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Ocean Carbon & Biogeochemistry **Compendium of Recent and Upcoming OCB Activities and Products**

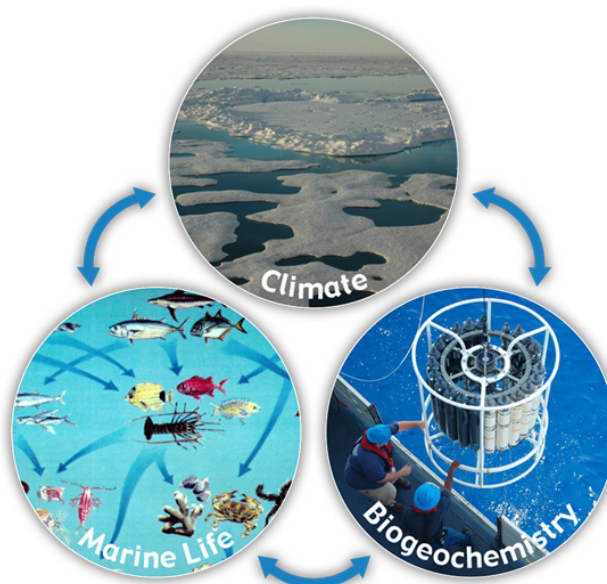
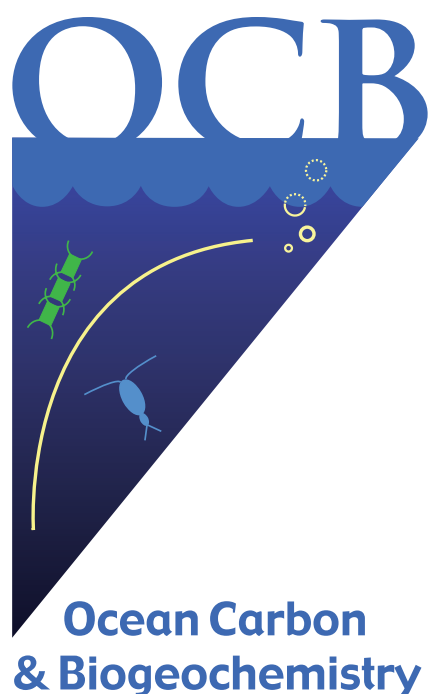


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get involved!

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Scientific Steering Committee (SSC)

<https://www.us-ocb.org/about/scientific-steering-committee/>



Seth Bushinsky



Dreux Chappell



Victoria Coles



Scott Doney



Andrea Fassbender



Marjorie Friedrichs



Julie Granger



Raleigh Hood



Matthew Long



Amy Maas



Adam Martiny



Jaime Palter



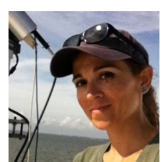
Patrick Rafter



Clare Reimers



Charlie Stock



Maria Tzortziou

[Seth Bushinsky](#) (UH) (**early career**) - chemical oceanography, carbon cycle, oxygen cycle, air-sea gas exchange, autonomous vehicles

[Dreux Chappell](#) (ODU) - molecular microbial ecology, phytoplankton cultivation/physiology, and trace metal biogeochemistry

[Victoria Coles](#) (UMCES) (2020) (**Vice Chair**) - observation and modeling of ocean and estuarine circulation; climate impact; biogeochemical, ecological, and genomic modeling

[Scott Doney](#) (Univ. Virginia) (ex officio) - marine biogeochemical modeling, ocean acidification

[Andrea Fassbender](#) (MBARI) (2020) - marine biogeochemical cycling, the ocean's role in global climate through the carbon cycle

[Marjorie Friedrichs](#) (VIMS) (2021) (**Chair**) - biogeochemistry of estuarine and coastal systems, biophysical modeling

[Julie Granger](#) (Univ. Connecticut) (2021) - nitrogen cycle, stable isotope geochemistry, high latitude biogeochemistry, benthic-pelagic coupling

[Raleigh Hood](#) (UMCES) (2021) - biological oceanography and biogeochemical modeling

[Matt Long](#) (NCAR) (2020) - biogeochemical and climate modeling

[Amy Maas](#) (BIOS) (2020) - physiology, distribution, and RNA sequencing of zooplankton, genetic response of pteropods to ocean acidification, carbon flux, circadian rhythms, diel vertical migration

[Adam Martiny](#) (Univ. California, Irvine) (2021) - marine bacteria, elemental stoichiometry, genomics

[Jaime Palter](#) (URI) - physics-biogeochemistry, ocean C and heat uptake, WBCs, autonomous assets

[Patrick Rafter](#) (UCI) - chemical oceanography, paleoceanography

[Clare Reimers](#) (OSU) (2020) - coastal and deep-sea benthic biogeochemistry, eddy covariance and microsensor profiling, redox processes and microbial metabolic pathways linking O₂, C, N and S cycles

[Charlie Stock](#) (NOAA/GFDL) - interactions between climate and marine ecosystems using global early system models

[Maria Tzortziou](#) (CCNY CUNY & Columbia Univ., Lamont Doherty Earth Observatory) (2021) - anthropogenic and natural stressors on biogeochemical exchanges, photochemical processes, and ecosystem functioning

Ocean Time series Committee

<https://www.us-ocb.org/about/ocean-time-series-committee/>

The primary focus of the Ocean Time-series Committee (OTC) is shipboard time-series stations, but this committee also seeks to improve existing and develop new ocean observing capabilities in support of OCB science, including autonomous instrument time-series. OTC continually works to align the evolving scientific needs of the OCB community with existing ocean observing capabilities and draw attention to critical observational gaps.



