

2005

## **Internal Chronology: Activities of CIOSS Fellows at the College of Oceanic and Atmospheric Sciences, Oregon State University**

**January:** New COAST index: NA108H. Janine Kobel requested budget transfer from NA108H to NA108B to reimburse CIOSS for COAST Meeting #1 in September.

**January 12:** SMILE meeting with Molly Phipps, Pete Strutton, Ted Strub, Ryan Collay, Janine Kobel. Second teacher training workshop coming up.

**January 13:** Three postdoc interviews (Bathgate, Saraceno, Li) on the phone w/Ted Strub, Mike Kosro, Janine Kobel.

**January 14:** Carol Wallace provided CIOSS with budget projections.

**January 18:** Postdoc interview (Volkov) on the phone w/ Ted Strub, Mike Kosro, Janine Kobel.

**January 18:** CIOSS Administrative Specialist Janine Kobel accepted a new position at Oregon State University (University Advancement office) starting March 1.

**January 19:** Terry Robertson began search for new admin specialist.

**January 19:** The CIOSS Council of Fellows held a meeting in Corvallis where the Director, Ted Strub, presented a summary of activities of the previous year. The change in emphasis for research projects was described – concentrating on directed research projects that addressed CIOSS Themes, with funding for personnel other than post-docs. New proposals for research projects were solicited.

**January 20:** All local CIOSS Fellows met.

**January 22:** Ted offered Volkov postdoc position; invited Li to come visit in late February.

**January 24-25:** Coastal Applications and Science Team (COAST) meeting #2, Portland, Oregon, hosted by CIOSS.

Meeting Objectives:

- Review HES-CW requirements; prioritize the goal requirements.
- Review the white paper and finalize it. Review the brochure and give direction so that it can be finalized.
- Review proposed GOES-R Risk Reduction activities. Edit the list and suggest other activities.
- Plan advocacy activities for the next 6 months.

**January 28-29:** SMILE conducted second teacher training workshop. Ted attended.

**January 31-February 1:** Ted attended GLOBEC NEP CGOA meeting in Seattle.

**February:** John Allen narrowed his postdoc list.

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**February:** The “final” Five-Year Plan was sent to ORA/ORAD.

**February:** The 2 COAST workshops have resulted in recommendations for the sensor specifications, a white paper describing applications that will become possible due to data from this sensor, modifications to the GOES-R Risk Reduction Plan that address needs in the coastal ocean, and a brochure that can be used to educate members of the community about the benefits of a HES-CW sensor. The brochure is called Coastal Waters Imaging on GOES-R. It features Coastal Monitoring in the Next Generation of GOES, Satellite Imagery for Coastal Resource Management and efforts for the future. The plans for risk reduction for GOES-R ocean data products were presented by Curt Davis and Mark Abbott at the Annual GOES-R Risk Reduction meeting in Silver Spring, MD on February 22-23. The brochure and a powerpoint presentation summarizing the GOES-R HES-CW plans can be found on the CIOSS web page (<http://cioss.coas.oregonstate.edu/>) under “Workshops/Portland (OR) COAST GOES-R Workshop, Jan 2005”.

**February 8-10:** A workshop was hosted by CIOSS (Dudley Chelton and Mike Freilich), NESDIS (Paul Chang) and the National Hurricane Center at the Florida International University in Miami, titled: Satellite Measurements of Ocean Vector Winds: Present Capabilities and Future Trends. The workshop brought together research and operational users to examine present and potential future missions and data sets related to near-surface ocean vector wind measurements. Participants established the measurement requirements for research and operational applications of satellite observations of ocean vector winds. Participants formulated and provided recommendations to NASA and NOAA regarding their development of future missions, new data products, and support for new scientific investigations. Powerpoint presentations and the agenda of the workshop can be found on the CIOSS web page (<http://cioss.coas.oregonstate.edu/>) under “Workshops/Miami (FL) Workshop on Ocean Winds, Feb 2005”.

**February 11:** Closing date on CIOSS admin specialist open position.

**February 16:** SMILE meeting.

**March 1-3:** CIOSS Fellow Dudley Chelton and Eric Maloney co-authored a poster at the CLIVAR Climate Model Evaluation Project (CMEP) Meeting in Honolulu, Hawaii. The poster was presented by Eric Maloney. The title of the poster was "SST Influence on Surface Wind Stress in Coupled Climate Models."

**March 23-25:** CIOSS Fellow Dudley Chelton attended the NASA Ocean Vector Winds Science Team (OVWST) meeting in Seattle, Washington and gave a presentation titled "An Assessment of the Accuracy of SST Influence on Low-Level Winds in the ECMWF and NCEP Numerical Weather Prediction Models."

**Abstract:**

The availability of QuikSCAT observations of surface winds in combination with satellite microwave observations of SST has revealed strong ocean-atmosphere interaction over SST fronts throughout the world ocean. On scales shorter than about 3000 km, SST and surface winds are positively correlated from SST-induced changes in the stability of the atmospheric boundary layer that modify the low-level winds through their effects on

vertical turbulent mixing. The objective of this study is to investigate the extent to which this ocean-atmosphere interaction is present in the surface wind fields from numerical weather prediction (NWP) models. From analyses of QuikSCAT observations and ECMWF and NCEP model analyses of surface wind stress, it is shown that the SST influence on surface winds is clearly identifiable in the NWP wind fields, albeit with underestimated intensity. It is shown that this is partly attributable to insufficient resolution of the SST boundary condition used in the NWP models, and partly to inadequacies in the models. The latter may be due to errors in the model parameterizations of boundary layer processes or to insufficient horizontal or vertical resolution in the model.

**March:** The CIOSS Council met as a review panel and selected the proposed project to forward to Eric Bayler, which was approved with minor modifications.

**March 25:** The CIOSS Year 3 Omnibus Proposal was submitted through NOAA Grants.gov.

**March 28:** The new CIOSS Administrative Specialist, Amy Vandehey, started in the CIOSS Office.

**March 28:** Amy Vandehey began attending the spring term course OC 331, Introduction to Oceanography, as part of her professional development. COAS Master's student, Craig Risien – author of the CIOSS web page, showed Amy how to manipulate and update the web page.

**March:** CIOSS Fellow John (Jack) Barth and his student, Renato Castelao, are collaborating with Tim Mavor in ORAD on the use of GOES SST data to identify and track SST fronts in the coastal ocean off Oregon.

“Spatial and temporal variability in sea surface temperature fronts In the California Current System from satellite observations” Renato M. Castelao and John A. Barth (COAS/OSU) and Timothy P. Mavor (NOAA NESDIS).

