Fall 1996

# Circulation, Fall 1996

Center for Coastal Physical Oceanography, Old Dominion University

# CCPO Circulation

## Antarctic Continental Shelves are Strange And Unique

When approached from the sea, Antarctica strikes visitors as being a unique and strange place with its monochrome vistas of ice and rock, strong persistent winds, cold water and air, perpetual cloudiness, and frequent snow. This impression comes from our lack of experience with such cold, ice-covered environments.

Physical oceanographic processes on Antarctic continental shelves are even stranger to traditionally trained physical oceanographers with a mid-latitude perspective. These differences have been highlighted recently by CCPO scientists, JOHN KLINCK, EILEEN HOFMANN, CATHY LASCARA, and DAVID SMITH, who have been analyzing hydrographic observations from several regions of the Antarctic continental shelf. Much of this effort has been on understanding the water mass structure and circulation of the continental shelf west of the Antarctic Peninsula. However, the scope of this effort has extended as far west as the Ross Sea and as far east as the eastern Weddell Sea.

It is obvious to even a casual observer that the strong Antarctic winds play an important role in maintaining a deep mixed layer, enhancing air-sea exchange of heat and freshwater, and providing the momentum for large scale circulation. The structure of the wind arises not only from global scale wind patterns but also from steering of winds by steep and tall mountain ranges and from cold air draining off the continent through valleys (katabatic winds). Some of these effects are very strong but localized (a few to 10's of kilometers from the coast), giving rise to considerable uncertainty in the structure and variability of the winds over the continental shelves. Winds remain a considerable unknown since there are few observation stations, large scale atmospheric models do not represent well these topographic or katabatic effects, and ice interferes with satellite-based wind observations (scatterometers).

The cold air and near freezing water are also obvious to any visitor. The air remains between the temperatures of household refrigerators and freezers and can dip to extremes of -15 to -25C (that is, 5 to -10F for the metrically challenged), which is mild compared to the killing cold on the high plateau of the south pole---the image that comes to mind when one thinks about Antarctica. This perpetually cold air has the effect of draining the heat from the ocean and creating ice during the winter. The by-product of ice formation at sea is the release of salt, a process responsible for part of the unique character of these continental shelves. The ocean surface temperatures reach summer highs around 2C and plunge to winter lows of -1.8C (freezing point of seawater).

The final feature obvious to the new arrival is ice in its many forms: sea ice, land-fast ice shelves, glaciers, icebergs, and the fascinating blue ice (as seen in the photograph). Glaciers take the place of rivers in Antarctica in that they drain the precipitation (snow) from the land back to the sea. However, the process is very slow so the `runoff' has a weak effect, although some scientists think that in the desert that is Antarctica, this runoff is enough to have an influence. Sea ice, rather than being just frozen water, greatly reduces exchanges between the ocean and atmosphere so that ice-free and ice-covered areas act remarkably differently. However, ice cover is seldom complete, and narrow cracks (leads) allow vigorous exchanges to continue. Even more important are polynyas, which are areas of open water, 10's to 100's of square kilometers in size, under conditions where the surface water should freeze. This remarkable feat is accomplished by two mechanisms: offshore winds blow new ice away from the coast, keeping the surface ice-free (a latent heat polynya), or warm water from deep in the ocean moves to the surface, keeping the water above the freezing temperature in spite of the heat loss to the atmosphere (a sensible heat polynya).

However different the surface looks to the new visitor, subsurface processes are more remarkable. A glance at the depth recorder reveals a deep (200 to 800 m) and rugged bottom which retains much of the character that resulted from geological forces, such as ice scour, that produced these shapes. The topography that you see out of the porthole is repeated below the ocean surface. Because the land runoff is so weak, the transport of sediments (or boulders in the case of the glaciers) is slow and has not had time to fill in the deep spots and smooth out the bottom as we are used to seeing on other continental shelves; even Arctic shelves are shallow and smoothed by sediments. These strong variations of the bottom topography have considerable influence on the circulation over the shelf and may provide

paths by which water moves between the ocean and the interior of the shelf.

