Annual Report for Period: 01/2002 - 12/2002
Submitted on: 11/26/2002
Principal Investigator: Barth, John A.
Award ID: 9907854
Organization: Oregon State University
Title:
Collaborative Research: Coastal Ocean Advances in Shelf Transport (COAST)

Project Participants

Senior Personnel

Name: Barth, John
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Allen, John
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Wheeler, Patricia
Worked for more than 160 Hours: Yes
Contribution to Project:

Name: Abbott, Mark
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI with R. Letelier on component to study phytoplankton physiology.

Name: Boyd, Timothy
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI with M. Levine and P. M. Kosro on mooring component of COAST.

Name: Caldwell, Douglas
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI with J. Moum on turbulence component of COAST.

Name: Cowles, Timothy
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI on bio-optical component of COAST.

Name: Desiderio, Russell
Worked for more than 160 Hours: Yes
Contribution to Project:
Research Associate working with T. Cowles on bio-optics component of COAST.

Name: Hales, Burke
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI working on macronutrient component of COAST.

Name: Kosro, P
Worked for more than 160 Hours: Yes
Contribution to Project:

Co-PI with M. Levine and T. Boyd on mooring component of COAST.

Name: Letelier, Ricardo
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI with M. Abbott on phytoplankton physiology component of COAST.

Name: Moum, James
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI with D. Caldwell on turbulence component of COAST.

Name: Peterson, William
Worked for more than 160 Hours: Yes
Contribution to Project:
co-PI on zooplankton component of COAST.

Name: Pierce, Stephen
Worked for more than 160 Hours: Yes
Contribution to Project:
Research Associate working with J. Barth on hydrographic, velocity, bio-optical and bioacoustic mapping component of COAST.

Name: Samelson, Roger
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI on atmospheric and oceanic modeling components of COAST.

Name: Spitz, Yvette
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI working with J. Allen on ecosystem modeling component of COAST.

Name: Levine, Murray
Worked for more than 160 Hours: Yes
Contribution to Project:
Co-PI working on mooring component of COAST.

Name: Pegau, Scott
Worked for more than 160 Hours: Yes
Contribution to Project:
Assistant Professor involved with bio-optics data collection and analysis. Supported by this grant.

Name: Dale, Andrew
Worked for more than 160 Hours: Yes
Contribution to Project:
Research Associate involved with pilot dye tracking experiment. Supported by this grant and by OSU funds.

Name: Erofeev, Anatoli
Worked for more than 160 Hours: Yes
Contribution to Project:
Research Associate involved with microstructure from SeaSoar (MicroSoar) data collection and analysis. Supported by this grant.

Name: Kurapov, Alexandre
Worked for more than 160 Hours: Yes
Contribution to Project:
Research Associate involved with physical circulation modeling and data assimilation.

Post-doc

Name: Gan, Jianping
Worked for more than 160 Hours: Yes
Contribution to Project:
Postdoc working with J. Allen on ocean modeling component of COAST.

Name: Perlin, Alexander
Worked for more than 160 Hours: Yes
Contribution to Project:
Postdoc working with J. Moum and D. Caldwell on turbulence component of COAST.

Name: Bielli, Soline
Worked for more than 160 Hours: Yes
Contribution to Project:
Postdoc working with R. Samelson on atmospheric modeling component of COAST.

Name: Karp-Boss, Lee
Worked for more than 160 Hours: Yes
Contribution to Project:
Postdoc working with P. Wheeler on characterizing particulate and dissolved organic material as part of COAST.

Name: Klymak, Jody
Worked for more than 160 Hours: Yes
Contribution to Project:
Postdoc working on microstructure profiler data collection and analysis. Supported by this grant.

Name: Ott, Michael
Worked for more than 160 Hours: Yes
Contribution to Project:
Postdoc involved with microstructure from SeaSoar (MicroSoar) data collection and analysis. Supported by this grant.

Name: Crouch, Scott
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Contribution to Project:
Postdoc working on physical circulation modeling in the CoOP WEST project. Supervised by J. Allen at OSU.

Name: Perlin, Natalie
Worked for more than 160 Hours: Yes
Contribution to Project:
Postdoc working with R. Samelson on atmospheric modeling.

Graduate Student

Name: O'Keefe, Sheila
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate Student working with P.M. Kosro on mapping of surface currents by land-based radar as part of COAST.

Name: Eisner, Lisa
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working with T. Cowles on bio-optics component of COAST.

Name: Bandstra, Leah
Worked for more than 160 Hours: Yes
Contribution to Project:

Graduate student working on nutrients.

Name: Bosch, Jennifer
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working on organic carbon and nitrogen.

Name: Castelao, Renato
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working on physical circulation and hydrography. Supported by Brazilian government fellowship.

Name: Gunderson, Gunnar
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working with J. Moum on microstructure.

Name: Howard, Cidney
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working with T. Cowles on bio-optics.

Name: Sanders, Rachael
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working with R. Letelier on phytoplankton physiology.

Name: Sutor, Malinda
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working with T. Cowles on bioacoustic detection of zooplankton.

Name: Wetz, Mike
Worked for more than 160 Hours: Yes
Contribution to Project:
Graduate student working with P. Wheeler on organic nitrogen and carbon.

Undergraduate Student

Name: Boehland, Tiffany
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate working on phytoplankton physiology.

Name: Harman, Jennifer
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate working on organic carbon and nitrogen.

Name: Reser, Katie
Worked for more than 160 Hours: Yes
Contribution to Project:
Undergraduate working on organic carbon and nitrogen.

Technician, Programmer

Name: O'Malley, Robert

Worked for more than 160 Hours: Yes

Contribution to Project:
Senior Faculty Research Assistant working with J. Barth on hydrographic, velocity, bio-optical and bioacoustic mapping component of COAST.

Name: Wingard, Christopher

Worked for more than 160 Hours: Yes

Contribution to Project:
Faculty Research Assistant working with T. Cowles on bio-optics component of COAST.

Name: Fleischbein, Jane

Worked for more than 160 Hours: Yes

Contribution to Project:
Senior Faculty Research Assistant working with B. Hales on macronutrients component of COAST.

Name: Jennings, Joe

Worked for more than 160 Hours: Yes

Contribution to Project:
Senior Faculty Research Assistant working with B. Hales on macronutrients component of COAST.

Name: Waldorf, Walt

Worked for more than 160 Hours: Yes

Contribution to Project:
Senior Faculty Research Assistant working with P.M. Kosro on mapping surface currents by land-based radar as part of COAST.

Name: Nahorniak, Jasmine

Worked for more than 160 Hours: Yes

Contribution to Project:
Faculty Research Assistant working with R. Letelier and M. Abbott on phytoplankton physiology component of COAST.

Name: Neeley-Brown, Mike

Worked for more than 160 Hours: Yes

Contribution to Project:
Senior Faculty Research Assistant working with J. Moum and D. Caldwell on turbulence component of COAST.

