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Center for Coastal Physical Oceanography, Old Dominion University

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[Carole E. Blett](mailto:carole@ccpo.odu.edu), Editor, at (757) 683-4945 or carole@ccpo.odu.edu.

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Bay Mouth Climatology

When CCPO was established in 1991, its director, **LARRY ATKINSON**, recognized the need to better understand the dynamics of the mouth of the Chesapeake Bay. Despite the numerous commercial, recreational, scientific, and military activities that take place in this region, there was scarce information on the mean hydrographic conditions and their seasonal and interannual variability. A quick review of available data and literature immediately suggested that CCPO should establish a monthly hydrographic (temperature and salinity) section across the Bay mouth. These data would help CCPO establish climatology and present data that would lead to new research. 

In 1992 the sections were started, and since then and up to July 1998, CCPO has completed 70 hydrographic monthly sections of the Chesapeake Bay mouth (see map for section location). As many researchers know, doing ``monitoring'' is often a thankless task, as the rewards in terms of published papers are years away. Nevertheless, the flame has been kept alive, and in this article, CCPO research assistant professor, **RICARDO A. LOCARNINI**; CCPO assistant professor, **ARNOLDO VALLE-LEVINSON**; and Larry will present a typical example of results from a monthly cruise and the companion to the climatology. The reader is encouraged to visit CCPO's website at <http://www.ccpo.odu> and click on the Monthly Chesapeake Bay Mouth Climatology page for up-to-date observations.

Overall, the monthly monitoring has been effective in illustrating the unusual Bay mouth conditions during the hot and dry summer of 1995, during the record river discharge rates of 1996, and during the first half of 1998, a period characterized by above normal air temperatures and river discharge. In addition, mean monthly conditions of the Bay mouth reveal persistent hydrographic features of the region such as the enhanced stratification associated with Thimble Shoal and Chesapeake Channels, the front in the Chesapeake Channel region between fresh bay waters and salty waters of continental shelf origin, the division of fresh bay waters by salty Thimble Shoal Channel waters, and the salty inflow on the shallow area between the Chesapeake and Beach Channels.

24 July 1998 Observations

The hydrographic section of the Bay mouth completed on 24 July 1998 was the second warmest and third freshest of the seven July sections completed since 1993, the year when the first July section was obtained in the present monitoring program. Only in 1995, average Bay mouth July temperatures were higher than those observed on 24 July 1998. Average Bay mouth July salinities lower than those measured on 24 July 1998 occurred early this month on 13 July and on July 1996. On 24 July 1998, waters warmer than 25C and fresher than 23 were found in the surface layer of the southern and central Bay mouth and extended down to about 10 m deep in the northern end of the section. In contrast, significantly cold (temperatures below 20C) and salty (salinities above 28) waters filled the Thimble Shoal and Chesapeake Channels. They probably represent the influence of deep water that has recently upwelled onto the continental shelf due to the predominant southwesterly July winds.

Shown to the right are the temperature (C) sections at the Bay mouth constructed with the data collected on 24 July 1998 and with the mean July conditions calculated with data from 7 hydrographic sections completed in 1993, 1994, 1995, 1996, 1997, and 1998 (2 sections). Norfolk is on the left, the Delmarva Peninsula on the right. TSC, CC, and BC indicate Thimble Shoal, Chesapeake, and Beach Channels, respectively. 

On Friday, 24 July, temperatures near the surface of the Bay mouth and throughout the entire water column in the shallow region between Chesapeake and Beach Channels were about 1C above the 1993-1998 July mean temperatures. Present temperatures were about the same as July mean values in the Beach Channel, while temperatures were about 2C below July mean values in the Chesapeake Channel and on the flanks of the Thimble Shoal Channel. The mean air temperature at the Bay mouth for July 1998 (25.8C) was just below the July 1992-1997 mean air temperature (26.0C). The present above normal near-surface temperatures are probably a remnant of the above normal air temperatures in the region during the first half of 1998. January and February air temperatures were about 2.9C above the January and February 1992-1997 means, March to May air temperatures were about 1.3C above the corresponding 1992-1997 means, and June air temperatures were 1.1C above the June 1992-1997 mean air temperature.

