Survey biogeochemical data from R/V Atlantis AT32, AT34, AT38, and AT39-06 in the western North Atlantic Ocean (35°N to 57°N; 45°W) in Nov. 2015, May 2016, Sep 2017, Mar/Apr 2018

Website: https://www.bco-dmo.org/dataset/659131
Data Type: Cruise Results
Version: 2
Version Date: 2020-09-14

Project
» Tracking the temporal and spatial variability of dissolved organic matter, its diagenetic state and bioavailability during various bloom states in the North Atlantic (DOM_SeasonalDynamics)

Program
» North Atlantic Aerosols and Marine Ecosystems Study (NAAMES)

Contributors	Affiliation	Role
Carlson, Craig A.	University of California-Santa Barbara (UCSB-MSI)	Principal Investigator
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract
This dataset includes analyses from Niskin bottle samples collected on R/V Atlantis cruises AT32, AT34, AT38 and AT39-6 as part of the NASA NAAMES campaign (2015-2018). Reported are survey biogeochemical including dissolved organic carbon, dissolved organic nitrogen, total dissolved amino acids.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
- Data Files
- Supplemental Files
- Related Publications
- Parameters
- Instruments
- Deployments
- Project Information
- Program Information
- Funding

Coverage

Spatial Extent: **N**:56.341 **E**:-37.514 **S**:39.187 **W**:-46.148
Temporal Extent: 2015-11-12 - 2018-04-05

Dataset Description

This dataset includes analyses from Niskin bottle samples collected on R/V Atlantis cruises AT32, AT34, AT38 and AT39-6 as part of the NASA NAAMES campaign (2015-2018). Reported are survey biogeochemical including dissolved organic carbon, dissolved organic nitrogen, total dissolved amino acids.

Methods & Sampling

Samples were collected on RV/Atlantis cruises in the North Atlantic between November 2015 and April

2018. Bacterial abundance was determined by flow cytometry on AT32 and by direct microscope counts for the rest of the cruises (AT34, AT38, AT39-6). Amino acid analysis was conducted for cruises AT34, AT38, and AT39-06.

Dissolved organic carbon DOC) and total dissolved nitrogen (TDN): See Supplemental Files.
Carlson C, Hansell D, Nelson N, Siegel D, Smethie W, Khatiwala S et al. (2010). Dissolved organic carbon export and subsequent remineralization in the mesopelagic and bathypelagic realms of the North Atlantic basin. Deep Sea Res Part II: Topical Stud Oceanogr 57: 1433–1445.

Bacterial production by Leucine Incorporation: See Supplemental Files.
Smith, D.C. and F. Azam (1992). A simple, economical method for measuring bacterial protein synthesis rates in seawater using 3H-leucine. Marine Microbial Food Webs 6:107-114.

Bacterioplankton abundance by flow cytometry: See Supplemental Files.
Nelson, C.E., A.L. Alldredge, E.A. McCliment, L.A. Amaral-Zettler, and C.A. Carlson. 2011. Depleted dissolved organic carbon and distinct Bacterial communities in the water column of a rapid-flushing coral reef ecosystem. The ISME Journal 5: 1374–1387. doi:10.1038/ismej.2011.12

Bacterioplankton abundance by DAPI DNA binding stain and epifluorescence microscopy: See Supplemental Files.
BATS Methods Manual. Chapter 17. Determination of Bacterial Abundance.Updated by K.Orcutt 4/1997, pp. 111-114.version 4.

Amino acid concentration using HPLC: See Supplemental Files (includes reference list.)

Data Processing Description

BCO-DMO Processing:
- added conventional header with dataset name, PI name, version date
- replaced blank cells and those with -999 with 'nd' (no data)

[table of contents | back to top]

Data Files

File
biogeochem_all.csv (Comma Separated Values (.csv), 977.59 KB) MD5:4444e94b5e8f660a491ee44f6ad0b2d4 Primary data file for dataset ID 659131

[table of contents | back to top]

