ADCP current depth profiles from R/V Atlantic Explorer cruise AE2207 to the Bermuda Atlantic Time Series (BATS) station in April 2022

Website: https://www.bco-dmo.org/dataset/877146
Data Type: Cruise Results
Version: 1
Version Date: 2022-07-18

Project
» Collaborative Research: Inferring Cellular Lysis and Regeneration of Organic Matter by Marine Viruses (InVirT)

Contributors	Affiliation	Role
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Abstract
This dataset was gathered from ADCP for depth profiles of current velocities with ship position, time, and includes some derived variables useful for plotting. Data are from R/V Atlantic Explorer cruise AE2207 to the Bermuda Atlantic Time Series (BATS) station in April 2022.

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Coverage

Spatial Extent: **N**:32.381 **E**:-64.156 **S**:31.012 **W**:-64.683
Temporal Extent: 2022-04-22 - 2022-04-25

Methods & Sampling

ADCP readings were taken approximately every 10 minutes over the course of the cruise. ADCP readings were derived from .mat files during the cruise.

Data Processing Description

Data Processing:
Data were retrieved directly from ADCP all_bins .mat files.

BCO-DMO Processing:
- replaced "NA" with "nd" to indicate "no data".

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Data Files

File
AE2207_ADCP_depth.csv(Comma Separated Values (.csv), 2.81 MB) MD5:cc067f681d6345fc3070f70eae0b3812 Primary data file for dataset ID 877146

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Parameters

Parameter	Description	Units
time	Observation time in Julian days	Julian days
z	Depth	meters (m)
u	East-west velocity	meters per second (m/s)
v	North-south velocity	meters per second (m/s)
w	Vertical velocity	meters per second (m/s)
amp	Current amplitude anomaly	percent (%)
mag	Current magnitude	meters per second (m/s)
dir	Current direction in the north-south + east-west plane	degrees

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Instruments

Dataset-specific Instrument Name	ADCP using osnb75
Generic Instrument Name	Acoustic Doppler Current Profiler
Generic Instrument Description	The ADCP measures water currents with sound, using a principle of sound waves called the Doppler effect. A sound wave has a higher frequency, or pitch, when it moves to you than when it moves away. You hear the Doppler effect in action when a car speeds past with a characteristic building of sound that fades when the car passes. The ADCP works by transmitting "pings" of sound at a constant frequency into the water. (The pings are so highly pitched that humans and even dolphins can't hear them.) As the sound waves travel, they ricochet off particles suspended in the moving water, and reflect back to the instrument. Due to the Doppler effect, sound waves bounced back from a particle moving away from the profiler have a slightly lowered frequency when they return. Particles moving toward the instrument send back higher frequency waves. The difference in frequency between the waves the profiler sends out and the waves it receives is called the Doppler shift. The instrument uses this shift to calculate how fast the particle and the water around it are moving. Sound waves that hit particles far from the profiler take longer to come back than waves that strike close by. By measuring the time it takes for the waves to bounce back and the Doppler shift, the profiler can measure current speed at many different depths with each series of pings. (More from WHOI instruments listing).

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Deployments

AE2207

Website	https://www.bco-dmo.org/deployment/873946
Platform	R/V Atlantic Explorer
Start Date	2022-04-22
End Date	2022-04-27
Description	See additional cruise information at the Rolling Deck to Repository (R2R): https://www.rvdata.us/search/cruise/AE2207

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Project Information

Collaborative Research: Inferring Cellular Lysis and Regeneration of Organic Matter by Marine Viruses (InVirT)

Coverage: Bermuda Atlantic Time Series

NSF Award Abstract:
Viral infections of marine microbes can transform the fate of microbial populations that fuel global ocean biogeochemical cycles. For example, viral infections of microbes lead to the release of carbon and nutrients back into the environment. This regeneration of carbon and nutrients stimulates the activity of other microbes and diverts carbon and nutrients from larger organisms in marine food webs. Because virus-microbe infections are relatively specific, it is critical to identify those pairs of viruses and microbes that may disproportionally contribute to the turnover of carbon and nutrients in the ocean. This project will develop

quantitative approaches and tools to quantify which viruses infect which microbes and to use these data to quantify how viral infections of microbes collectively shape nutrient and carbon cycles in the North Atlantic Ocean. The project will analyze virus-microbe interactions in mesocosms at the Bigelow Laboratory for Ocean Sciences in mid-coast Maine and during open ocean expeditions to the Bermuda Atlantic Time-Series Study (BATS) site. An interdisciplinary team will leverage recent advances in molecular biology, computational biology, and mathematical modeling to identify virus-host partners and their impact on the movement of elements through marine systems. This project will support three graduate students, six undergraduate students and one postdoctoral researcher in an interdisciplinary context. Research advances will be translated into reproducible software methods to be disseminated via the community cyberinfrastructure platform iVirus, with additional training materials presented as part of a viral methods and informatics workshop held at The Ohio State University. The translation of discoveries to the public will be furthered by the involvement of journalism undergraduate students at the University of Tennessee-Knoxville.

This project builds upon advances in the molecular toolkit of viromics to develop an integrated approach to characterize lineage-specific rates of infection, lysis, and nutrient release induced by marine viruses in open ocean ecosystems. It will combine theory, in vitro experiments, and in situ sampling to (i) extend a robust inference method for estimating virus-microbe cross-infection networks from time-series data; (ii) establish and characterize in-vitro protocols for inferring cross-infectivity in complex communities using culture-independent methods; (iii) estimate lineage-specific rates of lysis and regeneration of nutrients in marine systems, including applications to coastal and open ocean ecosystems. Project aims focus on quantifying the extent to which virus-induced lysis and regeneration of carbon and nutrients is heterogeneously distributed across microbial populations. To do so, the project will incorporate time series measurements of abundance information (via metagenomes) and activity information (via metatranscriptomes). In so doing, it will advance efforts to understand community-scale interactions rather than those amongst a single virus-host pair. Theoretical methods and in vitro protocols will directly infer lineage-specific infection, lysis, and nutrient release rates in coastal- and open-ocean ecosystems in the North Atlantic Ocean. Results will be used to identify key links that disproportionately influence bulk nutrient release. A novel PCR-based approach will augment and validate the core inference approach. Overall, the project aims to enhance our understanding of how viruses contribute to marine ecosystem function.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829636
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829640
NSF Division of Ocean Sciences (NSF OCE)	OCE-1829641

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