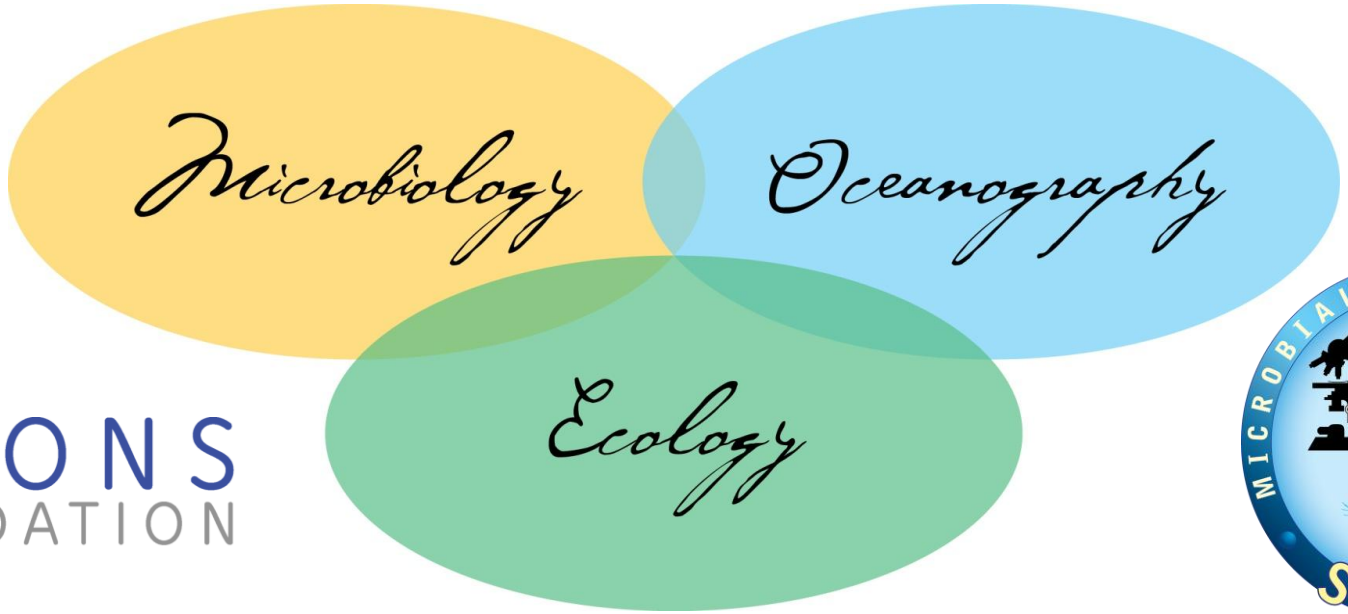


SIMONS FOUNDATION



SCOPE: A 2019 Status Report

AMERICAN SOCIETY FOR MICROBIOLOGY

MILESTONES IN MICROBIOLOGY SITE

University of Hawaii at Manoa
Ocean Station ALOHA

Scientific Advisory Board • 4 October 2019

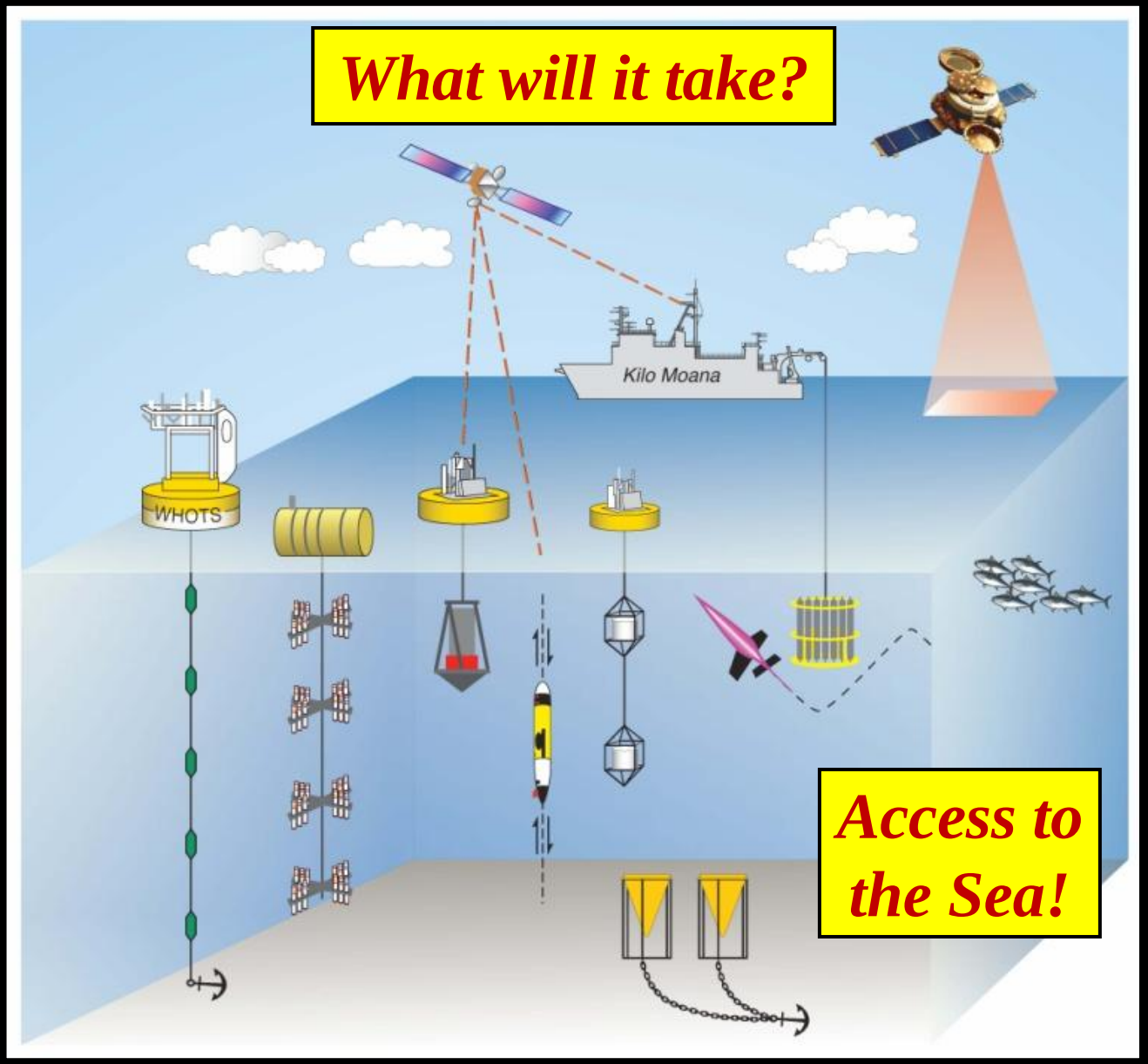


SCOPE

VISION: **To achieve a comprehensive understanding of microbial dynamics and ecosystem processes at Station ALOHA in the North Pacific Subtropical Gyre**

MISSION: **To study the ecosystem at Station ALOHA in situ, at various levels of biological organization, and at highly resolved, nested scales of space and time to achieve understanding and to build accurate models**

Established 1 July 2014



OBSERVATIONS

Theory • Experiments • Synthesis • Modeling

Who We Are




Ginger Armbrust


Randelle Bundy


Dave Caron


Penny Chisholm


Matt Church


Ed DeLong


Sonya Dyhrman


Zoe Finkel


Mick Follows


Anitra Ingalls


Seth John


Laurie Juranek


Dave Karl


Debbie Lindell


Dan Repeta

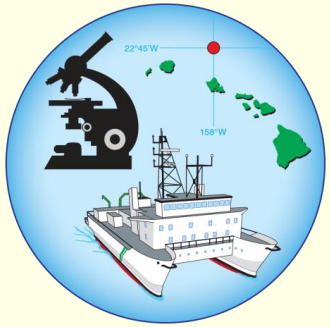

Ben Van Mooy


Joshua Weitz


Angel White


Jon Zehr

... and their teams!



Early Career Scientist Opportunities for 2019

It's all about the next generation!

- **Established a SCOPE – Early Career Webinar Series**
  - ***Marine microbial ecology*, May: Angie Boysen, Sacha Coesel, Emma Wear**
  - ***Viral ecology/modeling*, June: Stephen Beckett , Ashley Coenen, Daniel Muratore, GuanLin Li**
  - ***Microbe-virus interactions*, July: Paul Berube, Dror Shitrit, Thomas Hackl, Raphael Laurenceau**
  - ***Nitrogen fixation*, August: Kendra Turk-Kubo, Katie Harding, Ester Mak**
  - ***Trace metal metabolism*, September: Marianne Acker, Rachel Kelly, Nick Hawco**

- **Established a SCOPE – Early Career Travel Grant Program** ***for inter-laboratory collaborations and cross-training***

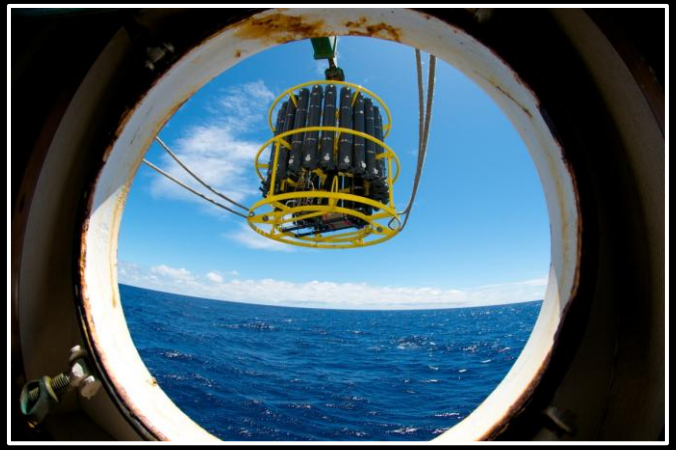
- **Inaugural SCOPE Early Career Science Symposium** ***9 Dec 2019 – prior to SCOPE Annual Meeting***

Today's Discussion Points:
Progress & Prospectus

- **Science Vignettes**
  MAHALO, MESO•SCOPE, Gradients, HOT, LAVA, and more
- **Data Inventory and Management**
  field obs, Seagliders/Wirewalkers, IFCB/SeaFlow, GitHub, iMicrobe-CyVerse, C-MAP
- **SCOPE 2020-2024**
  vision, prospectus, and implementation plan