Three and a half years (2001-Jun 2004) of Geostationary Operational Environmental Satellites (GOES) sea surface temperature (SST) frontal data over the shelf and slope along the U.S. west coast are used to analyze variability in the California Current System. Maps of seasonal probability of detecting a front (SPDF) reveal significant temporal and spatial variability in the area. Winter is characterized by very low SPDF along the entire coast. In spring, SPDF is still low north of Cape Blanco (43N), but increases considerably south of it. This is consistent with the wind stress seasonal cycle and the seasonal development of upwelling fronts. The SPDF reaches maximum values in Summer. The continuous input of energy from the wind to the system leads to intensification of the fronts and of the coastal upwelling jet. High SPDF are found around the 200 m isobath north of Cape Blanco, but span a much wider area south of it, presumably due to instability of alongshore currents and the generation of meanders and eddies, which increase in scale as the system adjust toward equilibrium. During fall, the SPDF decreases considerably, but the offshore extent of the area of higher activity is maximum. The interaction of the flow with major topography perturbations seems to strongly control the position of the fronts. Off Oregon, for example, high values of SPDF in 2001 are found inshore of the pinnacles of the Heceta Bank complex (44.2N) during spring, but move over and seaward of the pinnacles during summer. Mooring

observations show that the coastal jet moves seaward of the pinnacles over a period of ten days in early July during a strong upwelling favorable wind event. A similar offshore shift is observed in the daily GOES-derived SST fronts position. Flow topography interactions in the vicinity of topography perturbations are investigated in more detail using a numerical model.

**March 30-31:** CIOSS Fellow Dudley Chelton visited NESDIS in Camp Springs, MD to participate as a member of the Hiring Committee for the Branch Chief of the Ocean Dynamics and Data Assimilation Branch (formerly known as the Laboratory for Satellite Altimetry). While in Camp Springs, Dudley also gave a seminar in the Joint Center for Satellite Data Assimilation (JCSDA) seminar series. The title of the seminar was "The Impact of SST Specification on Surface Winds in Numerical Weather Prediction Models."

Abstract:

Satellite observations of surface winds and SST from QuikSCAT and the AMSR reveal that the ocean exerts a strong influence on boundary layer winds in regions of SST fronts associated with ocean currents. This ocean-atmosphere interaction is clearly evident in the surface wind fields of the NCEP and ECMWF operational models, albeit with reduced intensity and increased spatial scale. From comparisons with QuikSCAT, the accuracy of SST-induced perturbations of surface winds in the ECMWF model improved dramatically after May 2001 when the SST boundary condition was changed from the Reynolds SST analyses to the higher resolution and more accurate Real-Time Global SST analyses.

As a result of this analysis, Dudley is working with Dick Reynolds on methods to increase the horizontal resolution of the fields produced at NOAA.

**April 12:** Conference call with Marilyn Moll and CI Administrators.

**April:** The following article, which was partially supported by CIOSS funds, appeared in the April issue of the Journal of Physical Oceanography:

Choboter, P. F., R. M. Samelson, and J. S. Allen, 2005. A new solution of a nonlinear model of upwelling. *Journal of Physical Oceanography*, 35, 532-544.

**April 12-14:** The NASA Ocean Color Research Team meeting was held in Portland, OR. Curt Davis presented an update on HES-CW and its capabilities.

**April 14-15:** CIOSS and the Science and Math Investigative Learning Experience (SMILE) Program are collaborating on developing a curriculum for the 12 high school after-school clubs that meet throughout the school year. The new curriculum is focused on oceanography, remote sensing and mapping. SMILE has held two teacher-training workshops on the Oregon State University campus to introduce teachers from SMILE's rural and minority school districts to oceanography, remote sensing, and mapping. The culmination of these after-school club meetings was the SMILE High School Challenge during April 14-15, a one-and-a-half-day event, during which SMILE high school club members, teachers, and volunteers convened at Western Oregon University and Oregon State University to play out a disaster scenario. This year's challenge was called, "Reaction, Action and Remediation of an Oil Spill". Members of the NOAA/NOS HazMat team in Seattle contributed to the scenario by making available the GNOME trajectory model, which the students used to assess the possible paths the oil spill might take. Mixed teams of students (several schools represented on each team) collected

data on the local resources near the spill and developed plans to protect those they determined to be most valuable. Their plans were presented at the end of the second day to volunteers who role-played members of the community with different interests. The teams learned a tremendous amount of material in the 24 hours they had to prepare and present their plans. The presentations went well and the overall event was considered quite successful by all involved. This curriculum will continue to be developed over the next several years.

**April 18:** Ted Strub brought Amy Vandehey up-to-date on COAS and NOAA proposal budget requirements.

**April 25-29:** CIOSS Fellows Jack Barth and Dudley Chelton, along with graduate student Renato Castelao, attended the European Geophysical Union (EGU) Meeting in Vienna. Renato presented results of an ongoing collaboration with Tim Mavor in NESDIS: “Spatial and temporal variability in sea surface temperature fronts in the California Current System from satellite observations”.

Abstract:

Three and a half years (2001-Jun 2004) of Geostationary Operational Environmental Satellites (GOES) sea surface temperature (SST) frontal data over the shelf and slope along the U.S. west coast are used to analyze variability in the California Current System. Maps of seasonal probability of detecting a front (SPDF) reveal significant temporal and spatial variability in the area. Winter is characterized by very low SPDF along the entire coast. In spring, SPDF is still low north of Cape Blanco (43N), but increases considerably south of it. This is consistent with the wind stress seasonal cycle and the seasonal development of upwelling fronts. The SPDF reaches maximum values in summer. The continuous input of energy from the wind to the system leads to intensification of the fronts and of the coastal upwelling jet. High SPDF are found around the 200 m isobath north of Cape Blanco, but span a much wider area south of it, presumably due to instability of alongshore currents and the generation of meanders and eddies, which increase in scale as the system adjust toward equilibrium. During fall, the SPDF decreases considerably, but the offshore extent of the area of higher activity is maximum. The interaction of the flow with major topography perturbations seems to strongly control the position of the fronts. Off Oregon, for example, high values of SPDF in 2001 are found inshore of the pinnacles of the Heceta Bank complex (44.2N) during spring, but move over and seaward of the pinnacles during summer. Mooring observations show that the coastal jet moves seaward of the pinnacles over a period of ten days in early July during a strong upwelling favorable wind event. A similar offshore shift is observed in the daily GOES-derived SST fronts position. Flow topography interactions in the vicinity of topography perturbations are investigated in more detail using a numerical model.

Dudley’s presentation was titled “The dispersion characteristics of westward propagating sea surface height variability.”

Abstract:

The accuracy and 12-year duration of the merged TOPEX/POSEIDON, ERS-1, ERS-2 and Jason altimeter datasets have allowed detailed investigations of westward propagating sea surface height (SSH) variability with high spatial resolution throughout the world ocean. Outside of the equatorial waveguide, analyses of the altimeter data in the space-time domain have consistently found that the observed propagation speeds are faster than predicted by the

classical theory for extra-tropical Rossby waves. In this study, SSH variability along a variety of extra-tropical latitudes is examined in the zonal wavenumber-frequency domain to investigate the dispersion characteristics of westward propagating SSH variability. The resulting spectra are sorted according to a nonlinearity parameter computed from hydrographic data and the standard deviation of SSH variability. It is found that the westward propagation in regions of higher nonlinearity tends to be nondispersive over the range of wavenumbers resolved by the SSH fields computed from the merged altimeter datasets. The results are compared with predictions from theories that have recently been proposed to explain the discrepancies between the observations and the classical linear waves.