Name: Kreth, Raymond

Worked for more than 160 Hours: Yes

Contribution to Project:
Senior Faculty Research Assistant working with J. Moum and D. Caldwell on turbulence component of COAST.

Name: Thompson, Greig

Worked for more than 160 Hours: Yes

Contribution to Project:
Faculty Research Assistant working with J. Moum and D. Caldwell on turbulence component of COAST.

Name: Roestad, Anders

Worked for more than 160 Hours: Yes

Contribution to Project:
Research Assistant working with W. Peterson on zooplankton component of COAST.

Name: Barbour, Philip

Worked for more than 160 Hours: Yes

Contribution to Project:
Faculty Research Assistant working with R. Samelson on the atmospheric modeling component of COAST.

Name: Gard, Steve

Worked for more than 160 Hours: Yes

Contribution to Project:
Faculty Research Assistant working with M. Levine on mooring component of COAST.

Name: Fayler, Linda
Worked for more than 160 Hours: Yes
Contribution to Project:
OSU Marine Technician supported by NSF Ship Technical Support.

Name: Martin, Toby
Worked for more than 160 Hours: Yes
Contribution to Project:
OSU Marine Technician supported by NSF Ship Technical Support.

Name: Swensen, Daryl
Worked for more than 160 Hours: Yes
Contribution to Project:
OSU Marine Technician supported by NSF Ship Technical Support.

Name: Willis, Marc
Worked for more than 160 Hours: Yes
Contribution to Project:
OSU Marine Technician supported by NSF Ship Technical Support.

Name: Arrington, Julie
Worked for more than 160 Hours: Yes
Contribution to Project:
Technician working on organic carbon and nitrogen.

Name: Ashe, Amanda
Worked for more than 160 Hours: Yes
Contribution to Project:
Technician working on phytoplankton physiology.

Name: Covert, Paul
Worked for more than 160 Hours: Yes
Contribution to Project:
Technician working on nutrients.

Name: Hubbard, Dale
Worked for more than 160 Hours: Yes
Contribution to Project:
Technician working on nutrients.

Name: Keister, Julie
Worked for more than 160 Hours: Yes
Contribution to Project:
Technician working on zooplankton.

Name: Lamb, Jesse
Worked for more than 160 Hours: Yes
Contribution to Project:
Technician working on zooplankton.

Name: Meredith, Chi
Worked for more than 160 Hours: Yes
Contribution to Project:
Technician working on organic carbon and nitrogen.

Name: Root, Dennis

Worked for more than 160 Hours: Yes

Contribution to Project:

Technician working on mooring deployment and recovery.

Name: Simpkins, Jay

Worked for more than 160 Hours: Yes

Contribution to Project:

Technician working on pumped profiler engineering and construction.

Name: Dorkins, Anne

Worked for more than 160 Hours: Yes

Contribution to Project:

Faculty Research Assistant working on land-based radar data acquisition and processing.

Other Participant

Research Experience for Undergraduates

Organizational Partners

University of North Carolina at Chapel Hill

John Bane is a co-PI on our COAST project. He is providing remote sensing and atmospheric measurements from a small plane. Dr. Bane will participate in the 2001 field experiment staged using OSU facilities.

Columbia University Lamont Doherty Earth Observatory

Dr. Alexander van Geen is a co-PI on our COAST project. He is responsible for iron measurements. Dr. van Geen and his graduate student, Zanna Chase, will participate in the 2001 and 2003 field experiments using OSU research facilities.

Woods Hole Oceanographic Institution

Kathleen Ruttenberg is investigating the role of phosphate in a coastal upwelling system. She is funded by her own NSF grant and participated in our 2001 field work.

Monterey Bay Aquarium Research Institute

Zanna Chase is now a postdoc at MBARI after graduating from LDEO. She is responsible for the iron measurements during COAST. She, Kenneth Johnson (MBARI PI), Luke Coletti (MBARI technician) and Jack Barth collaborated on flying a spectrophotometer aboard SeaSoar for the detection of nitrate. The spectrophotometer was developed and built at MBARI.

Mote Marine Laboratory

Gary J. Kirkpatrick used his DOC instrument during the 2001
R/V Thomas G. Thompson COAST cruises. His instrument provides a second independent optical measurement for DOC and we will be comparing both optical measurements to the direct chemical measurements of DOC.

Other Collaborators or Contacts

Our project is one of two funded under the CoOP Northeast Pacific program. We have had extensive contact with the other project, Wind Events and Shelf Tranport (WEST), headed up by John Largier at Scripps Institution of Oceanography. These include a meeting of the PIs at a CoOP Scientific Steering Committee meeting (May 2000), a visit to OSU by two WEST colleagues (April 2000) and a meeting of several COAST and WEST co-PIs at the Oct 2000 Eastern Pacific Ocean Conference. There have also been many email conversations between COAST and WEST co-PIs who are working on similar aspects under each project (e.g., zooplankton collection, modeling, etc.). The intent of the collaboration is to compare and contrast our results for two different wind-driven west coast shelf regions.

Activities and Findings

Research and Education Activities:

This year the Coastal Ocean Advances in Shelf Transport (COAST) co-PIs
concentrated on processing and analyzing the many data sets that were collected during the 2001 field season. The COAST modeling efforts, both physical and ecosystem, continue and details are reported below. Extensive analyses of the summer 2001 upwelling measurements were made during 2002 and were presented or are planned for presentation at national and international meetings. A COAST co-PI (J. Barth) co-chaired a session at the 2002 Ocean Sciences Meeting in which results from the wind-driven and Great Lakes CoOP research were presented. COAST co-PIs, postdocs and students presented 15 papers at that meeting. A COAST co-PI (P. Wheeler) joins with a WEST co-PI (T. Garfield) to co-chair a session on 'Wind-Driven Processes along the U.S. West Coast' at the 2002 Fall AGU Meeting. COAST scientists plan to present over 20 papers in that session and closely related sessions on coastal oceanography and observing systems.

A presentation on the research activities of COAST and WEST was presented at an international conference in Namibia in July 2002 in an effort to make those working in the Benguela upwelling system aware of CoOP research off the U.S. west coast (Largier and Barth, 2002).

A two-day COAST data workshop was held in Corvallis on 18-19 July, 2002, and we were joined by our out-of-state colleagues (J. Bane and Z. Chase).

COAST co-PIs (Wheeler, Barth, Hales, Kosro, Peterson, Letelier) participated in a mini-symposium entitled 'Cold Halocline, Hypoxia and High Productivity off Oregon, 2002' during the GLOBEC Northeast Pacific PI/SI Meeting, 19-21 November 2002. The mini-symposium was motivated by the appearance of anomalously cold and nutrient-rich water in the halocline during spring and summer of 2002. Observations of hypoxia and fish kill inshore on Heceta Bank in July 2002 motivated a comparison of 2002 with previous years. COAST scientists have a unique physical, biological and chemical data set from the Heceta Bank region during 2001 with which to compare the 2002 events.