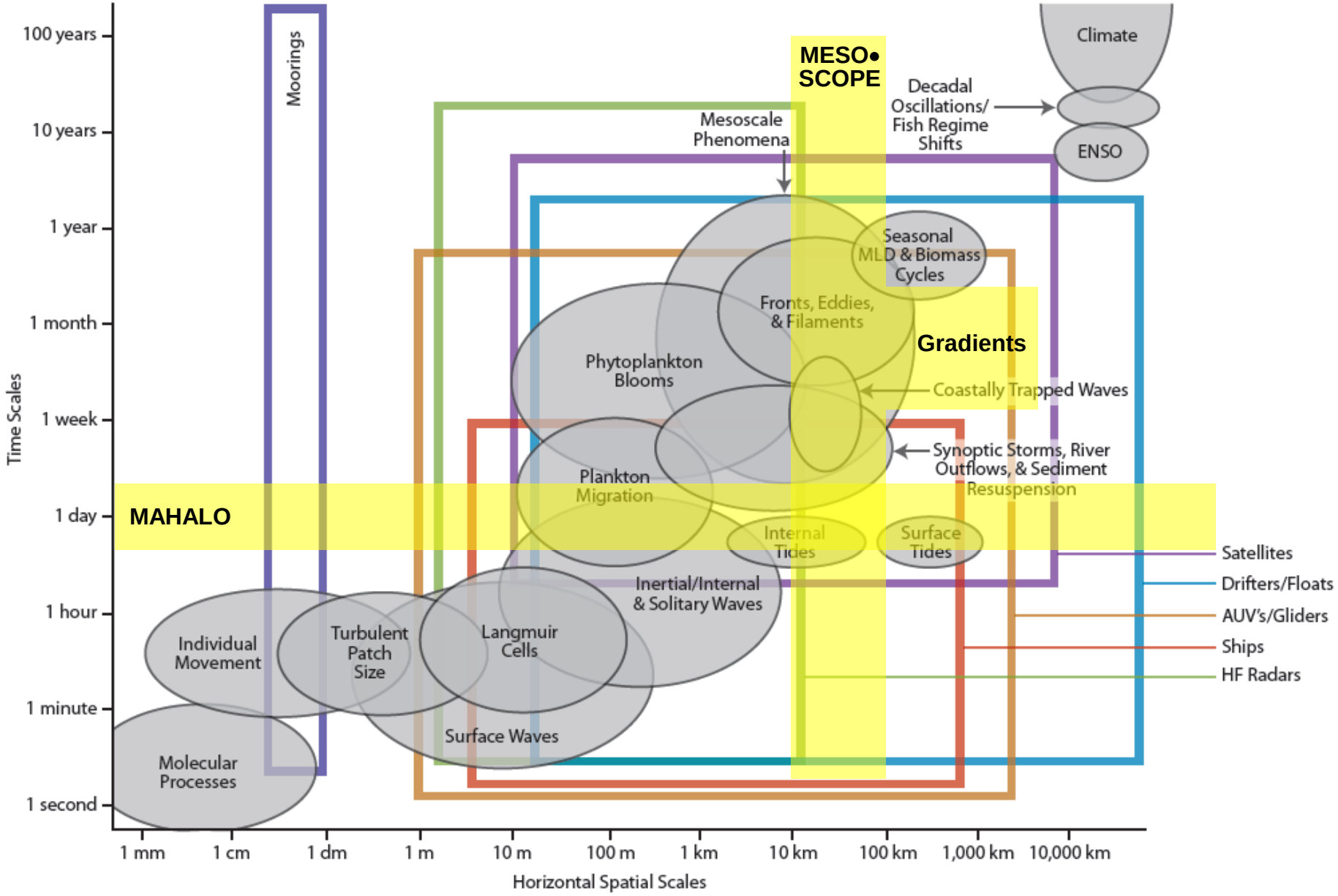


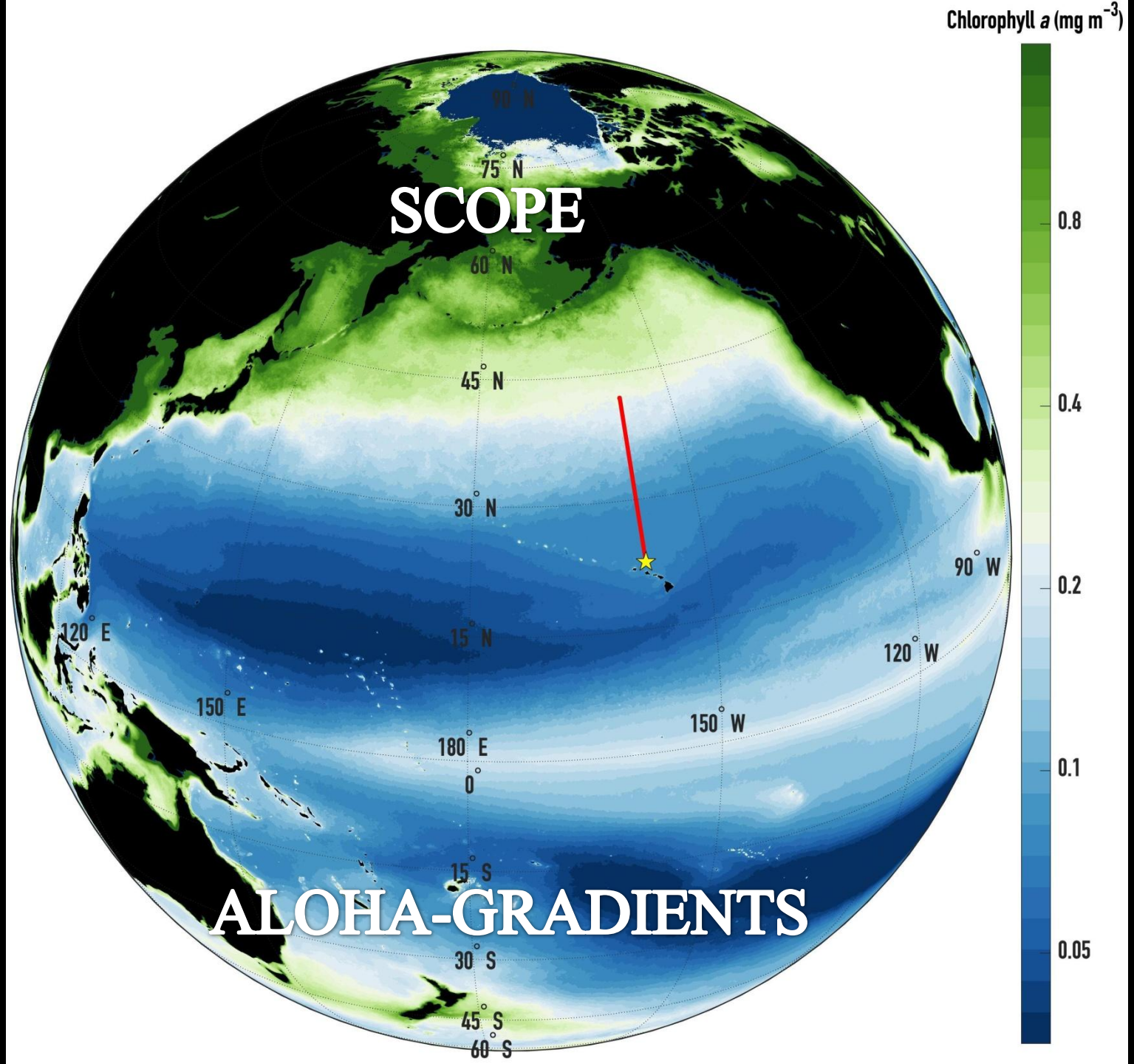
SCOPE's Int. HQ – Univ. Hawaii



SCOPE's Laboratory – The Pacific Ocean

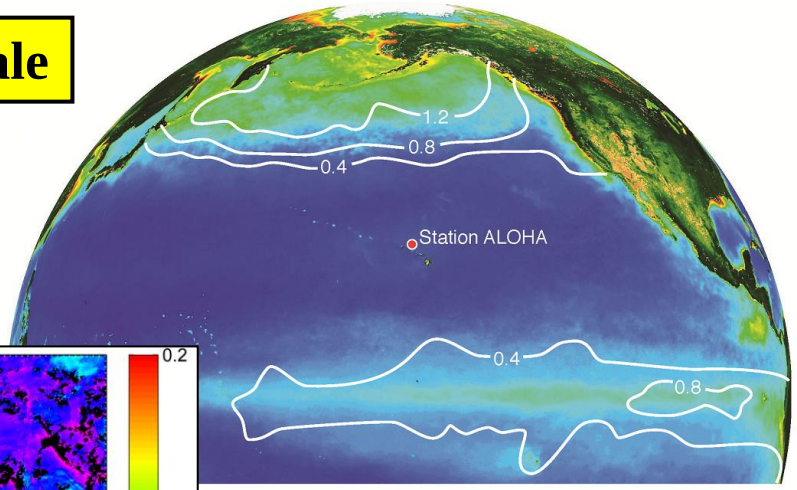
Time/Space Continuum

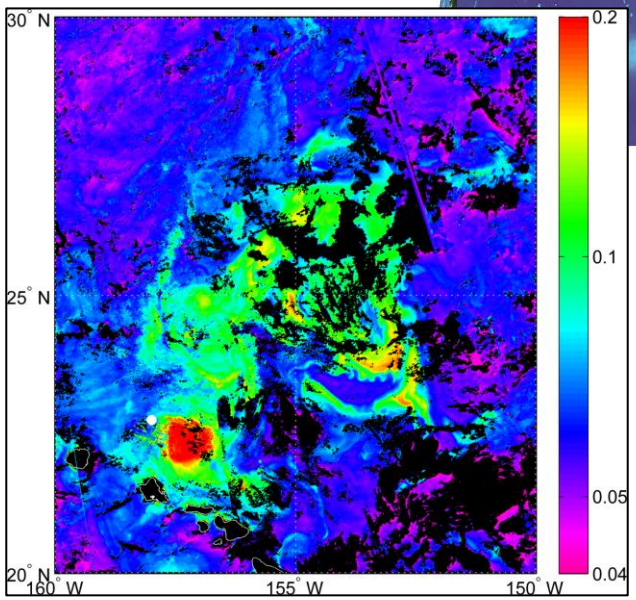


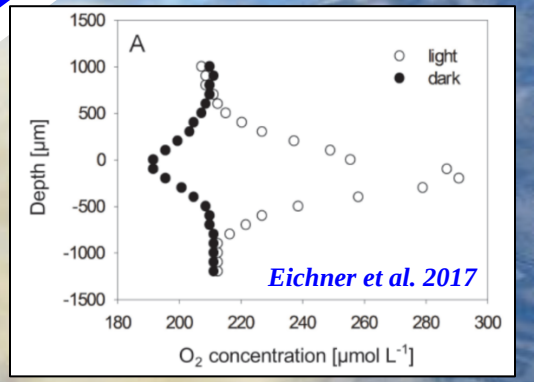

Chlorophyll a (mg m^{-3})
0.8
0.4
0.2
0.1
0.05
90° N
75° N
60° N
45° N
30° N
15° N
0
15° S
30° S
45° S
60° S
120° E
150° E
180° E
150° W
120° W
90° W
SCOPE
ALOHA-GRADIENTS

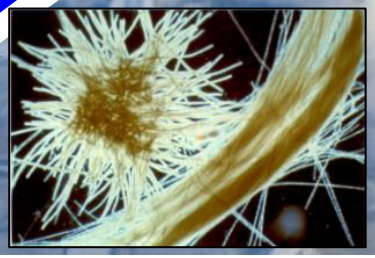
The Incredible World of *Trichodesmium*

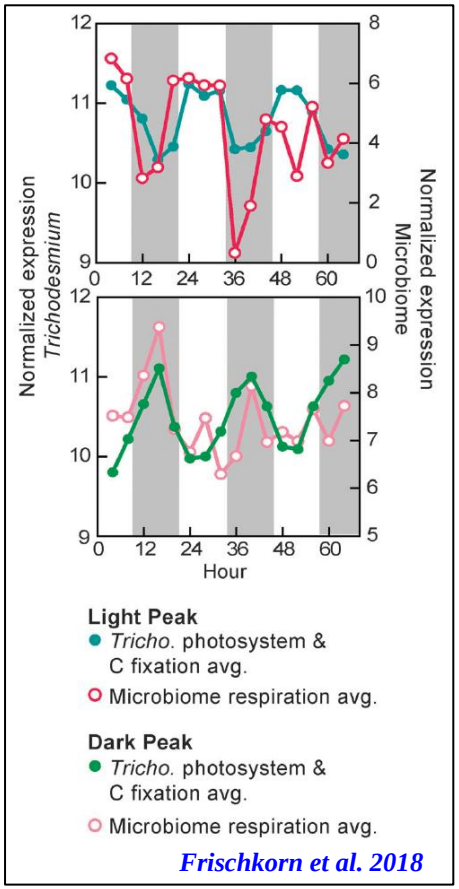
basin-to-meso scale







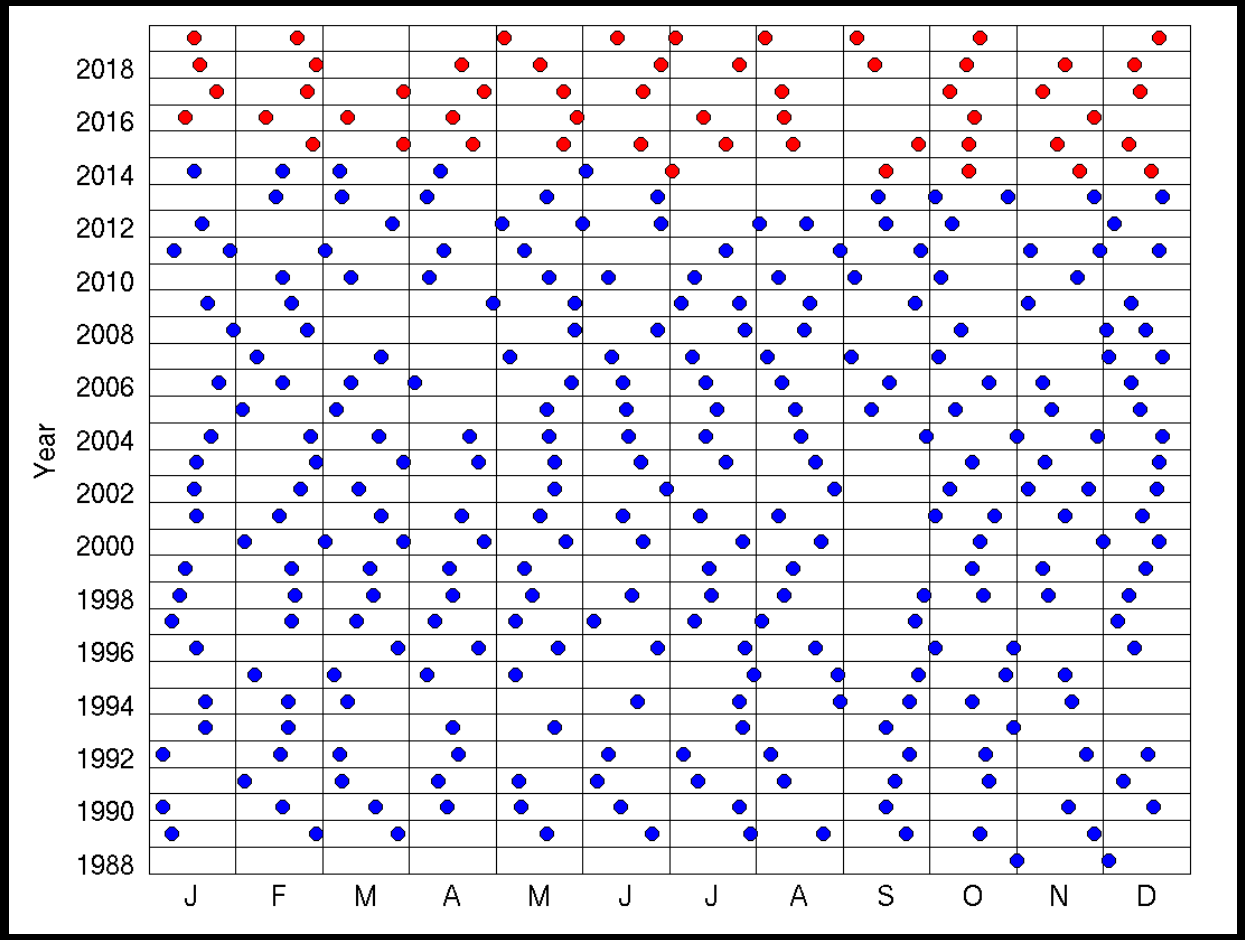




micro-to-nano scale


AMERICAN SOCIETY FOR MICROBIOLOGY
MILESTONES IN MICROBIOLOGY SITE
University of Hawaii at Manoa
Ocean Station ALOHA
22°45'N, 158°W
Ocean Station ALOHA est. 1988
MICROBIAL OCEANOGRAPHY
SCOPE
HAWAII OCEAN TIME-SERIES
GLOBAL OCEAN FLUX STUDY
WORLD OCEAN CIRCULATION EXPERIMENT
UNIVERSITY OF HAWAII
158°W
22°45'N
SCOPE-HOT partnership

