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Ship-Based and High-Resolution Array Measurements of the Inner Shelf

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LONG-TERM GOALS

We seek to measure and understand two key processes that contribute to exchange across the inner shelf. The inner shelf has water depths between 5 and 50 m, and is the region between the deeper continental shelf, where wind-driven processes dominate, and the surfzone, where wave-driven motions dominate. The first process we seek to understand is the exchange of fluid and the material it contains across the inner shelf by three-dimensional circulation features that originate either from the offshore side of the inner shelf due to instabilities of wind-driven currents and fronts, or from the shoreward side of the inner shelf via instabilities of surface wave-driven alongshore currents. The second key process is the shoreward transport of material by nonlinear internal waves and bores that originate offshore and propogate shoreward into the inner shelf. Each of these processes, eddy-driven exchange and transport by nonlinear internal waves, is strongly modified by changes in the background stratification and velocity fields set up through wind forcing. Our goal is to produce a data set that will enable us to work with our numerical modeling colleagues to better predict circulation, stratification and cross-shore exchange in the inner shelf.

OBJECTIVES

As part of the Inner Shelf DRI, we propose to: 1) Repeatedly measure the cross-shelf and vertical distribution of hydrographic and velocity fields across the mid to inner shelf and relate them to wind forcing; 2) Understand how these distributions relate to the creation and propagation of eddies that exchange water and tracers across the inner shelf; 3) Sample highly nonlinear internal motions as they transit from the mid shelf to the surfzone and understand how they contribute to cross-shelf exchange and how they alter inner-shelf hydrographic and velocity fields; and 4) Repeatedly sample along the coast in the inner shelf to quantify cross-shelf exchange and the dominant temporal and along-shore spatial scales driving the exchange.

APPROACH

We propose to exploit the synergies between two high spatial resolution measurement techniques: 1) Ship-based sampling will yield high spatial resolution measurements both across and along the inner

shelf, with sampling intervals set by both boat speed and the duration of ship-based sampling. Measurements across the mid to inner shelf are critical to setting the background conditions upon which inner-shelf processes act and will be needed for any numerical modeling of this region. 2) Water-column moorings arranged in a spatially-lagged array, primarily in the along-shelf direction in the inner shelf, but including some cross-shelf elements, will sample fast enough to capture both eddies and internal waves. Combining these two approaches will yield more information than possible from either on its own.

WORK COMPLETED

Our award was just received and we will use this year's funds to attend the "Inner Shelf" DRI kickoff meeting in early November in Seattle.

RESULTS

Award just received.

IMPACT/APPLICATIONS

Together with our Inner Shelf DRI collaborators, we will produce a data set that can be used to motivate, improve and verify numerical circulation models of the inner shelf. These models can then be used to make predictions about inner shelf circulation and exchange given the underlying bottom topography and wind forcing.