Bio-optical measurements made using the shipboard flow-through system within three hours of CTD casts conducted on R/V Robert Gordon Sproul cruises along the Southern California coast during July and August 2023

Website: https://www.bco-dmo.org/dataset/953193
Data Type: Cruise Results, experimental
Version: 1
Version Date: 2025-02-18

Project
» Postdoctoral Fellowship: OCE-PRF: Smoke on the water: the impacts of wildfire ash deposition on surface ocean biology (Smoke on the water)

Contributors	Affiliation	Role
Baetge, Nicholas	Oregon State University (OSU)	Principal Investigator
Graff, Jason	Oregon State University (OSU)	Scientist
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Abstract
These data include bio-optical measurements made using the shipboard flow-through system within three hours of CTD casts conducted on the R/V Robert Gordon Sproul (SP2319, SP2320) between dates 2023-07-28 and 2023-08-19 along the Southern California coast. These data were collected to provide context for the incubation experiments that were also conducted on board. Incubations were comprised of dilution experiments to assess phytoplankton growth and microzooplankton grazing rates and dissolved organic carbon (DOC) remineralization bioassays to assess bacterioplankton growth and DOC degradation. Deposition of wildfire ash on the ocean can fertilize microbial production but also has the potential to inhibit microbial growth due to heavy metal toxicity. The data collected from these field experiments can contribute to elevating understanding of wildfire-driven material transfer from the terrestrial system to the ocean and its impact on carbon and energy flow in marine food webs. These data were collected by Dr. Nicholas Baetge, Dr. Jason Graff, Dr. Allen Milligan, Brian Ver Wey, and Parker Hansen of Oregon State University. Data were also collected by Dr. Craig Carlson, Elisa Halewood, and Keri Opalk of the University of California Santa Barbara.

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
  - BCO-DMO Curation Notes
- Data Files
- Related Publications
- Parameters
- Instruments
- Deployments
- Project Information
- Funding

Coverage

Location: Southern California coast

Spatial Extent: **N**:35.21268 **E**:-118.402 **S**:33.54503 **W**:-122.2133
Temporal Extent: 2023-08-02 - 2023-08-19

Methods & Sampling

Bio-optical measurements of surface seawater were made using the shipboard flow-through system within three hours of a CTD cast. Measurements of particulate attenuation (cp) and particulate absorption (ap) at three wavelengths (λ = 470, 532, and 660 nanometers (nm)) were made with an AC-S spectrophotometer (serial number 94; Sea-Bird Scientific [WET Labs, Inc.]). Coincident measurements of particulate backscattering (bbp) at three wavelengths (λ = 470, 532, and 660 nm) were made with an ECO-BB3 (serial number 349; Sea-Bird Scientific [WET Labs, Inc.]) set in a custom enclosure (Dall'Olmo et al., 2009).

Data Processing Description

Bio-optical data were processed using InLineAnalysis available from the Maine In-situ Sound & Color Lab (https://github.com/OceanOptics/InLineAnalysis; Boss et al, 2019).

BCO-DMO Curation Notes

- Imported original file "BIO-OPTICS.csv" into the BCO-DMO system.
- Flagged "NA" as a missing data value; missing data are empty/blank in the final CSV file.
- PI applied rounding to numeric values and provided a new file.
- Saved final data file as "953193_v1_bio-optical_measurements.csv".

