

# Cruise sampling event log from R/V Oceanus, R/V Weatherbird II OC404-01, OC404-04, OC415-01, OC415-02, OC415-03, OC415-04, WB0409, WB0413 in the Sargasso Sea, 2004-2005 (EDDIES project)

**Website:** <https://www.bco-dmo.org/dataset/3042>

**Version:** 04 March 2009

**Version Date:** 2009-03-04

## Project

» [Eddies Dynamics, Mixing, Export, and Species composition](#) (EDDIES)

## Program

» [Ocean Carbon and Biogeochemistry](#) (OCB)

| Contributors                            | Affiliation   | Role                   |
|---|---|------------------------|
| <a href="#">Bates, Nicholas</a>         | Bermuda Biological Station for Research (BBSR)      | Principal Investigator |
| <a href="#">Ledwell, James R.</a>       | Woods Hole Oceanographic Institution (WHOI)         | Principal Investigator |
| <a href="#">McGillicuddy, Dennis J.</a> | Woods Hole Oceanographic Institution (WHOI)         | Principal Investigator |
| <a href="#">Chandler, Cynthia L.</a>    | Woods Hole Oceanographic Institution (WHOI BCO-DMO) | BCO-DMO Data Manager   |

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## Dataset Description

shipboard scientific sampling event log

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## Parameters

| Parameter             | Description  | Units           |
|-----------------------|--|-----------------|
| event                 | unique sampling event number composite of GMT date and time          | YYYYMMDDhhmm    |
| date                  | start date of event (GMT)  | YYYYMMDD        |
| time                  | start time of event (GMT)  | hhmm            |
| lon                   | longitude, negative denotes West                                     | decimal degrees |
| lat                   | latitude, negative denotes South                                     | decimal degrees |
| sta                   | station number   | dimensionless   |
| Pmax                  | pressure, maximum recorded   | decibars        |
| ev_type               | sampling event type  | dimensionless   |
| sampling_code         | concatenated string: cruise_ID, sampling method, and 2 digit station | dimensionless   |
| activity_and_comments | description of sampling event  | dimensionless   |
| cast                  | cast number for event  | dimensionless   |
| comments              | description of event   | dimensionless   |
| Pmax_n                | pressure, nominal maximum for cast                                   | decibars        |
| sampling_type         | sampling device type   | dimensionless   |
| depth_max             | maximum depth of sampling  | meters          |
| dist_EC               | distance from eddy center  | kilometers      |
| radiometer_file       | file associated with radiometer                                      | dimensionless   |

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## Deployments

### OC404-01

|                    |  |
|--------------------|--|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57956">https://www.bco-dmo.org/deployment/57956</a>  |
| <b>Platform</b>    | R/V Oceanus  |
| <b>Report</b>      | <a href="http://ocb.whoi.edu/EDDIES/CRUISES/2004/OC404-1_Draft_Cruise_Report.pdf">http://ocb.whoi.edu/EDDIES/CRUISES/2004/OC404-1_Draft_Cruise_Report.pdf</a>  |
| <b>Start Date</b>  | 2004-06-11   |
| <b>End Date</b>    | 2004-07-03   |
| <b>Description</b> | <p>EDDIES 2004 Survey 1 cruise Funded by: NSF OCE-0241310 Original cruise data are available from the NSF R2R data catalog (Cruise DOI: 10.7284/900337)</p> <p><b>Methods &amp; Sampling</b><br/>           PI: Dennis McGillicuddy (Chief Scientist) of: Woods Hole Oceanographic Institution (WHOI)<br/>           dataset: Cruise sampling event log dates: 12 June 2004 to 03 July 2004 (20040612-20040703)<br/>           location: N: 37.934 S: 28.641 W: -68.716 E: -58.754 project/cruise: EDDIES/OC404-1 2004<br/>           Survey 1 platform: R/V Oceanus Change history: YMMDD 050616: downloaded original station list from EDDIES data web site; 051213: added to OCB database by Cyndy Chandler, OCB DMO<br/>           060316: split event to add date and time 060503: full cruise event log provided by EDDIES<br/>           project office (replaces original version generated by OCB CDMO) 060523: CTD event metadata replaced by values in CTD header records; added CTD #65 metadata from sampling cast sheets<br/>           060629: add Pmax; add CTD station number to support bottle merge 060811: XBT_5 corrected from XBT_15 event on date 20040613 070227: modify ev_type codes to match merged log (typos) 090302: correct invalid times (&gt; 60 minues) for event 200406211477 and 200406221572; correct times 1448 and 1529 respectively and change event number to reflect corrected time<br/>           Related information: Cruise track</p> |

