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

\*CIOSS Fellows are in bold.

**January:** **Eric Maloney** left COAS and joined the faculty at Colorado State University, where he will contribute to the research and teaching of CIRA, another NESDIS CI.

**January 28-30:** Ocean Surface Topography Constellation - A Strategic Workshop: **Dudley Chelton** and **Ted Strub** attended this workshop, sponsored by the Committee on Earth Observing Satellites in Assmannshausen, Rüdeshheim, Germany. The purpose was to further develop plans for future altimeters.

**January 29-31:** A workshop on the use of MERIS and OCM by NASA, NOAA, Navy and university scientists was held at NRLSSC, led by Rick Stumpf, **Curt Davis** and Bob Arnone. The workshop goal was to develop a real working plan on how to address the issues of data collection for US sites, data access and cross calibration so that the data can be used in combination with SeaWiFS and MODIS to extend coverage and produce a consistent time series of ocean color data.

**February 1-2:** The Winter SMILE High School Teacher Workshop was held over 2 days in LaSells Stewart Center. Teachers were given curriculum to present in their after school clubs to prepare them for the Challenge event on tsunamis in April. Activities can be found on the web at: <http://oregonstate.edu/~dover1/SMILEWTW08/>.

**February 5-7 (February Hot Item):** CIOSS and the NOAA/NESDIS Laboratory for Satellite Altimetry convened a Coastal Altimetry Workshop in Silver Spring organized by **Laury Miller** (NOAA Laboratory for Satellite Altimetry), Walter Smith (NOAA Geosciences Laboratory) and **Ted Strub**. European and US experts in altimetry and radiometry joined scientists and forecasters expert in coastal tides, currents, waves and fisheries. Together they reviewed present problems, established an error budget, and proposed short- and long-term solutions that will allow altimetry to be better utilized in the coastal zone. For the future, they discussed methods to achieve better near-shore data coverage, using improved retrieval methods on the Jason-2/OSTM altimeter, a NOAA/NASA/CNES/EUMESAT mission scheduled for launch in June, 2008. New, high-resolution altimeters that will fly in the future were also discussed. Participants agreed to form an ad-hoc Coastal Altimetry Science Working Team to carry on these efforts. A second open workshop is planned November 5-7, 2008 in Pisa, Italy, prior to the NASA Ocean Surface Topography Science Team meeting. [Details of the workshop](#) can be found on the CIOSS website. NASA, NOAA, CNES and ESA funded travel and logistics of the February workshop.

**Significance:** The workshop formed new connections among diverse experts not previously networked, it established a consensus error budget and recommended data processing strategies aimed at enabling future operational applications and the mining of 15 years of historical data for retrospective studies, serving NOAA weather, water, climate, transportation and ecosystem goals.

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**February 12-14: Ted Strub**, Amy Vandehey and Linn Bright attended the annual All NOAA CI Director and Administrator's meeting in Silver Spring, MD. A CI Capabilities Fair was again held on the morning of the first day, giving the different groups a chance to display their foci and current projects to each other and people within NOAA that aren't familiar with CIs. The rest of the meeting addressed current issues and concerns for the CIs and NOAA.

**February 14: Ted Strub** gave a seminar at STAR HQ in Silver Spring: "Remote Sensing at the Cooperative Institute for Oceanographic Satellite Studies: CIOSS Research - On the Edge(s)."

**February 14:** While at STAR HQ, **Ted Strub** met with **Kent Hughes** and **Paul DiGiacomo** to discuss the projects proposed for Year-6 and the strategy for developing research projects for Year 7. Kent emphasized the need to align CIOSS and STAR/SOCD interests in the projects supported by core SOCD funding, which comes from the Ocean Remote Sensing (ORS) line of funding. This funding is competed for by SOCD PI's through internal proposals and some of them are concerned about how CIOSS projects relate to the rest of SOCD research. Ted and Kent discussed several lines of research that would satisfy both CIOSS and SOCD objectives, mostly using ocean color data. This was meant as the beginning of ongoing discussions regarding CIOSS core research.

**February 20: Ted Strub** and Amy Vandehey met with Kate Kusak, the new Federal legislative liaison for OSU. Kate did not know much about CIOSS or satellite uses for oceanography, so this was mostly a meeting to acquaint each other with what we do.

