



CCPO “... facilitating innovative research in the coastal ocean.”

CIRCULATION

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WORLDWIDE COASTAL OCEAN RESEARCH AT CCPO

The Center for Coastal Physical Oceanography (CCPO) was founded in 1991 with the long-term goal of facilitating innovative research in the coastal ocean. To begin addressing this broad goal, two specific areas of emphasis were identified: 1) elucidation of the thermodynamic processes involved in the flux of buoyancy, and 2) understanding the dynamics of large scale alongshore flows. The proximity of the Chesapeake Bay, with its strong seasonal and inter-annual changes in buoyancy forcing, and the offshore Virginia coastal waters, which are influenced by large-scale flows associated with the Gulf Stream and the Labrador Current, were primary reasons for selecting these two areas. Although the initial thrust of Center research was focused on modeling, the acquisition and analyses of observations were viewed from the start as an integral component of the overall research program. The focus of research at the Center has expanded to coastal areas outside of Virginia and to biological and chemical processes, in addition to physical processes.

Efforts by CCPO scientists have resulted in the development of the first consistent program of observations of the currents and hydrography of the lower Chesapeake Bay. This program, which has been ongoing for eight years, is presently coordinated by **ARNOLDO VALLE-LEVINSON** and **LARRY ATKINSON**, and involves many research scientists and students from Old Dominion University. The combination of the Bay mouth data sets with hydrographic

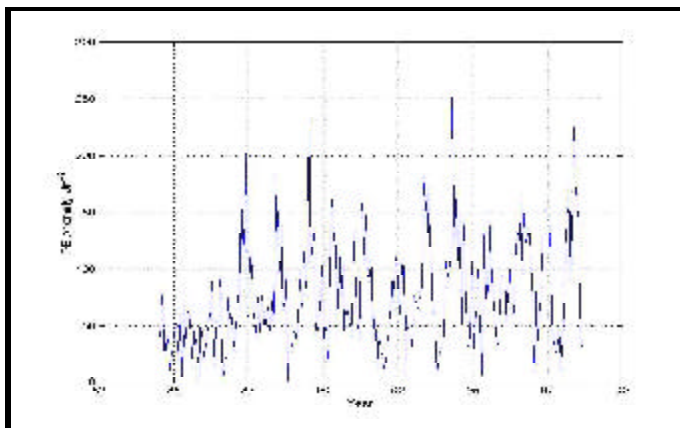
surveys of the Virginia coastal waters have provided insight into the role of buoyancy forcing in the circulation of the inner shelf coastal waters.

Circulation modeling studies by CCPO scientists extend the observational data base through simulations designed to analyze the ability of a shallow water model to

predict tidal flow, tidal and river exchange at the mouth of Chesapeake Bay, and the structure of tidal flow within the Bay and adjoining rivers. Additional modeling studies have focused on simulation of Bay water levels, the path and strength of fresh outflow from the mouth of Chesapeake Bay, and the effect of offshore winds and circulation in the coastal ocean on this exchange. Recent modeling efforts have focused on simulating tidal flow in rivers with scales of a few 100 meters to investigate the secondary circulation and the for-

mation of fronts during ebb and flood. Along with the development of circulation models has been the development of algorithms and procedures for implementing numerical circulation models on high performance computers. Current high performance computers range from clusters of loosely coupled PCs with Ethernet connections to arrays of high-end workstation processors tightly coupled through high bandwidth dedicated networks. The key element is using data structures that permit the problems to be partitioned among the processors with minimal data transfer and synchronization requirements. Collaborations between **CHET GROSCH** and colleagues from the Computer Science and Mathematics Departments at Old Dominion University and other universities are currently addressing these issues.

Because observational activities are important to the Center goals, several research activities are directed at enhancing the ability to do measurements. Foremost among these is the acquisition of an oceanographic research vessel. CCPO scientist, **TOM ROYER**, and others are leading the effort to replace the existing Old Dominion University research vessel, R/V *Holton*, with a 55-foot aluminum vessel, the R/V *Fay Slover*, in early 2002. It will have the ability to travel swiftly in lower Chesapeake Bay and adjacent coastal waters, will be capable of carrying 6 scientists on research cruises, and be able to carry up to 49 students and faculty on day cruises.



Time series of potential energy anomaly calculated from the vertical density structure measured in the Chesapeake Bay. Variations in the potential energy anomaly reflect the seasonal changes in stratification due to river runoff and surface heat fluxes. Furthermore, the time series illustrates year-to-year variability in stratification in the Bay.

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Another activity directed at improving the quality of observations is a study of the measurement of salinity, which is important not only in the coastal regions, such as those in the Tidewater Virginia region, but also over the global ocean since it affects the ocean circulation and is a measure of the global freshwater budget. Measurements of salinity using conductivity are often contaminated by biological growth on the sensors. The use of chemical poisons to prevent such growth is not necessarily kind to the environment. CCPO scientists (**ROYER, ATKINSON**) are working with Sea Bird Electronics and scientists from the Electrical Engineering Department at Old Dominion University to develop a high voltage technique to prevent biofouling on conductivity sensors. The testing of the system is being carried out at the Virginia Marine Science Museum as part of a public display on salinity in the ocean. If the technique is successful, it will be employed at coastal sites and on ships of opportunity for the global measurement of sea surface salinity.