**OC404-04**

|                    |   |
|--------------------|---|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57961">https://www.bco-dmo.org/deployment/57961</a>   |
| <b>Platform</b>    | R/V Oceanus   |
| <b>Report</b>      | <a href="http://ocb.whoi.edu/EDDIES/CRUISES/2004/OC404-4_Draft_Cruise_Report.pdf">http://ocb.whoi.edu/EDDIES/CRUISES/2004/OC404-4_Draft_Cruise_Report.pdf</a>   |
| <b>Start Date</b>  | 2004-07-25  |
| <b>End Date</b>    | 2004-08-12  |
| <b>Description</b> | <p>EDDIES project 2004 Survey 2 cruise Funded by: NSF OCE-0241310 Original cruise data are available from the NSF R2R data catalog</p> <p><b>Methods &amp; Sampling</b><br/> PI: Dennis McGillicuddy of: Woods Hole Oceanographic Institution (WHOI) dataset: Cruise sampling event log dates: 25 July 2004 to 11 August 2004 (20040725-20040811) location: N: 32.499 S: 29.954 W: -66.613 E: -59.450 project/cruise: EDDIES/OC404-4 2004 Survey 2 platform: R/V Oceanus Methodology: none provided with data Change history: YMMDD 050616: downloaded original station list from EDDIES data web site; 051213: added to OCB database by Cyndy Chandler, OCB DMO 060316: split event to add date and time 060503: full cruise event log provided by EDDIES project office (replaces original version generated by OCB CDMO) 060630: CTD event metadata replaced by values in CTD header records; add CTD station number to support bottle merge Related information: Cruise track</p> |

**OC415-01**

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|--------------------|---|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57962">https://www.bco-dmo.org/deployment/57962</a>   |
| <b>Platform</b>    | R/V Oceanus   |
| <b>Report</b>      | <a href="http://ocb.whoi.edu/EDDIES/CRUISES/2005/OC415_Draft_Cruise_Report_050722.pdf">http://ocb.whoi.edu/EDDIES/CRUISES/2005/OC415_Draft_Cruise_Report_050722.pdf</a>   |
| <b>Start Date</b>  | 2005-06-20  |
| <b>End Date</b>    | 2005-07-15  |
| <b>Description</b> | <p>EDDIES project 2005 Survey 1 cruise Funded by: NSF OCE-0241310 Original cruise data are available from the NSF R2R data catalog</p> <p><b>Methods &amp; Sampling</b><br/> PI: Dennis McGillicuddy (Chief Scientist) of: Woods Hole Oceanographic Institution (WHOI) dataset: Cruise sampling event log dates: 20 June 2005 to 15 July 2005 (20050620-20050715) location: N: 40.753 S: 28.559 W: -70.546 E: -61.920 project/cruise: EDDIES/OC415-1 2005 Survey 1 platform: R/V Oceanus Methodology: none provided with data Change history: YMMDD 051220: downloaded original cast list from EDDIES data web site; added to OCB database by Cyndy Chandler, OCB DMO 060503: full cruise event log provided by EDDIES project office (replaces original version generated by OCB CDMO) 060630: CTD event metadata replaced by values in CTD header records; add CTD station number to support bottle merge 090304: BCO-DMO corrected times and event number corrected for XBT 14 and 147; correct times taken from XBT data file headers</p> |