Matthew Church



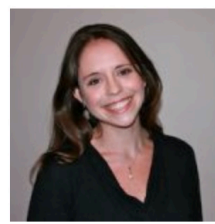
Michael DeGrandpre



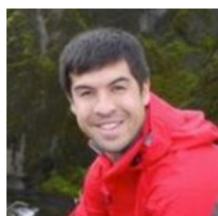
Stephanie Henson



Richard Lampitt



Naomi Levine



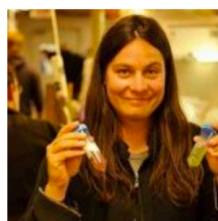
David Nicholson



Oscar Schofield



Heidi Sosik



Angel White

Recent Activities and Outcomes

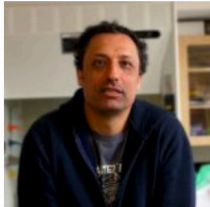
Benway, H. M., L. Lorenzoni, A. E. White, B. Fiedler, N. M. Levine, D. P. Nicholson, M. D. DeGrandpre, H. M. Sosik, M. J. Church, T. D. O'Brien, M. Leinen, R. A. Weller, D. M. Karl, S. A. Henson, R. M. Letelier (2019). Ocean time series observations of changing marine ecosystems: An era of integration, synthesis, and societal applications. *Frontiers in Marine Science*, <https://doi.org/10.3389/fmars.2019.00393>

Neuer, S., H. Benway, N. Bates, C. Carlson, M. Church, M. DeGrandpre, J. Dunne, R. Letelier, M. Lomas, L. Lorenzoni, F. Muller-Karger, M. J. Perry, P. Quay (2017). Monitoring ocean change in the 21st Century. *Eos* 98, <https://doi:10.1029/2017EO080045> (published on 08 September 2017).

Biogeochemical Argo Subcommittee

<https://www.us-ocb.org/about/ocb-subcommittees/us-biogeochemical-argo-subcommittee/>

This committee serves as a focal point for US community input on the implementation of the global biogeochemical float array and associated science program development. This committee also engages with and provides US input to the International Biogeochemical-Argo steering committee.



Emmanuel Boss



Brendan Carter



Scott Doney



John Dunne



Steve Emerson



Meg Estapa



Alison Gray



Ken Johnson



Todd Martz



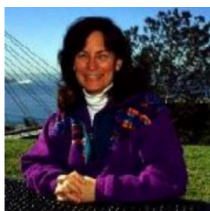
Jorge Sarmiento



Megan Scanderbeg



Joellen Russell



Lynne Talley



Toby Westberry



Cara Wilson

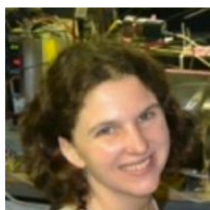
Recent Activities and Outcomes

- Building ocean biogeochemistry observing capacity, one float at a time: An update on the Biogeochemical-Argo Program <https://www.us-ocb.org/bgc-argo-update-2018/>
- NSF MSRI proposal for 500 new BGC-Argo floats
- OO19 white paper on Argo 2020 mission: Roemmich, D. et al. (2019). On the Future of Argo: A Global, Full-Depth, Multi-Disciplinary Array. *Frontiers in Marine Science* 6: | <https://doi.org/10.3389/fmars.2019.00439>

Ocean-Atmosphere Interaction Committee

<https://www.us-ocb.org/about/ocb-subcommittees/subcommittee-on-ocean-atmosphere-interactions/>

The scientific focus of this subcommittee is on ocean-atmosphere interactions and their role in marine biogeochemical cycles. There is a substantial overlap between the scientific goals of the OCB and [SOLAS](#) (Surface Ocean and Lower Atmosphere) communities, and this subcommittee seeks to strengthen communication and collaboration between ocean and atmospheric scientists to create a thriving, collaborative air-sea interaction research community in the US.



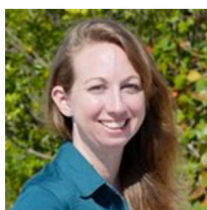
Rachel Stanley



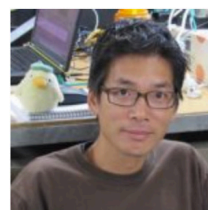
Tom Bell



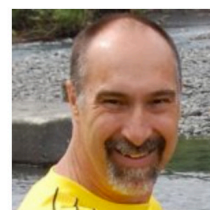
Yuan Gao



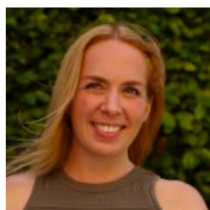
Cassandra Gaston



David Ho



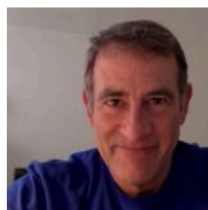
Dave Kieber



Kate Mackey



Nicholas Meskhidze



Bill Miller



Henry Potter



Penny Vlahos



Patricia Yager

Activities and Outcomes

Workshop: Ocean-Atmosphere Interactions: Scoping directions for U.S. research
October 1-3, 2019 <https://web.whoi.edu/air-sea-workshop/> - read the [workshop summary](#).
The full workshop report (in preparation) will be a science plan to help coalesce the US air-sea research community around a common set of science goals and research priorities and foster a more cohesive US contribution to international SOLAS.