[table of contents | back to top]

Data Files

File	
953193_v1_bio-optical_measurements.csv	(Comma Separated Values (.csv), 1.33 MB) MD5:626d74d52645a577f91ba3595287c4ec
Primary data file for dataset ID 953193, version 1	

[table of contents | back to top]

Related Publications

Baetge, N., Behrenfeld, M. J., Fox, J., Halsey, K. H., Mojica, K. D. A., Novoa, A., Stephens, B. M., & Carlson, C. A. (2021). The Seasonal Flux and Fate of Dissolved Organic Carbon Through Bacterioplankton in the Western North Atlantic. Frontiers in Microbiology, 12. https://doi.org/10.3389/fmicb.2021.669883
Methods

Baetge, N., Halsey, K.H., Hanan, E.J., Behrenfeld, M.J., Milligan, A.J., Graff, J.R., Hansen, P., Carlson, C.A., Boiteau, R.M., Arrington, E.C., Comstock, J., Halewood, E.R., Harvey, E.L., Nelson, N.B., Opalk, K., and Ver Wey, B. (2025), Pre-existing phytoplankton biomass concentrations shape coastal plankton response to fire-generated ash leachate. Limnol Oceanogr. https://doi.org/10.1002/lno.70087
Results

Boss, E., Haëntjens, N., Ackleson, S., Balch, B., Chase, A., Dall'Olmo, G., ... & Westberry, T. (2019). Inherent Optical Property Measurements and Protocols: Best practices for the collection and processing of ship-based underway flow-through optical data. Ioccg Ocean Optics and Biogeochemistry Protocols for Satellite Ocean Colour Sensor Validation; IOCCG: Dartmouth, NS, Canada. doi: 10.25607/OBP-664
Methods

Boss, E., Picheral, M., Leeuw, T., Chase, A., Karsenti, E., Gorsky, G., Taylor, L., Slade, W., Ras, J., & Claustre, H.

(2013). The characteristics of particulate absorption, scattering and attenuation coefficients in the surface ocean; Contribution of the Tara Oceans expedition. Methods in Oceanography, 7, 52–62. https://doi.org/10.1016/j.mio.2013.11.002
Methods

Dall'Olmo, G., Westberry, T. K., Behrenfeld, M. J., Boss, E., & Slade, W. H. (2009). Significant contribution of large particles to optical backscattering in the open ocean. Biogeosciences, 6(6), 947–967. https://doi.org/10.5194/bg-6-947-2009
Methods

Flores, J. M., Bourdin, G., Kostinski, A. B., Altaratz, O., Dagan, G., Lombard, F., Haëntjens, N., Boss, E., Sullivan, M. B., Gorsky, G., Lang-Yona, N., Trainic, M., Romac, S., Voolstra, C. R., Rudich, Y., Vardi, A., & Koren, I. (2021). Diel cycle of sea spray aerosol concentration. Nature Communications, 12(1). https://doi.org/10.1038/s41467-021-25579-3
Methods

Gardner, W. D., Gundersen, J. S., Richardson, M. J., & Walsh, I. D. (1999). The role of seasonal and diel changes in mixed-layer depth on carbon and chlorophyll distributions in the Arabian Sea. Deep Sea Research Part II: Topical Studies in Oceanography, 46(8–9), 1833–1858. https://doi.org/10.1016/s0967-0645(99)00046-6 https://doi.org/10.1016/S0967-0645(99)00046-6
Methods

Gasol, J. M., & Morán, X. A. G. (2015). Flow Cytometric Determination of Microbial Abundances and Its Use to Obtain Indices of Community Structure and Relative Activity. Hydrocarbon and Lipid Microbiology Protocols, 159–187. https://doi.org/10.1007/8623_2015_139
Methods

Graff, J. R., Nelson, N. B., Roca-Martí, M., Romanelli, E., Kramer, S. J., Erickson, Z., Cetinić, I., Buesseler, K. O., Passow, U., Zhang, X., Benitez-Nelson, C., Bisson, K., Close, H. G., Crockford, T., Fox, J., Halewood, S., Lam, P., Roesler, C., Sweet, J., … Siegel, D. A. (2023). Reconciliation of total particulate organic carbon and nitrogen measurements determined using contrasting methods in the North Pacific Ocean as part of the NASA EXPORTS field campaign. Elem Sci Anth, 11(1). https://doi.org/10.1525/elementa.2022.00112
Methods