Near surface salinities were about 1 (5) lower than the 1993-1998 July mean; Near bottom salinities were about 2 (8) lower than July mean values in the Beach Channel and on the shallow region in the northern Bay mouth. In contrast, present salinities were 1 to 3 (4 to 12) higher than July mean values in the Chesapeake Channel and on the flanks of the Thimble Shoal Channel. Although river discharge rates into the Bay in June and July were very close to the 1992-1997 mean discharge rates for these months, the near-surface low salinities measured on July 1998 are a remnant of the record river discharge into the Bay earlier in the year: the freshwater input rate into the Chesapeake Bay for the period 1 January-31 July 1998 was 4,406 m³/s. The 1992-1997 mean freshwater discharge rate for January to July is 3,040 m³/s.

Shown to the right are the salinity sections at the Bay mouth constructed with the data collected on 24 July 1998 and with the mean July conditions calculated with data from 7 hydrographic sections completed in 1993, 1994, 1995, 1996, 1997, and 1998 (2 sections). Norfolk is on the left, the Delmarva Peninsula on the right. TSC, CC, and BC indicate Thimble Shoal, Chesapeake, and Beach Channels, respectively. 

Acknowledgements. We thank **R. C. Kidd** for his work maintaining and operating the CTD system. We also thank **Captain Robert N. Bray** and **Donnie Padgett** of the *R/V Linwood Holton*. Thanks are extended to all ODU colleagues who participate and collaborate in the monthly Bay mouth cruises. The air temperature data is from the Chesapeake Bay Bridge Tunnel meteorological station, operated by the Oceanographic Products and Services Division of the National Oceanic and Atmospheric Administration. The river discharge data is provided by the United States Geological Survey, Chesapeake Bay Region. Support for the Chesapeake Bay mouth monitoring program was provided by the Department of Ocean, Earth & Atmospheric Sciences (formerly the Department of Oceanography) of Old Dominion University.

Notes from the Director

I am pleased to announce that the Center for Coastal Physical Oceanography (CCPO) of Old Dominion University (ODU) and the NOAA National Ocean Service (NOAA/NOS) have signed a Memorandum of Understanding to form a Cooperative Institute for Coastal Physical Oceanography. The Institute was created to: 

- To promote research aimed at applying data and knowledge of the ocean, especially the coastal ocean and estuarine environment, to the solution of specific applied and operational problems, including modeling, testing, evaluation, education, and training with emphasis on applications to ensure safe, efficient, and environmentally sound maritime navigation and commerce;
- To improve the effectiveness of research through close collaboration between NOAA/NOS and ODU/CCPO;
- To provide a joint facility at which scientists working on problems of mutual interest may come together and work advantageously in an environment different from that already provided in the Federal and university structure;
- To provide a focal point to coordinate multi-university, multi-agency studies, including those addressing regional problems and yielding increased understanding of oceanographic and hydrographic phenomena by Institute and NOS personnel, students, and users of NOS data and information;
- To development useful formats and delivery mechanisms for the dissemination of observed and predicted water level data and derived information products and to promote their effective utilization through creating a facility for interaction with the feedback from users of these data, such as schools, industry, community, and governmental agencies which have goals in common with the NOS;
- To foster public understanding of NOAA and its programs; To provide an opportunity for students to gain familiarity with operational oceanographic and related data sets and modeling procedures; and
- To prepare students for productive careers with the NOS by establishing programs to offer training and experience to students and employees under NOS supervision.

The specific studies to be conducted at the Institute, both at the time the Institute is created and in subsequent years, will be determined through negotiations between ODU/CCPO and NOAA/NOS as part of a normal funding proposal and review process.

This MOU will provide an example of how universities and a federal agency can work together to address the myriad of problems facing our growing maritime industries.

