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Study of surface wave effect on the turbulence underneath using wave-phase-resolved simulation ANQING XUAN, BING-QING DENG, LIAN SHEN, University of Minnesota — The Eulerian orbital motions and the Lagrangian motions of the water surface waves introduce different time scales to the turbulence underneath. In this study, the turbulence dynamics under progressive surface waves are studied using wave-phase-resolved simulations. Compared to the traditional wave-phase-averaged approach of modelling the wave-turbulence interaction, the fast turbulent motions with time scales similar to the waves are directly resolved. Based on the simulation data, we find that the coherent turbulence structures and turbulence statistics are wave-phase dependent. The mechanisms of the wave-phase variation of the turbulence are analyzed in the wave-phase-resolved frame and it is found that the variation is due to the periodic stretching and tilting of the wave orbital straining. The correlations between the wave phase and turbulence statistics, such as the vorticity and Reynolds stresses, are further quantified and their wave-phase-averaged contribution to the wave-turbulence interactions are modelled.

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