Workshops

Upcoming

[2020 OCB Summer Workshop](https://web.whoi.edu/ocb-workshop/) (July 22-25, 2020, Woods Hole, MA) - learn more on workshop website <https://web.whoi.edu/ocb-workshop/>

[OCB Scoping Workshop: Laying the foundation for a potential future BioGeoSCAPES program: Assessing needs and capabilities for studying controls on ocean metabolism through integrated omics and biogeochemistry](https://www.us-ocb.org/ocb-scoping-workshop-laying-the-foundation-for-a-potential-future-biogeoscapes-program/) (PIs: Ben Twining, Mak Saito, Alyson Santoro, Adrian Marchetti, Naomi Levine) - October 14-17, 2020 (Woods Hole, MA, registration opens in May 2020) <https://www.us-ocb.org/ocb-scoping-workshop-laying-the-foundation-for-a-potential-future-biogeoscapes-program/>

Recent

[Ocean nucleic acids 'omics intercalibration and standardization workshop](https://www.us-ocb.org/ocean-nucleic-acids-omics-workshop/) (January 9-11, 2020) <https://www.us-ocb.org/ocean-nucleic-acids-omics-workshop/>

[Ocean-Atmosphere Interactions: Scoping directions for U.S. research](https://web.whoi.edu/air-sea-workshop/) (October 1-3, 2019, Sterling, Virginia) <https://web.whoi.edu/air-sea-workshop/> - **Brief workshop summary:** <https://www.us-ocb.org/advancing-science-and-strengthening-collaboration-in-the-air-sea-research-community/> (full report in preparation)

[EarthCube Workshop for Ocean Time Series Data](https://www.us-ocb.org/earthcube-workshop-ocean-time-series-data/) (September 13-15, 2019, Univ. Hawai'i) <https://www.us-ocb.org/earthcube-workshop-ocean-time-series-data/>

[Oceanic Methane and Nitrous Oxide: The present situation and future scenarios](https://web.whoi.edu/methane-workshop/) (October 28-31, 2018 Lake Arrowhead, CA) <https://web.whoi.edu/methane-workshop/> - **this website is now an information and resource hub for the trace gas community; workshop report (in prep.) will be an Ideas and Perspectives article for Biogeosciences; several SOPs are also being developed for archival in the Ocean Best Practices System.**

[OCB Biogeochemical Profiling Float Workshop](https://web.whoi.edu/floats-workshop/) (July 9-13, 2018, Seattle, WA) <https://web.whoi.edu/floats-workshop/>

[4th U.S Ocean Acidification PI Meeting](https://web.whoi.edu/ocb-oa/) (February 17-19, 2018, Portland, OR) <https://web.whoi.edu/ocb-oa/>

[Ocean Carbon Hot Spots Workshop](https://usclivar.org/meetings/ocean-carbon-hot-spots-workshop) (joint with US CLIVAR) (September 25-26, 2017, Moss Landing, CA) <https://usclivar.org/meetings/ocean-carbon-hot-spots-workshop>

[Indian Ocean Science Workshop](https://web.whoi.edu/iioe2/) (September 11-13, 2017, La Jolla, CA) <https://web.whoi.edu/iioe2/> - **OCB now hosts the US IIOE2 (International Indian Ocean Expedition) website**

NEW Scoping Workshop: Laying the foundation for a potential future BioGeoSCAPES program: Assessing needs and capabilities for studying controls on ocean metabolism through integrated omics and biogeochemistry

<https://www.us-ocb.org/ocb-scoping-workshop-laying-the-foundation-for-a-potential-future-biogeo-scapes-program/>

Understanding ocean metabolism on a changing planet is a complex and challenging problem that requires coordination across

many different fields. We find ourselves finally at a point in time where international momentum has built and we are methodologically and intellectually poised to take on the challenge of an integrated microbial biogeochemistry program. Critically, we see the international community moving forward with a [BioGeoSCAPES initiative](#) and feel it is imperative that the US maintain a co-leadership role. This workshop represents an opportunity for interested US scientists to contribute to the development of key scientific questions that a coordinated microbial biogeochemistry program could address and articulate how those would bridge disciplines (e.g., questions that are fundamentally biological, chemical, or both). Participants will discuss currently available technical capabilities, as well as obstacles to be addressed in order to address the proposed studies. Project scope will be discussed, with efforts made to develop consensus on how to focus the BioGeoSCAPES program within the broader fields of biological and chemical oceanography. Ongoing 'omics intercomparison and intercalibration efforts ([ocean metaproteomics](#), [ocean nucleic acids](#)) will lay critical foundation for BioGeoSCAPES, and participants will provide updates on their status and discuss further efforts that will be needed for those domains. Furthermore, additional analytes that may be of scientific value may be identified as needing intercalibration efforts in order to create globally intercomparable values needed for a large-scale program. For a preliminary schedule, we propose to begin with an introduction by the conveners, followed by several plenary talks to set the stage for the discussions on various topics such as:



Benjamin Twining



Mak Saito



Alyson Santoro



Adrian Marchetti



Naomi Levine

- scientific questions of interest (with breakout groups by geographic region and depth)
- analytes of interest and availability of intercalibration standards for ensuring accuracy in large-scale sampling programs
- integration of sampling modes and their integration with scientific objectives (e.g., temporal and spatial)
- available and emerging sampling platforms
- challenges of data management and archival, synthesis, and modeling
- scope of the BioGeoSCAPES initiative (i.e. balance of field vs. lab measurements, section vs. process studies)
- mechanisms to facilitate international coordination
- potential funding sources and feasibility with the US system

Anticipated Outcomes

An important aspect of the workshop will be using the discussion to develop a list of action items to enable the US program to further the progression towards a global-scale microbial oceanography capability required for a BioGeoSCAPES program. Primary outcomes will include:

- Community-building of a diverse group of national scientists with expertise in microbial biogeochemistry
- Workshop report summarizing workshop findings and future action items

Small Group Activities

Working Group: Filling the gaps in observation-based estimates of air–sea carbon fluxes

<https://www.us-ocb.org/filling-the-gaps-in-observation-based-estimates-of-air-sea-carbon-fluxes-working-group/>