Larry P. Atkinson
Director, Center for Coastal Physical Oceanography

The IDesk Goes on the Road

CCPO's ImmersaDesk (IDesk) went on its first road trip in June to the Hampton Roads Information Technology (ITEC) Exposition held in Virginia Beach. **CATHY LASCARA** and **GLEN WHELESS**, both assistant research professors at CCPO, gave several virtual reality demonstrations as part of the Old Dominion University exhibit. During two of the demonstrations, the NSF-funded very High Bandwidth Network Service (vBNS) and other high speed networks were used to allow participants located in Chicago and Atlanta to enter a collaborative virtual world with the group from Old Dominion University. The development of collaborative, persistent virtual environments to support scientific studies is currently an active research effort of the Virtual Environments Lab at CCPO, which includes Cathy; Glen; **RUSS BURGETT**, CCPO research associate; **LARRY RAMEY**, CCPO virtual engineer; and two undergraduate students, **BRANDON HILL** and **GUSTIN PRUDNER**.

The disassembly, moving, and reassembly of the IDesk posed a new challenge to the CCPO group. Leaving nothing to chance, CCPO received critical training from Tom Coffin of the National Computational Science Alliance. The entire process went smoothly, and CCPO would like to thank the members of the University's Moving and Hauling for doing such a great job and maintaining a smile throughout the move.

COMMUNITY OUTREACH: Girls Excited About Mathematics and Science (GEMS)

On July 15, CCPO and Old Dominion University's Department of Mechanical Engineering hosted a full day of interactive learning for high school girls for the GEMS (Girls Excited about Mathematics and Science) program in cooperation with CHROME (Cooperating Hampton Roads Organizations for Minorities in Engineering). CHROME encourages underrepresented minorities to pursue non-traditional technical career fields through a network of high school clubs. GEMS is designed to introduce young students to successful female scientists; local university programs offering demanding academic programs in the fields of mathematics, science, and related technical fields; hands-on science and mathematics experiments; computer laboratory experience; female student panels; and much more. The program is funded by a grant from the National Science Foundation. Interested students who applied for the program were selected on the basis of course work, grades, content of their essays, and eagerness to participate. Only 20 students were selected to participate in the program.

ELIZABETH SMITH, CCPO research assistant professor, was instrumental in coordinating a fun and educational day for the students, which started with a presentation on dressing for success. Then the students viewed two videos produced by the Public Broadcasting System on careers in oceanography and cartography, followed by a discussion by Debbie Bland, a cartographer from NOAA. After enjoying lunch, donated by Dominos Pizza, the students participated in a virtual reality demonstration consisting of a trip through the Chesapeake Bay given by CCPO research assistant professor, **CATHY LASCARA**. Students also learned what oceanographers do from a slide presentation given by **EILEEN HOFMANN**, CCPO professor, on her extensive shipboard experience. **LISA DRAKE**, postdoctoral associate from the Department of Ocean, Earth, and Atmospheric Sciences, talked with the students about her research on ballast water.

New Face at CCPO: Kimberly Ross-Doswell

KIMBERLY (Kim) ROSS-DOSWELL came to work for CCPO in May 1998 as an office services specialist. She is responsible for managing the receptionist office and the maintenance for office supplies and grounds/building appearance. She acquired the position of distribution manager of the Center newsletter, CCPO CIRCULATION, and she coordinates the CCPO Seminar Series. Additionally, Kim is responsible for coordinating all travel for faculty, staff, and visitors to the Center.

Kim was born and raised in Richmond, Virginia, and she attended J. Sargeant Reynolds Community College for two years, studying secretarial science. She recently received a certificate from the Insight School of Investigations as a private investigator through the Department of Criminal Justice Services. She has held two state positions as office services assistant: one with the Department of Motor Vehicles and the second for nine years with the Department of Juvenile Justice at the Richmond Juvenile and Domestic Relations Court. At Richmond Juvenile Court, she was the CommonHealth Coordinator for five years. CommonHealth is a program sponsored by the Commonwealth of Virginia to promote health and fitness for the physical well-being of all state employees.

Kim has an American Pit Bull Terrier named Spice. She enjoys sports, basketball (Chicago Bulls), and football (Dallas Cowboys). She also enjoys walking, jogging, and dancing. Anxiously waiting, she sees herself continuing her education at Old Dominion University. Two weeks after Kim started work at CCPO, she married Gunner's Mate, Marc Doswell, stationed at the naval base in Bath, Maine. She is pictured here during her mini-bridal shower that the CCPO family gave her on June 11.

