3. Scientific Partnerships
10-15-06

Although NOAA personnel are not collocated with CIOSS, interactions between the academic and NOAA partners within CIOSS grew markedly during the first four years of CIOSS activity. The structure of these interactions evolved into several major efforts, aligned somewhat by CIOSS Theme but also crossing those themes. These involved a group of activities centered around ocean color/ecosystems, a group involved in surface vector winds and in air-sea interactions, and a set of modeling activities (some involving altimeter analyses). Some of these and other activities also produced "products" that are being made available by NOAA/NESDIS/NCDC and CoastWatch, comprising a less structured "Product Development" Working Group. These working groups were more formally constituted during the third year, when they met in September 2005 at CIOSS (Corvallis, Oregon). They are shown in the lower half of the CIOSS Organization Chart (Figure 1.1) and are composed of NOAA and academic personnel (mostly CIOSS Fellows).

Within the "Sensors and Techniques" and "Fields and Fluxes" Research Themes, the greatest amount of activity is within the **COAST (Coastal Ocean Applications and Science Team)** Working Group (WG), led by Curt Davis and Mark Abbott from CIOSS, along with Stan Wilson, John Pereira and Paul Menzel from NESDIS. It was originally funded, as part of the GOES-R Risk Reduction activities, to help prepare for the HES-CW (Hyperspectral Environmental Suite – Coastal Waters imager) sensor. Its activities, however, involve more general research into ocean optics and phytoplankton ecosystem dynamics, with applications to all ocean color sensors. Membership goes far beyond CIOSS Fellows, with members from ONR (NRL), NASA, a number of U.S. academic institutions and a private consulting firm. In a series of workshops, the COAST WG developed specifications for the HES-CW sensor, within a set of anticipated applications, developed an outreach brochure to explain HES-CW to the broader community and has provided responses to NOAA questions about sensor specification and cost-benefit trade-offs. It also planned 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 future ocean color sensors. The first of the field experiments successfully collected in water and aircraft hyperspectral data sets during September, 2006, in Monterey Bay, California. The others will take place in 2007 in the NY Bight region and in 2008 along a section of the Gulf Coast. In addition to the COAST efforts, other individual projects within CIOSS (below) other aspects of ocean color research, as well as workshops to help guide the development of vicarious calibration platforms for ocean color, specifications for color Climate Data Records, etc. These are shown in Table 3.1, where individual projects are grouped by NOAA Strategic Goals. Most of the COAST activities are grouped under the "Ecosystem Goal".

In another activity within the "Sensors and Techniques" and "Fields and Fluxes" Themes, the **Ocean Vector Wind WG**, led by Paul Chang (NESDIS), Dudley Chelton and Mike Freilich (COAS), has held two workshops and met during the CIOSS Working Group meeting in September 2005. These have concentrated on: 1) Assessing the utility and impact of satellite-derived ocean vector winds for operational weather forecast offices (WFO); and 2) Evaluating the accuracy and sampling characteristics of the two existing satellite technologies for measuring ocean vector winds: active-radar scatterometers (SeaWinds and ASCAT) and passive-microwave polarimetric sensors (WindSat and the recently-cancelled

CMIS). The workshops have been attended by research scientists from academic and private research institutes, from NOAA, NASA and ONR, and by operational forecasters from NOAA. Although the focus of this working group has been weighted toward operational uses of OVW products, research aspects are well covered in specific CIOSS research projects (below) and by the leadership roles and participation of CIOSS Fellows (Freilich, Chelton and Chang) in NASA's Ocean Vector Winds Science Working Group.

The **Product Development WG** met formally during the CIOSS Working Group meeting (September 2005) to discuss the types of remotely sensed fields and products that the operational, educational and research communities would like to see. Most of the products are in "coastal" regions and this WG is co-chaired by Ted Strub and Dave Foley, who directs the NESDIS CoastWatch node for the U.S. West Coast. Most of the interactions between NOAA and CIOSS regarding product development occur outside of this formal WG, in the form of individual projects (below) and interactions. The immediate venue for new and improved products is the CoastWatch site, as well as internal web portals at CIOSS. The ultimate venues for satellite products are the coastal and global components of the Integrated Ocean Observing System (IOOS). NESDIS is expected to provide the "national backbone" for that system and CIOSS efforts will help NESDIS to accomplish that mission. The mechanisms through which NESDIS will provide products and services to the IOOS networks have not been defined, at present, but some expanded form of CoastWatch is likely to be involved, at least initially. Thus, CIOSS and CoastWatch are actively pursuing their partnership in satellite product development. In a follow-up activity, Ted Strub participated in the IOOS Remote Sensing Workshop, where the remote sensing needs of the IOOS Regional Associations were discussed (Dave Foley and Stan Wilson, NESDIS, were among the organizers of the workshop).