The COAST group spent time in late 2002 planning for their Jan-Feb 2003 downwelling experiment. Cruise schedules for the R/V Wecoma and the R/V Roger Revelle, and mooring deployments and recoveries were coordinated. COAST scientists met several times with local fishermen, facilitated by an Oregon State University Sea Grant Extension Agent, to communicate about the oceanographic research we planned to conduct during the wintertime crab fishing season. The flow of information in both directions was deemed useful by both parties.

Updates on COAST activities can be found at our web site
(http://damp.coas.oregonstate.edu).

The following are short reports from the COAST subcomponents.

During 2002, the high-resolution survey component of COAST (Barth) continued to work with the vast number of vertical profiles of physical (temperature, salinity, pressure), bio-optical (chlorophyll fluorescence, nine wavelengths of light attenuation and absorption - see Cowles' group summary) and microstructure parameters collected using SeaSoar during the two 21-day cruises in 2001. The SeaSoar CTD data have been fully processed and web-based data reports have been produced for both cruises. The August 2001 cruise data report has been published (O'Malley et al., 2002) and data archived on a CD.
A similar report and CD for May-June 2001 is expected in early 2003.
A shipboard ADCP was used to measure water velocity and a towed,
four-frequency bioacoutics package (HTI) recorded backscatter from zooplankton and larval fish. An ADCP data report was published for the August 2001 cruise (Pierce and Barth, 2002) and the May-June 2001 ADCP report is planned for publication in early 2003.

By combining the high-spatial resolution SeaSoar and shipboard ADCP data sets, the wind-driven response off central Oregon can be described in detail. In the north, upwelling over simple bottom topography exhibited a classic response with a mid-shelf baroclinic coastal jet accompanied by upwelled isopycnals. Farther south, the equatorward, wind-driven, mid-shelf upwelling jet flows offshore following the isobaths as they widen around Heceta Bank. On the downstream side of the bank, some recirculation is observed, but most of the flow continues equatorward albeit displaced seaward of the continental shelf break. Inshore in the 'lee' of the bank, currents are weaker throughout the water column and a low-temperature, high-salinity bottom water pool is supplied from both upstream and from recirculation. The flow-topography interaction results in an alongshore pressure gradient that can drive northward currents on the inner part of the shelf when winds relax. Strong northward winds during the summertime upwelling season lead to downwelling within 15 km of the coast accompanied by significant (> 0.2 m/s) wind-driven northward currents. Seaward of this northward flow, the equatorward jet and isopycnals sloping up toward the coast still remain. The time-dependent and three-dimensional aspects of this system can lead to recirculation around or retention of water on the bank, significantly influencing the coastal ecosystem response in this shelf region. More on the wind-driven response in the COAST

study region is contained in Barth (2002a,b), Barth and Pierce (2002), Barth et al. (2002) and Pierce et al. (2002).

As an outreach activity, Jack Barth helped guide public tours of the R/V Wecoma and delivered a talk entitled 'Oregon's Dynamic Coastal Ocean' at the Hatfield Marine Science Center's H.M.S. SeaFest, June 22, 2002.

The zooplankton group (Peterson) continued to process samples in 2002. We have completed enumeration of all of the August 2001 cruise samples, and all vertical net tows from both cruises. All that remains are 11 MOCNESS samples from the May/June 2001 cruise. We anticipate having these samples completed by April 2003. Enumeration data from MOCNESS samples counted to date have been given to the bioacoustics group of COAST.

We have analyzed all of the vertical plankton net samples and have found strong cross-shelf gradients in both total copepod biomass and in species composition. Many of the patterns seen were the same as those described by Peterson et al. (1979). We have also analysed cross-shelf variations in community structure, using the multivariate techniques of ordination and cluster analysis. We found three community types, (1) an inner shelf group of species at stations in water depths of 20-40 m, (2) a mid-to-outer shelf group of species associated with the region of wind-driven upwelling, and (3) an offshore oceanic community. The first two community types are probably associated with differences in advection but we do not know what processes might be acting to separate the outer shelf group from the oceanic group. The differences could be due to a advection acting to keep the two communities separated or alternatively, the differences could be due to biological processes. That is, oceanic zooplankton may be less able to survive in coastal waters and coastal species may not survive well in oceanic waters.

Our sample counting includes enumeration of copepod and euphausiid species by developmental stage and we have corroborated the results of Peterson et al. (1979). That is, along the Cascade Head line, for both Calanus marshallae and Pseudocalanus mimus, we found cross-shelf gradients in age structure with younger stages being found in inner shelf waters and older stages in mid-shelf and outer shelf waters. Such a separation of ages is hypothesized to be the result of eggs being laid in the nearshore zone with subsequent offshore transport of progressively older stages, by the integrated surface Ekman layer offshore transport during the upwelling season. We did not see such clean results for the southern end of the Hecata Bank along Cape Perpetua line and our hypothesis is that offshore Ekman transport is not strong there. Rather, waters there are retained in place through recirculation on the southern end of the Bank. Recirculation would not lead to cross-shelf gradients in zooplankton age structure.

The ocean mixing component of COAST (Moum/Caldwell) has been investigating the following: 1) bottom Ekman layer response - simple Ekman dynamics do a good job of predicting the cross-shore motion of isopycnal bottom intersections. Corrections to the cross-shore bottom Ekman velocity due to buoyancy and to the location of isopycnal bottom intersections improve the correspondence but are small; 2) bottom boundary layer (BBL) stress and how this compares to a quadratic drag law - a quadratic drag law with Cd=0.001 gives good agreement with turbulent stress estimates when the BBL is stress-driven. However, there is good evidence that during relaxation from downwelling, the BBL is primarily convectively-driven. At these times a quadratic stress law is inappropriate;

3) turbulent stress in the interior and how its asymmetry affects the coastal jet. A short note on the distribution of turbulent kinetic energy across the shelf during upwelling was contributed to the CoOP Newsletter.

We have also been preparing for the January 2003 COAST downwelling experiment. Calibrations are in progress. A new bottom lander ADCP/ADV mooring has been constructed, tested and will be deployed along our offshore transect line. This will provide us with the necessary time series of currents and turbulence in the BBL to help to interpret our spatial series.

The nutrient group's (Hales) work in the last year has focused on data reduction and interpretation. Processing of nearly 1000 hours of CTD and PCO2 data is close to completion; a similar amount of nutrient data reduction is in process. In addition, we have implemented a number of in situ and shipboard measurement capability improvements: we have added a backscatter optical sensor to the suite of in situ sensors; we have improved the shipboard nutrient analyses; developed a high-speed TCO2 system with precision of better than 0.1% and a response time of about 6 seconds; and greatly improved our near-real time shipboard data visualization systems.

Data interpretation has led us to examine the nutrient, carbon, and oxygen balances in the Oregon coastal ocean. We found, to our surprise, that there is actually a sink of atmospheric CO2 to the coastal ocean during upwelling, which we believe is due to a unique combination of physical and biogeochemical aspects of this region. This is described in the below AGU abstract. In addition to the low surface PCO2, we saw large areas of low bottom-water oxygen in 2001, preceding similar observations by other researchers in 2002. We believe this low-oxygen is caused to some minor extent by local respiration on the shelf, but is due largely to a bottom-water source that is already extensively oxygen depleted when it encounters the shelf. This is discussed in the second abstract, below, which was presented at a GLOBEC meeting held in Corvallis in November of 2002.

