EXP Drifter measurements from R/V Wecoma multiple cruises in the Northeast Pacific coastal waters off states of Washington and Oregon from 2004 to 2006 (RISE project)

Website: https://www.bco-dmo.org/dataset/3245
Version: 28 October 2009
Version Date: 2009-10-28

Project
» River Influences on Shelf Ecosystems (RISE)

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Dataset Description

RISE - Drifters, EXP type
The drifter data come in two varieties: CT and EXP.
All drifters were Brightwaters Corp. drifters.

Methods & Sampling

EXP drifters
EXP or "expendable" drifters recorded only temperature (T) in addition to position (± 10 m) and time.
All EXP drifters transmitted data via the Argos satellite network at 30-minute intervals.
Most EXP drifters were deployed in surface configuration (top 1 m of the water), but a few were drogued with a 10-m long sock drogue (10-m long, 1-m diameter).
Processing of the data included linearly interpolating all data onto a 30-minutely time vector.
The data were snipped, meaning only data collected while in water are provided.
East and north velocity components are also included and were calculated by central-differencing of position data.

File naming:
EXP drifter files are named according to
Drifter PTT ID_configuration_CruiseDayMonth.txt
For example, a file named 09121_s01_R1W26J.txt contains drifter data recorded by
drifter #09121 starting on July 26th of the 1st RISE cruise aboard the R/V Wecoma.
Cruises were:
R1W - July 2004
R2W - May/June 2005
R3W - August 2005

R4W - May/June 2006

Drifter configuration:
The s01 configuration means that this drifter was in (s)urface configuration which spanned the top 1 m of the water column. A configuration designation of d25 implies that the drifter was (d)rogued and the drogue was centered at 25 m depth. This means the drogue spanned a depth range of 20-30 m depth. Realize that while drogued drifters followed water at the depth at which they were drogued, they still recorded temperature data at ~ 1 m depth, not the drogue depth.

Data are in the following units:
Lon - Decimal degrees
Lat - Decimal degrees
Date/Time - GMT
Temperature - Celsius (°C)
Velocity components - (m s-1)

Data Processing Description

BCO-DMO Processing Notes
Generated from original files contributed to BCO-DMO as a zipped data/docs file by Raphael Kudela

BCO-DMO Edits
Drifter Documentation/Metadata
- generated a file of all RISE drifter "metadata" from individual .xls yearly files
- file includes drifterids, models, deployment/recovery dates/times, deployment lats/lons and comments
- file was generated from data contained in the .xls files
- empty cells filled with "nd" (no data)
- Added Cruise names as RISE04W1, etc for consistency with other data sets
Drifter data files
- simple awk script generated to reformat RISE drifter data fmt to BCO-DMO
- date reformatted to YYYYMMDD
- time reformatted to HHMMSS
- lat/lon positions output unchanged
- remaining data output unchanged

[ ]

Data Files

File
EXP_Drifters.csv(Comma Separated Values (.csv), 6.32 MB) MD5:a473b4c863057f8a7897778c3ca01727 Primary data file for dataset ID 3245

[ ]

Parameters

Parameter	Description	Units
Cruise	RISE cruise name	text
Drifter_Data_File	Drifter data filename	text

DrifterID	Drifter id	text
Model	Drifter model	text
Date_Deployed	Drifter deployment date Event log indicates these dates are GMT although the drifter data date/time are local (PDT)	YYYYMMDD
Time_Deployed	Drifter deployment time Event log indicates these times are GMT although the drifter data date/time are local (PDT)	HHMMSS
Lon_Deployed	Drifter deployment longitude	decimal degrees (West is negative)
Lat_Deployed	Drifter deployment latitude	decimal degrees (South is negative)
Date_Recovered	Drifter recovery or timed out date Event log indicates these dates are GMT although the drifter data date/time are local (PDT)	YYYYMMDD
Time_Recovered	Drifter recovery or timed out time Event log indicates these times are GMT although the drifter data date/time are local (PDT)	HHMMSS
comments	Misc comments	text
date	Drifter data date (GMT)	YYYYMMDD
time	Drifter data time (GMT)	HHMMSS
lon_drift	Drifter data longitude	decimal degrees (West is negative)
lat_drift	Drifter data latitude	decimal degrees (South is negative)
temp	Temperature	degrees celsius
u_east	u or East velocity component	m s-1

