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Mixed surface layer deepening by Langmuir circulation and shear turbulence JAN-BERT FLOR, EMIL HOPFINGER, LEGI, ESTELLE GUYEZ, University of Warwick — We consider upper layer mixing by mixing processes such as by shear generated turbulence and by Langmuir circulation that are relevant to the surface mixed layer deepening in oceans and large lakes. In order to gain insight into the mixing process by continuously driven horizontal vortices, such as Langmuir circulation, with respect to mixing by shear generated turbulence, we consider recent experimental results on the mixing at a two-layer fluid interface by Taylor vortices. Relating the vortex induced mixing and the shear induced mixing to a surface friction-velocity u^*, we show that up to a Richardson number of $Ri_* = \frac{\Delta bh}{u_*^2} \leq 80$ layer deepening is dominated by shear turbulence, whereas it is taken over by Langmuir circulation for $Ri_* > 80$. The mixing efficiency of Langmuir circulation decreases gradually with increasing Richardson number, implying significant mixing also for higher Richardson numbers. As a consequence, there is no critical Froude-number criterion for the arrest of mixing by Langmuir cells as has been suggested previously. In agreement with in situ observations, the initial upper layer deepening is dominated by shear turbulence, and the subsequent principal layer deepening is due to Langmuir circulation.

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