The visitor lucky enough to see a few hydrographic stations will find the remarkable fact that below a thin (20 m) warm layer at the surface (during summer), the water becomes colder reducing nearly to the freezing point at about 100 m depth. Below this cold layer, the water becomes warmer and is oceanic in character. Unlike all other continental shelves, the water on Antarctic shelves is not freshened by river runoff and does not mix to the bottom; thus, it retains its oceanic character. Depending on the shelf that our visitor samples, the structure of the water can be simple or complex. West of the Antarctic Peninsula and along most of the shelf in the far south Pacific (Amundsen and Bellingshausen Seas), this relatively simple structure seems to hold. Relatively warm (2C) and salty water that was created in the far north Atlantic has drifted through the ocean to arrive along the Antarctic continent at the shelf break above the level of the continental shelf. This water floods onto the shelf and cools slightly, creating a relatively uniform environment below the mixed layer. It is thought that this warm (1.5C) water over the shelf provides heat to the mixed layer and from there into the atmosphere, thus affecting ice growth and melting, as well as providing a deep warm habitat for some animals (such as antarctic krill). This oceanic water, since it is old, contains abundant nutrients which play a role in maintaining the drifting plants (phytoplankton) on the shelf and thus the marine ecosystem.

Not all Antarctic continental shelves have such a simple water mass structure. In the southern continental shelves of the Ross and Weddell Seas, the water on the bottom is very cold (near or below freezing) and very salty. The extra salt is produced when ocean water freezes, which then sinks deeper into the water. Coastal polynyas are particularly effective ice factories which generate considerable amounts of salt, thus producing the densest water in the ocean from which the dense bottom water comes, which flows off the Antarctic continental shelves and fills the deep basins of the World Ocean. Additionally, thick ice shelves create another variety of cold water by pulling in warm water along the deepest parts, which melts some of the ice, thereby making the water fresher. The water rises along the base of the ice shelf and continues to freshen until it has cooled to the temperature of the ice, at which point it floats into the interior of the continental shelf. The Ross Sea is a region with a complex mix of warm and cold waters in a variety of layers, making this a particularly interesting area to study.

All of the above information may give the mistaken impression that coastal processes are well understood on Antarctic continental shelves; however, the observational base for these analyses is rather sparse, with some areas having fewer than a dozen hydrographic stations ever. For most of the Antarctic continental shelves, the only observations were taken during austral summer; yet in those places where observations are available in all seasons, the summer conditions seem to be representative of all seasons, except within the surface mixed layer.

Although we have some understanding of the distribution of water masses over the Antarctic continental shelves and the processes that create them, the circulation on these shelves is largely unknown. A few current meters have been set out, but these are not sufficient to characterize much beyond the local circulation at specific locations on these shelves. In many places, circulation is inferred from water mass analysis or dynamic topography, both of which can be misleading or incomplete.

The above overview of the physical processes on Antarctic continental shelves comes from an article by Eileen Hofmann and John Klinck which is included in the upcoming two-part volume of The Sea on physical processes on continental shelves. This review article is an outgrowth of the work at CCPO analyzing the oceanography of the shelf west of the Antarctic Peninsula. A detailed study of the hydrography of the west Antarctic Peninsula shelf, with contributions by Cathy Lascara and David Smith, has been submitted to Deep-Sea Research.

## Notes From The Director

This issue of CCPO Circulation notes the further growth of CCPO and our widening scope of research. Looking back, it is not clear but somehow we are becoming a cold water institute. I swore after trying to thaw out a Niskin bottle, one cold winter day in Halifax Harbor, that tropical research would be my goal. But now, we have research in the Artic and Antarctic and non, that I know of, in the tropics! Well true, some of our modelers use data from the tropics, but they don't go there. Even our recent local field work has been during cold weather spells. Maybe we haven't heard of global warming. On the positive side, higher latitudes do have interesting coastal processes, but I am still not sure how to handle buoyancy forcing of solid water falling into the ocean.

The arrival of two new faculty, Dr. Chunyan Li and Dr. Thomas Royer, marks our progress towards more observational areas of oceanography. When we started CCPO, the focus was on modeling since our observational infrastructure was lacking and would be expensive to start. Now we are achieving a nice balance between the two approaches to physical oceanography --balance that will benefit our research and our students' educations.