Halewood, E., Opalk, K., Custals, L., Carey, M., Hansell, D., & Carlson, C. A. (2022). *GO-SHIP Repeat Hydrography: Determination of dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) in seawater using High Temperature Combustion Analysis.[GOOS ENDORSED PRACTICE]*. UNESCO/IOC. https://doi.org/10.25607/OBP-1745
Methods

Hansell, D. A. (2005). Dissolved Organic Carbon Reference Material Program. Eos, Transactions American Geophysical Union, 86(35), 318. doi:10.1029/2005eo350003
Methods

Landry, M. R., & Hassett, R. P. (1982). Estimating the grazing impact of marine micro-zooplankton. Marine Biology, 67(3), 283–288. doi:10.1007/bf00397668 https://doi.org/10.1007/BF00397668
Methods

Morison, F., Harvey, E., Franzè, G., & Menden-Deuer, S. (2019). Storm-Induced Predator-Prey Decoupling Promotes Springtime Accumulation of North Atlantic Phytoplankton. Frontiers in Marine Science, 6. https://doi.org/10.3389/fmars.2019.00608
Methods

[table of contents | back to top]

Parameters

Parameter	Description	Units
stn	station number	unitless
lat	latitude	degrees North
lon	longitude	degrees East
dt	datetime (UTC) in ISO 8601 format	unitless
bbp_470	particulate backscattering at 470 nm	reciprocal meters (1/m)
bbp_532	particulate backscattering at 532 nm	reciprocal meters (1/m)
bbp_660	particulate backscattering at 660 nm	reciprocal meters (1/m)
ap_470	particulate absorption at 470 nm	reciprocal meters (1/m)
ap_532	particulate absorption at 532 nm	reciprocal meters (1/m)
ap_660	particulate absorption at 660 nm	reciprocal meters (1/m)
cp_470	particulate attenuation at 470 nm	reciprocal meters (1/m)
cp_532	particulate attenuation at 532 nm	reciprocal meters (1/m)
cp_660	particulate attenuation at 660 nm	reciprocal meters (1/m)
poc_cp_660	Particulate organic carbon concentration estimated from particulate attenuation at 660 nm	milligrams per cubic meter (mg/m3)
chl_ap676lh	Chlorophyll concentration estimated from the line height of particulate absorption at 676 nm	milligrams per cubic meter (mg/m3)
gamma_cp	The mean particle size index	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	AC-S spectrophotometer
Generic Instrument Name	WET Labs AC-S in-situ spectrophotometer
Dataset-specific Description	Measurements of particulate attenuation (cp) and particulate absorption (ap) at three wavelengths (λ = 470, 532, and 660 nm) were made with an AC-S spectrophotometer (serial number 94; Sea-Bird Scientific [WET Labs, Inc.]).
Generic Instrument Description	The WET Labs {Sea-Bird WETLabs} AC-S in-situ spectrophotometer is based on the AC-9 flow-through sensor offering increased spectral resolution of in-situ absorption and beam attenuation. The AC-S can have 80 (+/- 5) wavelength outputs with a range of 400-730 nm. The AC-S consists of a 10 or 25-centimeter (cm) pathlength, a 4-nanometer (nm) resolution, an accuracy of 0.001 - 10 m-1, an operational temperature range of 0 - 30 degrees Celsius, and an operational depth rating of 500 meters.

Dataset-specific Instrument Name	ECO-BB3
Generic Instrument Name	WET Labs ECO BB3SLO scattering sensor
Dataset-specific Description	Coincident measurements of particulate backscattering (bbp) at three wavelengths (λ = 470, 532, and 660 nm) were made with an ECO-BB3 (serial number 349; Sea-Bird Scientific [WET Labs, Inc.]) set in a custom enclosure (Dall'Olmo et al., 2009).
Generic Instrument Description	The WET Labs {Sea-Bird WETLabs} ECO Puck Triplet BB3SLO scattering sensor is a variant of the ECO Puck Triplet. The BB3 is a three-optical-sensor, user-defined instrument that carries 3 scattering meters. ECO Pucks are real-time only sensors as they are integrated onto the OEM platform that provides power and data handling. The SLO designation signifies this is a 1st generation model that is specific for integration into Slocum gliders. The fluorometers and scattering meter are single wavelength sensors. The model is depth-rated to 600 meters.

