Periodic Report: Activities of CIOSS Fellows at the College of Oceanic and Atmospheric Sciences, Oregon State University
March 16, 2006

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.

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" (see first abstract below). Renato Castelao, advised by Jack Barth, presented "Jet separation at Cape Blanco: The importance of wind stress curl" (see second abstract below).

ABSTRACT
"Ecological and Chemical Responses to Tropical Instability Waves in the Equatorial Pacific"
Wiley Evans

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.

ABSTRACT
"Jet separation at Cape Blanco: The importance of wind stress curl"
Renato Castelao and Jack Barth

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 8: The CIOSS Year 4 Omnibus Proposal was submitted through Grants.gov.

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 February 20-24 in Hawaii. The following are a selection of presentation and poster titles. The names of CIOSS Fellows are in bold.

Presentations:
Variational data assimilation in coastal ocean problems with instabilities: A. Kurapov, **J. Allen**, **G. Egbert**, **R. Miller**

Interactions Between Oregon's Coastal River Plumes and the Wintertime Wind-Driven Shelf Circulation: M.M. Whitney, **J. Allen**

The Evolution in Alongshore Scale of Finite Amplitude Instabilities on a Coastal Upwelling Front: S.M. Durski, **J. Allen**, **G. Egbert**, **R. Samelson**

Physical-Biological Interactions from the Inner Shelf to the Slope in an Upwelling Region with Alongshore Varying Bottom Topography: **J. Barth**

Spatial and temporal variability of inner-shelf circulation along the central Oregon coast during summer: A.R. Kirincich, **J. Barth**

GOES-R Coastal Waters Imaging as a Component of IOOS: **C. Davis**, P. Bissett

Tidal Energetics Along the Hawaiian Ridge: E. Zaron, **G. Egbert**

Seismic images of the ocean offshore western North America: internal tides and the California undercurrent: A. Trehu, **G. Egbert**

Charting the Time-Varying Surface Circulation off Oregon: **M. Kosro**

Inter-annual to Decadal Variability in Soluble Reactive Phosphorus Concentrations in the North Pacific Subtropical Gyre: **R. Letelier**, A. White, D.M. Karl, M.J. Church, J. Christian

Direct Numerical Simulation of Breaking Waves and Langmuir Circulation: **E. Skyllingstad**, C. Smith, J. Gerrits

Atmospheric Intraseasonal Oscillations and Their Impact on the Oregon Coastal Upwelling System: From the Jet Stream to Zooplankton: J.M. Bane, **Y. Spitz**, **R. Letelier**

Interactions of Pacific Eastern Boundaries With the Basin-Scale Circulation: **T. Strub**, C. James

Initial Results of Submersible Dives and Multibeam Mapping to Investigate Benthic Habitats of Tutuila, American Samoa: **D. Wright**, E.R. Lundblad, D. Fenner, L. Wheylan, J.R. Smith

Posters:
Dynamics of the California Undercurrent in the Navy Coastal Ocean Model: P. Choboter, **R. Samelson**, **J. Allen**, J. Kindle

On the dynamics of jet separation at Cape Blanco, R. Castelao, **J. Barth**

Upwelling and Ecosystem Response on Strongly Wind-Driven Continental Shelves and Slopes: What Have we Learned in the Last Decade?: **J. Barth**

Near-Cylindrical Solitary Rossby Waves in the Ocean: Mechanisms and Observations: R.A. De Szoeke, **R. Samelson**, M.G. Schlax, **D. Chelton**

Modeling internal tides in interaction with wind-driven current on the Oregon shelf: **G. Egbert**, A. Kurapov, S.Y. Erofeeva

Momentum Balance off the Oregon Coast during Upwelling Season: M.D. Levine, **M. Kosro**, T.J. Boyd

Impact of a Reduced State Space Kalman Filter on the Equatorial Pacific Cold Tongue and Tropical Instability Waves: R.C. Perez, **R. Miller**

Qualitative Analysis of the Variability of the Kuroshio off Japan: **R. Miller**, G. Vernieres, L. Ehret, J.L. McClean, M. Maltrud

Evidence for atmospheric control of sea-ice motion through Nares Strait: **R. Samelson**, T. Agnew, H. Melling, A. Muenchow

Disturbance growth in a baroclinic wave-mean oscillation: C.L. Wolfe, **R. Samelson**

Spatial and Temporal Variability in the Ecosystem Response to Upwelling Wind Forcing off Oregon: **Y. Spitz**, **J. Allen**

Satellite Measurements of Strong Negative Chlorophyll Anomalies in the California Current in Spring 2005: Thomas, P. Brickley, **T. Strub**

Variability in Mesoscale Physical Activity in the Northern California Current and its Affects on Biological Distributions: J.E. Keister, **T. Strub**

Spatial and Temporal Variability of Chlorophyll and Nutrients in the Equatorial Pacific From 1997 to the Present: **P. Strutton**, W. Evans, F. Chavez

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".

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

Additional activities of CIOSS Fellows working at NESDIS/STAR are reported separately in the STAR weekly reports.