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Technical Requirements for a Real-Time Oceanographic Mooring at LEO-15

by Chris Powell, Marine Technician

During the spring, summer and fall of 2003, CCPO Professor **ANN GARGETT'S** 5-beam turbulence Vertical Acoustic Doppler Current Profiler (VADCP) was deployed at LEO-15 to measure coastal ocean turbulence. LEO-15 is an oceanographic observatory located at the Rutgers Marine Field Station in Tuckerton, NJ and run by Rutgers University. The actual site of the research is about five miles off the coast of New Jersey, in 15 meters of water (hence the 15 in the name). This deployment was far from ordinary in its design and operational requirements. This article describes the challenges and problems and how they were handled.

The Challenges

For a prolonged observatory deployment of this instrument, a number of issues had to be dealt with: 1) the physical design of the mooring; 2) interfacing with the existing LEO infrastructure; 3) real-time command and control of the instrument; and 4) processing and archiving the data.

Mooring Design

The first challenge we encountered was to design a way for the instrument to be easily deployed and safely left on the bottom for six months and still allow for attitude adjustment and maintenance by divers.

Figure 1. The Vertical Acoustic Doppler Current Profiler (VADCP) in its adjustable frame on board the R/V *Arabella* prior to deployment at LEO-15.

After consulting with the operations staff at LEO-15, we discovered that their preferred method of instrument deployment was to jet in a pipe and have divers attach instruments to it. This eliminated the use of a large, prefabricated ADCP mount. So I designed an open frame cage made of aluminum, with an 18 inch × 12 inch flange for mounting to the jetted pipe. I chose aluminum over stainless steel because it's lightweight and cheap; however, I did have to consider corrosion, so I also attached sacrificial zinc anodes to the cage in areas where they could be easily replaced by divers (Figure 1).

With this cage in hand, I then turned my attention to adjusting the instrument's attitude. To measure turbulence, the transducer head of the VADCP had to be adjusted so that the fifth beam was accurately vertical. To adjust the roll of the VADCP, I fabricated two large clamps from polyethylene (Marine Starboard) to hold the VADCP. These clamps were then bolted through to the floor of the cage, and by loosening the clamps, the instrument could then be rotated by a diver until it reached 0º roll (Figure 2). To adjust pitch, I had originally fabricated a series of wedges of varying angles (1, 5, and 10) to insert between the frame's flange and the mating surface on the pipe mount. However, the staff at LEO-15 suggested that we use the bolts that attached the cage to the pipe mount as jack screws to adjust the pitch because it would be easier for the divers to work with. We did it their way, and it worked beautifully.

The final hurdle we had to cross was to prevent bio-fouling of the transducer head during the deployment. I would normally paint the entire instrument, transducers and all, with bottom paint like Trilux; however, since the LEO-15 site is used by a variety of

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researchers, including biologists and chemists who frowned on copper thiocynate leaking slowly into their long-term study site, we instead coated the ducers with a mix of cayenne and Dow Corning 111 silicone grease, and had the divers reapply it periodically. This didn't stop massive hydroid growth on the installation during the summer season. Fortunately, the acoustics worked right through much biofouling, including starfish mating on the transducers (Figure 3)! When return signal strength decreased significantly, the LEO-15 divers manually cleaned the instrument.

LEO-15 Interface

Unlike a more traditional mooring where you slide in some batteries, wipe the flash card, throw it in the water and hope for the best, the LEO-15 facility gives you the ability to remotely power and communicate with your instrument, provided you can interface it to their system.

The first step is power! The LEO-15 nodes provide 12VDC and 120VDC; however, a RD ADCP requires 48VDC so I had to devise a way to produce the required 48VDC without causing grounding problems that plague all oceanographic observatories. I did this by using a Vicor DC-to-DC converter and a small circuit originally designed by Ned Forester of Woods Hole Oceanographic Institution. For communications, I switched our VADCP from its default setting of RS-232 to RS-422 because of its ability to provide higher bandwidth at greater distance. We bought a pressure case from Prevco, put the power converter in it, spliced together the necessary cabling from the node to the converter and to the ADCP, and "CHUCK" (nickname for our power converter) was born (Figure 4).