Recent enhancements to the Chesapeake Bay program include bio-optical measurements by CCPO scientist, **GLENN COTA**. Surveys of bio-optical properties in coastal waters have been collected as part of the Chesapeake Outflow Plume Experiments, in cooperation with scientists from the Naval Research Laboratory and several universities. In collaboration with NOAA's National Data Buoy Center and NASA Langley, bio-optical observations have been made at the Chesapeake Light Tower (CLT), which is now a primary validation site for the NASA Goddard Space Flight Center AERONET CIMEL sunphotometer program and the NASA Langley component of the Clouds and the Earth's Radiant Energy System project. The radiometric observations made by NASA Langley are part of the World Meteorological Organization's Baseline Surface Radiation Network program and represent the only marine location in the network.

The focus of CCPO research from the outset has been interdisciplinary. Thus, the Chesapeake Bay and Virginia coastal water studies provide the nucleus for other studies, such as recent efforts to understand fluxes of nutrients, croaker larvae, and blue crab larvae into and out of the Bay. These studies, being undertaken by **ATKINSON** and **VALLE-LEVINSON**, are designed to illustrate the importance of circulation in nutrient loading to the lower Bay and recruitment to two commercially important species.

Another commercial species in Chesapeake Bay, the Eastern oyster (*Crassostrea virginica*), has been the subject of a long-term modeling effort by **EILEEN HOFMANN** and **JOHN KLINCK**, in collaboration with scientists from the Haskin Shellfish Research Laboratory of Rutgers University, the Virginia Institute of Marine Science, and the Sarbanes Cooperative

Oxford Laboratory in Maryland. Simulations from the coupled oyster-dual disease model show the importance of water residence time and climate variability in modulating the prevalence and intensity of the two diseases, which has strong implications for designing management strategies for diseased oyster populations.

Although the initial focus of CCPO was local waters, the range of the research undertaken by CCPO scientists is much broader because understanding obtained from other coastal and oceanic environments can only enhance understanding of the Chesapeake Bay and Virginia coastal waters. CCPO scientists are currently involved in studies of the circulation dynamics of submarine canyons (**KLINCK**), coastal and ocean processes in the U.S. Northeast Pacific (**ROYER**), and circulation over the Texas-Louisiana inner continental shelf (**VALLE-LEVINSON**).

The study of the circulation dynamics of submarine canyons on the west coast of the U.S. and Canada, using data analyses and both laboratory and numerical modeling, shows the role of submarine canyons in bringing offshore oceanic waters onto the continental shelf and the consequent effect on flushing of shelf waters. This study has local implications because of the large number of canyons that cross the continental shelf in the Middle Atlantic Bight from Cape Hatteras to Cape Cod, which potentially provide significant flushing for this shelf region.

The U.S. Northeast Pacific study, which is part of the U.S. Global Ocean Ecosystems Dynamics (GLOBEC) program, is an investigation into the patterns of salmon production from California to Alaska. Very low frequency changes in the atmospheric and oceanic conditions are thought to control the observed patterns of salmon production along the U.S. west coast and Alaska. CCPO scientists, **TOM ROYER** and **CHET GROSCH**, and students are continuing to work with scientists from other institutions to maintain and analyze a 30-year hydrographic time series in the northern Gulf of Alaska and to calculate the freshwater discharges into the Northeast Pacific. This interdisciplinary study is evaluating the roles of the coastal ocean in salmon production.

The study of the Texas-Louisiana inner shelf provides data from another system that has strong seasonal and interannual buoyancy and wind forcing of the coastal circulation. Using data from the Texas Automated Buoy System, several issues, such as the spatial and temporal variation of flows and winds, coastal trapped waves, and seasonal flow patterns, are investigated.

Recent advances in computational models and high resolution measuring instruments have generated a need for an objective methodology to blend disparate data sets. Current research by CCPO scientist, **CHET GROSCH**, in collabo-

ration with scientists from the University of Delaware and the California Institute of Technology, has demonstrated that such an objective method can be constructed using normal modes subject to specific dynamical constraints. This methodology is being applied to high-resolution radar observations and numerical model results from Monterey Bay and to time series of sea surface temperature from the Pacific Ocean. Recently, this research has been extended to include the use of Dynamical Systems Analysis to analyze the results.

Comparisons with coastal systems extend beyond U.S. or Canadian waters with CCPO scientists being involved in studies in Mexico, Central America, South America (**ATKINSON, VALLE-LEVINSON**) and the Antarctic (**HOFMANN, KLINCK**). The Mexican coastal lagoons provide environments of typically weak fresh water discharge but seasonal negative buoyancy. Therefore, their circulation patterns may reverse and have important implications to their water quality. A study in the Gulf of Fonseca off the coast of Central America is designed to provide information on the circulation as it relates to aquaculture. This is part of the U.S. government's relief efforts as a consequence of Hurricane Mitch in 1998. Another study in the Rio de la Plata, shared by Argentina and Uruguay, provides contrasting responses of an estuary to wind forcing. Upwelling conditions develop during the austral summer and have crucial repercussions on the productivity of the system.

