Newsletter of

Coastal Ocean Processes

NEW CHAIR OF THE CoOP SCIENTIFIC STEERING COMMITTEE

Mike Roman
Horn Point Laboratory, University of Maryland Center for Environmental Science

I will end my tenure as Chair of the CoOP Scientific Steering Committee (SSC) this year. As of the new millennium, Rick Jahnke of the Skidaway Institute of Oceanography will be the new Chair. Rick has served on the CoOP SSC, on the DOE Ocean Margins Executive Committee and on the UNOLS Advisory Committee. His broad experience in interdisciplinary coastal oceanography will be a great asset to the future development of the CoOP program.

As Chair of the CoOP SSC I have been fortunate to receive support and encouragement from Larry Clark (NSF-Ocean Sciences), Tom Kinder (ONR-Coastal Dynamics) and David Johnson (NOAA-Coastal Ocean Program). CoOP is truly an inter-agency research program. I have enjoyed working with the members of the CoOP SSC who unselfishly give their time to developing CoOP policies and research initiatives.

These are exciting times for the CoOP program. As you will read in this issue of our NEWSLETTER, we have two ongoing process studies in the Great Lakes (EEGLE; KITES). As part of the CoOP initiative in wind-driven transport studies, we have included descriptions of two new process studies that will begin in 2000 (Coastal Ocean Advances in Shelf Transport; The Role of Wind-Driven Transport in Shelf Productivity). In this NEWSLETTER issue you will also find two items pertaining to CoOP's interests in buoyancy-driven transport processes. There is a description of a CoOP workshop on buoyancy-driven transport processes. In addition, you will find a request for review papers on processes which influence buoyancy-driven transport and transformations over continental shelves.

As of January 1, 2000, the CoOP Office will move to the Skidaway Institute of Oceanography. During the past 6 years at the Horn Point Laboratory, Jane Hawkey has done a fantastic job as the CoOP webmaster, NEWSLETTER editor, workshop and meeting organizer, and CoOP office manager.

Inside This Issue...

CoOP Newsletter
Issue No. 10
December 1999

The purpose of the Coastal Ocean Processes (CoOP) Newsletter is to inform the ocean science community of current and planned CoOP activities. CoOP is funded by the National Science Foundation, the Office of Naval Research and the National Oceanic and Atmospheric Administration's Coastal Ocean Program. We view CoOP as a broad-based U.S. program in coastal oceanography. Thus this newsletter also contains information on coastal research activities from various Federal and State programs. We welcome your comments and suggestions regarding the CoOP newsletter.

The CoOP newsletter is published periodically by the Coastal Ocean Processes program. If you would like to be on our mailing list, please send your name and address via Internet to the CoOP Office.

New CoOP Office beginning Year 2000:

D.B. Jahnke
Skidaway Institute of Oceanography
10 Ocean Science Circle
Savannah, GA 31411
U.S.A.

voice: (912) 598-2493
fax: (912) 598-2310
email: djahnke@skio.peachnet.edu
website: www.skio.peachnet.edu/coop

CoOP BUOYANCY-DRIVEN TRANSPORT STUDY

OPPORTUNITY: Review Papers on Buoyancy-Driven Transport and Transformations Over Continental Shelves

The CoOP Program is developing a Science Plan for process studies which focuses on the transport, transformation and fates of biologically, chemically and geologically important matter on continental margins with substantial freshwater inflows. To support this planning and to provide background for proposal preparation, we will consider proposals for review papers on interdisciplinary topics related to freshwater-influenced shelf processes. Funding is available through the Office of Naval Research (ONR) for a limited number of review papers. The specific choice of review topic is left to the author. The papers should address an important aspect of buoyancy-driven transport or freshwater-influenced processes on continental shelves. Interdisciplinary topics are encouraged. While the following examples are appropriate, we have not attempted to make a comprehensive list.

- The interaction of freshwater outflows with tides, wind and topography in controlling the cross-margin transport of biogenic materials.
- The use of chemical and biological tracers in quantifying the cross-margin transport of freshwater discharges.
- Physical and biological controls of plankton populations in buoyant plumes.
- Temporal and spatial changes in sediment transport on shelves which receive large freshwater inputs.
- Dissolved and particulate biogeochemical transformations and transport on continental shelves with substantial freshwater inflows.
- The role of major river discharges in supporting coastal productivity.

(see OPPORTUNITY on page 9)

CoOP BUOYANCY-DRIVEN TRANSPORT STUDY

Buoyancy Processes over Continental Shelves

contributed by Susan Henrichs, University of Alaska

Coastal Ocean Processes (CoOP) is a program that seeks to plan and implement multi-investigator, interdisciplinary research in the coastal ocean. The overall CoOP goal is to "obtain a new level of quantitative understanding of the processes that dominate the transports, transformations, and fates of biologically, chemically, and geologically important matter on the continental margins" (Coastal Ocean Processes: A Science Prospectus, 1992). Winds, tides, positive or negative buoyancy inputs, boundary currents, and ice formation and melting are the major process categories influencing cross-margin transport. CoOP endeavors to conduct research programs in shelf regions where one physical forcing mechanism dominates, so that its effects can be studied in relative isolation. An important step in research planning has been a series of open, community workshops to discuss important questions and research strategies. The latest CoOP report is the Buoyancy-Driven Transport Processes Workshop, held October 6-8, 1998, in Salt Lake City, Utah. This report summarizes contributions from workshop participants, the workshop organizing committee, and the CoOP steering committee.

