

2006

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

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

Waliser, Duane E.; Murtugudde, Ragu; Strutton, Peter; Li, Jui-Lin.

Subseasonal organization of ocean chlorophyll: Prospects for prediction based on the Madden-Julian Oscillation. *Geophys. Res. Lett.*, Vol. 32, No. 23, L23602

<http://dx.doi.org/10.1029/2005GL024300> 03 December 2005

January: NESDIS CI Directors were asked by Ingrid Guch (CoRP Director) to compile a list of students associated with CIOSS along with their area of interest/title of projects. This was to facilitate travel between students and researchers between the CIs/CREST as well as to assist NOAA in picking the theme for the CoRP Science Colloquium in July 2006.

CIOSS/COAS Students and their area of interest/title of projects

Renato Castelao: Research topic - Sea surface temperature fronts in the California Current System from geostationary satellite observations. Partially funded by CIOSS and advised by Jack Barth.

<http://www.coas.oregonstate.edu/index.cfm?fuseaction=faculty.detail&id=233>

Wiley Evans: Thesis title - "Ecological and Chemical Responses to Tropical Instability Waves in the Equatorial Pacific". Advised by Peter Strutton. More information can be found at http://bioloc.oce.orst.edu/strutton/people_wiley.htm

Maria Jose Juan Jorda: M.S. Candidate in Marine Resource Management. Thesis title - "Integration of Oceanographic Information off the Oregon and Washington Coasts into West Coast Groundfish Ecology and Fisheries Management". Advised by Jack Barth and Jim Good.

<http://www.coas.oregonstate.edu/index.cfm?fuseaction=faculty.detail&id=262>

Julie Keister: Ph.D. candidate in Biological Oceanography. Thesis title is not set, but may be something like: "Effects of mesoscale circulation on zooplankton distributions in the northern California Current". Advised by Tim Cowles and Ted Strub.

<http://www.coas.oregonstate.edu/index.cfm?fuseaction=faculty.detail&id=263>

Anthony Kirincich: Research topic - Inner-shelf circulation along the central Oregon Coast. Paper - Wind-driven inner-shelf circulation off central Oregon during summer. (*JGR* v110 c10s03 doi: 10.1029/2004JC002611). Advised by Jack Barth.

<http://www.coas.oregonstate.edu/index.cfm?fuseaction=faculty.detail&id=266>

Sam Laney: Research topic - optical methods of assessing phytoplankton ecology. Please see his website (<http://oregonstate.edu/~laney/>) for more information about his research and publications. Advised by Ricardo Letelier.

Larry O'Neill: Thesis title - "Small-Scale Ocean-Atmosphere Interactions: Observations and Modeling of Atmospheric and Oceanic Responses ". Papers and presentations can be found in his CV, located on his web page, <http://numbat.coas.oregonstate.edu/~loneill> . Advised by Dudley Chelton.

Craig Risien: Thesis title - "A Satellite-Derived Climatology of Global Ocean Winds" and it can be accessed online at <http://numbat.coas.oregonstate.edu/cogow/>. Advised by Dudley Chelton.

Andrea Schuetz: Research deals with the assessment of cloud properties retrieved for partly cloudy imager pixels. She will be comparing the properties retrieved using a partly cloudy retrieval scheme to cloud properties derived from 250-m resolution MODIS observations. Advised by Jim Coakley.

<http://www.coas.oregonstate.edu/index.cfm?fuseaction=faculty.detail&id=704>

Emily Shroyer: Currently, she does not have a thesis topic. She is working with Jim Moun, studying bottom propagating bores off the Oregon Coast and is interested in the energetics associated with these events.

<http://www.coas.oregonstate.edu/index.cfm?fuseaction=faculty.detail&id=636>

Angel White: Ph.D. Candidate in Biological Oceanography. Thesis title - "Nitrogen Fixation in Summertime Surface Waters of the Gulf of California". Advised by Ricardo Letelier and Yvette Spitz.

<http://www.coas.oregonstate.edu/index.cfm?fuseaction=faculty.detail&id=322>

January 6: Strub asked CIOSS Fellows for short proposals for Year 4 projects, deadline January 20.

January 8: Received comments from Ingrid Guch regarding the GOES-R3 proposal. Curt answered those questions; Amy put the Word document back together with the PDF files and e-mailed the final, final version to Ingrid.

January 9: Amy began attending the winter term course OC 332, Coastal Oceanography, as part of her professional development.

January 9-13: CIOSS Director Ted Strub and many other researchers and students from OSU attended a NE Pacific (NEP) GLOBEC meeting in Seattle, WA this week. The meeting's first main objective was to provide project progress (status) reports to the scientific investigators involved in GLOBEC NEP synthesis, and to provide status reports on the online availability of data. The second major objective was to discuss future synthesis, including what kind of coordinated multi-project steps need to be undertaken in the next year to further NEP synthesis. During the meeting, Ted Strub stepped down as Chair of the NEP Executive Committee and Nick Bond was chosen as new Chair.

January 13: CIOSS Fellow Jack Barth's student, Anthony Kirincich, a Ph.D. Candidate Physical Oceanography, presented a seminar entitled, "Spatial and temporal variability of inner-shelf circulation along the central Oregon coast during summer".

Abstract:

The nature and variability of inner-shelf circulation along the central Oregon coast is examined using measurements obtained in water depths of 15 m during the summer of 2004. Although wind forcing and inner-shelf bathymetry are spatially uniform in the region, a comparison of velocity and pressure anomaly from 4 along-shelf locations reveal distinct differences in circulation. Upwelling circulation at the northernmost station, north of an offshore submarine bank, is similar to classic two-dimensional (2D) upwelling with bottom stress and acceleration balancing the along-shelf wind stress. Along-shelf velocities here are strong with large variations in magnitude and direction. In contrast, circulation at the southern 3 stations, all in-shore of the bank, is weaker and prone to large reversals under downwelling conditions. At these sites, the 2D balance is poor during upwelling winds and inclusion of the pressure gradient and nonlinear terms aids the along-shelf momentum balance. During downwelling conditions the 2D balance holds well at the southern sites, but poorly at the northern site.

Pressure anomalies are similar early in the season, but differences between the on-bank and off-bank stations grow over time, despite similar hydrographic conditions. An empirical orthogonal function analysis of pressure and along-shelf velocity finds two important modes. The first, explaining some off-bank but all on-bank variability, is associated with the local wind forcing. The second, matching density variations in the region, explains the bulk of the off-bank variability, and is similar to a weighted function of the local winds. Much of the temporal and spatial differences observed results from the large-scale upwelling circulation's encounter with the offshore bank. Due to flow-topography interactions, the on-bank stations are sheltered from the larger upwelling circulation offshore and to the north. A new, weak upwelling jet develops at the on-bank inner-shelf locations and strengthens to the south. These results agree favorably with previous outer- and mid-shelf studies conducted in the region, while offering new insight into interactions in the inner-shelf. The variability shown here has large ecological implications and begins to explain known along-shelf differences in onshore production in the region.

January 17: Natalie Perlin, who is partially funded by CIOSS and advised by CIOSS Fellows Roger Samelson and Eric Skillingstad, presented the following seminar: “Numerical study of idealized upwelling conditions off the Oregon coast using a coupled ocean-atmosphere model”.

January 20: Strub discussed plans for a combined NWS Training Workshop and Ocean Vector Winds Workshop with Ingrid Guch. Ingrid’s initial response was positive. Ted will send the details to Ingrid, Al Powell and Eric Bayler.