**April 25-29:** CIOSS Fellow Dudley Chelton attended the European Geophysical Union (EGU) Meeting in Vienna and gave a presentation titled "The dispersion characteristics of westward propagating sea surface height variability."

**Abstract:**

The accuracy and 12-year duration of the merged TOPEX/POSEIDON, ERS-1, ERS-2 and Jason altimeter datasets have allowed detailed investigations of westward propagating sea surface height (SSH) variability with high spatial resolution throughout the world ocean. Outside of the equatorial waveguide, analyses of the altimeter data in the space-time domain have consistently found that the observed propagation speeds are faster than predicted by the classical theory for extra-tropical Rossby waves. In this study, SSH variability along a variety of extra-tropical latitudes is examined in the zonal wavenumber-frequency domain to investigate the dispersion characteristics of westward propagating SSH variability. The resulting spectra are sorted according to a nonlinearity parameter computed from hydrographic data and the standard deviation of SSH variability. It is found that the westward propagation in regions of higher nonlinearity tends to be nondispersive over the range of wavenumbers resolved by the SSH fields computed from the merged altimeter datasets. The results are compared with predictions from theories that have recently been proposed to explain the discrepancies between the observations and the classical linear waves.

**April 26:** Ted Strub submitted supplemental proposal to CIOSS 3<sup>rd</sup> year omnibus proposal (3 more projects).

**April 27:** Amy Vandehey sent a Periodic Report to NESDIS (Eric Bayler and Mark DeMaria).

**April-May RESEARCH DIRECTIONS:** CIOSS efforts expanded within two NOAA initiatives: (1) The Research-to-Observations (R2O) project led by Stan Wilson (NESDIS); and (2) the GOES-R Risk Reduction (GOES-R3) research led by Paul Menzel (NESDIS). Supplemental proposals have been submitted for four R2O projects concerning improved wind fields for operational use, specifications for ocean color Climate Data Records and evaluation of re-engineering plans for the next ocean color cal/val buoys. A supplemental proposal is being prepared by members of the COAST team for GOES-R3 projects, to be directed by Curt Davis in CIOSS and to include CIOSS Principal Investigators at OSU, NESDIS and other academic and federal institutes. Curt visited CIOSS May 9-10 to work on the proposal and make further plans for his move to Corvallis in June.

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**May 2:** Amy Vandehey met with Alicia Lyman-Holt to find additional outreach opportunities for CIOSS.

**May:** Recent progress on the Oceans and Human Health project: “Oceans and Human Health: Optical tagging and tracking of water masses for prediction of human health hazards.” PIs: Peter Strutton (OSU) and Michelle Wood (UO). Michelle reports that:

A toxic phytoplankton bloom is currently occurring off the Oregon coast. Michelle Wood's group plans to sample this event on a cruise later this month.

Last month, Michelle and two students from the University of Oregon visited the laboratories of Mary Silver and Raphael Kudela at the University of California at Santa Cruz where they learned methods for collecting samples and detecting domoic acid in seawater, suspended particulates and animal tissues. These techniques will be combined with phytoplankton sampling and sampling for saxitoxin to provide data on the extent to which phytoplankton blooms that carry toxins can be detected and/or predicted using remote sensing.

**May:** The first meeting of the Executive Board for CIOSS scheduled for May 25-26 was postponed due to scheduling conflicts until late summer with the date TBD. The Board will meet to review progress of CIOSS in its first two years, and to make suggestions of what needs to be changed or added before the major review about two years from now. The goal is to get a consensus on a fairly specific and realistic list of objectives and milestones to accomplish over the next two years.

**May:** Updates from CIOSS Fellow Alexander Ignatov at NOAA:

**NESDIS 3<sup>rd</sup> generation ocean aerosol algorithm employed at EUMETSAT with the Spinning Enhanced Visible and Infra Red Imager (SEVIRI) onboard Meteosat Second Generation (MSG-1; renamed Metosat-8).** The 3<sup>rd</sup> generation NESDIS aerosol algorithm currently operational with AVHRR/3 onboard NOAA-16 and -17 has been implemented with the Meteosat-8/SEVIRI data at EUMETSAT, Germany (Drs. J. Schmetz/M. Koenig), Royal Meteorological Institute, Belgium (Drs. S. DeWitte/B. De Paepe), and Imperial College, UK (Dr. H. Brindley). Dr. Ignatov traveled to EUMETSAT from 10-23 April 2005, by their invitation, to assist with implementation and testing of the NESDIS algorithm. He also gave an invited one hour talk “Aerosol retrievals from AVHRR and MODIS: Lessons for SEVIRI” which was attended by over 40 EUMETSAT staff members and consultants.

**AVHRR Calibration paper published.** Paper titled “The usefulness of in-flight measurements of space count to improve calibration of the AVHRR solar reflectance bands” by A. Ignatov, C. Cao, J. Sullivan, R. Levin, F. Wu, and R. Galvin published in *JTech*, **22**, 180-200. Space counts are measured in all AVHRR bands, but currently they are used for calibration of only thermal bands. This paper explores potential use of space count data to constrain the calibration offset in the visible bands, and emphasizes the need for additional quality control of AVHRR reflectances.

**May 9:** Amy Vandehey sent a Periodic Report to NESDIS (Eric Bayler and Mark DeMaria).

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**May 13-19:** Revised 5 year plan with signatures (plus cover letter-dated 051205) sent by e-mail to Marie Colton, Al Powell, Eric Bayler, Marilyn Moll, and Kathy LeFevre.

**May 17:** Marilyn Moll sent revised CIOSS 5-year plan to NOAA's Grants Management Division.

**May 20:** Amy sent a Periodic Report to NESDIS (Eric Bayler and Mark DeMaria).

**May 20:** Curt Davis' Technical Support Supplemental Proposal was submitted through NOAA Grants.gov. Had problems with the submission process, possibly because of high user traffic.

**May 23-24:** Davis proposal did go through (7 times!) to Grants.gov. Finally got the situation figured out after talking with the Grants.gov and NOAA Technical Help Desks. Final tracking number to use is: GRANT00025192. The Agency Tracking number that was assigned is: 2010039.

**May 26-27:** Finalized CIOSS logo choices.

### **May-July: CIOSS RESEARCH UPDATE from Fellows located at COAS:**

During its first 2 years, the CIOSS strategy has been to use its core funding to hire post-docs to work on key CIOSS Research Themes.

#### **Initially, three post-docs were hired:**

**Iain MacCallum** finished two years of work with Ricardo Letelier in June. Iain collated the in-situ and satellite optics data for cal/val activities, as part of the GOES-R3 activities that are now beginning.

*Significance:* Ocean color algorithms used in coastal waters (Case II) are more problematic than those used in the clearer open ocean waters (Case I). In situ optical measurements have been made off Oregon during cruises in a number of programs over the past years.

Developing a data set of collocated satellite and in situ measurements in coastal regions requires a great amount of effort but should be invaluable in evaluating alternative algorithms in coastal waters of upwelling systems found in many regions of the global ocean.

*CIOSS Research Theme 1:* Satellite Sensors and Techniques

**Guang Guo** is finishing his first year, working with Jim Coakley to create a matched data set of AVHRR radiances and in situ surface radiation measurements from research cruises.

