

Data Management Workflow and Challenges in Developing a California Ocean Acidification and Hypoxia Data Portal

Marine Lebrec, CeNCOOS DMAC







OCEAN

PROTECTION COUNCIL

Project goal: Build a centralized information access hub, the California OAH Portal, to serve automated, high-quality and interoperable data and synthesis products

Project objectives

Objective 1. Improve data quality, interoperability, and access.

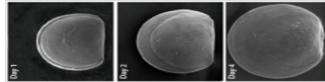
Objective 2. Streamline data ingestion for enhanced visualization and synthesis.

Objective 3. Establish a state-wide information hub for managers and stakeholders.

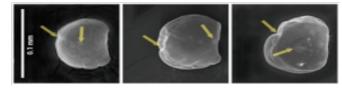
Objective 4. Develop and automate synthesis products and biological indicators.



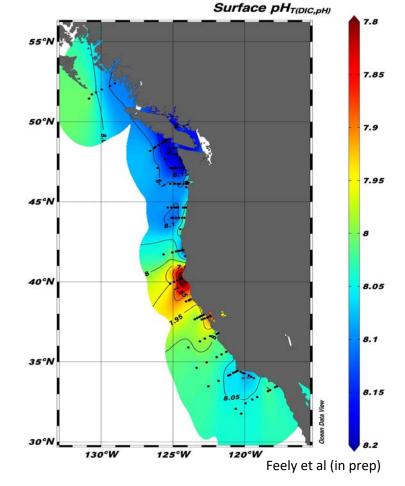
Oyster larvae developing in: normal seawater



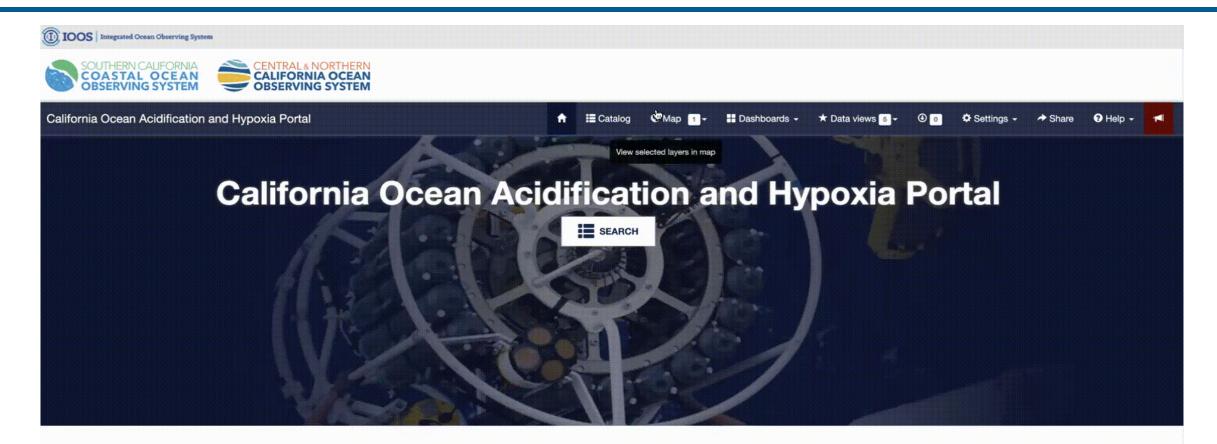
Oyster larvae developing in: acidified seawater



Elizabeth Brunner & George Waldbusser, Oregon State University







The California OAH Portal is a centralized information center serving relevant, timely, and reliable OAH information to managers, researchers, industry, and other marine stakeholders. This new information hub is designed to support the automated generation of data-driven products to solve user needs within the region. The Portal integrates standardized, quality controlled data from diverse sources and platforms, incorporate existing data layers from models and satellites, and collaborate with state and West Coast partners to serve additional data streams and curated synthesis products. We serve automated and interoperable data and synthesis products that incorporate the most current data to generate indicators of status and trends. Data and information products will be downloadable and shareable for a variety of uses.