SCOPE-HOT Report Card



- **Since July 2014, SCOPE scientists have been sampling Station ALOHA in partnership with the HOT program**
- **2014-2019: 54 cruises, >150 days at Station ALOHA**
- **This partnership enriches both programs**

Ocean Currents, Flow Fields and Ecological Frames of Reference



Leonhard Euler (1707-1783)

Observer is fixed at a specific location through which the fluid moves in time

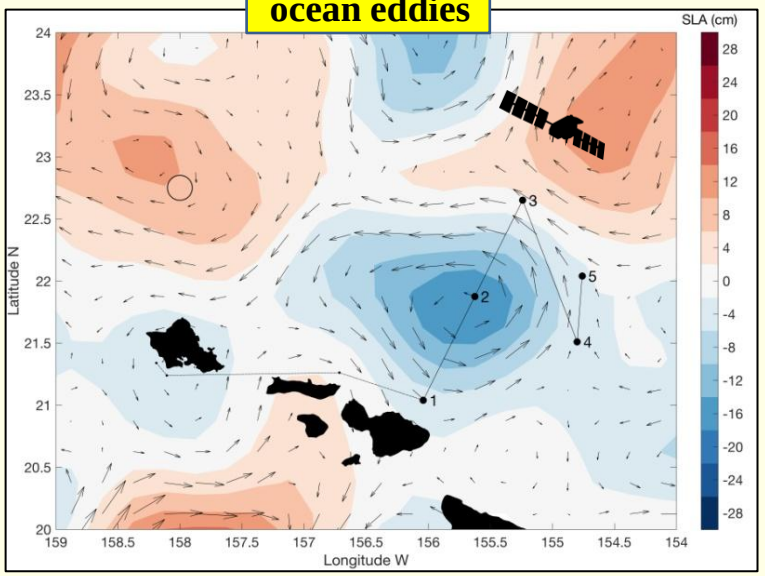


Joseph-Louis Lagrange (1736-1813)

Observer follows an individual fluid parcel as it moves in time and space







Modes of Field Observations in SCOPE



Ship: sample collection • underway SeaFlow / Flow Cytobot • incubation experiments • arrays



Satellite: ocean color • temperature • altimetry



Seaglider: autonomous subsurface drone • temperature/salinity • O_2 • fluorescence • particles • colored DOM



Wave Glider: autonomous surface drone • sensors are same as Seaglider



Wirewalker: high-resolution surface profiler • as above for Seaglider • wave powered



Optical floats: autonomous profiling instrument • as above for Seaglider plus bio-optics

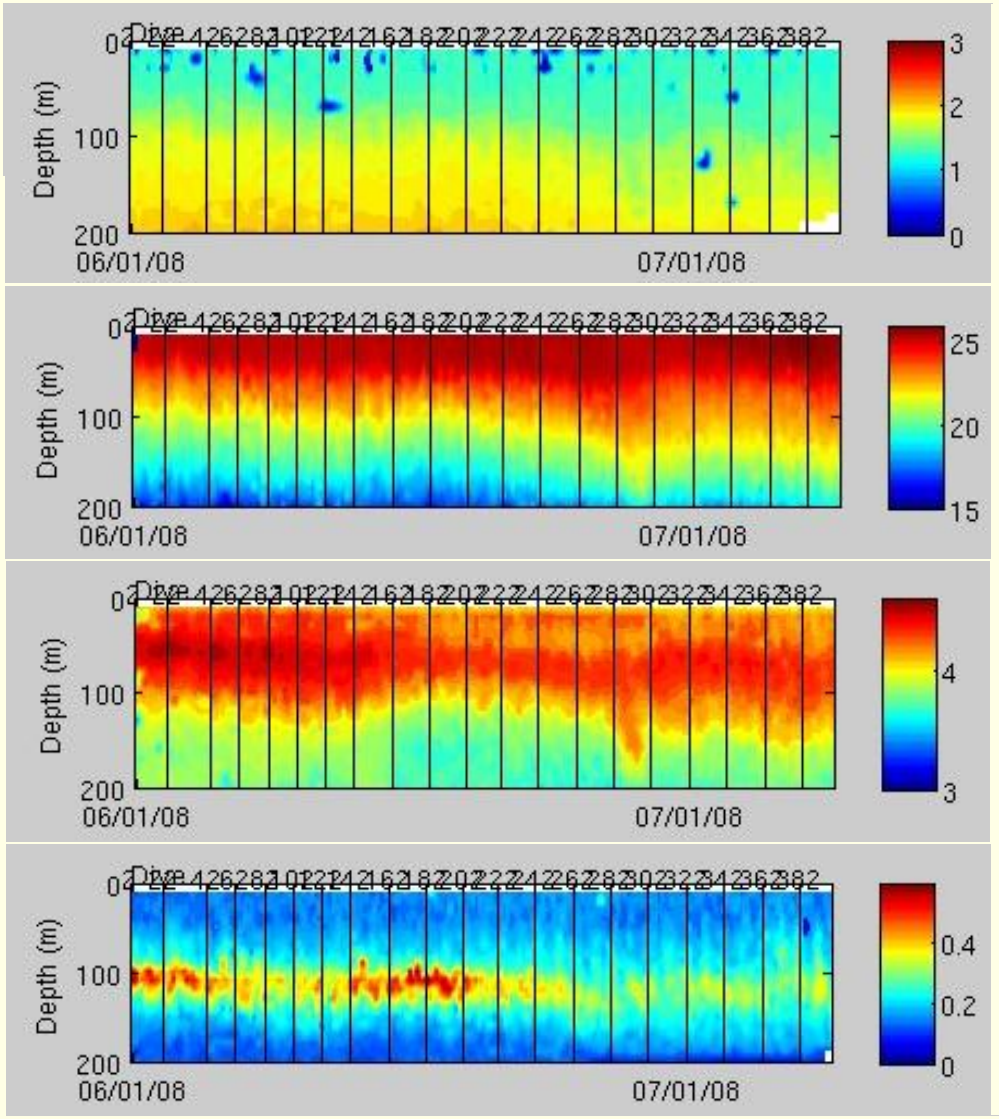
Marine Environmental Sequencing Using Seagliders

A absorption (DOM and light scattering particles)

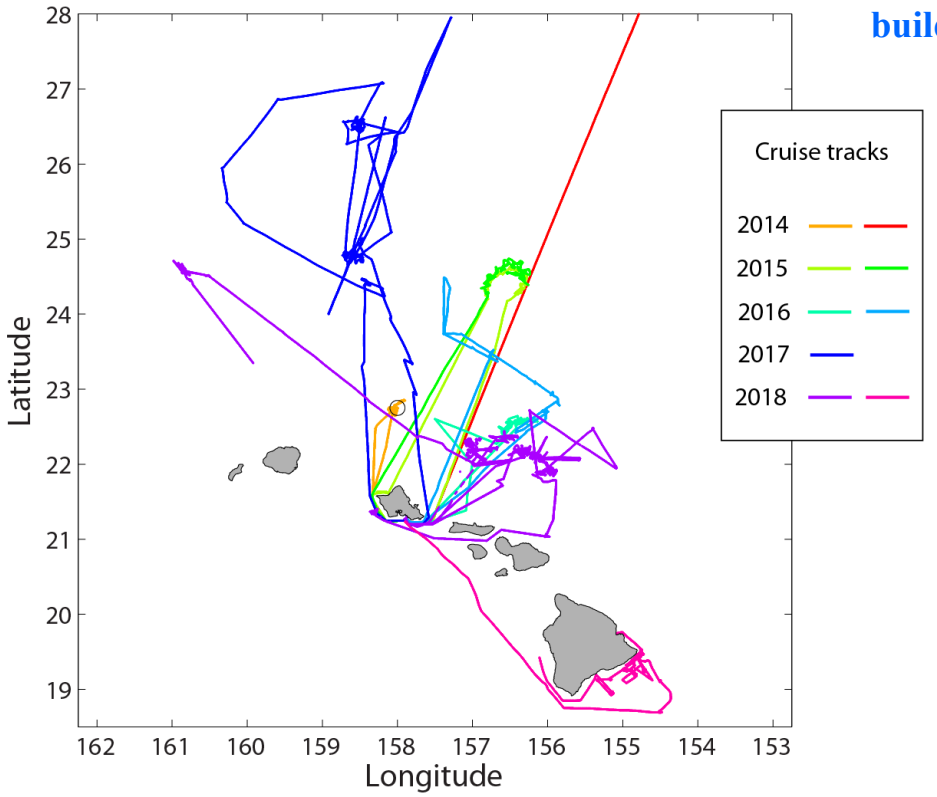
T temperature

G gas (O_2)

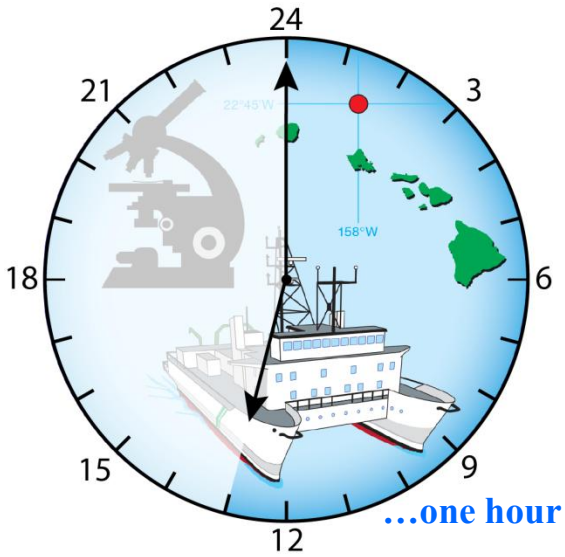
C chlorophyll



SCOPE Field Expeditions: 2014-2020



building the SCOPE legacy…



…one hour at a time

GRADIENTS

HOT-LAVA



Eddies (*Falkor*)

MESO-SCOPE

PDX-HNL transit

HOE-Legacy Series

I **II** **III** **IV**

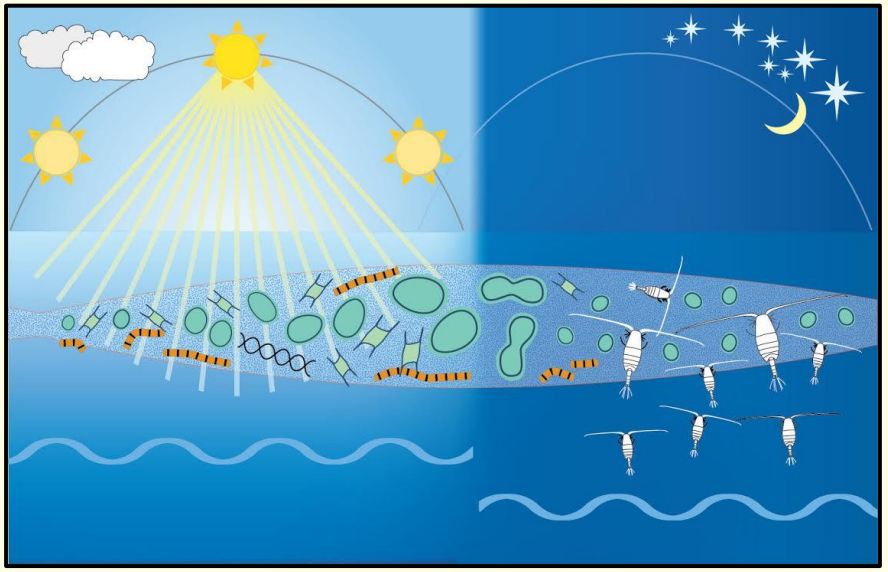
July

Year 1 ***Year 2*** G ***Year 3*** G ***Year 4*** ***Year 5*** G ***Year 6***

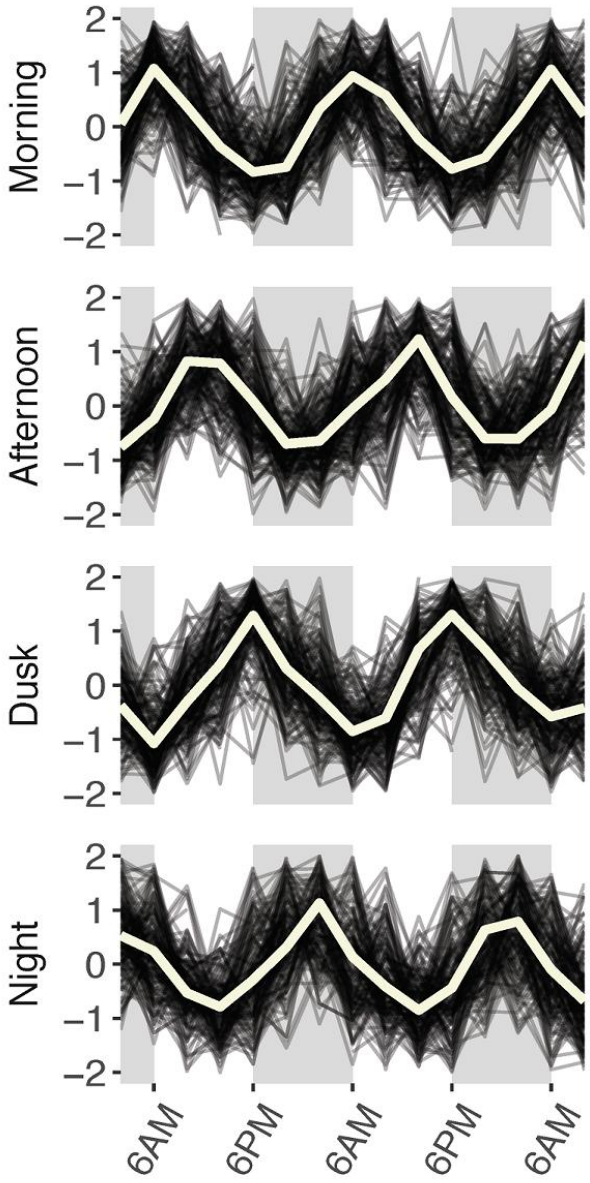
2014 **2015** **2016** **2017** **2018** **2019** **2020**

