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Turbulence structure over 1D and 2D periodic wavy walls: Coupling between coherent motions and large-scale undulations NICOLAS TOBIN, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign, PRANAV SURESH, Department of Ocean Engineering, IIT Madras, India, PRATAP VANKA, LEONARDO P. CHAMORRO, Department of Mechanical Science and Engineering, University of Illinois at Urbana-Champaign — Understanding the turbulence dynamics over topographies with mild perturbations is of great relevance at geophysical scale and on a number of other wall-bounded flow phenomena. Turbulence statistics and its spectral distribution in the boundary layer are heavily modulated by the topological features of walls in a very complex fashion. In this study we aim to understand some of the basic processes modulating the interaction of near-wall turbulence and large-scale mild perturbations superimposed to smooth walls. Large Eddy Simulations (LES) of channel flows with 1D and 2D periodic wavy surfaces are performed at a Reynolds number of 104 based on the channel depth. The computational domain spans 10λ (where λ is the wavelength) in the streamwise direction and 4λ and 1λ in the spanwise and vertical directions respectively. The sinusoidal waves have amplitude of 0.1λ. Turbulence structures and high-order statistics as well as features of energetic coherent motions are discussed in terms of the wall topology. The effect of the wall shape on the flow is examined through the pre-multiplied spectral features of the turbulence at key locations.

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