Workshop participants agreed that buoyancy-influenced shelves are prime locations for the study of cross-margin transport. Freshwater inflow is the main process transferring materials from continents to the coastal ocean, and the terrigenous materials have associated chemical and isotopic signatures which offer special opportunities for locating and quantifying transport. Three broad, guiding questions were posed at the workshop:

- How does freshwater inflow interact with winds, topography, and tides to produce cross margin transport of materials?
- How are primary production and its processing by higher trophic levels influenced by freshwater inputs?
- How are transport and transformation of dissolved and particulate materials affected by freshwater inflows?

No consensus on the optimal locations for study emerged at the workshop, but CoOP's overall goals and approach require that buoyancy-influenced flow be a major component of the coastal current and that dissolved and particulate materials delivered by the river(s) be in sufficiently large quantity to make quantification of cross-margin transport possible. Special concerns in designing a research program include the need for rapid characterization of the properties of the buoyancy-influenced water masses, which can change quickly in response to winds and other factors, and requirements for resolving and sampling small-scale vertical structure in physical and biogeochemical properties. Modeling will be an integral part of characterizing the buoyancy influences on these systems, and extending the results to other regions.

See below for CoOP's evening session at AGU's 2000 Ocean Sciences Meeting in San Antonio, TX this January where the CoOP Buoyancy-Driven Transport program will be discussed.

Upcoming CoOP Evening Session at AGU's 2000 Ocean Sciences Meeting

Wednesday, Jan. 26, 2000
5:15-7:15 pm.
Room 210B
H.B. Gonzalez Convention Ctr
San Antonio, TX

CoOP will hold an Evening Session at the 2000 Ocean Sciences Meeting next month. The purpose of this session will be to update the scientific community on current and planned CooP activities. A specific focus of this open forum will be to receive scientific input on the development of a CoOP Buoyancy-Driven Transport program.

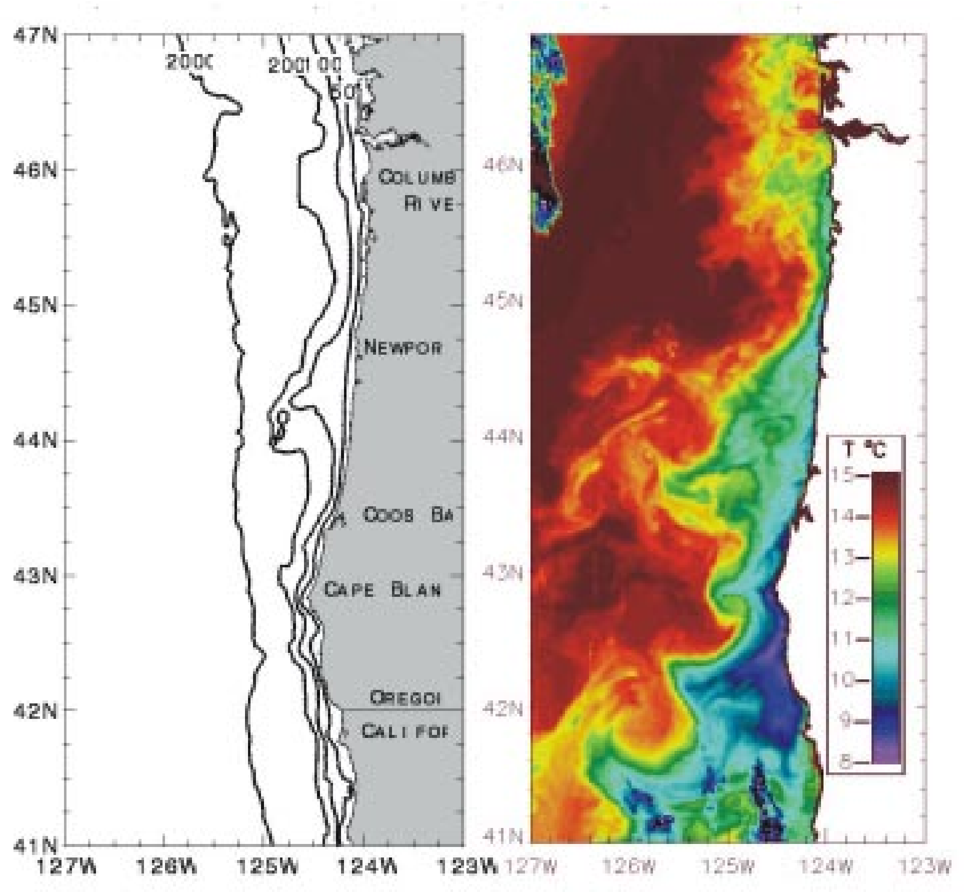
Coastal Ocean Advances in Shelf Transport (COAST)

contributed by Jack Barth, Oregon State University

Project Leaders (Oregon State University): Jack Barth, Patricia Wheeler and John Allen.