January 23: The proposal to fund FY06 GOES-R Risk Reduction activities for the HES-Coastal Water imager was submitted to NESDIS by Curt Davis. Activities of the multi-institutional COAST (Coastal Ocean Applications and Science Team) members will focus on a field experiment in Monterey Bay in Fall, 2006. Data from this field experiment will provide the first of three data sets designed for algorithm development and evaluation for the HES-CW sensor.

January 24: CIOSS Fellow Jim Coakley’s student Guang Guo gave a presentation entitled, “Surface measurements and satellite-derived estimates of surface radiative fluxes in the northeastern Pacific”.

January 24: Amy sent Periodic Report to Al Powell, Eric Bayler, Ingrid Guch, Mitch Goldberg, and Mark DeMaria electronically and posted it on the CIOSS website.

January 26: Craig Risien, a Master's degree student of CIOSS Fellows Jim Good and Dudley Chelton, defended his thesis in Marine Resource Management entitled, "A Satellite-Derived Climatology of Global Ocean Winds". Craig's electronic climatological wind atlas is being transitioned to the west coast CoastWatch site in Monterey.

ABSTRACT

A satellite-derived Climatology of Global Ocean Winds (COGOW) on a 0.5° latitude by 0.5° latitude grid is presented based on 5-years (August 1999 – July 2004) of measurements from the SeaWinds scatterometer that was launched on 19 June 1999 onboard the QuikSCAT satellite. SeaWinds is an active microwave radar that estimates wind speed and direction from measurements of electromagnetic backscatter from the wind roughened ocean surface. The accuracy of these wind estimates is equivalent to that of measurements by well-calibrated buoys. This five-year climatology provides the first high spatial resolution, observationally based, online atlas of global ocean winds. COGOW is a web-based interactive atlas from which users can retrieve climatological wind maps as well as wind statistics, both in tabular and graphic form, for any particular region of interest. The global coverage of these data provides valuable information about the wind statistics in the many regions of the world ocean that are sparsely sampled by ships and buoys.

An example of one of the anticipated uses of this climatology is presented in a case study of NOAA OR&R's involvement in the recovery of /Ehime Maru/, a Japanese training and fishing vessel that sank in 2001 off the island of Oahu. In addition, four wind phenomena observable within COGOW are discussed: the South Asian Monsoon, evidence of air-sea interaction over the Agulhas Return Current, gap winds in Central America, and corner accelerations south of Greenland as well as off the southern and northern tips of Madagascar. The possible utility of COGOW is discussed with regard to operational communities such as the U.S. and Canadian Coast Guard search and rescue teams as well as the scientific research community. Finally, recommendations for extensions that could be included in future versions of COGOW are made.

January 27: Maria Jose Juan Jorda and Angel White gave presentations as part of the COAS Student Seminar Series. Maria is a M.S. Candidate in Marine Resource Management, advised by CIOSS Fellows Jack Barth and Jim Good. The title of her presentation was, "Integration of Oceanographic Information off the Oregon and Washington Coasts into West Coast Groundfish Ecology and Fisheries Management" (see Abstract below). Angel is a Ph.D. Candidate in Biological Oceanography, advised by CIOSS Fellows Ricardo Letelier and Yvette Spitz. The talk she gave was entitled, "Nitrogen Fixation in Summertime Surface Waters of the Gulf of California".

Abstract:

"Integration of Oceanographic Information off the Oregon and Washington Coasts into West Coast Groundfish Ecology and Fisheries Management"
 Maria Jose Juan Jorda and John A. Barth

This work is an attempt to incorporate oceanographic information into fisheries management. To date, the use of oceanographic data in fisheries management has been minimal due to scarcity and the difficulty of accessing complete oceanographic datasets. Consequently, fish stocks are managed with limited knowledge about the habitat where fish live and incomplete understanding of what oceanographic conditions affect their populations.

This inadequate scientific knowledge among other factors has led to the management failure of the West Coast groundfish fishery. With the long term goal to improve the management of the groundfish fishery, this study assembles and merges oceanographic information off the Oregon and Washington coasts to investigate if there are particular ocean habitats associated with four different groundfish species with different life history. The fish data consist of NOAA NWFSC's West Coast Groundfish 2004 Survey and the oceanographic data are comprised of temperature, salinity, chlorophyll concentration, and ocean current velocity from a variety of sources (satellite sensors, conductivity-temperature-depth instruments, acoustic Doppler current profilers and high frequency radars located on the coast) from the earliest time possible to the year 2004. Climatological monthly means and standard deviations for each of the oceanographic variables have been computed at various depths for the cold regimes (1946-1977, 2000-2004).

The oceanographic and fish data are being organized in a GIS system, so that it may be combined with benthic habitat information. Work is in progress to carry out a statistical analysis between the oceanographic and fish data.

Jan 29 – Feb 2: CIOSS Fellow Eric Maloney and graduate student Larry O'Neill (student of CIOSS Fellow Dudley Chelton) presented papers at the AMS meeting in Atlanta. Eric Maloney's presentation is entitled, "10.10 Ocean-atmosphere interactions over the east Pacific warm pool associated with the boreal summer intraseasonal oscillation". Larry O'Neill's presentation is entitled, "Upper-ocean response to small-scale wind forcing in the Agulhas Return Current"

February 3: As part of the COAS Student Seminar Series, the students of 2 CIOSS Fellows gave presentations of their theses. Wiley Evans, advised by Pete Strutton, presented "Ecological and Chemical Responses to Tropical Instability Waves in the Equatorial Pacific".

ABSTRACT

Tropical instability waves (TIWs) are prominent intra-annual features in both the equatorial Pacific and Atlantic Oceans. Gradients in sea-surface temperature, air-sea carbon dioxide flux, nutrients, primary and export production, bacteria and higher trophic level consumers are all heavily impacted by these dynamic features. They have been proposed to be the dominant source of variability in the export of organic carbon, even greater than variability associated with El Nino/La Nina oscillations. This work elucidates the impact of TIWs by examining their role in modulating the concentration of macronutrients (nitrate, silicate and phosphate) in the upper ocean, and phytoplankton responses to these changes. Using an eight year record of biannual ship observations, individual cruise sections crossing TIWs were identified and composites were constructed for the longitude lines occupied by the Tropical Atmosphere Ocean (TAO) mooring array in the equatorial Pacific. Significant differences

exist between the composite TIW nutrient sections and their corresponding climatological means with the greatest enhancement of nutrients occurring in the central/western equatorial Pacific. However, the majority of lines show no significant differences from their climatologies. Examination of individual sections demonstrates that the chemical and ecological responses are determined by the portion of the TIW sampled. In considering the agreement between climatological mean conditions along the TAO lines and composite TIW sections, it would appear that TIWs play a large role in defining the mean conditions in the equatorial Pacific. This work advances our understanding of physical-chemical-biological interactions in this globally significant oceanic province.

Renato Castelao, advised by Jack Barth, presented “Jet separation at Cape Blanco: The importance of wind stress curl”.

ABSTRACT

Observations during summer off Oregon reveal that the coastal upwelling jet frequently separates from the coast at Cape Blanco. Despite its biological importance via increasing the area influenced by upwelled waters, the dynamical reasons for jet separation at Cape Blanco are still not well understood. Although coastline curvature is probably important in the separation from the cape, wind stress intensification near the cape could also play a significant role in the process. In order to explore the importance of wind intensification on separation, we use idealized numerical simulations with the Regional Ocean Modeling System (ROMS). The bottom topography is alongshore uniform with a continental shelf and slope, except where a cape with dimensions similar to Cape Blanco is imposed, and the model is implemented with open boundary conditions. The wind forcing in the basic case resembles the summer-averaged wind stress field in the region, including the wind stress curl.