These will be used to formulate and validate algorithms to parameterize radiation at the surface of the ocean from satellite data.

*Significance:* Estimates of surface radiation at the ocean's surface provide one of the driving terms in the heat budget of the ocean.

*CIOSS Research Theme 1:* Satellite Sensors and Techniques

*CIOSS Research Theme 2:* Ocean-Atmosphere Fields and Fluxes

**Paul Choboter** is nearing the end of his two years, working with John Allen and Roger Samelson. Paul has investigated upwelling systems, such as the California Current, using analytic models and the numerical ocean circulation model, run at NRL by John Kindle's group (one of the original "partners" of CIOSS). Paul is presently looking at the relationship

between the variability of alongshore surface slopes (that could be estimated from altimeter data) and the strength of the poleward undercurrent.

*Significance:* Analytic solutions provide one test of numerical model fields, which need to be evaluated as a step leading to data assimilation. Once there is faith in the model, it can be used to explore the dynamics of poorly understood ocean features, such as the ubiquitous poleward undercurrents found in all eastern boundary currents.

*CIOSS Research Theme 3: Ocean-Atmosphere Models and Data Assimilation*

### **Three new post-docs have joined CIOSS during May-July:**

**Hai-Ying Jiao** is working with Mike Freilich. There are two thrusts to this work. First, Hai-Ying is using QuikSCAT data to evaluate the vector winds from WindSat, within overlapping swaths from the two different types of wind sensors (an active radar scatterometer vs a passive polarimetric microwave radiometer). When this evaluation is complete, Hai-Ying will join the efforts of Mike Freilich, Paul Chang (NESDIS) and colleagues elsewhere to evaluate methods of constructing wind fields with higher spatial resolution, perhaps with combinations of the two sensors. The increased resolution is needed in the coastal ocean, as is the reduction in the gap between the coast and the first usable data.

*Significance:* Winds are poorly known on smaller spatial scales in the ocean. In the coastal ocean, the presence of land can cause amplifications of mesoscale variability, with strong wind stress curl. These small-scale features may be important for local upwelling and changes in the circulation. Increasing the horizontal resolution and reducing the gap next to the coast in remotely-sensed winds is a difficult but necessary problem.

*CIOSS Research Theme 1: Satellite Sensors and Techniques*

*CIOSS Research Theme 2: Ocean-Atmosphere Fields and Fluxes*

**Byoung-Ju Choi** has come from Rutgers to join the team of John Allen, Gary Egbert and Bob Miller, working on the assimilation of radar and altimeter data into coastal ocean circulation models. Techniques such as this will be needed in the coastal observing and modeling systems planned for the U.S. coastal regions as part of the IOOS (Integrated Ocean Observing System) program.

*Significance:* The IOOS coastal observing systems will undoubtedly involve modeling of the circulation, assimilating the available observations to produce more uniform fields required for various applications. Coastal radars are expected to provide estimates of surface currents in all regions of the U.S. coastline, and thus are obvious elements of the assimilated data. Altimeters estimate coarser fields of surface height, providing data offshore of the region seen by the radars. Altimeters cannot be used in the region within 10-20 km of the coast, where the radars provide the highest resolution. Thus the combination is the logical first step in constraining coastal models.

*CIOSS Research Theme 3: Ocean-Atmosphere Models and Data Assimilation*

**Martin Saraceno** has come from Argentina, by way of France, to work with Ted Strub and Mike Kosro on methods of producing fields of surface velocity from altimeter, scatterometer and coastal radar data. The resulting velocity fields will be used to investigate the mesoscale circulation in the California Current.

*Significance:* As described in the previous project, the combination of the coarser altimeter surface height fields offshore (where spatial scales of circulation features are larger) and higher resolution surface velocity fields closer to the coast (where spatial scales are smaller)

is a natural combination. Velocities estimated from the altimeter height fields are geostrophic, lacking the influence of the surface winds. Scatterometer wind fields can provide this component, making the satellite-derived surface velocities compatible with the radar surface velocities. A number of problems must be overcome with regard to sampling and scales of resolution, before the surface velocity fields produced by this combination can be analyzed with confidence.

*CIOSS Research Theme 1: Satellite Sensors and Techniques*

*CIOSS Research Theme 2: Ocean-Atmosphere Fields and Fluxes*

*CIOSS Research Theme 4: Ocean-Atmosphere Analyses*

**May-July: CIOSS OUTREACH UPDATE from Fellows located at COAS:**

CIOSS partnered with Hatfield Marine Science Center (HMSC) in Newport to bring Chris Moore from UW/PMEL to demonstrate a 3-D projection system that can be used to show 3-D surveys of the ocean, combining satellite fields with in-situ data. This technology is under consideration for public displays at HMSC, along with other types of interactive technology. Chris demonstrated the system for those working in the public wing of HMSC and then at the annual SeaFest celebration, held at HMSC on June 25, 2005.

*Significance:* Educating the public, with regard to the science done by NOAA and University research scientists is an important activity. This is especially true in the coastal ocean, as the U.S. is planning to invest a considerable amount of effort and funding to build a coastal ocean observing system. The public wing of HMSC has a long history of public education on topics of marine science. It also offers a “laboratory” in which to study how best to introduce scientific material to the public. This event will offer an opportunity to evaluate the public response to a new technology that may literally open the ocean to the public view, during an annual celebration of the ocean at HMSC.

*CIOSS Research Theme 5: Outreach*

**June RESEARCH UPDATE: Update on NOAA’s Oceans and Human Health initiative:**

**“Oceans and Human Health: Optical tagging and tracking of water masses for prediction of human health hazards.”** PIs: Peter Strutton (OSU) and Michelle Wood (UO) provided this update on harmful algal bloom and field efforts.

In April, Michelle Wood and two students from the University of Oregon visited the laboratories of Mary Silver and Raphael Kudela at the University of California at Santa Cruz where they learned methods for collecting samples and detecting domoic acid in seawater, suspended particulates and animal tissues. In late April and early May, the Oregon Department of Agriculture detected high levels of domoic acid in coastal razor clams and mussels. Domoic acid is a neurotoxin produced by the diatom *Pseudonitzschia*. Harvesting of razor clams and mussels has been closed since May and the ODA continues to monitor toxin levels in coastal shellfish.

In May-June, Peter Strutton and Michelle Wood (funded under NOAA's OHHI) obtained samples from ~50 stations off the coast of Oregon and northern California. These data were collected courtesy of Bill Peterson and his group at NOAA's Northwest Fisheries Science Center in Newport, OR. These samples will be analyzed in conjunction with satellite physical and ocean color data, as well as shore-based radar measurements of surface currents. The goal is to determine the origin and trajectory of the bloom. In order to map the

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Pseudonitzschia bloom that is presumably the cause of the domoic acid accumulations, in order to determine the origin and trajectory of the bloom.

**June 2-3:** CIOSS Director Ted Strub attended the Cooperative Institute Directors Meeting in New York, hosted by CREST. The Administrator's portion of this meeting was postponed to October 26 and 27, 2005 because of scheduling conflicts.