Co-Principal Investigators (all OSU unless indicated otherwise): Mark Abbott, John Bane (UNC), Tim Boyd, Doug Caldwell, Tim Cowles, Jianping Gan, Burke Hales, Mike Kosro, Ricardo Letelier, Murray Levine, Jim Moum, Bill Peterson (also NMFS), Roger Samelson, Yvette Spitz and Alexander van Geen (LDEO).

A collaboration between scientists at Oregon State University, the University of North Carolina and the Lamont-Doherty Earth Observatory has been funded by CoOP to address a specific set of scientific hypotheses related to cross-shelf transport processes in a wind-driven system by conducting field experiments off the Oregon coast together with coordinated ocean circulation/ecosystem and atmospheric modeling. The hypotheses, motivated below, are: (H1) the presence of upwelling and downwelling jets and fronts locally alters cross-shelf circulation in the surface and bottom boundary layers and in the interior; (H2) alongshore topographic variations dictate the relative importance of two-dimensional versus three-dimensional cross-shelf transport processes; (H3) patterns of turbulence on the shelf during upwelling and downwelling are influenced by fronts and jets, and the levels of turbulence can reach sufficient intensity to influence the mesoscale circulation; (H4) the magnitude and distribution of primary production on the shelf and its subsequent transport offshore is controlled solely by the geometry of upwelling as described in H1 and H2; (H5) (a hypothesis competing with H4) alongshore variations in turbulent mixing control the magnitude and distribution of primary production, e.g. via enhanced nutrient and/or trace chemical supply from the bottom boundary layer; (H6) the reduced cross-shelf transport implied by the presence of a downwelling front allows nutrients, trace metals and seed stocks of phytoplankton and zooplankton to accumulate in the mid- to inner shelf, thus priming the system for a strong biological response at the outset of upwelling.



Satellite sea surface temperature image from off Oregon, emphasizing the features of the study.

(see COAST on page 10)

The Role of Wind-Driven Transport in Shelf Productivity

contributed by John Largier, Scripps Institution of Oceanography, University of California-San Diego

Project Leaders and PIs: John Largier, Ed Dever and Clive Dorman (Scripps); Dick Dugdale, Frances Wilkerson, Steve Bollens and Toby Garfield (SFSU); Loo Botsford and Alan Hastings (UC-Davis); Raphael Kudela (UC-Santa Cruz); and Darko Koracin (UNevada).

Wind-driven continental shelves represent a paradox in that while they are characterized by high productivity due to upward fluxes of nutrients into the euphotic zone. Wind forcing also represents negative physical and biological controls via offshore transport and deep (light-limiting) mixing of primary producers. Specifically, upwelling ecosystems along mid-latitude eastern boundaries of the ocean are well-known for wind forcing and high productivity at lower trophic levels, with concomitant transport of near-surface plankton offshore.

We will conduct an interdisciplinary study to critically examine the roles that wind-driven transport plays in productivity over the shelf off northern California. We will focus on key processes to explain the integrated functioning of highly productive planktonic systems over eastern boundary shelves in response to wind-driven transport. Specifically, we will determine the sensitivity of these processes to both wind intensity and the time scales of wind forcing. Greater productivity is expected to result from direct transport effects as well as through wind-related trophic effects. We anticipate striking differences in the dominant physical-biological links during winter and summer. We will identify specific features of the nutrient-phytoplankton-zooplankton (NPZ) food web that lead to greater or lesser secondary productivity in response to changes in wind forcing.

We propose to study the 3-dimensional wind-driven circulation of water concurrently with size-structured distributions of phytoplankton and zooplankton species. Further, we propose to study the key physical and biological processes that control primary production, zooplankton population responses, and offshore transport of plankton and nutrients over the strongly wind-driven shelf and slope off Bodega Bay. We have chosen this wind maximum region for reasons of science, logistics and active research interests.

From the outset, this project has been conceived as an integrated study - the key interdisciplinary questions were identified first and then the disciplinary questions were developed to support the interdisciplinary challenges. There are 7 overlapping sub-projects: (i) wind forcing and surface heating, (ii) moorings, drifters and CODAR, (iii) hydrography & circulation from shipboard measurements, (iv) phytoplankton size spectra & the fate of upwelled nutrients and CO_2, (v) zooplankton population maintenance, grazing and reproductive response, (vi) satellite remote sensing, and (vii) biological & physical modeling. Recent developments in disciplinary understanding, field techniques and modeling expertise allow us to propose a study that promises advances in understanding the integrated system. We identify five general questions:

- What is the sensitivity of the NPZ system to the intensity of wind forcing?
- What is the sensitivity of the NPZ system to the time scales of wind forcing?
- To what degree is water and water-borne biogenic material retained over a wind-driven shelf? Conversely, what is the quantity and quality of productivity exported via an upwelling plume?
- How do the structure and strength of links in winter compare with that in summer?
- How are the transport and plankton dynamics influenced by the adjacent shelf region (Farallones)?