The **Dynamics and Modeling WG** also met during the CIOSS Working Group meeting in September 2005. Several of the attendees are planning workshops on data assimilation within ocean circulation models. Spatial scales addressed include both regional/coastal models (led by CIOSS Fellow John Allen, Frank Aikman [NOS] and colleagues) and global models (led by CIOSS Fellow Jim Richman, Eric Bayler [NESDIS] and NCEP colleagues). The workshop for coastal modeling and data assimilation is planned for April 2007 and a similar workshop for global modeling is under discussion (led by Jim Richman). Richman spent two weeks at NCEP in September 2006, working with David Behrenger and other NCEP modelers, and continued to plan collaborative projects and workshops. Similar to the development of improved satellite-derived products, improved models of ocean circulation are expected to become part of IOOS activities, with NCEP and NOS running the global and coastal models, respectively. Frank Aikman (NOS modeling) attended the first meeting of the Dynamics and Modeling WG and is expected to continue as a CIOSS partner in the coastal modeling and DA activities. ONR is also expected to be a strong partner and CIOSS modelers have long-established collaborations with John Kindle and others at NRL.

A need has not developed within CIOSS for formal working groups under the fourth and fifth CIOSS Research Themes – **Ocean-Atmosphere Analyses** and **Education and Outreach.** The Outreach Theme includes the workshops described above, which constitute "scientific outreach." Also included are two efforts in formal and informal education, described below.

The next section describes the partnerships within the individual projects.

A. Partnerships with colleagues in NESDIS Laboratories, other NOAA, other Federal and non-Federal government entities.

Of the 38 funded projects or unfunded collaborations, 32 involve active partnerships with NESDIS or another line office of NOAA; four others involve potential partnerships with NOAA. Ten projects/activities involve partnerships with colleagues in other federal and/or state agencies.

Individual projects are described in detail in Section 4, “Science Review”. The purpose here is to explicitly introduce the individual project topics, related to CIOSS Themes and NOAA Strategic Mission Goals. This is done with very brief descriptions of the PIs and post-docs or students, Federal or other partners, project titles, CIOSS Task number and Theme and NOAA Mission Goals. Projects are grouped by NOAA Mission Goal. Table 3.1 summarizes the information. No projects are associated with Transportation as a primary goal and only the CIOSS Administrative component is associated with a primary goal of Mission Support. Projects that have these as secondary goals are identified as such in the table.

CIOSS Participants	Partner	Project Name	CIOSS Theme	NOAA Mission Goal
Batchelder	NMFS: Peterson	Modeling Euphausiid Population Dynamics - Calif Current	3	Ecosystems
Batchelder	*[Potential with NOAA members of NW Atlantic GLOBEC]*	Modeling Copepod Population Dynamics - Georges Bank	3	Ecosystems
Davis	NESDIS/HQ: GOES-R HES Design Team	Technical Support for the HES Review Team	1 & 5	Ecosystems*
Davis, Abbott	NESDIS/HQ, STAR, NOS, NMFS, etc.	COAST Project - Ocean Color Sensors on GOES-R	1	Ecosystems*
Davis	NESDIS/HQ, STAR, NIST, NASA, ONR	Workshop to Review Ocean Color Calibration (MOBY-2)	1 & 5	Ecosystems*
Letelier, McCallum	*[Potential with NOAA members of COAST]*	Satellite and In Situ Color Data Matchup	1 & 2	Ecosystems*
Strub, Wilson, Foley	NMFS: Wilson, NESDIS/CoastWatch: Foley	Short-course on Satellite Data Use for Fisheries Applications	5	Ecosystems*
Strutton, Wood	NOS:, NRL: Arnone	Oceans and Human Health: HAB Research off Oregon	2	Ecosystems
Strutton, Letelier	*[Potential with NOAA members of COAST]*	Hyperspectral Data Analysis for GOES-R Risk Reduction	1	Ecosystems*
Allen, Samelson, Choboter	NRL: Kindle	NRL Model Analysis	3	Weather/Water
Allen, Egbert, Kurapov, Miller, Cho	NMFS: Hermann	Core Modeling in the GLOBEC NEP Program	3	Weather/Water+
Barth, Castelao	NESDIS/STAR: Mavor	SST Fronts in the Northern California Current	4	Weather/Water
Chelton, Song	NWS: Sienkiewicz; NRL; ECMWF	SST Influence on Wind Stress in Operational Forecast Models	4	Weather/Water+
Chelton	NWS: Sienkiewicz	Application of Scatterometer Winds to Weather Forecasts	2	Weather/Water*+
Chelton	NESDIS/NCDC: Reynolds	SST Operational Fields - Increased Resolution	2	Weather/Water*
Davis-Butts	NESDIS/CoastWatch: Foley; Coast Guard	An Oceanographic Remote Sensing Curriculum for SMILE	5	Weather/Water
Esbensen, Thum	*[Potential with NWS modelers]*	Atmospheric Modeling of SST-Boundary Layer Interactions	3	Weather/Water
Freilich	NESDIS/STAR: Chang	Develop & Test 12.5 km QuikSCAT Near-coastal Wind Data	2	Weather/Water*+
Freilich, Jiao	NESDIS/STAR: Chang, Jelenak	Surface Wind Forcing Fields from WindSat & QuikSCAT	1 & 2	Weather/Water*+
Freilich, Chelton	NESDIS/STAR: Chang; NWS	Workshops for Research and Operational Uses of OVW Products	5	Weather/Water*+
Freilich	NWS	Training for NOAA Weather Forecasters in Coastal Regions	5	Weather/Water*+
Freilich, Milliff, Stamus	NWS: NOAA Regional Forecast Offices	Use of Satellite OVW for Coastal NWS Forecasts	5	Weather/Water*+
Kosro	OAR: Jack Harlan	Evaluation of Coastal Radars Surface Currents in IOOS	4	Weather/Water+
Kurapov, Egbert, Samelson, Strub	STAR: Miller; *[Future CoastWatch: Foley; NOS: Aikman]*	Pilot Real-Time Coastal Ocean Forecasts/ Validation	3	Weather/Water+
Kurapov, Allen, Egbert, Samelson	JCSDA: Bayler; NOS: Aikman; NRL: Kindle	Workshop on Coastal Modeling and Data Assimilation	3 & 5	Weather/Water+
Letelier	NESDIS: Hughes	X-Band Reception of International Satellite Transmissions	1 & 2	Weather/Water*
Miller, Richman	NWS/NCEP: Behrenger, JCSDA, GFDL	NCEP Collaborations on Basin-scale Models	3	Weather/Water+
Phipps, Rowe	Oregon Sea Grant	Informal Education: An HMSC Pilot Display	5	Weather/Water
Samelson, Skyllingstad, Perlin	*[Potential with NOS: Aikman, NWS]*	Coupled Ocean-Atmosphere Modeling	3	Weather/Water+
Strub, Kosro, Saraceno	NESDIS/STAR: L. Miller and colleagues	Mesoscale Circulation from Satellites and Coastal Radars	2	Weather/Water+
Chelton, Risien	NESDIS: CoastWatch; NOS: HazMat	Surface Wind and Wind Stress Climatology	2	Climate*+
Coakley, Guo	NASA (CERES)	Estimates of Surface Radiation from AVHRR Data	2	Climate
Kosro, Letelier	NMFS: Various	Latitudinal Variability of Physical Forcing of CCS Ecosystems	4	Climate
Letelier, Abbott, Strutton	NOAA, NASA: various	Workshops to Develop Consensus on Ocean Color CDRs	1 & 5	Climate*
Strub, Barth	NOAA Climate: Koblinsky; NMFS: Peterson; NOS: Aikman	Workshop on Climate Impacts on CCS Ecosystems	5	Climate*
Strub	NMFS: Schwing and colleagues	Basin-Scale Influences on Mesoscale Structure in the CCS	4	Climate
Strub, Barth	NESDIS/CoastWatch: Foley, OAR/GFDL: Leetma	CCS Multi-Sensor Satellite Fields for Climate Variability	2	Climate
Wright, Goldfinger, Good	NOS/CSC, Oregon Sea Grant, State of Oregon	GIS Project to Map Coastlines and Ocean Bottom Topography	2	Climate
Strub	NOAA/NESDIS/STAR	CIOSS Administration		Mission Support

