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Numerical Simulations of the Reduced Craik–Leibovich Equations in Spatially-Extended Domains ZHEXUAN ZHANG, GREGORY CHINI, University of New Hampshire, KEITH JULIEN, University of Colorado, Boulder — Large-eddy simulations of the Craik–Leibovich (CL) equations, a surface-wave filtered version of the Navier–Stokes equations, have been used extensively over the last decade to investigate Langmuir turbulence in the ocean surface boundary layer (BL). However, the simulations are generally restricted to moderate-sized domains, several hundreds of meters in lateral scale; in contrast, spatially-extended arrays of quasi-coherent vortical structures in Langmuir turbulence routinely span lateral scales from 1–10 km. To facilitate simulations of Langmuir turbulence in spatially-extended domains, Chini et al. (GAFD 2009) derived an asymptotically reduced model that consistently filters streamwise variability on scales comparable to the BL depth or less and temporal fluctuations associated with rapid-distortion transients. Preliminary simulations were performed in a moderate-sized domain (fitting only 1 or 2 pairs of vortical flow structures) to verify that the model is well posed and retains the essential dynamics of Langmuir circulation. Here, a more comprehensive set of simulations in a spatially-extended domain is performed to investigate the physics and the computational efficiency of the reduced model.

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