Abstract View

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Observations of Strongly Nonlinear Internal Motion in the Open Sea Using a Range-Gated Doppler Sonar

Robert Pinkel

Marine Physical Laboratory, Scripps Institution of Oceanography, University of California, San Diego, 92152

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ABSTRACT

A Doppler sonar has been developed at the Marine Physical Laboratory for the remote measurement of the upper ocean velocity field. The sonar transmits a 1° beam at 87.5 kHz, with 3 KW peak power. The sound scatters off drifting plankton, as well as other organisms in the upper ocean. From the Doppler shift of the backscattered sound, the component of water velocity parallel to the beam can be determined at many ranges. During an early test of this system, from FLIP in May 1975, two large propagating events were observed. The events had peak velocity >20 cm s^{-1}, scale wavelength <20 m, and a phase velocity of 40 cm s^{-1}. The horizontal strain rate associated with their passage exceeded 0.01 s^{-1}. Estimates of the Doppler spectral width of the backscattered sound were significantly higher within the core of the events. These events could be internal solitary waves propagating on a high-density gradient layer in the thermocline. Efforts to compare the observations to existing theoretical predictions of weakly nonlinear, two-dimensional solitary waves are not conclusive, perhaps because either the observed events are too nonlinear for the theoretical models to apply or the complex background velocity field of the thermocline is inadequately modeled in the simplified theory.