**February-March:** At the CIOSS Executive Board Meeting in Corvallis in August 2007, Ingrid Guch encouraged CIOSS PIs to interact with NOAA scientists at other institutions. Following up on this suggestion, **Dudley Chelton** visited three different NOAA institutes during the first quarter of 2008. The interactions at each of these institutes are summarized in [this document](#).

**March 3-8:** The 2008 Ocean Sciences Meeting, sponsored by the [American Society of Limnology and Oceanography](#), the [American Geophysical Union](#), [The Oceanography Society](#) and the [Estuarine Research Federation](#), was held in Orlando, FL. Amy Vandehey presented on outreach at CIOSS, specifically the SMILE-CIOSS Partnership. **Ted Strub** presented on approaches for altimeter uses in coastal regions. Many other CIOSS Fellows attended and presented papers.

**March 21: Ted Strub** attended the NANOOS meeting in Portland where "products" were discussed. **Dave Foley** (NESDIS CoastWatch) and Craig Risien (COAS/ORCOOS) are active in defining and developing products involving remote sensing. Some of the CIOSS research provides the basis for these products.

**March 24-26:** CIOSS co-hosted the Third "[Short Course](#)" on satellite data for NOAA Fisheries (NMFS). The course was organized by **Cara Wilson** (NOAA/NMFS), **Dave**

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**Foley** (CoastWatch) and their colleagues. **Ted Strub, Pete Strutton** and **Dave Foley** gave introductory presentations ranging from a general overview of remote sensing, to altimeter and scatterometer details and applications, to ocean color details and applications. While the participants in the First Short Course were mostly from NOAA Fisheries and NOAA/NOS sanctuaries, participants in the Third Short Course came from a wider range of agencies and also included local graduate students and staff. According to **Cara Wilson**, this class has generated quite a bit of enthusiasm within the wet side of NOAA (i.e. NMFS and NOS).

**April 1: Ted Strub** delivered material to Eric Lindstrom at NASA that gave examples of research that would be enabled by a new scatterometer wind sensor - the XOVWM. NOAA has been given the lead to develop this sensor by the Decadal Survey, but will contract the technical development to NASA. This material will be used to demonstrate the need for this new sensor.

**April 17-18:** The SMILE High School Challenge - Laura Dover (MS student in the MRM program) took over as the coordinator for the SMILE high school program during summer 2007 and began developing the activities for use in the after-school clubs and in the High School Challenge. SMILE High School Teacher Workshops were held in August 2007 and February 2008 in preparation for the 2008 Challenge. The 13 SMILE high school clubs gathered to participate in an intense 36 hour Challenge that focused on tsunami awareness and preparedness. Students learned about tsunamis from a number of sources, including a physical model of a tsunami hitting a coastal town at the OSU wave tank. After learning about methods of presenting information concerning tsunami preparedness and response, the teams prepared [Public Service Announcements](#), including posters and short video presentations.

To begin preparation for the 2009 Challenge, Laura held a SMILE High School Teacher Workshop in August, 2008. Beginning in 2009, the theme will turn to more climate-related issues, starting with the effects of climate change and variability on whale migrations and distributions. These workshops prepare teachers involved in the SMILE after-school program to present activities during the coming school year. A number of CIOSS personnel took part in the activities preceding, during and after the High School Challenge.

**April 28-May 2:** NASA Carbon Cycle and Ecosystems Joint Science Workshop, Adelphi, MD: **Peter Strutton** participated in the first part of this joint meeting and presented a poster summarizing preliminary results from a NASA project to develop satellite algorithms for air-sea CO<sub>2</sub> fluxes in the Southern Ocean. Burke Hales (a COAS colleague but not a CIOSS Fellow) presented a poster of results to date from a similar but longer-running project for the US West Coast. Hales attended the latter part of the workshop which included the NASA Ocean Color Science Team Meeting.

**May: Dudley Chelton** received an American Geophysical Union Fellow award.

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**May 16-17:** The Spring SMILE High School Teacher Workshop was held over 2 days in LaSells Stewart Center.

**May 23:** The [CIOSS Year 5 Annual Progress Report](#) was submitted through NOAA Grants Online covering the period of April 1, 2007 – March 31, 2008.

**May 27:** OrCOOS, a subregional partner of NANOOS (Northwest Association of Networked Ocean Observing Systems; <http://www.nanoos.org>) gave a [press release](#) to give updates on recent OrCOOS developments as well as what <http://www.orcoos.org> has to offer in terms of near real-time (NRT) ocean and atmosphere information and data.