**June 6:** Curt Davis from ONR joined OSU as a new Professor (Senior Research). Curt and Mark Abbott are leading the team known as COAST (Coastal Ocean Applications and Science Team) This team is defining the applications and specifications of a new sensor that will fly on the next generation of geostationary satellites (presently called GOES-R) - the Hyperspectral Environmental Suite - Coastal Waters imager (HES-CW).

**June 14:** Amy Vandehey sent a Periodic Report to Eric Bayler and Mark DeMaria and posted it on the CIOSS website.

**June 20-24:** Ted Strub presented a talk at the ASLO Meeting in Santiago de Compostela, Spain entitled, "Satellite Estimates of Eddy-Mediated Offshore Transports in Eastern Boundary Currents".

**June 20-27:** Amy Vandehey got help from Craig Risien with the CIOSS website. There was some discussion with Curt Davis about what he wanted the section that highlights COAST activities to look like. We worked with Dudley to get the final version of the CIOSS logo to replace the COAS logo per OSU.

**June 25:** CIOSS partnered with HMSC in Newport to bringing in Chris Moore from UW/PMEL to demonstrate a 3-D projection system that can be used to show 3-D surveys of the ocean at annual SeaFest celebration. This technology is under consideration for public displays at HMSC, along with other types of interactive technology.

**June 29:** Amy Vandehey turned in the CIOSS Year 2 Annual Progress Report to Eric Bayler, Kathy LeFevre, Marilyn Moll, Al Powell, and Mark DeMaria. Deadline was July 1.

**July 5:** Amy Vandehey participated in NOAA Grants Online Pilot Study with Pat Hawk from OSPRC.

**July 13-14:** Several CIOSS Fellows, colleagues and students attended and gave presentations at the NOAA/NESDIS Cooperative Research Program Second Annual Science Symposium: Satellite Calibration and Validation in Wisconsin (CIMSS).

**July:** CIOSS welcomed visiting scientists Dick Reynolds and Laury Miller to work with Dudley Chelton, Ted Strub, and other CIOSS fellows on specific research projects and to look more generally at how interactions with NOAA research scientists can be enhanced by visits—both short and long—to CIOSS. The reports from these visits were posted on the CIOSS web site.

**July:** CIOSS Administrative Specialist Amy Vandehey attended an Excel and PowerPoint workshop offered through the Forestry Department as part of her ongoing professional development.

**Four meetings/workshops were held in August and September in Corvallis:**

- CIOSS held the [Ocean Color Climate Data Record \(CDR\) Workshop](#) in Corvallis on August 11 and 12. The aim of the workshop was to gather participants, representing both users and producers of ocean color variables, to help define science applications and requirements, and identify ocean color CDRs in support of NOAA's mission. Presentations made at the meeting were posted on the CIOSS web site.

- A meeting of the CIOSS Executive Board was held on August 30 and 31. In approximately one year, CIOSS will go through a review to determine if it will be renewed for a second five-year period. This meeting reviewed major activities at CIOSS and made recommendations to CIOSS and NOAA/NESDIS to help prepare more completely for the review a year from now. Those recommendations are summarized in a short meeting report that were posted on the CIOSS web site.

- The [COAST Meeting #3](#) was held September 7 and 8 in Corvallis. The meeting objectives were to: review the status of HES procurement and HES-CW requirements; overview the Risk Reduction Proposal and Plans; initiate planning for risk reduction activities; and develop an initial plan for the September 2006 Monterey Bay experiment. Presentations made at the meeting were posted on the CIOSS web site.

- A meeting of the CIOSS Working Groups was held September 8 and 9 in Corvallis. The 4 working groups include Vector Winds, Dynamics, Products and Ecosystems (COAST). The goal of the meeting was to allow the working groups to meet and make progress on their specific action items. Summaries of the working group discussions were posted on the CIOSS web site.

**September** - Paper appeared in Geophysical Research Letters:

“Error Estimates for Assimilation of Satellite Sea Surface Temperature Data in Ocean Climate Models,” James G. Richman, Robert N. Miller and Yvette H. Spitz

**September** - Paper submitted to Geophysical Research Letters:

“Flow-topography interactions in the northern California Current System observed from geostationary satellite data,” by Renato M. Castelao, John A. Barth and Timothy P. Mavor.

**September 6:** Amy Vandehey sent the Curt Davis \$1.5 Million per year proposal (GOES-R3) to Paul Menzel on e-mail (10 subprojects). We were not yet able to submit through Grants.gov because we have not yet received a number for FY2006 funds.

**September 12:** CIOSS Fellow Dudley Chelton attended the European Meteorological Society Meeting in Utrecht, The Netherlands and gave a presentation entitled "The Impact of Sea Surface Temperature Specification on Surface Winds in Numerical Weather Prediction and Climate Models".

**September 14-19:** CIOSS Fellow Dudley Chelton visited the Royal Netherlands Meteorological Institute in Utrecht, The Netherlands and gave a seminar entitled, "The Impact of Sea Surface Temperature Specification on Surface Winds in the ECMWF Operational Model". The same seminar was given September 16 at the European Centre for Medium-range Weather

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Forecasting in Reading, England and September 19 at the United Kingdom Meteorological Office in Exeter, England.

**September 16-17:** CIOSS Fellow Bob Miller participated in the eighth annual "Case Studies in Bayesian Statistics" workshop at Carnegie Mellon University. The series of workshops -- Case Studies in Bayesian Statistics at Carnegie Mellon University -- is unique in devoting an entire meeting to extended presentation and discussion of scientific investigations in which statisticians play central roles within integrated, cross-disciplinary teams. Bob was invited to present discussion of the case study:

"An Assessment of Climate Change in the Ocean, Mixed-Layer Depth, and Subjective Likelihood," by Ana Rappold, Michael Lavine and Susan Lozier. The paper and discussion will be published in the journal "Bayesian Analysis."

**September 18-21:** CIOSS Fellow Pete Strutton attended the University of Washington's Program on Climate Change Summer Institute, held in Leavenworth, WA. Strutton gave a presentation entitled, "What are the impacts of El Nino on the carbon cycle?" This meeting was part of a program focused on the relationship between El Nino and climate change.

**September 20-23:** Ted Strub attended a Coastal Carbon Cycling meeting in Boulder, CO.

**September 26:** Amy Vandehey sent a Periodic Report to Eric Bayler and Mark DeMaria and posted it on the CIOSS website.

**September 27-30:** A number of CIOSS Fellows and their students attended the annual Eastern Pacific Ocean Conference (EPOC), held at Fallen Leaf Lake, California, during September 28-30.

Renato Castelao, student of CIOSS Fellow Jack Barth, gave a presentation entitled, "Sea-surface temperature fronts in the California Current System: Observations from geostationary satellite." Timothy Mavor (NESDIS) was a co-author.

Fellows Michael Freilich, Dudley Chelton and Curtiss Davis also gave presentations in a session on "Satellite Remote Sensing Primer for the New Millennium" which was co-chaired by CIOSS Director Ted Strub. Their presentations were titled, "Microwave remote sensing of ocean surface wind speed and directions: accomplishments, challenges and predictions" (Freilich), "Summertime influence of sea-surface temperature on the wind stress field over the California Current" (Chelton) and "Monitoring the coastal ocean from geostationary orbit" (Davis).