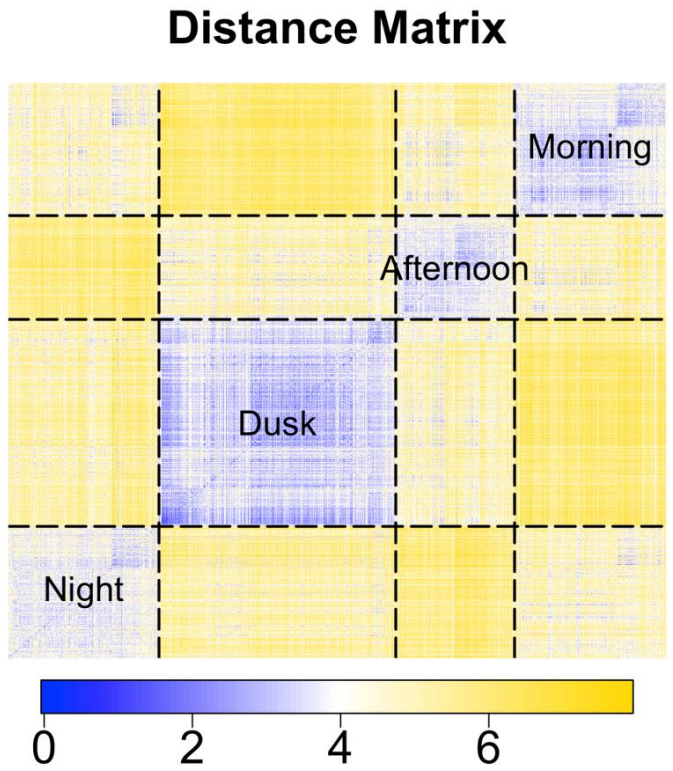
MAHALO: Synthesis and Modeling of Diel Microbial Processes

- **1st major data synthesis effort**
- **MAHALO proposal Dec 2016, workshops for model development**
- **Tripartite approach: Metabolism & Growth, Mortality, Multi-scale ecosystem model**
- **MAHALO status**
  - ***ECLIPSS (Ecological Community with Light, Infection and Phytoplankton Size Structure) model manuscript ready to submit (S. Beckett, J. Weitz et al., Ecological Monographs)***
  - ***Metabolism & Growth manuscript circulating (D. Muratore, J. Weitz et al.)***
  - ***Mortality workshop, Sept 2019 (D. Lindell and D. Caron, co-leads)***
  - ***Presentation planned for 2019 Annual Meeting***



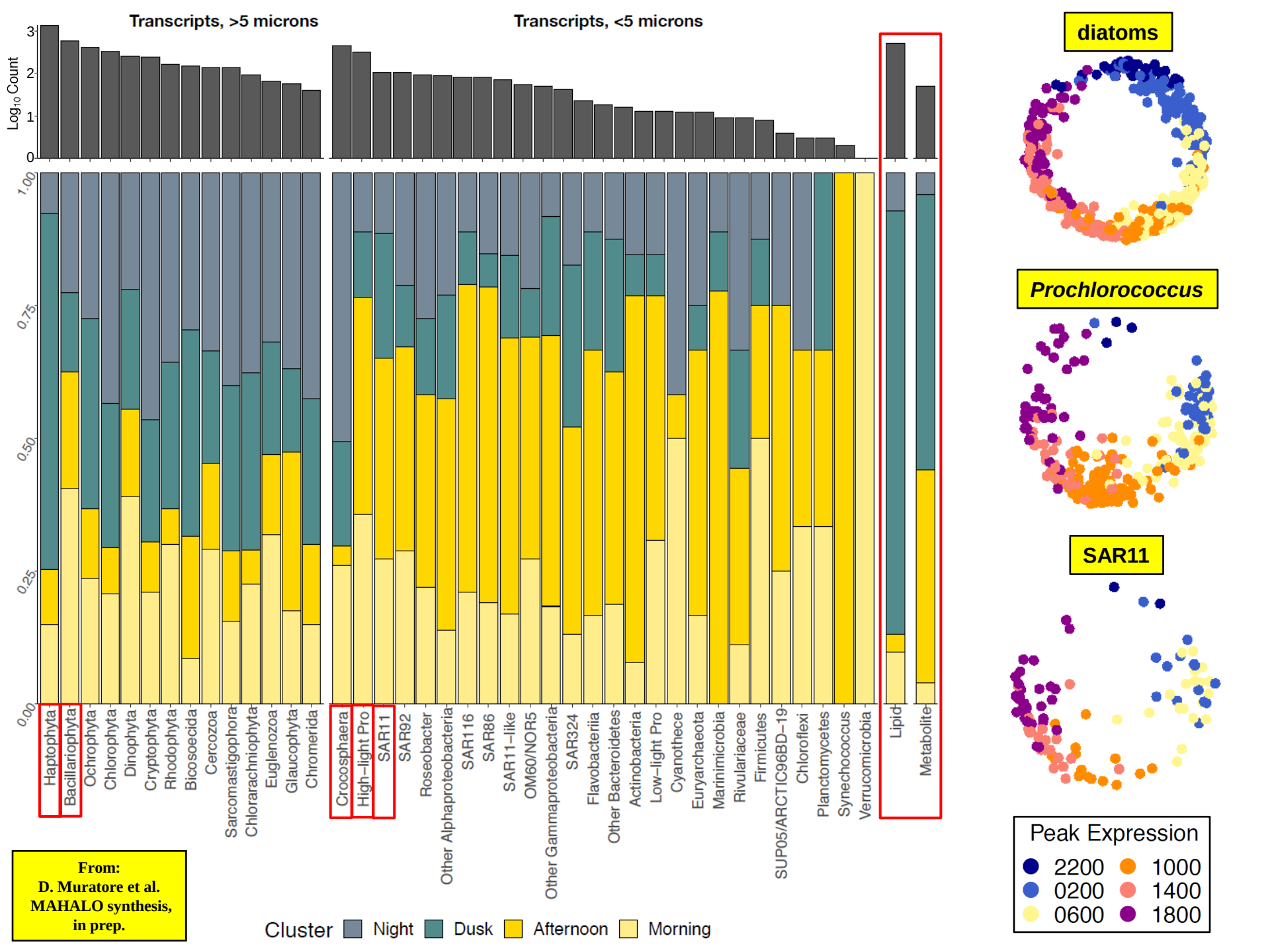
Multiomics Diel Patterns at Station ALOHA





- **Clustering analysis of 6273 periodic signals in transcripts, lipids and metabolites**
- **4 unique time-series patterns**

From: D. Muratore et al., MAHALO synthesis, in prep.


Transcripts, >5 microns
Transcripts, <5 microns
Log10 Count
0
1
2
3
0.00
0.25
0.50
0.75
1.00
Haptophyta
Bacillariophyta
Ochrophyta
Chlorophyta
Dinophyta
Cryptophyta
Rhodophyta
Bicosoecida
Cercozoa
Sarcomastigophora
Chlorarachniophyta
Euglenozoa
Glaucophyta
Chromerida
Crocosphaera
High−light Pro
SAR11
SAR92
Roseobacter
Other Alphaproteobacteria
SAR116
SAR86
SAR11−like
OM60/NOR5
Other Gammaproteobacteria
SAR324
Flavobacteriia
Other Bacteroidetes
Actinobacteria
Low−light Pro
Cyanothece
Euryarchaeota
Marinimicrobia
Rivulariaceae
Firmicutes
SUP05/ARCTIC96BD−19
Chloroflexi
Planctomycetes
Synechococcus
Verrucomicrobia
Lipid
Metabolite
Cluster
Night
Dusk
Afternoon
Morning
diatoms
Prochlorococcus
SAR11
Peak Expression
2200
0200
0600
1000
1400
1800
From:
D. Muratore et al.
MAHALO synthesis,
in prep.

MESO•SCOPE

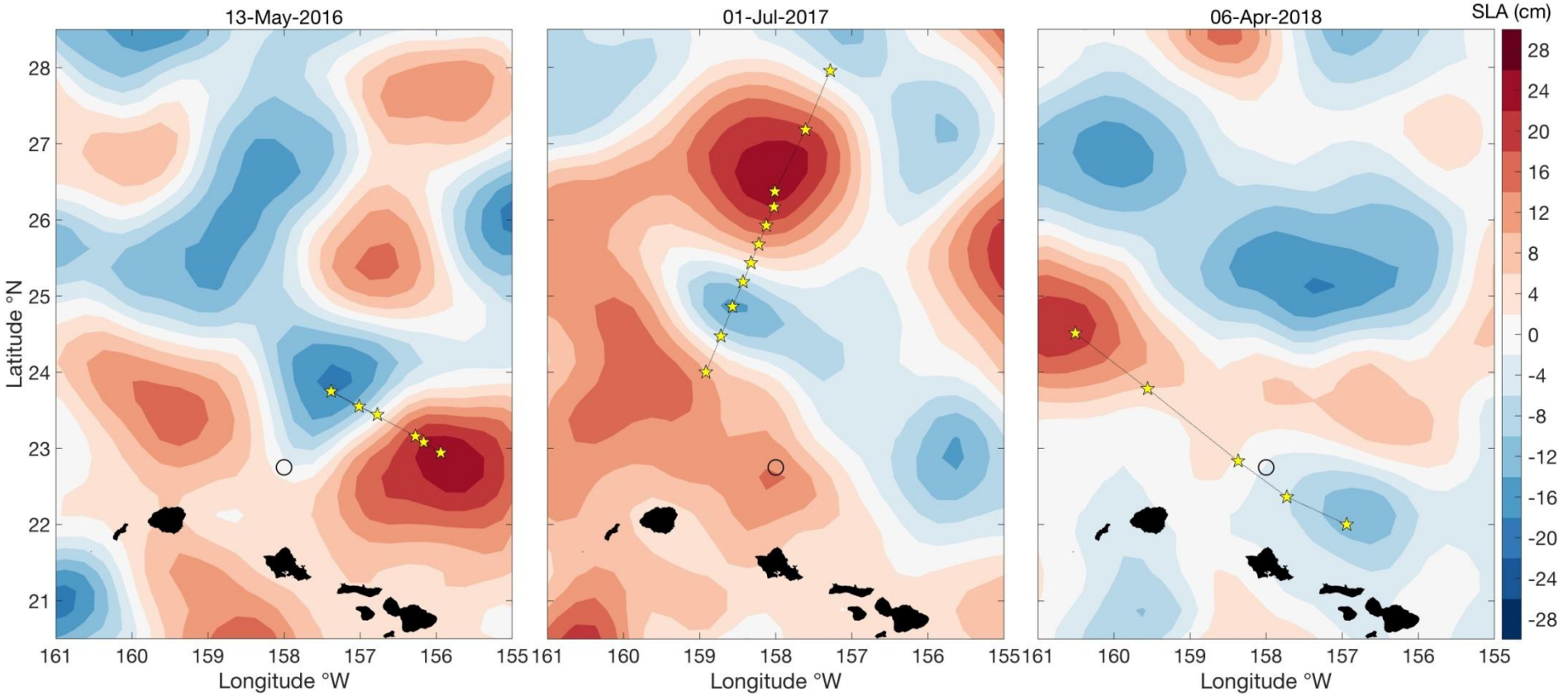
Microbial Ecology of the Surface Ocean

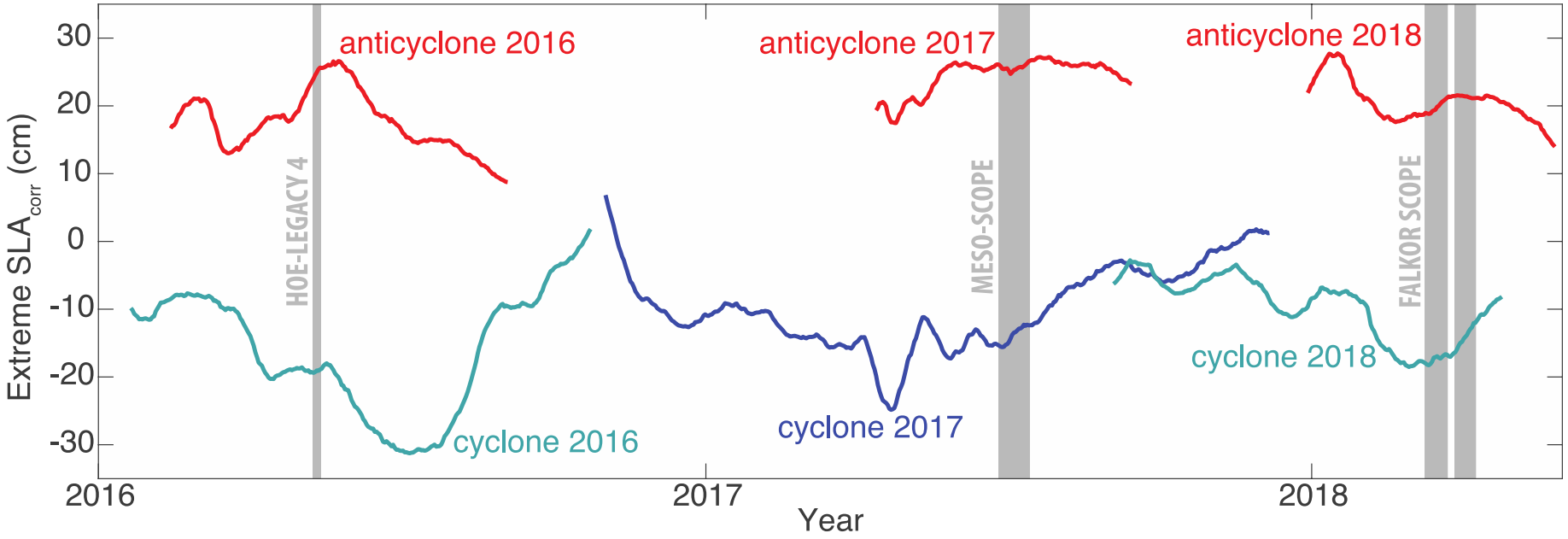
Synthesis & Modeling Project

HOE-LEGACY 4
(9-14 May 2016)

