Processes at Sloping Boundaries in the Coastal Ocean

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LONG-TERM GOALS

To understand the dynamical processes occurring in the surface layer of the ocean and parameterize them in ocean models. To understand and parameterize interior and near-boundary mixing processes. To understand the circulation of semi-enclosed seas.

OBJECTIVES

To exploit Juan de Fuca Strait as a natural laboratory for the study of rotating stratified shear flows with sloping lateral boundaries.

APPROACH

Integrate theory, observations and modelling of flows in Juan de Fuca Strait. Field studies involve a bottom-mounted 300 kHz broadband ADCP and temperature and conductivity moorings. CTD, turbidity and microstructure profiles have also been obtained.

WORK COMPLETED

In 1997 we obtained a four week data set near the sloping northern side of the strait, with the ADCP moored at a depth of 120 metres at the center of a triangle of T/C moorings.

RESULTS

The data set is currently being analyzed for the mean estuarine flow, the tidal currents, and the vertical and horizontal Reynolds stresses arising from higher frequency motions. The ADCP velocity and backscatter intensity data show occasional bursts of high frequency vertical motion of scattering layers, which will allow for confirmation of the simultaneous vertical velocity and particulate displacement measurements from the ADCP, and so lend confidence to Reynolds stress estimates. Comparison of microstructure and current data from the center of the strait in 1996 suggest the possibility of a major role for critical layer absorption of internal waves generated at the sea floor.

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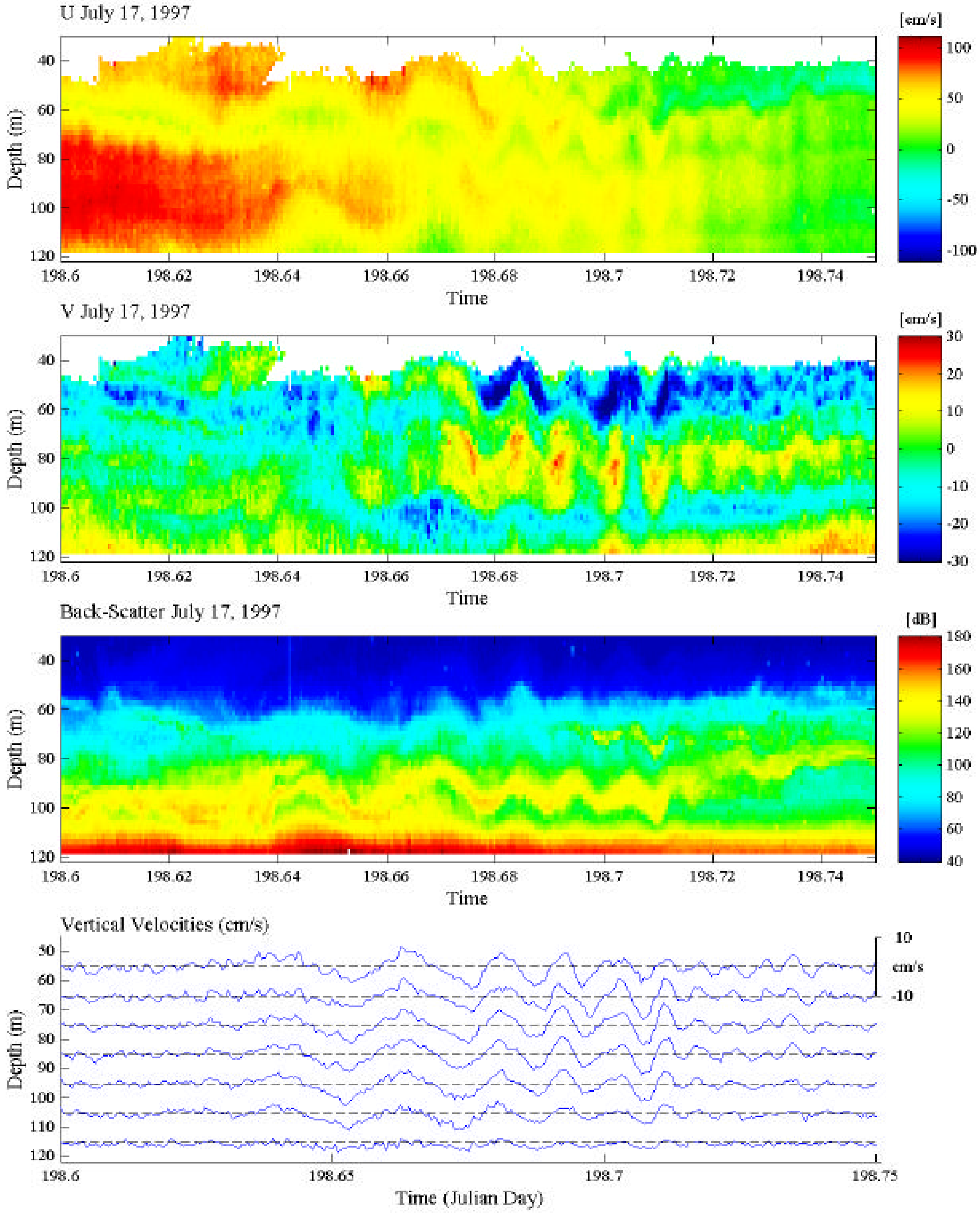

Figure 1 Example section of data from the bottom mounted ADCP in Juan de Fuca Strait (July 1997) showing along (U) and cross (V) channel velocities, relative acoustic back-scatter (dB), and coincident vertical velocities (W). Strong internal waves motions appear during the transition from flood to ebb tide.

IMPACT/APPLICATIONS

Our results should clarify the extent to which the estuarine circulation is limited by internal vertical friction as opposed to lateral friction at the sloping sides. It will also provide a better understanding of the contribution to cross-strait secondary flows of internal Ekman layers, converging bottom Ekman layers on the sloping sides and the density driven flow of boundary-mixed fluid. We hope that results obtained in Juan de Fuca Strait will lead to understanding and parameterizations of general relevance.

TRANSITIONS

We are planning cooperative work with colleagues at the University of Washington (P. MacCready) and the University of British Columbia (R. Pawlowicz).

RELATED PROJECTS

We also deployed our ADCP and a borrowed one (D. Farmer) near the sloping side of a tidal channel (Georgia Strait) in order to measure the lateral eddy momentum flux and relate it to assumed bottom friction in tidal models. This, our main studies in Juan de Fuca Strait and other projects on the surface mixed layer, air-sea interaction and semi-enclosed seas such as the Gulf of Thailand and the Red Sea, are partially supported by Canadian funding agencies.

REFERENCES