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Numerical simulation of wind-wave evolution and breaking YI LIU, LIAN SHEN, ROBERT DALRYMPLE, Johns Hopkins University — The wind-wave evolution and breaking play an important role in air-sea interaction by affecting the mass, momentum, and energy exchange between the atmosphere and the oceans. We perform large-eddy simulation of wind-wave interaction using a coupled level set/volume-of-fluid (CLSVOF) method. The dynamic evolution of waves including the entire breaking process under the wind forcing is simulated. With CLSVOF method, surface overturning, pinching off, and merging associated with wave breaking are captured. Different wind speeds are considered and their effects on the wave growth and breaking are examined. Based on the simulation results, various wind-wave interaction stages including wave growth, evolution, and breaking are investigated. Spectral analysis and wavelet analysis are applied to the wave field. The wave spectrum evolution under wind forcing is quantified and frequency downshift is observed. Wave groups leading to breaking are identified. The influence of the airflow separation over breaking waves on wave growth is also examined.

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