January 12th, 2018

35th Annual Graduate Student Symposium

USF

UNIVERSITY OF SOUTH FLORIDA
COLLEGE OF MARINE SCIENCE

Abstract Booklet

Table of Contents

Poster Presentation Abstracts

Graduate Student Symposium Schedule
January 12, 2018

9:30	Kara Radabaugh *Plenary Speaker*	Blue Carbon in Tampa Bay Coastal Wetlands and Other Mangroves Tales *Kara Radabaugh is a Biological Scientist at Florida Fish and Wildlife Research Institute specializing in Coastal Wetlands Research. She is a USF CMS alumni and former student of Dr. Ernst Peebles.*

10:00 Break

10:15 - 3:45 Oral Presentations – MSL Conference Room

10:15	Adrienne Hollister	Mapping Marine Trace Metal Remineralization After a Phytoplankton Bloom
10:30	Jordan Meyer	Observing Bottom Currents Associated with the Atlantic Meridional Overturning Current (AMOC) Using GRACE
10:45	Julie Vecchio	You Are What You Eat: What $\delta^{15}N$ Disequilibrium Says About Diet and Movement in Fish
11:00	Makenzie Burrows	Fish Egg DNA Barcoding to Support Gulf Reef-Fish Stock Assessments
11:15	Jing Chen	A Tampa Bay Circulation Nowcast/Forecast System and Its Application During Hurricane Irma

11:30 Lunch

1:00	Katelyn Schockman	Spectrophotometric Determinations of Carbonate Dissociation Constants in Seawater
1:15	Michael J. Schram	Using a Temperate Rocky Reef Fish, *Rhinogobiops nicholsii*, to Estimate Direct Effects of Size-Selective Harvesting on Protogynous Hermaphrodites
1:30	Brent A. Summers	A Comparison of Extremes: Pb Isotopic Composition in Arctic and Indian Aerosols
1:45	Shuangling Chen	Improving Ocean Color Data Coverage Through Near Real-Time Machine Learning
2:00	Benjamin Ross	Recovery of the Photosymbiotic Foraminifera *Amphistegina gibbosa* Following Long-term Aphotic Incubation

2:15 Break

2:30	Ellie Hudson-Heck	Characterization of Sulfonephthalein Indicator Dyes for Spectrophotometric pH Measurements in Seawater, Estuaries and Freshwater over an Extended Range of pH Conditions
2:45	Jong Jin Lee	Elevated Rates of Biogenic Silica Deposition in the Sediment from the Northern Gulf of Mexico During the Deepwater Horizon Oil Spill
3:00	Mengqiu Wang	Monitoring Pelagic *Sargassum* in the Intra-Americas Sea and Atlantic Ocean from Space
3:15	Ed Hughes	Characterizing West Florida Shelf Reef-Associated Fish Communities Using Acoustics – Update 2018
3:30	Catherine Prunella	Reconstructing Changes in Southern Ocean Bottom Water Ventilation on the Ross Sea Continental Shelf During the Middle Miocene

4:00 – 5:00 Poster Presentations During TGIF Event – MSL Lounge

4:00	Gabriel A. Browning	The Direct Detection of Humic-Type Iron-Binding Ligands in Samples from GEOTRACES Cruise GP16 in the Tropical East Pacific
	Chao Liu	Vertical Redistribution of Global Ocean Salt Content
	Yingjun Zhang	Seasonal and Interannual Variability of Frontal Density in Coastal Waters of Central West Florida
	Shannon Burns	Dissolved Trace Metal Concentrations in Southern Ocean Phytoplankton Incubation Experiments
	Chih-Wei Huang	Space Eyes at Night: VIIRS DNB Applications
	Dylan Peck	Tapping Deglacial Secrets of Lake Oneida Sediments: Establishing a Connection Between Radiocarbon and Paleomagnetics in Fish Creek Sediments
	Savannah Hartman	Fish Communities and Climate Change in the Anoxic Cariaco Basin