[table of contents | back to top]

Deployments

SP2320

Website	https://www.bco-dmo.org/deployment/953019
Platform	R/V Robert Gordon Sproul
Start Date	2023-08-14
End Date	2023-08-19
Description	See more information at R2R: https://www.rvdata.us/search/cruise/SP2320

SP2319

Website	https://www.bco-dmo.org/deployment/953028
Platform	R/V Robert Gordon Sproul
Start Date	2023-07-28
End Date	2023-08-10
Description	See more information at R2R: https://www.rvdata.us/search/cruise/SP2319

[table of contents | back to top]

Project Information

Postdoctoral Fellowship: OCE-PRF: Smoke on the water: the impacts of wildfire ash deposition on surface ocean biology (Smoke on the water)

Coverage: Pacific Ocean

NSF Award Abstract:
Climate-driven warming is projected to increase the frequency, intensity, and size of wildfires that can have severe environmental, human, and economic impacts, particularly along the U.S. West Coast. These wildfires result in dramatic CO2 emissions and deposition of ash carrying nutrients, organic matter, and trace metals onto the coastal and open ocean. Deposition of wildfire ash on the ocean can alter the carbon and energy flow through marine food webs by fertilizing microbial production or inhibiting microbial growth due to heavy metal toxicity. How the character of both the ash (e.g., chemical quality, fertilizing v. toxic) and the starting microbial community composition (e.g., diversity, size distribution) influences the microbial response to ash-derived material is unknown. This project will address this knowledge gap by investigating the physiological responses of marine plankton off the U.S West Coast to different types of ash generated from local wildfires and plant biomass. This work will advance interdisciplinary science, bridging biological oceanography with terrestrial ecology and biogeochemistry, by generating foundational knowledge of wildfire impacts on surface ocean biology and carbon and energy transfer from land to ocean. Results from this project will enable improved forecasts of changes in marine ecosystems in response to wildfires, which is information pertinent to communities and industries that depend on ocean ecosystem resources, including fisheries. The work will also inform national efforts to mitigate and adapt to the impacts of climate change by addressing whether wildfire-stimulated fertilization and carbon fixation in the ocean can offset CO2 emissions from wildfires. This project will broaden participation and education in ocean science by providing immersive research experiences for multiple undergraduate students and opportunities for them to disseminate their work through scientific conferences and publications. Additionally, a day-long content unit related to the project will be developed and implemented in Oregon State University’s annual week-long Microbiology Summer Camp, which provides local high school students with a hands-on learning experience in microbiology.

Specifically, this project consists of mechanistic studies designed to quantitatively describe the physiological responses (e.g., growth, productivity, cellular stoichiometry) of phytoplankton and bacterioplankton to a variety of ash types. The quantity and proportion of nutrients, organic matter, and trace metals leached from ash into seawater likely depends on the quality of the ash, which is influenced by vegetation type and the temperature at which the ash was produced. This study will assess how microbial production and growth are fertilized or inhibited by the composition of ash and will consist of two primary elements. In the first element, ash will be collected from the field and generated in the lab from plant biomass. The ash will then be leached in seawater and chemically characterized for inorganic and organic matter content. In the second element, seawater incubation experiments will be conducted to quantify physiological and diversity-based responses of naturally occurring phytoplankton and bacterial communities to different ash types. Data generated from this project will contribute to improved predictive models of wildfire-driven material transfer from the terrestrial system to the ocean and its impact on carbon and energy flow in marine food webs.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2306993

[table of contents | back to top]