* Also counted as Mission Support
\+ Also counted as Transportation

Table 3.1: Scientific Partnerships (NOAA and other); CIOSS Themes and NOAA Mission Goals

Projects Addressing the NOAA "Ecosystems" Mission Goal

Batchelder: NOAA: NMFS (Peterson).
Synthesis of Euphausiid Population Dynamics, Retention and Loss Under Variable Climatic Conditions. Graduate student, Brie Lindsay. Task III, additional research. Theme 3. NOAA Mission Goal: Ecosystems.
Specifically, this project is the individual-based modeling component of an integrated assessment of the influence of variable climate-forced ocean conditions (transports, temperatures) on the spawning, distribution, and use and retention in favorable habitat and general population dynamics (growth, mortality) of the euphausiid, *Euphasia pacifica*, in the Northern California Current. The collaborator, William Peterson at the NOAA Fisheries NWFSC, is doing a synthesis of extensive recent data collected from the central Oregon coast region, and experimental measurements of vital rates of this species, upon which the modeling will be based.

Batchelder: NOAA: none specifically funded, but interacting with other GLOBEC NW Atlantic PIs, some of whom are NOAA investigators.
Impacts of climate and basin-scale variability on seeding and production of *Calanus finmarchicus* in the Gulf of Maine/Georges Bank region. Task III, additional research. Theme 3. NOAA Mission Goal: Ecosystems.
This project will link basin-scale (climate) forcing, such as the NAO, to the NW Atlantic region using a ROMS physical model coupled with data synthesis and Lagrangian based organism modeling to examine the role of ocean productivity and supply of seed stocks of *Calanus finmarchicus* from the Labrador Sea region to the slope sea region and Gulf of Maine. This work addresses CIOS Theme 3 by developing models that might eventually be incorporated into integrated ocean observing/modeling systems.

Davis: NOAA: NESDIS (Dan Flanagan, GOES-R HES Design Team).
Technical Support for the HES Review Team. Task II, additional outreach. Theme 5. NOAA Mission Goal: Ecosystems.
CIOSS Fellow Curt Davis has served on the HES Design Team, providing scientific oversight for the engineering designs that are being developed for the HES instrument.