Posters were also presented by CIOSS Fellows and their students: "A high resolution scatterometer-based climatology of wind-stress and wind-stress curl over the California Current, 1999-2005" (Craig Risien, student working with Dudley Chelton);

"Satellite-derived climatology and interannual variability in surface ocean fields along the Pacific Northwest" (Roberto Venegas, student working with Ted Strub);

"Integration of oceanographic information off the Oregon and Washington coasts in fisheries management: Can we define 'ocean fish habitats'?" (Maria Jose Juan Jorda, student working with Jack Barth);

"Bioacoustical analysis of zooplankton distributions during mesoscale surveys in the northern California Current System," Stephen D. Pierce, John A. Barth, William T. Peterson, and Timothy J. Cowles.

**October:** CIOSS fellows Pete Strutton (COAS) and Michelle Wood (UO) have received some publicity for their work on Harmful Algal Blooms (HABs). A press release by Mark Floyd at OSU received coverage on Eugene TV and radio, and in several Oregon newspapers. The goal of their project, funded by NOAA's Oceans and Human Health Initiative (OHHI), is to identify and track blooms of toxic phytoplankton species using primarily satellite data. This would serve as an early warning system for coastal managers and have applications for Oregon's commercial and recreational shellfish harvests.

**October:** A collaborative effort between Renato Castelao, CIOSS Fellow Dudley Chelton and Tim Mavor at NESDIS was in progress, which is to use high resolution sea-surface temperature gradient fields from the GOES satellite to redo the analysis Chelton did on the influence of sea surface temperature on the wind stress field over the California Current using data from AMSR-E.

**October:** David Foley, Director of the West Coast CoastWatch node, worked with CIOSS Fellow Dudley Chelton and his student, Craig Risien, to transition to CoastWatch an interactive web site that allows users to access a global, 1 degree wind climatology based on QuikSCAT data. This product was developed by Craig Risien for his MS thesis in the Marine Resource Management program at COAS. This is the first of several projects that CIOSS hopes to contribute to the CoastWatch site.

**October 2-7:** CIOSS Fellows Pete Strutton and Michelle Wood, and Michelle's student, Brittany Scott, attended the 3rd Symposium on Harmful Algae in Pacific Grove, California.

**October 10-15:** CIOSS Director Ted Strub attended the CLIVAR workshop on the South Pacific, held in Concepcion, Chile during October 10-15. The purpose of the workshop was to develop plans for research intended to examine climate variability in the South Pacific. Ted presented a summary of past, present and future satellite capabilities that can be used in these studies. Ted and several other CIOSS/COAS oceanographers are involved in plans for a project called VOCALS, which is a coupled atmosphere and ocean study that will focus on the marine stratus cloud deck off southern Peru and Northern Chile, with field-work in October 2007. After the workshop, Ted met with several of the Chilean and Peruvian scientists to design a coastal component to VOCALS, to look at the influence of the coastal region (both ocean and atmosphere) in influencing the atmospheric and oceanographic characteristics farther offshore under the stratus deck. The role in the coastal ocean and land in producing aerosols and in changing the ocean farther offshore in ways that may affect aerosol production is the primary link between the coast and the region farther offshore.

As part of the South Pacific CLIVAR meeting, a separate working group was created to advance a program called "GRASP" (GOOS Regional Alliance for the Southeast Pacific).

The working group was led by Rodney Martinez (Ecuador) and is intended to unite Colombia, Ecuador, Peru and Chile in a GOOS Regional Alliance. Plans for this alliance were developed and these will be presented at the next International GOOS meeting by Rodney Martinez. Ted Strub attended this working group and showed the SST fields and frontal positions from the geostationary satellite that Dave Foley is making available (experimentally) on his CoastWatch/OceanWatch web site. Dave is also making other products available for the region off western South America. The four South American countries have a well developed collaborative structure on other oceanographic projects, including annual coordinated hydrographic cruises and a system of tide gauges (some with automated reporting) that has been recently upgraded to form an extensive system stretching from Colombia to southern Chile. This established, international alliance represents a good opportunity for development of a pilot observation system off western South America, in collaboration with CoastWatch/OceanWatch and CIOSS.

**October 12:** Conference call with CI administrators to pin down logistics for the NY meeting. Need to bring 20 copies of the NOAA Disclaimer to the meeting. This is a reminder that when papers are submitted from CIOSS-supported work, authors need to include both acknowledgements to CIOSS for support as well as a disclaimer that says the “opinions” expressed are those of the authors and not NOAA.

**October 13:** Amy Vandehey sent an e-mail to Molly Phipps, Shawn Rowe and Jon Luke asking for summaries for SMILE and the HMSC pilot program to put on a poster focusing on CIOSS outreach. Ted Strub submitted an abstract for a meeting held in Italy in March 2006. We may also put together another poster that is about CIOSS in general.

**October 26-27:** CIOSS Administrative Specialist and Grants Accountant, Amy Vandehey and Carol Wallace respectively, attended a Cooperative Institute (CI) Administrator's Meeting held at CREST in New York on October 26-27. This meeting provided an opportunity for the CI Administrative personnel to meet and become more familiar with the structure of other institutes. In addition, common issues, such as CIOSS' upcoming 5-year formal review, were discussed. Action items that came out of the meeting discussions included improved communications on both the CI and NOAA sides, ways to make proposals move more quickly through the Grants Management Division, and the sharing of an example of the new annual report format. Mark DeMaria posted presentations and action items from the meeting on the web.

**October 31:** Renellys Perez, a student working with CIOSS Fellow Bob Miller, successfully defended her doctoral dissertation: Numerical and Assimilative Studies of the Equatorial Pacific Cold Tongue. CIOSS Fellows Dudley Chelton and John Allen were on her committee. The following is a short summary of her dissertation:  
A four-dimensional multivariate data assimilation scheme was developed with the goal of obtaining a better understanding of surface mixed layer temperature balance in the cold tongue on interannual to intraseasonal timescales during August 1999 to July 2004. Using a reduced state space Kalman filter, the assimilation scheme combines a nonlinear general circulation model driven by QuikSCAT satellite winds with Tropical Atmosphere Ocean dynamic height anomalies. Assimilation improved the interannual and intraseasonal variability of sea surface height and the seasonality, zonal structure, spectral properties, and phase propagation of TIWs. Flaws in the model mean state and seasonal cycle limited the

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ability of the anomaly-for-anomaly assimilation scheme to improve the surface mixed layer temperature balance in the eastern equatorial Pacific. Future assimilation experiments will need to resolve these issues by using better numerical models, applying bias-correction algorithms, improving the heat flux specification, or constructing forecast error models that incorporate heat flux errors.

### **November** - Peer-Reviewed Papers (in press and in progress):

Flow-topography interactions in the northern California Current System observed from geostationary satellite data, by Renato M. Castelao, John A. Barth and Timothy P. Mavor. *Geophysical Research Letters*, in press.

