings are consistent with the attached eddy model (Townsend 1976, The Structure of Turbulent Shear Flow, CUP), with the constants being dependent on the seabed roughness. The present work provides a reduced-order framework for studying the effect of boundary layer turbulence on turbines.

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