**OC415-02**

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| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57964">https://www.bco-dmo.org/deployment/57964</a>   |
| <b>Platform</b>    | R/V Oceanus   |
| <b>Start Date</b>  | 2005-07-18  |
| <b>End Date</b>    | 2005-08-04  |
| <b>Description</b> | <p>EDDIES project 2005 Tracer 1 cruise Funded by: NSF OCE-0241310 Original cruise data are available from the NSF R2R data catalog</p> <p><b>Methods &amp; Sampling</b><br/> PI: Jim Ledwell (Chief Scientist) of: Woods Hole Oceanographic Institution (WHOI) dataset: Cruise sampling event log dates: 18 July 2005 to 02 August 2005 location: N: 32.017 S: 28.154 W: -67.953 E: -65.017 project/cruise: EDDIES/OC415-2 2005 Tracer 1 platform: R/V Oceanus Methodology: none provided with data Change history: YYYYMMDD 060214: downloaded original data from EDDIES data web site; added to OCB database by Cyndy Chandler, OCB DMO 070314: spilt SAM ev_type to cast number and ev_type to be consistent with OC415-4 cruise and support data joins OCB DMO Note: data were taken from original Excel format event log Corrections: XBT Seq#2 time corrected from 2925 to 2024 Caution: The location data in this cruise event log for CTD casts 4, 19 and 28 differs by more than .01 from the positions as recorded in the CTD cast data file headers: event log positions: cast 4 lon: -66.930 lat: 30.526 lon: -66.927 lat: 30.624 cast 19 lon: -66.577 lat: 28.406 lon: -66.560 lat: 28.406 cast 28 lon: -67.516 lat: 30.020 lon: -67.516 lat: 30.031</p> |

#### OC415-03

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| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57965">https://www.bco-dmo.org/deployment/57965</a>  |
| <b>Platform</b>    | R/V Oceanus  |
| <b>Report</b>      | <a href="http://ocb.whoi.edu/EDDIES/CRUISES/2005/OC415-3_CrRptDraft_091405.pdf">http://ocb.whoi.edu/EDDIES/CRUISES/2005/OC415-3_CrRptDraft_091405.pdf</a>  |
| <b>Start Date</b>  | 2005-08-07   |
| <b>End Date</b>    | 2005-08-26   |
| <b>Description</b> | <p>EDDIES project 2005 Survey 2 cruise Funded by: NSF OCE-0241310 Original cruise data are available from the NSF R2R data catalog</p> <p><b>Methods &amp; Sampling</b><br/> PI: Dennis McGillicuddy (Chief Scientist) of: Woods Hole Oceanographic Institution (WHOI) dataset: Cruise sampling event log dates: 07 August 2005 to 25 August 2005 (20050807-20050825) location: N: 33.243 S: 29.279 W: -69.412 E: -63.146 project/cruise: EDDIES/OC415-3 2005 Survey 2 platform: R/V Oceanus Methodology: none provided with data Change history: YYYYMMDD 060217: data were recovered from NMEA header records in CTD data files downloaded from EDDIES data web site; added to OCB database by Cyndy Chandler, OCB DMO 060503: full cruise event log provided by EDDIES project office (replaces original version generated by OCB CDMO) 060630: CTD event metadata replaced by values in CTD header records; add CTD station number to support bottle merge</p> |

#### OC415-04

|                    |   |
|--------------------|---|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57967">https://www.bco-dmo.org/deployment/57967</a>   |
| <b>Platform</b>    | R/V Oceanus   |
| <b>Report</b>      | <a href="http://ocb.whoi.edu/EDDIES/CRUISES/2005/OC415-4_cruise_report.pdf">http://ocb.whoi.edu/EDDIES/CRUISES/2005/OC415-4_cruise_report.pdf</a>   |
| <b>Start Date</b>  | 2005-08-29  |
| <b>End Date</b>    | 2005-09-15  |
| <b>Description</b> | <p>EDDIES project 2005 Tracer 2 cruise Funded by: NSF OCE-0241310 The cruise end date was originally entered as 9/14/2005 (source: UNOLS final ship schedule), but this was changed in February 2015 to end date 9/15/2005. The official record from the vessel operator shows the end date being 9/15/2015. Original cruise data are available from the NSF R2R data catalog</p> <p><b>Methods &amp; Sampling</b><br/> PI: Jim Ledwell (Chief Scientist) of: Woods Hole Oceanographic Institution (WHOI) dataset: Cruise sampling event log dates: 29 August 2005 to 14 September 2005 (20050829-20050914) location: N: 41.367 S: 28.734 W: -70.926 E: -69.196 project/cruise: EDDIES/OC415-4 2005 Tracer 2 platform: R/V Oceanus Methodology: none provided with data Change history: YYYYMMDD 060214: downloaded original data from EDDIES data web site; 060301: added to OCB database by Cyndy Chandler, OCB DMO 070301: corrected event numbers and times for CTD casts 1 and 7 DMO Note regarding QA</p> |