A number of recent studies have applied novel statistical and machine-learning methods to *in situ* surface ocean carbon dioxide (CO₂) observations to estimate the ocean carbon sink with unprecedented spatio-temporal resolution. These studies suggest that the oceanic CO₂ sink is more variable on multiyear timescales than previously estimated from biogeochemical model simulations. This newly identified variability challenges our model-based mechanistic understanding and puts into question our projections of the future ocean carbon sink. These observation-based estimates, however, rely on extensive interpolation of limited observations, and thus their reliability is unclear, particularly in data-sparse regions and seasons. Furthermore, inconsistencies regarding the area covered by open and coastal ocean estimates hampers our ability to constrain CO₂ fluxes across the full marine continuum (i.e., all tidal waters). The goal of this working group will be to assess critical uncertainties in existing observation-based products, determine how best to integrate observation-based open-ocean and coastal-ocean CO₂ air–sea fluxes, and quantify uncertainties in the natural (pre-industrial) outgassing of CO₂. These efforts will lead to better constraints on the contemporary ocean carbon sink and its variability. The results of this OCB Working Group will assist the global carbon community in understanding the state of the global carbon cycle so as to contribute to international efforts to address climate change.

Activities and Outcomes

Spring 2020: Working Group Meeting 1 (Lamont Doherty Earth Observatory): Critically review the latest flux estimates for the open ocean, coastal ocean, Arctic Ocean, and natural outgassing. A detailed plan will be developed to integrate data-based flux estimates for the open ocean, coastal ocean, the Arctic Ocean, and natural outgassing.

OCB2020: Working Group report out on preliminary findings and proposed path forward

Summer 2021: Working Group Meeting 2 (Woods Hole, MA): discuss and compare existing approaches to assess and represent uncertainties of the air–sea CO₂ flux, e.g., spread across ensembles, random subsampling or bootstrapping approaches, or using synthetic data from internally consistent output from ocean model simulations to evaluate data-based gap-filled estimates. We will consider strategies that use ocean model output to test gap-filling methods and quantify uncertainties.

Working Group: Towards a better understanding of fish contribution to carbon flux

<https://www.us-ocb.org/wg-fish-carbon/>

The goals of this working group are to 1) synthesize the existing research on fish carbon flux, 2) recognize challenges in measuring fish carbon flux and discuss approaches to resolve them, 3) develop research priorities to fill in the large gaps in understanding fish carbon flux, 4) identify opportunities to obtain resources needed to move this research forward.



Members:

Grace Saba (Rutgers Univ.), Nicola Beaumont (Plymouth Marine Laboratory), Adrian Burd (Univ. of Georgia), Peter Davison (Farallon Institute), John Dunne (NOAA GFDL), Santiago Hernández-León (Institute of Oceanography and Global Change), Angela Martin (Univ. of Agder), Kenneth Rose (UMCES), Joe Salisbury (Univ. of New Hampshire), Deborah Steinberg (VIMS), Clive Trueman (National Oceanography Centre), Rod Wilson (Univ. of Exeter), Stephanie Wilson (Bangor Univ.)

Activities and Outcomes

A full report of this workshop is available at <https://www.us-ocb.org/towards-a-better-understanding-of-fish-contribution-to-carbon-flux-ocb-workshop-summary/>

Working group members are developing two peer-reviewed manuscripts focused on 1) a synthesis of fish carbon flux research, and 2) a quantitative analysis of fish carbon flux.

Working Group: Developing best practices for measurement of oceanic $^{15}\text{N}_2$ fixation rates and relationships to communities

<https://www.us-ocb.org/n-fixation-working-group/>

Using field and laboratory data from a recently funded NSF EAGER award, this working group is conducting a thorough assessment of the $^{15}\text{N}_2$ tracer incubation method (accuracy, error analysis, detection limit, etc.) for measuring nitrogen fixation rates and accompanying molecular methods that identify responsible diazotrophs.



Mar Benavides



Ilana Berman-Frank



Sophie Bonnet



Annie Bourbonnais



Bonnie Chang



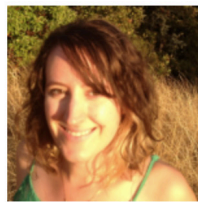
Dreux Chappell



Anne Dekas



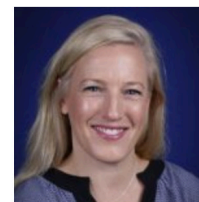
Wally Fulweiler



Rosie Gradoville



Julie Granger



Bethany Jenkins



Todd Kana



Angela Knapp



Etai Landou



Wiebke Mohr



Pia Moisander



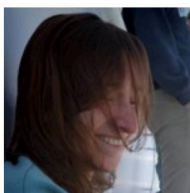
Margie Mulholland



Eric Raes



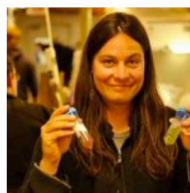
Lasse Riemann



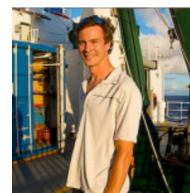
Corday Selden



Kendra Turk-Kubo



Angel White



Sam Wilson

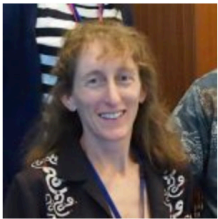
Recent Activities and Outcomes

- Visit the [webpage](#) to view or contribute to the $^{15}\text{N}_2$ Contaminant Database and the Metadata: ^{15}N tracer incubations for N_2 fixation measurements
- White, A. E., J. Granger, C. Selden, M. R. Gradoville, L. Potts, A. Bourbonnais, R. W. Fulweiler, A. N. Knapp, W. Mohr, P. Moisander, C. R. Tobias, M. Mulholland (In Review). A Roadmap for Measurement of $^{15}\text{N}_2$ Fixation in Pelagic Ecosystems. *L&O Methods*

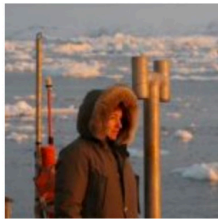
Working Group: Phytoplankton Taxonomy

<https://www.us-ocb.org/phytoplankton-taxonomy-working-group/>

Working Group Objective: In an effort to facilitate community-wide access to phytoplankton data products that support critical satellite algorithm development and validation, this working group convenes relevant expertise (e.g., phytoplankton ecology and taxonomy, data systems, informatics, etc.) to develop a set of standards and best practices for phytoplankton taxonomy data.