To answer these questions, we have developed an integrated sampling scheme coupled with appropriate physical-biological models designed to synthesize and guide the field work. The field work

(see SHELF PRODUCTIVITY on page 11)

CoOP WIND-DRIVEN TRANSPORT STUDY

Circulation and Ecosystem Modeling for the Oregon Shelf

contributed by John Allen, Oregon State University

In advance of the CoOP field program concerned with "Wind-driven Transport Processes in the NE Pacific", John S. Allen and co-workers Jianping Gan and Yvette Spitz at the College of Oceanic and Atmospheric Sciences, Oregon State University are pursuing research on a project entitled "Circulation and Ecosystem Modeling for the Oregon Shelf". Some preliminary results from the physical circulation modeling are briefly described below.

Time-dependent, three dimensional circulation on the continental shelf off Oregon in the region from 41.7° N to 47° N is studied using the Blumberg-Mellor, finite difference, hydrostatic primitive equation model. A limited-area high resolution curvilinear grid (<1.5 km horizontal spacing, 30 vertical sigma levels) with realistic Oregon bottom topography is used. The grid extends about 600 km alongshore and 250 km offshore and contains three open boundaries where approximate open boundary conditions are implemented. The response of the coastal ocean during summer upwelling conditions to forcing by observed wind stress and heat flux is examined for July and August 1973 and compared to current and hydrographic measurements from the Coastal Upwelling Experiment (CUE-2).

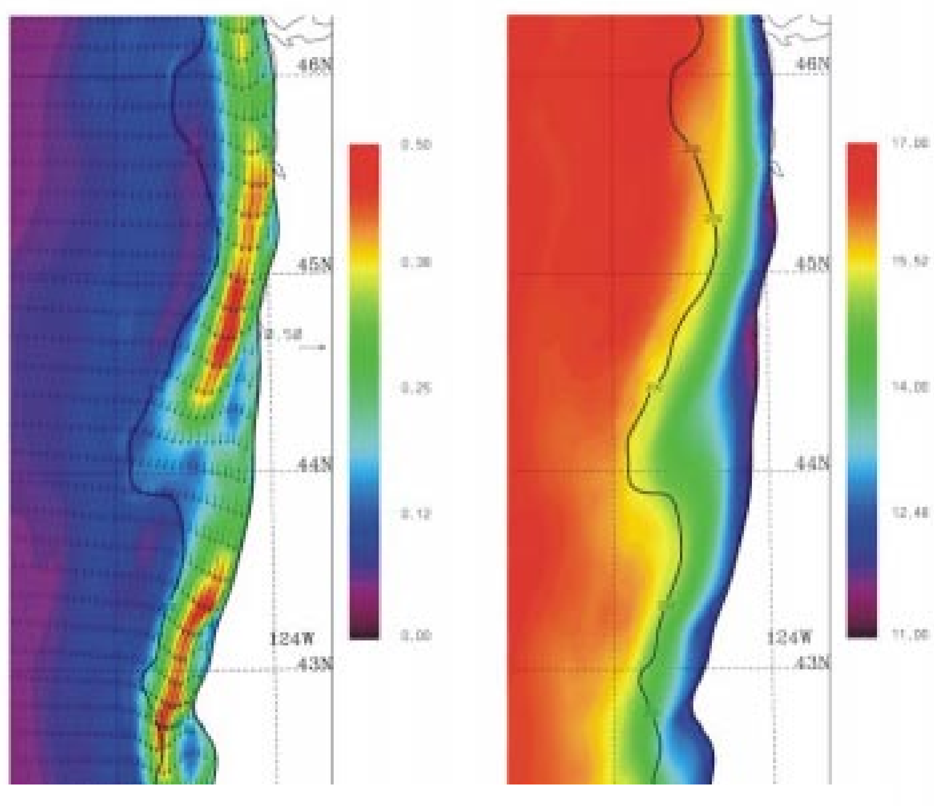


Figure 1. Time mean surface velocity vectors and rms values (color contours, m/s) of surface velocity magnitude (left) and time mean surface temperature (C) field (right). Gan and Allen, ms. in preparation.

Time mean and rms values of model surface velocity vectors and the corresponding time mean surface temperature field are shown in Figure 1 for part of the model domain centered near Newport, OR (44.6° N). The shelf velocity and density features are generally characterized by the presence of a southward alongshore coastal jet together with an upwelling density front on the nearshore edge. These features exhibit substantial time- and space-dependent variability. The large distortion of the shelf bottom topography associated with Heceta Bank (44° N) and the large coastline variation provided by Cape Blanco (42.8° N) exert major influences on the shelf velocity and density fields. The alongshore coastal jet is typically displaced offshore at Heceta Bank, such that colder upwelled water extends offshore over the bank. Separation of the coastal jet can occur at Cape Blanco, accompanied by significant eddy generation south of the cape. During periods of strong southward

(see MODELING on page 11)

Episodic Events - Great Lakes Experiment (EEGLE)

contributed by Brian Eadie, NOAA GLERL

The Episodic Events - Great Lakes Experiment (EEGLE) program is a CoOP program designed to examine the impacts of massive storm events in late winter-early spring on sediment resuspension and transport of particles and associated materials and on subsequent spring ecology. While it appears that the winter-spring storms occur annually, there is a large range in scale. As illustrated in Figure 1, the 1999 storm event was much smaller than the very large 1998 storm event. The two images of AVHRR reflectance (channel 1 – channel 2) illustrate the approximate maximum of each years' event. A longer-term estimate of the scale of the event is illustrated by the yearly maximum of the 10 day running mean of winter-spring turbidity from the St Joseph, MI Water Treatment Plant. The last bar represents 1999 and shows it to be somewhat below the average. The 1998 bar is similar to 1973 and they are the largest events for this 39 year period. Other water intake (and wind/wave) data are being accumulated for similar long-term evaluations.