#### WB0409

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| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57955">https://www.bco-dmo.org/deployment/57955</a>   |
| <b>Platform</b>    | R/V Weatherbird II  |
| <b>Start Date</b>  | 2004-06-23  |
| <b>End Date</b>    | 2004-07-02  |
| <b>Description</b> | <p>EDT1 2004 Transect 1 cruise Funded by: NSF OCE-0241310</p> <p><b>Methods &amp; Sampling</b><br/> PI: Nick Bates (Chief Scientist) of: Bermuda Biological Station for Research (BBSR) dataset: Cruise sampling event log dates: 24 June 2004 to 02 July 2004 (20040624-20040702) location: N: 31.928 S: 29.773 W: -66.178 E: -64.082 project/cruise: EDDIES/WB0409 2004 Transect 1 (EDT1) platform: R/V Weatherbird II Methodology: processing notes are available with the full merged version Change history: 051213: create merged cruise log from OC404-1 and WB0409 CTD event logs 060313: add date and time fields (cchandler, OCB DMO) 070227: add all sampling events from complete event log created and contributed by Courtney Ewart (UCSB); (added by cchandler) 071030: extract WB0409 events from merged E2 cruise log Related information: 070227: Courtney Ewart (UCSB) contributed a merged CTD map for OC404-1 and WB0409 that may help to determine relative CTD station locations (PDF file of 3 maps) DMO note: The WB0409 cruise is also called EDDIES Transect #1 or EDT1 (EDDIES Transects 1 and 2 were done in 2004, 3 and 4 in 2005) The dist_EC (distance from eddy center, ADCP eddy center trajectories) was calculated by Valery Kosnyrev (WHOI).</p> |

#### WB0413

|                    |   |
|--------------------|---|
| <b>Website</b>     | <a href="https://www.bco-dmo.org/deployment/57960">https://www.bco-dmo.org/deployment/57960</a>   |
| <b>Platform</b>    | R/V Weatherbird II  |
| <b>Start Date</b>  | 2004-08-02  |
| <b>End Date</b>    | 2004-08-11  |
| <b>Description</b> | <p>EDT2 2004 Transect 2 cruise Funded by: NSF OCE-0241310</p> <p><b>Methods &amp; Sampling</b><br/> PI: Nick Bates (Chief Scientist) of: Bermuda Biological Station for Research (BBSR) dataset:<br/> Cruise sampling event log dates: 02 August 2004 to 11 August 2004 location: N: 31.817 S:<br/> 30.331 W: -66.406 E: -64.154 project/cruise: EDDIES/WB0413 2004 Transect 2 (EDT2)<br/> platform: R/V Weatherbird II Methodology: processing notes are available with the full merged<br/> version Change history: 051220: create merged cruise log from OC404-4 and WB0413 CTD<br/> event logs 060310: add date and time fields (cchandler, OCB DMO) 070227: add all sampling<br/> events from complete event log created and contributed by Courtney Ewart (UCSB); (added by<br/> cchandler) 071030: extract WB0413 events from merged E1 cruise log DMO note: The<br/> WB0413 cruise is also called EDDIES Transect #2 or EDT2 (EDDIES Transects 1 and 2 were<br/> done in 2004, 3 and 4 in 2005) The dist_EC (distance from eddy center, ADCP eddy center<br/> trajectories) was calculated by Valery Kosnyrev (WHOI).</p> |

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## Project Information

### Eddies Dynamics, Mixing, Export, and Species composition (EDDIES)

**Website:** [http://science.whoi.edu/users/olga/eddies/EDDIES\\_Project.html](http://science.whoi.edu/users/olga/eddies/EDDIES_Project.html)

**Coverage:** Sargasso Sea

The original title of this project from the NSF award is: Collaborative Research: Impacts of Eddies and Mixing on Plankton Community Structure and Biogeochemical Cycling in the Sargasso Sea".

Prior results have documented eddy-driven transport of nutrients into the euphotic zone and the associated accumulation of chlorophyll. However, several key aspects of mesoscale upwelling events remain unresolved by the extant database, including: (1) phytoplankton physiological response, (2) changes in community structure, (3) impact on export out of the euphotic zone, (4) rates of mixing between the surface mixed layer and the base of the euphotic zone, and (5) implications for biogeochemistry and differential cycling of carbon and associated bioactive elements. This leads to the following hypotheses concerning the complex, non-linear biological regulation of elemental cycling in the ocean:

H1: Eddy-induced upwelling, in combination with diapycnal mixing in the upper ocean, introduces new nutrients into the euphotic zone.