Stace Beaulieu



Ivona Cetinić



Susanne Craig



Emmanuel Devred



Joe Futrelle



Lee Karp-Boss



Aimee Neely



Marc Picheral



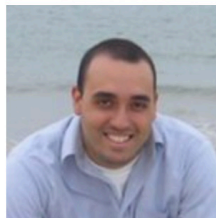
Nicole Poulton



Chris Proctor



Collin Roesler



Adam Shepherd



Heidi Sosik

Recent Activities and Outcomes

- Developing prototypes for submitting phytoplankton taxonomic data and metadata to public data repositories (e.g., SeaBASS and BCO-DMO)
- Developing a technical memo for publication that outlines standards and best practices for taxon-resolved phytoplankton data
- Poster presentation (AGU 2018): [Building Essential Biodiversity Variable Data Sets from Plankton Imaging Systems to Support Satellite Ocean Color Algorithm Development and Validation](#)

Workshop: Lateral Carbon Flux in Tidal Wetlands

<https://www.us-ocb.org/lateral-c-flux-tidal-wetlands/>

The OCB-supported activity “Lateral Carbon Flux in Tidal Wetlands” brought together experts to review methods and synthesize data on tidal exchange of carbon between wetlands and the coastal ocean. The ultimate, ongoing goal is to estimate annual rates of carbon exchange across the contiguous U.S. Knowledge of the magnitude and mechanisms of carbon cycling in tidal wetlands, including salt marshes, mangroves and tidal fresh wetlands, is necessary to understand their role in coastal ecology and carbon budgets, as well as interaction with the chemistry of the coastal ocean. The high rate of carbon exchange in tidal wetlands provides a strong linkage between the atmosphere and the coastal ocean, since lateral aquatic export appears to be an important or dominant fate of that fixed carbon.

During the workshop, two approaches were agreed to pursue the U.S.-scale flux estimation:

1. Develop a set of new flux rate estimates based on ongoing research of participants; test relationships to measures of carbon supply rate and frequency of aquatic exchange between wetland and ocean. Derive predictive relationships, and use to map rates.
2. Calculate the lateral flux as the unknown in the net ecosystem carbon balance, based on measured or estimated rates of carbon storage and productivity.



Kevin Kroeger



Maria Tzortziou



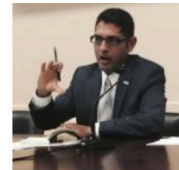
Meagan Gonneea



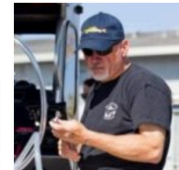
Chris Osburn



Aleck Wang



Neil Ganju



Brian Bergamaschi



Alana Menendez

Recent Activities and Outcomes

- Successful development of mapped products to support the lateral flux estimations, led by workshop participants:
 - Feagin, RA et al. (In Press). Tidal wetland Gross Primary Production across the continental United States, 2000-2018. *Global Biogeochemical Cycles*.
 - A CONUS-scale map of relative tidal marsh elevation: an essential variable for coastal wetland sustainability. Holmquist, J, et al. Journal article in preparation.
- New, measured rates of lateral carbon flux at sites around the U.S.
 - Mann, A.G., O’Keefe Suttles, J.A., Gonneea, M.E., Brosnahan, S.M., Brooks, T.W., Wang, Z.A., Ganju, N.K., Kroeger, K.D., 2019. Time-series biogeochemical and flow data from a tidal salt-marsh creek, Sage Lot Pond, Waquoit Bay, Massachusetts, 2012-2016. <https://doi.org/10.5066/P9STIROQ>
 - Kroeger, KD, Gonneea, ME, Wang, ZA, Ganju, NK, Pohlman, JW, Abdul-Aziz, O, Tang, J, Spivak, A, Moseman-Valtierra, S. 2019. Salt Marsh Net Ecosystem Carbon Balance: Comprehensive Measurements of the Lateral Flux. Biennial CERF Conference, Mobile, AL.
- Coastal & Estuarine Research Federation (CERF) 2019 session on lateral fluxes

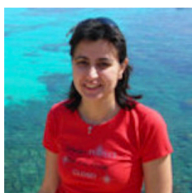
Ocean Carbonate System Intercomparison Forum

<https://www.us-ocb.org/ocean-carbonate-system-intercomparison-forum/>

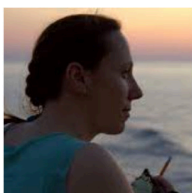
Recent literature has highlighted several ongoing challenges regarding the consistency of seawater CO₂ measurements with estimates from alternate input pairs. These gaps in our knowledge of the ocean carbonate system are probably related to carbonate constant uncertainties, frequently-unknown concentrations of organic bases in seawater, and unrecognized measurement uncertainties. CO₂ measurement intercomparability is also challenged by the large and growing variety of instruments and approaches used for measurements and the lack of robust assessments or certified reference materials for some methods. While measurement strategies diversify and evolve, the need remains for consistent records of key measurements over time to assess marine CO₂ cycling and its impacts: e.g. dissolved inorganic carbon (DIC) records for anthropogenic carbon storage and changes in the biological pump, partial pressure of CO₂ (pCO₂) records for air-sea CO₂ flux estimates, pH records for ocean acidification (OA) monitoring, and seawater alkalinity (AT) records for assessing the impacts of OA on carbonate mineral cycling. It is therefore more critical than ever that scientists develop a strategy for identifying and addressing carbonate system intercomparability uncertainties, thus enabling existing and future data to be reconciled into internally-consistent data products with associated uncertainties. A forum between experts in carbonate system parameter measurements, data documentation, and interconversion to debate the nature of the problems, advocate for needed research to resolve these problems, and provide guidance for data product assembly and documentation.