**June 2-6: Ted Strub and Jack Barth** attended and gave presentations at the Eastern Boundary Upwelling Systems Symposium in Las Palmas, Gran Canaria, Spain, which considered the ecosystem dynamics of eastern boundary currents (EBCs). During the last day of the Symposium, there was a special workshop on hypoxia, led by Jane Lubchenco, which they also attended. The California Current, which serves as a test-bed for CIOSS research, is one of the four EBCs that served as the focus of the Symposium. Some papers presented at the Symposium will appear in a special volume of Progress in Oceanography.

**June 17-19:** Amy Vandehey and CIOSS Accountant Aviva Rivera attended the annual NESDIS CI Director's and Administrator's Meeting held at CICS in College Park, MD. Topics discussed in the administrator's meeting included summer student exchanges, annual progress report formats and timelines, shadow awards, the CI competition schedule, and personnel changes (Chris Brown for Ingrid Guch while she is on maternity leave, and Philip Hoffman for John Cortinas). [Notes from the meeting](#) can be found on the CIOSS website.

**June:** Ingrid Guch asked CIOSS to prepare PowerPoint slides highlighting some of our research for a [NOAA bulletin board](#). The first page shows photos of the CIOSS Director, Program Specialist and local Council of Fellows, as well as the Research Themes. Other slides show projects from Themes 1 (COAST), 2 (wind speed) and 3 (ocean modeling).

**July 20-25:** Amy Vandehey helped to coordinate the logistics for the C-MORE/EARTH/MBARI Workshop held at LaSells Stewart Center. The workshop brought together K-12 teachers from all over the US to learn about cutting edge marine science and technology, ocean observatories and the data that they collect, and develop new curriculum that uses real science and near-real-time data to teach science content and process and addresses their needs and the needs of their students.  
<http://www.mbari.org/earth/2008/EARTHwksp.htm>

**August 12-14:** The Summer SMILE High School Teacher Workshop was held over 3 days in LaSells Stewart Center. Teachers were given curriculum to present in their after school clubs to prepare them for the Challenge event on whales and satellite tracking in April 2009. Activities can be found on the web at:  
[http://oregonstate.edu/~dover/SMILE\\_STW08/](http://oregonstate.edu/~dover/SMILE_STW08/).

**August 12-13 (August Hot Item): CIOSS hosts NESDIS CoRP Science Symposium:**

NOAA Cooperative Institutes foster collaborations between academic and Federal scientists. To further this goal, NESDIS CI's hold an annual Science Symposium to share activities, especially showcasing student and post-doc work. The Cooperative Institute for Oceanographic Satellite Studies (CIOSS) hosted this Symposium at Oregon State University during August 12-13, 2008. The Symposium Theme, "Data-Model Fusion – Use of Satellite Data with *in situ* Data and Models," encompassed a wide range of presentations, linked to the on-line agenda

([http://cioss.coas.oregonstate.edu/CIOSS/CoRP\\_symposium.html](http://cioss.coas.oregonstate.edu/CIOSS/CoRP_symposium.html)).

**Background:**

NESDIS CIs conduct research on remote-sensing of the environment in these areas:

- Earth-Atmosphere-Ocean observations
- Design and simulation of satellite observing systems
- Development of algorithms, products and applications for satellite data
- Instrument calibration/intercalibration/validation
- Processing system technology
- Data Assimilation into ocean, atmosphere and coupled models

**Significance:**

Many atmospheric remote sensing products are assimilated into weather forecast models. For the ocean (the CIOSS focus), nowcast/forecast models are under development for the Integrated Ocean Observing System (IOOS) and other programs. This makes it timely to exchange information on ocean-atmosphere observing/modeling systems. CIOSS improves products available through NESDIS/CoastWatch (<http://coastwatch.noaa.gov/>; <http://coastwatch.pfel.noaa.gov/>), IOOS, etc. Along the Oregon coast, researchers led by CIOSS Fellow **A. Kurapov** produce experimental forecasts of ocean surface temperatures and currents ([www-hce.coas.oregonstate.edu/~orcoss/SSCforecast.html](http://www-hce.coas.oregonstate.edu/~orcoss/SSCforecast.html)), which are used by researchers and Oregon tuna fishermen for cruise planning. Other regional oceanic and atmospheric fields are maintained on the OrCOOS website by CIOSS Fellows **J. Barth, M. Kosro** and C. Risien (<http://agate.coas.oregonstate.edu/>). The study of air-sea interaction has been enhanced by a new global climatology of Ocean Vector Winds and wind-products (<http://numbat.coas.oregonstate.edu/scow/>), compiled by CIOSS Fellows **D. Chelton** and C. Risien. NOAA partners in these and related studies include NESDIS/STAR/SOCD, NESDIS/CoastWatch, IOOS/NANOOS, NESDIS/RAMMB, NCEP, NOS and JCSDA modelers. U.S. Navy (NRL) colleagues also collaborate on coupled ocean-atmosphere dynamics.