5:00 Judging ends

5:30 Awards & Raffle Drawings - *MSL Lounge*

Mapping Marine Trace Metal Remineralization After a Phytoplankton Bloom

Adrienne Hollister

Phytoplankton are a vital part of marine nutrient cycling and are responsible for ~50% of Earth's photosynthetic carbon fixation. In order to grow and survive, phytoplankton require macronutrients (C, N, P, Si), as well as trace metals (Fe, Zn, Cu, Mn, Co, Ni, and Cd). When phytoplankton die and sink, they release these stored elements back into the water column in a process known as remineralization. This study explores the timing and chemistry of remineralization by monitoring the controlled bloom and death of phytoplankton gathered in the Gulf of Mexico (GOM), simulating a process that occurs naturally in the water column. Bottles of unfiltered GOM seawater were spiked with iron (4 nM) and macronutrients (50:50:3.1 µM N:Si:P) and incubated. After a bloom occurred, the water was combined in a carboy and placed in the dark for 6 months as the phytoplankton died. Over this time, samples were collected for total dissolved trace metals, macronutrients, chlorophyll *a*, and iron speciation. Chl*a* levels indicated near-complete death after ~2 months. Dissolved trace metals generally showed the expected uptake during the grow-in and release during remineralization. Co and Cd tracked closely phosphate and quickly returned to near initial levels. Fe displayed a slower remineralization. Mn spiked immediately after the crash, followed by a sharp decrease, possibly from scavenging, and a gradual increase after 2-months. These results offer a novel glimpse into marine trace metal chemistry.

Degree: MS
Field: Chemical Oceanography
Advisor: Dr. Kristen Buck

Observing Bottom Currents Associated with the Atlantic Meridional Overturning Current (AMOC) Using GRACE

Jordan Meyer

The Atlantic Meridional Overturning Circulation (AMOC) is an important component of the Earth's climate system and variability in its magnitude can have large effects on the transport of heat to the northern hemisphere. Remotely sensed ocean bottom pressure data from the Gravity Recovery and Climate Experiment (GRACE) and mission may provide a way to measure the deep currents associated with the AMOC along the entire western side of the Atlantic. To better understand the relationship between bottom pressure and AMOC transport, we use ocean bottom pressure and velocity data from the second ECCO2 state estimate. We have examined the cross-correlation between the transport calculated with velocity estimates and ocean bottom pressure anomalies to understand the pattern and spatial extent of pressure changes, to see if they are recoverable with new GRACE mascon solutions. Finding reasonable agreement, we investigate meridional bottom currents along the continental slope in the western Atlantic, utilizing GRACE bottom pressure data. We find variability in the local bottom currents along the continental shelf north of the Gulf Stream separation that is consistent with the observed upper geostrophic transport at 26.5°N, including a similar trend indicating a slow down of the upper limb of the AMOC. We also find anti-correlated bottom currents east of the shelf in water deeper than 4000 meters that is consistent with the inferred slow-down of the North Atlantic Deep Water.

Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Don Chambers

You Are What You Eat: What $\delta^{15}N$ Disequilibrium Says About Diet and Movement in Fish

Julie Vecchio, Chris Stallings, Amy Wallace, Joseph Curtis, Ernst Peebles

Stable isotope ratios of $\delta^{15}N$ have been used in a variety of ecological contexts including trophic position and tissue turn-over rate. In teleost fishes, liver has been consistently found to turn over faster than muscle. It follows that disequilibrium between these tissues may serve as an indicator of movement along a $\delta^{15}N$ gradient background. The current work includes a meta-analysis using captive studies of a variety of teleost fish species in equilibrium with their diet. The mean value of $\delta^{15}N$(muscle-liver) was 1.8 ‰ for all species combined regardless of size, trophic level, or swimming speed. In addition, $\delta^{15}N$muscle and $\delta^{15}N$liver, were linearly correlated. Comparing wild-caught reef fish from Florida waters against this value reveals substantial disequilibria in $\delta^{15}N$(muscle-liver) of most species. We found only one species, *Haemulon plumierii*, in equilibrium with diet. All other species displayed $\delta^{15}N$(muscle-liver) values lower than that expected for a sedentary species. In short, a standard $\delta^{15}N$(muscle-liver) can be devised for fish in equilibrium with diet. However, it seems that diet is often in flux, even for sedentary species such as those found on Florida reefs.