## Correction

In the last issue of CCPO CIRCULATION (Summer 1996, Vol. 3, No. 4), some text was omitted and overlooked from the article, ``How Important are Currents Across Estuaries?'' Because the missing text changed a valid meaning of the article, CCPO CIRCULATION felt a correction was in order. On page 8 of the newsletter, ``cover story, continued,'' it should read, ``The objectives of the field sub-program... and (4) evaluate the dominant terms in the cross-estuary momentum balance. These objectives will be furthered through sampling that will concentrate on the formation and dissipation of along-estuary fronts, such as the one in Figure 1. The additional sampling of the fronts will be carried out by Jim O'Donnell of the Department of Marine Sciences, University of Connecticut...'' CCPO CIRCULATION apologizes for any inconvenience this error may have caused the reader.

{PHOTO CAPTION}

WELCOME WARREN TAYLOR, CCPO's new computer systems engineer. Warren comes to CCPO with a wide range of systems engineering experience. He worked at ODU's Computer Science Department for three years as an assistant systems engineer. He then joined the Air Force (active for one year and now in the reserves) and worked as an aerospace maintenance engineer-journeyman before going to work for Infinet for 1-1/2 years as a systems operations engineer. Between Infinet and CCPO, he took a contract position at the Elizabeth City Coast Guard base as a systems administrator. In addition to working full-time, Warren is enrolled in ODU's undergraduate program in computer science. Warren can be reached at warrent@ccpo.odu.edu.

## New Laboratory Space At CCPO

Over the last two years, CCPO has had the pleasure of adding many new researchers to its family, which has prompted the need for new space. Recently, CCPO announced the renovation of Crittenton Hall's basement into wet labs. This project is another proud example of the growth CCPO has achieved since its establishment in July 1991.

The renovation of the basement was a nine-month effort primarily coordinated by CCPO senior research assistant, KURT CLEMENTE, along with the assistance of other CCPO/ODU staff, particularly Beverly Scott, office services specialist; Harry Brown, Building and Grounds Supervisor of ODU's Physical Plant; Glenn Cota, research associate professor; and Louis Codispoti, research professor. Kurt diligently interacted with plumbers, painters, electricians, and laboratory casing personnel to revitalize the basement into a pleasant and efficient working environment. Before, the basement was used primarily as a place to store outdated equipment or to put stuff that someone felt could ``maybe'' be used one day for something (like grandma's attic). Now the new laboratory space houses a fume hood, one large and two smaller storage spaces equipped with racks to help keep ``stuff'' neat and orderly, and three lab rooms. Improvements include a new sump pump, better lighting, windows, fresh paint, and the addition of a heating and air conditioning system.

To celebrate the completion of the renovation, there was a reception and ribbon cutting ceremony held on September 6, 1996. All of the CCPO family was present, and Larry Atkinson, director, extended thanks to all those who were instrumental in the renovation. One person who was especially thrilled with being invited to the celebration was CCPO professor, Chester (Chet) Grosch. At the time Chet received his invitation to the ceremony, he as quoted as saying, ``This is a classy place [CCPO and Crittenton Hall]. I have never been invited to a basement opening.'' When Chet was a child in England, he used to play with his friends in ``the basement.'' The basements in England were city blocks long, were shared with the neighbors, were dark and dreary, and had a variety of little cubby holes, thus making them great for playing Chet's favorite childhood game, hide-and-seek.

Next time you visit CCPO, please ask to see the laboratory space in the basement. While you will not see the researchers playing hide-and-seek (though you might see Chet instigating a game), you will see some extraordinary research in

action.

**Student MARJORIE A. M. FRIEDRICHS**

While a physics major in college, MAJORIE (Marjy) A. M. FRIEDRICHS became involved in oceanography through the Sea Semester program in Woods Hole, MA in 1988. Later that same year, this positive experience led her to participate in a Research Experience for Undergraduates (REU) with Robert Weller at the Woods Hole Oceanographic Institution (WHOI). After graduating summa cum laude from Middlebury College in 1989, she returned to Woods Hole with an Office of Naval Research Fellowship and entered the MIT/WHOI Joint Program in Oceanography. There she published her earlier work on solar radiation measurements taken from sea and embarked on a new area of research on the transport of deep water within the tropical Atlantic. This work led to a Masters degree under the instruction of Melinda Hall and Harry Bryden in 1992, to include several first-authored publications. After spending an additional two years working within the WHOI Physical Oceanography Department as a Research Assistant, Marjy switched research tracks again when she enrolled in the Ph.D. program at Old Dominion University in the fall of 1994, under the instruction of Eileen Hofmann. Here, she is working with coupled biological/physical models of the Equatorial Pacific in an effort to understand the physical and biological controls of primary production on weekly to interannual time scales. A central effort of this work is to examine the feasibility of assimilating biological data, including satellite ocean color data, into such models.