The shelf and inland sea waters of Chile present an opportunity to conduct field experiments under different conditions. Upwelling along the Chilean coast is localized at many points, but the upwelled water often intrudes into shallow terraces or gulfs along the coast, resulting in increased primary production in regions that are removed from the initial upwelling site. A collaborative research effort, which involves observational and modeling studies, between CCPO and Chilean scientists is ongoing to study the intrusion process and residual circulation of these areas.

The continental shelf waters of the west Antarctic Peninsula (WAP) provide an interesting counter to many of the coastal systems previously described. Buoyancy forcing in this region is dominated by the seasonal cycle in the formation and decay of sea-ice cover, the continental shelf is deep, and the Antarctic Circumpolar Current flows along the outer shelf edge. Across-shelf exchanges, via the Antarctic equivalent of submarine canyons, and double diffusion process are important in maintaining the temperature and salinity structure of this region. Studies of the circulation and hydrography of the WAP by CCPO scientists are continuing as a component of the U.S. Southern Ocean GLOBEC program.

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Studies of coastal waters in other regions are not limited to hydrographic and current measurements. Rather, CCPO scientists bring a range of instruments and approaches to these studies. Ocean color satellites and a variety of optical instruments are integral to the research efforts undertaken by **GLENN COTA** and his colleagues in the Arctic region. Arctic waters have distinct bio-optical properties, and global ocean color algorithms tend to underestimate phytoplankton biomass in this highly productive ecosystem. Recent cruises to the Beaufort, Chukchi, and Labrador Seas by **COTA** and his students have provided data for the growing bio-optical data base for the Arctic that are being used for algorithm development and validation by several ocean color satellite programs in the U.S. and Japan.

The CCPO emphasis on interdisciplinary studies continues in programs outside of Chesapeake Bay and the Virginia coastal waters. A long-term effort on modeling the dynamics of the lower trophic levels in the equatorial Pacific Ocean undertaken by CCPO scientists, **MARJORIE FRIEDRICHS** and **EILEEN HOFMANN**, in collaboration with colleagues

from NASA Goddard Space Flight Center, has resulted in improved understanding of the role of high frequency circulation variability phenomena on biological production. This study also resulted in testing and implementing approaches for the assimilation of biological data into marine ecosystem models. Related modeling studies have focused on understanding the physical and biological factors controlling the nitrogen-fixing phytoplankton, *Trichodesmium*, and the potential biological effects on heating of the surface mixed layer in the equatorial ocean.

Interdisciplinary studies, with the desire to better understand structure and function of the marine ecosystem of Antarctic coastal waters, consist of models of growth and development of Antarctic krill (*Euphausia superba*) and Adlie penguin (*Pygoscelis adeliae*) chicks, as well as bio-optical models for estimating marine primary production. The model for Antarctic krill growth has also been in a circulation model to examine transport of krill from the WAP across the Scotia Sea. This latter study, a joint effort with scientists from the British Antarctic Survey, makes a connection between circulation processes on the WAP continental shelf with

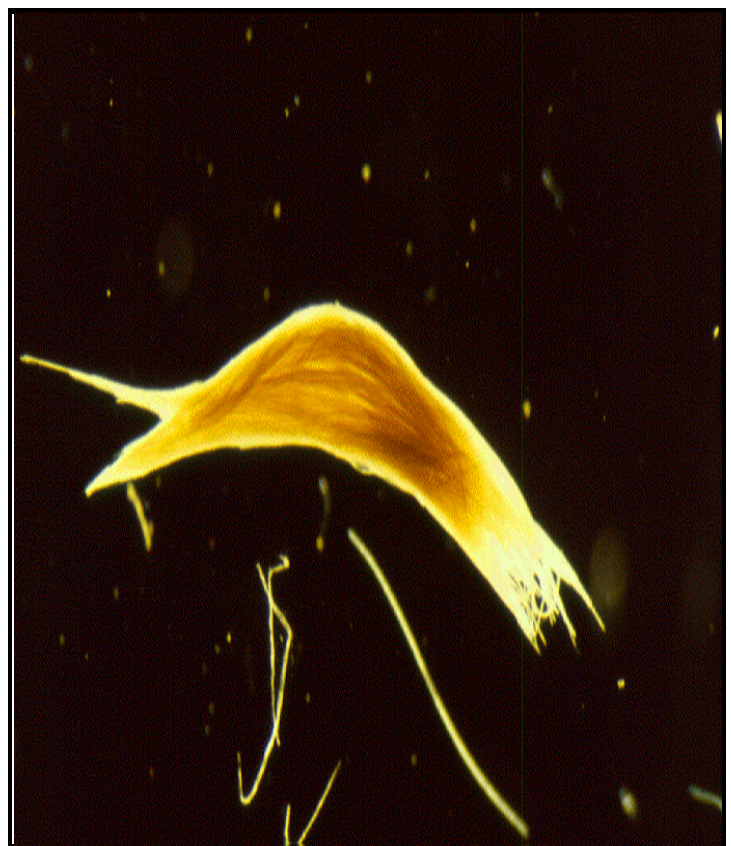
those in the large-scale flow of the Antarctic Circumpolar Current.