Real-Time Command and Control

Having tackled the problems of getting the instrument in the water and getting it interfaced with the LEO-15 system, we were left with the problem of being able to remotely send it commands and to view and retrieve data.

Figure 2. Top view of VADCP showing adjustable roll clamps (photo taken after recovery and pressure washing).

Data collected by the ADCP were relayed along the LEO-15 cable back to the Rutgers Marine Field Station in Tuckerton and logged and displayed on a purpose-built computer we left connected to the field station's network. Since this machine had a "real world" IP address, we were able to communicate with it using a commercial remote control package for computers called Netop Remote©, which is less susceptible to break-ins by unauthorized users than other similar software packages. With this package installed, we were able to sit behind a workstation in Norfolk, VA and have full control over the logging computer in New Jersey. Later in the season, when Dr. Gargett was in Canada and I went on vacation, we were both able to use laptops to remotely control the installation and check data quality. Netop Remote© allowed scheduled batched downloads of VADCP data from the installation site to a workstation in Norfolk, VA on a daily basis. Without this critical piece of the puzzle, this project would have been impossible.

Figure 3. Biological interaction by mating starfish on VADCP.

Processing and Data Management

The final hurdle of this installation was the data management and processing of raw data into a useful, readable format. During the course of the six-month deployment, we produced in excess of 9 GB of compressed raw data that had to be transferred, processed, and displayed on a daily basis. Data were transferred in compressed format daily and read by Matlab© scripts, written by graduate student, **SHUANG HUANG**. These scripts first unpacked the RDI raw data files, using a routine based on one originally written by Rich Pawlowicz at the University of British Columbia, then stored them as a Matlab© mat file. Subsequent routines pre-processed the data (identifying missing pings, tracking the surface, etc.), then produced visualizations of data from each of the five beams. These files were finally transferred to a Web site, where data could be accessed and where patterns of interest or problems in the data could be identified. All of the data transfers, processing, plotting, and Web generation routines were automated by a variety of scripts written by myself and Shuang Huang. In addition to these general housekeeping tasks, we also wrote scripts to check on the installation remotely and e-mailed project personnel about any potential problems with the installation, including loss of power, communication, and computer woes.

Figure 4. Marine technician Chris Powell with "CHUCK."

In the end, a tremendous amount of work and effort went into this deployment, and it was extremely successful. The deployment ran for six months, through a number of coastal storms and one hurricane, and still had less than 4% downtime.

NOTES from the Director...

It is a great pleasure to let the readers of *Circulation* know that John Klinck, CCPO Professor, has taken the helm of CCPO as Acting Director. It has been a great ride since the early 1990s, when we got CCPO started. Seeing a group of scientists develop their research programs with the incredible scope that we have here is very satisfying. I have especially enjoyed seeing the students and post-docs grow, strengthen their wings, and fly off to start their careers.

Change in any organization can be a time of anxiety, but I firmly believe that change is good and even necessary for continued existence of any organization. I also thought of advice from my mentors, Dick Richards, Peter Wangersky, Unnsteinn Stefansson and Gordon Riley, remembering how they noted the importance of occasional change in the direction of one's professional life.

I will continue the work I am doing at Ocean.US in Washington, D.C., and continue to promote increased coordination of research and observing in the region. Both efforts take persistence and will probably not pay off for years, but I think it is worth it.

Finally, thanks to all who have made CCPO a successful enterprise.

Larry Atkinson
Samuel and Fay Slover Professor of Oceanography

STUDENT PROFILE

NANDITA SARKAR

NANDITA SARKAR has been a graduate student at CCPO since fall 1998. She received a B.S. in Geography in 1996 and a M.S. in coastal geomorphology in 1998 from the University of Pune in Pune, India. As a part of her M.S. thesis in India, she worked with a team to quantify wave energy from ripple patterns. This work led her to be interested in physical oceanography. At CCPO, she works with her advisors, **TOM ROYER** and **CHET GROSCH**, both of whom are CCPO professors, on time series analysis and modeling of mixed layer depths in the northern Gulf of Alaska. In 2001, she received her M.S. in physical oceanography, and she is continuing with her Ph.D. studies at CCPO.