'Upwelling Along the Oregon Coast is a Sink for Atmospheric CO2'
(Paper Number: OS61D-03 To be presented at the AGU Fall Meeting, Saturday, 7 December)

The first-ever high-resolution cross-shelf sections of nutrient and PCO2 measurements, made during the upwelling season of 2001 off the Oregon Coast, show the effects of strong upwelling of nutrient-and CO2-rich water, followed by rapid biological uptake. Photosynthetic production draws nitrate from over 30 uM to undetectable levels; along with this nitrate uptake, PCO2 is drawn down from values of 300 uatm above, to 200 uatm below, atmospheric saturation. High PCO2 surface waters are confined to a narrow region near the coast; low PCO2 conditions persist seaward over areas covering most of the shelf. If these conditions are representative of other upwelling areas in the North Pacific, the total CO2 uptake in upwelling regions approaches 1012 mol/year, a significant contribution to the total summertime uptake of CO2 by the entire North Pacific.

This phenomenon makes the Oregon Coast unique among upwelling regions of the world's oceans, which are typically sources of CO2 to the atmosphere. Three factors appear to contribute to this singularity: 1) Upwelled source waters have high alkalinity (ALK) and preformed nitrate relative to total CO2 (TCO2),

which allows for the necessarily high ALK:TCO2 ratios implied by low PCO2; 2) Productivity limited only by available nitrate (i.e. no micronutrient limitation) such that all upwelled nitrate can be consumed; and 3) only moderate warming of upwelled waters in comparison to lower-latitude upwelling regions.

'PCO2 and Oxygen Distributions in Waters on the Oregon Shelf: Was There Hypoxia in 2001 Too? Is the Hypoxia Due to Low-Oxygen Source Waters, or Local Respiration?'
(Presented at the GLOBEC NEP CCSI Meeting, 19 November 2002)

Recent observations of hypoxia and crab and fish kills on Heceta Bank during the summer of 2002 have prompted questions of just how anomalous these conditions are, and what drives the observed hypoxia. Repeated high-resolution cross-shelf transects between the 30 and 200m isobaths from Cascade Head, a region of simple bathymetry approximately 80 km north, to Heceta Bank, in late May and August of 2001, show widespread hypoxic or near-hypoxic conditions in those times as well as in 2002. Waters along the bottom at the northern site are cold (7 C), salty (33.8), and dense (26.5 sigma-t) all the way in to the 30 m isobath, and appear to be continuous with such water at much greater depths (200m) offshore. In May, these waters have low (1 ml/l) oxygen concentrations and high (1000 ppm) PCO2. This cold, dense near-bottom water appears to be continuous with the water found along the bottom at Heceta Bank to the south, and oxygen concentrations and PCO2 there are similar, leaving little room for extensive modification of the source-water's oxygen and PCO2 content by local, on-shelf respiration. In August, bottom waters at both northern and southern sites have similar T-S characteristics as in May, but lower oxygen and higher PCO2 implying some contribution from respiration ove the course of the summer upwelling season. Oxygen concentrations are lowest (0.3 ml/l) and PCO2 highest (1300 ppm) in bottom waters at Heceta Bank, as might be expected from a simple representation of the flow path of the upwelled water along the shelf. In neither location, however, do the decreases in near-bottom water oxygen appear sufficient to be explained by respiration of the organic matter export production in surface waters implied by the observed oxygen production and CO2 consumption and PCO standing stocks. The reasons for this apparent discrepancy remain to be determined.

During 2002 the organic carbon and nitrogen group (Wheeler) completed all laboratory analyses for all samples collected during the May and August 2001 veertical profiling cruises. The data set includes nutrients, chlorophyll, particlulate and dissolved carbon and nitrogen for fixed depth pump stations and time series stations. The data will be used to define the vertical distribution of these parameters and to calibrate the optical measurements for high vertical resolution mapping. Preliminary results were presented at the July 2002 workshop and will be presented at the AGU session in December 2002. Our data shows highest particle distributions in the surface water and moderately high values in the bottom boundary layer. There is a definite change in particle composition between the northern sampling area (lower C:N ratios) than in the southern samples area (higher C:N ratios). This difference appears to be due to nutrient limitation of the dense blooms over Heceta Bank.

Few studies have examined the partitioning of organic matter (OM) in upwelling systems, despite the fact that these systems play a key role in carbon and nitrogen budgets in the ocean. During the August 2002, Mike Wetz (M.S. student) examined production and partitioning of phytoplankton-derived OM in deck incubations aboard RV Thompson. During exponential growth of

the phytoplankton, approximately 78% of total accumulated organic matter was in particulate (POM) form. Following nitrate depletion, carbon-rich (C:N approximately 16)
dissolved organic matter (DOM) accumulated in incubations dominated by the diatom Chaetoceros sp., accounting for up to 50% of accumulated TOC and 30% of accumulated TON. However, in a bloom dominated by Thalassiosira sp. and an unidentified pennate diatom, a relatively smaller amount of DOM accumulated, accounting for only 15% of accumulated TOC and 7% of accumulated TON. While DOC remained elevated, DON accumulation was transient as most of the accumulated DON was removed by the following day. Bacterial growth rates doubled when the DON increase occurred and abundances peaked one day later, coinciding with the draw down of the DON and suggesting selective utilization of the fresh DON by bacteria. Following nitrate depletion, POC continued to increase while PON remained nearly constant. Approximately 70 to 157% more carbon was fixed than can be supported by nitrate based on Redfield stoichiometry, with 20 to 69% of the excess carbon fixation occurring after nitrate depletion. Accumulation of DOM and excess carbon fixation suggests that nitrate assimilation might not equate to net primary production in coastal upwelling systems.

As reported in last year's annual report, the bio-optics group (Cowles) collected data from each research vessel during each of the cruises during 2001. In particular, the survey vessel (R/V Wecoma) mapped the mesoscale distribution patterns of hydrographic and bio-optical properties (nine-wavelength in situ light absorption and attenuation, chlorophyll fluorescence) with the instrumented SeaSoar vehicle on spatial scales of 0.5-100 km over a vertical depth range of 0-110 m. We also acquired continuous surface tracks of the bio-optical properties during the cruises on the same surface water flow-through system used by Van Geen and Chase.

On the process vessel (R/V Thompson), we acquired continuous bio-optical data (nine-wavelength particulate and dissolved light absorption and attenuation, chlorophyll fluorescence, fluorescence emission spectra) from the flow stream of the Hales' pumping system along the two primary lines, on which we did repeated cross-shelf transits. These observations were made coincident with measurements on the same flow stream by a large number of investigators (including Wheeler, Hales, Letelier, Kirkpatrick).