MESO-SCOPE
(26 June – 17 July 2017)

SCOPE Falkor cruise
(10 March – 10 April 2018)

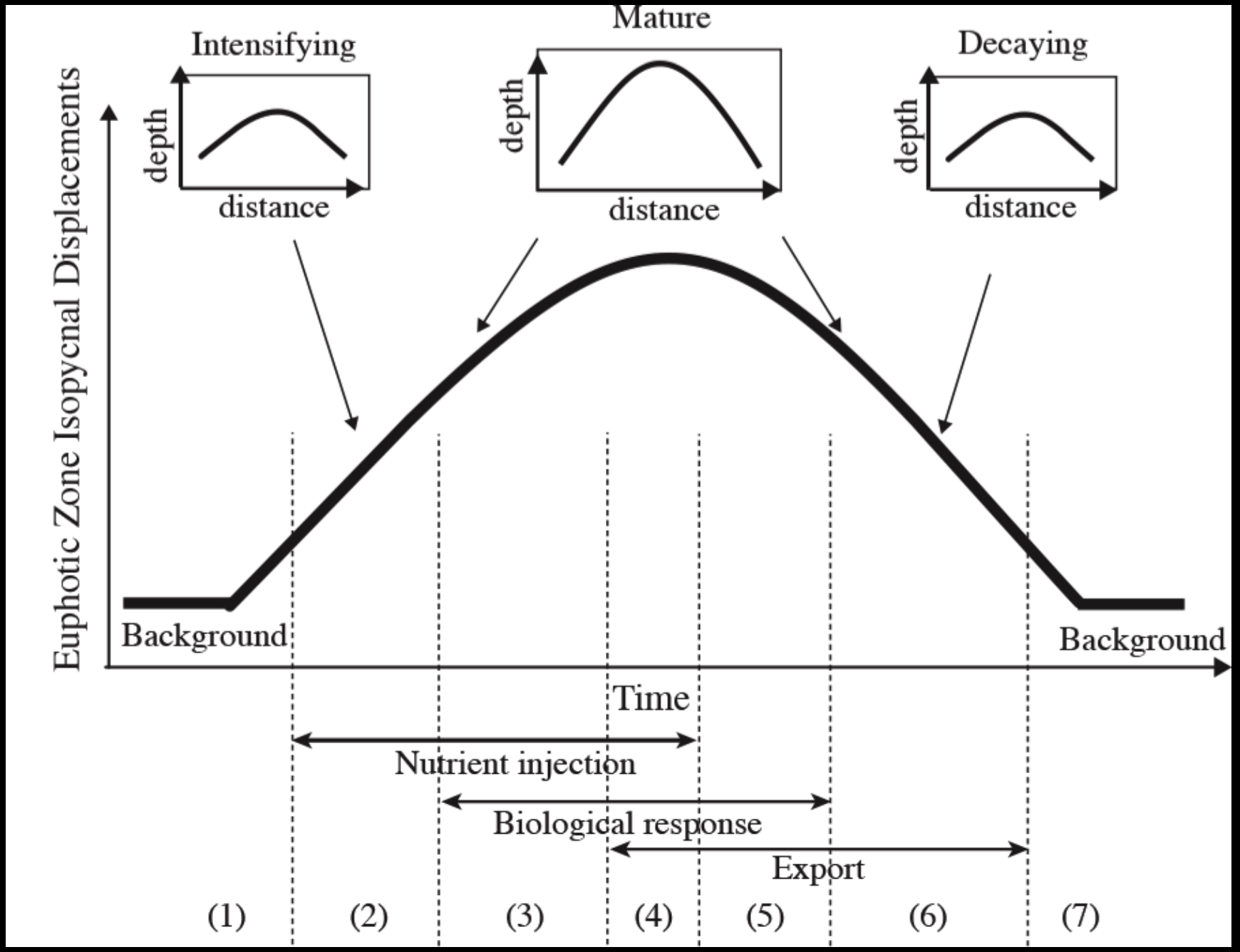




		ANTICYCLONES			CYCLONES		
	SEASON	PHASE	SLA$_{CORR}$	AGE	PHASE	SLA$_{CORR}$	AGE
2016	spring	intensifying	25 cm	88 days	stable	-19 cm	112 days
2017	summer	stable	26 cm	83 days	weakening	-14 cm	246 days
2018*	spring	stable	21 cm	95 days	weakening	-14 cm	212 days

