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**Simulation-based study of wind load on surface-piercing body and its dependency on waves** SHENGBAI XIE, LIAN SHEN, Johns Hopkins University — The wind load acting on surface ships and offshore structures are important for their operation and safety. In this study, we simulate the flow fields of wind and wave past a surface-piercing structure using a multi-scale modeling strategy. At large scales, the turbulent wind is simulated using large-eddy simulation on boundary-fitted grid coupled with nonlinear wavefield simulation using a high-order spectral method. The large-scale simulation provides environmental inputs for the local-scale simulation around the body. At local scales, the air and water flows are simulated by a coupled level-set and volume-of-fluid method. An immersed boundary method is used to represent the body. From the simulation, the statistics and structure of the wind and wave fields around the body are elucidated, and the loads on the body are quantified. A variety of developing and fully developed wave spectra at different sea states are considered. Swells and their interactions with the local wind-waves are included in the simulation. It is found that the mean wind loads are highly dependent on the wave conditions, and the instantaneous wind forcing varies with the wave phase.

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