Degree: PhD
Field: Marine Resource Assessment
Advisor: Dr. Ernst Peebles

Fish Egg DNA Barcoding to Support Gulf Reef-Fish Stock Assessments

Makenzie Burrows, Mya Breitbart, Jeremy Browning, Ernst Peebles

Identification of fish eggs is important for understanding where fish are located at different stages of life. Fish eggs can be used to identify spawning grounds and manage fisheries around the globe. While visual identification is typically impossible, DNA barcoding is a quick and reliable method to identify fish eggs to the species level. This method gives a quantitative snapshot of the egg community at a given spawning location by sequencing individual eggs. In the past, identification was done by waiting for eggs to hatch into larvae or catching the larvae in the water column. Fish eggs are a more precise way of finding where fish are spawning because they are only hours old when collected, so current estimations can be used to pinpoint their spawning location. For this project, fish eggs were collected from 40 stations distributed throughout the Gulf of Mexico on cruises of opportunity in 2015-2016. The goal of the project was to get an understanding of how far offshore neritic (continental shelf) species are spawning. We discovered a diversity of fishes with little spatial overlap between neritic and pelagic species, and a demarcation at the continental shelf break. These data and methods will pave the way for many future studies in the Gulf of Mexico.

Degree: MS
Field: Biological Oceanography
Advisor: Dr. Mya Breitbart

A Tampa Bay Circulation Nowcast/Forecast System and Its Application During Hurricane Irma

Jing Chen, Robert H. Weisberg, Yonggang Liu, Lianyuan Zheng

Tampa Bay is the largest of the Florida coastal plain estuaries, and it also contains the only deep water port on Florida's west coast. Here we apply a very high resolution, numerical model to establish a circulation nowcast/forecast system for Tampa Bay and the adjacent continental shelf. The horizontal resolution gradually increases from about 8.5 km along the open boundary to about 200 m near the coast, and then down to 20 m at locations within Tampa Bay. Thus, the model grid resolves the main shipping channel, all of the inlets connecting Tampa Bay, the Intra-coastal Waterway and Sarasota Bay with the adjacent Gulf of Mexico (GOM) and with each other. The forcing to drive the model includes winds and surface heat flux from NOAA, river discharge rates from the USGS and open boundary conditions from the West Florida Coastal Ocean Model (WFCOM). Knowing the estuarine circulation distribution is a key element in understanding estuarine ecology as organized by the material property distributions. The forecast circulation result is also a good reference for activities associated with water (such as shipping, fishing, sailing and kayaking etc.) in the Tampa Bay area. In this presentation, we will show the model result during Hurricane Irma which impacted the Tampa Bay area during September 10-11, 2017. The Tampa Bay response to Hurricane Irma is analyzed using a combination of in situ observations and numerical model simulations.

Degree: PhD
Field: Biological Oceanography
Advisor: Dr. Robert Weisberg

Spectrophotometric Determinations of Carbonate Dissociation Constants in Seawater

Katelyn Schockman

The marine carbonate system can be characterized using four parameters: pH, total alkalinity (TA), total dissolved inorganic carbon (DIC), and the fugacity of carbon dioxide (fCO_2). Using measurements of any two of these parameters, the other two can be calculated through thermodynamic relationships. The CO_2 system dissociation constants (K_1 and K_2) that relate CO_2, HCO_3^- and CO_3^{2-} concentrations to pH have uncertainties on the order of 2% and 5%, and this decreases the accuracy of parameter calculations. The goal of my study is improvement of the accuracy of K_1 and K_2 over a wide range of salinity and temperature. My determinations of K_1 and K_2 are being performed using a spectrophotometric pH indicator, meta-cresol purple (mCP). Ratios of the two absorbance maxima of mCP are used to calculate pH at a given salinity and temperature. The experimental procedure used in this work involves adjustments of the pH of a sample to values near an expected equilibrium pH, and then adding $NaHCO_3$ in order to determine the pH at which $NaHCO_3$ addition produces no pH change. The pH at which an addition of $NaHCO_3$ leads to no change is equal to $\frac{1}{2}(pK_1+pK_2)$. Literature values of K_1, which have much smaller uncertainties than K_2, are then used to calculate improved K_2 values. These improved values will subsequently be assessed by examining their use in calculations that relate measurements of TA, DIC and pH that were obtained during my participation in the GOMECC-3 cruise in the summer of 2017.

