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Numerical study of wind-wave generation at the initial stage
TIANYI LI, LIAN SHEN, Univ of Minn - Minneapolis — We present direct numerical simulation (DNS) results of wind-wave generation process at the initial stage. In the simulation, air and water are coupled by an efficient iteration scheme using dynamically-evolving wave-surface-fitted grid. Due to the high water-air density ratio, the air sees the water surface as a moving deformable boundary and the water is driven by the shear stress and normal stress at the air-water interface. We use algebraic mapping to transform the irregular physical domain to the rectangular computational domain in the air phase and water phase. At the interface, the air phase provides stress information to the water phase and the water phase transfers geometry and velocity information to the air phase. The continuity of velocity and balance of stress at the interface are enforced via iteration. Fully-nonlinear kinematic and dynamic boundary conditions are implemented. The results show that the mean square of wave amplitudes grow linearly at the initial stage and exponentially at the later stage. Effects of different physical parameters on the wave growth rate at the initial stage are investigated.

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