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Interaction between deformable free surface and homogeneous turbulence XIN GUO, LIAN SHEN, Department of Civil Engineering, Johns Hopkins University — In order to understand the dynamics of free-surface turbulence, we perform direct numerical simulation for isotropic turbulence, which is generated and maintained by a random force method, interacting with a free surface with appreciable surface deformations. A wide range of Froude number and Weber number values are considered in our simulation. It is found that waves are generated at the surface, of which the low wave number components are controlled by the turbulence underneath. Splat and antisplat events are prominent features of this type of flows. Towards the free surface, the isotropic turbulence becomes axisymmetric and disk-like within the surface blockage layer. By examining the turbulence structure, turbulence intensity, vorticity fluctuation, and turbulence length scales, we find that the blockage effect of the free surface on the turbulence is sensitive to the Froude and Weber numbers. We also investigate water concentration, velocity fluctuation, and budgets of turbulence kinetic energy and enstrophy within the air-water intermittency layer, of which the results shed lights on turbulence modeling.

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