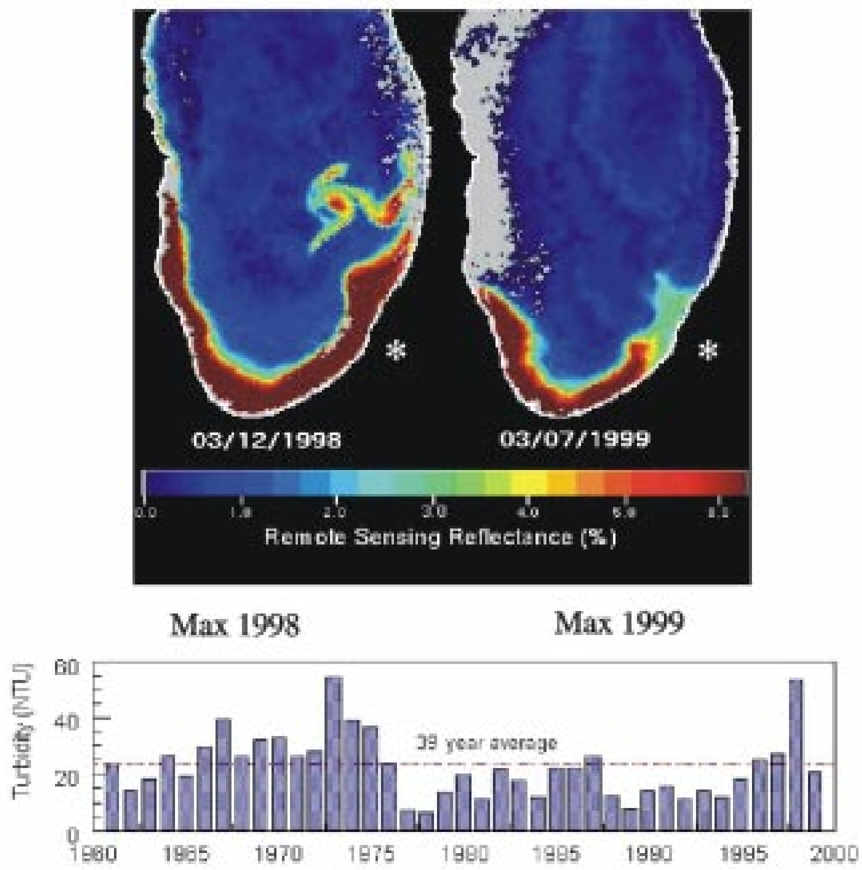


Figure 1. Maximum (10 day running average) Turbidity at the St. Joseph, MI Water Intake (*).

The relatively small 1999 event allows for an interesting contrast to the large 1998 event. During 1999, we've had successful survey cruises before, during and after the event, along with a number of process cruises. Water sample and Plankton Survey System (PSS) tows will continue on a monthly basis throughout the year. Table 1 shows program activities in calender years; the 3rd column is a snapshot of where we are now. There is one more field year, which should be similar to 1999.

Preliminary interpretation of 1998 cruise data show that the large resuspension event resulted in a large flux of sediment-associated phosphorus, but that this did not result in elevated primary production. Autotrophy was apparently impeded by the low light and low temperatures. The 1998 plume decoupled

Table 1. EEGLE Statistics from the web data base - August, 1999

	1997	1998	Aug 17, 1999
Cruises	8	34	27
Total Days	22	104	123
Water Samples	12	133	208
PSS Tows	0	22	41
Traps samples	12	205	169
ROV Dives	0	120	220
Current meters	0	11	27
Drifter days	0	40	350