Several simulations are run, varying the magnitude and the spatial scales of the wind intensification. In all cases the wind forcing is constant in time.

Results show that the wind intensification by itself, without imposing the wind stress curl, leads to jet separation, but on unrealistically long (90-100 days) time scales compared with observations. The strong positive wind stress curl close to the coast plays an important role in the dynamics near the cape, leading to separation on time scales (50-80 days) much closer to observations. These results point to the importance of forcing regional ocean models with spatially variable winds to accurately represent the circulation in the region.

February 3: A draft of the Year 4 Annual Omnibus Proposal was sent to Eric Bayler for comments.

February 8: The CIOSS Year 4 Omnibus Proposal was submitted to NOAA through Grants.gov. An electronic version was also sent to Eric Bayler, Ingrid Guch, Marilyn Moll, and Patty Mayo.

February 9: A meeting was held at the SMILE office with Molly Phipps, Ryan Collay, Cori Hall, Ted Strub and Amy Vandehey. Went over a draft version of the set-up for the Highschool Challenge in April (20-21) and made some comments and suggestions.

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February 10: CIOSS Fellow Jim Coakley's student Matthew Segrin, a M.S. candidate in Atmospheric Sciences, gave a presentation entitled, "Using Ship Tracks to Characterize the Effects of Haze on Cloud Properties" as part of the COAS Student Seminar Series.

ABSTRACT

1-km MODIS observations of ship tracks off the west coast of the U.S. are used to characterize changes in cloud visible optical depths, cloud droplet radii, cloud cover fraction, and column cloud liquid water amount as low-level marine clouds respond to particle pollution from underlying ships.

The study re-examines the finding of earlier studies based on AVHRR observations showing that when restricted to pixels overcast by low-level, single-layered cloud systems, the polluted clouds in the ship tracks had, on average, 15-20% less liquid water than the nearby uncontaminated clouds. In addition to using MODIS instead of AVHRR radiances, this new study uses a retrieval scheme that accounts for the effects of partial cloudiness within the 1-km pixels on the retrieved cloud properties. The new study also employs an improved automated track finding scheme that allows the selection of unpolluted clouds to be closer to the clouds identified as being polluted. Results obtained with the partly cloudy pixel retrieval scheme show that the pixel-scale cloud cover within the ship track is almost invariably greater than that found in the surrounding region containing the unpolluted clouds. In addition, when restricted to overcast pixels, as was done in earlier studies, preliminary results from the Terra MODIS indicate that cloud liquid water amount is just slightly less in the polluted than the nearby uncontaminated clouds. The liquid water amount appears to be constant regardless of the wavelengths of the channels used in the retrieval scheme. The discrepancy with the loss of liquid water found in the earlier study probably results from the limited sample of Terra observations examined thus far.

February 14-15: CIOSS Administrators Amy Vandehey and Carol Wallace attended a NOAA Grants Workshop in Seattle, WA. The conference provided workshops that offered valuable information regarding NOAA program objectives as well as changes in internal operations in relation to business processes that impact how to find, apply, award, administer, and close grants.

February 17: The CIOSS Year-4 Supplement - GLOBEC Year-2 Projects proposal was submitted through Grants.gov.

February 20-24: Many CIOSS Fellows attended and presented at the 13th Ocean Sciences Meeting, a joint meeting of ASLO, ERF, TOS and AGU, that was held in Hawaii.

March 1: Sent in revised 4th Year Omnibus Proposal documents, with comments and modifications from Eric addressed to Eric, Ingrid, Marilyn, and Patty.

March 3: Finished CIOSS Poster focusing on Outreach with Dave, Molly and Ted that Ted will take to the altimetry meeting in Venice.

March 6: Patty Mayo sent an e-mail on March 3 that the budget for the GLOBEC supplemental proposal was off by \$2, and that the total should match the funding memo sent by Beth Turner that was for \$333,209 (not \$333,211 as was sent through Grants.gov). The rounding

errors were found, and the revised documents were sent to Patty and Ingrid, including the Project Narrative, Budget Narrative, SF424A form, completed CD511 form and OSU F&A Agreement.

March 13-17: The Ocean Surface Topography Science Team meeting was held in conjunction with the Symposium on 15 Years of Progress in Radar Altimetry during the week of March 13-17. The Symposium addressed a wide range of topics, including High- and Low-Frequency Signals (within the 15-year record), the Cryosphere, Hydrology and Land Processes, Coastal Applications, Tropical Applications, Tides, Marine Meteorology, Marine Geodesy, Changes in Mean Sea Level, Integrated Approaches to Altimetry, Outreach and the Future of Altimetry. The OST Science Team meeting addressed specific issues for the TOPEX/POSEIDON and Jason-1 projects, including algorithm and model improvement, CalVal activities, merging with other altimetric satellites (GFO, ENVISAT), preparation for the Jason-2 mission. A number of CIOSS Fellows and their colleagues in COAS and NESDIS attended the two related meetings and gave oral presentations and posters. Those in attendance included Dudley Chelton, Gary Egbert, John Lillibridge, Ricardo Matano, Laury Miller, Walter Smith and Ted Strub. Some members of the CIOSS Working Group on dynamics and SSH used the opportunity to meet and discuss efforts to increase the resolution of altimeters in near-shore coastal regions. Ted presented a CIOSS Outreach Poster at the symposium.

March 15: CIOSS Fellow Jack Barth's student Maria Jose Juan Jorda, who is a M.S. Candidate in Marine Resource Management, defended her thesis entitled, "Integration of oceanographic information off the Washington and Oregon coasts into the west coast groundfish ecology and fisheries management".

March 17: Sam Laney, a Biological Oceanography PhD student under CIOSS Fellows Ricardo Letelier and Mark Abbott, presented "Ubiquitin levels in antarctic phytoplankton" as part of the COAS Student Seminar Series.

ABSTRACT

Ubiquitin is a small 8.5 kDa protein found in all eukaryotic cells, used to mark damaged proteins for proteolysis. The amount amount of ubiquitin in a cell is a rough indicator of the amount of damaged proteins. Experiments were conducted in January 2006 at McMurdo Station, Antarctica to assess a) whether or not current assays for ubiquitin work with phytoplankton samples, and b) whether or not measurable changes in ubiquitin content could be induced by exposure to natural and artificial UV treatments. We found that photosynthetic pigments made measuring ubiquitin with a common current method difficult, but qualitative differences in ubiquitin as a function of UV treatments in our samples could still be identified.

Ubiquitin assays may therefore provide an alternate approach for assessing systematic UV damage in antarctic phytoplankton.

March 22: Guillame Vernieres, a PhD candidate in Physical Oceanography under CIOSS Fellow Bob Miller, presented his thesis entitled, "Modeling Studies of Ocean Circulation Using Inverse Methods and Bifurcation Theory".

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March 30: Hal Batchelder submitted a proposal through CIOSS on Grant.gov that was funded by GLOBEC (NOAA/NOS). The CIOSS supplement was called the “GLOBEC NW Atlantic Year-1 Project.”

April 3-5: CIOSS Director Ted Strub and CIOSS Grants Accountant Carol Wallace attended the “all-NOAA” meeting for CI Directors and Administrators held in Silver Spring, MD. From the agenda, “The purpose of the meeting [was] to support quality research partnerships between Cooperative Institutes and NOAA through dialog and information dissemination.”

