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Numerical Simulations of an Asymptotically Reduced Model of Anisotropic Langmuir Turbulence ZHEXUAN ZHANG, GREGORY CHINI, University of New Hampshire, KEITH JULIEN, University of Colorado, Boulder, EDGAR KNOBLOCH, University of California, Berkeley — The Craik–Leibovich (CL) model of Langmuir circulation (LC), a prominent form of shear turbulence in the ocean surface boundary layer (BL), is a variant of the Navier–Stokes equations in which high-frequency surface wave dynamics are filtered. Various investigators have performed large-eddy simulations of the CL equations in moderate-sized domains. Extension of these simulations to wide domains, several hundred times the BL depth, is computationally intensive, yet is necessary for investigating the impact of LC on submesoscale upper ocean phenomena. To facilitate such simulations, Chini et al. (GAFD, 2009) derived asymptotically exact, reduced CL equations by exploiting the strongly anisotropic character of LC in the strong CL vortex-force limit using multiscale analysis. The reduced equations go beyond strictly 2D (downwind invariant) formulations by consistently incorporating the dominant 3D physical processes while averaging or filtering certain fast, fine-scale flow features. Here, secondary stability analysis and pseudospectral numerical simulations are performed to explore the dynamics of the reduced model. The simulations suggest a possible dynamical explanation for the commonly observed Y-junctions in LC surface signatures.

Zhexuan Zhang
University of New Hampshire

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