v_north	v or North velocity component	m s-1

Instruments

Dataset-specific Instrument Name	Drifter Buoy
Generic Instrument Name	Drifter Buoy
Dataset-specific Description	Brightwater Corp. Model 115
Generic Instrument Description	Drifting buoys are free drifting platforms with a float or buoy that keep the drifter at the surface and underwater sails or socks that catch the current. These instruments sit at the surface of the ocean and are transported via near-surface ocean currents. They are not fixed to the ocean bottom, therefore they "drift" with the currents. For this reason, these instruments are referred to as drifters, or drifting buoys. The surface float contains sensors that measure different parameters, such as sea surface temperature, barometric pressure, salinity, wave height, etc. Data collected from these sensors are transmitted to satellites passing overhead, which are then relayed to land-based data centers. definition sources: https://mmisw.org/ont/ioos/platform/drifting_buoy and https://www.aoml.noaa.gov/phod/gdp/faq.php#drifter1

Deployments

W0407A

Website	https://www.bco-dmo.org/deployment/58008
Platform	R/V Wecoma
Report	http://bcodata.whoi.edu/RISE/CruiseReports/RISE-1_Wecoma_CruiseReport.pdf
Start Date	2004-07-08
End Date	2004-07-28
Description	W0407A, RISE-1, RISE1W, RISE04W1 This cruise is the first of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. The R/V Pt. Sur conducted studies of the Columbia R. plume frontal structure, mixing processes and zooplankton dynamics concurrently with this cruise on the R/V Wecoma. Cruise Objectives The purpose of this cruise was to make physical, chemical and biological measurements within the plume of the Columbia River and over the shelves north and south of the river mouth, with the objective of determining the effect of the river plume on regional productivity. Historical observations have shown that in spite of weaker upwelling winds the Washington shelf is more highly productive than much of the Oregon shelf. Comparative measurements of biological rates, chemical constituents including iron and other micro nutrients and plankton growth and grazing as well as community distributions were made in the three regions. These data complement data from three moored arrays deployed in the study area, data from a second ship, the R/V Pt. Sur, that focused on mixing rates and large scale physical, nitrate, fluorescence surveys as well as frontal processes, and data from remote sensing and model studies. RISE-1 Figures: Cruise Track Stations and Moorings Wind Events

W0505C

Website	https://www.bco-dmo.org/deployment/58010
Platform	R/V Wecoma
Report	http://bcodata.whoi.edu/RISE/CruiseReports/RISE-2_Wecoma_CruiseReport.pdf
Start Date	2005-05-29
End Date	2005-06-21
Description	W0505C, RISE-2, RISE2W, RISE05W2 This cruise is the second of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. Cruise information and original data are available from the NSF R2R data catalog. The R/V Pt. Sur, concurrently with this cruise on the R/V Wecoma, conducted studies of the Columbia R. plume frontal structure, mixing processes and a Triaxis survey of the shelf

W0508

Website	https://www.bco-dmo.org/deployment/58012
Platform	R/V Wecoma
Report	http://bcodata.whoi.edu/RISE/CruiseReports/RISE-3_CruiseReport_Daily.pdf
Start Date	2005-08-04
End Date	2005-08-26
Description	W0508, RISE-3, RISE3W, RISE05W3 This cruise is the third of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. The R/V Pt. Sur, concurrently with this cruise on the R/V Wecoma, conducted studies of the Columbia R. plume frontal structure, mixing processes and a Triaxis survey of the shelf Stations and Moorings

W0605B

Website	https://www.bco-dmo.org/deployment/58015
Platform	R/V Wecoma
Report	http://bcodata.whoi.edu/RISE/CruiseReports/RISE-4_Wecoma_CruiseReport_F_TDP.pdf
Start Date	2006-05-21
End Date	2006-06-13
Description	W0605B, RISE-4, RISE4W, RISE06W4 This cruise is the fourth of four cruises in the RISE program aboard the R/V Wecoma, which was charged with the task of conducting hydrographic surveys. Cruise information and original data are available from the NSF R2R data catalog. The R/V Pt. Sur, concurrently with this cruise on the R/V Wecoma, conducted studies of the Columbia R. plume frontal structure, mixing processes and a Triaxis survey of the shelf

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Project Information

River Influences on Shelf Ecosystems (RISE)