Dashboards

Ingesting new datasets & products into the CeNCOOS/Axiom DMAC pipeline

- NOAA PMEL West Coast Ocean Acidification cruises via NCEI:
 - CTD data & discrete samples
 - Underway PCO₂
 - Pteropod abundance/dissolution severity
- Co-located environmental data + zooplankton monitoring (Trinidad Head, N. California) via ERDDAP
- **MBARI underway PCO₂ time-series** via MySQL db
- Water quality dashboards for shellfish growers (CeNCOOS shore station network ERDDAP)
 - Data access
- Processing / QC'ing steps
- Challenges, lessons learned

Background

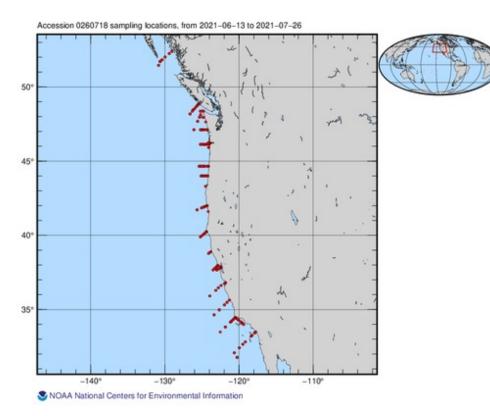
- West-Coast wide cruises to obtain snapshots of key carbon, physical, biogeochemical parameters relating to OA (2007 – present)
- All data (.xlsx) + metadata (HTML or XML) are published on NCEI Ocean Carbon and Acidification Data System (OCADS)

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NOAA Ship Bell M. Shimada 2017 Harmful Algal Blooms cruise (NOAA HABs)	332220170918/SH1709	USA	NOAA HABs Cruise	San Diego, CA - San Francisco, CA - Seattle, WA	from 2017-09- 18 to 2017-09- 28	Simone R. (NOAA/PM Richard Fee	EL),	Simone R. (NOAA/PN Richard Fe	CTOPRESSURE_DBAR, CTOTMP_ITS90_DEG_C, CTDSAL_PSS78, CTOOXYGEN_UMOL_KG, CTDOXYGEN_MG_L. Data OXYGEN_UMOL_KG, OXYGEN_MG_L_, DXYGEN_MG_L_Z, DIC_UMOL_KG, TAL_UMOL_KG, SULFATE_UMOL_KG, MCTATE_UMOL_KG, MCTATEL_UMOL_KG, MCTATEL_MCTAL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_MCTAL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_MCTATEL_UMOL_KG, MCTATEL_	PMEL Coasta CO2 Project d

(Discrete/Bottle data)

EXPOCODE/Cruise					Dates of					
Vessel/ Data Set Name	Name	Country	Мар	Ports	Operation	Chief Scientist	Carbon PI	Measurements in data set	Data/Metadata	Project Link
NOAA Ship Ronald H. Brown 2016 Ocean Acidification Cruises (Discrete/Bottle data)	Leg 1: 33R020160505 Leg 2: 33R020160524	USA	WCOA2016 Cruise map	San Diego, CA - San Francisco, CA - Seattle, WA	Leg 1: May 5- 21, 2016; Leg 2: May 24- June 07, 2016	Feelyga	Simone R. Alin (NOAA/PMEL), Richard FeelygP	CTOPES, DAR, CTOTHE, TSHO, DEG, C, CTOSH, PSSTS, SLIUHTY, PSSTR, CTOOYU, LWOL, KG, OWIGHN, LWOL, KG, DIC, UMOL, KG, TA, UMOL, KG, PH, TOT, MEA, TIMP, PH, MEA, DEG, C, CARBONATE, UMOL, KG, SILICATE, UMOL, KG, AMMONIUM, UMOL, KG, NITHATE, UMOL, KG, HITHEL, UMOL, KG, CH, A, UG, L, GFF, CHL, A, UG, L, PC	Data Metadata	PMEL Coastal