**CCPO Seminar Series, Spring 1997**

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, coordinates the lecture series with the assistance of BEVERLY SCOTT, office services specialist. Below is a schedule of lectures for the spring semester 1997. Please contact Beverly at (757) 683-4945 or beverly@ccpo.odu.edu for more information or if you would like to be included on the mailing list for lecture announcements. Specific lecture topics are announced one week prior to each lecture.

February 3 John Holdzkom Center for Coastal Physical Oceanography

February 10 Anthony Busalacchi NASA/Goddard Space Flight Center

February 17 Tom Gatski NASA/Langley Research Center

February 24 Constance Schober Mathematics Department Old Dominion University

March 3 Donald Scavia NOAA/Coastal Ocean Program

March 17 Kate Bosley NOAA/National Ocean Service Center for Coastal Physical Oceanography

March 24 Gene Burreson Virginia Institute of Marine Science

March 31 Glenn Cota Center for Coastal Physical Oceanography

April 7 Tom Osborn The Johns Hopkins University

April 14 Raleigh Hood Horn Point Environmental Laboratory

April 21 James Koziana Center for Coastal Physical Oceanography

## New Faces at CCPO

CHUNYAN LI

CHUNYAN LI joined CCPO in September 1996 as a research assistant professor. He received his M.S. in physical

oceanography at the Institute of Oceanology, Academy of Science of China in 1985. He then stayed on for the next five years at the Institute to work on several national key projects of tidal dynamics and storm surges. In September 1990, he enrolled in the Ph.D. program at the University of Connecticut to study under the direction of Professor James O'Donnell and graduated in August 1996. Chunyan's dissertation research focused on the effects of lateral bathymetry on tidally-driven sub-tidal circulation in estuaries. This study was aimed to better understand the exchange processes between an estuary and adjacent ocean on time scales longer than a tidal cycle.

Since Chunyan's arrival at CCPO, he has participated in several observational projects in the James River and the Chesapeake Bay. He is also actively involved in the analysis of data collected by Acoustic Doppler Current Profiler (ADCP) from various measurements in different coastal and estuarine regions. He is interested in estuarine circulation, particularly the exchange of water and materials between estuaries and the coastal environment. He has already identified several mechanisms that may contribute to the transverse structure of estuarine transport. Presently, he is collaborating with other CCPO researchers on observational, modeling, and data analysis activities.

To Chunyan's credit, he has won two awards for a national key project in which he was PI from The Board of Education, Shandong Province, P. R. China in December 1989 and from The Government of Shandong Province, P. R. China in 1991.

THOMAS C. ROYER

THOMAS (Tom) C. ROYER joined CCPO in fall 1996 as a Samuel L. and Fay M. Slover Professor of Oceanography. Before coming to CCPO, he spent most of his oceanographic career at the Institute of Marine Science, University of Alaska. Typical of many oceanographers, his early years were in the Midwest, where he received an A.B. in physics and mathematics from Albion College (Michigan). His initial oceanographic work was as a Woods Hole Oceanographic Institute (WHOI) summer employee, sailing on Atlantis II in the North Atlantic. This work was prior to beginning his graduate studies at Texas AM, where he obtained an M.S. and Ph.D. in physical oceanography. Tom's work, under the supervision of Robert O. Reid, involved the numerical modeling and data analysis of long waves (tsunamis). Partially because Alaska is a renown source of tsunamis, he ventured to Fairbanks to begin his academic career.

Tom has focused on hydrographic measurements in the North Pacific from the inshore waters of Alaska into the open ocean to Hawaii, with emphasis on seasonal and interannual variations. He and his colleagues discovered an intense (speeds in excess of 3 knots) coastal current (Alaska Coastal Current) that borders the northern Gulf of Alaska. This current is influenced by coastal rainfall and has important biological and fisheries implications. The EXXON VALDEZ oil spill also took place within this coastal flow. He established a hydrographic time series in the Gulf of Alaska that is now more than 25 years in length. Data from that series suggest that there are interdecadal fluctuations in water temperature and salinity that could affect fisheries in the region.