**August 13:** During the CoRP Symposium in Corvallis, **Kent Hughes** (SOCD) and Chris Brown (STAR/CoRP) met with **Ted Strub, Curt Davis, Ricardo Letelier** and **Peter Strutton** to discuss projects that may be proposed in the Year-7 Omnibus. Kent again stressed the need to align CIOSS research with SOCD interests. Three potential projects were described by Davis, Letelier and Strutton, all involving the use of satellite ocean color data. Kent and Chris made suggestions as to how these projects would fit into the needs of SOCD, involving: cal/val activities for present and future U.S. sensors (MODIS,

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SeaWiFS, VIIRS) and sensors from other nations (especially MERIS); development of higher resolution products from MODIS and MERIS data; and use of color sensors to develop products useful in identifying and/or tracking harmful algal blooms.

**August 14:** Ruhul Amin, a graduate student from The City College of the City University of New York (CREST), wrote a short summary of his stay here after the NESDIS CoRP Symposium as part of the NESDIS Summer Student Exchanges program.

“After the NESDIS CoRP Symposium, which was held at the Oregon State University (OSU) August 12-13 2008, I stayed one additional day to participate in the NESDIS Summer Student Exchanges program. On August 14, I had a meeting with Dr. Pete Strutton whose research interests are phytoplankton productivity, specifically coupling between biological processes and ocean physics and chemistry. He has also been working with harmful algal blooms which are my research interest as well. During the meeting, we discussed harmful algal blooms, specifically: (1) *Pseudo-nitzschia* - a diatom that produces domoic acid and leads to amnesic shellfish poisoning, and (2) *Alexandrium* - a dinoflagellate that produces saxitoxin and leads to paralytic shellfish poisoning. Both of these species often bloom off the coast of Oregon and Dr. Strutton and his team are trying to develop a new satellite product to predict and track these toxic blooms. Since both of these blooms are driven by upwelling and upwelling is usually caused by sea surface wind, we discussed wind products which might be helpful to predict these blooms. However, there are some spatial resolution problems with the wind satellite and we had a brief discussion on this topic.

Recently, I also developed a novel satellite bloom detection technique and a novel satellite toxic dinoflagellate *Karenia brevis* bloom classification technique which I named red band difference (RBD) and *Karenia brevis* bloom index (KBBI), respectively. We also had a long discussion about my algorithms and the possibility of applying these algorithms to other regions such as the Oregon Coast. Over all this was a very informative meeting.”

**August 19-21:** Ted Strub and Mike Kosro participated in a meeting to review a report on the evolving system of coastal radars for IOOS. The meeting was chaired by Jack Harlan (NOAA) and discussed a report that was in draft form. Mike Kosro is one of the leaders of the coastal radar system development within IOOS. Ted Strub represented the connection of the radars to satellite sensors, such as altimeters.

**August 20:** For the second summer, CIOSS sponsored 4 Research Experiences for Undergraduates (REU) students during 2008. The NSF-funded REU program provides the logistics for advertising, selecting students and running the program, allowing CIOSS to contribute to this successful program at minimum cost. The four students supported by CIOSS work with CIOSS Fellows in Corvallis on research projects following CIOSS themes. By supporting these students, CIOSS helps the program include equally sized cohorts of students in Corvallis and at the coast in Newport, Oregon (about 10 students in each location).

During the final week of the 10 week session, students gave a short presentation about their projects. Below is a list of students with their respective mentor, area of study and abstract of their project. Following this summer's internship program, three of the four CIOSS-funded students (Joel Craig, Rosalinda Fortier and Sam Kanner) attended the annual Fall Meeting of the American Geophysical Union and gave presentations, based on their summer work.