Nandita is also interested in oceanography education for children. As a part of the Department of Ocean, Earth and Atmospheric Science's outreach program, Nandita has conducted many workshops and given many talks to kids, ranging from 5 years to 18 years of age. While at CCPO, Nandita has participated in a number of cruises in the Chesapeake Bay, Alaska and Chile. In her free time, Nandita enjoys reading and traveling. She has recently started learning to quilt the American way, which is very different from Indian quilting. After she graduates, she would like to continue working on observational oceanography and time series analysis in a postdoctoral research capacity.

STUDENT PROFILE

YUSUF SINAN HUSREVOGLU

YUSUF (SINAN) HUSREVOGLU is a doctoral student at CCPO, working under the supervision of **JOHN KLINCK**, CCPO professor, on sea ice-ocean interaction in the Ross Sea, Antarctica. After receiving his M.Sc. in physical oceanography from the Institute of Marine Sciences of Middle East Technical University in Turkey, he came to CCPO in 1998. The focus of his studies is on coupled numerical modeling of the sea ice-ocean system, and hence, analysis of cross-interface heat and buoyancy fluxes. During his tenure as a student, he had a chance to take part in research cruises in a variety of geographical settings and appreciates this as a wonderful perk of marine studies. Although his habitat is mainly curbed by the Crittenton Hall, he likes to get out to sweat on fake stairs, run on fake ground, and climb fake rocks. The thickness distribution in his bookshelf is skewed toward cooking books, but nevertheless, the collection includes sparsely read novels and books on political theory. Sinan is interested in social ecology, human nature interaction and econo-politics. Upon completion of his doctoral degree, he would like to continue onto the next available academic level and eventually return to his homeland, Turkey, to be closer to the Black Sea-Mediterranean salinity contrast.

CCPO Presentations from the 2004 Ocean Sciences Meeting, Portland, OR, January 26-30, 2004

CHAPMAN, E.W., C.A. Ribic, W.R. Fraser, G.L. Lawson, P.H. Wiebe and C.J. Ashjian, "Associations Between Seabird Distribution and Physical and Biological Oceanographic Features During Winter, 2001 in the Marguerite Bay Area on the Western Antarctic Peninsula," oral presentation.

DINNIMAN, M.S., J.M. KLINCK and W.O. Smith Jr., "Impact of a Large Iceberg on Circulation in the Southwestern Ross Sea, Antarctica," oral presentation.

GUO, X. and **A. VALLE-LEVINSON**, "Tidal Effects on Estuarine Circulation in the Chesapeake Bay," poster presentation.

HOFMANN, E.E., M.A. FRIEDRICHS, J. Christian, W. Wang, R. Murtugudde and A.J. Busalacchi, "Comparison of Model-derived Phytoplankton Distributions with SeaWiFS data at Two Sites in the Equatorial Pacific Ocean," poster presentation.

HOFMANN, E.E., J.M. KLINCK, E.N. Powell, J. Kraeuter, R. Grizzle, M. Bricelj and S. Buckner, "A Simulation Model of the Population Growth of Hard Clams (*Mercenaria mercenaria*)," oral presentation.

HUSREVOGLU, Y.S., and **J.M. KLINCK**, "The Influence of Sea Ice Processes in Controlling the Water Column Structure in the Ross Sea," poster presentation.

KIM, H.-C., **E.E. HOFMANN**, **M.S. DINNIMAN,** and **J.M. KLINCK**, "The Fate of the Primary Production in Antarctic Coastal Waters: A Modeling Study," oral presentation.

KLINCK, J.M., **M.S. DINNIMAN,** and **E.E. HOFMANN**, "Coastal-Ocean Exchange on the West Antarctic Peninsula Shelf Using Observations and a Model," oral presentation.