He is active in research vessel operations, serving as the chair of the University of Alaska's ship committee and as their University-National Oceanographic Laboratory System (UNOLS) representative. He chaired a UNOLS committee that designed an Arctic Research Vessel and served on the UNOLS Fleet Improvement Committee and Council. He has served on the MMS Scientific Committee and NSF's Ocean Science Advisory Committee. Additionally, Tom presently serves with CCPO professor, Eileen Hofmann, on the National Academy of Science's Ocean Studies Board. His research interests include buoyancy driven flows; ocean climate changes, especially at high latitudes; and global ocean monitoring. He is also concerned about science literacy. His interests extend to the role of oceanography in influencing world events, such as early global explorations and the establishment of international boundaries.

## Just The Facts

Appointments

E. E. HOFMANN, Editorial Board, Antarctic Science.

Graduates

M.S.: D. A. RUBLE, December 1996, Advisor: L. P. Atkinson.

Grants/Contracts Awarded

L. P. ATKINSON, ``Provide Services for Developing an Instrument Field Evaluation Site," 49,808, NOAA.

G. F. COTA, W. T. Platt, S. Sathyendranth, W. G. Harrison, all three at the the Bedford Institute of Oceanography, and S. Saitoh, Hokkaido University, ``Collaborative Research on High Latitude Bio-optional Algorithms, 77,981, National Space Development Agency of Japan.

C. M. LASCARA, ``Physical and Biological Factors Affecting Trophic Interactions in Chesapeake Bay," NSF/University of Maryland, 37,005.

G. H. WHELESS and D. F. HARNAGE, ``The Establishment of a High Performance Connection to the vBNS for Old Dominion University," 349,732, NSF.

Presentations

G. F. COTA and S. Saitoh, Hokkaido University, ``Bio-optical Relationships and Remote Sensing Algorithms for High Latitude," Ocean Optics Meeting, Nova Scotia, October 24, 1996.

M. FRIEDRICHS, ``Data Assimilation in Marine Ecosystem Modeling," NASA/Goddard Space Flight Center, November 22, 1996.

A. HASKELL, A. Valle-Levinson, and K. M. M. Lwiza, State University of New York, Stony Brook, NY, ``The Effects of a Buoyant Plume on a Semidiurnal Tidal Currents Along an Inner-Shelf Transect," Middle Atlantic Bight Physical Oceanography and Meteorology (MABPOM) Workshop, College of Marine Studies, University of Delaware, October 17-18, 1996.

E. E. HOFMANN, ``Goals and Scope of Ecosystem Modeling," plenary presentation, Gulf of Maine Ecosystem Dynamics, A Scientific Symposium and Workshop, St. Andrews, New Brunswick, Canada, September 17, 1996.

E. E. HOFMANN, ``Assimilation of Data into Biological Models," Remote Sensing Seminar, College of Marine Studies, University of Delaware, September 26, 1996.

E. E. HOFMANN, J. M. Klinck, E. N. Powell and S. Ford, both of Haskin Shellfish Research Laboratory, Rutgers University, and S. Jordan, Cooperative Oxford Labortory, Oxford, MD, ``Crassostrea virginica Pathogens in Chesapeake Bay Oyster Populations: A Dual Disease Simulation Model of Parasite-Host Interactions Over a Large-Scale," International Conference on Shellfish Restoration, Hilton Head, SC, November 21, 1996.

A. D. KIRWAN, JR., ``Its Entropy Not Energy, Stupid. A Short Disclosure on the Scientific, Philosophical, and Economic Implications of the Second Law and Global Change," retirement ceremony for Professor William Sackett, distinguished chemical oceanographer, University of South Florida, St. Petersburg, FL, October 28-30, 1996.

A. VALLE-LEVINSON and K. M. M. Lwiza, State University of New York, Stony Brook, NY, ``Hydrography and Flow Velocity off the Chesapeake Bay Mouth During Northeasterly Winds," Physics of Estuaries and Coastal Seas Conference, The Hague, The Netherlands, September 8-12, 1996.