Joel Craig – **Pete Strutton**, Optical Indices of Phytoplankton Dynamics in the Equatorial Pacific

A database of chlorophyll fluorescence, particulate backscatter and beam attenuation was constructed from 17 cruises spanning the equatorial Pacific between August 2005 and February 2008. These optical measurements serve at least two important purposes. First, they can be used to document changes in phytoplankton abundance and physiology in a globally significant ecosystem. Second, they represent an important validation database for satellite observations that form the core of emerging primary productivity models. The data consist of CTD profiles from the surface to 1000m at least every degree of latitude between 8N and 8S, from near the Galapagos to beyond the date line. The optical data were calibrated with in situ samples of chlorophyll and particulate organic carbon (POC) from 4 of the 17 cruises. Chlorophyll concentration was derived from a multiple linear regression of chlorophyll fluorescence, time of day and depth, to account for photoinhibition of the fluorescence signal near the surface during the day. POC was derived from both particulate backscatter and beam attenuation. The optical data were then used to produce maps and latitude-depth sections of chlorophyll and POC for cruises where no in situ samples exist. In the eastern and central equatorial Pacific, phytoplankton chlorophyll to carbon ratios decreased by 30 to 50 percent during the weak El Nino conditions of 2006-2007. This change was due mostly to a decrease in chlorophyll, while POC remained relatively constant. In the western Pacific, the decrease in chl:C was absent, but an increase occurred in early 2008 when the system recovered from El Nino. Changes in chl:C, mostly indicative of photoadaptation, were also observed with depth and latitude as upwelled waters from the equator move poleward. Satellite-based maps of chlorophyll, phytoplankton C and chl:C were also produced and compared with the in situ optical measurements, with mostly good agreement.

Rosalinda Fortier – **Jack Barth, Kipp Shearmann**, Upwelling Tongues on the Oregon Continental Shelf: a Study using AUV Gliders

Year-round high resolution data from three Autonomous Underwater Vehicle Gliders from the Oregon shelf along the Newport Hydrographic (NH) Line (44.65°) are used to study small scale tongues of relatively warm, high-chlorophyll water subducting from near the surface to depth along isopycnal surfaces. Tongues are observed only during upwelling season and 15 tongues were observed over two years. Tongues are on average 7 km in length and 17 m thick with a temperature of 9°C, averaging almost a degree warmer than surrounding water. The average density is 1026.2 kg/m<sup>3</sup> with an average density thickness of 0.4 kg/m<sup>2</sup>. One tongue is investigated in detail using wind and temperature data from locally moored instruments. The tested theory is that tongues are formed by sub-pycnocline water that has been heated by the sun and sinks along the



upwelling front. The tongues seem to appear at the transition to relaxed conditions after a period of upwelling.

Sam Kanner – Jim Lerczak, Kipp Shearman, Quantifying Transport Associated with Internal Waves in Massachusetts Bay

Previous studies have shown that large-amplitude internal waves are significant agents in transporting water-borne materials, such as nutrients, larvae and sewage outfall effluent, across continental shelves towards shorelines. In August and September 2008, surface drifters, drogued at fixed depths, were deployed in Massachusetts Bay, a location where large amplitude internal waves are predictably observed to propagate towards the coast. The drifters were equipped with GPS devices to quantify the transport due to internal waves. Over the course of two ten-day cruises, drifters were deployed in front of the leading edges of non-linear wave packets and remained in the water for periods ranging from 4 to 16 hours. In addition, Acoustic Doppler Current Profilers (ADCPs) were affixed to moorings and tripods in order to measure the currents throughout the entire water column. The data garnered from these current meters were also used to estimate transport at fixed depths. By using Runge-Kutta integration methods and estimating the phase speed and propagation direction of the wave, transport estimates from drifters and ADCPs were compared. It was determined that a phase speed of 5% higher than the maximum currents measured was the best fit for the theoretical drifter tracks. During the study period, it was observed that drifters traveled more quickly onshore when drogued closer to the surface. This was especially apparent, 2-3 hours after deployment. By leaving the drifters in the water for longer than a semidiurnal tidal cycle (12.4 hours), the effects of the ebb and flow of the tide were negated. During such a time period the drifters were transported 10-15 km WSW. Such analyses can be useful when quantifying the transport of materials in Massachusetts Bay, particularly those that have the ability to remain at a fixed depth, such as an oil spill or zooplankton.