In collaboration with the COAST mooring group, we had deployed six sets of bio-optical sensors on the COAST moorings in mid-May 2001. At 15m depth on each mooring we had a fluorometer and an optical backscattering sensor (3-angles). All 12 instruments were recovered successfully at the end of August 2001, and all instruments recorded a full data set for the experimental period.

During the most recent funding interval (January 2002-present), we have been conducting data quality checks and data calibration on all of the data sets. We now have completed calibration and processing for all the bio-optical data for the mesoscale sections obtained with the SeaSoar for June and August 2001. The calibration and processing of the bio-optical data for the June 2001 process cruise on the R/V Thompson is 75% complete, while the August 2001 process cruise data is now 100% complete. The mooring bio-optical data processing is also 100% complete.

Some preliminary analysis of the bio-optical data was discussed in a

presentation at the February 2002 Ocean Sciences meeting in Hawaii (Cowles et al., 2002). In addition to this presentation, one of our graduate students, Ms. Malinda Sutor, presented a paper (Sutor et al. 2002) on the integration of a 6-frequency bio-acoustics system (TAPS) with the zooplankton collections of Dr. William Peterson (using MOCNESS). This coordination of higher frequency bio-acoustics and zooplankton expands upon the extensive bio-acoustics work being conducted by Dr. Stephen Pierce, using the 4-frequency HTI system.

A paper is being presented at the 2002 AGU Fall Meeting (Cowles et al. 2002) that will combine bio-optical data from the COAST cruises in 2001 with the bio-optical data collected within the GLOBEC cruises in 2000 and 2002.

During 2002 the phytoplankton physiology group (Letelier/Abbott) has focused on the processing of discrete samples collected during the 2001 COAST field campaigns. All 692 chlorophyll samples have been analyzed. In addition, all 260 particulate absorption samples for the August 2001 cruise have been processed, leaving only the May cruise particulate absorption (321) and all HPLC (671) samples to be processed.

Productivity versus Irradiance (PvsE) experiments results have been reprocessed in order to obtain rates of carbon fixation per photosynthetically usable radiation (PUR). Furthermore, the continuous record of Fast Repetition Rate fluorometry (FRRf) has been merged with the remaining online optical data collected by Dr. Cowles group. We still need to merge this dataset with the records of Dr. Hales in order to place our FRRf traces in depth coordinates.

All data from the ADOS drifters released during the 2001 COAST cruises have been processed and can be found at
http://oosa/wff.nasa.gov/archives/ADOS.html.
Microtops measurements collected during these cruises have not been processed yet.

The mooring component of COAST (Levine, Boyd, Kosro) has been working on final calibration of the data recorded by instruments deployed on 7 moorings from mid-May through August 2001 during the upwelling experiment. The census of independently recording instruments included: 50 temperature recorders, 15 temperature-conductivity recorders, 8 Doppler current profilers and a suite of meteorological sensors. While the data return was greater than 95%, we are in the process of carefully checking the quality of the observations to insure we do not archive inaccurate data.

A draft data report has been compiled. The data report will be released in both a relatively short hardcopy version and a more extensive electronic format. An early release of some of the data was used in preparing presentations among our COAST group and at meetings. The modelers (Allen, Gan, Kurapov, Samelson) were also given some of the observations to assist in their analysis.

We are currently preparing 4 moorings for deployment in January 2003 as part of the COAST downwelling experiment. Preparation includes refurbishment of the components of mooring structure as well as the calibration and check out of the instruments.

High-resolution surface current mapping (Kosro) along the Oregon coast continued throughout the present year between 45.1 N and 44.0 N, with data being collected from five coastal stations operating at 12-13 MHz. Maps were made available in near-real time via our web site http://bragg.coas.oregonstate.edu/seasonde. These data are being used to study the seasonal variation in surface current patterns, and the effects of wind and subsurface topography on coastal flow. Animations have been prepared that show the time-varying maps of surface circulation during each of the COAST cruises, along with markers of the ship's position; these can be seen at the web site above. A student, Sheila O'Keefe, is examining the effectiveness of different algorithms for mapping the coastal flow, and applying the results to a study of wind-driven currents north of Cape Blanco. In collaboration with Gary Egbert, John Allen and others, the data are being used in data assimilation schemes to improve the modeling of wind-driven flow, as well as tidal-band motions.

Progress during 2002 from the ocean modeling component (Allen, Gan, Spitz) is as follows. A high-resolution physical circulation model for the Oregon coast, based on the Princeton Ocean Model (POM), is being applied for the May-August 2001 time period of the COAST field experiment. The model extends alongshore 633 km from about 41.7N to 47.2N and offshore 250 km. Two configurations are presently in use, one a channel with periodicity conditions at the north and south across-shelf boundaries and one with open boundary conditions. The periodic channel allows the formation of well-posed initial value problems, without uncertainties from approximate boundary conditions, and is being used also for the ecosystem model studies. That model is forced with buoy-measured winds, assumed spatially uniform, and observed heat flux. The open boundary condition model allows utilization of spatially variable forcing fields obtained from the mesoscale atmospheric model being run as part of COAST by R. Samelson and colleagues. Open boundary conditions also allow more sensible incorporation of Columbia River outflow. Model-data comparisons involving velocity measurements from the moored array are in progress. Initial results show generally good agreement and are encouraging. Additional comparisons with HF radar surface velocity and SEASOAR hydrographic measurements are planned. Analyses of momentum and heat balances, as part of studies of the dynamical and thermodynamical processes of the shelf flow, are in progress. Special efforts are focused on determining the time and spatial variability associated with across-shelf volume transport and with the across-shelf transport of temperature and other flow variables. Substantial differences are found in the character of these transports in the northern region around 45N and in the southern region over Heceta Bank around 44N.

A physical circulation model, with configuration similar to the Oregon periodic channel, is also being applied to the region between 36.6N and 40.2N during the May-June time period of the WEST field experiment in 2001. Coordination at these modeling studies with WEST investigators is in progress. Two COOP supported papers on the physical circulation in the region of the Coastal Ocean Dynamics Experiment (CODE), which is the same region as the WEST field experiment, were published in JGR Oceans in 2002 (Gan and Allen, 2002a,b). These papers included model comparisons with CODE observations and a process-oriented study on the response to relaxation of upwelling winds.

The COAST ecosystem modeling involves application of a five component nitrogen-based model, previously analyzed (Newberger et al., 2002) and utilized in two-dimensional modeling studies off Oregon (Spitz et al., 2002) as part of COOP supported research, in the three-dimensional Oregon physical model for the May-August 2001 time period of the COAST field experiment. The model results are being compared with chlorophyll, nitrate, and ammonium measurements and with zooplankton net measurements. Effects of variations in the grazing parameters are being studied. It has been found, for example, that compared to the original parameters allowing for increased grazing by zooplankton of low concentrations of phytoplankton gives resultant zooplankton and phytoplankton concentrations that are in better agreement with the observations. Substantial time and space variability of the phytoplankton and zooplankton concentrations are evident in the model solutions. The analyses includes a focus on the impact of three-dimensional aspects of the shelf circulation, particularly that associated with Heceta Bank, on the ecosystem response.