Degree: MS
Field: Chemical Oceanography
Advisor: Dr. Robert Byrne

Using a Temperate Rocky Reef Fish, *Rhinogobiops nicholsii*, to Estimate Direct Effects of Size-Selective Harvesting on Protogynous Hermaphrodites

Michael J. Schram, Mark A. Steele

Minimum size limit, a commonly used management approach, is a form of size-selective harvesting that adds increased pressure on the largest, most fecund size classes of target species. Persistent removals may alter population demography, but the magnitude of that change is often associated with species ecology. Correlative studies suggest protogynous fishes are negatively impacted by removals targeting large individuals, however controlled studies are necessary to establish causal links. By selectively manipulating the density and size structure of controlled blackeye goby populations this study aimed to identify the effects of size-selective harvesting on the (1) reproductive output, (2) growth, and (3) maturation and sex change of a temperate protogynous hermaphrodite. Results indicate that simulated size-selective harvesting had no effect on these metrics in blackeye gobies suggesting protogynous species may be resilient to moderate removals. Sequentially hermaphroditic fishes may be able to replace high value reproductive individuals at a relatively quicker rate than non sex-changing species, buffering anthropogenic impacts on their populations; however, the inclusion of additional species and harvesting intensities is still necessary to elucidate differences in empirical results and observational trends at larger scales.

Degree: PhD
Field: Marine Resource Assessment
Advisor: Dr. Chris Stallings

A Comparison of Extremes: Pb Isotopic Composition in Arctic and Indian Aerosols

Brent A. Summers, Peter L. Morton, Vincent J. Salters, William M. Landing, Cliff S. Buck, Chris M. Marsay

Anthropogenic lead is transported great distances through the atmosphere, rendering local pollution a global concern. Here, we present a comparison of aerosol lead concentrations and isotopic composition in two extreme environments: the remote Arctic Circle and the anthropogenically perturbed Bay of Bengal. Aerosol samples from the Arctic Circle were collected during the 2015 U.S. GEOTRACES cruise, which sampled the western Arctic Ocean in August-October 2015, while aerosol samples from the Bay of Bengal were collected during the 2008 CLIVAR I08S/I09N cruise, which sampled the Indian Ocean from the Antarctic margin to the interior of the Bay of Bengal (Feb-Apr 2007).

The resulting Pb concentrations show that the Arctic Ocean receives exceedingly low anthropogenic inputs in the late summer/early fall, while isotopic compositions yielded a common origin of the Pb encountered throughout the Arctic occupation: a roughly even mixture of continental crust and North American Ore deposits. In contrast, the widespread dispersion of industrial Pb is found the Bay of Bengal. The Pb isotopic compositions in these aerosols closely matched the reported composition of industrial aerosols collected in an urban setting on the east coast of India. In summary, despite the phase-out of leaded fuels, coal combustion in developing regions continues to supply Pb to the Indian Ocean, while Pb supply to the Arctic is likely subject to seasonal inputs due to changing meteorological patterns.

Degree: PhD
Field: Chemical Oceanography
Advisor: Dr. Tim Conway

Improving Ocean Color Data Coverage Through Near Real-Time Machine Learning

Shuangling Chen, Chuanmin Hu

Chlorophyll (CHL) from satellite ocean color measurements plays an important role in studying ocean biology. Currently, the most often used data products by community are optimized for global oceans. However, as with any other satellite data, there is always a compromise between quality and quantity. These standard products excluded non-optimal measurement conditions such as strong sun glint, thin clouds, or straylight. As a result, only 5% of the global ocean has valid daily coverage at 1-km resolution. A recently developed ocean color index (CI) is immune to such conditions, therefore producing more spatial and temporal coverage but at the price of quality. Specifically, CI was designed to trace relative color patterns instead of absolute values, and how to make quantitative use of CI is unclear. In this study, we developed an approach to convert CI to CHL to improve data quantity without losing data quality. For any daily image pair of CHL and CI, a machine learning is applied to common pixels where both data have coverage, with the derived algorithm applied to pixels where only CI has coverage. The approach has been developed and tested for the East China Sea, with very encouraging results obtained. On average, data quality increased by ~1-3 times without quality degradation comparing to the standard CHL. The CI-based CHL data are used to compose weekly and monthly means, which show advantage over the standard composites in examining spatial and temporal changes.

Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Chuanmin Hu

Recovery of the Photosymbiotic Foraminifera *Amphistegina gibbosa* Following Long-term Aphotic Incubation

Benjamin Ross

The larger benthic foraminifera *Amphistegina gibbosa* maintains an obligate symbiotic relationship with diatom symbionts. The photosynthate produced by the symbionts is necessary for the foraminifer to successfully live and grow. Bleached individuals, which have digested their symbionts as a reaction to stress, exhibit altered behaviors and lifestyle. In this experiment, two populations of *Am. gibbosa* were maintained in aphotic conditions for 7 and 12 months respectively. Upon removal from these incubations and a return to normal ambient light levels, the foraminifers showed recovery of vital activity in a number of days, as well as recovery of color (provided by the internal symbiont population). This shows that both the foraminifer and its symbiont population are apparently capable of surviving extended period with no sunlight. This could help explain how these obligate mixotrophs, currently found in tropical and semitropical waters, could have thrived in warmer periods of earth's history when they were found significantly farther poleward, where days are significantly shorter seasonally. It could also play a role in their ability to expand their range as waters continue to warm in the near future.