Samuel Peterson – Alexander Kurapov, Investigations on the Coastal Undercurrent off Cape Blanco

Sam Peterson worked with Dr. Alexander Kurapov on the modeling analysis of currents in the wind-driven coastal ocean and more eddy-dominated coastal transition zone (CTZ). In particular he developed an algorithm for three-dimensional Lagrangian particle tracking. The Regional Ocean Modeling System (ROMS) provides circulation fields in the fixed (Eulerian) framework. We initialized and ran the model simulation with three additional tracers or "labels" (Kuebel Cervantes et al., 2003). These label fields are initialized as two horizontal and a vertical coordinate values (x, y, and z labels). Then these initial particle coordinates are advected by ROMS as passive tracers. These label fields sampled at a given point at a later time give the location of the fluid particle at the initial time.

The label tracers show a release point of a fluid particle, but the full trajectory. At the same time, this information is presented in the ROMS solution, since at any given time there must be a unique point with a given set of labels (x<sub>0</sub>, y<sub>0</sub>, z<sub>0</sub>). Together with Sam Petersen, we developed and tested a nonlinear optimization algorithm to reconstruct Lagrangian trajectories from the labels, backward and forward in time. Sam has written



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the Matlab code based on this algorithm.

This technique was implemented on the slope near Cape Blanco. In this area, the surface alongshore current separates in the coastal transition zone. The deep-water undercurrent is found both south and north of Cape Blanco, although at different depths (Springer et al., 2008). The particle tracking suggested that the undercurrent might not be continuous, since all alongslope particles from south of Cape Blanco deflected offshore. Sam's results facilitate interest to study deep-water pathways in the CTZ in more detail.

Kuebel Cervantes, B.T., J.S. Allen, and R.M. Samelson, 2003: A Modeling Study of Eulerian and Lagrangian Aspects of Shelf Circulation off Duck, North Carolina, *J. Phys. Oc.*, **33** (10), 2070-2092.

Springer, S. R., R. M. Samelson, J. S. Allen, G. D. Egbert, A. L. Kurapov, R. N. Miller, and J. C. Kindle, 2008: A nested grid model of the Oregon coastal transition zone: simulations and comparisons with observations during the 2001 upwelling season, *J. Geophys. Res.*, in press.

**August 27:** A meeting of the local CIOSS Council of Fellows was held with **Curt Davis** (Chair), **Mark Abbott**, **Hal Batchelder**, **Dudley Chelton**, **Roger Samelson** and **Ted Strub** (ex-officio). **Ricardo Letelier**, and **Mike Freilich** (extended leave) were absent. Some highlights of the meeting:

- **Hal Batchelder** was added to the list of CIOSS Fellows as well as the Council. He will serve as Deputy Director during the upcoming year.
- Long-term plans for CIOSS in the coming 5 years including increased interactions with NOAA, allocations of core funding for projects and obtaining additional funding from other sources, and ways CIOSS can help NOAA in key areas, among others.
- Discussion of projects to be included in the annual Omnibus proposal.

The entire [summary of the meeting](#) can be found on the CIOSS website.

The next action was for Ted to discuss these projects and the overall strategy for CIOSS with **Kent Hughes** and Chris Brown, which occurred on Sept 4, 2008. See next entry for this discussion.

**August - October:** Individual and conference calls were held before and after the Council Meeting between those with ideas for research projects for the Year-7 Omnibus and NOAA/STAR/SOCD managers and research scientists. The Council action items included contacts between CIOSS Director **Ted Strub** and potential partners in NOAA - especially those leading efforts in altimetry (**Laury Miller**), scatterometry (**Paul Chang**), ocean color (**Mike Ondrusek** and Chris Brown), SST and dynamics for GOES-R (Tim Mavor), and modelers in NOS (Rich Patchen and Frank Aikman).

Although everyone is aware of the need for increased interactions and partnerships between COAS and NOAA Fellows, it is taking a large amount of effort to get these established.

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**August 28:** Jana Zvibleman, a public relations officer in the OSU research office, contacted **Ted Strub** and Amy Vandehey to put together a short article about CIOSS research to feature in the campus-wide publication "Update, the Research Office Newsletter." Her article is below:

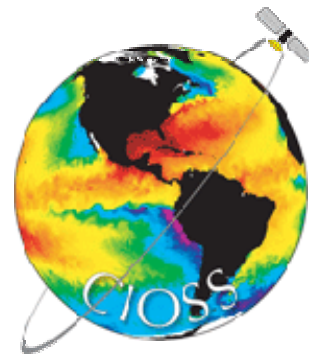
### **Ocean, Air, Tuna Fish**

If you've been at the coast this summer chilling your toes in the water or walking against the winds . . . or if you've wondered whether tomorrow night would offer a clear view of the ocean as you enjoy a grilled tuna . . .

