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Modifications to Symmetric and Baroclinic Instabilities in the Presence of Surface Gravity Waves SEAN HANEY, Department of Atmospheric and Oceanic Sciences, University of Colorado, Boulder, CO, BAYLOR FOX-KEMPER, Department of Geological Sciences, Brown University, Providence, RI, KEITH JULIEN, Department of Applied Mathema-cs, University of Colorado, Boulder, CO — The depth of the ocean mixed layer is determined by several processes that mix and restratify the ocean. The classical Eady problem (linear stability of flow in thermal wind balance) describes the growth of baroclinic instabilities which are important for restratification in the mixed layer. The Eady problem has been extended by Stone to include non-hydrostatic effects and a range of Richardson numbers appropriate for the ocean mixed layer. Here, the problem is extended further to include the Stokes drift (a drift current that is the time averaged effect of the surface gravity waves). A new, wave-induced, instability is introduced that coexists with the symmetric and baroclinic instabilities. In addition, both the symmetric and baroclinic instabilities are modified by the presence of Stokes drift. While the baroclinic mode becomes a hybrid baroclinic/wave-induced mode at modest wave forcing, the symmetric mode is only slightly modified. This transition to a hybrid mode is marked by a change in the energy source and the vertical structure. Dominance by each of the three modes may occur in a realistic parameter regime for the ocean mixed layer, and therefore wave forcing cannot be neglected when considering the stability of the mixed layer.

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