April 14: Larry O’Neill, a Physical Oceanography PhD student under CIOSS Fellow Dudley Chelton, presented a seminar as part of the COAS Student Seminar Series. "Ocean Response to Small-Scale SST-Induced Wind Stress Perturbations: Preliminary Model Results." The abstract summarizes the talk:

ABSTRACT

Patches of warm and cool sea surface temperature (SST) perturbations with spatial scales of about 50-1000km strongly influence the overlying surface wind stress field. Warm SST perturbations increase the surface wind stress and cool SST perturbations decrease the surface wind stress via a response of atmospheric boundary layer turbulence stress divergence and surface air pressure to horizontal SST variations. Near the Antarctic Circumpolar Current, large SST perturbations result from quasi-stationary meanders in the current and transient eddies. Observations have shown that these SST perturbations produce wind stress curl perturbations of nearly the same magnitude as the background wind stress curl field. Given the large magnitude of the wind stress curl perturbations, the ocean circulation should respond in some way. In my presentation, I will present results from a series of ocean circulation model experiments conducted to describe the modelled ocean response to these SST-induced wind stress perturbations. As it turns out, SST-induced wind stress perturbations distinctly influence the horizontal and vertical structures of the large-scale ocean currents. In the interests of time, I will mainly limit my presentation to meridional heat transport associated with the Agulhas Return Current. We have concluded from our preliminary model results that the coupled feedbacks of SST-induced wind stress onto the ocean are likely important.

April 17: CIOSS Fellows Dudley Chelton and Mike Freilich’s MS student, Craig Risien, submitted a journal article to Remote Sensing of Environment.

Risien, C.M., D.B. Chelton, J.W. Good, and M.H. Freilich, 2006. A satellite-derived climatology of global ocean winds. Remote Sensing of Environment, submitted.

ABSTRACT

An interactive Climatology of Global Ocean Winds (COGOW) is presented based on five years (August 1999 – July 2004) of QuikSCAT satellite measurements of wind speed and direction 10 m above the sea surface. This climatology provides the first high spatial resolution, observationally based, online atlas of ocean winds. Users can retrieve climatological wind maps and wind statistics, both in tabular and graphical form from the COGOW web-based atlas. The global coverage of these data provides uniformly accurate information about the wind statistics in regions of the world ocean that are sparsely sampled by ships and buoys. A case study of the recovery of the vessel Ehime Maru off the Hawaiian

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island of Oahu is presented to demonstrate the usage and value of COGOW. Evidence of air-sea interactions, one of many wind phenomena visible within COGOW, is discussed to further familiarize users with COGOW. Finally, the utility of COGOW with regard to various operational and research communities is summarized.

April 20-21: The SMILE Highschool Challenge was held at WOU and OSU on April 20-21. The theme this year was Fisheries in the Community. Students collected data about fisheries and their associated communities, then formed and presented plans to manage this resource. The purpose of SMILE is to provide science and math enrichment for underrepresented and other educationally underserved students in grades 4-12. CIOSS collaborates with SMILE as part of its outreach program.

April 21: Jeffrey Early, a PhD student in Physical Oceanography under CIOSS Fellow Roger Samelson, presented "A Brief Look at Inertial Dynamics" as part of the COAS Student Seminar Series.

April 24: Eric Bayler has moved on to a new assignment doing data assimilation focusing on oceans at the joint center for satellite data assimilation. Kent Hughes, is acting as oceans division chief and so will be taking over Eric's role with CIOSS.

April 25: CIOSS Fellow Bob Miller presented a seminar entitled, "Observing System Simulation Experiments: A Review" as part of the Physical Oceanography Seminar Series.

May 1-3: CIOSS Director Ted Strub and CIOSS Fellow Curt Davis attended the GOES-R Users Conference near Boulder, CO. Curt gave a talk describing the COAST activities and Ted displayed a poster describing the CIOSS Outreach activities. The Conference Objectives were to:

- 1) Seek ways/define methodologies to ensure user readiness for GOES-R;
- 2) Continue to improve communication between NOAA and the GOES user communities;
- 3) Inform users on the status of the GOES-R constellation, instruments, and operations; and
- 4) Promote understanding for the various applications of data and products from the GOES-R series.

May 1-4: CIOSS Deputy Director Mike Freilich lectured on satellite wind measurements at the annual National Weather Service Western Region Marine Forecasters Training Workshop at the Naval Postgraduate School, Monterey, California. This was the 7th year that he has presented at this workshop for new and veteran Marine Forecasters from the Western Region, Alaska, and Hawaii.

May 4: CIOSS Fellow Mike Kosro submitted a proposal through CIOSS on Grants.gov entitled, "FY06 Integrated Ocean Observing System (IOOS) High Frequency Radar (HFR) Project."

May 5: A meeting of the CIOSS Local Council of Fellows was held in Corvallis. A summary can be found on the CIOSS website.

May 8: CIOSS Fellows Dudley Chelton and Mike Freilich led a very successful effort that summarized the scientific needs for oceanographic satellite observations over the next decade and communicated those needs to the members of the NRC Earth Science Decadal Survey

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via an open letter from the oceanographic community. A more complete summary of this activity is available at:

(http://cioss.coas.oregonstate.edu/CIOSS/Documents/Summary_of_Survey_Letter.pdf) as well as the original text of the letter at: (<http://cioss.coas.oregonstate.edu/CIOSS/letter.html>).

May 11: A CIOSS Periodic Report was sent to Kent Hughes, Al Powell, Ingrid Guch, Mitch Goldberg, and Mark DeMaria.

May 12: Two students under CIOSS Fellows gave presentations as part of the COAS Student Seminar Series. Nilesh Araligidad, an Atmospheric Sciences MS student under CIOSS Fellow Eric Maloney, presented "Madden-Julian Oscillation : Wind Evaporation Feedback" (no abstract available). RaeSeol Park, an Atmospheric Sciences PhD student under CIOSS Fellow Eric Skillingstad, presented "Air-sea interaction over the Gulf Stream - Preliminary data focusing on the mixing layer" (see abstract below).

ABSTRACT

In the winter, lots of storms are developed and move following the Gulf Stream. The wind velocity and wind stress near to the storm are very strong and can affect the ocean variables such as the mixing layer, the lateral advection or the surface current. Also, the SST in this region can affect a storm developing. My big questions are how SST distribution can affect the storm intensity and track and how the storm intensity and moving speed can be related to the change of the mixing layer and the surface current. However, in this presentation, I'll focus on the change of the mixing layer and the surface current with different wind forcing for a simpler, more idealized model. The surface current is not affected by the weak wind but can be changed by the strong wind forcing and this effect can be explained with Ekman transport. The mixing layer is governed by the wind magnitude and the wind direction.

May 16-18: PaCOOS Meeting at Scripps in La Jolla, CA. Help with logistics/payment for non-federal and non-OSU people (travel and some break food).

May 19: **Chris Wolfe**, a PhD candidate in Physical Oceanography under CIOSS Fellow **Roger Samelson**, presented "Quantifying Linear Predictability" as part of the COAS Student Seminar Series.

ABSTRACT

One compelling explanation for the apparent randomness of atmospheric and oceanic motions is that small changes in the initial, boundary, and forcing conditions are amplified by instabilities of the fluid motion. This is the so-called sensitive dependence on external conditions often associated with nonlinear dynamical systems. Several techniques have been developed to quantify the linear predictability of systems subject to sensitive dependence on external conditions. In this presentation, we will briefly describe two ways of describing linear disturbance growth based on these techniques: singular vectors and Lyapunov vectors. In addition, we will very briefly outline recent work on an efficient algorithm for recovering Lyapunov vectors from singular vectors.