Li, C., and **A. VALLE-LEVINSON**, "Contrast of Flow Field in Lower Chesapeake Bay from Harmonic-Statistical Analysis," poster presentation.

Loeb, V., **E.E. HOFMANN, J.M. KLINCK** and R. Hewitt, "Hydrographic Control of Salp and Copepod Distributions in the South Shetland-Elephant Island and Bransfield Strait Region," oral presentation.

ROYER, T.C., C.E. GROSCH, T. J. Weingartner, and S. Danielson, "Ocean Climate Conditions during GLOBEC Northeast Pacific Program (NEP) Long-Term Observation Program (LTOP)," oral presentation.

SALIHOGLU, B., and **E.E. HOFMANN**, "Phytoplankton Species Interactions and Lower Trophic Level Structure in the Equatorial Pacific Regions: A Modeling Study," oral presentation.

SARKAR, N., T.C. ROYER, and **C.E. GROSCH, "**Modeling Seasonal Mixed Layer Depths in the Northern Gulf of Alaska," poster presentation.

VALLE-LEVINSON, A, G. Gutierrez and A. Trasviña, "Fortnightly Modulation of Tidal Residual Flows in a Hypersaline Coastal Lagoon," oral presentation.

WIGGERT, J.D., R.G. Murtugudde and J.R. Christian, "Biogeochemical Variability in the Indian Ocean: Results of a Coupled Bio-physical Model," poster presentation.

WIGGERT, J.D., A.G.E. Haskell, G.A. Paffenhöfer, **E.E. HOFMANN** and **J.M. KLINCK**, "The Role of Feeding Behavior in Sustaining Copepod Populations in the Tropical Ocean," oral presentation.

QUOTES FROM THE FIELD

"The leitmotif, the ever recurring melody, is that two things are indispensable in any reasoning, in any description we shape of a segment of reality: to submit to experience and to face the language that is used, with unceasing logical criticism."

from an unpublished paper of R. v. Mises

Submitted by Chet Grosch

CONGRATULATIONS!

ERIK CHAPMAN, CCPO graduate research assistant and Dominion Scholar, married Michèle Rosenshield on July 26, 2003, in Sharon, VT. They are expecting a baby in June 2004.

MICHAEL DINNIMAN, CCPO research scientist, and Anne Shewan welcomed Shannon Marie Dinniman on September 5, 2003. Shannon was 21 inches long and weighed 8 lbs., 4 oz.

Benjamin Thomas Austin was born on November 29, 2003. He weighed 7 lbs., 9 oz. and was 22 inches long. His parents are JAY AUSTIN, CCPO research assistant professor, and Liz Austin-Minor.

CCPO Hosts Third Primary Production Algorithm Round-Robin (PPARR3) Workshop

MARJY FRIEDRICHS, CCPO research assistant professor, and Dr. Mary-Elena Carr of NASA's Jet Propulsion Laboratory, are leading an effort to compare models that estimate marine primary production from satellite measurements of ocean color (PP models). This comparison exercise, called the Primary Production Algorithm Round-Robin 3 (PPARR3), builds from previous efforts led by Dr. Janet Campbell of the University of New Hampshire (PPARR1 and PPARR2). These initial efforts consisted of anonymous comparisons between *in situ* estimates of integrated primary production from ^{14}C uptake, and the output of algorithms given measured surface variables accessible from space-borne instruments, such as surface chlorophyll, sea surface temperature (SST), photosynthetically available radiation (PAR), latitude, longitude, and year day. PPARR3 involves comparisons that are much more comprehensive in approach and are not anonymous.

PPARR3 consists of three parts. The first part is a comparison of monthly global primary production fields generated by the different algorithms. Part two is a step-by-step sensitivity study of the different algorithms in which there is no comparison back to *in situ* production measurements. The third part is similar to the previous two exercises: a blind comparison using a much larger, quality-controlled database of ^{14}C measurements that is more representative of the world ocean than the databases used in the previous PPARR studies.