Supplemental Files

File
Bacterial abundance using DAPI DNA binding stain and Epifluorescence microscopy filename: Bacterial_Abundance_using_DAPI_DNA_binding_stain_and_EFM.pdf (Portable Document Format (.pdf), 367.91 KB) MD5:bcc7f60bea95a080fe056e1bb095536e C. Carlson [version date: 2017-08-29]
Determination of Amino Acid Concentrations using HPLC filename: Method-total_dissolved_amino_acids_Carlson_2020-08-19.pdf (Portable Document Format (.pdf), 435.78 KB) MD5:fd43f2485298a9bde730c64b516f56cc This procedure describes the measurement of total dissolved amino acids (TDAA) and its 18 constituents using high performance liquid chromatography (HPLC). Craig Carlson [2018-10-30]
Flow Cytometry Protocol for Determination of Bacterial Abundance filename: Flow_Cytometry_Protocol_for_Determination_of_Bacterial_Abundance.pdf (Portable Document Format (.pdf), 369.15 KB) MD5:d44db238e643d3f4828a732ee3447215 Flow Cytometry Protocol for Determination of Bacterial Abundance Craig Carlson [version date: 2017-08-29]
Protocol: Bacterial Production Rates via 3H-Leucine incorporation filename: Microcentrifuge_Method_for_Bacterial_Production_Rates_via_3H-Leucine_incorp.pdf (Portable Document Format (.pdf), 445.74 KB) MD5:08a05d9a15af3ba56cabb7836296f99f Microcentrifuge Method Protocol for Determination of Bacterial Production Rates via 3H-Leucine incorporation. Craig Carlson [version date: 2017-08-29]
Protocols for Dissolved Organic Carbon and Total Dissolved Nitrogen Analysis filename: DOC_TDN_method_Carlson.pdf (Portable Document Format (.pdf), 258.09 KB) MD5:46973edce747f7f77099db51ac36acfa Version date: 2017-10-10. UCSB - CRAIG CARLSON. v

[table of contents | back to top]

Related Publications

BATS Methods Manual. Chapter 17. Determination of Bacterial Abundance.Updated by K.Orcutt 4/1997, pp. 111-114.version 4. http://eprints.soton.ac.uk/id/eprint/361194
http://eprints.soton.ac.uk/id/eprint/361194#chapter17
Methods

Baetge, N., Graff, J. R., Behrenfeld, M. J., & Carlson, C. A. (2020). Net Community Production, Dissolved Organic Carbon Accumulation, and Vertical Export in the Western North Atlantic. Frontiers in Marine Science, 7. doi:10.3389/fmars.2020.00227
Results

Carlson, C. A., Hansell, D. A., Nelson, N. B., Siegel, D. A., Smethie, W. M., Khatiwala, S., Meyers, M. M., Halewood, E. (2010). Dissolved organic carbon export and subsequent remineralization in the mesopelagic and bathypelagic realms of the North Atlantic basin. Deep Sea Research Part II: Topical Studies in Oceanography, 57(16), 1433–1445. doi:10.1016/j.dsr2.2010.02.013
Methods

Halewood, E., Carlson, C., Brzezinski, M., Reed, D., & Goodman, J. (2012). Annual cycle of organic matter partitioning and its availability to bacteria across the Santa Barbara Channel continental shelf. Aquatic Microbial Ecology, 67(3), 189–209. doi:10.3354/ame01586
Methods

James, A. K., Passow, U., Brzezinski, M. A., Parsons, R. J., Trapani, J. N., & Carlson, C. A. (2017). Elevated pCO2 enhances bacterioplankton removal of organic carbon. PLOS ONE, 12(3), e0173145. doi:10.1371/journal.pone.0173145
Methods

Liu, S., Parsons, R., Opalk, K., Baetge, N., Giovannoni, S., Bolaños, L. M., Kujawinski, E. B., Longnecker, K., Lu, Y., Halewood, E., & Carlson, C. A. (2020). Different carboxyl-rich alicyclic molecules proxy compounds select distinct bacterioplankton for oxidation of dissolved organic matter in the mesopelagic Sargasso Sea. In Limnology and Oceanography (Vol. 65, Issue 7, pp. 1532–1553). Wiley. https://doi.org/10.1002/lno.11405
Methods

Nelson, C. E., Alldredge, A. L., McCliment, E. A., Amaral-Zettler, L. A., & Carlson, C. A. (2011). Depleted dissolved organic carbon and distinct bacterial communities in the water column of a rapid-flushing coral reef ecosystem. The ISME Journal, 5(8), 1374–1387. doi:10.1038/ismej.2011.12
Methods

