

Longitudinal vortices beneath breaking waves

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Abstract. The formation of longitudinal vortices has been observed in a wavy channel flow and appears to be linked to spilling breaking and/or to vertical vorticity generated by a wave instability at the wave maker. Both conditions were present when the wave slope, ak exceeded 0.25. The wave instability produced velocity jets beneath and just downstream of the plunger that could provide the initial perturbation for the CL2 instability mechanism (Faller and Caponi, 1978). The breaker activity could also contribute to the CL2 production mechanism by eliminating the negative, stabilizing shear observed within the wave maker wake and by providing seed perturbations to the vorticity field. As the cells evolved downstream, they were maintained through interaction with the bottom boundary layer. When the vortices were present, both vertical mixing and turbulent kinetic energy were enhanced. Despite some differences in scale these results suggest that Langmuir circulation may produce similar changes in the mixed layer.