GARY L. SMITH

GUEST EDITOR'S INTRODUCTION

The first issue of the *Johns Hopkins APL Technical Digest* devoted to the theme of ocean science appeared some three and one-half years ago (Vol.3, No. 1, January-March, 1982). Up to that time, almost all of the APL work in this field was motivated by submarine detection considerations. A notable exception was the high-quality research on ocean surface imaging by synthetic aperture radar, based primarily on data from the Seasat satellite. Since then, much progress has been made, not only in those investigations that were ongoing, but also in new and equally exciting technologies with a wider motivational base. To more fully represent the range of current efforts in this important area, this issue and the next are devoted to the theme of ocean science. In-situ measurements and modeling of subsurface processes are treated in the current issue; remote measurements of surface and subsurface phenomena from satellites and aircraft are subjects for the next one.

For years, the oceanographic community has had difficulty in deriving estimates of internal wave displacements from towed-thermistor-chain data, largely because of problems with finestructure contamination. ("Finestructure" is a term used to describe variations in vertical stratification on scales between approximately 1 and 10 meters.) The first article (Dubbel) reports results of an investigation that shows that such contamination can be substantially reduced by sampling the ocean to small vertical scales and by using appropriate techniques for estimating internal wave displacement.

It has often been said that one man's noise is another man's signal. So it is with finestructure. Both fine- and microstructure (which is similar to finestructure but occurs on scales smaller than about 1 meter) result from mixing events in the ocean, events that are important in the transfer of energy from large-scale flows into turbulence. In order to understand these energy-transfer processes better, it is important to characterize properly the patches of fine- and microstructure that result. In the second article, Schoeberlein presents such a characterization, using data from a 200-kilometer-long tow of an APL-developed thermistor array having very high vertical resolution.

Given the wide range of physical phenomena in the ocean, their inherent complexity, and their dependence on a large number of parameters, any attempt at understanding ocean processes based solely on experimental measurements is not likely to succeed. However, considerable progress has been made through a suitable combination of theoretical, computational, laboratory, and field work. The third article (Hirsh) exemplifies some of the APL computational capability and illustrates how computational techniques can be useful in providing physical insight. The specific problem presented is that of the effect of vertical stratification on the motion of a pair of counterrotating vortices.

The utility of laboratory experiments is illustrated next, in Calman's article. Here, the flow pattern near the corner of a melting ice block is simulated by heating a metal corner in a salt-stratified fluid. Although the investigation is not yet complete, the preliminary results are interesting in that they show an unexpectedly strong horizontal boundary current moving out from under the "ice."

No discussion of ocean science, particularly science motivated by submarine detection, would be complete without some mention of acoustics. The fifth article (Boyles et al.) constitutes that mention. Until recently, accepted theory did not permit full treatment of acoustic propagation in a surface duct, bounded on one side by a rough surface and subject to horizontal variation of the vertical sound-speed profile. Various approximate treatments were available, but all had notable deficiencies. The authors describe an exact solution of the wave equation for this problem involving the method of coupled, local normal modes.

The last theme article in this issue (Sarabun et al.) represents a significant departure from the foregoing work. In its role as a member of the greater Johns Hopkins University community, APL embarked a few years ago on an attempt to bring its physical oceanography expertise to bear on some of the problems of the Chesapeake Bay. This article presents the background for that initiative and reports the results obtained with a suite of physical oceanographic instruments deployed during an initial field effort conducted in the spring of 1984.

The content of the remaining ocean-science theme articles will be described in a brief introduction to the next issue. In concert, those articles reveal that substantial progress has been made in understanding how several important ocean features are revealed through the use of sensors mounted on platforms well removed from the ocean environment.

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