Degree: PhD
Field: Biological Oceanography
Advisor: Dr. Pamela Hallock Muller

Characterization of Sulfonephthalein Indicator Dyes for Spectrophotometric pH Measurements in Seawater, Estuaries and Freshwater over an Extended Range of pH Conditions

Ellie Hudson-Heck

Purified indicator dyes for spectrophotometric pH measurements require physical/chemical calibrations over the full range of salinities and temperatures encountered in seawater, estuaries and river water. With an indicating range between 7.2 and 8.2, meta-cresol purple (mCP) has been used extensively for open-ocean pH measurements for more than 25 years. However, very little work has been devoted to indicator characterizations appropriate to pH measurements in estuaries and freshwater and, as such, prior indicator characterizations need to be expanded to include a wide range of pH, salinity and temperature conditions. In this project I am characterizing four indicator dyes that can be used for measurements between approximately pH 5 and pH 9 over a 0 – 40 range of salinity and a 5 – 35 ^{o}C range of temperature. The project will greatly expand the range of indicating conditions for mCP, thymol blue (TB) and phenol red (PR), and will constitute the first characterization of bromo-cresol purple (BCP) for measurements under organic-rich low-pH conditions. The project will enable accurate and precise spectrophotometric pH measurements over most conditions that are encountered in natural aqueous environments.

Degree: PhD
Field: Chemical Oceanography
Advisor: Dr. Robert Byrne

Elevated Rates of Biogenic Silica Deposition in the Sediment from the Northern Gulf of Mexico During the Deepwater Horizon Oil Spill

Jong Jin Lee, Patrick T. Schwing, Isabel C. Romero, Gregg R. Brooks, Rebekka A. Larson, Will A. Overholt, Joel E. Kostka, David J. Hollander

The Deepwater Horizon (DWH) oil spill resulted in a Marine Oil Snow Sedimentation and Flocculent Accumulation (MOSSFA) event that is characterized by increased deposition of surface-derived components and biological (mass mortality of benthic fauna) conditions.
In an effort to constrain the amount of surface-derived MOSSFA-related biological inputs, biogenic silica contents were determined from sediment cores utilizing a wet-alkaline extraction method modified from DeMaster (1981).

Sedimentary biogenic silica has been used as a proxy record of diatom production and surface water primary productivity. Biogenic silica concentrations and mass accumulation rates increased by 2 ~ 3 fold during the 2010-2011 interval. This suggests that a significant portion of the surface biological materials entrained during the MOSSFA event was sourced by diatom production.

Elevated biogenic silica coordinate with 16S-RNA measurements of diatom-derived materials. Biogenic silica results also corroborate existing records of other surface derived MOSSFA materials including planktonic foraminiferal tests, pyrogenic hydrocarbons, and other petroleum-derived biomarkers. Moreover, biogenic silica results confirm sediment trap studies that document increases in the numbers of diatom frustules settling through the water column during the DWH oil spill (Beizhan et al., 2016). Overall, biogenic silica provides a proxy for MOSSFA related surface material deposited and diatom production during the DWH.

Degree: MS
Field: Geological Oceanography
Advisor: Dr. David Hollander

Monitoring Pelagic *Sargassum* in the Intra-Americas Sea and Atlantic Ocean from Space

Mengqiu Wang

Since 2011, massive *Sargassum* landings on the Lesser Antilles islands in the southern Caribbean have been reported frequently, representing a serious environmental problem to local tourism and economy. Yes despite an initial effort of using MERIS to document *Sargassum* distributions between 2003 and 2011, our knowledge on the source, abundance, distribution, and long-term trend of this ecologically important marine organism is extremely limited. The objective of this research is to address the technical challenges of remote quantification of *Sargassum* in the tropical Atlantic Ocean, and then study their spatial and temporal changing patterns as well as their potential origin and environmental response. The technical approach is based on the MODIS AFAI (alternative floating algae index) images and statistical analysis of the classified *Sargassum* pixels over the Atlantic region. The fully-automatic classification takes into account of various confusion features that influence the detection accuracy, such as cloud shadow, cloud adjacency effect, and sun glint induced large-scale variance. A weighting factor is also determined by comparing the *Sargassum* pixel with the nearest water pixel to determine the sub-pixel *Sargassum* coverage. *Sargassum* percent coverage for each pixel is then generated at monthly, seasonal, and annual intervals, which are then used to study their spatial and temporal distributions as well as their long-term trends.

Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Chuanmin Hu

Characterizing West Florida Shelf Reef-Associated Fish Communities Using Acoustics – Update 2018

Ed Hughes, Dr. David Naar, and Dr. Steve Murawski

A potential approach for performing rapid, broadscale assessments of fish in a reef ecosystem are the applications of active sonars that can survey the entire water column. Although such applications are still in their nascency, the approach is showing promising results. I propose to evaluate the efficacy and limitations of opportunistic acoustic surveys to characterize reef fish populations in various hardbottom habitats on the West Florida Shelf.

The novelty of our work is that it utilizes scientific sonar technology (EK60 split beam echosounder) coupled with near concurrent underwater video data of West Florida Shelf reef fish communities in a rapid, fisheries-independent approach. This research will also evaluate where strengths and weaknesses exist in these approaches.

This presentation will provide an overview of how water column acoustics data are processed and early analysis of datasets collected as part of the ongoing C-SCAMP research program led by Dr. Steve Murawski. Two areas of research will be highlighted which include: 1) calculating Nautical Area Scattering Coefficients (NASC) as a proxy for fish biomass to explore trends/relationships in several regions of the West Florida Shelf and 2) using the acoustics data in tandem with towed camera-based data to determine in-situ target strengths (TS) and associated error (and ultimately abundance with associated error) of more commonly observed schooling reef-associated fish (e.g. Gray Snapper, *Lutjanus griseus*).

Degree: PhD
Field: Biological Oceanography
Advisor: Dr. David Naar and Dr. Steve Murawski

Reconstructing Changes in Southern Ocean Bottom Water Ventilation on the Ross Sea Continental Shelf During the Middle Miocene

Catherine Prunella, Amelia Shevenell, and the IODP Expedition 374 Science Party

I will investigate changes in ventilation and productivity of Southern Ocean water masses during the middle Miocene (17-13.5 Ma), a time characterized by Antarctic ice sheet fluctuations under a narrow range of estimated atmospheric CO2 (300-500 ppm). The Miocene Climatic Optimum (MCO; 16.3-14.5 Ma) was a relatively warm climate interval that preceded Antarctic ice growth across the middle Miocene Climatic Transition (MMCT; 13.8 Ma). I hypothesize that increased upwelling of relatively warm Circumpolar Deep Waters (CDW) around Antarctica during the MCO supplied moisture to the continent, forcing ice sheet growth across the MMCT. I will utilize sediments collected during the upcoming IODP Expedition 374 to the Ross Sea's continental shelf to generate a record of changes in redox-sensitive trace metals (authigenic Mn, U, Re, Mo) across the MCO and MMCT. Because trace metals become enriched in sediment underlying oxygen poor water masses, authigenic enrichment indicates either a decrease in ventilation and/or an increase in local primary productivity. To disentangle the effects of physical and biologic processes on bottom water oxygenation changes, I will combine records of Re, which is not influenced by biologic processes, with biogenic opal burial rates, which serves as a proxy for paleoproductivity. This record of water mass changes will provide insight into how ice proximal ventilation facilitated enigmatic expansion of the Antarctic cryosphere during the middle Miocene.

Degree: MS
Field: Geological Oceanography
Advisor: Dr. Amelia Shevenell

The Direct Detection of Humic-Type Iron-Binding Ligands in Samples from GEOTRACES Cruise GP16 in the Tropical East Pacific

Gabriel A. Browning, Kristen Buck

As a trace metal and an essential micronutrient, the distributions and cycling of iron have been heavily researched over the past 40 years. A distinguishing feature of the iron cycle is its reliance on organic ligands to persist in the soluble phase. Inorganic iron has very poor solubility in seawater, thus 99.9% of dissolved iron in the oceans is organically complexed. This feature is so dominant that understanding the concentrations, strengths, and characteristics of these iron-binding ligands is a better predictor of iron cycling than the actual iron concentrations. Significant portions of the ocean have been mapped for ligand concentrations and strengths using competitive ligand exchange adsorptive cathodic stripping voltammetry (CLE-AdCSV). However, characterizing these ligands has proven difficult. This research applies a voltammetric method developed by Laglera and van den Burg that directly detects any ligand that forms an electroactive complex with iron, such as humic substances. This allows a portion of the ligand pool to be independently measured. To date, measurements using this method have been mostly limited to laboratory and coastal measurements where concentrations of humic-type substances are high. There have been few measurements in the open ocean where the concentrations are much lower. Here this method is applied to open ocean samples from GEOTRACES cruise GP16, the U.S. GEOTRACES East Pacific Zonal Transect conducted in 2013.