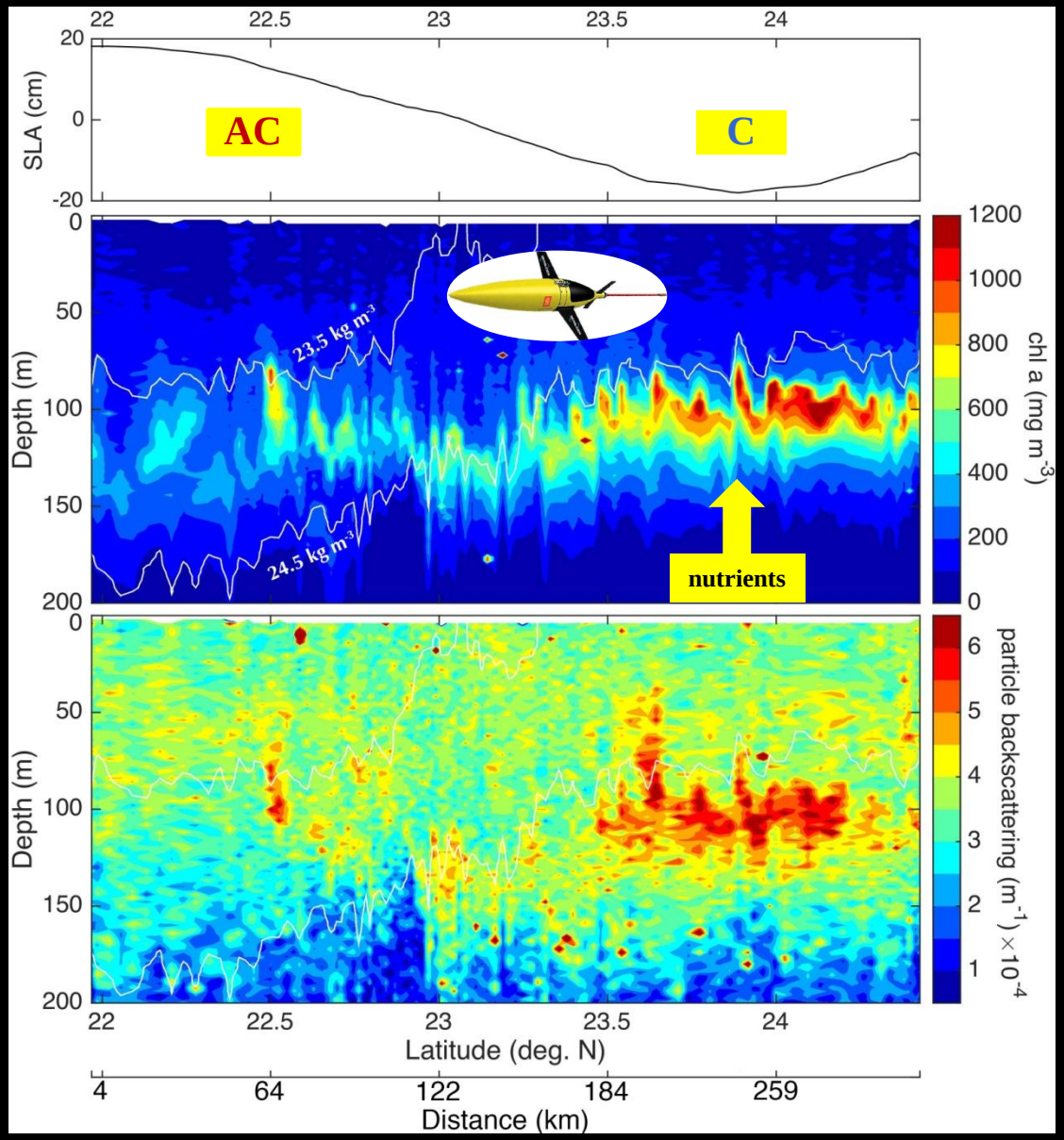
* Leg 2 only

B. Barone and MESO•SCOPE Team

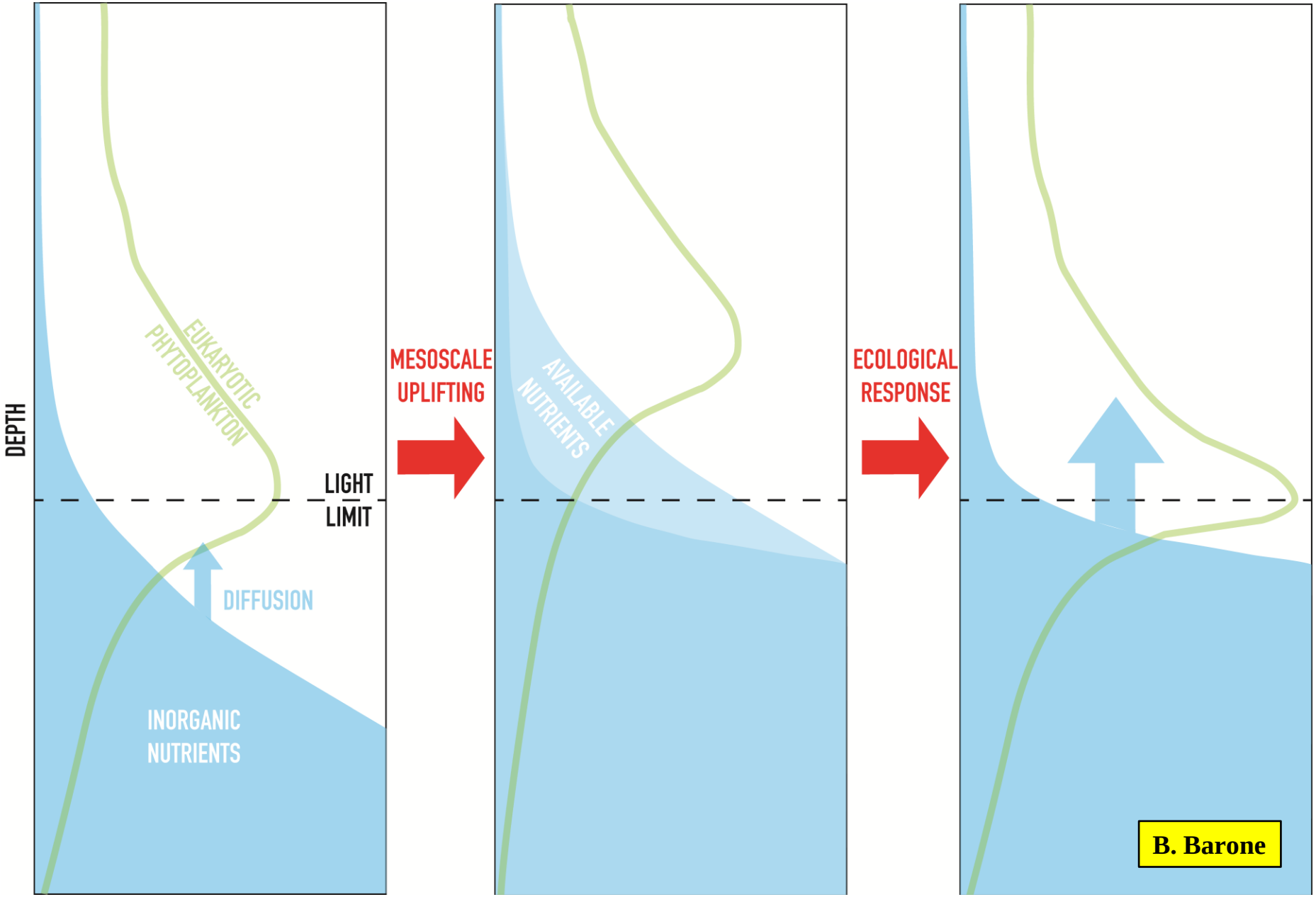


Sweeney et al., 2003

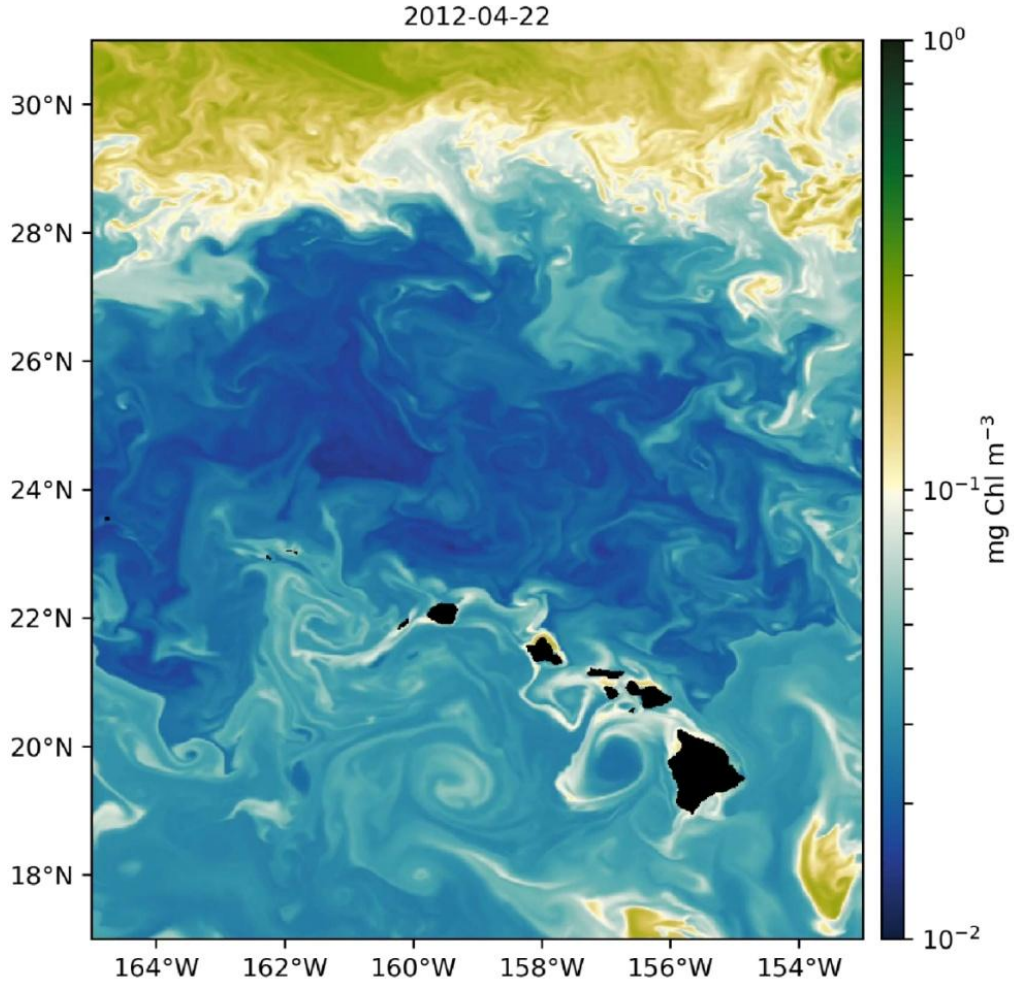
Physical-Biological Interactions in Eddy Ecosystems

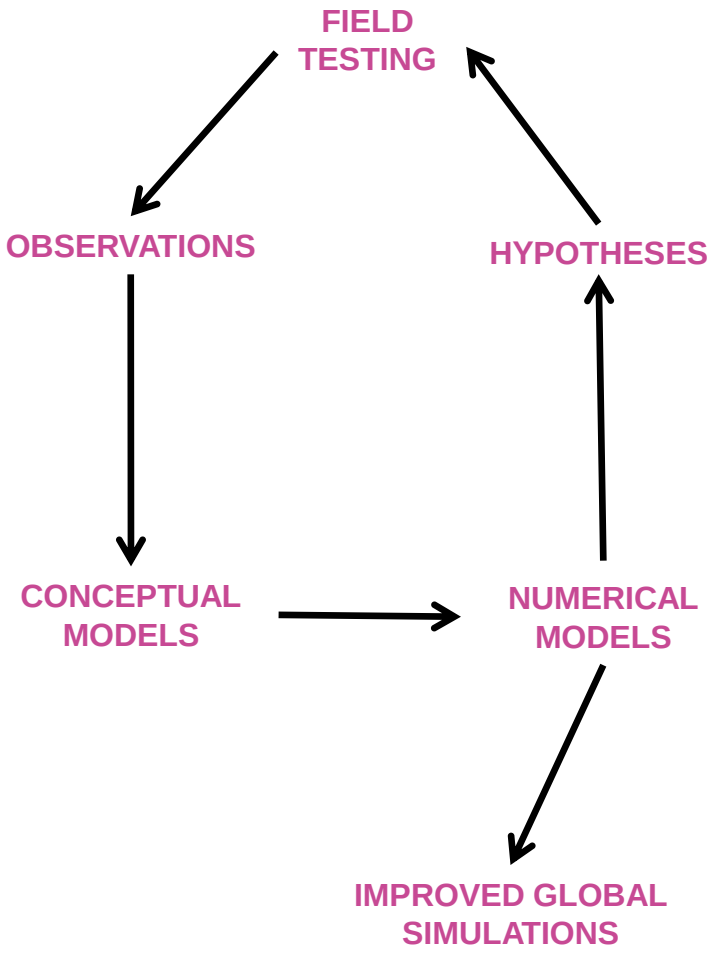


- Dynamical, non steady-state systems
- >70% of all kinetic energy … *the weather of the sea*
- Motions impact nutrient delivery and microbial metabolism
- Eddies change as they move E→W in the NPSG


DEPTH
EUKARYOTIC PHYTOPLANKTON
LIGHT LIMIT
DIFFUSION
INORGANIC NUTRIENTS
MESOSCALE UPLIFTING
AVAILABLE NUTRIENTS
ECOLOGICAL RESPONSE
B. Barone

MESO•SCOPE
Sub-mesoscale Modeling Project





Courtesy of O. Jahn, C. Hill, S. Dutkiewicz, and M. Follows

MESO-SCOPE Project

Timeline

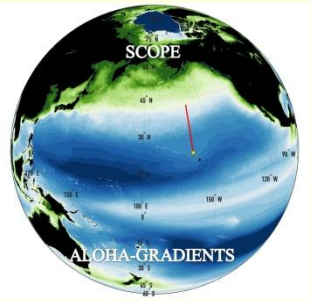
May 9-14, 2016	HOE-LEGACY 4 (KOK1607 aka Dipole cruise, report)
Nov 22, 2016	SCOPE eddy discussion (video, slides)
June 26 - Jul 15, 2017	MESO-SCOPE cruise (KM1709, report)
Dec 5, 2017	Report during SCOPE annual meeting (slides)
March 10-24, 2018	SCOPE Falkor cruise leg 1 (FK180310, report)
March 28-Apr 10, 2018	SCOPE Falkor cruise leg 2 (FK180310, report)
Nov 27, 2018	MESO-SCOPE planning meeting (video, slides)
Dec 3-5, 2018	SCOPE annual meeting: report (slides) and working groups
Jun 11, 2019	MESO-SCOPE Symposium (agenda, slides, video 1, video 2)

Working Groups

- Horizontal & Temporal Variability
  - PI : M. Church
  - Young Investigators : N. Hawco, F. Henderikx, U. Sheyn
- Nitrogen Fixation
  - PI : J. Zehr
  - Young Investigators : M. Dugenne, R. Gradoville
- Modeling
  - PI : M. Follows
  - Young Investigators : K. Evans, C. Follett

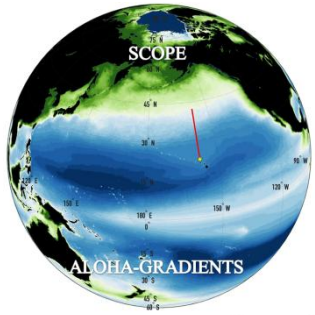
Upcoming Activities

- Meeting, 15 min talks (Oct 2019)
- Working group meetings (Oct/Nov 2019)
- Working group reports in NY (Dec 2019)
- All hands meeting in early spring (2020)