Research activities undertaken by CCPO scientists encompass a wide range of environments, ideas, and approaches. The direct result of this work is a better understanding of oceanographic processes in a variety of coastal environments. The net effect of this work is that ideas from one place are tested in others, leading to an overall improvement in understanding of coastal ocean processes. A more important result is the development of a large network of collaborators, both national and international. Some of these connections develop through membership in various oversight and steering committees; some develop through joint consideration of a particular coastal system. And some develop as students and young scientists visit the Center and later become members of the oceanographic community. The success of CCPO is best measured by the people who have visited, collaborated, or become part of the Center. These personal relations are the basis of success in most scientific studies.

"A Fistful o' Tricho" Cruise

"One hundred three feet of raging orange and white steel!" That's how Chief Scientist Tracy Villareal (University of Texas) describes the R/V *Longhorn*, platform for the July 2000 "A Fistful o' Tricho" cruise. With a long-standing interest in buoyancy regulation and vertical migration among marine phytoplankton, Tracy and compatriots set sail upon the steamy Gulf of Mexico one week last summer to explore similar phenomena among *Trichodesmium thiebautii* (Tricho). In addition to the UT crew, other members of the diverse scientific party included representatives from the labs of B. Byrne (University of South Florida), D. Capone (University of Southern California), and J. Montoya (Georgia Institute of Technology). **TONYA CLAYTON**, a CCPO graduate student working with **EILEEN HOFMANN**, was also privileged to be along for the *Longhorn* ride.

The geographic cruise target was a warm-core eddy that had pinched off the Loop Current some months earlier. As anticipated from earlier field reports, abundant *Trichodesmium* populated the waters. Good weather, low winds, and high insolation held day after day, just right for sailors in search of both *Trichodesmium* and a smooth ride. At open-water stations and a subsequent cross-shelf transect, busy Trichonauts deployed nutrient profilers, CTD/Niskin rosettes, and plankton nets in order to measure hydrographic parameters, nutrient distributions, nitrogen fixation rates, and isotope distributions, plus various measures of Tricho buoyancy and photosystem state. At dusk, piscine samples were collected at the local Amoco FAD (Fish-Attracting Device, i.e., offshore oil rig). All in all, a wealth of diverse Tricho data was collected, laying a firm foundation for future, more extensive investigations into the possibility of vertical migration by these enigmatic diazotrophs. Special thanks go to Captain Noe Cantu and his crew for a safe and fruitful scientific cruise.



Colony of *Trichodesmium thiebautii* ("tuft" morphology). Colony is approximately 1 cm in length. Image courtesy of Tracy Villareal, University of Texas.

Submitted by Tonya Clayton.

STUDENT PROFILE

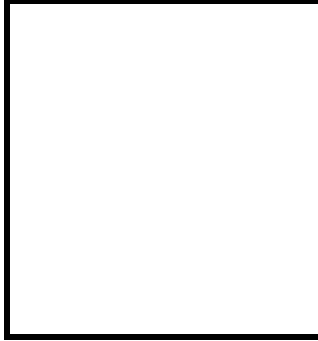
Hae-Cheol Kim

HAE-CHEOL KIM

graduated from the Department of Oceanography, Seoul National University in 1991. His passion for the ocean made him continue his research on marine ecosystems as a graduate student. During his enrollment in the graduate school of the same university, he was fortunate to take advantage of a once-in-a-lifetime opportunity. His former supervisor, Dr. Suam Kim, for whom Hae-Cheol was working at Korea Ocean Research and Development Institute (KORDI), ordered a special “Mission Possible” in Antarctica. In 1993, Hae-Cheol went to the Korean Antarctic station, called King Sejong Station, as part of an overwintering research party and stayed there for 15 months, making friends with seals, penguins, and other Homo sapiens from different countries, in the name of “doing research”.

He finally returned alive to the civilized world after successful completion of the overwintering mission and resumed his work to get a master’s degree in biological oceanography. He wrote his master’s thesis, “The Seasonal Variation of Primary Productivity in the Antarctic Coastal Ecosystems”, with the data sets he collected when he was in Antarctica. (He learned one obvious but important fact that oceanography is an art of cooperation and coordination itself. He still gives many thanks to his overwintering members who helped him acquire those invaluable data sets in spite of the unfavorable conditions and harsh environment.)