In early September 2003, PPARR3 participants* arrived from all over the globe (Japan, Brazil, Italy, the UK, Hawaii) and gathered in Norfolk, VA for a three-day workshop in order to discuss progress to date. The meeting included presentations by each of the participating modeling groups, summaries of our progress in making the global primary production comparisons and performing the sensitivity analyses, and many lively discussions. Hands-on computational time was provided at CCPO, as was a dinner reception on the back lawn of Crittenton Hall. All agreed that the workshop successfully brought together many scientists working on similar research and resulted in many fruitful discussions and debates. Planning for a second workshop in 2004 is already under way.

PPARR3 is a community effort, and all algorithms and researchers are welcome. Visit http://oceans-www.jpl.nasa.gov/bio/PrimaryProd/index.html for more information.

*PPARR3 participants: Ichio Asanuma, Kirk Waters, Bob Bidigare, Michele Sciardi, Tim Smyth, Nick Hoepffner, Frederic Melin, John Marra, Heidi Dierssen, Aurea Ciotti, Mike Behrenfeld, Kevin Turpie, Janet Campbell, Dick Barber, Marjorie Schmeltz, Mary-Elena Carr and Marjy Friedrichs.

POST-DOCTORAL PROFILE

ANDRES TEJADA-MARTINEZ

ANDRES TEJADA-MARTINEZ joined CCPO in December 2002 as a post-doctoral research scientist, working with professors **ANN GARGETT, CHET GROSCH** and **JOHN KLINCK**. His research interests are in the general areas of computational mechanics and fluid dynamics, specifically in large-eddy simulations (LES) of turbulent flows. In December 2002, he received a Ph.D. in mechanics from Rensselaer Polytechnic Institute (RPI), where he worked at the Scientific Computation Research Center under the guidance of Kenneth Jansen. Andres' Ph.D. research focused on the extension of subgrid-scale (LES) modeling to unstructured-grid, stabilized finite element methods.

Prior to attending RPI, Andres became interested in fluid dynamics and numerical methods through undergraduate research experiences at Columbia University's engineering mechanics department and at Argonne National Laboratory's mathematics and computer science division. Later in graduate school, he took a course at Columbia's Lamont-Doherty Earth Observatory, where he first learned about and became interested in geophysical fluid dynamics. Undecided whether to obtain a Ph.D. in engineering mechanics or applied mathematics, Andres pursued graduate studies at New York University's Courant Institute of Mathematical Sciences, where he continued taking courses in geophysical fluids and numerical methods. In 1998, he opted for a graduate research assistantship at RPI in the area of large-eddy simulation (LES), with the hope of one day applying LES to turbulence in the ocean. At CCPO, Andres is presently conducting LES of turbulence in the coastal ocean. This research is in support of turbulence observations being made in the southern coast of New Jersey by **ANN GARGETT** and a team of CCPO researchers.

Andres is a native of the Dominican Republic in the Caribbean paradise of La Hispaniola. In 1985, at the age of 11, his parents brought him to the United States, where he lived in the Bronx, NY. He is an avid fan of the New York Yankees (the Bronx Bombers) and often can be spotted discussing his team with fellow CCPO workers. Andres is married to his long-time college friend, Judit Tejada.

R/V *FAY SLOVER* UPDATE

By Dick Moody, Marine Superintendent

Old Dominion University's new research vessel, R/V *Fay Slover*, has completed its first complete calendar year of work. Captain Richard Cox, having recently left a long career with the Army Corps of Engineers as a vessel captain, took the helm last April and the lion's share of the field season. All in all, over 8,700 nautical miles were logged last year in the Chesapeake Bay, and the Elizabeth, James, Pamunkey, York, and Rappahannock Rivers, as well as a few excursions offshore in the Atlantic Ocean.

Operations on board included Rosette water sampling/CTD/fluorometry/dissolved oxygen/transmissometry casts, fish and plankton tows, box cores and multicores, as well as continuous underway measurements of top-to-bottom currents, surface conductivity/salinity and temperature, and weather parameters, including Photosynthetically Available Radiation. Of the 115 day cruises, most were attributed to monthly, sometimes semi-monthly, water quality sampling of the Chesapeake Bay south of the Maryland border and in the Elizabeth River for the Virginia Department of Environmental Quality. We are also using *Fay Slover* to continue our decade-long hydrographic time series across the entrance to the Chesapeake Bay. Under the direction of **JAY AUSTIN**, CCPO research assistant professor, we have been able to expand the number of parameters now sampled on this valuable section. Class trips for oceanography and biology characterized most other day cruises.