May 30: A bundled Supplemental Proposal was submitted through NOAA Grants.gov (Freilich w/ subcontract, Strub/Barth, and Letelier).

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June 2: CIOSS Fellow Jack Barth's student, Renato Castelao, defended his PhD thesis in Physical Oceanography. The title was "Coastal ocean response to topographic effects and spatial variability in the wind forcing."

Renato Castelao received the 2006 Distinguished Dissertation Award, which recognizes scholarly achievement by a doctoral degree recipient whose dissertation makes an unusually significant contribution to a discipline in mathematics, physical sciences and engineering. His dissertation, "Coastal Ocean Response to Alongshore Variations in Topography and Wind Forcing," has been advanced as OSU's nominee for consideration in the national Distinguished Dissertation Award competition sponsored by the Council of Graduate Schools and Univ. Microfilms International.

June 2: Two students under CIOSS Fellows gave presentations as part of the COAS Student Seminar Series. **Angkana Rawichutiwan**, a Marine Resource Management MS student under CIOSS Fellow **Jim Good**, presented "School Group Use of Oregon's Rocky Intertidal Areas: Use, Impacts and Management" (abstract 1). **Chris Hayes**, an Atmospheric Sciences MS student under CIOSS Fellow **Jim Coakley**, presented "Characterizing near cloud aerosol retrievals using CALIPSO and MODIS data" (abstract 2).

ABSTRACT (1)

School groups from all over Oregon use rocky intertidal field trips as a highlight of their biology curricula. However, there are no comprehensive studies of how many school groups take such field trips each year; where they tend to go and why; and how students are prepared for the trips, particularly with respect to protection of sensitive resources. This study is designed to address these data gaps. It is part of Oregon's ongoing effort to provide appropriate recreational and educational opportunities for its citizens and other visitors, while protecting and conserving its rocky shore resources. This project is done with the assistance and advice of the Oregon Parks and Recreation Department and will contribute to its Rocky Shores Management Strategy.

This study is composed of three parts. The first part is the literature review on the vulnerability of rocky shores to intensive visitor use. One or more rocky shore scientists will be interviewed as part of this process. The second part is the interview of managers of coastal rocky shore and intertidal areas to estimate rocky shore use by school groups. The third part is the interview of school teachers who arrange the field trips on rocky intertidal areas. Finally, data from the three sources above will be integrated to estimate rocky shore use pressures by school groups along the Oregon coast and potential management measures that could be implemented to minimize adverse impacts of this use.

ABSTRACT (2)

A major problem in climate prediction is modeling how aerosols affect clouds. The effect is known as the aerosol indirect radiative forcing. Several studies have attempted to use satellite imagery to infer the magnitude of this forcing. These studies show that as aerosol optical depth increases, cloud droplet radius decreases and cloud optical depth increases, consistent with the aerosol indirect effect. The observed correlations between aerosol burdens and cloud properties, however, fail to account for a number of physical processes that could also give rise to the observed behavior. One of these processes is the illumination of aerosols by sunlight scattered by clouds, enhancing aerosol reflectivity and thus their apparent optical depth. The recently launched CALIPSO satellite

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carries a space based lidar for probing the near cloud aerosol without being influenced by light scattered from nearby clouds. Retrieved cloud and aerosol backscatter profiles will give a vertical profile of the atmosphere and when combined with MODIS observations will give a much more accurate characterization of aerosols near the clouds. Lidar inversion schemes are being studied to learn how aerosol returns and optical depths retrieved from MODIS can be used to better characterize aerosols near clouds.

June 5-7: CIOSS Fellows **Dudley Chelton** and **Michael Freilich** were involved with the NOAA Operational Ocean Surface Vector Winds Requirements Workshop held at the National Hurricane Center in Miami, FL.

http://cioss.coas.oregonstate.edu/CIOSS/Documents/SVW_workshop_report_final.pdf

June 14: The first part of the CIOSS Year 3 Progress Report was sent to Ingrid Guch, Kent Hughes, Al Powell and Marilyn Moll.

June 14: Matt Segrin, a Master's degree student of CIOSS Fellow **Jim Coakley**, defended his thesis in Atmospheric Sciences entitled, "Using Ship Tracks to Characterize the Effects of Haze on Cloud Properties."

June 19-July 8: CIOSS Fellow **Jack Barth** co-taught a 3-week course on "Coastal Physical Oceanography and Marine Ecosystems" at the Long Marine Laboratory, University of California Santa Cruz.

June 20-22: The Directors and Administrators of the NESDIS Cooperative Institutes held their annual meeting at CIOSS, in Corvallis, Oregon.

<http://cioss.coas.oregonstate.edu/CIOSS/meetings.html>

June 23: **Guido Corno**, a PhD student of CIOSS Fellows **Mark Abbott** and **Ricardo Letelier**, defended his thesis in Biological Oceanography entitled, "Primary Production dynamics in the North Pacific subtropical gyre." Also, **Wiley Evans**, a Master's degree student of CIOSS Fellow **Pete Strutton**, defended his thesis in Biological Oceanography entitled, "Impacts of Tropical Instability Waves on Chlorophyll and Nutrient Distributions in the Equatorial Pacific."

June 26: The CIOSS Year 3 Annual Progress Report was submitted to NOAA through Grants Online.

June 28-29: The fourth COAST workshop, organized by CIOSS Fellow **Curt Davis**, was held in Monterey, CA to plan the first field program, which will take place there in September, 2006. This is part of the planning for a series of field experiments in different types of U.S. coastal waters to collect hyperspectral remote and in situ data sets that can be used to develop and test algorithms for use with the HES-CW sensor. The agenda for this meeting is available on the CIOSS website:

http://cioss.coas.oregonstate.edu/CIOSS/workshops/COAST_meeting4/Final_Agenda_COAST.html.

July 18-19: A Review of MOBY Replacement Advanced Hyper-spectral Autonomous Buoy (AHAB) Design and Plans for Implementation was held at NIST in Gaithersburg, MD. The

meeting objectives were to review the MOBY background, review the Research and Operations progress, and to describe a future vision and design for a new instrument. CIOSS Fellow **Curt Davis** is chairman of the Review Team. The agenda for this meeting is available on the CIOSS website:

(http://cioss.coas.oregonstate.edu/CIOSS/workshops/MOBY_review_meeting_06/Final_Agenda_MOBY-AHAB.html).

August 1: A new CIOSS postdoc, Qingtao Song, from the University of Rhode Island, arrived at OSU to work with CIOSS Fellow **Dudley Chelton** on ocean-atmosphere interaction.

August 9: The Summer SMILE Highschool Teacher Workshop was held in Corvallis, OR. This workshop prepares teachers involved in the SMILE after-school program to present activities during the coming school year. These activities culminate in the SMILE Highschool Challenge in April of each year.

*Update: The activities presented at the Teacher Workshops held in August 2004, January 2005, August 2005, February 2006, and August 2006 are now available for download from the CIOSS website at: http://cioss.coas.oregonstate.edu/CIOSS/teacher_activities.html.

August 9: Jurgen Theiss from Theiss Research in La Jolla, CA visited CIOSS Fellow **Dudley Chelton**, sponsored by CIOSS. While here, Jurgen presented, "New Features in Geostrophic Turbulence" as part of the COAS Physical Oceanography Seminar series.