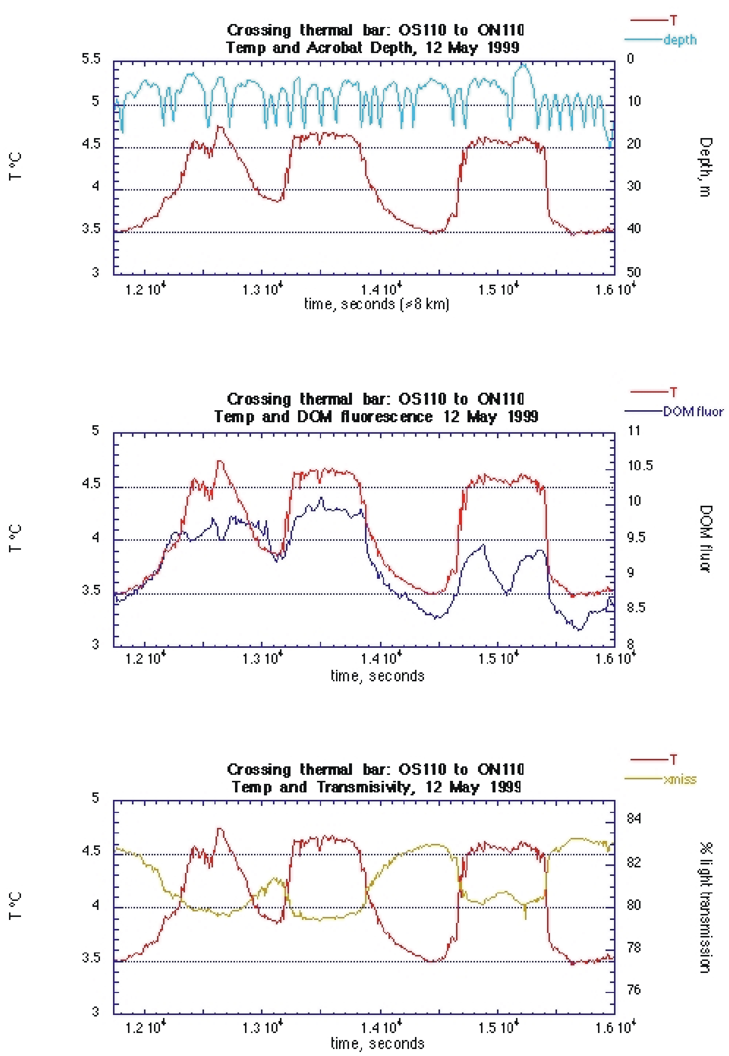
(see EEGLE on page 9)

KITES 1999

contributed by Sarah Green, Michigan Technological University

The Keweenaw Interdisciplinary Transport in Superior (KITES) CoOP project is winding down its second year of intensive sampling on the largest Great Lake, Superior. We began the season with an unexpected bonus cruise on the Canadian icebreaker, CCCG Samuel Risley, which was especially useful for early larval fish sampling at the end of March. Our regular sampling began on May 10th with the R/V Laurentian when we visited our standard transects at Ontonagon (ON), the Houghton Canal, and Eagle Harbor in an effort to track the development of the thermal bar and its effects on the coastal environment.

At Ontonagon the shore-parallel coastal front was well defined and dynamic in mid-May 1999. To investigate the horizontal structure of the bar an Acrobat towbody carrying a Seabird SBE-25 CTD package was towed parallel to the coastline at about 11 km from shore, at ON on May 12, 1999 (see figure). The data is plotted against towing time at about 4 kts; the x-axis represents a distance of approximately 8 km. On this straight transit line the thermal bar, as defined by the 4° isotherm, showed several meanders relative to the coast and the ship crossed it at several points. The figure shows three plots of temperature with (a) the depth of towing (~5-15 m), (b) dissolved organic matter (DOM) fluorescence, and (c) relative particle concentration (via light transmission). The temperature was seen to vary smoothly up to the 4° point where transitions were abrupt and dramatic. The water appeared to be well mixed over the sampled depth range, except, perhaps, at one early point (~1.25x104 s) where the instrument encountered water below 4° on a dive from the slightly warmer surface. Panels (b) and (c) demonstrate that the thermal bar is a effective physical barrier to transport. Both particle scattering and DOM signals are higher in warmer, nearshore water and drop sharply in parallel with the temperature drop at the bar.



The combination of these towbody results with those from moored and shipboard current profilers is showing that the front is very dynamic, sometimes shifting by kilometers within a few hours. Thus, one of our greatest challenges is to interpret the chemical and biological results in the context of this dynamic system.

Large scale views of this phenomenon can be seen on the satellite images posted on the KITES web site (http://chmac2.chem.mtu.edu/KITES/kites.html). Automation of image processing and posting by J. Budd, with her students, was a big accomplishment this year. (Now we hope they'll learn to see through clouds!)

More CROSS-MARGIN...

EEGLE *(continued from page 7)*

heterotrophic processes from autotrophic processes yet stimulated bacterial production to a great extent. The DOC inventory for the southern basin was high in spring 98, partly as a consequence of DOC coming off particles or perhaps due to runoff from the basin. This DOC seems to have been important in stimulating bacterial production perhaps into the summer months.

Examination of the meteorological conditions during the storm that generated the March 1998 turbidity plume suggests the existence of a mesoscale atmospheric vortex above southern Lake Michigan coinciding with the generation of the observed eddy. Measured currents and the bulge in the nearshore turbidity pattern are consistent with the hypothesis that longshore convergence in the current field can generate sufficient offshore transport of fine-grained sediments to account for the visible features.

One of the major recommendations from our October 1998 All Hands Meeting was that more, truly coastal, meteorological stations were needed to provide accurate forcing for the models. Most National Weather Service meteorological stations are somewhat inland and are not representative of overlake conditions. Since the meeting, a total of 5 stations at exposed coastal sites have been established.

For more on EEGLE, please visit our website: www.glerl.noaa.gov\eegle.

More BUOYANCY-DRIVEN...

