

Abstract Submitted
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Froude number effects on free surface turbulence in open channel flow YUJIA DI, University of Minnesota, Twin Cities; Shanghai Jiao Tong Univeristy, BINGQING DENG, ANQING XUAN, University of Minnesota, Twin Cities, YE LI, Shanghai Jiao Tong Univeristy, LIAN SHEN, University of Minnesota, Twin Cities — Direct numerical simulations of free surface turbulent flows in open channel at different Froude numbers have been conducted to study the surface deformation and the turbulence below. The deformation of the free surface is captured using a boundary-fitted grid and fully nonlinear free-surface boundary conditions. By studying the frequency-wavenumber spectrum of surface elevation, we find that the advection of the mean current alone contributes to the surface deformation at low Fr, while the contribution of the surface wave becomes more important as Fr increases. It is also found that in the bulk flow region, more energy of the streamwise velocity component is distributed at large length scales as Fr increases, indicating that the Fr number effect can also reach into the bulk region. The underlying mechanism of the modified bulk flows at high Fr numbers is further analyzed using the TKE budget spectrum.

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