August 11: **Sam Laney**, a PhD student of CIOSS Fellows **Mark Abbott** and **Ricardo Letelier**, defended his thesis in Biological Oceanography entitled, "Seconds to Hour Scale Photosynthetic Responses in Marine Microalgae."

August 15-16: The Cooperative Research Program Symposium was held in Fort Collins, CO. The theme this year was "NPOESS, GOES-R and Beyond: New Observations and Applications to Benefit Society." Participants from COAS included **BJ Choi**, **Antonio Fetter** and **Maria Kavanaugh** who presented posters, and **Larry O'Neill** who gave an oral presentation.

Poster Titles:

BJ Choi: Circulation modeling and data assimilation along the Oregon Coast

Antonio Fetter: A Numerical Study of the Annual Cycle of the Western Boundary Currents of the South Atlantic Ocean

Maria Kavanaugh: Scales of variability in coastal oceans: lessons from EO-1

Oral Presentation Title:

Larry O'Neill: Coupled interactions between surface winds and sea surface temperature

August 22-24: CIOSS co-hosted a "short course" on satellite data for NOAA Fisheries (NMFS), along with **Cara Wilson** (NOAA/NMFS), **Dave Foley** (CoastWatch) and their colleagues. CIOSS Director **Ted Strub**, and CIOSS Fellows **Dudley Chelton** and **Pete Strutton** gave presentations ranging from a general overview of remote sensing, to altimeter and scatterometer details and applications, to ocean color details and applications. The 30 participants were mostly from NOAA Fisheries, with half a dozen from different NOAA sanctuaries. According to Cara, this class has generated quite a bit of enthusiasm within the wet side of NOAA (i.e. NMFS and NOS).

<http://www.pfeg.noaa.gov/events/workshops/NoAASatCourse2006/PostCourseInfo.html>

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August 26-September 2: Lei Zhou from University of Maryland visited COAS/CIOSS (**Dudley Chelton**) as part of the NESDIS CI Summer Exchange program. A short report of his visit is on the CIOSS web site.

August 29: CIOSS Director **Ted Strub** and Deputy Director **Mike Freilich** participated in a one-day Climate Data Stewardship Workshop, held in the Washington DC area. Tom Karl (NCDC) led the workshop, which was attended by a number of NOAA scientists involved with climate and the choice of data for Climate Data Records, as well as the NESDIS CI Directors and others from their CIs. Since the choice of sensors for the redesigned NPOESS system will affect the ability to form CDRs, the CI Directors were also involved in follow-up conference calls and revisions to a joint NOAA/NASA white paper on the effects of the NPOESS redesign.

August 31: CIOSS Fellow **Pete Strutton** co-authored the following article that was recently published in Nature: Behrenfeld, M.J., Worthington, K., Sherrell, R.M., Chavez, F.P., Strutton, P.G., McPhaden, M. and Shea, D.M., 2006. Controls on tropical Pacific Ocean productivity revealed through nutrient stress diagnostics. Nature, 442, 1025-1028.

September: Guang Guo, a post-doc student who formerly worked with CIOSS Fellow **Jim Coakley**, is now working at I.M.System Group, Inc. (IMSG). He is involved in the research and operational use associated with GOES satellite data for NOAA.

September 4-15: The field experiment at the Monterey Bay, CA site took place during the first two weeks of September. The Monterey Bay region includes many of the characteristic oceanographic features found on the West Coast in a very local area making it an ideal location for remote sensing product development and calibration/validation research.

CIOSS Fellows **Curtiss Davis**, **Ricardo Letelier** and Burke Hales participated in the first Coastal Ocean Applications and Science Team (COAST) field experiment in Monterey Bay, CA. The experiment was to collect half-hourly airborne hyperspectral imagery and a full suite of in situ data to begin to develop algorithms for future geostationary ocean color imagers. Davis was the overall experiment lead and worked on analysis of the remote sensing imagery. Letelier, with graduate student Maria Kavanaugh, measured chlorophyll, chlorophyll fluorescence and the productivity of the phytoplankton. Hales, with technician Dale Hubbard, measured CO₂ concentrations and addressed the role of the Monterey Bay as a source or sink for atmospheric CO₂.

September 4-8: CIOSS Fellow **Pete Strutton** participated in and gave an invited talk at the Experts Workshop on Bioregionalisation of the Southern Ocean, Hobart, Australia. The workshop was sponsored by the World Wildlife Fund and Peregrine Travel. The goals of the workshop were to use data from the Southern Ocean (mostly satellite data) to define regions of similar environmental characteristics, and present these findings to the Committee for the Conservation of Antarctic Marine Living Resources (CCAMLR).

September 8: Chris Wolfe, a PhD student of CIOSS Fellow **Roger Samelson**, defended his thesis in Physical Oceanography entitled, "Linear Disturbance Growth in a Time-Periodic System."

ABSTRACT

The mathematical and physical connections between three different ways of quantifying linear predictability in geophysical fluid systems are studied in a series of analytical and numerical models.

Normal modes, as they are traditionally formulated in the instabilities theories of geophysical fluid dynamics, characterize the asymptotic development of disturbances to stationary flows. Singular vectors, currently used to generate initial conditions for ensemble forecasting systems at some operational centers, characterize the transient evolution of disturbances to flows with arbitrary time dependence.

Lyapunov vectors are an attempt to associate a physical structure with the Lyapunov exponents, which give the rate at which the trajectories of dynamical systems diverge. These seemingly divergent ways of quantifying linear disturbance growth are closely related. These connections are studied using a (time-periodic) wave-mean oscillation in an intermediate complexity baroclinic channel model. For time-periodic systems, normal modes may be defined in terms of Floquet vectors. It is argued that Floquet vectors are equivalent to Lyapunov vectors for time-periodic flows. The Floquet vectors of the wave-mean oscillation are found to split into two dynamically distinct classes that have analogs in the classical theories of the baroclinic instability and parallel shear flow. The singular vectors of the oscillation are found to preserve this dynamical splitting. The representations of the singular vectors in terms of the forward and adjoint Floquet vectors display much simpler temporal behavior than the singular vectors or the Floquet vectors individually. It is further demonstrated that while the Floquet vectors point 'onto' the local system attractor, the singular vectors point 'off' the attractor.

September 11-15: CIOSS fellow **James Richman** visited the National Center for Environmental Prediction (NCEP) and Joint Center for Satellite Data Assimilation. Richman presented a seminar at JCSDA entitled, "Error Estimates for Assimilation of Satellite Sea Surface Temperature Data in Ocean Climate Models." Richman discussed collaboration between CIOSS and NCEP on assimilation of satellite data into the Climate Forecast System using techniques developed at OSU.

September 13: Nicolai Thum, A PhD student of CIOSS Fellow **Steve Esbensen**, defended his thesis in Atmospheric Sciences entitled, "Atmospheric Boundary Layer Coupling to Midlatitude Mesoscale Sea Surface Temperature Anomalies."

September 14: CIOSS Fellow **Pete Strutton** gave a seminar at Old Dominion University in Norfolk, VA entitled, "Primary productivity and air-sea CO₂ fluxes in equatorial and coastal upwelling systems."

September: CIOSS held two half-day Internal Review sessions on September 15 and 21 in preparation for the October Formal Review. The following schedule was loosely followed. The presenter's name is in bold.