A. VALLE-LEVINSON and K. M. M. Lwiza, State University of New York, Stony Brook, NY, ``Observations on the Influence of Downwelling Winds on the Chesapeake Bay Outflow," Middle Atlantic Bight Physical Oceanography and Meteorology (MABPOM) Workshop, College of Marine Studies, University of Delaware, October 17-18, 1996.

Publications

L. P. ATKINSON; J. L. Miller, Naval Research Laboratory, Stennis Space Center, MS; T. N. Lee, Rosenstiel School of Marine and Atmospheric Science; and W. M. Dunstan, Department of Oceanography, Old Dominion University,

``Nutrients and Chlorophyll at the Shelf Break off the Southeastern United States During the Genesis of Atlantic Lows Experiment: Winter 1986," Journal of Geophysical Research, Vol. 101(C9), 20,565-20,578, September 15, 1996.

F. Kozusko, Department of Mathematics and Statistics, Old Dominion University; C. E. GROSCH; T. L. Jackson, NASA Langley Research Center; C. A. Kennedy, Sandia National Laboratory, Livermore, CA; nd T. B. Gatski, NASA Langley Research Center, ``The Structure of Variable Property, Compressible Mixing Layers in Binary Gas Mixtures," Physics of Fluids, Vol. 8(7), 1,945-1,953, July 1996.

F. Kozusko and D. G. Lasseigne, both of the Department of Mathematics and Statistics, Old Dominion University; C. E. GROSCH; and T. L. Jackson, NASA Langley Research Center, ``The Stability of Compressible Mixing Layers in Binary Gases," Physics of Fluids, Vol. 8(7), 1,954-1,963, July 1996.

J. R. Moisan, Scripps Institution of Oceanography and E. E. HOFMANN, ``Modeling Nutrient and Plankton Processes in the California Coastal Transition Zone, 1. A Time- and Depth-Dependent Model," Journal of Geophysical Research, Vol. 101(C10), 22,647-22,676.

J. R. Moisan, Scripps Institution of Oceanography, E. E. HOFMANN, and D. B. Haidvogel, Rutgers University, ``Modeling Nutrient and Plankton Processes in the California Coastal Transition Zone, 2. A Three-Dimensional Physical-Bio-Optical Model," Journal of Geophysical Research, Vol. 101(C10), 22,677-22,691.

J. R. Moisan, Scripps Institution of Oceanography and E. E. HOFMANN, ``Modeling Nutrient and Plankton Processes in the California Coastal Transition Zone, 3. Lagrangian Drifters," Journal of Geophysical Research, Vol. 101(C10), 22,693-22,704.

J. L. Miller, Naval Research Laboratory, Stennis Space Center, MS, and A. VALLE-LEVINSON, ``The Effect of Bridge Piles on Stratification in Lower Chesapeake Bay: 1992," Estuaries, Vol. 19(3), 526-539, September 1996.

M. C. PARASO and A. VALLE-LEVINSON, ``Meteorological Influences on Sea Level and Water Temperature in the Lower Chesapeake Bay: 1992," Estuaries, Vol. 19(3), 548-561, September 1996.

A. VALLE-LEVINSON, J. M. KLINCK, and G. H. WHELESS, ``Inflows/Outflows at the Transition Between a Coastal Plain Estuary and the Coastal Ocean," Continental Shelf Research, Vol. 16(14), 1,819-1,847, 1996.

G. H. WHELESS and A. VALLE-LEVINSON, ``A Modeling Study of Tidally Driven Estuarine Exchange through a Narrow Inlet onto a Sloping Shelf," Journal of Geophysical Research, Vol. 101(C11), 25,675-25,687, November 15, 1996.

## Shelf-Basin Interactions Science Planning Workshop

A Shelf-Basin Interactions (SBI) Science Planning Workshop was held at the Virginia Beach Resort and Conference Center, Virginia Beach, VA, September 19-21, 1996. This initiative falls under the National Science Foundation's (NSF's) Arctic System Science (ARCSS) initiative, and it is the workshop's goal to produce a research plan that will, hopefully, form the basis of a new research program that will be an element of ARCSS's Ocean-Atmosphere-Ice-Interactions (OAII) component. The purpose of the workshop was to lay the groundwork for the National Science Foundation's ``Biological Initiative in the Arctic: Shelf-Basin Interactions (SBI)" science plan. This encompassed: (1) setting priorities for experiments along the margins of continental shelves that are needed to understand climate change's impact on the Arctic system and the Arctic system's impact on climate; and (2) discussing coordination with other U.S. and international programs in the Arctic in order to develop an integrated program.