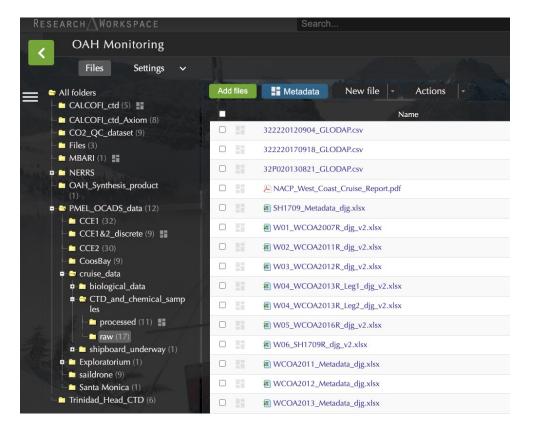
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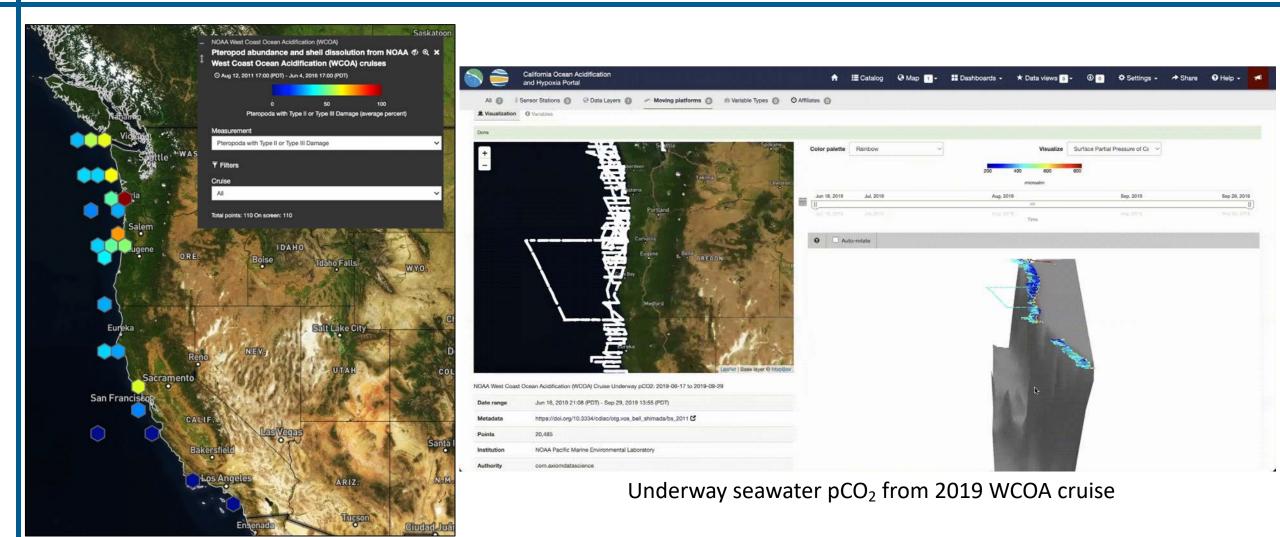
NOAA PMEL West Coast Ocean Acidification cruises: data processing

- Using Axiom's Research Workspace to share notebooks, files, metadata, documentation
- Data cleaning
 - Multiple files for multiple legs per cruise
 - Variable units included as rows in certain cruises but not others
 - Multiple tabs of data
 - Inconsistencies in variable names between cruises; converting to CF format
 - Reformatting time to ISO
- Converting cruise data to netCDF, use IOOS compliance checker

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NOAA PMEL West Coast Ocean Acidification cruises: data discovery & visualization



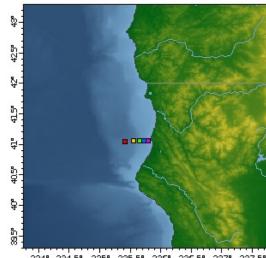
Pteropod with type II or type III shell damage

Background

Ocean observing cruises since 2007 led by Southwest Fisheries Science Center (SWFSC) and Cal Poly Humboldt (CPH) to characterize seasonal and interannual variability in the plankton ecosystem in coastal waters off northern California.

