Abstract Submitted
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Asymptotic descriptions of self-sustaining processes in shear and Langmuir turbulence: A comparative study[1] GREG CHINI, ZHEXUAN ZHANG, University of New Hampshire, CEDRIC BEAUME, Imperial College London, EDGAR KNOBLOCH, University of California Berkeley, KEITH JULIEN, University of Colorado Boulder — It has long been observed that stress-driven turbulence either in the presence or the absence of surface waves is characterized by streamwise-oriented roll vortices and streamwise streaks associated with spanwise variations in the streamwise flow. To elucidate the fundamental differences between wave-free ("shear") and wave-catalyzed ("Langmuir") turbulence, two separate asymptotic theories are developed in parallel. First, a large Reynolds number analysis of the Navier–Stokes equations that describes a self-sustaining process (SSP) operative in linearly stable wall-bounded shear flows is recounted. This theory is contrasted with that emerging from an asymptotic reduction in the strong wave-forcing limit of the Craik–Leibovich (CL) equations governing Langmuir turbulence. The comparative analysis reveals important structural and dynamical differences between the SSPs in shear flows with and without surface waves and lends further support to the view that Langmuir turbulence in the upper ocean is a distinct turbulence regime.

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