Upon finishing his master’s in 1996, he worked briefly in the Department of Environmental Engineering, Kwangju University as a research associate, continuing his research interest on the coastal ecosystem of the southern coast of the Korean peninsula. After this short occupational experience, he came to the United States in 1997 to start working as a Ph.D. student at CCPO. Since coming here, he has switched his research interest from laboratory- and observation-based biological oceanography to the interdisciplinary field of biological and physical oceanography using computation-based ecosystem modeling techniques. He is currently working with **EILEEN HOFMANN** on an integrated bio-optical production model as an approach to a marine ecosystem of the Southern Ocean, a place for which he will always be nostalgic. After graduation, Hae-Cheol plans to obtain a postdoctoral research position in the United States.



QUOTES FROM THE FIELD

Many years ago, while pouring over our “textbook” in the “Waves and Tides” course taught by Professor Rattray, I came across the following quote. For some reason it sticks in my mind.

After a discussion of the basic gravitational forces, Doodson and Warburg state:

“It is now possible to assert that it is a simple matter of common-sense to deduce that somehow or other, in greater or less degree, with relatively unknown amplitudes, and at unknown times relative to the forces, the variations in the forces will naturally lead to similar variations in the actual tides.”

From *Admiralty Manual of Tides* by A.T. Doodson and H.D. Warburg. H. M. Stationary Office. 1941.

Submitted by Larry P. Atkinson.

Please send in your favorite quote, preferably by or about oceanographers to mcquay@ccpo.odu.edu or julie@ccpo.odu.edu.

GOOD NEWS!

Congratulations to CCPO graduate research assistant, **CHRISTOPHER KATZENMILLER**, who married Jennifer Post on June 24, 2000 in Annapolis, MD. Jennifer is a public relations coordinator for a Norfolk oral surgery practice.

Congratulations to **ARNOLDO VALLE-LEVINSON** and **ANNE WEST-VALLE**, CCPO assistant professor and outreach coordinator, on the birth of their daughter. Liliana was born July 9, 2000 at 4 p.m. and weighed 7 lbs. 12 oz.

WHAT'S HAPPENING AT CCPO

TIDES COURSE

The Cooperative Institute for Coastal Physical Oceanography (CICPO) will be presenting a short course entitled, "Tides and Water Levels for Hydrographers", on December 11-15, 2000 at the downtown Norfolk campus of Tidewater Community College. CICPO is a collaboration between Old Dominion University's Center for Coastal Physical Oceanography and NOAA's National Ocean Service (NOS). Those enrolled in the course include managers and technical staff of public agencies and private industry that conduct hydrographic surveys. The course is designed to educate participants in all aspects of operational tides and water levels support related to surveying and mapping and will enable them to comply with U.S. survey specifications and deliverables for vertical control in hydrographic surveys. Many of the companies are seeking federal contracts or contracts with state agencies planning local charting projects. International participation includes the United Arab Emirates and Tanzania. The information presented in this course will enable participants to understand and satisfy the survey specifications and deliverables for vertical control. Steve Gill of NOAA/NOS in Silver Spring, MD will be the course instructor. RICHARD MOODY and ELIZABETH SMITH of CCPO are providing course coordination and logistical support.

PECS

The Tenth Biennial Conference on the Physics of Estuaries and Coastal Seas (PECS) was held in Norfolk, VA, October 7-11, 2000, with more than 100 attendees from different parts of the world. The PECS conferences seek to promote interactions among people working in coastal regions independently of any mother institution and under a relaxed setting. The first PECS Conference of the millennium was co-hosted by ARNOLDO VALLE-LEVINSON and Carl Friedrichs (Virginia Institute of Marine Science) and was organized by ANNE WEST-VALLE. As the first PECS of the 21st century, it was epitomized by multi-media presentations and entertainment. The program was filled with topics that stimulated the exchange of information and featured the exposition of the most recent advances in topics relevant to coastal and estuarine hydrodynamics; sediment transport in estuaries, inlets and coastal regions; and morphodynamics. The program also included receptions on a schooner that sailed the local estuary and at the local maritime center, which enhanced the interactions among attendees despite some reluctance to start the conference on a Sunday. The PECS meetings then provided a unique setting in which scientists interested in the dynamics of coastal regions found a forum to discuss ideas. The Eleventh Biennial PECS meeting will be held in Hamburg, Germany in 2002. Plan on attending and look for announcements in late 2001. It will definitely be scientifically stimulating, just the way it was in Norfolk 2000.

SO GLOBEC PLANNING OFFICE AT CCPO

The U.S. component of the Southern Ocean Global Ocean Ecosystems Dynamics (SO GLOBEC) program is a large interdisciplinary research effort, consisting of about 25-30 primary science investigators. Because of the breadth of the program, it was felt that a coordinating activity was essential for the U.S. SO GLOBEC program, as well as for ensuring that the U.S. program is coordinated with the International SO GLOBEC effort. Following the precedent set by the U.S. Northwest Atlantic and Northeast Pacific GLOBEC programs, a coordination office for SO GLOBEC was established in Fall 2000 at CCPO with funding from the National Science Foundation Office of Polar Programs. The daily activities of the SO GLOBEC office are handled by JULIE MORGAN and EILEEN HOFMANN, both of whom have been involved in SO GLOBEC planning efforts for the past several years. The office activities are diverse, but the current focus is on coordination of the four U.S. SO GLOBEC cruises that will take place in 2001. Information on the SO GLOBEC program is available at http://www.ccpo.odu.edu:80/Research/globec_menu.html.