September 15**Radiation and Winds**

8:30am Surface radiation estimates from satellite – **Coakley**

8:50am High resolution scatterometer winds – **Freilich**, Chang

Windsat-QuikSCAT winds – **Freilich**

Operational use of SCAT winds – **Freilich**, Milliff

9:30am Two Wind Workshops – **Chelton**, Freilich

9:50am BREAK

10:10am Air-Sea Interaction and Reynolds SST – **Chelton**

10:30am SCAT wind climatology – **Risien**, Chelton

Models

10:50am Coupled ocean-atmosphere model – Skillingstad, **Samelson**

11:10am Pilot ocean prediction system – **Kurapov**, Egbert

11:30am Coastal Ocean Modeling and Data Assimilation – Allen, Egbert,
Kurapov, Miller, **Choi**

11:50am Coastal Ocean Modeling and DA workshop – **Kurapov**, Allen

12:00pm GLOBEC biophysical models – **Batchelder**

12:20pm Interaction with NCEP and JCSDA basin-scale ocean modeling –
Richman, **Miller**

September 21

Outreach

8:30am SMILE – Davis-Butts, **Collay**

8:50am HMSC pilot display - **Phipps**

Ocean Color

9:10am COAST sensors and algorithms, and MOBY redesign – **Davis**

9:30am Hyperion data analysis – **Strutton**, Letelier, Kavanaugh

9:50am CDR workshops – **Letelier**, Abbott

10:00am Oceans and Human Health – Wood, **Strutton**

10:20am Evaluation of X-Band reception of international satellites – **Letelier**

10:30am BREAK

Mesoscale Circulation, Front Analyses and Misc.

10:50am SST fronts – **Barth**

11:10am Mesoscale “coastal” circulation – Strub, Kosro, **Saraceno**

11:30am Multi-sensor fields over the CCS – **Strub**, Barth

11:40am Circulation differences N-S of C. Blanco – **Kosro**

12:00pm Coastal Radar evaluation for IOOS – **Kosro**

September 18: CIOSS Post-doc Martin Saraceno, along with CIOSS Director **Ted Strub**, submitted the following article to the Journal of Geophysical Research Oceans: "Mesoscale circulation in the Northern California Current as seen by satellite altimetry.", M Saraceno and P T Strub.

In addition, Saraceno submitted this article to Geophysical Research Letters: "Low frequency variability of the Zapiola anticyclone as observed from satellite altimetry: indication of possible collapses", M Saraceno and C Provost.

September 21: Angka Rawichutiwan, a Master’s student of CIOSS Fellow **Jim Good**, defended her thesis in Marine Resource Management entitled, "School Group Use of Oregon’s Rocky Intertidal Areas: Use, Impacts, and Management.”

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September 22: Local CIOSS Council members met to discuss the above mentioned Internal Review sessions and the agenda and presentations for the upcoming Formal Review.

September 24-27: Kristopher Karnauskas from University of Maryland visited COAS/CIOSS as part of the NESDIS CI Summer Exchange program. On September 25, Kris presented a seminar entitled, "Interannual Variability of SST and Chlorophyll in the Eastern Pacific Warm Pool: High-Resolution Satellite Observations." After visiting CIOSS, he then attended the EPOC meeting (see below) at Timberline Lodge and presented a poster with the same title.

September 27-30: The 53rd annual Eastern Pacific Ocean Conference (EPOC) will be held at the Timberline Lodge in Oregon. Many CIOSS Fellows and students will attend and give oral or poster presentations. Some examples of presentations that will be given follow.

Pete Strutton and Wiley Evans, oral presentation, EPOC meeting, Timberline Lodge, OR: 'New observations of carbon cycle parameters from the equatorial Pacific'.

Martin Saraceno, "Mesoscale events off the coast of Oregon (US): a satellite point of view.", poster presentation to EPOC meeting.

September 28: Angelicque White, a PhD student of CIOSS Fellows **Ricardo Letelier** and **Yvette Spitz**, will defend her thesis in Biological Oceanography entitled, "Phosphorus Physiology and Environmental Forcing of Oceanic Cyanobacteria, Primarily *Trichodesmium* spp."

September 30-October 3: Stephanie Henson, a post doc for Andrew Thomas at the University of Maine, visited COAS and gave a seminar, co-hosted by CIOSS. Her seminar was based on the theme of satellite observations of the California Current. Stephanie works on GLOBEC issues, and her focus is mainly on SeaWiFS in the California Current.

September 30-31: CIOSS Fellows **Dudley Chelton** and **Ted Strub** attended the NASA Wide-Swath Altimeter planning meeting in Washington DC. Dudley gave a presentation entitled, "Altimeter observations of oceanic eddies." Ted gave a presentation entitled, "Needs for understanding Coastal Zone Processes."

October: CIOSS Deputy Director **Mike Freilich** has assumed the role of Division Director for Earth Science at NASA Headquarters in Washington DC. This comes at a critical time for NASA, and we know Mike will do an outstanding job representing the needs of the Earth science community. He will serve in this role with NASA for at least one or two years, maintaining his status as professor on faculty here at COAS.

October 3-5: CIOSS Director **Ted Strub** attended the "Workshop on Regional Needs for Coastal Remote Sensing" at the University of New Hampshire. This workshop is sponsored by the National Federation for Regional Associations for Coastal and Ocean Observing (NFRA), along with NOAA, NASA and Ocean US.

The purpose of the workshop was to pull together representatives of the Regional Associations (RAs) to identify the regional needs for coastal satellite remote sensing, document remote sensing requirements of the RAs, and identify commonalities. This was planned as the first in a series of biennial workshops focused on satellite remote sensing

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needs for the IOOS Regional Associations. After attending the NFRA workshop, he visited the University of Maine, Orono, to give a seminar (expanded from his EPOC talk) on "Satellite estimates of transport and SST anomalies during the 2005 'Warm Event' in the northern California Current.

October 5: Mailed briefing books to panel members.

October 10: Admin dry run

October 12: Science dry run

October 13: Craig Smith, a PhD student in Atmospheric Sciences of CIOSS Fellow **Eric Skyllingstad**, gave a presentation as part of the COAS Student Seminar Series entitled, "On the Effects of Upstream Boundary Layer Development on Stably Stratified Flow over a 2-D Ridge: Preliminary Results from a Large Eddy Simulation."

Abstract

The effects of upstream boundary layer conditions on stably stratified flow over a two-dimensional mountain ridge are explored using high resolution large eddy numerical simulations. Previous modeling studies, which have parameterized turbulence or been run either at significantly lower Reynolds numbers than those found in the atmosphere, indicate that surface friction is a key process in the formation of rotors in the lee of 2-D topography. Our preliminary results verify this result and yield insights into the effects of boundary layer height on downstream flow regimes. Other preliminary results indicate that convective near surface conditions, leading to neutral upstream boundary layers, enhance internal wave breaking and the production of large surface velocities in the lee of the ridge. While the majority of numerical results have yet to be obtained, the goals of this project include a thorough understanding of the role of upstream surface fluxes and stratification, shear, and boundary layer height on the dynamical regimes initiated by stably stratified flow over a 2-D mountain. Flow regimes, such as vertically propagating waves, vertically trapped waves and internal gravity wave breaking, will be quantified and compared to previous linear and mesoscale modeling efforts based on dynamical similarity of relevant nondimensional numbers such as the vertical Froude number. Modeling results will be also used validate operational mesoscale models, such as the WRF, and provide guidance to forecasters on the likelihood of mountain wave and downslope windstorm events based on upstream soundings. To help bridge the gap between size limited LES results and the relatively large scale Sierra Nevada range, a climatological study of atmospheric conditions upstream of the Sierra Nevada, using soundings from the T-Rex IOP data set, will be done to better understand how variations of Froude numbers, Scorer parameter, critical layer height and boundary layer height, affect mountain wave and wave breaking flows on time scales ranging from diurnal to seasonal.