H2: The increase in inorganic nutrients stimulates a physiological response within the phytoplankton community.

H3: Differing physiological responses of the various species bring about a shift in community structure.

H4: Changes in community structure lead to increases in export from, and changes in biogeochemical cycling within, the upper ocean.

### Publications

Andrews, J.E., Hartin, C., and Buesseler, K.O.. "7Be Analyses in Seawater by Low Background Gamma-Spectroscopy.," *Journal of Radioanalytical and Nuclear Chemistry*, v.277, 2008, p. 253.

Andrews, J.E., Hartin, C., Buesseler, K.O.. "7Be Analyses in Seawater by Low Background Gamma-

Spectroscopy," *Journal of Radioanalytical and Nuclear Chemistry*, v.277, 2008, p. 253.

Benitez-Nelson, C.R. and McGillicuddy, D.J.. "Mesoscale Physical-Biological-Biogeochemical Linkages in the Open Ocean: An Introduction to the Results of the E-Flux and EDDIES Programs.," *Deep Sea Research II*, v.55, 2008, p. 1133.

Benitez-Nelson, C.R. and McGillicuddy, D.J.. "Mesoscale Physical-Biological-Biogeochemical Linkages in the Open Ocean: An Introduction to the Results of the E-Flux and EDDIES Programs," *Deep-Sea Research II*, v.55, 2008, p. 1133.

Bibby, T.S., Gorbunov, M.Y., Wyman, K.W., Falkowski, P.G.. "Photosynthetic community responses to upwelling in mesoscale eddies in the subtropical North Atlantic and Pacific Oceans," *Deep-Sea Research Part II: Topical Studies in Oceanography*, v.55, 2008, p. 1310.

Buesseler, K.O., Lamborg, C., Cai, P., Escoube, R., Johnson, R., Pike, S., Masque, P., McGillicuddy, D.J., Verdeny, E.. "Particle Fluxes Associated with Mesoscale Eddies in the Sargasso Sea," *Deep Sea Research II*, v.55, 2008, p. 1426.

Carlson, C.A., del Giorgio, P., Herdl, G.. "Microbes and the dissipation of energy and respiration: From cells to ecosystems," *Oceanography*, v.20, 2007, p. 89.

Davis, C.S., and McGillicuddy, D.J.. "Transatlantic Abundance of the N<sub>2</sub>-Fixing Colonial Cyanobacterium *Trichodesmium*," *Science*, v.312, 2006, p. 1517.

Ewart, C.S., Meyers, M.K., Wallner, E., McGillicuddy, D.J., Carlson, C.A.. "Microbial Dynamics in Cyclonic and Anticyclonic Mode-Water Eddies in the Northwestern Sargasso Sea," *Deep Sea Research II*, v.55, 2008, p. 1334.

Ewart, C.S., Meyers, M.K., Wallner, E., McGillicuddy, D.J., Carlson, C.A.. "Microbial Dynamics in Cyclonic and Anticyclonic Mode-Water Eddies in the Northwestern Sargasso Sea," *Deep-Sea Research II*, v.55, 2008, p. 1334.

Goldthwait, S.A. and Steinberg, D.K.. "Elevated biomass of mesozooplankton and enhanced fecal pellet flux in cyclonic and mode-water eddies in the Sargasso Sea," *Deep-Sea Research Part II: Topical Studies in Oceanography*, v.55, 2008, p. 1360.

Greenan, B.J.W.. "Shear and Richardson number in a mode-water eddy," *Deep-Sea Research Part II: Topical Studies in Oceanography*, v.55, 2008, p. 1161.

Jenkins, W.J., McGillicuddy, D.J., and Lott III, D.E.. "The Distributions of, and Relationship Between <sup>3</sup>He and Nitrate in Eddies," *Deep Sea Research II*, v.55, 2008, p. 1389.

Jenkins, W.J., McGillicuddy, D.J., Lott III, D.E.. "The Distributions of, and Relationship Between <sup>3</sup>He and Nitrate in Eddies," *Deep-Sea Research II*, v.55, 2008, p. 1389.

