Current velocity measurements taken from the collection sites at the surface using a Vectrino Acoustic Doppler Velocimeter from the Friday Harbor dock and laboratory in 2012 (Jellyfish predation in turbulence project)

Website: https://www.bco-dmo.org/dataset/649913
Data Type: Other Field Results
Version:
Version Date: 2016-07-06

Project
» Influence of organism-scale turbulence on the predatory impacts of a suite of cnidarian medusae (jellyfish predation in turbulence)

Contributors	Affiliation	Role
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Table of Contents

Dataset Description

Related Dataset:
Tank and field turbulence

Methods & Sampling

Current velocity measurements were taken from the collection site at the surface using a Vectrino Acoustic Doppler Velocimeter (ADV; Nortek, Oslo, Norway), at depth between 0.5 and 5 m using in situ PIV (Katija and Dabiri, 2008). The ADV measurements were collected at a sampling rate of 100 Hz over 1-5 min intervals.

Data Processing Description

The TKE dissipation rate at the surface was calculated from the ADV-produced velocities in the horizontal, x, direction, u, following (Sanford, 1997) Epsilon(ADV)=(urms)3/ZK where Z is the total water column depth (14 m) and κ is von Karman's constant (0.4).

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO and BODC standards

- replaced blanks with 'nd', no data
- replaced '# to #' with '#-#'
- split date and time into separate columns
- added 'sampling rate' column
- reduced digits to right of decimal from 13 to 2

[table of contents | back to top]

Data Files

File
ADV_field.csv (Comma Separated Values (.csv), 3.77 KB) MD5:5acd113e299312489ab4711cb164a3e3 Primary data file for dataset ID 649913

[table of contents | back to top]

Parameters

Parameter	Description	Units
year	year	unitless
filename	file name	unitless
date	date of measurements in field; formatted as yyyy-mm-dd	unitless
time_start	time of first measurement; formatted as HH:MM	unitless
time_end	time of last measurement; formatted as HH:MM	unitless
sample_rate	sampling rate	Hz
totl_measure	total number of measurements	unitless
time_tot_sec	total time in seconds	seconds
time_tot_min	total time in minutes	minutes
time_increment_min	time increments	minutes
meas_interval	observation interval range	measurements
flow	Flow speed estimated as speed = sqrt(rmsU^2 + rmsV^2 + rmsW^2); (Finelli et al. 2009 p 463 used (sqrt (u2 + v2 + w2)	cm/sec
mean_u	mean horizontal velocity 1	cm/sec
mean_v	mean horizontal velocity 2	cm/sec
mean_w	mean vertical velocity	cm/sec
u_rms	root mean square of u	cm/sec
v_rms	root mean square of v	cm/sec
w_rms	root mean square of w	cm/sec
current_avg	average current	cm/sec
TKE	turbulent kinetic energy: 0.5(ave_u_prime_sq+% ....) ; where u_prime is instantaneous deviations from the mean velocity (e.g. Finelli et al 2009) and the instantaneous values are averaged over time.	m^2/s^2
dissip_rate	dissipation rate of the surface field: E = rmsV^3/depth*0.4 (Sanford 1997 p. 273; 0.4 is von Karman's constant); used V because it is usually the largest rms component.	m^2/s^3
L_k_cm	kinematic viscosity at 11.5 deg C and 35 ppt is 1.3 x 10-6 m2 s-1	cm
Taylor_microscale_cm	turbulence length scale is a length scale used to characterize a turbulent fluid flow: λ= sqrt(15vurms2/ε)	cm
Re	Reynolds number	unitless

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	
Generic Instrument Name	Acoustic Doppler Velocimeter
Dataset-specific Description	ADV; Nortek, Oslo, Norway
Generic Instrument Description	ADV is the acronym for acoustic doppler velocimeter. The ADV is a remote-sensing, three-dimensional velocity sensor. Its operation is based on the Doppler shift effect. The sensor can be deployed either as a moored instrument or attached to a still structure near the seabed. Reference: G. Voulgaris and J. H. Trowbridge, 1998. Evaluation of the Acoustic Doppler Velocimeter (ADV) for Turbulence Measurements. J. Atmos. Oceanic Technol., 15, 272–289. doi: http://dx.doi.org/10.1175/1520-0426(1998)0152.0.CO;2

[table of contents | back to top]

Deployments

FHL_Sutherland

Website	https://www.bco-dmo.org/deployment/649916
Platform	Friday_Harbor
Start Date	2012-06-01
End Date	2016-06-30

[table of contents | back to top]

Project Information

Influence of organism-scale turbulence on the predatory impacts of a suite of cnidarian medusae (jellyfish predation in turbulence)

Coverage: Friday Harbor Labs, WA

Bloom-forming jellyfish are increasing in number, frequency and magnitude, in part due to anthropogenic impacts, underscoring a need for enhanced understanding of trophic exchanges in jellyfish-dominated ecosystems. Interactions between jellyfish and their prey are driven by morphology, behavior, and unique fluid signatures that result in species-specific prey selection patterns. Fluid signatures generated by predators entrain prey, and motile prey organisms have evolved to sense and respond to these stereotyped fluid signatures. The shape and coherence of these unique fluid signatures are strongly mediated by turbulence, which is ubiquitous in the ocean. Yet, the effects of turbulence are almost always neglected in feeding studies. This three-year project will investigate the influence of turbulence on predator-prey interactions using a suite of cnidarian hydromedusae with unique morphologies, fluid signatures and prey selection patterns collected in the region of Friday Harbor Laboratory, WA.

This project seeks to establish a detailed, mechanistic understanding of the effects of turbulence on organism-scale predator-prey interactions using gelatinous zooplankton predators with contrasting predation modes. The PI will investigate prey selection under varying levels of turbulence by studying swimming behavior, wake structure, and predator-prey interactions in a laboratory turbulence generator designed for fragile plankton. The PI will also make in situ measurements of turbulence and observations of organism behavior using a Self-contained Underwater Velocimetry Apparatus (SCUVA). This is a fully submersible instrument for flow

visualization, and its use will provide a cross-calibration of field and laboratory rates and behaviors. The influence of turbulence on trophic position among the different species of hydromedusae will be quantified through field studies of prey selection patterns. The proposed comparative approach using species with distinct predation modes will provide insights applicable to other planktonic predators that can be similarly grouped.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1155084

[table of contents | back to top]