Porter, K. G., & Feig, Y. S. (1980). The use of DAPI for identifying and counting aquatic microflora. Limnology and Oceanography, 25(5), 943–948. doi:10.4319/lo.1980.25.5.0943
Methods

Smith, D.C. and F. Azam (1992). A simple, economical method for measuring bacterial protein synthesis rates in seawater using 3H-leucine. Marine Microbial Food Webs 6:107-114
http://www.gso.uri.edu/dcsmith/page3/page19/assets/smithazam92.PDF
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
Cruise	Cruise	unitless
Station	Station	unitless
Type	Sample Type (ODV format)	unitless
Time_Stamp	Date/Time (ODV format); formatted as ISO_DateTime yyyy-mm-ddThh:mm or yyyy-mm-ddT	unitless
Latitude	Latitude; north is positive	decimal degrees
Longitude	Longitude; east is positive	decimal degrees
Bottom_Z	Bottom Depth	meters
CruiseCN	Cast number according to CTD/Bottle log sheets (cruise sequential cast number)	unitless
SCN	Cast numbers restart at each station i.e. for Station x; Biology Cast 1 = SxC1; Biology Cast 2 = SxC2; Deep Cast 1 =SxC3; Deep Cast 2 = SxC4 (station sequential cast number)	unitless
CampCN	Cast numbers carried through the entire NAAMES campaign; never resetting for an individual cruise nor station (campaign sequential cast number)	unitless
Niskin	Niskin Number	unitless

Cast_Type	Biology; Deep; Shallow (does not fit Biology or Deep cast scheme); Microlayer	unitless
Target_Z	Target Depth according to CTD/Bottle log sheets	meters
Pressure	Pressure from Digiquartz sensor	decibars (db)
Density00	Density; 1st sensor	kilograms/meter^3 (kg/m3)
Density11	Density; 2nd sensor	kilograms/meter^3 (kg/m3)
Sal11	Salinity; 2nd Sensor	Practical Salinity Units (psu)
SoundVel	Sound velocity; 1st sensor	meters/second (m/s)
SoundVel1	Sound velocity; 2nd sensor	meters/second (m/s)
Oxygen_uM	Oxygen; 1st sensor	micromol/liter (umol/l)
Oxygen_V	Oxygen; 1st sensor; voltage	volts (V)
Temperature	Temperature; 1st sensor	degrees C
Temperature1	Temperature; 2nd sensor	degrees C
Conductivity	Conductivity; 1st sensor	Siemans/meter (S/m)
Conductivity1	Conductivity; 2nd sensor	Siemans/meter (S/m)
BeamT	Beam Transmission; 1st Sensor	percent
BeamAt	Bean Attenuation; 1st sensor	per meter
Fluorescence	Fluorescence; 1st sensor	milligrams/meter^3 (mg/m3)
Turbidity	Turbidity; 1st sensor	Nephelometric Turbidity Units (NTU)
TOC	Total Organic Carbon; Method: High temperature combustion/oxidation (HTCO) (Carlson et al; 2010)	micromol carbon/liter (umol C/L)

TOC_QF	Total Organic Carbon Quality Flag: 1 sample taken; 2 acceptable measurement; 3 Questionable measurement; 4 Bad measurement; 5 not reported; 9 no sample drawn	unitless
TOC_sd	Total Organic Carbon Standard Deviation	micromol carbon/liter (umol C/L)
DOC	Dissolved Organic Carbon; Method: High temperature combustion/oxidation (HTCO). Glass fiber filtrate type GF/F (Whatman) (Carlson et al; 2010)	micromol carbon/liter (umol C/L)
DOC_QF	Dissolved Organic Carbon Quality Flag: WOCE Quality Flags (QF): 1 sample taken; 2 acceptable measurement; 3 Questionable measurement; 4 Bad measurement; 5 not reported; 9 no sample drawn	unitless
DOC_sd	Dissolved Organic Carbon Standard Deviation	micromol carbon/liter (umol C/L)
TDN	Total Dissolved Nitrogen	micromol nitrogen/liter (umol N/L)
TDN_QF	Total Dissolved Nitrogen Quality Flag: WOCE Quality Flags (QF): 1 sample taken; 2 acceptable measurement; 3 Questionable measurement; 4 Bad measurement; 5 not reported; 9 no sample drawn	unitless
TDN_sd	Total Dissolved Nitrogen Standard Deviation	micromol nitrogen/liter (umol N/L)
BactProd	Bacterial Production by 3H Leu uptake (Smith & Azam; 1992)	picomol Leucine/liter/hour (pmol Leu /L/h)
BactProd_QF	Bacterial Production Quality Flag:WOCE Quality Flags (QF): 1 sample taken; 2 acceptable measurement; 3 Questionable measurement; 4 Bad measurement; 5 not reported; 9 no sample drawn	unitless
BactProd_sd	Bacterial Production Standard Deviation	picomol Leucine/liter/hour (pmol Leu /L/h)
BactAbund	Bacterial abundance by epifluorescent microscopy and flow cytometry (Porter & Feig,1980; Halewood et al, 1980)	10^8 cells/liter (E8 cells/L)
BactAbund_QF	Bacterial Abundance; Quality Flag: 1 sample taken; 2 acceptable measurement; 3 Questionable measurement; 4 Bad measurement; 5 not reported; 9 no sample drawn	unitless
BactAbund_sd	Bacterial Standard Deviation	10^8 cells/liter (E8 cells/L)