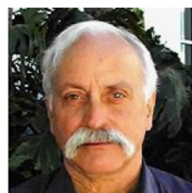
Brendan Carter



Marta Alvarez



Leticia Barbero



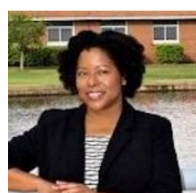
Robert Byrne



Wei-Jun Cai



Melissa Chierici



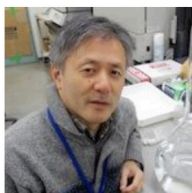
Regina Easley



Andrew Dickson



Andrea Fassbender



Akihiko Murata



Yui Takeshita



Nancy Williams



Ryan Woosley

Recent Activities and Outcomes

First meeting was held June 22-23, 2019 in Woods Hole, MA. A meeting summary is available at <https://www.us-ocb.org/ocb-workshop-report-ocean-carbonate-system-intercomparison-forum/>

Working group members are currently planning and securing funding for a laboratory intercomparison activity (Spring/Summer 2020).

OCB-NACP Aquatic Continuum Science Focus Group

<https://www.us-ocb.org/ocb-nacp-science-focus-group/>

OCB coordinated with the NACP and the US Carbon Cycle Science Program leadership to establish new OCB-NACP Aquatic Continuum Science Focus Group to help identify community-based mechanisms (e.g., workshops, small group efforts, publications, etc.) to facilitate exploration of and progress on high-priority coastal carbon research and other high-level, pertinent NACP-OCB cross-cutting questions.



Simone Alin (NOAA/PMEL)



Cecilia Chapa (Universidad del Mar, Mexico)



Kyle Cavanaugh (UCLA)



Marjy Friedrichs (VIMS)



Iris Anderson (VIMS)



Maria Herrmann (Penn State)



Sara Knox (UBC, Canada)



Maria Tzortziou (CUNY)



Peter Raymond (Yale)

Agency Representatives

- NSF - [Hedy Edmonds](#), [Elizabeth Canuel](#)
- NASA - [Paula Bontempi](#), [Laura Lorenzoni](#)
- USDA - [Nancy Cavallaro](#)
- USGS - [Zhiliang Zhu](#)
- NOAA - [Kathy Tedesco](#)
- OPP - [Xujing Jia Davis](#)

Program Representatives

- U.S. Carbon Cycle Science Program - [Gyami Shrestha](#)
- North American Carbon Program (NACP) - [Libby Larson](#)
- Ocean Carbon and Biogeochemistry (OCB) Program - [Heather Benway](#)

Recent Activities and Outcomes

OCB 2019 Plenary Session: Approaches and challenges to understanding biogeochemical cycling across the land-ocean aquatic continuum - Watch the whole session on YouTube <https://tinyurl.com/v6ucp7v>

NACP 2020 Breakout Session: Climate change and extreme hydrologic events: A temporal

Workshop: Ocean Nucleic Acids 'Omics

<https://www.us-ocb.org/ocean-nucleic-acids-omics-workshop/>

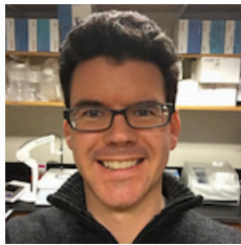
The Ocean Nucleic Acids 'Omics Intercalibration and Standardization Workshop is aimed at developing a focused marine microbial nucleic acid (na) 'omics intercomparison and intercalibration effort. Increasingly, field programs of relevance to the OCB community include major components that use high-throughput molecular barcoding, metagenomics, and transcriptomics (nucleic acid 'omics or na'omics herein) to understand the functioning of prokaryotic and eukaryotic microbes in the ocean. A pressing challenge for both our community and the broader microbiome research community is the need for more standardization and intercalibration to facilitate comparison between na'omics data.



