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Vortex Dynamics Around a Bottom-Mounted, Short Cylinder in Oscillatory Flow HEATHER SMITH, Louisiana State University, DIANE FOSTER, University of New Hampshire — In coastal environments, the interaction of the reversing flow field with a stationary object is governed by complex vortex dynamics. For obstacles bounded by the sea bed, the locally generated and ejected vortices play a significant role in the scour and burial of these obstacles. In this research, the vortex dynamics around a short, bottom-mounted cylinder in oscillatory flow and the resulting time-dependent forcing at the bed are investigated with detailed numerical simulations performed with the commercially available model, FLOW-3D, utilizing a Large Eddy Simulation (LES) turbulence closure scheme. Model predictions of the magnitude, location, and shape of the centerline vortical structures were in good agreement with available laboratory data. During the wave half period, two vortex structures are identified: the upstream horseshoe vortex and the downstream arch vortex. As the flow reverses, the upstream horseshoe vortex advects away from the cylinder and dissipates, while the lee arch vortex flips over the top of the cylinder. In regular waves, this process is mirrored and repeated every half wave period. Two Keulegan-Carpenter number dependent vortex flipping regimes were observed: the single-vortex mode and the two-vortex mode. Ongoing investigations will examine the impact of these vortex dynamics on the applied bed shear.

Heather Smith
Louisiana State University

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