Davis & Abbott (COAST): NOAA: NESDIS HQ, NESDIS STAR, NESDIS/CICS, NESDIS/CREST, NOS, NMFS. NASA GSFC, NASA HQ. ONR, Navy Operations.
The approximately 40 members of the COAST project include at least 19 Universities and 1 private consulting company. These include graduate student and post-doc support. COAS graduate student, Sam Laney. Task II. Theme 1. NOAA Mission Goal: Ecosystems.

Davis: NOAA: NESDIS/HQ, NESDIS/STAR. NIST. NASA. ONR.
Ocean Color Workshop to Review Issues Regarding Vicarious Calibration (MOBY-2). Task II, additional outreach. Themes 1 & 5. NOAA Mission Goal: Ecosystems.
CIOSS Fellow Curt Davis chaired a panel that reviewed plans for the next generation buoy for optical calibration and validation of ocean color sensors. The evaluation team included CIOSS and NIST members.

Letelier, MacCallum – NOAA: none (those in the COAST project, indirectly).

Post-Doc Project 2, for Iain MacCallum. Satellite and in situ color data matchup. Task II. Themes 1 and 2. NOAA Mission Goal: Ecosystems.
Post-Doc Iain MacCallum developed software and identified matched data (satellite and in water measurements of ocean optics). These matched data sets will be used for algorithm evaluation and improvements by those in the COAST project.

Strub: NOAA: NMFS (Wilson), NESDIS/CoastWatch (Foley).
Short-Course on Satellite Data Use for Fisheries Applications. Task I, core outreach. Theme 5. NOAA Mission Goal: Ecosystems.
This short course brought 30 NMFS and Marine Sanctuary research scientists to CIOSS for a 3-day course on the use of satellite data in fisheries-related studies. CIOSS provided the venue and the first half-day of lectures on ocean remote sensing. Wilson and Foley then led the rest of the workshop, which was a hands-on exploration of available satellite data and GIS software.

Strutton, Wood: NOAA: NESDIS/CoastWatch (Foley); NRL: Arnone.
Oceans and Human Health. HAB research off Oregon. Task III, additional research. Graduate Student, Brittany Scott. Theme 2. NOAA Mission Goal: Ecosystems.
The goal of this project is to further our understanding of when and where harmful algal blooms (HABs) occur off coastal Oregon. Using satellite data from multiple sensors, we expect to improve our ability to predict and track HABs. This will contribute to an early warning system for coastal managers who are tasked with protecting the public from toxic shellfish.

Strutton, Letelier: NOAA: none directly. Potential for those in the COAST project.
Sensor and Data Intercomparison for GOES-R Risk Reduction: Spatial and Temporal Resolution Thresholds/Goals (Hyperion Data Analysis). Graduate student, Maria Kavanaugh. Task II, core research. Theme 1. NOAA Mission Goal: Ecosystems.
This project has used Hyperion hyperspectral, 30m spatial resolution data as a prototype data set to determine the optimal spatial and spectral resolution for coastal ocean color sensors. Preliminary data from the Florida Keys indicate that a pixel resolution of 250m is likely adequate for quantifying much of the spatial variability in coastal environments. These same data also show that the spectral width of individual wavelengths is important for distinguishing features, particularly in regions where the ocean bottom is visible. Further analyses will adapt these initial analyses to other regions and, where possible, assess the impact of temporal resolution for quantifying biological processes in the coastal zone.

Projects Addressing the NOAA "Weather and Water" Mission Goal

Allen, Samelson, Choboter – NOAA: none NRL: Kindle.
Post-Doc Project 1, for Choboter. NRL model analysis. Task II. Theme 3. NOAA Mission Goal: Weather and Water.
Postdoctoral Research Associate Paul Choboter worked with John Allen and Roger Samelson to evaluate numerical models of coastal circulation, with an emphasis on the dynamics of the poleward undercurrent and wind-driven coastal upwelling. Most of this effort was directed at the diagnosis of the dynamical balances that support the undercurrent in the Naval Research Laboratory's California Current System Navy Coastal Ocean Model (NCOM-CSS). Related scientific results on fundamental aspects of time-dependent and topographically influenced upwelling dynamics were also obtained during this project.

Allen, Egbert, Kurapov, Miller, Choi: NOAA: OAR (Hermann).
Core Modeling in the GLOBEC NEP Program, with Data Assimilation, combined with Post-Doc Project 4 for B. J. Choi (combining funds from NESDIS and NOS, so Task II and Task III, core and additional research). Theme 3. NOAA Mission Goal: Weather and Water.
A primary goal of this project is to obtain the best possible model estimates for the physical fields in the region of the GLOBEC field experiments off the Oregon coast by assimilation of satellite altimeter and GLOBEC current measurements in a high-resolution limited-area nested coastal model. A second goal involves use of this coastal model to determine the important physical dynamics in this region. Post-Doc Choi is developing the methods of assimilating altimeter and coastal radar (surface velocity) data into coastal models. The coastal models are nested within basin-scale models run at NRL (John Kindle) or by other GLOBEC modelers. Collaborators include Al Hermann at PMEL (NOAA/OAR). Bio-physical models are also incorporated in other versions of this model. NOAA/NMFS fisheries scientists are also members of the GLOBEC project.