Kim is a joy to have at CCPO. Next time you telephone CCPO, you will know it is Kim answering because you will feel her cheerfulness when she greets you with, "Center for Coastal Physical Oceanography; may I help you?"

Puzzler

The purpose of the **Puzzler** is to record thought-provoking questions and problems that have appeared on comprehensive, qualifying, and candidacy exams. Readers are encouraged to submit their own favorites, as well as to

attempt to answer all questions. All communications should be directed to: wizzard@ccpo.odu.edu. *Wizzard* will acknowledge the sources of all questions/problems used and will publish selected thought-provoking (not necessarily correct) answers to previous submissions. Before posing this issue's Puzzler question (Question 98.3), *Wizzard* would first like to answer last issue's **Puzzler, Question 98.2**.

Question 98.2. Consider a half a mole of carbon monoxide gas, CO and a half a mole of N_2 gas. Note that both gases have the same molecular weight 28. Let these mix at standard temperature and pressure so that a mole of gas of molecular weight 28 is obtained. A straightforward calculation shows that the entropy of the mixture is the sum of the entropies of each constituent before mixing plus entropy of mixing given by $NK \log 2$. Here N is Avagadro's number and K is the Boltzmann constant. If the half mole of CO is replaced by a half mole of N_2 application of the same methodology gives the same entropy of mixing. But there can be no mixing if the constituents are the same chemical species. *Wizzard* wants an explanation.

Answer to Question 98.2. *Wizzard* received one answer to 98.2 from ramey@ccpo.odu.edu, who joins lou@ccpo.odu.edu in hating thermodynamics. *ramey* noted that from the quantum mechanical perspective, replacing the half mole of CO with N_2 so that both gases are N_2 means that when mixing the two, half moles of N_2 are indistinguishable. Thus their entropy of mixing must be zero. The calculation described by *Wizzard* was based on classical statistical mechanics, which regards the two half moles as distinguishable since they were originally separated in space.

This problem is the well-known "Gibbs paradox" since it was first posed by Josiah Gibbs, before quantum mechanics was devised. Gibbs was a professor of chemistry at Yale and is one of the towering figures in science. The first resolution of this paradox, *ramey's* answer, did not occur until quantum mechanics was available. *Wizzard* also notes that H. Grad, another towering figure in science, resolved the paradox using a simple but elegant classically-based idea. This is described in the "The Many Faces of Entropy, Communications on Pure and Applied Mathematics," Vol. XIV, 232-354, 1961. *Wizzard* strongly recommends this paper to all, particularly *ramey* and *lou*.

Question 98.3. This problem is an adaptation of one given on *Wizzard's oral*. While driving a panel pickup, a liberal arts major, LAM, was ticketed by the police for blocking traffic. In court, LAM pleaded innocent because of extenuating circumstances. The truck was rated for 2 tons but was carrying 4,001 pounds of pigeons. LAM claimed it was necessary to stop every 100 yards, get out of the cab, and beat on the panels to keep the pigeons from roosting so the axle wouldn't break. Should the judge accept this excuse? Would it make any difference if the truck had open, screened sides?

Halfway 'Round the World and Back in Five Days

by Glenn Cota, Research Associate Professor

Japan is not really halfway around the world; it just seems that far when you are exhausted and lose a day crossing the dateline. With decent connections and no serious delays on three flights and a bus ride in Tokyo traffic, it was only 25 hours of traveling before falling into bed near Tokyo's domestic airport. A fourth flight early the following morning brought me to my destination, Hakodate, on the island of Hokkaido. Having traveled to Japan before and to McMurdo Sound, Antarctica, I knew it could be worse. However, I was dreading this trip given the long distances, limited time, and jet lag. Happily, I was wrong. I had a productive stay, a wonderful time, and wished I could have stayed longer. 

My host, Sei-ichi Saitoh, met me at the airport, and we proceeded to Hokkaido University's Faculty of Fisheries. With support from Japan's National Space Development Agency (NASDA) and our NASA we are collaborating on ocean color studies of the Bering Sea. In a whirlwind of introductions, I met the dean, colleagues, and students. I am bad with any names at the best of times, let alone another language, so the only one I was really sure about was Miyoi-san because I had been to sea with her. She and another student worked closely with us during my visit. The students also joined us for lunch at a restaurant atop my hotel with a nice view of the harbor. Imagine having to go to Japan to try

African spaghetti (that is not a typo, Lou).