Data

T, S, Chl-a, DO, pH + QARTOD flagging Zooplankton samples (abundance, size) @ TH04, TH05



234° 234.5° 235° 235.5° 236° 236.5° 237° 237.5°

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5	D-D	AP	A	м	Source Data Files	sible		Sum

he	Dataset's	Variables	and	Attributes	

ERDDAP: ERD Projects

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ERDDA

ERDDAP > info > th04-trinidad-head-line

Grid DAP Data	Sub- set	DAP		м	Source Data Files	Title	Sum- mary	FGDC, ISO, Metadata	Back- ground Info	RSS	Institution	Dataset ID
		data	oraph		files	TH04, Trinidad Head Line	0	FIM	background d?	W PISS	Cal Poly Humboldt	th04-trinidad-head-line

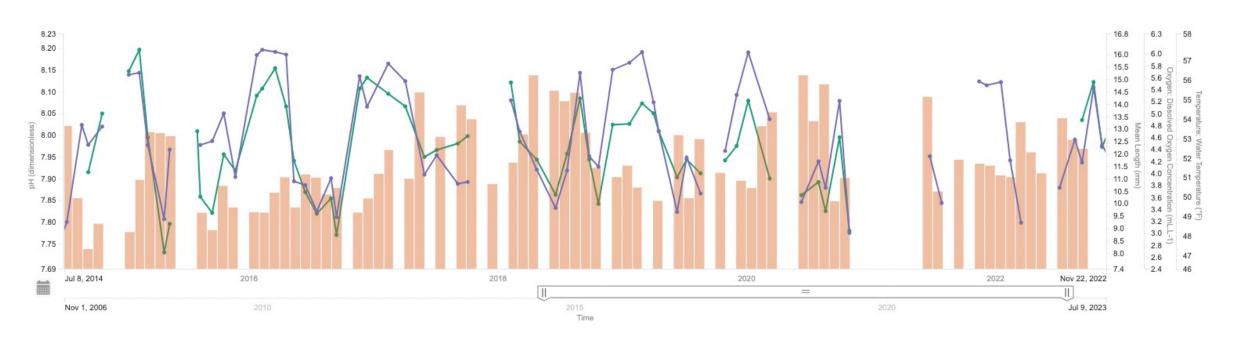
The Dataset's Variables and Attributes

Row Type	Variable Name	Attribute Name	Data Type	
attribute	NC_GLOBAL	_NCProperties	String	version=2,netcdf=4.7.4,hdf5=1.10.6
attribute	NC_GLOBAL	cdm_altitude_proxy	String	z
attribute	NC_GLOBAL	cdm_data_type	String	TimeSeriesProfile
attribute	NC_GLOBAL	cdm_profile_variables	String	time
attribute	NC_GLOBAL	cdm_timeseries_variables	String	station,longitude,latitude
attribute	NC_GLOBAL	contributor_email	String	feedback at axiomdatascience.com
attribute	NC_GLOBAL	contributor_name	String	Axiom Data Science
attribute	NC_GLOBAL	contributor_role	String	processor
attribute	NC_GLOBAL	contributor_role_vocabulary	String	NERC
attribute	NC_GLOBAL	contributor_url	String	https://www.axiomdatascience.com dP
attribute	NC_GLOBAL	Conventions	String	IOOS-1.2, CF-1.6, ACDD-1.3
attribute	NC_GLOBAL	creator_country	String	USA
attribute	NC_GLOBAL	creator_email	String	None
attribute	NC_GLOBAL	creator_institution	String	Cal Poly Humboldt
attribute	NC_GLOBAL	creator_name	String	Cal Poly Humboldt
attribute	NC_GLOBAL	creator_sector	String	academic
attribute	NC_GLOBAL	creator_type	String	institution
attribute	NC_GLOBAL	creator_url	String	http://cencoos.humboldt.edu/ 19
attribute	NC_GLOBAL	defaultDataQuery	String	sea_water_ph_reported_on_total_scale_qc_agg,sea_water_temper
attribute	NC_GLOBAL	Easternmost_Easting	double	-124.436691
attribute	NC_GLOBAL	featureType	String	TimeSeriesProfile
attribute	NC_GLOBAL	geospatial lat_max	double	41.058019