Severe frontal weather, followed by Hurricane Isabel, suspended operations for two weeks in September. Isabel caused *Fay Slover* to find refuge up the Intracoastal Waterway in Great Bridge, along with the *Spirit of Norfolk*. The only damages suffered were a few chafed and broken lines. Back in action, fall semester class trips dominated, including those for the Oceanography 106 cruises staged out of Little Creek, Fisherman's Cove. Other highlights of 2003 included:

- Hauling on three occasions to pressure-wash the hull, which maintained the all-important 20-knot speed essential to quick sampling.
- Two sound surveys for underway vessel noise, which resulted in several square feet of carpet being laid down. *Fay Slover* is now a quieter vessel, and more sound reduction renovations are planned for the engine room.
- Additional equipment for the *Slover* including a side-scan sonar system, newly-acquired from NOAA, which will soon be tested as an additional useful tool for geologists or other sea-bottom explorers. A second, portable utility winch for the afterdeck is also anticipated, as well as a customized box corer.

At the time of this writing, *Fay Slover* is enjoying the first of many annual shipyard periods for routine maintenance, minor alterations and repairs. In August, the *Slover* is scheduled to work off the notorious Cape Hatteras during a two-week period, which will challenge the crew and the operations group to exercise their best weather-watching skills. Other new ventures and challenges are sure to come in the ensuing months.

Just the *facts*

PRESENTATIONS

DINNIMAN, M.S., J.M. KLINCK, W.O. Smith Jr. and **E.E. HOFMANN**, "Cross Shelf Exchange in the Ross Sea and West Antarctic Peninsula from Models of the Circulation and Biogeochemistry," Gordon Research Conference on Coastal Ocean Modeling, Colby-Sawyer College, New London, NH, June 22-27, 2003.

HOFMANN, E.E., "An Overview of the Southern Ocean Global Ocean Ecosystem Dynamics Program," invited presentation, International Whaling Commission Scientific Committee Meeting, Berlin, Germany, May 26-30, 2003.

HOFMANN, E.E., "Advection, Krill and Antarctic Marine Ecosystems," invited seminar, Marine Science Research Center, SUNY, Stony Brook, NY, October 17, 2003.

HOFMANN, E.E., "The Role of Advection in Structuring Antarctic Marine Ecosystems," invited seminar, Duke University Marine Laboratory, Beaufort, NC, October 29, 2003.

HOFMANN, E.E. and E.J. Murphy, "Advective Processes and Effects on Antarctic Ecosystems," invited presentation, The Role of the Southern Ocean in Global Processes: An Earth System Science Approach, The Royal Society, London, England, July 14-16, 2003.

HOFMANN, E.E., A.G.E. Haskell**, J.M. KLINCK** and C.M. Lascara, "Lagrangian Modeling Studies of the Spatial Dynamics of Antarctic Krill (*Euphausia superba*)," poster presentation, Third International Zooplankton Production Symposium, Gijon, Spain, May 20-23, 2003.

Holland, D.M., J. Hunter, K. Grosfeld, H. Hellmer, A. Jenkins, M.A. Morales-Maqueda, M. Hemer, M. Williams, **J.M. KLINCK** and **M. DINNIMAN**, "The Ice Shelf-Ocean Model Intercomparison Project (ISOMIP)," oral presentation at Fall 2003 AGU Meeting, San Francisco, CA, December 8-12, 2003.

KLINCK, J.M., "Circulation and Nutrient Flux West of the Antarctic Peninsula and in the Ross Sea," Symposium for Upper Ocean Circulation and Air-Sea Interaction, Tallahassee, FL, April 28-29, 2003.