Degree: PhD
Field: Chemical Oceanography
Advisor: Dr. Kristen Buck

Vertical Redistribution of Global Ocean Salt Content

Chao Liu, Xinfeng Liang, Rui M Ponte, Christopher G Piecuch

Ocean salinity is an important proxy for detecting and understanding changes in the global water cycle. Multi-decadal trends have been observed in both surface and subsurface salinity over the past decades, and have generally been attributed to changes in air-sea freshwater fluxes. Although air-sea freshwater flux, a major component of the global water cycle, certainly affects surface and upper ocean salinity, internal salt redistribution within the ocean could also play an important role. Here we consider ocean salinity changes on global scales and over the ocean's full depth, as well as the vertical redistribution of salt within the ocean from a 20-year (1992-2011) dynamically consistent and data-constrained ocean state estimate. Freshening in the upper ocean and salinification in the abyssal ocean are observed. These opposing upper- and abyssal- ocean salinity trends partly reflect vertical salt redistribution.

These findings indicate that over the examined period, increased surface freshwater flux contributes to the decrease in global mean upper ocean salinity, but is partly compensated by the vertical redistribution of salt within the ocean. Thus, the vertical transport of salt in the ocean interior, which potentially involves different dynamical processes and shows complex spatial patterns, should be considered in using the observed surface and upper ocean salinity changes to infer information about changes in the global water cycle.

Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Xinfeng Liang

Seasonal and Interannual Variability of Frontal Density in Coastal Waters of Central West Florida

Yingjun Zhang, Chuanmin Hu, Chao Liu

Oceanic fronts are relatively narrow zones of enhanced horizontal gradients of physical, chemical and biological properties (temperature, salinity, density, nutrients, etc.), which are often associated with enhanced biological activity. In addition, ocean fronts can also modulate mixing processes and fluxes of energy and water mass. Detecting and quantifying ocean fronts can help understand biological and physical processes of the marine ecosystem, and knowledge of fronts can also be useful for studies of fisheries and ocean pollutants. In coastal regions of central west Florida, fronts may be formed by tidal mixing, winds, and upwelling/downwelling. Chlorophyll (CHL) and sea surface temperature (SST) satellite imagery can often provide high-resolution information of the ocean fronts. However, in summer, increased solar insolation makes SST nearly uniform. CHL imagery are also problematic due to sun glint and thin clouds. Here, I use a recently developed color index (CI) that is immune to perturbations by sun glint and thin clouds, which therefore provides much improved spatial and temporal coverage as compared with traditional ocean color data products. In this study, long-term (2002-2017) and high-resolution (daily, 1-km resolution) MODIS data are used to delineate ocean fronts from individual daily imagery, and then compose monthly and seasonal frontal density maps. The maps are used to analyze the seasonal and interannual variability of frontal density, which can be explained by changing oceanic processes in coastal areas of the central west Florida.

Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Chuanmin Hu

Dissolved Trace Metal Concentrations in Southern Ocean Phytoplankton Incubation Experiments

Shannon Burns, Dr. Kristen Buck

Trace metals act as important micronutrients and toxicants to marine phytoplankton, yet few studies have measured them in phytoplankton growth experiments. Phytoplankton are especially important to ocean health, supplying approximately half the oxygen in the Earth's atmosphere. We have done a baseline study of the feedbacks between phytoplankton growth and the concentrations of bioactive trace metals in multiple incubation experiments conducted shipboard with Southern Ocean surface waters in austral Spring 2016. Incubations included six treatments: (1) unamended water, (2) +1 nM ^{57}Fe, (3) +4 nM ^{57}Fe, (4) +10 nM ^{57}Fe, (5) +600 pM Vitamin B_{12}, and (6) +4 nM ^{57}Fe with 600 pM Vitamin B_{12}. Filters size-fractionated the samples into large phytoplankton (>3 µm), free-living bacteria (0.4-3 µm), and dissolved metals (<0.4 µm). Here, I report results for the dissolved fraction concentrations of Mn, Fe, Co, Ni, Cu, Zn, Cd, and Pb. This work aims to improve understanding of the biogeochemical feedbacks between phytoplankton communities and trace element chemistry to inform interpretation of elemental distributions in the marine environment.