Sea-surface temperature fronts in the California Current System from geostationary satellite observations, by Timothy Mavor, Renato Castelao, John Barth and Laurence Breaker. To be submitted to *Journal of Geophysical Research*.

Upwelling around Cabo Frio, Brazil: The importance of the wind stress curl, by Renato Castelao and John Barth. To be submitted to *Geophysical Research Letters*.

**November 1:** CIOSS Fellow Dudley Chelton presented the seminar, ‘Summertime influence of sea surface temperature on the wind stress field over the California Current System’ as part of the Physical Oceanography Seminar series at Oregon State University.

**November 1:** Received new FY06 opportunity number from Kathy LeFevre, the one we had been waiting for to submit the \$4.5 million GOES-R3 proposal from Curt Davis.

**November 1-3:** CIOSS Fellow Pete Strutton and Hemantha Wijesekara attended the 2nd workshop on Autonomous Lagrangian platforms and Sensors (ALPS-II) in Skamania Lodge, WA. See <http://optics.dmc.maine.edu/ALPS/>

**November 4:** Amy Vandehey sent a Periodic Report to Eric Bayler, Mark DeMaria, Al Powell, Ingrid Guch, and Mitch Goldberg. All reports are now called “Periodic Reports” to avoid confusion with “weekly” reports. They come out about 1 per month, and are then posted on the website under “Periodic Report to NESDIS” and “Archived Reports”.

**November 7:** Have new FY06 opportunity number, but realized that we cannot submit a proposal that spans 2 cooperative agreement periods of performance. We had to modify the Davis proposal by taking out the requested 3<sup>rd</sup> year (FY08) of funding. Since the proposal has been delayed, the start date was changed from October 1, 2005 to April 1, 2006 to coincide with CIOSS’ annual dates.

**November 8:** Amy Vandehey received a list of action items from the CI meeting from Marilyn Moll. Some items had already been completed, while others were still in process.

**November 15-16:** CIOSS Fellow Dudley Chelton presented an invited 2-day short course on Microwave Remote Sensing of the Ocean at Scripps Institution of Oceanography as part of the Physical Oceanography Research Division Distinguished Lecturer Series. Titles of the seminars presented include “Satellite altimeter observations of westward propagating sea

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surface height variability: Rossby waves or eddies?”, as well as the one given at OSU on November 1.

**November 28-29:** CIOSS Director Ted Strub attended the CICS 5-year review in Maryland. This will provide guidance for the CIOSS review, scheduled for sometime in Fall, 2006. Ted and Marilyn Moll discussed aspects of the review, which needs to be scheduled soon.

**November 28:** A CIOSS Supplemental Proposal was submitted to John Pereira to support the second year of COAST activities entitled, “COAST Science Support for GOES-R/HES for Imaging Coastal Waters” through Grants.gov.

**November 30:** A proposal was submitted to the GOES-R Risk Reduction Effort (Paul Menzel) for research by the COAST (Coastal Ocean Applications and Science Team), led by Curt Davis at CIOSS. This multi-institutional team is planning to collect hyperspectral optical data (in situ and aircraft) over a three year period at three locations, characteristic of different sites along the U.S. coast: off Monterey, California (2006); New Jersey and New York (2007); and the Gulf Coast (2008). These data sets will allow the team to simulate data that will be collected by the HES-CW (Coastal Waters imager) on GOES-R, in order to develop algorithms for various applications for HES-CW. The team is also providing guidance in the design specifications for HES-CW.

**December - Peer-Reviewed Papers by CIOSS Fellows and their students (published, accepted and submitted):**

O'Neill, L. W., D. B. Chelton, S. K. Esbensen and F. J. Wentz, 2005: High-resolution satellite observations of SST modification of the marine atmospheric boundary layer over the Agulhas Return Current. *J. Climate*, 18, 2706--2723. (July 2005 issue.)

Chelton, D. B., and F. J. Wentz, 2005: Global High-Resolution Satellite Observations of Sea-Surface Temperature for Numerical Weather Prediction and Climate Research. *Bull. Amer. Meteor. Soc.*, 86, 1097-1115. (August 2005 issue)

Samelson, R. M., E. D. Skillingstad, D. B. Chelton, S. K. Esbensen, L. W. O'Neill, and N. Thum, 2006: A note on the coupling of wind stress and sea surface temperature. *J. Climate*, accepted for publication.

Chelton, D. B., M. H. Freilich, J. M. Sienkiewicz, and J. M. Von Ahn, 2006: On the use of QuikSCAT scatterometer measurements of surface winds for marine weather prediction. *Mon. Wea. Rev.*, accepted for publication.

Maloney, E. D., and S. K. Esbensen, 2005: Buoy and satellite observations of intraseasonal variability in the tropical northeast Pacific. *Mon. Wea. Rev.*, submitted.

Zhang, C., M. Dong, H. H. Hendon, E. D. Maloney, A. Marshall, K. R. Sperber, and W. Wang, 2005: Simulations of the Madden-Julian oscillation by global weather forecast and climate models. *Clim. Dyn.*, submitted.

Chelton, D. B., M. G. Schlax and R. M. Samelson, 2006: Summertime influence of sea surface temperature on the wind stress field over the California Current System. *J. Phys. Oceanogr.*, submitted.

Castelao, R. and J. Barth, 2006: Upwelling around Cabo Frio, Brazil: The importance of the wind stress curl, by Renato Castelao and John Barth. *Geophysical Research Letters*, submitted.

Matheson, M.A., J.A. Coakley, Jr., and W.R. Tahnk, 2005: Multiyear AVHRR observations of summertime stratocumulus collocated with aerosols in the northeastern Atlantic. *J. Geophys. Res.*, submitted.

**December 1:** CIOSS Fellow Eric Maloney presented a seminar entitled “East Pacific Intraseasonal Variability” as part of the Physical Oceanography Seminar series at Oregon State University.

**December 1-2:** Remi Tailleux visited OSU for 2 days from the University of Reading in Reading, England. While at CIOSS, he gave two seminars: "Spiciness and Available Ocean Energetics" and "On the theory and observations of oceanic Rossby waves". The second seminar utilized satellite altimeter observations of westward propagating sea level variability. The primary purpose of Remi's visit was to present the results of his recent theoretical studies and to discuss his results with CIOSS investigators Dudley Chelton and Roger Samelson and OSU faculty member Roland de Szoeke.

**December 2:** CIOSS Director Ted Strub participated in the first quarterly Directors' teleconference call, initiated by Al Powell and run by the new head of CoRP, Ingrid Guch. This was a productive discussion of a number of topics, including the recently compiled document linking NOAA and NESDIS/STAR milestones. One of the most important action items is to comment on the interim CI Handbook.

**December:** CIOSS Fellow Mike Kosro's student, Brian Zelenke, presented his master's thesis defense entitled, “An Empirical Statistical Model Relating Winds and Ocean Surface Currents: Implications for Short-Term Current Forecasts” on December 2<sup>nd</sup>. Brian is moving to Cal Poly at San Luis Obispo, where he will continue to work with HF radar measurements of ocean currents.

