Abstract View

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Observations of the Deepening of the Wind-Mixed Layer in the Northeast Pacific Ocean

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ABSTRACT

Measurements of winds, currents and temperature are used to describe the response of the upper ocean in the northeast Pacific to the passage of an August 1971 synoptic-scale meteorological disturbance. The experiment was designed so that at the beginning of the 32-day study the uppermost two current meters were located in the upper isothermal layer, a third current meter was placed at the top of the seasonal thermocline, and the fourth current meter was located near the bottom of the seasonal thermocline. Thermistors attached to a multi-conductor cable were placed in the mixed layer and in the thermocline region.

Before the onset of the storm the thickness of the mixed layer was about 15 m. The storm produced a more homogeneous temperature distribution above 20 m with a lower average temperature, higher temperature values below 20 m, and a thicker (25 m) mixed layer. The heat content of the upper layer changed little (<±5%) as the mixed layer deepened. The storm generated large currents and vertical current shears, especially at the inertial frequency. Currents in the mixed layer were strongly coupled to the wind and responded to the large increase in the wind speed within a time interval equal to about a half-pendulum day; the currents in the stably stratified water beneath the mixed layer were weary coupled to the storm.

During the experimental interval the water in the upper 50 m was, on the average, dynamically stable as measured by the Richardson number. After the onset of the storm the dynamic stability of the transition zone between the mixed layer and the stratified region was marginal (Ri<1) for a period of a few days and vertical mixing was produced by the large velocity shear. The stratified region was always dynamically stable. Quantitative estimates of the mixing are discussed: the increase in the potential energy of the water column is compared to the amount of available mixing energy, and the depth of the mixed layer produced by the storm is compared with theoretical results and with other observations.

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