Degree: MS
Field: Chemical Oceanography
Advisor: Dr. Kristen Buck

Space Eyes at Night: VIIRS DNB Applications

Chih-Wei Huang; Chuanmin Hu

The Visible Infrared Imaging Radiometer Suite (VIIRS) satellite sensor is equipped with a Day/Night Band (DNB) that measures light at night under extremely low-light conditions. While it is well known that DNB can provide maps of city lights and boat lights at night, two other applications have not been explored: one is to observe coastal water turbidity, and the other is to observe bioluminensence. The former may provide extra information about water turbidity to complement daytime observations, and the latter is unique to study phytoplankton behaviors. Some algae are known to produce bioluminescence light, such as *Vibrio harveyi* and *Noctiluca Scintillans*. In this study, we evaluate the VIIRS DNB ability to estimate coastal water turbidity and to detect bioluminenscence in the East China Sea and the Arabian Sea, where river plumes may cause strong turbidity gradients and specific algae may produce bioluminenscence. Results are obtained under various illumination conditions from full moon to new moon.

Degree: PhD
Field: Physical Oceanography
Advisor: Dr. Chuanmin Hu

Tapping Deglacial Secrets of Lake Oneida Sediments: Establishing a Connection Between Radiocarbon and Paleomagnetics in Fish Creek Sediments

Dylan Peck, Brad Rosenheim, Jack Ridge

Postglacial varved and rhythmically-laminated clays deposited within the Ontario Basin are often associated with the retreat of the Laurentide Ice Sheet immediately preceding the onset of the Younger Dryas. The paleoclimatic significance of the Ontario Basin has made it a popularly studied region, however Lake Oneida sediments have yet to be exploited. These sediments are from the deepest part of pro-glacial lake Iroquois and may hold a long continuous record of climate during the evolution of the pro-glacial lake during deglaciation. Low total organic carbon (TOC) from multiple sources complicate the use of radiocarbon dating in these glaciolacustrine sediments. Ramped PyrOx ^{14}C has improved ages and chronologies from Antarctic margin glaciomarine sediments, suggesting that the same could be true in sediment from Lake Oneida.

Using samples taken from exposed varved glaciolacustrine sediment exposed by the incision of Fish Creek, a fluvial system terminating in eastern Lake Oneida, into pro-glacial lake sediments, we compare Ramped Pyrolysis ^{14}C data with natural remnant magnetization (NRM) paleomagnetic data. Our comparison will test whether Ramped PyrOx ^{14}C data match paleomagnetic data well enough to be used as the sole chronometer in sediment cores taken from Lake Oneida for which paleomagnetic orientation becomes more difficult to ascertain.

Degree: MS
Field: Geological Oceanography
Advisor: Dr. Brad Rosenheim

Fish Communities and Climate Change in the Anoxic Cariaco Basin

Savannah Hartman, Frank Muller-Karger

Biological particulates preserved in sediments provide an opportunity for evaluating the impact of climate change on fish communities; however, bioperturbation presents a challenge for interpreting these records. The anoxic waters of the Venezuelan Cariaco basin range from 250–1400 meters depth and prohibits bioperturbation, therefore making it an ideal location to study climate change. The predominantly unexplored Cariaco basin relies on strong, seasonal coastal upwelling stimulated by the Intertropical Convergence Zone (ITCZ). Since the oxygenated part of the water column is restricted to the upper 250 meters, a disturbance in the ITCZ could disrupt the influx of nutrients into the basin and impact fish biodiversity. To understand how fish community dynamics have changed since the Little Ice Age, sediment cores collected from the Cariaco basin were separated by varves that distinguished each year of the 500 year series. Each segment will be freeze dried to preserve organic compounds for specific dating purposes. The number of fish scales in each varve will be counted, and each scale will be attributed to a specific species. Since the Cariaco basin is controlled by physical processes and relies on upwelling to keep fish communities diverse and abundant, the results of this study will provide insight about changing global processes, how decreased primary productivity can affect certain populations of fish, and how these effects could impact the fisheries industry.

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