KLINCK, J.M., "Effect of Submarine Canyon Geometry on Coastal Circulation and Shelf-Ocean Exchange," Gordon Research Conference on Coastal Ocean Modeling, Colby-Sawyer College, New London, NH, June 22-27, 2003.

Muter, F. J. and **T.C. ROYER**, "Recruitment of Pelagic and Demersal Fishes in the Gulf of Alaska in Relation to Coastal Freshwater Discharge," PICES XII, Seoul, Korea, October 10-18, 2003.

Powell, E.N., E.A. Bochenek, **E.E. HOFMANN** and **J.M. KLINCK**, "Influence of Environment and Food Supply on Survival of *Crassostrea gigas* Larvae: a Modeling Study," oral presentation, Third International Zooplankton Production Symposium, Gijon, Spain, May 20-23, 2003.

ROYER, T.C., "Oceanography of the North Pacific," invited presentation to the North Pacific Research Board (NPRB), Anchorage, Alaska, March 28, 2003.

ROYER, T.C., Oil Spill Recovery Institute Modeling Workshop Presentation, Anchorage, Alaska, June 16-18, 2003.

ROYER, T.C. and **C.E. GROSCH**, "Northeast Pacific Freshwater Discharge; Past and Future, Estuarine Research Federation Conference," invited paper, Seattle, WA, September 14-18, 2003.

ROYER, T.C. and **C.E. GROSCH,** "The Role of Freshwater in the Coastal Circulation in the Northeast Pacific; Past, Present and Future," invited paper, PICES XII, Seoul, Korea, October 10-18, 2003.

SANAY, R. and **A. VALLE-LEVINSON**, "Wind-induced Exchange in Semi-Enclosed Rotating Bains," poster presentation, Gordon Research Conference on Coastal Ocean Modeling, Colby-Sawyer College, New London, NH, June 22-27, 2003.

SANAY, R. and **A. VALLE-LEVINSON**, "Wind-driven Circulation in Non-Homogeneous Rotating Estuaries," oral presentation, 17th Biennial Conference of the Estuarine Research Federation, Seattle, WA, September 14-18, 2003.

SEPULVEDA, H.H., A. VALLE-LEVINSON and M. Framiñan, "Observations of Subtidal and Tidal Flow in the Rio de la Plata Estuary," 17th Biennial Conference of the Estuarine Research Federation, Seattle, WA, September 18, 2003.

Smythe, S.A. and **A. VALLE-LEVINSON**, "Subtidal Exchange at a Tributary to the Chesapeake Bay: the Lafayette River," 17th Biennial Conference of the Estuarine Research Federation, Seattle, WA, September 17, 2003.

VALLE-LEVINSON, A., "Physical Mechanisms that Drive the Circulation in Chilean Fjords," at Chilean Marine Sciences Congress, Punta Arenas, Chile, May 6, 2003.

VALLE-LEVINSON, A., "Diurnal Vertical Motions Over a Seamount of the Gulf of California," Marine Sciences and Limnology Center of the National University, Mexico City, Mexico, June 11, 2003.

VALLE-LEVINSON, A, "Diurnal Vertical Motions Over a Seamount," Peruvian Sea Institute, Callao, Peru, July 2, 2003.

VALLE-LEVINSON, A., "Diurnal Vertical Motions Over a Seamount, a Shelf Break and in an Estuary," National University Research Station, Puerto Morelos, Mexico, July 18, 2003.

VALLE-LEVINSON, A, "Diurnal Vertical Motions Over a Seamount, a Shelf Break and in an Estuary," Universidad del Mar, Puerto Angel, Mexico, August 25, 2003.

VALLE-LEVINSON, A, "Effects of Bathymetry, Friction and Rotation on Estuary-Ocean Exchange," Universidad del Mar, Puerto Angel, Mexico, August 25, 2003.

VALLE-LEVINSON, A, "Effects of Bathymetry, Friction and Rotation on Estuary-Ocean Exchange," 17th Biennial Conference of the Estuarine Research Federation, Seattle, WA, September 15, 2003.