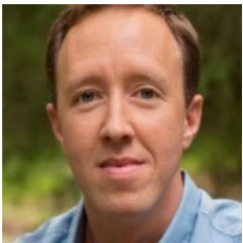
Bethany Jenkins



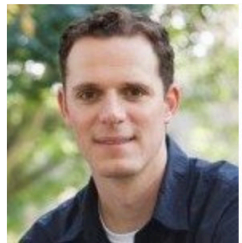
Andrew Allen



Paul Berube



Scott Gifford



Adrian Marchetti



Alyson Santoro

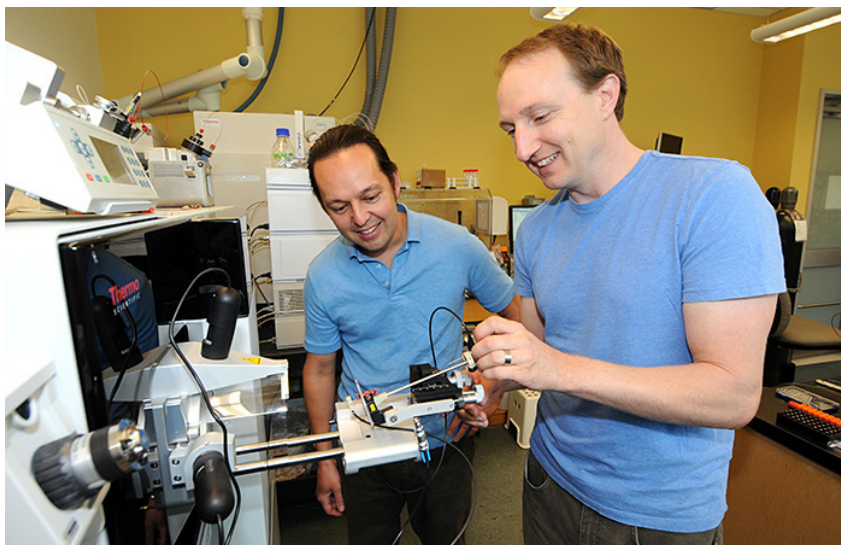
Recent Activities and Outcomes

The workshop was held January 9-11, 2020 at the University of North Carolina, Chapel Hill. The agenda (with linked workshop presentations) and participant list are available on the workshop website (<https://www.us-ocb.org/ocean-nucleic-acids-omics-workshop/>). A full workshop report is in preparation.

Intercomparison and Intercalibration of Ocean Metaproteomic Analyses

<https://www.us-ocb.org/intercomparison-and-intercalibration-metaproteomics/>

Ocean metaproteomics is an exciting new datatype that has the potential to provide valuable new insights into the metabolic functions of marine microbes and their impact on ecological and biogeochemical processes. However, as for most new measurement types there are uncertainties associated with the accuracy and precision of measurements due to the limited extent of the application of analyses thus far, and hence there is a need to generate community confidence in metaproteomics. We propose to initiate an intercomparison and intercalibration effort whereby an ocean metaproteome sample from the Bermuda Atlantic Time Series is collected, divided and shared among multiple laboratories for global and targeted metaproteomic analyses. The results will be collated and discussed at a workshop of intercalibration participants. In addition, an informatic intercomparison will also be conducted using a representative mass spectra data file. This effort is a follow up of the 2010 OCB scoping workshop “[The Molecular Biology of Biogeochemistry: Using molecular methods to link ocean chemistry with biological activity](#)” and NSF EarthCube workshop that assembled US and Canadian scientists involved in metaproteomic research in May of 2017: [Ocean Proteomics Data Sharing and Best Practices Workshop Report](#).



PIs Mak Saito and Matthew McIlvin

Recent Activities and Outcomes

Filter samples were collected from the North Atlantic Bermuda Atlantic Time Series Station and are currently being distributed with peptide standards and a paired metagenomic database to research labs. Intercomparison efforts will include three components 1) global metaproteomic analyses, 2) targeted metaproteomic analyses, and 3) informatic pipeline analyses from a shared data file. Email metap-intercomp@whoi.edu to participate in any or all of the three components. Sample analysis should occur in the spring of 2020 followed by a workshop planned for May 2020 to compare results and discuss methodologies.

Training Activities

CMIP6 Hackathon - October 16-18, 2019

The CMIP6 Hackathon was a hands-on event including tutorials, software development, data analysis, and opportunities for collaboration centered around effective computational workflows and CMIP-related science.



The event was held concurrently at the NCAR Mesa Lab, in Boulder CO, and the Lamont Doherty Earth Observatory, in Palisades NY, with a self-organized node at University of Washington, Seattle. Participants were selected on the basis of interests, experience, and potential to contribute to collaborative initiatives, and people from observational or application-related backgrounds.

The CMIP6 Hackathon Team: Matthew Long (NCAR), Ryan Abernathy (Columbia/LDEO), John Dunne (NOAA/GFDL), Joseph Hamman (NCAR), Flavio Lehner (NCAR), Galen McKinley (Columbia/LDEO), Angeline Pendergrass (NCAR), Isla Simpson (NCAR), and Kevin Paul (NCAR)

More information: <https://cmip6hack.github.io>

Workshop Summary: <https://www.us-ocb.org/collaborative-approaches-to-big-data-questions-in-earth-system-science/>

Products & Reports

Reports

Bingham, F., L. Juranek, M. Mazloff, G. McKinley, N. Nelson, S. Wijffels
October 2019: Review of US GO-SHIP (Global Ocean Shipboard Hydrographic Investigations Program) An OCB and US CLIVAR Report. Report 2019 (OCB) and 2019-6 (US CLIVAR). 112pp. [doi:10.1575/1912/24897](https://doi.org/10.1575/1912/24897).

Dunne, John P., Romanou, Anastasia, McKinley, Galen A., Long, Matthew, Doney, Scott C., “Synthesis and Intercomparison of Ocean Carbon Uptake in CMIP6 Models workshop report, December 8-9, 2018 Washington, DC”, 2019-04, [doi:10.1575/1912/24038](https://doi.org/10.1575/1912/24038), <https://hdl.handle.net/1912/24038>.

Fassbender, A. J., J. B. Palter, M. C. Long, T. Ito, S. P. Bishop, and M. F. Cronin, 2018: Ocean Carbon Hot Spots. A Joint US CLIVAR and OCB Workshop Report, 2018-3, 34pp., [doi:10.5065/D6Z036ZS](https://doi.org/10.5065/D6Z036ZS).

Hood, R. R., Beal, L. M., Benway, H. M., Chandler, C. L., Coles, V. J., Cutter, G. A., Dick, H. J. B., Gangopadhyay, A., Goes, J. I., Humphris, S. E., Landry, M. R., Lloyd, K. G., McPhaden, M. J., Murtugudde, R., Subrahmanyam, B., Susanto, R. D., Talley, L. D., Wiggert, J. D., Zhang, C. (2018), United States contributions to the Second International Indian Ocean Expedition (US IIOE-2), 2018-08-02, DOI:10.1575/1912/10510, <https://hdl.handle.net/1912/10510>, 65 pp.

