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Free-surface turbulent wake of a surface-piercing slender body at various Froude numbers¹ JEONGHWA SEO, Seoul Natl Univ, ABDUS SAMAD, Indian Institute of Technology Madras, SHIN HYUNG RHEE, Seoul Natl Univ — Free-surface effects on the near-wake around a surface-piercing slender body were investigated through flow field and wave elevation measurements. The near-wake flow field was measured by a towed underwater stereoscopic particle image velocimetry (SPIV) system. The measured flow field was analyzed to obtain coherent turbulence structures by using the Reynolds and proper orthogonal decomposition methods. Three different Froude numbers (Fr) - 0.126, 0.282, and 0.400 - were selected to represent mild, intermediate, and violent free-surface motions. At Fr = 0.126, the wave was hardly visible, although the turbulence strength and isotropy increased near the free-surface. At Fr = 0.282, though it was steady and smooth, wave-induced separation was clearly observed near the juncture of the free-surface and model trailing edge. At Fr = 0.400, wave breaking and the resulting bubbly free-surface were developed with an expanded wave-induced separation region. The wave-induced separation stimulated momentum transfer and turbulence dissipation, resulting in a significant change in the frequency of dominant free-surface motion in the downstream.

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