TDAA	Total Dissolved Amino Acids by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
TDAA_QF	Total Dissolved Amino Acids Quality Flag: 1 sample taken; 2 acceptable measurement; 3 Questionable measurement; 4 Bad measurement; 5 not reported; 9 no sample drawn	unitless
TDAA_sd	Total Dissolved Amino Acids Standard Deviation	nanomolar (nM)
Asp	Aspartic Acid concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Glu	Glutamic Acid concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
His	Histadine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Ser	Serine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Arg	Arginine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Thr	Threonine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Gly	Glycine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Tau	Taurine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Bala	Beta-alanine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Tyr	Tyrosine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Ala	Alanine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
GABA	Gamma-aminobutyric acid concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)

Met	Methionine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Val	Valine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Phe	Phyenylalanine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Ile	Isoleucine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Leu	Leucine concentration by High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
Lys	Lysine by concentration High performance liquid chromatography (HPLC) (Liu et al; 2020)	nanomolar (nM)
file_name	All cruise data tables were combined into one table. This is the original file name.	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Centrifuge
Dataset-specific Description	For measurement of bacterial production.
Generic Instrument Description	A machine with a rapidly rotating container that applies centrifugal force to its contents, typically to separate fluids of different densities (e.g., cream from milk) or liquids from solids.

Dataset-specific Instrument Name	BD LSR II equipped with a BD High Throughput Sampler (HTS) - Biosciences, San Jose, CA, USA
Generic Instrument Name	Flow Cytometer
Dataset-specific Description	Used to measure bacterial abundance. Flow cytometer equipped with a high throughput sampler, coherent sapphire 488nm laser and a default suite of six detectors (side-scatter and forward-scatter photodiodes and green, orange, red and far-red photomultipliers).
Generic Instrument Description	Flow cytometers (FC or FCM) are automated instruments that quantitate properties of single cells, one cell at a time. They can measure cell size, cell granularity, the amounts of cell components such as total DNA, newly synthesized DNA, gene expression as the amount messenger RNA for a particular gene, amounts of specific surface receptors, amounts of intracellular proteins, or transient signalling events in living cells. Description from: http://www.bio.umass.edu/micro/immunology/facs542/facswhat.htm

Dataset-specific Instrument Name	Olympus BX51 Epiflourescence Microscope
Generic Instrument Name	Fluorescence Microscope
Dataset-specific Description	For bacterial abundance estimates
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of fluorescence and phosphorescence instead of, or in addition to, reflection and absorption of visible light. Includes conventional and inverted instruments.

Dataset-specific Instrument Name	
Generic Instrument Name	GO-FLO Bottle
Dataset-specific Description	For water sample collection
Generic Instrument Description	A GO-FLO (also written as "Go-Flo") bottle is used to collect discrete water samples at depth, often for analyses of pigments, nutrients, plankton, etc. The GO-FLO sampling bottle, made by General Oceanics, is specially designed to avoid sample contamination at the surface, internal spring contamination, loss of sample on deck (internal seals), and exchange of water from different depths.