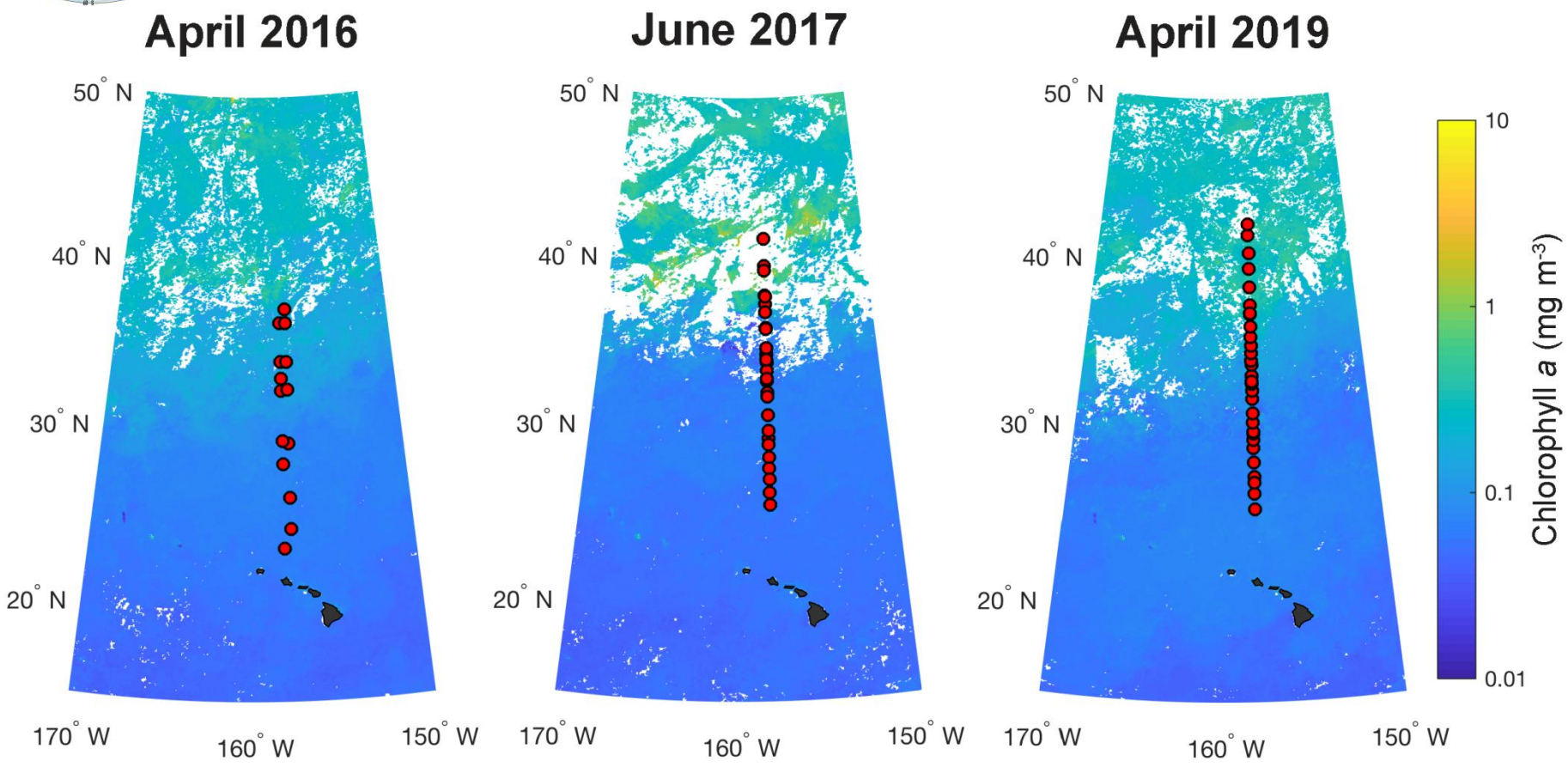


SCOPE-Gradients: *Model-driven Investigations of Ocean Transition Zones*

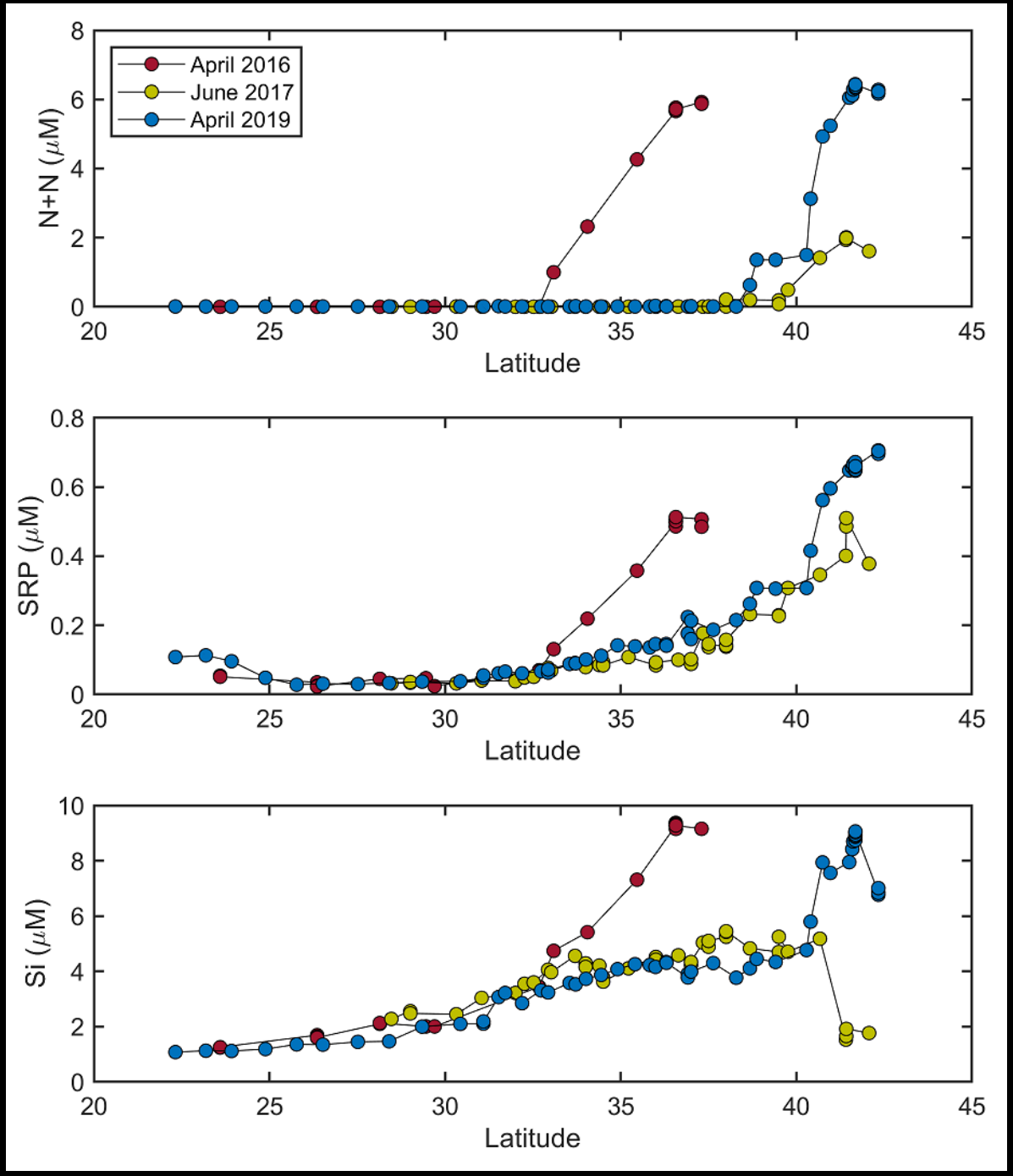
- **E. Virginia Armbrust – Director and lead PI**
- **Three cruises to date to examine habitat variability, microbial community structure and ecosystem dynamics along the gradient in light, temperature, nutrients, turbulence, phytoplankton size structure, productivity and export, with a focus on transition zones**
- **To test specific hypotheses as well as conceptual and numerical models of ecosystem and biogeochemical organization**
- **To develop new ecological theories on phytoplankton size structure and nutrient resource supply ratio impacts on elemental stoichiometry, productivity and export**

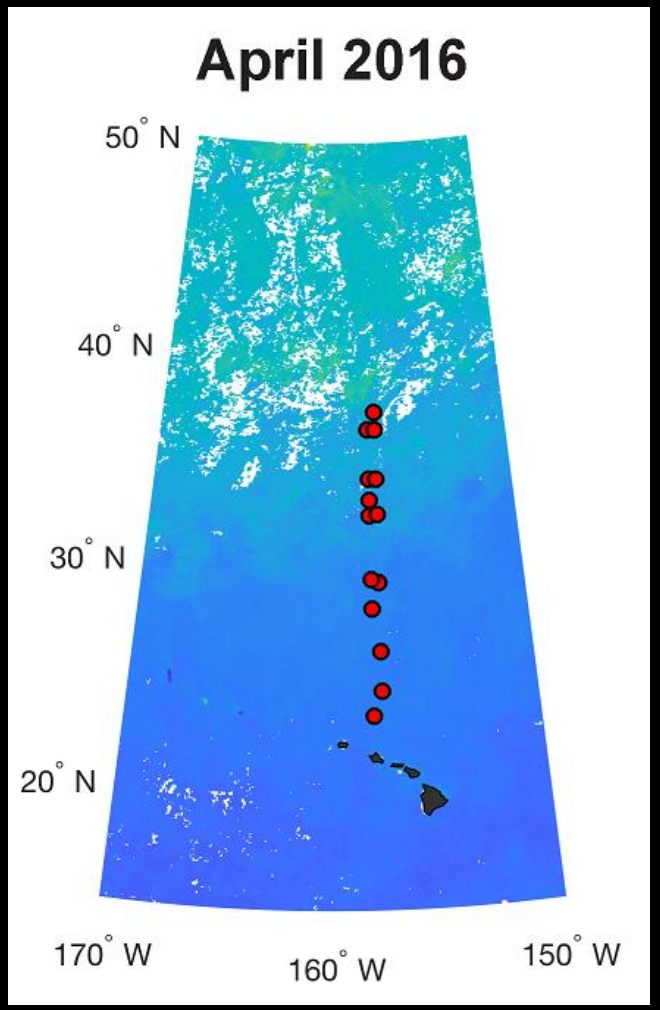


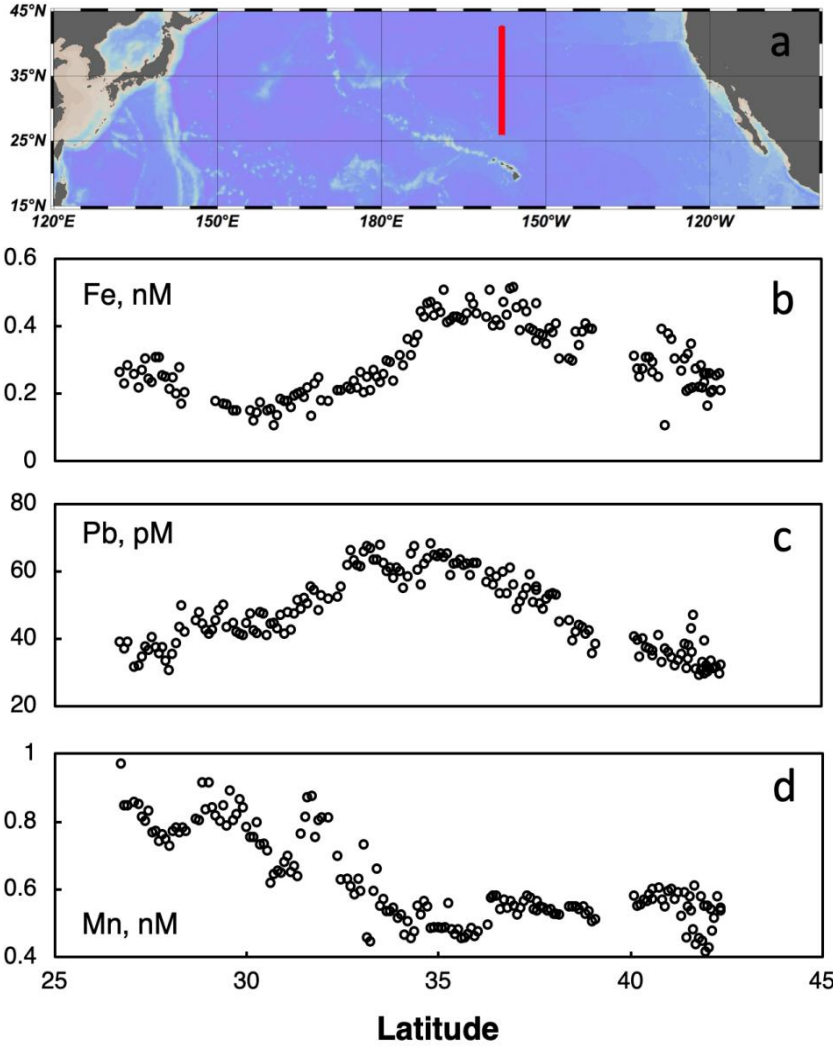
SCOPE-Gradients Expeditions



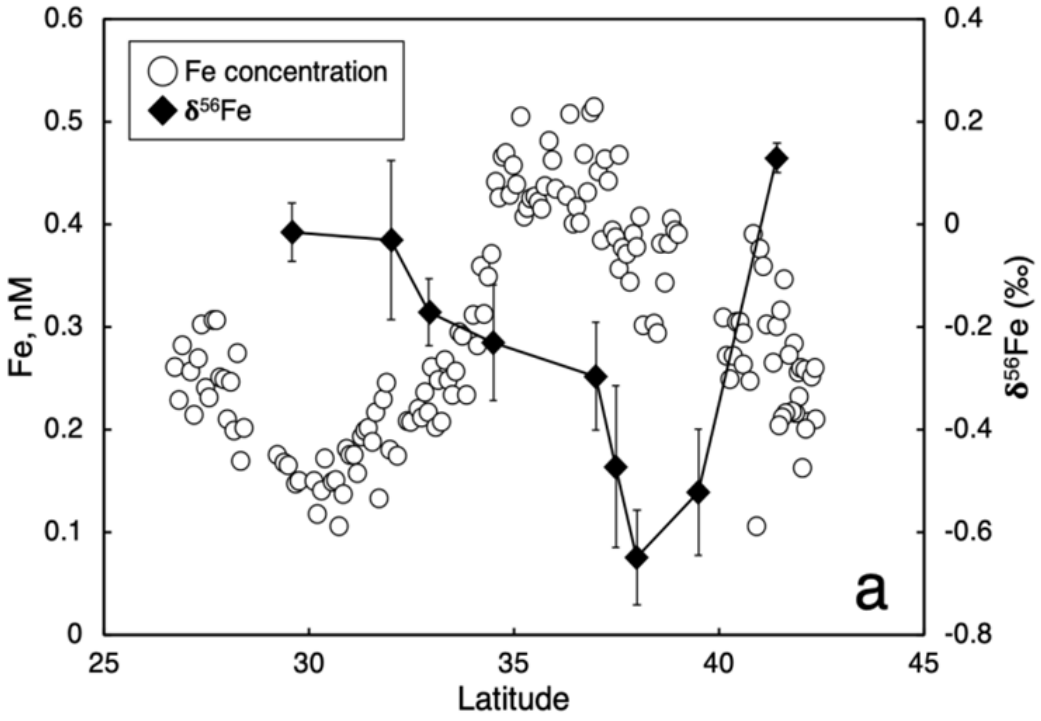
Laboratories of Armbrust, Bundy, Finkel, Follows, Ingalls, Juranek, Karl, Lindell, White, Zehr, and SCOPE ops field team

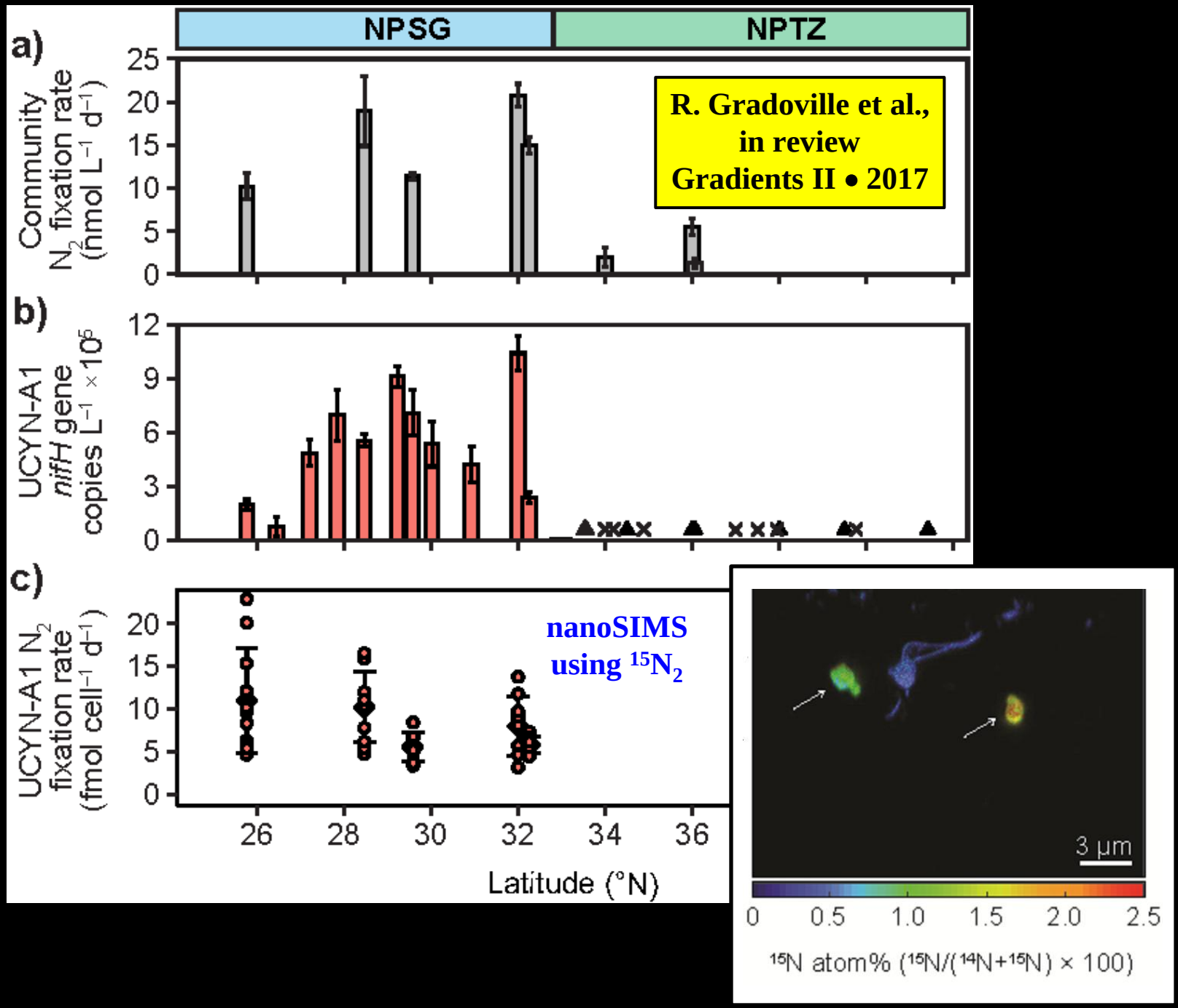

April 2016
June 2017
April 2019
N+N (μM)
SRP (μM)
Si (μM)
Latitude
20
25
30
35
40
45