. . . your perspective was only slightly different than that of the Cooperative Institute for Oceanographic Satellite Studies.

CIOSS uses remote sensing from satellites, and computer modeling, to increase understanding of the ocean and its interface with the atmosphere.

One recent CIOSS innovation uniquely forecasts conditions of the ocean. "Other satellite systems and models focus on weather," says Ted Strub, CIOSS Director. "The one produced by CIOSS Fellow Alexander Kurapov's team tracks ocean conditions and uses modeling to forecast the currents, and water temperature."



While the system is still being developed, the researchers have been posting [several-day forecasts along the Oregon coast](#). Tuna fishers have been consulting these fields, also made available on the [Oregon Coastal Ocean Observing System website](#), to plan their trips to the warm water preferred by tuna.

"We found this out only because they contacted us on a day when the fields were *not* posted!," says Strub. "The application is already helping them to conserve fuel."

CIOSS has been active this summer with an outreach workshop for teachers and a symposium on data-model fusion. Within the College of Oceanic and Atmospheric Science, CIOSS is a center of excellence for ocean remote-sensing and modeling within NOAA. See <http://cioss.coas.oregonstate.edu/CIOSS/index.html>.

**September 4:** **Ted Strub** had a follow-up meeting with **Kent Hughes** and Chris Brown to discuss the main points from the local Council of Fellows meeting: CIOSS – NESDIS/STAR/SOCD Interactions, Partnerships and Projects and Long-Term and Short-Term Plans. A [full summary](#) can be found on the CIOSS website. A list of long-term interests of STAR and CIOSS are below.

Long-Term (Next 3-5 Years) Interests of STAR and CIOSS:

- Increase real, active interactions between CIOSS and NOAA partners –
  - SOCD Science Teams, POP Teams and Branches.
  - Other NESDIS CI's and Centers.
  - Other NOAA Line Offices, CI's, Centers and Labs.
- Help NOAA in Critical Areas

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- IOOS – Integrating Remote Sensing and Modeling Products, Especially in Coastal Applications; Helping NOAA to Develop the “National Backbone.”
- Ocean Color – VIIRS and International Satellite Preparation and Use.
- Scatterometer – Coastal & Deep Ocean Applications and XOVWM preparation.
- Altimeter – Coastal & Deep Ocean Applications and Future Satellite Preparation.
- SST – Fronts and Feature Detection; Improved Merged SST Fields.
- Cross-Cutting (Multi-Sensor) Research.

**October 7:** **Alexander Kurapov** presented a seminar entitled, “A Modeling Study of Combined Effects of Wind-Driven upwelling and Internal Tide on the Continental Shelf” as part of the COAS Physical Oceanography Seminar series.

**October 14:** There was a NOAA and OSU press release highlighting the ongoing collaboration between OSU and NOAA on ocean temperature and current forecasts. NOAA sent the story to over 200 west coast newspapers and trade and fishing journals/magazines. Improved ocean prediction systems could provide a number of benefits to the general public, for example, by improving chances to be rescued at sea and helping fishermen to locate schools of fish.

[http://www.noaanews.noaa.gov/stories2008/20081014\\_tunamodel.html](http://www.noaanews.noaa.gov/stories2008/20081014_tunamodel.html) (NOAA)

<http://oregonstate.edu/dept/ncs/newsarch/2008/Oct08/oceantemperature.html> (OSU)

**October 21:** Meeting with Ted, Hal, Craig, Alexander, Amy to discuss future plans for the pilot prediction project based on the NOAA/OSU press releases.

**October 30:** **Ted Strub** presented a seminar entitled, “Altimeter Data Retrievals in Coastal Regions” as part of the COAS Atmospheric Sciences-Physical Oceanography Seminar series.

**November 6-7:** **Ted Strub** took part in the Second Coastal Altimetry Workshop, held in Pisa, Italy (<http://www.coastalt.eu/pisaworkshop08/>). At this workshop, progress in the retrieval of alongtrack altimetry was summarized in a number of presentations and discussions. This updated the result of the first workshop, hosted by CIOSS and NESDIS/STAR in February 2008. A third workshop is scheduled to be held in Fall 2009.