Co-located biological and chemical datasets: data-view comparison chart



- Adult mean biomass of *Euphausia pacifica* (krill)
- Dissolved oxygen concentration @50m
- **pH @50m**

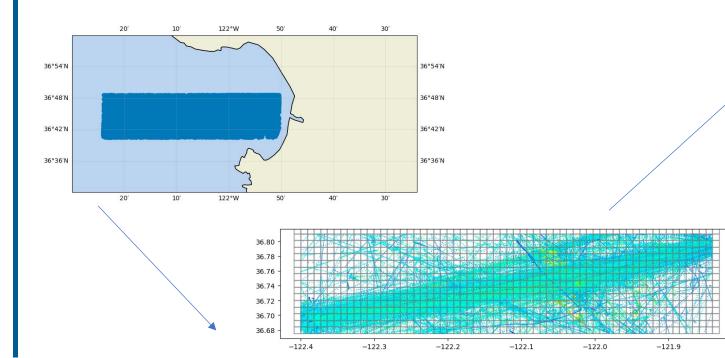


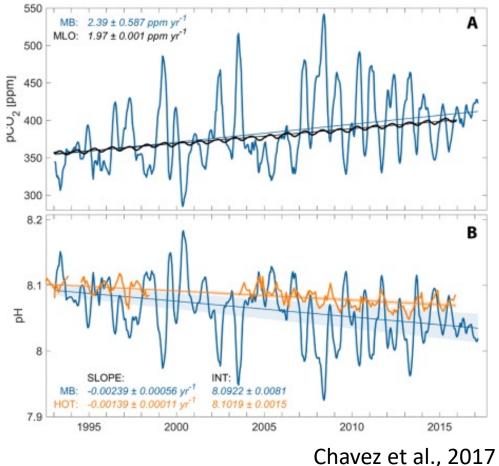
Background

Surface pCO2, temperature, salinity, chlorophyll-a, and nitrate from 1993 to present from MBARI research vessels in Monterey Bay, California, USA.

Data access/processing

Pymysql to access SQL database Data queried to region where ship commonly passes 1km grids generated, followed by aggregation





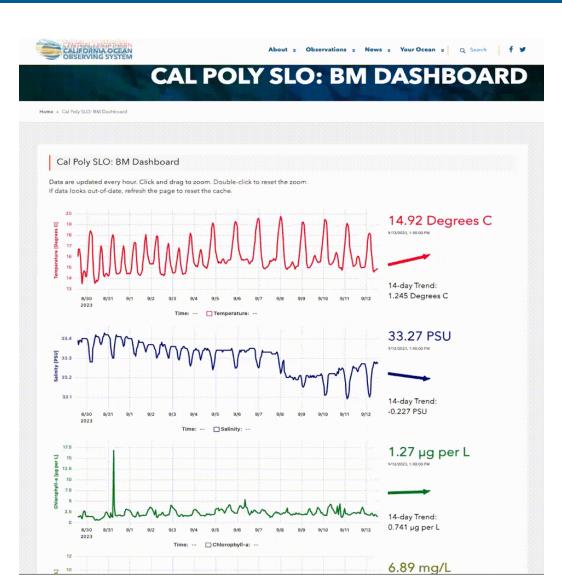
Developing dynamic water quality dashboards

Background

- Feedback from shellfish growers for user-friendly water quality dashboard interface
- Collaboration with Morro Bay shellfisheries community / researchers