During 2002, this grant provided support for the atmospheric and ocean process modeling component (Samelson). Partial support was provided for two postdoctoral investigators, Natalie Perlin and Paul Choboter. Perlin has nearly completed a study of the dynamics of the lower atmosphere along the central Oregon coast, focusing on model and QuikSCAT scatterometer estimates of surface wind stress. The analysis of scatterometer measurements is being conducted in collaboration with D. Chelton (COAS/OSU). Choboter has been studying the dynamics of the poleward undercurrent along the U.S. west coast, focusing on the analysis of output from two high-resolution eastern Pacific regional ocean model simulations conducted by researchers at the Naval Research Laboratory. Partial support was also provided for a research assistant, Phil Barbour, who is assisting with the meteorological modeling and conducting process-oriented simulations to study atmospheric boundary layer development in the flow of warm air over cool water. The latter studies are being conducted in collaboration with L. Mahrt (COAS/OSU) and are partially motivated by surface air temperature observations obtained with COAST support during 2001. In addition, this grant has provided partial support for Samelson to advise the two post-docs and oversee the COAST realtime meteorological modeling component, and for Samelson's research on ocean dynamics (de Szoeke and Samelson, 2002; Samelson et al., submitted).

Analysis of meteorological model and scatterometer wind stress fields during summer 2000 and summer 2001 show that mean and fluctuating wind stress fields over the Oregon coastal zone have strong, systematic, spatial variations, including intensification of upwelling favorable winds near Cape Blanco, that are likely to exert an important influence on the coastal ocean circulation. The influence of the atmospheric diurnal cycle on the surface wind stress extends more than 100 km offshore, and involves three-dimensional effects associated with enhanced surface heating over the high orography along the California-Oregon border, including a reversal across 41 N in the diurnal timing of the maximum stress. The comparision with scatterometer observations indicates that high-resolution atmospheric mesoscale models can improve the spatial representation of orographically intensified wind stress, but do not enhance temporal correlations with the observed stress, relative to moderate resolution models. COAST surface air temperature and aircraft observations made during summer 2001 show a significant effect of coastal ocean upwelling on coastal lower atmosphere air temperatures, extending from the surface to 200 m altitude near the coast.

Surface air temperature and relative humidity data, and supporting calibration files, from the summer 2001 supplementary meteorological measurements have been contributed to the summer 2001 COAST field program data report. Some of the meteorological model and related results can be found on http://www-hce.coas.oregonstate.edu.

Findings:

See the findings reported under individual COAST subcomponent reports contained under 'Research and education activities' above.

Training and Development:

Three undergraduates (T. Boehland, J. Harman and K. Reser) gained experience in oceanographic research.

Eleven graduate students are receiving training, including extensive sea-going experience: L. Bandstra (nutrients), J. Bosch (organic carbon and nitrogen), R. Castelao (physical oceanography), Lisa Eisner (bio-optics and phytoplankton), G. Gunderson (microstructure), C. Howard (bio-optics), M. Meaux (aircraft measurements, UNC), Sheila O'Keefe (land-based radio mapping of ocean surface currents), R. Sanders (phytoplankton physiology), M. Sutor (bio-acoustics and zooplankton) and M. Wetz (organic carbon and nitrogen).

Ten postdocs are receiving training in oceanic (S. Crouch, J. Gan) and atmospheric (S. Bielli, N. Perlin) modeling, in hydrographic and microstructure measurements (M. Ott), in turbulence measurements and analysis (J. Klymak, A. Perlin), and in assessing the concentration and distributions of iron (Z. Chase, LDEO), particulate and dissolved organic material (L. Karp-Boss) and dissolved organic phosphorus (S. Dyhrman, WHOI). S. Bielli has successfully finished her postdoctoral tenure at OSU, with first authorship on one accepted manuscript and co-authorship on a second, and has moved to a research position in the Department of Atmospheric Sciences at the University of Washington.

Outreach Activities:

At the beginning of the second intensive COAST observation period in August 2001, we hosted an Open House with tours of the two large research vessels, R/V Wecoma and R/V Thomas G. Thompson, docked in Newport, Oregon, as they loaded for the COAST cruises. Over 500 people attended and learned about COAST, CoOP and OSU coastal research.

Motivated by the success of the 2001 research vessel tours, several COAST scientists helped guide public tours of the R/V Wecoma during Hatfield Marine Science Center's H.M.S. SeaFest held on June 22, 2002. At that same event, Jack Barth delivered a talk entitled 'Oregon's Dynamic Coastal Ocean.'

Journal Publications

Barth, J. A., P. M. Kosro and S. D. Pierce, "A submarine bank's influence on coastal circulation: Heceta Bank, Oregon", Eos, Transactions, American Geophysical Union, p. F662, vol. 81(48), (2000). Conference abstract

Kosro, P. M., J. D. Paduan and L. Washburn, "Time-series mapping of currents in the coastal ocean.", Eos, Transactions, American Geophysical Union, p. F661, vol. 81(48), (2000). Conference abstract

Karp-Boss, L., P. A. Wheeler and R. M. Letelier, "Spatial variability of particulate and dissolved material in relation to hydrographic parameters in an upwelling system.", American Society of Limnology and Oceanography, p. 1, vol. , (2001). Conference abstract

Bane, J. M., S. M. Haines and M. F. Meaux, "Oceanic and atmospheric structure and evolution observed by aircraft during COAST 2001", Eos, Transactions, American Geophysical Union, p. OS41O-01, vol. 83(4), (2002). Conference abstract

Barth J. A. and S. D. Pierce, "The coastal ocean response to summertime downwelling favorable winds off Oregon", Eos, Transactions, American Geophysical Union, p. OS41O-02, vol. 83(4), (2002). Conference abstract

Coletti, L. J., K. S. Johnson, C. M. Sakamoto, Z. Chase, F. P. Chavez, J. A. Barth, P. G. Strutton, S. E. Fitzwater, N. Tervalon and P. M. Walz, "New insights from high-resolution and long-term chemical measurements with the MBARI In Situ Ultraviolet Spectrophotometer (ISUS): Optical nitrate and bisulfide determinations", Eos, Transactions, American Geophysical Union, p. OS12A-119, vol. 83(4), (2002). Conference abstract

Edwards, K., P. MacCready, G. Pawlak, J. Moum, J, Klymak, A. Perlin and R. Dewey, "Flow features at a sharp coastal point", Eos, Transactions, American Geophysical Union, p. OS41N-04, vol. 83(4), (2002). Conference abstract

Gan, J., and J. S. Allen, "A modeling study of shelf circulation off northern California in the region of the Coastal Ocean Dynamics Experiment. Response to relaxation of upwelling winds", J. Geophys. Res., p. 3123, vol. 107, (2002). Published

Gan, J., and J. S. Allen, "A modeling study of shelf circulation off northern California in the region of the Coastal Ocean Dynamics Experiment, 2, Simulations and comparisons with observations", J. Geophys. Res., p. 3184, vol. 107, (2002). Published