**November 10-14:** NASA Ocean Surface Topography Science Team and SWOT Workshop: **Ted Strub** attended the first meeting of the new international OST Science Team November 10-12 in Nice, France. Strub and **Dudley Chelton** lead separate 4-year projects in the re-constituted altimeter team. Strub presented a poster summarizing his new project and also a plenary presentation of efforts to retrieve altimeter data closer to land for coastal oceanographic applications. Strub also attended a workshop on the next generation altimeter, the SWOT (Surface Water and Ocean Topography) sensor, and presented the requirements for SWOT for coastal oceanography.

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**November 18:** On his way back from meetings in Italy (Coastal Altimetry Workshop 2) and France (Ocean Surface Topography Science Team and SWOT Workshop), **Ted Strub** stopped in Silver Spring and Camp Springs and discussed the developing Year-7 Omnibus proposal with **Kent Hughes, Paul DiGiacomo**, Chris Brown, Tim Mavor, Rich Patchen and Frank Aikman).

Kent, Paul and Chris felt a need for further conference calls.

**November 19-21:** NASA Ocean Vector Wind Science Team (OVWST):

**Dudley Chelton**, Qingtao Song and Barry Vanhoff attended the OVWST meeting in Seattle, where research involving ocean surface winds, performance of QuikSCAT and the plans for future scatterometers were discussed. **Michael Freilich**, presently on loan to NASA but still a CIOSS Fellow, also attended and provided suggestions for the research on ocean winds that Barry Vanhoff is carrying out at OSU, supervised by **Ted Strub** and **Dudley Chelton**.

**Mid-November to Mid-December:** Several conference calls occurred between **Paul DiGiacomo**, Chris Brown and CIOSS Fellows. One included those involved in proposed projects that used satellite ocean color data (**C. Davis** and **P. Strutton**). Another included those who would propose to develop new products from satellite altimeter and scatterometer data (**Jack Barth** and Craig Risien). **Ted Strub, Hal Batchelder** and others also took part. There were other local meetings between CIOSS Fellows and calls to others in NOAA to finalize the proposal plans.

**December:** Research from **Ricardo Letelier** and others was featured in "[COAS Research 2008](#)."



Transport of Carbon to the Deep, with Wave-powered Ocean Pumps

A team of scientists is studying the complex ocean upwelling process by mimicking nature – pumping cold, nutrient-rich water from deep within the Pacific Ocean and releasing it into surface waters near Hawaii that lack the nitrogen and phosphorous necessary to support high biological production.

The researchers are harnessing the power of the ocean to conduct their experiments, using the up-and-down motion of waves to pump deep water to the surface. Their next step is to create a pump that can withstand the rigors of the rugged Pacific and then see if the biology follows the physics. Lead investigators Ricardo Letelier of Oregon State University and David

*Deployment of the single pump off the back deck of the research vessel Kilo Moana. The initial test of the pumps in the open ocean is the focus of a documentary broadcast Sept 5 on the Discovery Channel. Photo:Karin*

Karl of the University of Hawaii and Angelicque White, an OSU postdoctoral researcher, stress that the goal of creating artificially induced upwelling is to understand how marine microbial ecosystems respond to largescale perturbations. Their studies have shown that water at a depth of 300 to 700 meters has the proper ratio of nitrogen and phosphorus to trigger a two-stage phytoplankton bloom. The researchers believe that this upwelling will first cause a bloom of diatoms, a common type of plankton. The diatoms will consume the nitrogen, leaving phosphorus in the water, which will stimulate a second-stage bloom of nitrogen-fixing cyanobacteria.

“We know a lot about how upwelling works and the physics of the ocean,” Letelier said, “but there are also things we don’t know, which is why this study is so important. These vast, seemingly barren regions comprise more than two-thirds of our oceans and nearly 40 percent of the entire Earth,” he added. “It is a large area of exchange between the atmosphere and the ocean and understanding large-scale interactions is critical to understanding climate change.” The researchers believe they can control plankton growth by determining which species respond to specific nutrients, and then adjusting the rate of nutrient feeding by the frequency and duration of water pumping.

“These vast regions may be perfect for sequestering carbon,” Letelier said, “but before we can begin to seriously consider a large-scale intervention, we must better understand how the biology responds by using perturbations on a small scale. We’re getting there.”