Dataset-specific Instrument Name	Dionex ICS 5000+
Generic Instrument Name	High-Performance Liquid Chromatograph
Dataset-specific Description	Used for amino acid concentration measurements.
Generic Instrument Description	A High-performance liquid chromatograph (HPLC) is a type of liquid chromatography used to separate compounds that are dissolved in solution. HPLC instruments consist of a reservoir of the mobile phase, a pump, an injector, a separation column, and a detector. Compounds are separated by high pressure pumping of the sample mixture onto a column packed with microspheres coated with the stationary phase. The different components in the mixture pass through the column at different rates due to differences in their partitioning behavior between the mobile liquid phase and the stationary phase.

Dataset-specific Instrument Name	Hidex 300 Liquid Scintillation Analyzer
Generic Instrument Name	Liquid Scintillation Counter
Dataset-specific Description	For microcentrifuge method protocol for determination of bacterial production rates via 3H-Leucine incorporationEnergy window settings: Channel A: 0-19 KeV Channel B: 2-19 KeV
Generic Instrument Description	Liquid scintillation counting is an analytical technique which is defined by the incorporation of the radiolabeled analyte into uniform distribution with a liquid chemical medium capable of converting the kinetic energy of nuclear emissions into light energy. Although the liquid scintillation counter is a sophisticated laboratory counting system used to quantify the activity of particulate emitting (ß and a) radioactive samples, it can also detect the auger electrons emitted from 51Cr and 125I samples. Liquid scintillation counters are instruments assaying alpha and beta radiation by quantitative detection of visible light produced by the passage of rays or particles through a suitable scintillant incorporated into the sample.

Dataset-specific Instrument Name	
Generic Instrument Name	Niskin bottle
Dataset-specific Description	For water sample collection
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	
Generic Instrument Name	Shimadzu TOC-V Analyzer
Dataset-specific Description	Used to measure dissolved organic carbon (DOC) and total dissolved nitrogen (TDN). Shimadzu TOC-V analyzers (Shimadzu Scientific Instruments, Columbia, MD, USA) were slightly modified from the manufacturer's model system. The condensation coil was removed and the head space of an internal water trap was reduced to minimize system dead space. The combustion tube contained 0.5 cm Pt pillows placed on top of Pt alumina beads to improve peak shape and to reduce alteration of the combustion matrix throughout the analytical run. CO2-free carrier gas was delivered to the TOC-V systems via commercial ultra high purity gas cylinders or a Whatmans gas generator. A magnesium perchlorate trap was added to the existing water and halide traps to ensure removal of water vapor from the gas line prior to entering a nondispersive infrared detector. The resulting peak area was integrated with Shimadzu chromatographic software.
Generic Instrument Description	A Shimadzu TOC-V Analyzer measures DOC by high temperature combustion method.

[table of contents | back to top]

Deployments

AT32

Website	https://www.bco-dmo.org/deployment/658983
Platform	R/V Atlantis
Start Date	2015-11-06
End Date	2015-12-01
Description	North Atlantic Aerosols and Marine Ecosystems Study (NAAMES) cruise

AT34

Website	https://www.bco-dmo.org/deployment/716567
Platform	R/V Atlantis
Start Date	2016-05-11
End Date	2016-06-05
Description	Part of the 'North Atlantic Aerosols and Marine Ecosystems Study' (NAAMES) project

AT38

Website	https://www.bco-dmo.org/deployment/822600
Platform	R/V Atlantis
Start Date	2017-08-30
End Date	2017-09-22
Description	North Atlantic Aerosols and Marine Ecosystems Study (NAAMES) cruise

AT39-06

Website	https://www.bco-dmo.org/deployment/824382
Platform	R/V Atlantis
Start Date	2018-03-20
End Date	2018-04-13
Description	Cruise for project "Project: North American Aerosols and Marine Ecosystems Study (NAAMES)".