The workshop was sponsored by NSF's Office of Polar Programs. The meeting hosts were: Jackie Grebmeier, co-chair, SBI, University of Tennessee, Knoxville; Terry Whitledge, co-chair, SBI, University of Texas at Austin; and CCPO research professor, LOUIS (Lou) CODISPOTI, director, OAII Science Management Office. In attendance were 30 participants selected to represent a variety of research backgrounds, including physical, biological, and biogeochemical processes. Represented countries include the United States, Canada, Germany, Norway, Russia, and Japan.

The discussions included research needs and proposed activites in the areas of: (1) shelf/slope physical processes; (2) biogeochemical fluxes and transformations of major constituents in ice, water, and sediments; and (3) characterization of carbon pools and trophic structure. Decisions were made on what processes would be important to study, what time scales would be needed, what type of sampling program to use, what platforms would be required, and where to focus the study. All of these will be included in the science plan to be drafted in November 1996 and submitted to NSF during spring 1997.

In addition to Lou Codispoti, other CCPO representatives were: LINDA PROSPERIE, oceanographic data technician, who assisted with meeting minutes; CATHY LASCARA, research assistant professor, who was instrumental with setting up e-mail access on-site; and Lou's wife, CODIE CODISPOTI, who assisted with meeting registration.

## A Report of the UCAR Annual Members' Meeting

On October 8-9, 1996, JOHN KLINCK and DENNY KIRWAN, both CCPO professors of oceanography, represented Old Dominion University (ODU) at the University Corporation for Atmospheric Research (UCAR) Annual Members' meeting in Boulder, Colorado. UCAR is a consortium of over 60 universities with Ph.D. programs in atmospheric and related sciences. There is an equal number of affiliates which are research and education institutions in the U.S. and Canada.

At the two-day meeting, many agenda items were discussed among institutional representatives. One of the most critical was restrictions on data exchange. Over the past few years, there have been proposals that would limit the exchange of atmospheric observations or that the originating organization (or country) would retain the intellectual rights to the observations. These proposals are an outgrowth of budget constraints in some countries (mostly in Europe) and attempts to recover costs of obtaining meteorological observations. Many countries are providing observations to commercial activities for a fee, and the companies do not want the observations given to competitors. The U.S. is adamantly against this policy. Several proposals have been defeated by U.S. action, but the issue keeps coming up. Presently, only the atmospheric observations used for daily analyses and forecasts are involved; however, there is every reason to think that oceanographic observations will not be treated in a similar manner if this trend continues. This could be a serious issue for all sciences.

Another agenda item was UNIDATA access. UNIDATA is a UCAR program that provides real-time weather observations, analyses, and forecasts to universities at a modest cost. Participating institutions can decide what part of the daily informations stream is of interest and copies of files are moved to the their local computer system. There are also tools for manipulating and plotting the data. Such observations are in meteorology classes. Universities and other research establishments could use UNIDATA to support prediction operations.

There were several political presentations at the UCAR Annual Meeting. Tim Wirth, a former Congressman from Colorado and now in the State Department, addressed the meeting about the international aspects of the climate change political meetings and IPCC activities. There was considerable discussion about expanding the range of political discussions at the annual meeting by inviting other politicians.

There is an increasing feeling in UCAR that science support within the U.S. government should not be eroded excessively and that scientists need to become involved in the political process. UCAR has an explicit policy that it supports earth sciences in general and will not engage in activities that support one sector of earth sciences at the expense of another. UCAR has staff in Washington and is encouraging individual scientists to contact local representatives.

An agenda item particularly important to CCPO was the renewal of ODU as an UCAR member. The membership committee recommended renewal for ODU and approximately 15 other universities. Renewal was approved unanomously by the members.

### ADK's Words of Wisdom

``There is more joy in heaven in a good approximation than in an exact solution." Julian Schwinger, recepient of the Noble Prize in Physics

Quoted by Orson L. Anderson in Equations of State of Solids for Geophysics and Ceramic Science