Barth, Castelao: NOAA: NESDIS/STAR (Mavor).
SST Fronts in the Northern California Current: The Development of an Ocean Observing System Data Product Based on GOES Imagery. Graduate student, Renato Castelao. Task II, core research. Theme 4. NOAA Mission Goal: Weather and Water.
In this project, CIOSS Fellow Jack Barth and his student, Renato Castelao collaborated with Tim Mavor (NESDIS) in the analysis of SST frontal positions in the California Current. Two peer-reviewed journal articles resulted from this work.

Chelton, Song: NOAA: NWS (Joe Sienkiewicz). NRL. ECMWF.
SST Influence on Surface Wind Stress in Operational Forecast Models. Post-doc, Qingtao Song. Task I, core research. Theme 4. NOAA Mission Goal: Weather and Water.
This project is analyzing ECMWF wind fields at 850 hPa and 700 hPa to determine whether the observed influence of SST on surface winds can be detected above the atmospheric boundary layer. If such a link can be found, improvements in the SST boundary condition and boundary layer parameterizations may lead to improvements in weather forecasting. ECMWF wind fields were chosen for this analysis because a change in the SST boundary condition in the ECMWF model in May 2001 resulted in a dramatic improvement in the resolution of surface wind fields compared with the NCEP model.

Chelton, Freilich: NOAA: NWS (Joe Sienkiewicz).
Application of scatterometer winds to weather forecasts. Task III, additional research. Theme 2. NOAA Mission Goal: Weather and Water.
This collaboration resulted in a paper published in the August 2006 issue of *Monthly Weather Review* showing two detailed case studies that demonstrate the utility of QuikSCAT observations of surface winds for marine weather prediction.

Chelton: NOAA: NESDIS/NCDC (Richard Reynolds).
SST operational fields – increased spatial and temporal resolution. Task I. Theme 2. NOAA Mission Goal: Weather and Water.
This collaboration has resulted in improvements in the optimal interpolation algorithm used by Richard Reynolds to produce global SST fields from satellite infrared and in situ observations. The technique has now been applied to data dating back to January 1985. The resulting SST fields are a major improvement in both accuracy and resolution over the old Reynolds SST

analyses. A manuscript summarizing the results of this effort is in preparation for submission to the *Journal of Climate*.

Davis-Butts: NOAA: NESDIS/CoastWatch (Foley); Coast Guard speaker at the HS Challenge.
Development of an Oceanographic Remote Sensing Curriculum for the SMILE High School Program. Graduate students, Molly Phipps and Bronwen Rice; participation by various other graduate and undergraduate students. (Task II, additional outreach). Theme 5. NOAA Mission Goal: Weather and Water.
Dave Foley participated in the 2005 High School Challenge and will participate in the 2006 event. In these events, high school students from the twelve SMILE school districts assemble for about a day and a half and are faced with a scenario-based problem. The problem in 2005 involved developing plans for a sustained fishery in a coastal community and Foley taught a several hour "expert session" on the use of satellite data for fisheries applications.

Esbensen, Thum: NOAA: none. Potential with NWS modelers.
Atmospheric Modeling of the SST-Influence on the Atmospheric Boundary Layer. Graduate student, Nicolai Thum. Task III, additional research. Theme 3. NOAA Mission Goal: Weather and Water.
This study used a numerical model to study the mechanisms by which SST anomalies affect the atmospheric boundary layer and surface winds. It complements the studies of Chelton and colleagues who have documented these phenomena using satellite SST and wind measurements. The ultimate goal is to help numerical weather forecasts at NOAA to improve their representation of this phenomenon.

Freilich: NOAA: NESDIS/STAR (Chang).
Research-to-Operations Development and Test of 12.5 km resolution near-coastal wind data set from QuikSCAT. Task II, additional research. Theme 2. NOAA Mission Goal: Weather and Water.
This project develops, refines, and implements an impact-based land flag to allow retrieval of accurate, 12.5 km wind speed and direction estimates from QuikSCAT closer to the coast than is presently possible in the NOAA near-real-time processing system. Analyses of the full 7-year QuikSCAT data set allow determination of egregiously land-contaminated slice backscatter estimates at each geographical location and for each QuikSCAT viewing geometry. Retrieval of winds within ~10 km of land is possible at some West Coast locations. Following ongoing tests using a COAS-based advanced version of the NOAA NRT processing system, revised algorithms will be provided to NESDIS/STAR for implementation in the operational retrievals.

Freilich, Jiao: NOAA: NESDIS/STAR (Chang, Jelenak).
Construction and Evaluation of Surface Wind Forcing Fields from WindSat and QuikSCAT. Post-Doc Project 6 for Hai-Ying Jiao. Task II, core research. Themes 1 & 2. NOAA Mission Goal: Weather and Water.
The broad-swath, vector measurements of WindSat and QuikSCAT allow calculation of dynamically important derivative fields (wind stress curl and surface divergence). The accuracies of the derivative quantities are estimated for the first time by satellite-satellite comparisons, utilizing the fact that the QuikSCAT and WindSat orbits/swaths provide spatially extensive regions of nearly simultaneously sampled winds. Results to date demonstrate that curl features on scales less than ~80 km are virtually uncorrelated between the two measurement

systems, while larger-scale features are well-correlated over a wide range of wind conditions and geographical locations.

