



## Abstract View

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# Observation and Simulation of Storm-Induced Mixed-Layer Deepening

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### ABSTRACT

Two observed cases of mixed-layer (ML) deepening due to storms are analyzed and simulated. The primary goal is to learn whether the relevant scale velocity in the parameterization of wind-driven deepening is  $U_*$ , the wind stress friction velocity, or  $\delta V$ , the magnitude of the horizontal mean velocity difference across the base of the ML. ML deepening is isolated from air–sea exchange and horizontal advection by diagnosing the entrainment tendency of ML temperature.

ML deepening is found to be highly intermittent on the storm time scale. Deepening in response to a wintertime atmospheric cold front occurred as  $\delta V$  was accelerated during the initial rise in wind stress. Deepening abruptly ceased as wind stress began to decelerate  $\delta V$ , though the stress magnitude continued to increase. A similar relationship between wind stress  $\delta V$  and ML deepening was also observed in a summertime case and is evidence that the relevant scale velocity is  $\delta V$  not  $U_*$ .

In both cases the observed phase and extent of ML deepening are simulated realistically by the parameterization of Pollard *et al.* (1973) in which an overall Richardson number,  $Rv = g'h/\delta V^2$ , where  $g'$  and  $h$  are the ML buoyance and thickness, sets a lower bound on the ML thickness. The value of  $Rv$  is  $\cong 0.65$ .

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