VPR data from R/V Oceanus OC469-01, OC471-01 in the NW Atlantic: Woods Hole to Barbados from 2010-2011 (Trichodesmium project)

Website: https://www.bco-dmo.org/dataset/511466
Version: 2
Version Date: 2022-06-22

Project
» Quantification of Trichodesmium spp. vertical and horizontal abundance patterns and nitrogen fixation in the western North Atlantic (Trichodesmium)

Program
» Ocean Carbon and Biogeochemistry (OCB)

Contributors	Affiliation	Role
McGillicuddy, Dennis J.	Woods Hole Oceanographic Institution (WHOI)	Principal Investigator
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Dataset Description

The raw VPR data file collection organized by cruise.

Cruise ID	Listing of Files in Compressed tar	Compressed tar of VPR Data Files
OC469 - 8 casts 28 GB	vpr_dirs.ls.txt (40 KB) vpr1.filelist.txt (2.5 MB) vpr3.filelist.txt (85 KB) vpr4.filelist.txt (3.8 MB) vpr5.filelist.txt (1 KB) vpr6.filelist.txt (155 KB) vpr7.filelist.txt (3.3 MB) vpr8.filelist.txt (1.36 MB)	vpr_dirs.tar.gz (14 MB) vpr1.tar.gz (2.2 GB) vpr3.tar.gz (92 MB) vpr4.tar.gz (2.9 GB) vpr5.tar.gz (135 KB) vpr6.tar.gz (.24 GB) vpr7.tar.gz (6.1 GB) vpr8.tar.gz (1.9 GB)
OC471 - 16 casts 150 GB	basic directory structure vpr_dirs.filelist.txt (127 KB) data files for rois from individual VPR tows vpr1.filelist.txt (7.7 MB) vpr2.filelist.txt (4.8 MB) vpr3.filelist.txt (5.0 MB) vpr4.filelist.txt (6.0 MB) vpr5.filelist.txt (6.5 MB) vpr6.filelist.txt (14.8 MB) vpr7.filelist.txt (12.1 MB) vpr8.filelist.txt (5.4 MB) vpr9.filelist.txt (13.2 MB) vpr10.filelist.txt (12.5 MB) vpr11.filelist.txt (8.2 MB) vpr12.filelist.txt (7.2 MB) vpr14.filelist.txt (2.3 MB) vpr15.filelist.txt (6.5 MB) vpr16.filelist.txt (10.1 MB)	basic directory structure vpr_dirs.tar.gz (189 MB) data files for rois from individual VPR tows VPR-1: vpr1.tar.gz (7.3 GB) VPR-2: vpr2.tar.gz (4.8 GB) VPR-3: vpr3.tar.gz (5 GB) VPR-4: vpr4.tar.gz (6.3 GB) VPR-5: vpr5.tar.gz (7.1 GB) VPR-6: vpr6.tar.gz (16.5 GB) VPR-7: vpr7.tar.gz (16 GB) VPR-8: vpr8.tar.gz (7.3 GB) VPR-9: vpr9.tar.gz (18.7 GB) VPR-10: vpr10.tar.gz (16.9 GB) VPR-11: vpr11.tar.gz (11 GB) VPR-12: vpr12.tar.gz (9.2 GB) VPR-14: vpr14.tar.gz (2.9 GB) VPR-15: vpr15.tar.gz (7.8 GB) VPR-16: vpr16.tar.gz (12.9 GB)

Hint: To work with the raw files files, make a separate subdirectory for the cruise and download the compressed data file tar files to that cruise subdirectory. Then decompress and unpack only the .tar.gz files for that cruise into that cruise subdirectory. For example, to work with the VPR data files from OC469, on a linux system:

1. mkdir OC469; cd OC469
2. download all the .tar.gz files for cruise OC469
3. gunzip OC469_vpr.tar.gz
4. tar -xvf OC469_vpr.tar

After the OC469 tar file is unpacked, it will require about 28 GB of disk space (the Total size noted in column (1), and you should have a collection of subdirectories similar to those listed above for OC469 VPR file set.

Contact:

Anyone trying to use these raw VPR files is encouraged to contact either Dennis McGillicuddy with any questions.

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Methods & Sampling

Each VPR tow (VPR1, VPR2, VPR3, etc.) has a subdirectory that includes:

a VPRstartup_readme.txt file and these subdirectories:
/calibration
/processed
/rois
/trois

Data Processing Description

The images (.TIFF files) were extracted from video using Matlab-based software. The data are raw; no processing has been applied.

BCO-DMO Data Manager Notes:
* Version 1 2014-04-08 replaced by Version 2 2022-06-22
* [2022-06-22] Fixed broken link in metadata and data since it was broken due to a missing a slash between the cruise and filename "OC471vpr16.filelist.txt" -> "OC471/vpr16.filelist.txt"

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Data Files

File
vpr_filelist_tricho.csv (Comma Separated Values (.csv), 6.86 KB) MD5:0401eba3e9493885da3272516ca16934 Primary data file for dataset ID 511466

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Parameters

Parameter	Description	Units
cruise_id	cruise identification	unitless
num_casts	number of VPR casts available	unitless
size_unpacked	size of files for whole cruise VPR's once uncompressed	gigabytes
file_lists	text file listing of compressed VPR files; one file per cast	unitless
file_list_size	download size of text files	megabytes
compressed_files	name and link for compressed VPR file; one file per cast	unitless
compressed_files_size	download size of compressed files	KB=kilobytes; MB=megabytes; GB=gigabytes