In a related QuikSCAT-WindSat-SSM/I comparison study, we demonstrate that non-raining WindSat wind speed retrievals with indicated wind speeds > 28 m/s are highly inaccurate – while for these high speed WindSat data simultaneous QuikSCAT and SSM/I measurements agree with each other, the QuikSCAT and SSM/I speeds are only 50% of the WindSat speed (V1.9.0 WindSat data set).

Analysis approaches developed and refined at CIOSS as part of this project may be used by NESDIS researchers to assess and guide their development of refined, more accurate WindSat vector wind retrievals.

Freilich, Chelton: NOAA: NESDIS/STAR (Chang); NWS (tropical and severe weather forecast offices).
Workshops for Research and Operational Uses of OVW Products. Task I, core outreach. Theme 5. NOAA Mission Goal: Weather and Water.
The objectives of this effort is to establish a partnership between the research and operational communities with a common goal of establishing a sustained data record of high-quality satellite measurements of ocean vector winds that satisfies the needs of both communities. This is being achieved through a series of workshops at approximately yearly intervals. To date, two workshops have been conducted, one in February 2005 and the other in June 2006.

Freilich: NOAA: NWS (Jeffrey Lorens, NWS Western Region).
Annual training workshop for operational weather forecasters in coastal regions. Task III, additional outreach. Theme 5. NOAA Mission Goal: Weather and Water.
Approximately half-day presentations of satellite microwave wind measurement techniques, bases, and interpretation focused specifically for training of WFO forecast personnel having marine prediction responsibilities, as part of the annual Western Region Marine Forecaster Training Workshop (Freilich has presented annually since 2000). The present internet COMET training module on scatterometry is based on lectures presented by Freilich at COMAP as well as at the WR Marine Forecaster Training Workshops
(http://meted.ucar.edu/npoess/scatterometry/)

Freilich/Milliff/Stamus: NOAA: NWS (NOAA Regional Forecast Offices).
Expanding the Impact of Satellite Surface Vector Wind Measurements on Coastal Operational Forecasts Produced by National Weather Service Forecast Offices. Task II, additional outreach. Theme 5. NOAA Mission Goal: Weather and Water.
Site visits and associated training sessions in the use and interpretation of QuikSCAT measurements, coupled with written forecaster and SOO surveys at WFOs with marine forecast responsibility, have been conducted by Milliff and Stamus over the past 12 months. Guidance from Milliff and Stamus has significantly increased the use and perceived value of QuikSCAT measurements at some WFOs, while the formal written and oral feedback from the SOOs and forecasters is being used to guide the development of enhanced forecaster vector wind products and requirements for new and more capable vector wind measurement systems.

Kosro: NOAA: OAR (Jack Harlan).
Evaluation of Coastal Radar systems for ocean surface currents. Task III, additional research. Theme 4. NOAA Mission Goal: Weather and Water.

In this project, Mike Kosro is looking at specific problems encountered in the use of coastal radars to estimate coastal currents. This is in preparation for the use of these systems in the IOOS efforts.

Kurapov, Egbert, Samelson, Strub: NOAA: NESDIS/STAR L. Miller, Potential for collaborations with CoastWatch (Foley) and NOS (Aikman).
A Pilot Real-Time Oregon Coastal Ocean Simulation System, Validated Using Satellite-Derived Products. Task II, core research. Theme 3. NOAA Mission Goal: Weather and Water.
In this project, a pilot real-time coastal ocean forecast system has been developed and run operationally since June 1, 2005. The oceanic component of our system is based on the Regional Ocean Modeling System (ROMS). The model domain extends between 41-47N alongshore and 250 km offshore, with a horizontal resolution of 2 km and 31 terrain- following vertical levels. The model is forced with wind stress and heat flux computed using forecast fields from the NOAA/NCEP mesoscale atmospheric NAM operational forecast model. The model results will be compared to remote sensing and in-situ data. Strub is collaborating with Remko Scharroo in looking at the high-resolution (10-20Hz) TOPEX and Jason-1 data in the region next to the coast of Oregon, which will serve as a comparison to the model results.

Kurapov, Allen, Egbert, Samelson: NOAA: NOS (Aikman); JCSDA (Bayler). NRL (Kindle).
Workshop on Coastal Modeling and Data Assimilation. Task I, core outreach. Themes 3 and 5. NOAA Mission Goal: Weather and Water.
The goal of this workshop is to bring together experts on coastal modeling and data assimilation to define the state of the art in coastal modeling. This is a first step in helping NOAA/NOS to look forward to its role as the National Backbone for coastal modeling in the IOOS efforts.

Letelier: NOAA: NESDIS (Hughes).
Evaluation of X-Band requirements to receive international satellite transmissions. Task II, additional research. Themes 1 and 2. NOAA Mission Goal: Weather and Water.
The goal of this project is to investigate the necessary changes to an existing satellite receiving station for MODIS that would allow the reception of data transmitted from different satellites. Specifically, the goal is to be able to receive data from satellites belonging to other nations, anticipating future gaps in coverage by U.S. satellites.