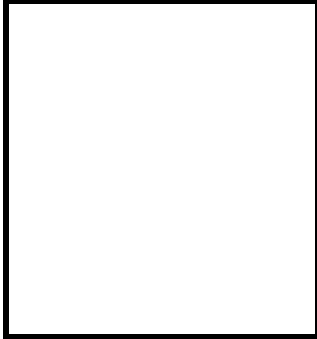
SO GLOBEC

The International Southern Ocean Global Ocean Ecosystems Dynamics (SO GLOBEC) program is focused on understanding circulation processes and their effect on sea ice formation and Antarctic krill (*Euphausia superba*) distribution, and on examining the factors that govern krill survivorship and availability to higher trophic levels, including seals, penguins, and whales. Several nations will participate in a series of SO GLOBEC field studies, which start in late 2000 and extend to 2003. The U.S. component of SO GLOBEC, funded by the U.S. National Science Foundation Office of Polar Programs, is focused on physical and biological processes in austral fall and winter on the west Antarctic Peninsula continental shelf. About 25 investigators will use two ships (RV *L.M. Gould* and RV *N.B. Palmer*), moorings, and satellite sensors to study circulation, sea ice, microbial communities, zooplankton, Antarctic krill, and top predators. The major field activities for the U.S. program are cruises in April-May and July-August of 2001 and 2002. CCPO researchers, JOHN KLINCK, EILEEN HOFMANN, and Ricardo Locarnini (now at the National Oceanographic Data Center), are participants in the U.S. SO GLOBEC program. They will collect and analyze hydrographic data and develop numerical models for investigation of circulation and biological processes. This work extends their efforts over the last decade, which have been directed at understanding the circulation and its effects on biological distributions. These SO GLOBEC activities will provide opportunities for CCPO students and scientists to experience research in the wonderful and exciting Antarctic.

Student Profile

Christopher Katzenmiller

CHRIS KATZENMILLER is a CCPO graduate student who relinquished his career in Intelligence to learn how to conquer Matlab and Unix programming.



Chris' interest in science began in his childhood. He greatly admires his father, a high school biology teacher in Tennessee who has always encouraged Chris' scientific curiosity. Chris attended the U.S. Naval Academy for his undergraduate degree in oceanography. Because of his desire to remain in the sciences, Chris

chose oceanography over chemistry in order to keep his GPA above 2.0. Upon completion of his four years of study, Chris entered the Naval service, as all graduates do, as an Ensign in cryptology. Cryptology is a hush-hush profession, so he cannot say much else about his duties. He was stationed in Rota, Spain and served onboard the aircraft carrier *USS George Washington*. He began to see the world (well, just the Mediterranean Sea) and then the Persian (Arabian for the politically correct) Gulf. While there, he was diagnosed with insulin-dependent diabetes and was subsequently transferred back to the States. He worked in Chesapeake, VA for two more years as a cryptologic officer until he was medically retired from the Navy. Chris then headed to Maryland for the strange world of government contracting. The excitement and challenge of this work left much to be desired, so he packed up and headed back to Virginia for graduate school at Old Dominion University and to be closer to his future wife.

Chris is currently working with **LARRY ATKINSON**, CCPO's director. His research is on stratification in the Chesapeake Bay. He also participates in monthly cruises, collecting data for climatology of the Chesapeake Bay Mouth. Chris went to Argentina this past January on a cruise to collect data for a study of the Rio de Plata with **ARNOLDO VALLE-LEVINSON**, CCPO assistant professor. He is currently serving as president of the Ocean, Earth, and Atmospheric Sciences Department's Graduate Student Organization. Outside of life at school, Chris enjoys running, basketball, and spending time with his wife, Jennifer, and their two cats. After completing his thesis, Chris hopes to work in environmental policy for the government in a scientific capacity.

Collaboration with Chilean Hydrographic Service Signed

by Larry Atkinson, Director

CCPO has developed a solid relationship with oceanographers in Chile over the past years. As shown in the accompanying picture, **LARRY ATKINSON** signed an agreement with Capitán de Navío Rafael Mac-Kay Bäckler, Director of Servicio Hidrográfico y Oceanográfico de la Armada de Chile in Valparaíso. Over the past few years, we have worked with Capt. Mac-Kay and his colleague, Dr. Rodrigo Nuñez Gundlach, who is head of the oceanographic department. The result of that work is the enrollment of Mario Caceres in our Ph.D. program, collaboration on research cruises in Chilean waters, and help with our collaborative research in Chile.

Establishing such collaborations, as many of you know, takes time and patience. To us, the key is to have students going back and forth and have collaborative research. This is done by working together to build trust. I am happy to say that our dealings with all our Chilean colleagues have been excellent and a diverse mix of projects is underway.