OPPORTUNITY *(continued from page 2)*

CoOP sponsored a workshop in October 1998, and the draft report is available at: http://www.hpl.umces.edu/coop. The workshop provides additional guidance, but proposals for relevant reviews outside the scope of the workshop will be considered.

Some members of the CoOP steering committee will review the proposals, but final decisions will be made by ONR. (See http://www.hpl.umces.edu/coop for the objectives of CoOP.) We anticipate the drafts of the papers will available publicly about one year after the grants are started (i.e., we anticipate starting grants in March 2000 and having pre-prints of the review papers available in March 2001).

The proposal should be brief (about 5 pages) and include an explanation of the importance of the topic and an outline of the paper. Include a full curriculum vitae.

Formal proposals are due at ONR by **15 February 2000.** Send original and 6 copies to:

Thomas H. Kinder

Office of Naval Research, Coastal Dynamics

ONR Code 321 CD Room 428

800 North Quincy Street

Arlington, VA 22217-5660

Questions should be directed to Tom Kinder at kindert@onr.navy.mil.

CoOP Welcomes New Scientific Steering Committee Members in 1999

Coastal Ocean Processes welcomes the newest members of the Scientific Steering Committee (SSC): Dr. Patricia Wiberg of University of Virginia (9/99) and Dr. Jim Wilczak of NOAA's Environmental Technology Laboratory (9/99).

Additionally, many thanks to Dr. Dave Cacchione and Dr. Carl Friehe who have recently completed their terms on the SSC. Coastal Ocean Processes and the community of coastal scientists have benefited from their time, effort and wisdom in guiding the CoOP program.

COAST (continued from page 4)

The Oregon coastal ocean exhibits a strong wind-driven response, both physically and biologically and in both upwelling favorable (summer) and downwelling favorable (winter) seasons. Off northern Oregon, the region of active upwelling is narrow and the bottom topography is relatively uniform alongshore. Here, three-dimensional effects should be minimized and the presence of a strong baroclinic upwelling jet and front will locally alter cross-shelf circulation in the surface and bottom boundary layers (BBL) and in the interior. Off central Oregon, the continental shelf broadens and alongshore uniformity is broken by Heceta Bank. The distribution of cold water and surface chlorophyll from satellite imagery mimics the width of the continental shelf, suggesting the control of bottom topography on shelf circulation and upwelling. An exception to this general pattern is associated with Heceta Bank, where cold, chlorophyll-rich upwelled water is found well seaward of the continental shelf break, representing an important cross-shelf transport process. Far less is known about the shelf flow and thermohaline fields during the downwelling season. Recent two-dimensional modeling results predict the formation of a strong downwelling front and jet near the mid-shelf. Offshore of the mid-shelf density front there is onshore transport in a surface Ekman layer, which turns downward at the mid-shelf front, and returns offshore in a thick BBL. Inshore of the downwelling front, the water column is well mixed, the alongshore flow is considerably reduced compared with that in the mid-shelf jet, and cross-shelf flow is nearly zero. Thus, the inner shelf is a region of relatively quiescent flow.

To address the above hypotheses we will make intensive observations in two regions off the Oregon coast during the upwelling season: one north of Newport in a region of relatively simple topography and one south of Newport centered on Heceta Bank. High-resolution sampling will be conducted using two ships simultaneously. One ship will conduct rapid, high-resolution surveys of the three-dimensional thermohaline, bio-optical, zooplankton and velocity fields using SeaSoar, shipboard ADCP and a towed, multi-frequency acoustics system (Barth, Cowles, Peterson). A second ship, operating within the same region, will conduct high-vertical resolution profiling of water properties: temperature, conductivity, turbulence (Moum, Caldwell), nutrients and carbonate species (Hales), phytoplankton photosynthesis parameters via Fast Repetition Rate fluorometry (Letelier, Abbott), particulate and dissolved organic material (Wheeler, Cowles) and the important trace metal iron (van Geen). We will conduct two three-week cruises during the upwelling season (June and August) 2001 and sampling will take place in both the northern and southern regions during each cruise in order to directly compare results. A downwelling experiment will be conducted during Jan-Feb 2003 during one three-week cruise and measurements will be concentrated in the northern study region where the bottom topography is simpler.

An instrumented aircraft will be used to make measurements of the lower atmosphere (wind, temperature, humidity, pressure) and the upper ocean (SST, ocean color, subsurface temperature via AXBTs) (Bane). A set of moorings, spanning the continental shelf in each study region and equipped with instruments to measure velocity, temperature, conductivity, spectral irradiance, phytoplankton fluorescence and particulate light scattering, will be deployed during both upwelling and downwelling experiments (Levine, Boyd, Kosro, Abbott, Cowles, Letelier). Land-based coastal radar will be used to make high-spatial resolution surface current maps (Kosro). A high-resolution, three-dimensional shelf circulation and coupled ecosystem ocean model will be used in direct support of the field experiments by contributing to the dynamical synthesis of the observations and for relevant process studies (Allen, Gan, Spitz). A mesoscale atmospheric modeling effort will provide estimates of surface forcing, continuous in space and time, for the ocean model and for interpretation of the oceanic observations

COAST *(continued from previous page)*

(Samelson).