Features

- Updated hourly
- 14-day trend
- QARTOD filtering

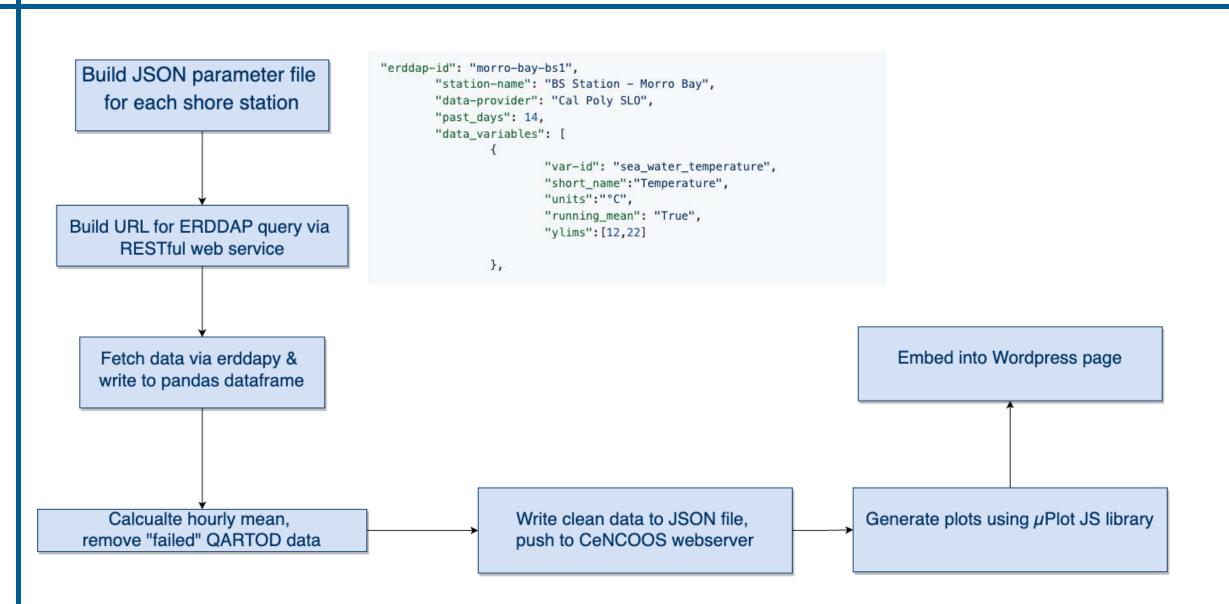




Led by Patrick Daniel, UCSC/CeNCOOS

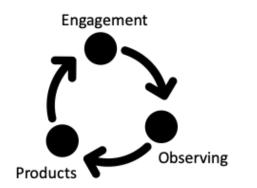
Prototype: www.cencoos.org/cal-poly-slo-bs1-dashboard/

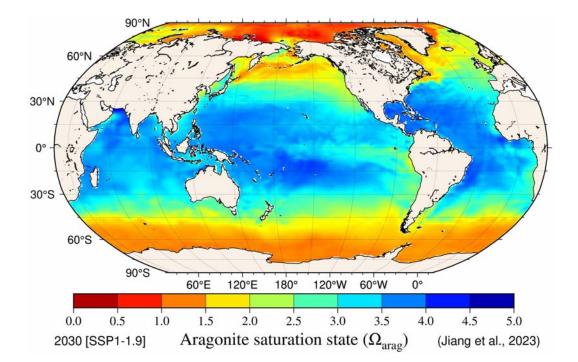
Developing dynamic water quality dashboards



Future directions for CA OAH data product delivery

- Integration of other high-priority datasets into CA OAH Portal
 - CalCOFI: carbonate chemistry + zooplankton
 - Synthesis products, indicators
 - ROMS BEC model
- Development of next gen dashboards w/ Axiom
 - Shellfish growers
 - Water mgmt
 - Fisheries
 - MPAs
- Notification/alert system for users
- Stakeholder/end user engagement & outreach





Global Surface Ocean Acidification Indicators from 1750 to 2100 (Jiang et al., 2023) (Available on OCADS in netCDF format)

Thank you! mlebrec@mbari.org



M B A R I