Website: http://www.ocean.washington.edu/rise

Coverage: Northeast Pacific, coastal waters off states of Washington and Oregon

River Influences on Shelf Ecosystems (RISE) - A Study of the Columbia River Plume
A Multi-Institutional Collaborative Project Sponsored by the National Science Foundation

In 2004 an interdisciplinary study "River Influences on Shelf Ecosystems" (RISE) was initiated to determine the extent to which alongshore gradients in ecosystem productivity might be related to the existence of the massive freshwater plume from the Columbia River. RISE was designed to test three hypotheses: - During upwelling the growth rate of phytoplankton within the Columbia plume exceeds that in nearby areas outside the plume being fueled by the same upwelling nitrate.
- The plume enhances cross-margin transport of plankton and nutrients.
- Plume-specific nutrients (Fe and Si) alter and enhance productivity on adjacent shelves.

Within those constraints, RISE provides the first comprehensive interdisciplinary study of the rates and dynamics governing the mixing of river and coastal waters in an eastern boundary system, as well as the effects of the plume formed by the mixing processes on rates, standing stocks and community structure of plankton in the local ecosystem. The RISE project, includes 4 field and two different numerical model applications. We collected simultaneous measurements of water chemistry, phytoplankton growth and grazing rates, zooplankton populations, water currents, and turbulent mixing. These are being combined with data from satellites, radar, and moorings, as well as detailed numerical simulations, to develop a deeper understanding of this important ecosystem.

The overall RISE sampling strategy was to compare mixing rates, nutrient supply, and phytoplankton production, grazing and community structure within the plume and outside the plume; i.e. on the shelf to the north of the river mouth, presumed more productive, and on the shelf to the south of the river mouth, presumed less productive, as well as in the important "plume lift off" area (the region where the plume loses contact with the bottom) near the river mouth and the plume "near field". The backbone for this project consists of data collected during four cruises that took place in the seasonally high-flow period (May-June) in each of three years (2004-06) and in a low-flow period in the second year (August, 2005). The sampling was spread over three years to attempt to include interannual differences in processes related to wind and river flow variability. The 21-day length of the cruises ensured that a variety of circulation and growth regimes, including upwelling and relaxation/downwelling and neap/spring tides, were observed.

The field studies used two vessels operating simultaneously. The R/V Wecoma obtained primarily biological and chemical rate data: a) at individual stations on cardinal lines north and south of the river mouth (off Grays Harbor, WA and Cape Meares, OR) and near the river mouth; b) at selected process study stations; and c) at fixed stations near the river mouth during strong neap and spring tides (time series). A towed sensor package

was used to obtain micronutrient samples near the sea surface on cardinal lines and other selected transects. Underway measurements included macronutrients (N, P, Si), dissolved trace metals (Fe, Mn), supplemented with discrete samples from the underway system (microscopy, FlowCAM and particulate trace metals). At CTD stations vertical profiles (0-200 m where possible; and 500 m at selected stations) of T, S, vertical shear and currents, dissolved O2, in vivo fluorescence, PAR, chlorophyll a, dissolved macronutrients (NO3, NH4, urea, PO4, SiO4), dissolved trace metals, and heterotrophic and autotrophic plankton composition were obtained. Surface drifters were used to follow the mixing of individual plumes and to provide information on surface currents.

On the R/V Pt. Sur, synoptic mesoscale and fine-scale features were sampled with underway measurements of near-surface T, S, velocity, particle size and concentration, PAR, transmissivity and fluorescence and nitrate+nitrite. The Pt. Sur's Triaxus tow fish provided high-resolution sections of T, S, zooplankton (Laser-OPC), PAR and transmissivity, fluorescence, particle size and concentration (LISST-FLOC25X), UV absorption and nitrate (Satlantic ISUS) and radiance/irradiance (7 channels) through the upper water column to 50 m. Rapidly-executed transects of turbulence and fine-structure were also carried out using the Chameleon profiler; these provide full-depth profiles of T, S, optics (880 nm backscatter and fluorescence), turbulence dissipation rates and turbulent fluxes every 1-3 minutes. During selected periods, transects were repeated hourly to capture the high-frequency evolution in the plume's nearfield and river estuary. Acoustics (surface-deployed 1200 kHz ADCP and 120 kHz echosounder) were used to image fine-scale features of the velocity and backscatter fields, resolving fronts, nonlinear internal waves, and turbulent billows.