The COAST project will obtain satellite remote sensing information through existing projects at OSU: ocean color (Mark Abbott) and SST (Ted Strub). Other collaborations include the regular sampling being done off Newport through GLOBEC (Jane Huyer, Bob Smith, et al.) and the nearshore (15-m isobath) observations being made as part of the PISCO project to study oceanographic influences on marine communities in the rocky intertidal (Jane Lubchenko and Bruce Menge, OSU Zoology).

Shelf Productivity *(continued from page 5)*

will be comprised of fixed station time-series, ship surveys, drifter releases, and satellite remote sensing. There are two parts to the fieldwork - one focused on the mooring array off Bodega Bay, and a second that is more extensive and adaptive, involving ship surveys and drifters. The mooring array places emphasis on eulerian measurements of cross-shelf circulation over a topographically 'simple' shelf region, aiming also to resolve up/downwelling fluxes. The moorings will extend from the inner to the mid/outer shelf, allowing comparison of wind, current velocity, stratification, chlorophyll fluorescence, and SPM transmissivity patterns. The surveys and drifters place emphasis on transformations in the water column, specifically the maturation of upwelled water as it moves away from the mooring site. This second component will address the more complex cross-shelf flows and fluxes associated with topographic features such as Pt Reyes and resolve spatial differences in how the NPZ system is structured. By combining these data with the synoptic measurements available from satellites and the integrative aspects of the modeling, we can adequately address all the important processes associated with wind-driven transport. This promises to allow us to unravel the paradox of how wind-driven transport supports high levels of productivity over eastern boundary shelf regions.

Modeling *(continued from page 6)*

winds, these topographically forced flow processes are intensified. The turbulent kinetic energy fields, as represented by the Mellor-Yamada submodel, likewise show large time- and space-dependent variability associated with the above mentioned physical features of the mesoscale shelf flow field. In particular, relatively large values of turbulent kinetic energy are found connected with intensified upwelling fronts, in regions offshore of local capes, and in the region around Heceta Bank.

Comparisons of mean values and standard deviations of the observed and modeled alongshore velocity v show the following: The mean values are reasonably close with similar spatial structures reflecting the presence of a vertically sheared southward coastal jet. The model standard deviations are generally smaller than the observed, but show a similar increase toward the coast. Correlation coefficients between observed and modeled v are higher near the bottom than at mid-depth. Space-lagged correlation coefficients for model- produced v and across-shore velocity u in the alongshore direction show large correlation scales for v and short correlation scales for u, similar to those found in the observations. In general, the reasonably positive comparison of model results with CUE-2 observations is encouraging. Analyses to find improved dynamical rationalizations for the modeled flow behavior are in progress.

PRINTED WITH SOY INK

CoOP Publications

Report No. Publications can be requested by contacting the CoOP office.

1. *Coastal Ocean Processes (CoOP): Results of an Interdisciplinary Workshop* (1990). Report prepared by the CoOP Interim Steering Committee. Contribution number 7584 from the Woods Hole Oceanographic Institution, Woods Hole, MA.

2. *Coastal Ocean Processes: A Science Prospectus* (1992). Report prepared by the CoOP Steering Committee. Woods Hole Oceanographic Institution Technical Report, WHOI-92-18.

3. *Long Time Series Measurements in the Coastal Ocean: A Workshop* (1993). C.L. Vincent, T.C. Royer, and K.H. Brink. Coastal Ocean Processes (CoOP) Report No. 3, Nov., 1993. Woods Hole Oceanographic Institution Technical Report, WHOI-93-49.

4. *Coastal Ocean Processes: Wind-Driven Transport Processes on the U.S. West Coast* (1994). R.L. Smith and K.H. Brink. Coastal Ocean Processes (CoOP) Report No. 4, Oct., 1994. Woods Hole Oceanographic Institution Technical Report, WHOI-94-20.

5. *Coastal Ocean Processes (CoOP): Cross-Margin Transport in the Great Lakes* (1995). J.V. Klump, K.W. Bedford, M.A. Donelan, B.J. Eadie, G.L. Fahnenstiel and M.R. Roman. Coastal Ocean Processes (CoOP) Report No. 5. Technical Report number TS-148-95 from the University of Maryland Center for Environmental Science, Cambridge, MD.

6. *Coastal Ocean Processes: Wind-Driven Transport Science Plan* (1998). Coastal Ocean Processes (CoOP) Report No. 6. Technical Report number TS-170-98 from the University of Maryland Center for Environmental Science, Cambridge, MD.

7. *Coastal Ocean Processes (CoOP): Transport and Transformation Processes Over Continental Shelves with Substantial Freshwater Inflows. Report on the CoOP Buoyancy-Driven Transport Processes Workshop, October 6-8, 1998, Salt Lake City, UT (in progress).* Coastal Ocean Processes (CoOP) Report No. 7.

Coastal Ocean Processes

Coastal Ocean Processes (CoOP)
University of Maryland
Center for Environmental Science
Horn Point Laboratory
Post Office Box 775
Cambridge, MD 21613-0775