[table of contents | back to top]

Project Information

Tracking the temporal and spatial variability of dissolved organic matter, its diagenetic state and bioavailability during various bloom states in the North Atlantic (DOM_SeasonalDynamics)

Coverage: North Atlantic Ocean (35°N to 57°N; 45°W)

Tracking the temporal and spatial variability of dissolved organic matter, its diagenetic state and bioavailability during various bloom states in the North Atlantic
Craig Carlson
ID: 1537943

The North Atlantic phytoplankton bloom is among the most conspicuous biological events annually recorded. This bloom represents a hot spot of biological activity during which a significant amount of dissolved organic matter is produced through bloom-associated food web processes. While recent work has shed some light on the spatial distribution of dissolved organic matter during the North Atlantic bloom, temporal resolution of dissolved organic matter variability in the context of the North Atlantic bloom is lacking. This project aims to understand the temporal and spatial dynamics of dissolved organic matter, its compositional variability, as well as the mechanisms that control its accumulation, persistence and export in the North Atlantic. This project will leverage a large, recently funded, NASA field-program called the North Atlantic Aerosols and Marine Ecosystem Study (NAAMES) designed to evaluate the fundamental controls of the north Atlantic phytoplankton bloom initiation, its magnitude and interannual variability. Results from this research will provide a mechanistic understanding of carbon cycling in the context of the North Atlantic phytoplankton bloom. The research will be carried out at the University of California ? Santa Barbara, a Hispanic-serving institution, and will involve educational opportunities for students from elementary through graduate school.

Recent work examining the spatial distribution of dissolved organic matter in the North Atlantic coupled to measurements of water mass ventilation rates has estimated that a significant amount of carbon is vertically exported out of the surface ocean to deep waters as dissolved organic matter. However, an overarching gap in dissolved organic matter knowledge is the lack of valuable temporal resolution necessary to investigate the mechanisms that control dissolved organic matter production, accumulation, or its change in quality and bioavailability as a result of changing bloom phases and phytoplankton cycles. This research will examine the temporal and spatial variability of dissolved organic matter dynamics along a repeated meridional transect during four distinct phases associated with the North Atlantic spring phytoplankton bloom including 1) pre-bloom, mixing phase, 2) nutrient-replete, increasing biomass phase, 3) nutrient-stressed decreasing biomass phase, and 4) post bloom stratified phase. This will be accomplished by coupling continuous water column and surface layer ecosystem properties from autonomous in situ sensors, and satellite observations with four 26-day coordinated ship and airborne field campaigns.

[table of contents | back to top]

Program Information

North Atlantic Aerosols and Marine Ecosystems Study (NAAMES)

Website: http://naames.larc.nasa.gov/

Coverage: North Atlantic Ocean

The North Atlantic Aerosols and Marine Ecosystems Study (NAAMES) is an interdisciplinary investigation resolving key processes controlling marine ecosystems and aerosols that are essential to our understanding of Earth system function and future change. NAAMES is funded by the NASA Earth Venture Suborbital Program and is the first EV-S mission focused on studying the coupled ocean ecosystem and atmosphere.

Plankton ecosystems of the global ocean profoundly affect climate and life on Earth. NASA's ocean color satellite record tells us that these invaluable ecosystems are highly responsive to climate variability, with changes in ocean production impacting food production, uptake of atmospheric carbon dioxide, and emission of climate-regulating aerosols. Intergovernmental Panel on Climate Change (IPCC) simulations suggest that surface ocean temperatures will warm by +1.3 to +2.8 degrees C globally over the 21st century, with major consequences on physical properties of the surface ocean where plankton populations thrive. **The pressing question is, how will these changes alter plankton production, species composition, and aerosol emissions?** Today, even the sign of these potential changes remains unresolved. Our ability to predict Earth System consequences of a warming ocean and develop realistic mitigation and adaption strategies depends on resolving conflicting hypotheses regarding the factors controlling plankton ecosystems and biogenic aerosol emissions.

NAAMES consists of four, combined ship and aircraft field campaigns that are each aligned to a specific event in the annual plankton lifecycle. Ship-based measurements provide detailed characterization of plankton stocks, rate processes, and community composition. Ship measurements also characterize sea water volatile organic compounds, their processing by ocean ecosystems, and the concentrations and properties of gases and particles in the overlying atmosphere. These diverse data are extended over broader spatial scales through parallel airborne remote sensing measurements and in situ aerosol sampling that target ocean properties as well as the aerosols and clouds above. The airborne data crucially link local-scale processes and properties to the much larger scale continuous satellite record. Integrating the NAAMES observations with state-of-the-art climate and ecosystems models enables the creation of a process-based foundation for resolving plankton dynamics in other ocean regions, accurately interpreting historical satellite records, and improving predictions of future change and their societal impacts.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1537943

[table of contents | back to top]