Haines, S. M., J. M. Bane, M. F. Meaux, "Airborne hyperspectral ocean color measurements off the Oregon coast", Eos, Transactions, American Geophysical Union, p. OS22D-218, vol. 83(4), (2002). Conference abstract

Karp-Boss, L., P. A. Wheeler, B. Hales and P. Covert, "Organic matter in the Oregon upwelling zone: distributions and processes", Eos, Transactions, American Geophysical Union, p. OS22D-222, vol. 83(4), (2002). Conference abstract

MacCready, P., K. Edwards, G. Pawlak, J. Moum, J. Klymak, A. Perlin and R. Dewey, "Tidal headland eddies in deep water", Gordon Conference on Coastal Circulation, p. , vol. , (2001). Conference abstract

Newberger, P. A., J. S. Allen, and Y. H. Spitz, "Analysis and comparison of three ecosystem models", J. Geophys. Res., p. , vol. , (2002). Accepted

Ott, M. W., A. Y. Erofeev, J. A. Barth, J. N. Moum and A. Perlin, "Microstructure measurements from a towed undulating platform and their relationship to mesoscale circulation and bottom topography", Eos, Transactions, American Geophysical Union, p. OS41O-05, vol. 83(4), (2002). Conference abstract

Perlin, A., J. N. Moum and J. M. Klymak, "Observations of the details of coastal upwelling response and relaxation across a simple bathymetry", Eos, Transactions, American Geophysical Union, p. OS32D-148, vol. 83(4), (2002). Conference abstract

Ruttenberg, K.C. and S. T. Dyhrman, "Examining the occurrence of phosphate-stress in coastal phytoplankton communities using a cell-specific enzymatic assay", Eos, Transactions, American Geophysical Union, p. OS41O-06, vol. 83(4), (2002). Conference abstract

Spitz, Y. H., P. A. Newberger, and J. S. Allen, "Ecosystem response to upwelling off the Oregon coast: Behavior of three nitrogen-based models", J. Geophys. Res., p. , vol. , (2002). Accepted

Sutor, M., J. Lamb, T. Cowles and W. Peterson, "Comparison of acoustic and net sampling systems to determine distribution patterns of zooplankton biomass and taxonomic groups", Eos, Transactions, American Geophysical Union, p. OS21N-09, vol. 83(4), (2002). Conference abstract

Ashe, A. L., M. R. Abbott, P. M. Kosro, B. A. Grantham and R. M. Letelier, "Linking phytoplankton fluorescence patterns in the nearshore and inner shelf off Oregon", Eos Trans. AGU, p. OS12K-04, vol. 83(4), (2002). Conference abstract

Gan, J., and J. S. Allen, "Model simulations of Eulerian and Lagrangian aspects of the upwelling circulation over the Oregon shelf", Eos Trans. AGU, p. OS41O-04, vol. 83(4), (2002). Conference abstract

Kosro, P. M. and J. D. Paduan, "Shore-based mapping of ocean surface currents at long range using 5 MHz HF backscatter", Eos Trans. AGU, p. OS21E-101, vol. 83(4), (2002). Conference abstract

Kurapov, A. L., G. D. Egbert, J. S. Allen, R. N. Miller, S. Erofeeva and
P. M. Kosro, "M2 internal tide off Oregon: Inference from data assimilation", Eos Trans. AGU, p. OS41E-75, vol. 83(4), (2002). Conference abstract

O'Keefe, S., P. M. Kosro and J. A. Harlan, "Effects of topography on currentsEffects of topography on currents
during an upwelling relaxation event
during an upwelling relaxation event", Eos Trans. AGU, p. OS41O-03, vol. 83(4), (2002). Conference abstract

de Szoeke, R. A., and R. M. Samelson, "The duality between the Boussinesq and non-Boussinesq hydrostatic equations of motion", J. Phys. Oceanogr., p. 2194, vol. 32, (2002). Published

Barth, J. A., D. Hebert, A. C. Dale and D. S. Ullman, "Direct observations of along-isopycnal upwelling and diapycnal velocity at a shelfbreak front", J. Phys. Oceanogr., p. , vol. , (2002). Submitted

Samelson, R., R. Temam, C. Wang, and S. Wang, "Surface pressure Poisson
equation formulation of the primitive equations: Numerical schemes", SIAM J. Num. Anal., p. , vol. , (2002). Submitted

Wetz, M. S. and P. A. Wheeler, "Production and partitioning of organic matter during simulated upwelling phytoplankton blooms", Limnol. Oceanogr., p. , vol. , (2002). Submitted

Barth, J. A., "The influence of Heceta Bank, Oregon, on the coastal ecosystem", North Pacific Marine Science Organization (PICES) Eleventh Annual Meeting, p. , vol. , (2002). Conference abstract

Largier, J. and J. Barth, "W.E.S.T. and C.O.A.S.T. - CoOP studies of cross-shelf transport and plankton ecosystems over wind-driven shelves", Southern African Marine Science Symposium, p. , vol. , (2002). Conference abstract

O'Malley, R., J. A. Barth and A. Y. Erofeev, "SeaSoar observations during the Coastal Ocean Advances in Shelf Transport (COAST) survey II, W0108A, 6-25 August 2001", Oregon State Univ., College of Oceanic and Atmospheric Sciences, Data Rep. 186, Ref. 2002-2, 538 pp., p. 1, vol. 186, (2002). Technical report

Pierce, S. D. and J. A. Barth, "Acoustic Doppler current profiler observations during the Coastal Ocean Advances in Shelf Transport (COAST) survey II: R/V Wecoma cruise W0108A, 6-25 August 2001", Oregon State Univ., College of Oceanic and Atmospheric Sciences, Data Rep. 188, Ref. 2002-4, 106 pp., p. 1, vol. 188, (2002). Technical report

Allen, J. S., "Progress on physical circulation and ecosystem modeling in the COAST and WEST programs", Eos Trans. AGU, p. OS61D-09, vol. 83(47), (2002). Conference abstract

Bane, J. M., M. F. Meaux, S. M. Haines, and R. M. Samelson, "Atmospheric forcing of the Oregon shelf during COAST 2001", Eos Trans. AGU, p. OS61D-02, vol. 83(47), (2002). Conference abstract

Barth, J. A., "Investigation of the wind-driven coastal ocean off Oregon: A
COAST overview", Eos Trans. AGU, p. OS61D-01, vol. 83(47), (2002). Conference abstract

Barth, J. A., S. D. Pierce and P. M. Kosro, "Three-dimensional time-dependent flow near a continental shelf submarine bank", Eos Trans. AGU, p. OS52C-023, vol. 83(47), (2002). Conference abstract

Carney, M. A., R. M. Letelier and W. S. Pegau, "Particle size distributions over the Oregon continental shelf during upwelling: Relationship to inherent optical properties", Eos Trans. AGU, p. OS62A-022, vol. 83(47), (2002). Conference abstract