VALLE-LEVINSON, A, "Diurnal Vertical Motions Over a Seamount, a Shelf Break and in an Estuary," Universidad de Magallanes, Punta Arenas, Chile, December 16, 2003.

VALLE-LEVINSON, A, S. Monismith, R. Chant, J. Delgado and M. Cruz, "Multiple States in Coastal Lagoons and Estuaries: Next Steps Toward Understanding the Lagoons of the Yaqui Valley," Workshop on Integrated Studies for Sustainability of the Yaqui River Valley, San Carlos, Sonora, Mexico, October 20, 2003.

PUBLICATIONS

Babin, S.M., J.A. Carton, T.D. Dickey and **J.D. WIGGERT**, "Satellite evidence of hurricane-induced plankton blooms in an oceanic desert," *Journal of Geophysical Research*, **109**, doi:10.1029/2003JC001938, 2004.

Cáceres, M., **A. VALLE-LEVINSON** and **L. ATKINSON**, "Observations of cross-channel structure of flow in an energetic tidal channel," *Journal of Geophysical Research*, **108**(C4):3114, doi:10.1029/2001JC000968, 2003.

DINNIMAN, M.S., J.M. KLINCK and W.O. Smith Jr., "Cross-shelf exchange in a model of the Ross Sea circulation and biogeochemistry," *Deep-Sea Research II*, **50**:3103-3120, 2003.

Fraser, W.R and **E.E. HOFMANN**, "Krill-sea ice interactions, a predator's perspective on causal links between climate change, physical forcing and ecosystem response," *Marine Ecology Progress Series*, **265**:1-15, 2003.

GARGETT, A.E., "Differential diffusion: an oceanographic primer," *Progress in Oceanography*, **56**(3-4):559-570, 2003.

GARGETT, A.E., W.J. Merryfield and G. Holloway, "Direct numerical simulation of differential scalar diffusion in three-dimensional stratified turbulence," *Journal of Physical Oceanography*, **33**(8):1758-1782, 2003.

HOFMANN, E.E. and **Y.S. HUSREVOGLU**, "A circumpolar modeling study of habitat control of Antarctic krill (*Euphausia superba*) reproductive success," *Deep-Sea Research II*, **50**:3121-3142, 2003.

Ruddick, B. and **A.E. GARGETT**, "Oceanic double-diffusion: Introduction," *Progress in Oceanography*, **56**(3-4), 381-393, 2003.

SARKAR, N. and **T.C. ROYER**, "Mixed layer depth at GAK 1 in the north Gulf of Alaska," in: *Status of Stocks & Multispecies Assessments*, Appendix C: Ecosystem Considerations for 2004, J. Boldt (ed.), Alaska Fisheries Science Center, National Marine Fisheries Service, 2003.

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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, at 3:30 P.M. on Mondays. **EILEEN HOFMANN**, professor of oceanography, coordinates the lecture series. Below is a schedule of lectures for the spring semester 2004. For more information, or if you would like to be included on the mailing list for lecture announcements, **please call (757) 683-4949 or e-mail** *julie@ ccpo.odu.edu*. Specific lecture topics are announced one week prior to each lecture. Titles and abstracts of the seminars can be found at *www.ccpo.odu.edu*.

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Center for Marine Environmental Studies, Ehine University, Japan

February 16
JOHN KLINCK
CCPO

February 23
JERRY WIGGERT
CCPO

March 1
RAYMOND HAYES
Howard University College of Medicine

March 15
MARTINA DOBLIN
Old Dominion University

March 22
DON WELLER
Smithsonian Environmental Research Center

March 29
TOM FISHER
Horn Point Environmental Laboratory, University of Maryland Center for Environmental Science

April 5
ERIK CHAPMAN
CCPO

April 12
RICK JAHNKE
Skidaway Institute of Oceanography

PUBLICATIONS (CONTINUED)

VALLE-LEVINSON, A., C. Reyes and **R. SANAY**, "Effects of bathymetry and Earth's rotation on estuary/ocean exchange," *Journal of Physical Oceanography*, **33**(11):2375-2393, 2003.

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