October 17-19: CIOSS had its 5 year NOAA program review on October 17-19, 2006 in Corvallis. The review panel gave CIOSS a rating of "Outstanding" and recommended continuation for another five years (2008-2013). The review panel Chair, Otis Brown, said it was the best of these types of reviews he has attended.

For addition information, please visit the Formal Review web page on the CIOSS website at: <http://cioss.coas.oregonstate.edu/CIOSS/review.html>.

October 23: Tom Pagano from the Jet Propulsion Laboratory gave a CIOSS sponsored seminar entitled, “Instrument Requirements for the Advanced Remote-sensing Imaging Emission Spectrometer (ARIES), the Next Generation 1 km Resolution Hyperspectral Imaging Spectrometer.” Tom is the AIRS project Manager and played a key role in the design of SeaWiFS and MODIS. He talked about ARIES which could provide excellent ocean color data for the future.

November 9: CIOSS Fellow **Curt Davis** attended the Analysis of Alternatives (AoA) kickoff meeting at NOAA Headquarters in Silver Spring, MD. CIOSS Director **Ted Strub** participated by phone. This AoA study will analyze alternatives to satisfy sounding and coastal imaging requirements as specified in the Consolidated Observing Requirements List (CORL) which remain unmet now that the Hyperspectral Environmental Suite (HES) is no longer included as part of GOES-R. Curt Davis was asked to lead the coastal waters part of the AoA with support from the Coastal Ocean Applications and Science Team (COAST) and NOAA ocean color data users.

November 14-16: CIOSS and JIMO jointly sponsored a workshop concerning "Climate Impacts on the California Current Ecosystems" held in La Jolla, CA. This workshop was requested by the NOAA Climate and Ecosystems Goals Teams and planned by an organizing committee that included CIOSS Fellows **Jack Barth** and **Ted Strub**. Other CIOSS Fellows attending included **Dudley Chelton**, **Roger Samelson** and **Yvette Spitz**. Dudley Chelton gave a presentation entitled, “Air-sea interaction in the California Current System.”

The meeting addressed research and monitoring in the California Current that are pertinent to the following:

- (1) methods for describing the physical state of the California Current System and predicting inter-seasonal to decadal changes in that state;
- (2) testing predictions of climate impacts on selected trophic levels that are now possible to see whether they are reliable enough to inform management decisions; and
- (3) improving knowledge and models of other trophic levels so that climate impacts on them can also be predicted.

The “Climate Impacts on the California Current Ecosystems” workshop was meant to address (1) efforts within NOAA to integrate research under the Climate and the Ecosystems Goal Teams, (2) the need for coordination of climate and ecosystem monitoring and data dissemination between the three West Coast proto Regional Associations, (3) efforts within the Pacific Coast Ocean Observing System to develop a program of observation, analysis and data management for California Current Large Marine Ecosystem, and (4) the emerging consensus that single-species management must expand to include awareness of all elements of an ecosystem including climate forcing.

JIMO and CIOSS called this workshop to develop specific plans for carrying forward a coordinated research program on assessing and predicting climate impacts on marine resources and ecosystems along the west coast of the continental U.S., including both the

California Current and inshore waters. The meeting intended to identify the highest priorities for the following:

(1) modeling ocean physics and the selected trophic levels of the region with the intent (a) to eventually develop forecasts for selected fish species under the varying climate of the California Current, (b) to describe the physical manifestations of the varying climate and relate these to biological observations of key species such as krill and commercially important fish, and (c) to develop and test a capability to predict elements of the ecosystem from nutrients and pollutants through planktonic and fish populations;

(2) augmenting the present sustained ocean and meteorological observations needed to initialize and constrain models and initialize prediction schemes; and

(3) expanding sustained biological and chemical observations needed to (a) test model descriptions of nutrients and plankton populations and (b) provide impetus to the development of stock assessment and ecosystem models with the objective of predicting climate impacts on the entire ecosystem.

November 21: CIOSS Fellow **Jack Barth**, along with Francis Chan from the OSU Zoology Department, gave a seminar entitled, "Oregon Shelf Hypoxia 2006: What we Know and Don't Know."

November 27-December 1: CIOSS Director **Ted Strub** attended a conference on the Humboldt Current System in Lima, Peru, and gave a presentation entitled, "A Satellite Study of the Oceanic Circulation in the Southeast Pacific."

November 30-December 1: CIOSS Fellow **Jim Coakley** is a member of the National Research Council's Climate Research Committee and attended the CRC meeting in Washington, D.C. A website that shows the meeting agenda is at:
http://dels.nas.edu/basc/CRC_Fall_2006_Agenda.pdf.

December 1: Anthony Kirincich, a student of CIOSS Fellow **Jack Barth** in Physical Oceanography, gave a seminar entitled, "Upwelling Efficiency in the Inner-Shelf: The Effects of Variable Forcing and Stratification."

ABSTRACT:

During upwelling or downwelling, the fraction of full Ekman transport present in the boundary layers decreases approaching the coast. Recent studies (Lentz et al, 1999; Kirincich et al 2005) have reported that transport decreases from 100% of full Ekman transport in water depths of 50 m to 25% in water depths of 15 m. This trend, controlled by eddy viscosity and its effect on boundary layer depth, is based on mean results averaged over long time periods. Yet, as eddy viscosity varies at these inner-shelf locations due to event-scale hydrographic changes and intermittent forcing, the boundary layer depth and fraction of full transport should also vary. Using observations made in 15 m of water on the central Oregon inner-shelf, the event-scale variability of cross-shelf transport is investigated. Hydrographic and velocity observations show rapid cross-shelf movement of water masses and variable residence times. However, Ekman transport fraction does not vary with stratification. Thus, to better understand event-scale variations in cross-shelf exchange, an

inverse calculation is used to estimate vertical mixing and eddy viscosity from measured velocity profiles and wind forcing. The estimated eddy viscosity is smaller in magnitude than previously reported in model results of the inner-shelf, with a mean value of $1.7 \times 10^{-3} \text{ m}^2 \text{ s}^{-1}$ but peak values greater than $1 \times 10^{-2} \text{ m}^2 \text{ s}^{-1}$. The fraction of full Ekman surface transport is a function of the eddy viscosity, ranging from 55% during times of rapidly changing stratification and forcing, and low eddy viscosity, to 10% during times of weak stratification, strong forcing, and high eddy viscosity. These results quantify the variability of cross-shelf transport efficiency and have significant implications for ecological processes in the inner-shelf.

December 5: CIOSS Fellow **Jack Barth** gave a seminar entitled, "Intraseasonal Wind Oscillations and Their Influence on Northern California Current Coastal Ecosystems."

December 7: CIOSS Director **Ted Strub** and Administrative Specialist Amy Vandehey participated in the recent NESDIS CI Directors teleconference. The agenda items included: news from NOAA/NESDIS/STAR; Research to Operations; the upcoming all NOAA CI Meeting and the next NESDIS CI Director and Administrators Meeting; student exchanges; CoRP symposium; and the JCSDA data assimilation workshop.

December 11-15: The 2006 AGU Fall Meeting was held in San Francisco, CA.

Many CIOSS Fellows and students attended and gave oral or poster presentations. The meeting provided an opportunity for more than 12,000 researchers, teachers, students, and consultants to present and review the latest issues affecting the Earth, the planets, and their environments in space. This meeting covered topics in all areas of Earth and space sciences.