The temporal context for observed variability was provided by an array of moored sensors deployed in the plume near field as well as on the shelf north and south of the plume (complemented by the pre-existing long-term estuarine and plume stations of the CORIE/SATURN network. To better resolve regional differences, moorings were moved farther north and south to the cardinal sampling lines after the first year of the program. Surface currents were mapped hourly from shore using HF radar with two simultaneously operating arrays, one with a 40 km range and a 2 km range resolution, the other with a 150 km range and a 6 km range resolution. Satellite ocean color, sea surface temperature, turbidity and synthetic aperture radar (SAR) were also obtained when available.

Two modeling systems were developed or enhanced during RISE. The system developed specifically for RISE employed a structured grid model (ROMS) and was used in hindcast mode (MacCready et al., 2008). The CORIE/SATURN modeling system (Baptista, 2006)- based on two unstructured-grid models (SELFE, Zhang and Baptista, 2008; and ELCIRC, Zhang et al., 2004)- was used in both near real-time prognostic mode and multi-year hindcast mode. Both modeling systems incorporated the estuary in the simulation domain (although at different resolutions) and used realistic river, ocean and atmospheric forcing conditions, tidal forcing, and Columbia River estuary forcing. Wind/heat flux model forcing for ROMS was derived from the 4 km MM5 regional wind/heat flux model. SELFE and LCIRC were also forced by MM5. Conditions on open boundaries were provided by ~9 km resolution models from the Navy Research Laboratory (NRL) (NCOM); ROMS used the smaller domain NCOM-CCS NRL model, SELFE and ELCIRC used the larger domain Global-NCOM model. The biological model is a four-box ("NPZD") nitrogen-budget model that tracks nutrients, phytoplankton, zooplankton, and detritus in every cell of the ROMS grid. The rich RISE biological dataset allowed model validation against not just stocks (chlorophyll, microzooplankton, nutrients) but rates (phytoplankton growth and grazing) directly, a level of validation that is seldom possible. These rate observations also allowed the setting of key model parameters (e.g., zooplankton ingestion rate and mortality) empirically (Banas, et al., 2008).

References:
Banas, N. S., P. MacCready, and B. M. Hickey (2008), The Columbia River plume as cross-shelf exporter and along-coast barrier, doi:10.1016 Cont. Shelf Res., 2008.03.011

Baptista, A. M. (2006), CORIE: the first decade of a coastal-margin collaborative observatory, Oceans'06, MTS/ IEEE, Boston, MA.

Hickey, B.M., and the RISE PIs. River Influences on Shelf Ecosystems: Introduction to the RISE Volume, Cont. Shelf Res., in press.

MacCready, P., N. S. Banas, B. H. Hickey, E. P. Dever, and Y. Liu (2008), A model study of tide- and wind-induced mixing in the Columbia River Estuary and Plume, ,doi:10.1016/j. Cont. Shelf Res. 2008.03.015.

RISE Cruise Reports and Figures:
2004 RISE-1
RISE04W1=R/V Wecoma, W0407A, July 8-28, 2004

Cruise Report
Cruise Track
Stations and Moorings
Wind Events

RISE2004=R/V Point Sur, (tbd), July 8-28, 2004
Cruise Report

2005 RISE-2
RISE05W2=R/V Wecoma, W0505C, May 29-June 21, 2005
Cruise Report
Cruise Track
Stations and Moorings
Wind Events

RISE2005a=R/V Point Sur, (tbd), May 29-June 21, 2005
Cruise Report

2005 RISE-3
RISE05W3=R/V Wecoma, W0508, August 4-August 26, 2005
Daily Cruise Report
Lessard Cruise Report
Peterson/Shaw Zooplankton Report
Cruise Track
Stations and Moorings
Wind Events

RISE2005b=R/V Point Sur, (tbd), August 2-August 27, 2005
Cruise Report
Cruise Log

2006 RISE-4
RISE06W4=R/V Wecoma, W0605B, May 21-June 13, 2006
Cruise Report 1
Cruise Report 2
Cruise Track
Stations and Moorings
Wind Events

RISE2006a=Leg 1, R/V Point Sur, (tbd), May 21-May 31, 2006
Cruise Report Leg 1
RISE2006b=Leg 2, R/V Point Sur, (tbd), June 2-June 12, 2006
Cruise Report Leg 2

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0239089