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Flow past a cylinder near a free surface[1] KEEGAN DELANEY, MARCOS VANELLA, ELIAS BALARAS, The George Washington University, AMIR RIAZ, University of Maryland — Flow past a cylinder close to a free surface gives rise flow phenomena that are very different from ones in cases where the cylinder is fully submerged. In this study we will report resolved large-eddy simulations, where we examine the effects of various parameters that have been shown to effect the flow phenomena in previous experimental studies. In all computations a Navier-Stokes solver for multiphase incompressible flows with immersed boundaries and Adaptive Mesh Refinement is utilized. It employs level-set techniques to sharply define the interface between different phases. A fractional step method is used to solve the momentum and continuity equations, which results in a variable coefficient Poisson pressure equation. Proper jump conditions are applied to the Poisson pressure equation to accurately capture the jump in pressure that results from surface tension between different phases. Scalability and efficiency were placed at a premium during development of the solver, which has been tested to core counts on the order of 10,000. We will present details on the interactions between the free surface and vortices shed from the cylinder and their impact in the structure of the immediate wake and air entrainment.

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