Abstract View

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The Intradiurnal Temperature Variation in the Upper Ocean Layer

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ABSTRACT

An experiment to investigate the structure of the oceanic mixed layer was conducted between 28 September and 14 October, 1971, at 21N and between 66 and 67W aboard the NOAA *Discoverer*. During the experiment a quartz thermometer system capable of measuring temperature changes to within 0.001C was deployed from a surface buoy. Time-series temperature data were obtained from 10, 20, 30, 40 and 50 m depths and digitally recorded with a sampling interval of 1.1 min. This paper presents the results of an analysis of the temperature fluctuations in the mixed layer at selected levels for a three-day period characterized by fair weather conditions. STD measurements indicate there were no observable changes in salinity during this period.

The observations show downward propagation of the diurnal heat wave at a rate of about 5 m hr^{-1} resulting in a turbulent exchange coefficient for the diurnal cycle of the order of 100 cm^2 sec^{-1}. During the heating portion of the cycle, which occurs during the day, the mixed layer tends to be stabilized. When there is a net cooling of the mixed layer, which occurs during the nocturnal periods, there is an increase of density in the surface water leading to destabilization and convective overturning. Spectra for selected daytime periods of the band-pass filtered data for 20 and 30 m levels approximately follow the −2 spectral decay law. However, spectra for the nocturnal periods follow approximately a −1 decay law. Thus, a buoyancy subrange seems to dominate the frequency range of interest during the nocturnal periods, which is supported by dimensional analysis applied to an unstable stratified fluid. During the nocturnal periods, the mean temperature difference between the 10 and 20 m levels indicates unstable stratification and an average buoyancy time scale (period) of approximately 24 min per cycle. This corresponds to a turbulent exchange coefficient two orders of magnitude larger than for the heating portion of the cycle.

In the transition sublayer which begins at about 40 m, the semidiurnal internal tide and internal waves are apparent.

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