#### ABSTRACT

An empirical statistical model is developed that relates the non-tidal motion of the ocean surface currents off the Oregon coast to forecasts of the coastal winds. The empirical statistical model is then used to produce predictions of the surface currents that are evaluated for their agreement with measured currents. Measurements of the ocean surface currents were made at 6 km resolution using Long-Range CODAR SeaSonde high-frequency (HF) surface current mappers and wind forecasts were provided at 12 km resolution by the North American Mesoscale (NAM) model. First, the response of the surface currents to wind-forcing measured by five coastal National Data Buoy Center (NDBC) stations was evaluated using empirical orthogonal function (EOF) analysis. A significant correlation of approximately 0.8 was found between the majority of the variability in the seasonal anomalies of the low-pass filtered surface currents and the seasonal anomalies of the low-pass filtered wind stress measurements. The U and the V components of the measured

surface currents were both shown to be forced by the  $\tau^y$  and  $\tau^x$  components of the wind-stress at the NDBC stations. Next, the NAM wind forecasts were tested for agreement with the measurements of the wind at the NDBC stations. Significant correlations of around 0.8 for  $\tau^y$  and 0.6 for  $\tau^x$  were found between the seasonal anomalies of the low-pass filtered wind stress measured by the NDBC stations and the seasonal anomalies of the low-pass filtered wind stress forecast by the NAM model. Given the amount of the variance in the winds captured by the NAM model and the response of the ocean surface currents to both components of the wind, bilinear regressions were formed relating the seasonal anomalies of the low-pass filtered NAM forecasts to the seasonal anomalies of the low-pass filtered surface currents. The regressions turned NAM wind forecasts into predictions of the seasonal anomalies of the low-pass filtered surface currents. Calculations of the seasonal cycle in the surface currents, added to these predicted seasonal anomalies, produced a non-tidal estimation of the surface currents that allowed a residual difference to be calculated from recent surface current measurements. The sum of the seasonal anomalies, the seasonal cycle, and the residual formed a prediction of the non-tidal surface currents. The average error in this prediction of the surface currents off the Oregon coast remained less than  $4 \text{ cm s}^{-1}$  out through 48 hours into the future.

Another of Kosro's students, Sheila O'Keefe, defended her master's thesis entitled, "Observing the Coastal Ocean with HF Radar" on December 7<sup>th</sup>.

#### ABSTRACT

Coastal-based high-frequency radar systems are an increasingly used tool for monitoring surface currents in the coastal ocean. These systems provide a spatial and temporal resolution not achievable with other methods. Typically, hourly maps of surface currents can be obtained on a 2km grid extending approximately 50km from shore. Generating these maps from the data presents mapping challenges addressed in this thesis. The known geometric errors in HF radar current maps are reviewed. A new method of mapping coastal-based HF radar measurements is developed. One year of data from the Oregon coast and idealized radials representing different analytically-defined currents are used to evaluate mapping issues, comparing the new method with the traditional method. The new mapping method is applied to a deployment of two CODAR standard-range HF radar sites from May 8, 1996 through May 22, 1996. The sites were located at Bandon and Cape Blanco, Oregon. A nearby coastal wind station, an R/V Wecoma research cruise, a mooring and satellite-tracked drifters provide additional observations. Wind patterns during the study period included upwelling-favorable conditions, a relaxation event, a weak reversal and a strong reversal. Analysis of the data provides insight into coastal circulation during these varied wind conditions.

**December 6:** CIOSS Fellows Dudley Chelton and Eric Maloney gave presentations at the Fall Meeting of the American Geophysical Union in San Francisco, California entitled, "Satellite measurements of coupled ocean-atmosphere interaction" and "An Observational Study of East Pacific Intraseasonal Variability During Boreal Summer", respectively. The Fall Meeting provides an opportunity for researchers, teachers, students, and consultants to present and review the latest issues affecting the Earth, the planets, and their environments in space.

**December 6:** CIOSS Fellow Jim Coakley with Michael King and Marck Schoeberl, NASA Goddard Space Flight Center, co-convoked sessions at the Fall AGU meeting--Atmospheric Sciences: Discoveries from Space. Jim Coakley also prompted the organization of two other sessions: 1) Hydrology from Space, organized by Dennis Lettenmaier (U. Washington) and 2) Oceanography: Discoveries from Space, organized by Kathie Kelly (U. Washington) and Jim Yoder (U. Rhode Island). In addition, Guang Guo, a PostDoc supported in part by CIOSS, and Jim Coakley presented their findings in a poster at the Fall AGU meeting: "Surface and Space-based Estimates of the Surface Radiation Budget for the Northeastern Pacific".

**December 9:** Amy Vandehey sent a Periodic Report to Al Powell, Eric Bayler, Ingrid Guch, Mitch Goldberg, and Mark DeMaria electronically and posted it on the CIOSS website.

**December 13:** Mark Matheson, a PhD student supervised by CIOSS Fellow Jim Coakley, defended his thesis entitled, "Aerosol indirect radiative forcing over the northeastern Atlantic from AVHRR observations." A paper describing part of the work in this thesis was submitted for publication.

#### ABSTRACT

Advanced Very-High Resolution Radiometer 4-km data were collected over the northeast Atlantic for May-August, 1995-1999. Aerosol optical depth was retrieved in cloud-free pixels. In pixels containing clouds from only single-layered, low-level systems, a retrieval scheme that accounts for partly-cloudy pixels was used to retrieve: cloud optical depth, droplet effective radius, cloud altitude, pixel-scale fractional cloud cover, liquid water path and column droplet concentration. Mean aerosol optical depths from 1 degree by 1 degree latitude-longitude regions were associated with mean cloud properties in the same region for the same satellite overpass. Results were composited for 5 degree latitude-longitude regions. As aerosol optical depth increased, droplet radius decreased and column droplet number concentration and cloud optical depth increased, consistent with the aerosol indirect effect. In many regions, liquid water path decreased as aerosol optical depth increased, contrary to the trends expected for drizzle suppression. The simultaneous increase in aerosol and cloud optical depths with increasing fractional cloud cover might be mistaken for the aerosol indirect effect. The five-year data set was sorted into clean and polluted cases. Clouds in clean air had larger droplets and smaller cloud optical depths than clouds in polluted air, consistent with the aerosol indirect effect. Liquid water path increased as fractional cloud cover increased but no difference was found between clouds in clean and polluted air. Influences other than changes in aerosol burden may be controlling changes in liquid water. Observed changes in aerosol and cloud properties were used to estimate the aerosol indirect radiative forcing. Aerosol indirect forcing for overcast conditions was 1.4-2.2 times larger than the aerosol direct forcing for cloud-free conditions. To simulate threshold retrievals, which do not account for partial cloud cover in partly-cloudy pixels, radiances in pixels that had a fractional cloud cover greater than 0.20 were used to recalculate cloud properties assuming the pixel was overcast. The decrease in droplet radii and increase in cloud optical depths for a given change in aerosol optical depth were larger using threshold retrievals than when using partly-cloudy retrievals. Threshold retrievals lead to a slight overestimation of the aerosol indirect radiative forcing.

**December 13-19:** Ted Strub travelled to Washington, DC to attend a GLOBEC steering committee meeting.