Miller, Richman: NOAA: NWS/NCEP (David Behrenger), JCSDA, GFDL.
Science exchange (visit to NCEP by Richman) to explore collaborations with a focus on basin-scale models, data assimilation and error estimates. Task II, additional outreach. Theme 3. NOAA Mission Goal: Weather and Water.
All data assimilation methods require estimates of the errors in both the model and the data. In the course of implementing data assimilation schemes for two ocean general circulation models, we have constructed and evaluated statistical models for model and observation error, including representation error, We believe this latter estimate to be the first of its kind. We have established contact with the Environmental Modeling Center at NCEP and we plan to incorporate our statistical error models into data assimilation systems to be run in parallel with the CFS. This will allow us to evaluate the impact of using our calibrated error models in an operational forecast system, and, if the impact is significant and positive, we will work with NCEP personnel to incorporate our assimilation formulation into the operational system.

Phipps, Rowe: NOAA: Oregon Sea Grant.

Informal Education, Pilot Display at the HMSC. Graduate student, Molly Phipps. Task I, Core Outreach. Theme 5. NOAA Mission Goal: Weather and Water.
Molly Phipps is collaborating with those in the public wing of the Hatfield Marine Science Center, which is run by the NOAA Sea Grant program. The goal is to create an interactive public display that highlights the use of satellite data in studying the ocean. Phipps is a PhD student in the Informal Education at OSU and Rowe is her advisor.

Samelson and Skyllingstad: NOAA: none, potential for collaborations with NOS (Aikman) and NWS.
Coupled Ocean-Atmosphere Modeling. Post-doc, Natalie Perlin. Task II, core research. Theme 2. NOAA Mission Goal: Weather and Water.
The long-range goal of this project is to improve our ability to understand and predict environmental conditions in the coastal zone, especially with regard to the use and augmentation of satellite observations of wind stress, and to improve understanding of the processes that link wind stress variations to sea-surface temperature variability and ocean circulation patterns. The specific scientific objectives are to use a coupled ocean-atmosphere model to investigate and quantify interaction between the oceanic and atmospheric boundary layers in the coastal zone, and to compare the results to high-resolution satellite remote sensing data.

Strub, Kosro, Saraceno: NOAA: NESDIS/STAR (L. Miller and colleagues).
Mesoscale Circulation from Satellites and Coastal Radars. Post-Doc Project 5, for Saraceno. Task II, core research. Theme 2. NOAA Mission Goal: Weather and Water.
Post-doc Martin Saraceno is combining altimeter, tide gauge, scatterometer and coastal radar data to form high resolution surface velocity fields in the region off Oregon. This is in collaboration with Laury Miller (NOAA/NESDIS/STAR) and Fabrice Bonjean and Gary Lagerloef at Earth and Space Research (ESR), an environmental contracting company. ESR is funded by NOAA to produce surface velocity fields from the combination of altimeter and scatterometer data on a 1 degree grid. The work of Saraceno will provide a high-resolution extension of this data set in the large-scale coastal domain.

Projects Addressing the NOAA "Climate" Mission Goal

Chelton, Risien: NOAA: NOS (HazMat), NESDIS (CoastWatch).
Surface Wind and Wind Stress Climatology. Graduate student, Craig Risien. Task II, core research. Theme 2. NOAA Mission Goal: Climate.
The objective of this project is to develop QuikSCAT-based climatologies of wind stress and derivative products for use in operational and research applications. The effort has thus far resulted in an interactive Climatology of Global Ocean Winds (COGOW) designed for HazMat type applications, as summarized in a paper that recently appeared in *Remote Sensing of the Environment*. A gridded climatology more suited to research applications for ocean modeling is nearly complete.

Coakley, Guo – NOAA: none. NASA: CERES project (Langley Research Center).
Post-Doc Project 3, for Guang Guo. Estimates of surface radiation from satellite data. Task II. Theme 2. NOAA Mission Goal: Climate.
In this project, satellite (AVHRR) data were used to estimate surface radiation (long wave and short wave). These estimates were compared to ship-based estimates from research vessels. The project is finished and Guo now works for a NOAA contractor.

Kosro, Letelier: NOAA: NMFS (Various NOAA members of the GLOBEC NEP project).
Latitudinal Variation of Upwelling, Retention, Nutrient Supply and Freshwater Effects in the California Current System. Task III, additional research. Theme 4. NOAA Mission Goal: Climate.
In this GLOBEC project, CIOSS Fellows Kosro and Letelier are collaborating with others in the U.S. GLOBEC NE Pacific program to look at latitudinal variations in mesoscale circulation between Northern California and Washington. One of the hypotheses of the GLOBEC program is that climatic variability causes changes in mesoscale circulation that affect the distributions and abundances of zooplankton, which, in turn, have impacts on fish populations. A number of the GLOBEC colleagues are NOAA/NMFS fisheries research scientists.