Ledwell, J.R., McGillicuddy, D.J., and Anderson, L.A.. "Nutrient Flux into an Intense Deep Chlorophyll Layer in a Mode-water Eddy.," *Deep Sea Research II*, v.55, 2008, p. 1139.

Ledwell, J.R., McGillicuddy, D.J., Anderson, L.A.. "Nutrient Flux into an Intense Deep Chlorophyll Layer in a Mode-water Eddy," *Deep-Sea Research II*, v.55, 2008, p. 1139.

Li, Q.P. and Hansell, D.A.. "Intercomparison and coupling of MAGIC and LWCC techniques for trace analysis of phosphate in seawater," *Analytical Chemica Acta*, v.611, 2008, p. 68.

Li, Q.P., Hansell, D.A., McGillicuddy, D.J., Bates, N.R., Johnson, R.J.. "Tracer-based assessment of the origin and biogeochemical transformation of a cyclonic eddy in the Sargasso Sea," *Journal of Geophysical Research*, v.113, 2008, p. 10006.

Li, Q.P., Hansell, D.A., Zhang, J.-Z.. "Underway monitoring of nanomolar nitrate plus nitrite and phosphate in oligotrophic seawater," *Limnology and Oceanography: Methods*, v.6, 2008, p. 319.

Li, Q.P., Zhang, J.-Z., Millero, F.J., Hansell, D.A.. "Continuous colorimetric determination of trace ammonium in seawater with a long-path liquid waveguide capillary cell," *Marine Chemistry*, v.96, 2005, p. 73.

McGillicuddy, D.J., et. al.. "Eddy/Wind Interactions Stimulate Extraordinary Mid-Ocean Plankton Blooms," *Science*, v.316, 2007, p. 1021.

McGillicuddy, D.J., Ledwell, J.R., and Anderson, L.A.. "Response to Comment on "Eddy/Wind Interactions Stimulate Extraordinary Mid-Ocean Plankton Bloom".," Science, v.320, 2008.

McGillicuddy, D.J., Ledwell, J.R., Anderson, L.A.. "Response to Comment on "Eddy/Wind Interactions Stimulate Extraordinary Mid-Ocean Plankton Bloom",," Science, v.320, 2008.

McGillicuddy, et. al.. "Eddy/Wind Interactions Stimulate Extraordinary Mid-Ocean Plankton Blooms.," Science, v.316, 2007, p. 1021.

Mourino B., and McGillicuddy, D.J.. "Mesoscale Variability in the Metabolic Balance of the Sargasso Sea," Limnology & Oceanography, v.51, 2006, p. 2675.

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## Program Information

### Ocean Carbon and Biogeochemistry (OCB)

**Website:** <http://us-ocb.org/>

**Coverage:** Global

The Ocean Carbon and Biogeochemistry (OCB) program focuses on the ocean's role as a component of the global Earth system, bringing together research in geochemistry, ocean physics, and ecology that inform on and advance our understanding of ocean biogeochemistry. The overall program goals are to promote, plan, and coordinate collaborative, multidisciplinary research opportunities within the U.S. research community and with international partners. Important OCB-related activities currently include: the Ocean Carbon and Climate Change (OCCC) and the North American Carbon Program (NACP); U.S. contributions to IMBER, SOLAS, CARBOOCEAN; and numerous U.S. single-investigator and medium-size research projects funded by U.S. federal agencies including NASA, NOAA, and NSF.

The scientific mission of OCB is to study the evolving role of the ocean in the global carbon cycle, in the face of environmental variability and change through studies of marine biogeochemical cycles and associated ecosystems.

The overarching OCB science themes include improved understanding and prediction of: 1) oceanic uptake and release of atmospheric CO<sub>2</sub> and other greenhouse gases and 2) environmental sensitivities of biogeochemical cycles, marine ecosystems, and interactions between the two.

The OCB Research Priorities (updated January 2012) include: ocean acidification; terrestrial/coastal carbon fluxes and exchanges; climate sensitivities of and change in ecosystem structure and associated impacts on biogeochemical cycles; mesopelagic ecological and biogeochemical interactions; benthic-pelagic feedbacks on biogeochemical cycles; ocean carbon uptake and storage; and expanding low-oxygen conditions in the coastal and open oceans.

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## Funding

| Funding Source   | Award                       |
|--|-----------------------------|
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-0241310</a> |

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