That evening, Saitoh-san and his wife, Ryoko, took me for a traditional Japanese dinner. The KIRA restaurant, replete with low tables, charcoal braziers and tatami mats, was on the side of a mountain overlooking the city and the ocean. Waitresses in kimonos served about a dozen courses of delicious, tasty treats. The setting, view, service, and food were fabulous.

The next day proved to be even more special. We accomplished more than we had planned, but I also had the special honor of attending the Faculty of Fisheries graduation ceremony. In many ways, this was the highlight of my trip because it was a surprise, and I really had no idea what to expect. I soon forgot any western preconceptions of caps and gowns. Faculty were seated on one side and spectators sat in the balcony. The students and faculty have their own small orchestra (see photo by Anma-san), which played while the students marched in and out. Male and female students were mostly dressed in conventional suits, but attire ranged from casual costumes (e.g., karate gi and soccer or street hockey players with ball and in-line skates) to formal with about a quarter of the females in kimonos and one in a wedding dress with a bouquet. There were also about a dozen cadets in uniform. The University President and other officials were decked out in tails and sat on the stage with a podium and Banzai tree. The President presented diplomas to the top students, while the Dean made the rest of the presentations. The top cadet made a brief speech, and all of the cadets tossed their hats in the air like their counterparts in other parts of the world. The orchestra was very good and added much to this special experience. All the mothers and grandmothers in the balcony clapped in rhythm to the exit march, while beaming with pride. The students spent the afternoon celebrating, and when Saitoh-san had to respond to a request from the dean, I joined them. It was amazing how well the students spoke English with the proper preparation. We shared stories and perspectives over beer and shashimi. With inhibitions repressed, their individual characters and unique senses of humor surfaced. Two of the cadets were hilarious. It is customary there to refill your guest's glass whenever it is empty. After preparing me well, they clued me in to the polite way to say enough "Ah tototototo....". My version invoked peels of laughter, and I was sorry to have left that delightful interlude.

Enroute to graduation, we had met an old friend, Anma-san, Captain of the Oshoro Maru. The Captain graciously provided photos from the graduation ceremony and our cruises. His hospitality on the Oshoro Maru was much appreciated, and I regret we could not have visited more on this trip. I look forward to sailing with him again, and now know how to say, "no, thank you," politely at the legendary Oshoro Maru science meetings. I also had the pleasure of meeting Tsutomu (Tommy) Ikeda, whose work on weight-specific metabolism of zooplankton was highly influential during my graduate studies.

That night, I dined with Sei-ichi and Ryoko at their home. Ryoko prepared her special beef dish that was incredible, and they taught me how to roll my own sushi. The food was delicious and the evening was very special.

I also got brief chances to play tourist. We went up the mountain on the Hakodate tram for a panoramic night view of the port city, walked around three churches, toured a stately old wooden government prefecture building, stopped at a coastal promontory, boarded another University ship, and shopped for souvenirs. Visits to a Shinto shrine (photo by Saitoh-san) and a Buddhist temple were highlights. I have to go back to view more gardens, shrines, and temples.

Being a stranger in an unknown land without knowledge of the language and customs can be daunting, but a local guide makes all the difference. In the States, you hear about southern or western hospitality. Japanese hospitality comes highly recommended. Thank you very much to everyone I met at the Faculty of Fisheries, but especially to Sei-ichi and Ryoko for a wonderful time. We look forward to hosting you in America.

CCPO Seminar Series: Fall 1998

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. Below is a schedule of lectures for the fall semester 1998. For more information or to be included on the mailing list for lecture announcements, please contact **Carole Blett**, CCPO administrator, at (757) 683-4945 or carole@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>.