MARIO CACERES is working on his Ph.D. here, with his focus being on tidal currents in the restricted channels of the Inland Sea. **ANDRES SEPULVEDA** is in the midst of his Ph.D. research on the coastal waters of Virginia. **JOSE BLANCO**, formerly of Instituto de Fomento Pesquero in Valparaíso, is just starting his Ph.D. program. His research will focus on large-scale oceanographic processes off Chile, and he will use data collected along the coast by a variety of long-term observational programs.

Other collaborations include those with Dr. Leonardo Castro, Dr. Victor Ariel Gallardo, and colleagues at the Universidad de Concepción; Julio Moraga at the Universidad Católica del Norte in Coquimbo, and others at the Universidad de Chile in Santiago and Universidad de Austral de Chile in Puerto Montt.

In the future, our graduates will go off to their jobs, hopefully in Chile, but they will maintain their contacts with CCPO faculty and their fellow students. Thus, the international science network is maintained.



Larry Atkinson and Capitán de Navío Rafael Mac-Kay Bäckler, Director of Servicio Hidrográfico y Oceanográfico de la Armada de Chile in Valparaíso.

Just the facts ...

GRANTS/CONTRACTS AWARDED

ATKINSON, L.P., "CMTT Eastern and Western Boundary Currents Workshop," Joint Global Oceans Flux Study (JGOFS) and the Land-Ocean Interactions in the Coastal Zone (LOICZ), \$20,000.

PRESENTATIONS

Bochenek, E.A., E.N. Powell, **J.M. KLINCK**, and **E.E. HOFMANN**, "A biochemically-based model of the growth and development of *Crassostrea gigas* larvae." International Conference on Shellfish Restoration, Hilton Head, SC, November 15-18, 2000.

CACERES, M., A. VALLE-LEVINSON, and **A. SEPULVEDA**, "Flow patterns in the vicinity of the mouth of a Chilean fjord." Tenth International Conference of Physics of Estuaries and Coastal Seas, Norfolk, VA, October 9, 2000.

COTA, G.F., "A) The Arctic: Why you might care, B) Marine ecosystems in marginal ice zones, C) Bio-optical oceanography and ocean color." USCGC Polar Star, Chukchi Sea, August 13, 2000.

COTA, G.F., "Polar marine ecology." Norfolk Collegiate Lower School, 2nd grade class, Norfolk, VA, June 5, 2000.

COTA, G.F., and L.R. Pomeroy, "Arctic shelf-basin production." Shelf-Basin Interactions Pan Arctic Meeting, Callaway Gardens, GA, November 7-9, 2000.

COTA, G.F., D.A. RUBLE, and **J. WANG**, "Arctic bio-optical properties: Distinct differences." Global Line Imager ADEOS II meeting, Kanazawa, Japan, November 6-10, 2000.

Fraser, W.R., and **E.E. HOFMANN**, "Antarctic krill longevity and its implications to understanding trends evident in Adlie Penguin populations." Waterbird Society Meeting, Plymouth, MA, November 2, 2000.

HOFMANN, E.E., J.M. KLINCK, E.N. Powell, S.E. Ford, S. Jordan, and E. Bureson, "Effects of climate variability on the prevalence and intensity of Dermo and MSX diseases in Eastern Oyster populations." International Conference on Shellfish Restoration, Hilton Head, SC, November 15-18, 2000.

KLINCK, J.M., E.N. Powell, J.E. Krauter, and S.E. Ford, "A fisheries model for managing the oyster fishery during times of disease." International Conference on Shellfish Restoration, Hilton Head, SC, November 15-18, 2000.

KLINCK, J.M., "Flow in the vicinity of submarine canyons." University of Delaware, Newark, DE, October 20, 2000.

Moraga, J., and **A. VALLE-LEVINSON**, "Circulation in Semi-arid Bays of Chile." Tenth International Conference of Physics of Estuaries and Coastal Seas, Norfolk, VA October 8, 2000.

Li, C., **A. VALLE-LEVINSON, L. ATKINSON**, K. Holderied, **C. REYES, A. SEPULVEDA**, and **R. SANAY**, "Thermodynamics and Hydrodynamics at Sand Shoal Inlet, Virginia." Tenth International Conference of Physics of Estuaries and Coastal Seas, Norfolk, VA, October 9, 2000.

ROYER, T. C., and **C. E. GROSCH**, "Analysis of Low Frequency Signals in the Northeast Pacific Coastal Freshwater Discharge, Salinity, Temperature and Salmon Production Using Wavelet Techniques." Ninth Annual Meeting of PICES, North Pacific Marine Science Organization, Hakodate, Japan, October 25, 2000.

ROYER, T.C., "The Development and Testing of an Antibiofouling Method for the Measurement of Salinity." Virginia Marine Science Museum, Virginia Beach, VA, November 13, 2000.