Letelier, Abbott, Strutton (CDR Workshops): NOAA: NESDIS/STAR, NESDIS/HQ, PPI/Climate Office, NPOESS/IPO, NMFS. NASA/GSFC.
Workshops to Develop Consensus on Production of Ocean Color Climate Data Records. Task II, additional outreach. Themes 1 and 5. NOAA Mission Goal: Climate.
Two workshops were planned and one has been held. The other is yet to come. The first involved various NOAA Line Offices and NASA and produced a concise statement of what the requirements for CDRs (see the report on the CIOSS web page). The next is still in planning and will again bring NOAA, NASA and academic research scientists together to develop more specific plans for ocean color CDRs.

Strub, Barth: NOAA: PPI/Climate Office (Koblinsky), NMFS (Peterson), NOS (Aikman).
Workshop on Climate Impacts on California Current Ecosystems (jointly supported by CIOSS and JIMO). Numerous NMFS participants. Task I, core outreach. Theme 5. NOAA Mission Goal: Climate.
CIOSS is co-sponsoring this workshop with the Joint Institute for Marine Observations (JIMO) at Scripps, at the request of Chet Koblinsky (NOAA/Climate). The objectives are: to define the present state of knowledge regarding the effects of climate variability on components of the California Current Ecosystem; and to provide the conceptual framework for future observing and modeling systems that would be necessary to monitor those effects.

Strub: NOAA: NMFS (Frank Schwing and colleagues at the NMFS/ERD lab).
Large-scale Influences on Mesoscale Structure in the CCS, A Synthesis of Climate-forced Variability in Coastal Ecosystems. Task III, additional research. Theme 4. NOAA Mission Goal: Climate.
The is a GLOBEC project within the effort to synthesize the research in the Northeast Pacific (NEP) program. It specifically looks at the connections between the large-scale circulation in the North Pacific and the mesoscale variability in the California Current. Frank Schwing (NOAA/NMFS/ERD) is the lead PI and there are several other collaborators at the Environmental Research Division in Pacific Grove, CA.

Strub, Barth: NOAA: NESDIS/CoastWatch (Foley), OAR/GFDL (Leetma).
Construction of satellite fields for the California Current for multi-sensor analyses of climate variability. Unidentified student support. Task II, additional research. Theme 2. NOAA Mission Goal: Climate.
This is a one-year "Research and Operations" project to construct comparable fields of several types of satellite data over the large-scale California Current System (CCS, 32°N-52°N). Fields

of SSH, SST, surface chlorophyll-a pigment concentrations and vector winds will be constructed from the available satellite data. The fields will be used to look at climate variability in the CCS.

Wright, Goldfinger, Good – NOAA: NOS/CSC, Oregon Sea Grant. State of Oregon.
GIS projects to map coastlines and ocean bottom topography. Several graduate students. Task II. Theme 2. NOAA Mission Goal: Climate.
This was a one-year project funded by the NOAA/NOS Coastal Service Center. It involved the use of high-resolution (IKONOS) satellite data in GIS projects (Wright) and mapping of the bottom topography of the coastal ocean shelf off Oregon (Goldfinger).

B. Formal procedures for joint planning

In general there is an ongoing dialog between CIOSS members and NOAA personnel. These are fairly frequent between established colleagues (Freilich and Chang, Chelton and Reynolds, Abbott, Freilich and Stan Wilson, Strub and Foley, Strub and L. Miller, etc.). However, these would be easier and even more frequent, if there were NOAA personnel physically present at CIOSS.

More formal planning procedures include:

- As described elsewhere, our annual review process for new and continuing projects supported by our annual core funding involves both a local review by the Council of Fellows and a review by our program manager and his colleagues in NOAA/NESDIS/STAR. Prior to the local review, the program manager has sometimes provided a prioritized set of topics for the annual omnibus proposal.
- Within the GOES-R Risk Reduction program, NOAA holds annual meetings in which the various Risk Reduction efforts are presented and discussed. Suggestions for modifications to those efforts are made at that time.
- As described above, during Year-3, we held a joint meeting of four “working groups” (WGs) within CIOSS: COAST/Ecosystems, Dynamics, Ocean Vector Winds and Product Development. Our Program Manager (Eric Bayler) brought members of his staff to CIOSS and the working groups to discuss possible future projects. The Ecosystems WG is identical to the COAST project members. The Dynamics group includes the modelers and those using altimeter data for analysis of ocean dynamics. The Wind WG consists of the organizers of the OVW workshops from CIOSS and NOAA. The Product Development WG was lead by Strub and Dave Foley and discussed the kinds of products presently available through CoastWatch and products that the group thought could be developed that would be useful.
- The COAST project has held four workshops, during which it has made general plans for field studies off the West, East and Gulf Coasts (workshops 2 and 3) and specific plans for the field work off the West Coast (workshop 4).
- The planned workshops on coastal modeling and on climate effects on California Current ecosystems will discuss plans for future projects.
- There are periodic discussions between CIOSS personnel and NOAA managers at CI Directors’ meetings and other meetings with more focused themes. Al Powell (NOAA/NESDIS/STAR) has initiated periodic conference calls with the NESDIS CI Directors to discuss future plans.
- Members of CIOSS participate on teams assembled by NOAA to plan specific types of activities, such as the “Research and Operations” teams.