Date	Lecturer	Institute
September 21, 1998	Cathy Lascara	<i>Ctr Coastal Physical Oceanography</i>
September 28, 1998	Jesus Pineda	<i>Woods Hole Oceanographic Inst.</i>
October 5, 1998	Ed Urban	<i>Ocean Studies Board, Nat'l Res. Council</i>
October 12, 1998	William Seitz	<i>Texas A&M University</i>
October 19, 1998	Lynda Butler	<i>College of William and Mary</i>
October 26, 1998	Daniel Dauer	<i>Biology Dept., Old Dominion Univ.</i>
November 2, 1998	Thomas Royer	<i>Ctr Coastal Physical Oceanography</i>
November 9, 1998	Robert Orth	<i>Virginia Institute of Marine Science</i>
November 16, 1998	James Miller	<i>Rutgers University</i>
November 23, 1998	Elizabeth Smith	<i>Ctr Coastal Physical Oceanography</i>
November 30, 1998	Fred Grassle	<i>Rutgers University</i>

Just the facts . . .

Announcements

KATHRYN BOSLEY, NOAA/NOS oceanographer stationed at CCPO, and her husband, William Bosley, and sone, Jake, welcome baby boy, Gabriel Howard Bosley, born July 27, 1998.

In Honor of the Year of the Ocean, the Office of Naval Research and the National Science Foundation donated the three-volume set of the Collected Works of Henry M. Stommel to CCPO students: **T. CLAYTON**, **M. FRIEDRICHS**, **J. HOLDZKOM**, and **D. SMITH**. A set was also donated to the CCPO library.

Appointments

E. E. HOFMANN, Editorial Board of *Estuaries*.

Grants/Contracts Awarded

L. P. ATKINSON and **A. VALLE-LEVINSON**, "Provide Services for Developing an Instrument Field Evaluation Site," \$74,000, NOAA.

L. P. ATKINSON, "IPA Mobility Assignment," \$92,750, NOAA.

G. F. COTA, "The Chesapeake Light Tower: Automated Coastal Monitoring Station to Measure Ocean Optics in Real

Time, \$59,000, NOAA.

E. E. HOFMANN, "Development and management Applications of a Dual-Disease (MSX and Dermo) Model for Chesapeake Bay Oyster Populations," \$22,794, Virginia Graduate Marine Science Consortium.

C. M. LASCARA, "Physical and Biological Factors Affecting Trophic Interactions in Chesapeake Bay," \$55,000, University of Maryland.

T. C. ROYER, "Physical-Chemical Structures and Biological Productivity of the Gulf of Alaska Shelf: A GLOBEC Monitoring Proposal," \$49,687, University of Alaska.

E. A. SMITH, "Provide Computer Lab Resources for Module 3 of the Educational Product: Studying Earth's Environment from Space," \$13,000, NASA Goddard Space Flight Center.

A. VALLE-LEVINSON and **L. P. ATKINSON**, "Support for a Current Meter Inter-Comparison," \$35,000, NOAA.

A. VALLE-LEVINSON, "Physical Exchange Processes at the Chesapeake Bay Mouth," \$54,961, Virginia Graduate Marine Science Consortium.

G. H. WHELESS, "The Use of Interactive Technology and Virtual Reality in Support of the Naval Special Warfare Mission," \$145,370, ONR.

G. H. WHELESS, "Collaborative Visualization and Numerical Modeling of Ocean Processes," \$40,000, University of Illinois.

G. H. WHELESS, "Physical Processes in the Chesapeake Bay Mouth and Their Relationships to Biological Recruitment," \$28,345, Virginia Graduate Marine Science Consortium.

Publications

S. W. A. Naqvi, National Institute of Oceanography, India; T. Yoshinari, New York State Department of Health and State University of New York-Albany; D. A. Jayakumar, National Institute of Oceanography, India; M. A. Altabet, University of Massachusetts; P. V. Narvekar, National Institute of Oceanography, India; A. H. Devol and J. A. Brandes, University of Washington; and **L. A. CODISPOTI**, "Budgetary and Biogeochemical Implications of Isotope Signatures in the Arabian Sea," *Nature*, Vol. 394, pp. 462-464, July 30, 1998.

V. Interrante, ICASE NASA Langley Research Center, and **C. E. GROSCH**, "Visualizing 3D Flow," *IEEE Computer Graphics and Applications*, Vol. 18, 49-53, July/August 1998.