Choboter, P. F., J. S. Allen and R. M. Samelson, "Model dynamical balances within the California Undercurrent", Eos Trans. AGU, p. OS62A-024, vol. 83(47), (2002). Conference abstract

Couch, S. J. and J. S. Allen, "Simulation of wind-driven circulation on the northern California coast", Eos Trans. AGU, p. OS62A-024, vol. 83(47), (2002). Conference abstract

Cowles, T. J., J. A. Barth, C. E. Wingard, R. A. Desiderio, R. M. Letelier and
S. D. Pierce, "Mesoscale structure of bio-optical properties within the northern California Current System, 2000-2002", Eos Trans. AGU, p. OS62A-022, vol. 83(47), (2002). Conference abstract

Dale, A. C., J. A. Austin, J. A. Barth and M. Levine, "Dye tracer studies of wind-driven upwelling on the Oregon shelf", Eos Trans. AGU, p. OS62A-022, vol. 83(47), (2002). Conference abstract

Durski, S. and J. S. Allen, "Comparison of hydrostatic and nonhydrostatic models in the coastal ocean", Eos Trans. AGU, p. OS62A-024, vol. 83(47), (2002). Conference abstract

Egbert, G. D., L. Erofeeva and P. M. Kosro, "Tidal currents on the central Oregon shelf: Models, data, and assimilation", Eos Trans. AGU, p. OS51D-09, vol. 83(47), (2002). Conference abstract

Gan, J. and J. S. Allen, "Modeling study of upwelling processes over the Oregon shelf", Eos Trans. AGU, p. OS62A-022, vol. 83(47), (2002). Conference abstract

Hales, B., T. Takahashi, L. Bandstra, and P. Covert, "Upwelling along the
Oregon coast is a sink for atmospheric CO2", Eos Trans. AGU, p. OS61D-03, vol. 83(47), (2002). Conference abstract

Kosro, M., J. S. Allen, J. A. Barth, G. D. Egbert, A. Huyer, R. L. Smith,
B. A. Grantham, J. Lubchenco and B. A. Menge, "Oregon coastal observing system", Eos Trans. AGU, p. OS71F-01, vol. 83(47), (2002). Conference abstract

Kuebel, B. T., J. S. Allen, and R. M. Samelson, "A modeling study of Lagrangian and Eulerian shelf flows due to periodic wind forcing", Eos Trans. AGU, p. OS62A-023, vol. 83(47), (2002). Conference abstract

Kurapov, A. L., J. S. Allen, G. D. Egbert, P. M. Kosro, M. D. Levine and
T. Boyd, "Data assimilative studies of coastal circulation off Oregon", Eos Trans. AGU, p. OS71F-02, vol. 83(47), (2002). Conference abstract

Perlin, A., J. N. Moum, and J. M. Klymak, "Bottom boundary layer behavior during COAST", Eos Trans. AGU, p. OS61D-04, vol. 83(47), (2002). Conference abstract

Pierce, S. D., J. A. Barth, W. T. Peterson, T. J. Cowles and M. Zhou, "Mesoscale bio-acoustic surveys in the northern California Current System", Eos Trans. AGU, p. OS62A-023, vol. 83(47), (2002). Conference abstract

Ruttenberg, K. C. and S. T. Dyhrman, "Spatial and temporal patterns of dissolved phosphorus distribution in coastal waters of central Oregon", Eos Trans. AGU, p. OS62A-022, vol. 83(47), (2002). Conference abstract

Samelson, R. M., "Coastal meteorology and wind-forced coastal ocean currents", Eos Trans. AGU, p. OS51D-02, vol. 83(47), (2002). Conference abstract

Spitz, Y. H., J. Gan and J. S. Allen, "Three-dimensional response of the ecosystem to upwelling off the Oregon coast", Eos Trans. AGU, p. OS62A-024, vol. 83(47), (2002). Conference abstract

Wheeler, P. A., "Production and fate of organic C and N in the wind-driven coastal ocean off Oregon", Eos Trans. AGU, p. OS62A-023, vol. 83(47), (2002). Conference abstract

Books or Other One-time Publications

Web/Internet Site

URL(s):

http://damp.coas.oregonstate.edu/coast

Description:

This web page contains an overview of our COAST project with pointers to all the subcomponent project web pages. It also contains links to near real-time satellite SST imagery, land-based coastal radio system surface current maps and atmospheric model forecasts.

Other Specific Products

Product Type: Data or databases

Product Description:

Near real-time daily-averaged maps of the ocean surface currents between Newport and Waldport, Oregon. These maps are produced by a network of SeaSonde High-Frequency land-based radio systems.

Sharing Information:

The near real-time ocean surface current maps are available at a website http://bragg.coas.oregonstate.edu/seasonde.

Product Type: Atmospheric model forecasts

Product Description:

Experimental daily weather forecasts for Oregon and the Pacific Northwest using the ARPS (Advanced Regional Prediction System) mesoscale meteorological model.

Sharing Information:

The daily weather forecasts are available at a web site http://www-hce.coas.oregonstate.edu.

Product Type: Data or databases

Product Description:

Shipboard ADCP data and the ship-based scientific data from the two 2001 R/V Thomas G. Thompson cruises is available on the OSU Ocean Mixing group web page. An improved bathymetry data set compiled by and obtained from Eric D'Asaro (UW) is available on the website.

Sharing Information:

This data is available at the web site http://mixing.coas.oregonstate.edu/.

Contributions

Contributions within Discipline:

Contributions to Other Disciplines:

Contributions to Human Resource Development:

Three undergraduates (T. Boehland, J. Harman and K. Reser) gained experience in oceanographic research.

Eleven graduate students are receiving training, including extensive
sea-going experience: L. Bandstra (nutrients), J. Bosch (organic carbon and nitrogen), R. Castelao (physical oceanography), Lisa Eisner (bio-optics and phytoplankton), G. Gunderson (microstructure), C. Howard (bio-optics), M. Meaux (aircraft measurements, UNC), Sheila O'Keefe (land-based radio mapping of ocean surface currents), R. Sanders (phytoplankton physiology), M. Sutor (bio-acoustics and zooplankton) and M. Wetz (organic carbon and nitrogen).

Ten postdocs are receiving training in oceanic (S. Crouch, J. Gan) and atmospheric (S. Bielli, N. Perlin) modeling, in hydrographic and microstructure measurements (M. Ott), in turbulence measurements and analysis (J. Klymak, A. Perlin), and in assessing the concentration and distributions of iron (Z. Chase, LDEO), particulate and dissolved organic material (L. Karp-Boss) and dissolved organic phosphorus (S. Dyhrman, WHOI). S. Bielli has successfully finished her postdoctoral tenure at OSU and has moved to a research position in the Department of Atmospheric Sciences at the University of Washington.

Contributions to Resources for Research and Education:

Contributions Beyond Science and Engineering:

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope: None

Unobligated funds: less than 20 percent of current funds

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Any Book
Contributions: To Any within Discipline
Contributions: To Any Other Disciplines
Contributions: To Any Resources for Research and Education
Contributions: To Any Beyond Science and Engineering