VALLE-LEVINSON, A., K. Wong, and **K. BOSLEY**, "Response of the lower Chesapeake Bay to forcing from Hurricane Floyd." Tenth International Conference of Physics of Estuaries and Coastal Seas, Norfolk, VA, October 9, 2000.

VALLE-LEVINSON, A., K. Wong, and **K. BOSLEY**, "Wind-induced exchange at the entrance to a coastal plain estuary." Instituto Mexicano de Tecnologia del Agua, Morelos, Mexico, October 26, 2000.

VALLE-LEVINSON, A., C. Li, K. Wong, and K. Lwiza, "Fortnightly variability in the transverse dynamics of a coastal plain estuary." Instituto Mexicano de Tecnologia del Agua, Morelos, Mexico, October 27, 2000.

VALLE-LEVINSON, A., J. Delgado, and **L. ATKINSON**, "Reversing Water Exchange Patterns at the Entrance to a semi-arid coastal lagoon." Meeting of the Division of Fluid Dynamics of the Mexican Physical Society, Puebla, Mexico, October 31, 2000.

VALLE-LEVINSON, A., Participant on the television program, "Burden of Proof," on the Cable News Network (CNN) on the subject of floatable transport, September 11, 2000.

CCPO Seminar Series

Spring 2001

During the academic year, CCPO invites several distinguished scientists to present seminars on topics related to coastal oceanography. The lectures take place in Room 109, Crittenton Hall, Old Dominion University on Mondays at 3:30 p.m. **EILEEN HOFMANN**, professor of oceanography, coordinated the lecture series with the assistance of **JOY HAYES MCQUAY**. Below is a schedule of lectures for the spring semester 2001. For more information or if you would like to be included on the mailing list for lecture announcements, please call Joy at (757) 683-4945 or e-mail seminar@ccpo.odu.edu. Specific lecture topics are announced one week prior to each lecture. Titles and abstracts of the seminars can be found at <http://www.ccpo.odu.edu>.

January 29 RODGER HARVEY Chesapeake Biological Laboratory	March 19 EILEEN HOFMANN CCPO
February 5 MARGARITA CONKRIGHT NOAA National Oceanographic Data Center	March 26 JOEY COMISO NASA Goddard Space Flight Center
February 12 DAVID RICHARDS Department of Physics Old Dominion University	April 2 KEVIN SELLNER NOAA Coastal Ocean Program
February 19 ROBIN MUENCH Earth and Space Research	April 9 RACHEL PINKER University of Maryland
February 26 LARRY P. ATKINSON CCPO	April 16 HAE-CHEOL KIM CCPO
March 12 MARIO CACERES CCPO	

Continued from Page 7

VALLE-LEVINSON, A., Panelist on the television program, "This Week in Hampton Roads," on the local public television station (WHRO) on the subject of hurricanes, July 2000.

PUBLICATIONS

Cooper, L.W., I.L. Larsen, T.M. O'Hara, S. Dolvin, V. Woshner, and **G.F. COTA**, "Radionuclide Contaminant Burdens in Arctic Marine Mammals Harvested During Subsistence Hunting," *Arctic*, 53(2), 174-182, 2000.

Deksheniaks, M.M., **E.E. HOFMANN**, **J.M. KLINCK**, and E.N. Powell, "Quantifying the Effects of Environmental Change on an Oyster Population: A Modeling Study," *Estuaries*, 23, 593-610, 2000.

Oguz, T., and **B. SALIHOGLU**, "Simulation of eddy-driven phytoplankton production in the Black Sea," *Geophysical Research Letters*, 27(14), 2125-2128, 2000.

VALLE-LEVINSON, A., K.C. Wong, and K.M.M. Lwiza, "Fortnightly variability in the transverse dynamics of a coastal plain estuary," *Journal of Geophysical Research*, 105(C2), 3413-3424, 2000.

VALLE-LEVINSON, A., C. Li, K. Wong, and K.M.M. Lwiza, "Convergence of Lateral Flow Along a Coastal Plain Estuary," *Journal of Geophysical Research*, 105(C7), 17,045-17,061, 2000.

VALLE-LEVINSON, A., J. Moraga, J. Olivares, and **J. BLANCO**, "Tidal and Residual Circulation in a Semiarid Bay: Coquimbo Bay, Chile," *Continental Shelf Research*, 20(15), 2009-2028, 2000.

COMMITTEE SERVICE

ROYER, T.C., Representative to the Technical Committee on Data Exchange (TCODE), Ninth Annual PICES Meeting, Hakodate, Japan, October 18-31, 2000.

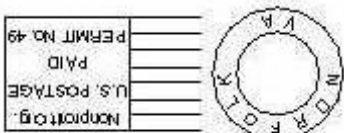
ROYER, T.C., Committee Member, Gulf of Alaska Ecosystem Monitoring (GEM) Plan, National Research Council, Polar Research Board Committee, Anchorage, AK, October 6-10, 2000.

ROYER, T.C., Committee Member, Southeast Bering Sea Carrying Capacity (SEBSCC) Advisory Committee, NOAA, Seattle, WA, August 27-29, 2000.

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