E. E. HOFMANN and **J. M. KLINCK**, "Thermohaline Variability of the Waters Overlying the West Antarctic Peninsula Continental Shelf," *Ocean, Ice, and Atmosphere: Interactions at the Antarctic Continental Margin*, *Antarctic Research Series*, Vol. 75, 67-81, 1998.

E. E. HOFMANN and **J. M. KLINCK**, "Hydrography and Circulation of the Antarctic Continental Shelf: 150 E to the Greenwich Meridian," *The Sea*, A. R. Robinson and K. H. Brink, eds., Vol. 11, 997-1,042, 1998.

Y. H. Spitz, Oregon State University and **J. M. KLINCK**, "Estimate of Bottom and Surface Stress During a Spring-Neap Tide Cycle by Dynamical Assimilation of Tide Gauge Observations in the Chesapeake Bay," *Journal of Geophysical Research*, Vol. 103(C6), 12,761-12,782, 1998.

C.-Y. LI; J. O'Donnell, University of Connecticut; **A. VALLE-LEVINSON**; H.-Y. Li, University of Connecticut; K.-C. Wong, University of Delaware; and K. M. M. Lwiza, State University of New York, Stony Brook, "Tide Induced Mass-Flux in Shallow Estuaries," B. L. Edge and J. M. Hemsley, eds., Vol. 2, 1,510-1,524, 1998.

B. L. LIPPHARDT, Jr.; **A. D. KIRWAN, Jr.**; **C. E. GROSCH**; L. M. Ivanov, Marine Hydrophysical Institute,

Ukraine; and J. K. Lewis, Ocean Physics Research Development, Long Beach, MS, "Merging Disparate Oceanographic Data," In: *Rapid Environmental Assessment, SACLANTCEN Conference Proceedings Series CP-44*, March 10-14, 1997, E. Pouliquen, **A. D. Kirwan, Jr.**, and R. T. Pearson, eds., NATO SACLANT Undersea Research Centre, La Spezia, Italy, pp. 211-218, 1998.

K. J. Heywood, University of East Anglia, United Kingdom; **R. A. LOCARNINI**; R. D. Frew, University of Otago, New Zealand; P. F. Dennis, University of East Anglia, United Kingdom; and B. A. King, Southampton Oceanography Centre, United Kingdom, "Transport and Water Masses of the Antarctic Slope Front System in the Eastern Weddell Sea," In: *Ocean, Ice, and Atmosphere: Interactions at the Antarctic Continental Margin, Antarct. Res. Ser.*, S. Jacobs and R. Weiss, eds., American Geophysical Union, Washington, DC, pp. 189-202, Vol. 75, 1998.

T. Whitworth, III, A. H. Orsi, S.-J. Kim, W. D. Nowlin, Jr., all from Texas A&M University; and **R. A. LOCARNINI**, "Water Masses and Mixing Near the Antarctic Slope Front," In: *Ocean, Ice, and Atmosphere: Interactions at the Antarctic Continental Margin, Antarct. Res. Ser.*, S. Jacobs and R. Weiss, eds., American Geophysical Union, Washington, DC, pp. 1-27, Vol. 75, 1998.

A. VALLE-LEVINSON and R. E. Wilson, SUNY at Stony Brook, "Rotation and Vertical Mixing Effects on Volume Exchange in Eastern Long Island Sound," *Estuarine, Coastal and Shelf Science*, 46, 573-585, 1998.

A. VALLE-LEVINSON and K. M. M. Lwiza, State University of New York, Stony Brook, NY, "Rapid Assessment of Current Velocities in the Coastal Ocean," In: *Rapid Environmental Assessment, SACLANTCEN Conference Proceedings Series CP-44*, March 10-14, 1997, E. Pouliquen, **A. D. Kirwan, Jr.**, and R. T. Pearson, eds., NATO SACLANT Undersea Research Centre, La Spezia, Italy, pp. 131-136, 1998.

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," *Physics of Estuaries and Coastal Seas*, J. Dronkers, M. Scheffers, A. A. Balkema, and Rotterdam, eds., pp. 247-256, 1998.

ADK's Words of Wisdom

"If it's green and wiggles, it's biology. If it smells bad, it's chemistry. If it doesn't work, it's physics."

Professor Hubert N. Alyea (deceased), Princeton University

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