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Instruments

Dataset-specific Instrument Name	VPR
Generic Instrument Name	Video Plankton Recorder
Dataset-specific Description	The Video Plankton Recorder (VPR) is a video-microscope system used for imaging plankton and other particulate matter in the size range from a few micrometers to several centimeters. The VPR is essentially an underwater microscope. It consists of four video cameras (with magnifying optics) synchronized at 60 fields per second (fps) to a red-filtered 80 W xenon strobe (pulse duration = 1 microsecond). The current lens on each camera can be adjusted to provide a field of view between 5 mm and 10 cm.
Generic Instrument Description	The Video Plankton Recorder (VPR) is a video-microscope system used for imaging plankton and other particulate matter in the size range from a few micrometers to several centimeters. The VPR is essentially an underwater microscope. It consists of four video cameras (with magnifying optics) synchronized at 60 fields per second (fps) to a red-filtered 80 W xenon strobe (pulse duration = 1 microsecond). The current lens on each camera can be adjusted to provide a field of view between 5 mm and 10 cm. Use of higher magnification lenses is currently being explored for viewing protozoans (less than 1 micrometer resolution). The four cameras are set for concentric viewing fields so that a range of up to four magnifications can be viewed simultaneously, allowing a wide size range of plankton to be sampled. Depth of field is adjusted by the lens aperture setting, and the volume sampled in each video field ranges from about 1 ml to 1 liter, depending on lens settings. The cameras have been configured for stereoscopic viewing as well.A strobe on the other arm illuminates the imaged volume and flashes 60 times per second, producing 60 images per second of the particles and plankton in the water. The images are then saved internally on a computer hard disk and later plotted. Deployment: Most commonly, the VPR is mounted in a frame and lowered into the water from the stern of the ship. Sometimes, a CTD also is mounted next to the VPR to collect depth, temperature, and salinity information at the same time as each video image. The instrument is lowered down through the water to a maximum depth of 350 meters to generate a profile of plankton/particle abundance and taxon group along with temperature and salinity. In addition to the towed configuration for mapping plankton distributions, it is possible to deploy the VPR in a fixed position (on a mooring) for viewing plankton swimming behaviors in two or three dimensions. The VPR instrument system has been used in both configurations, and deployment on ROVs has been proposed. This definition was taken from the WHOI Ocean Instruments Web site and from a US GLOBEC Newsletter.

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Deployments

OC469-01

Website	https://www.bco-dmo.org/deployment/473009
Platform	R/V Oceanus
Start Date	2010-10-02
End Date	2010-10-22
Description	Project: Trichodesmium spp. Abundance Patterns and Nitrogen Fixation Cruise information and original data are available from the NSF R2R data catalog.

OC471-01

Website	https://www.bco-dmo.org/deployment/473010
Platform	R/V Oceanus
Start Date	2011-04-23
End Date	2011-05-13
Description	Project: Trichodesmium spp. Abundance Patterns and Nitrogen Fixation Cruise information and original data are available from the NSF R2R data catalog.

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Project Information

Quantification of Trichodesmium spp. vertical and horizontal abundance patterns and nitrogen fixation in the western North Atlantic (Trichodesmium)

The diazotroph Trichodesmium spp. constitutes a major pathway of nitrogen flow into marine planktonic ecosystems, but estimates of its impact on global nitrogen budgets vary widely. Sampling is made difficult by the fragility of the organism with the consequence that Trichodesmium spp. are difficult to manipulate in both field and laboratory experiments. Optical methods that sample the organism nondestructively are thus appealing. A recent transatlantic survey using the Video Plankton Recorder (VPR) revealed unexpectedly high abundance of Trichodesmium spp. at depth, suggesting the vertical distribution of the organism within the euphotic zone may be more uniform than previously thought (Davis, C.S. and McGillicuddy, D.J., 2006. Transatlantic Abundance of the N2-Fixing Colonial Cyanobacterium Trichodesmium. Science, 312: 1517-1520). Application of a simple bio-optical model of productivity to the observed profile of abundance suggests the depth-integrated nitrogen fixation rate could be three to five times higher than that based on the canonical profile of exponential decrease in abundance with depth. However, the observations described in Davis and McGillicuddy (2006) come from a latitude range where Trichodesmium spp. are not especially abundant. This raises a key question: is there a similar vertical distribution in waters further to the south, where Trichodesmium spp. are an order of magnitude more abundant overall? If so, are the deep populations actively fixing nitrogen? If so, the implications for the global nitrogen budget would be substantial.

To answer these questions, we propose two cruises to survey the waters of the southern Sargasso Sea and tropical Atlantic, where Trichodesmium spp. are commonly found in high abundance. Along-track VPR measurements will document the abundance and distribution of the organism on the scale of meters to thousands of kilometers. Standard hydrographic station work will provide for comparison of VPR-based estimates with microscope counts, as well as some additional in situ optical methods. A combination of nifH gene expression assays and direct determinations of N2-fixation rates will be made to assess whether or not the deep populations are actively fixing nitrogen. These observations will be synthesized in the context of an eddy-resolving numerical model. This will permit investigation of the mechanisms controlling the vertical and horizontal distribution and abundance of Trichodesmium spp. at multiple scales, including the enigmatic association of relative maxima in abundance with anticyclonic eddies (also described in Davis and McGillicuddy, 2006). Moreover, integration of these observations into the numerical model will facilitate revised estimates of nitrogen fixation by Trichodesmium spp. in the North Atlantic. The intellectual merit of this effort stems from our interdisciplinary approach (physics and biology), advanced observational techniques (optical imaging, molecular methods) and integrated analysis in the context of state-of-the-art coupled physical-biogeochemical models.

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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 CO2 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
NSF Division of Ocean Sciences (NSF OCE)	OCE-0925284

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