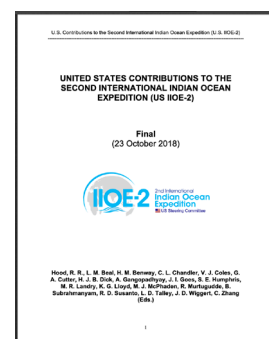
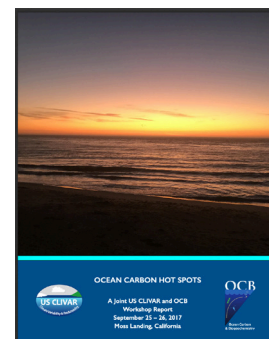
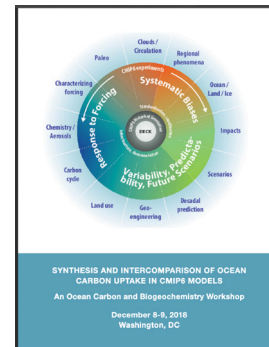
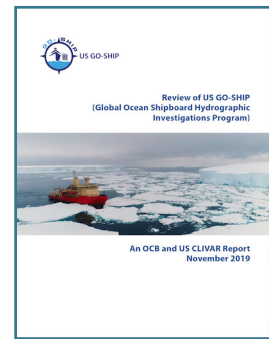
Papers

Benway, H. M., L. Lorenzoni, A. E. White, B. Fiedler, N. M. Levine, D. P. Nicholson, M. D. DeGrandpre, H. M. Sosik, M. J. Church, T. D. O'Brien, M. Leinen, R. A. Weller, D. M. Karl, S. A. Henson, R. M. Letelier (2019). Ocean time series observations of changing marine ecosystems: An era of integration, synthesis, and societal applications. *Frontiers in Marine Science*, <https://doi.org/10.3389/fmars.2019.00393>

Related to 2018 OA PI Meeting

Carter, BR, NL Williams, W Evans, AJ Fassbender, L Barbero, C Hauri, et al. (2019). Time of detection as a metric for prioritizing between climate observation quality, frequency, and duration. *Geophysical Research Letters*, 46, 3853–3861. <https://doi.org/10.1029/2018GL080773>.

Turk D, H Wang, X Hu, DK Gledhill, ZA Wang, L Jiang, W-J and Cai (2019). Time of Emergence of Surface Ocean Carbon Dioxide Trends in the North American Coastal Margins in Support of Ocean Acidification Observing System Design. *Front. Mar. Sci.* 6:91. <https://doi.org/10.3389/fmars.2019.00091>.



Related to 2016 Joint OCB-GEOTRACES Workshop

Hayes, C. T., R. F. Anderson, H. Cheng, T. M. Conway, R. L. Edwards, M. Q. Fleisher, P. Ho, K.-F. Huang, S. G. John, W. M. Landing, S. H. Little, Y. Lu, P. L. Morton, S. B. Moran, L. F. Robinson, R. U. Shelley, A. M. Shiller, and X.-Y. Zheng (2018), Replacement times of a spectrum of elements in the North Atlantic based on thorium supply, *Global Biogeochemical Cycles*, 32(9), 1294-1311, <https://doi.org/10.1029/2017GB005839>.

Hayes, C. T., E. E. Black, R. F. Anderson, M. Baskaran, K. O. Buesseler, M. A. Charette, H. Cheng, J. K. Cochran, R. L. Edwards, P. Fitzgerald, P. J. Lam, Y. Lu, S. O. Morris, D. C. Ohnemus, F. J. Pavia, G. Stewart, and Y. Tang (2018), Flux of particulate elements in the North Atlantic Ocean constrained by multiple radionuclides, *Global Biogeochemical Cycles*, 32(12), 1738-1758, <https://doi.org/10.1029/2018GB005994>.

Pavia, F. J., R. F. Anderson, P. J. Lam, B. B. Cael, S. M. Vivancos, M. Q. Fleisher, Y. Lu, P. Zhang, H. Cheng, R. L. Edwards (2019). Shallow particulate organic carbon regeneration in the South Pacific Ocean. *Proceedings of the National Academy of Sciences* 116 (20) 9753-9758; <https://doi.org/10.1073/pnas.1901863116>.

Media & Outreach

OCB hosts a large collection of education and outreach products spanning its science focus areas at <https://www.us-ocb.org/science-support/outreach-education/>

Short films and recordings of summer workshop and other talks are available on the [OCB YouTube Channel](#).

OCB Short Film - highlighting science focus areas and scientists



https://youtu.be/EF_LHx9g3DA

OCB Oceanic Methane and Nitrous Oxide Workshop short film



<https://youtu.be/0DyMyIVs4Qs>



<https://web.whoi.edu/ocb-fert/>

OCB developed this website as a clearinghouse for ocean fertilization news and informational resources to 1) increase public knowledge and awareness on this topic, and 2) advance scientific research to improve our understanding of the implications of ocean fertilization for marine ecosystems.

Learn more about [OCB and other organizations' stances](#) on ocean fertilization experiments.

Content overview (also organized on the site for non-scientists)

- Scientific Literature by topic, including synthesis papers, experiments, regional and related research papers
- Large-scale ocean fertilization experiments
- London Convention and other governance and policy documents
- Informational web resources for outreach and teaching
- Position statements
- Gray literature

The ocean fertilization infographic is available full-size and also in Spanish on the website listed above.