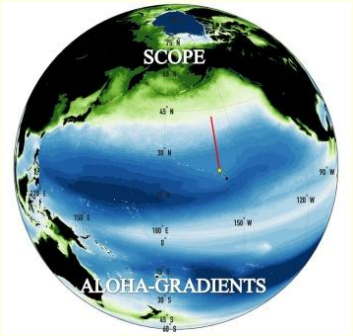

April 2016
50° N
40° N
30° N
20° N
170° W
160° W
150° W



- **Gradients II • 2017**
- **Peak in Fe and Pb due to anthropogenic, pollutant atmospheric inputs**
- **P. Pinedo-Gonzalez et al., in review**



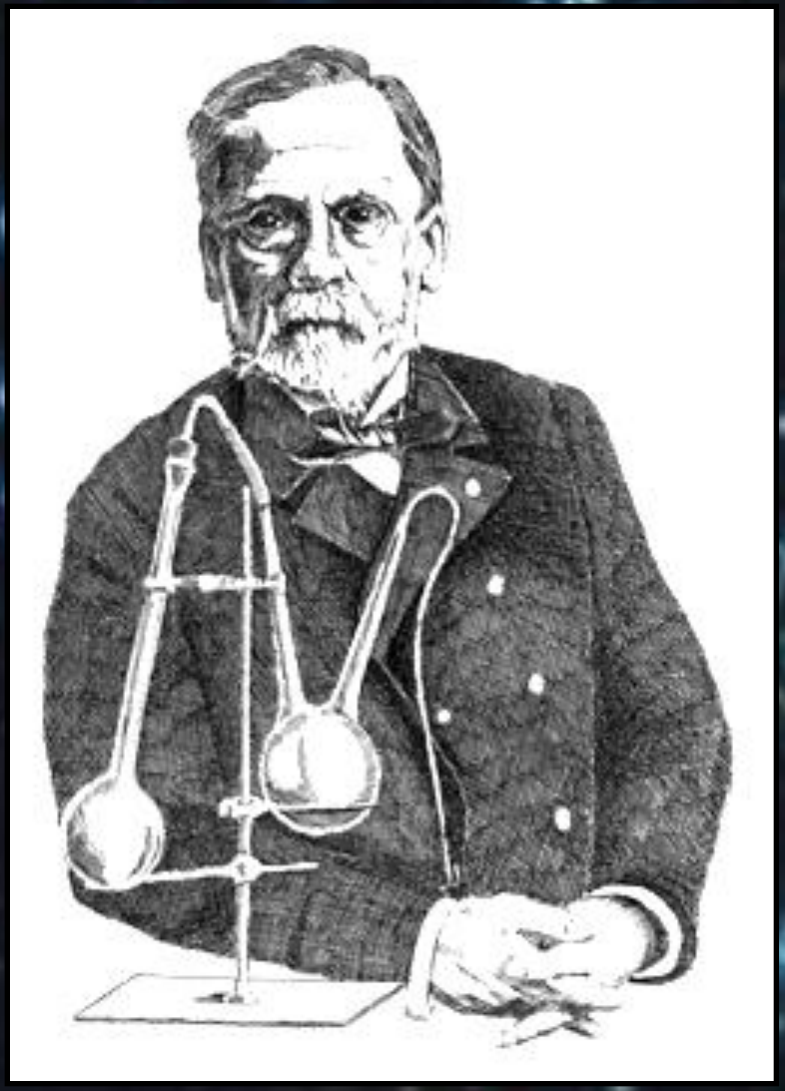

NPSG
NPTZ
a)
Community N_2 fixation rate (nmol L^{-1} d^{-1})
25
20
15
10
5
0
R. Gradoville et al., in review
Gradients II • 2017
b)
UCYN-A1 *nifH* gene copies L^{-1} $\times 10^5$
12
9
6
3
0
c)
UCYN-A1 N_2 fixation rate (fmol $cell^{-1}$ d^{-1})
20
15
10
5
0
nanoSIMS using $^{15}N_2$
26
28
30
32
34
36
Latitude (°N)
3 µm
0
0.5
1.0
1.5
2.0
2.5
^{15}N atom% (^{15}N/(^{14}N+^{15}N) × 100)



SCOPE Gradients: Data Synthesis Workshop

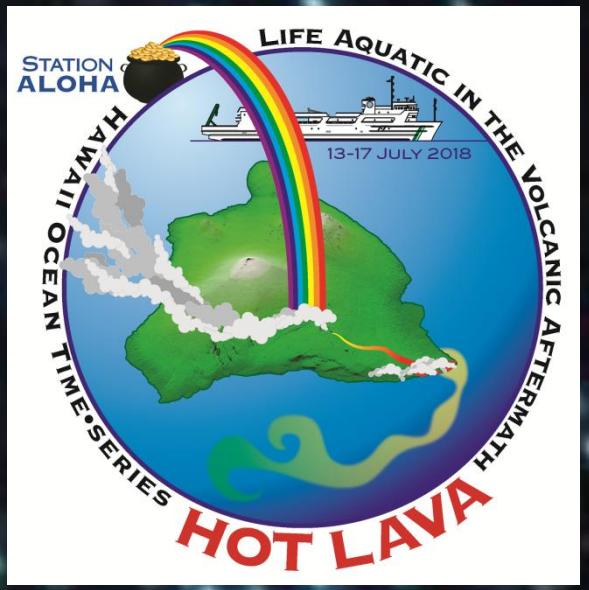
15-17 October 2019, Seattle, WA

- **3 working groups**
  - ***Physical oceanography, macro-nutrients, trace elements, circulation models (Randelle Bundy et al.)***
  - ***Organism distributions, productivity, Darwin model (Sara Ferrón et al.)***
  - ***Stoichiometry, metabolites, metatranscriptomes (Bryn Durham et al.)***
- **Most data are already available, several manuscripts are published or in review, and a major synthesis manuscript (v. 2.0) has already been distributed to prospective co-authors for further development at the Seattle workshop.**



Louis Pasteur

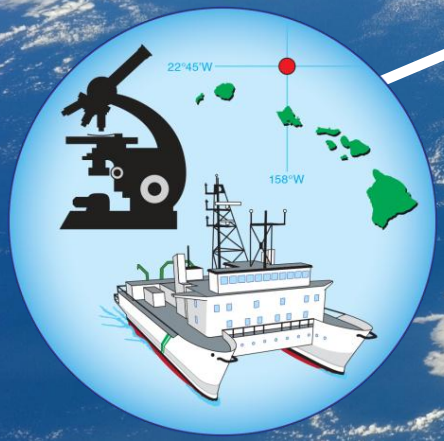
“In the field of observation, chance favours only the prepared mind”



"…the loveliest fleet of islands that lies anchored in any ocean…"
Samuel Langhorne Clemens, 1866

ALOHA

est. 1988

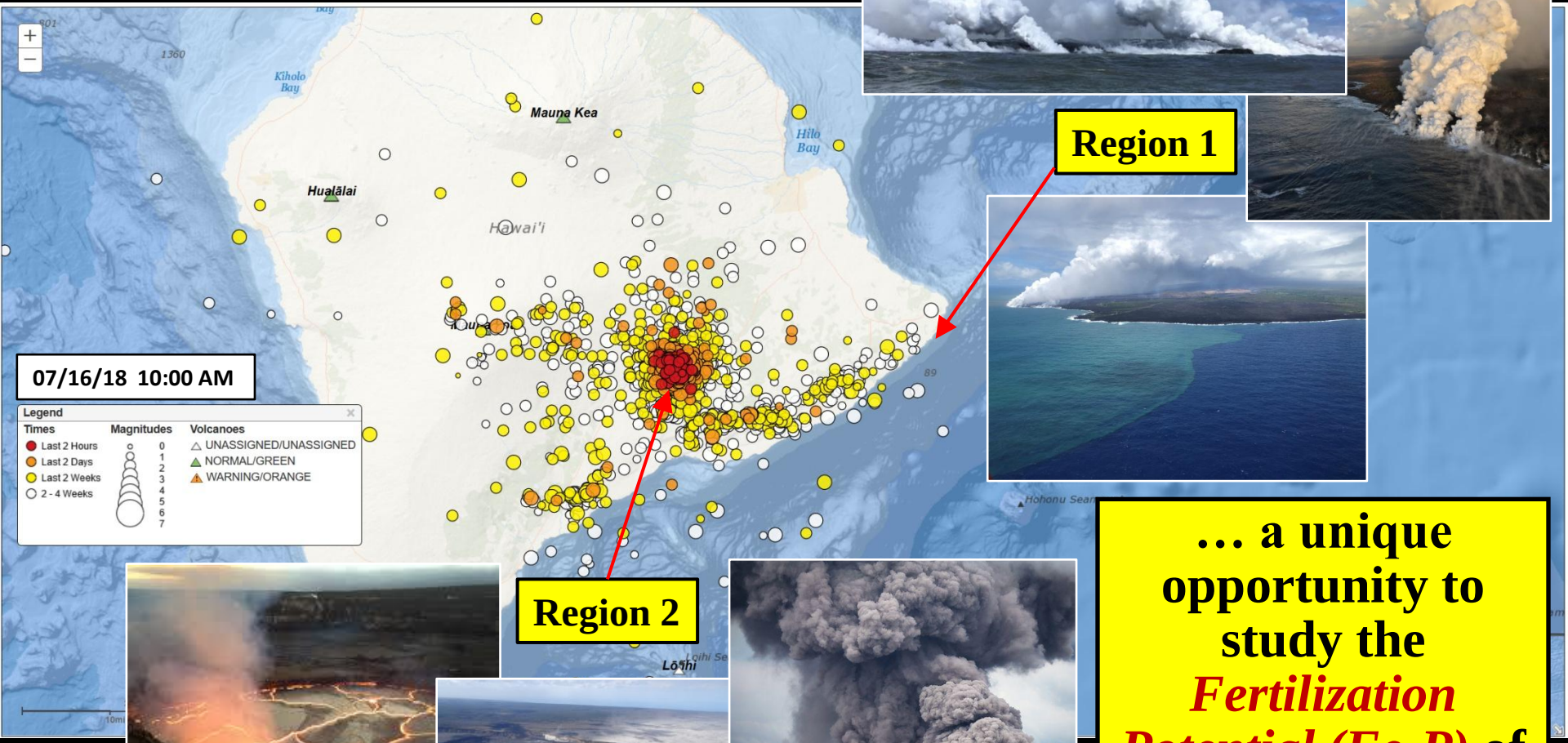


est. ~0.7 MYA



The *Sleeping Giant* Awakens

4 May 2018 • 6.9 mag. EQ





Region 1

Region 2



… a unique opportunity to study the *Fertilization Potential (Fe-P)* of a volcanic eruption

HOT-LAVA I
13-17 July 2018

R/V *K-O-K*: Observations, sample collections, incubations and deployment of autonomous vehicles

Hilo Bay, Friday 13 July





homeward bound! S. T. Wilson, Chief Scientist

REPORT

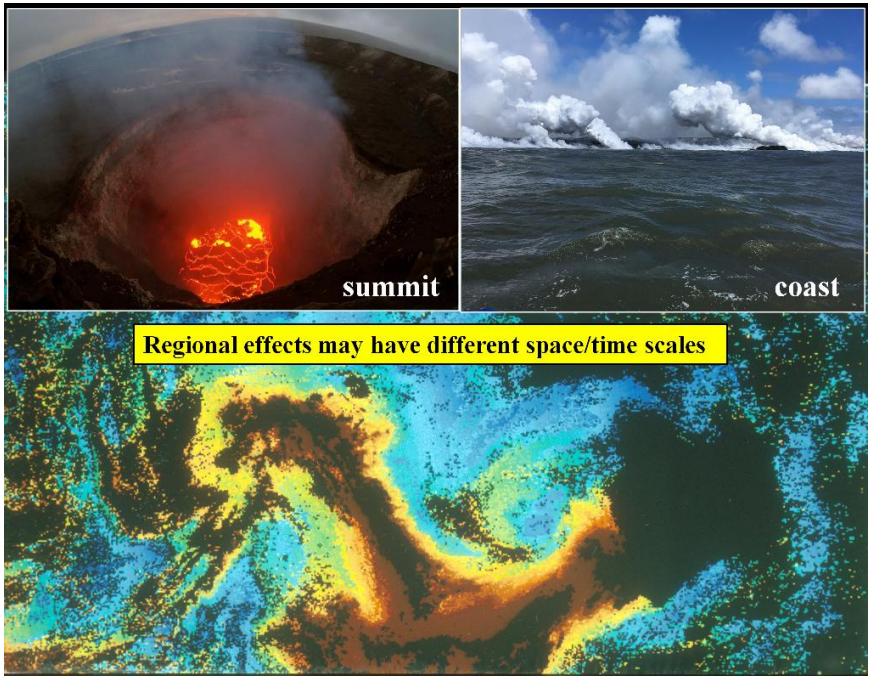
6 SEPTEMBER 2019

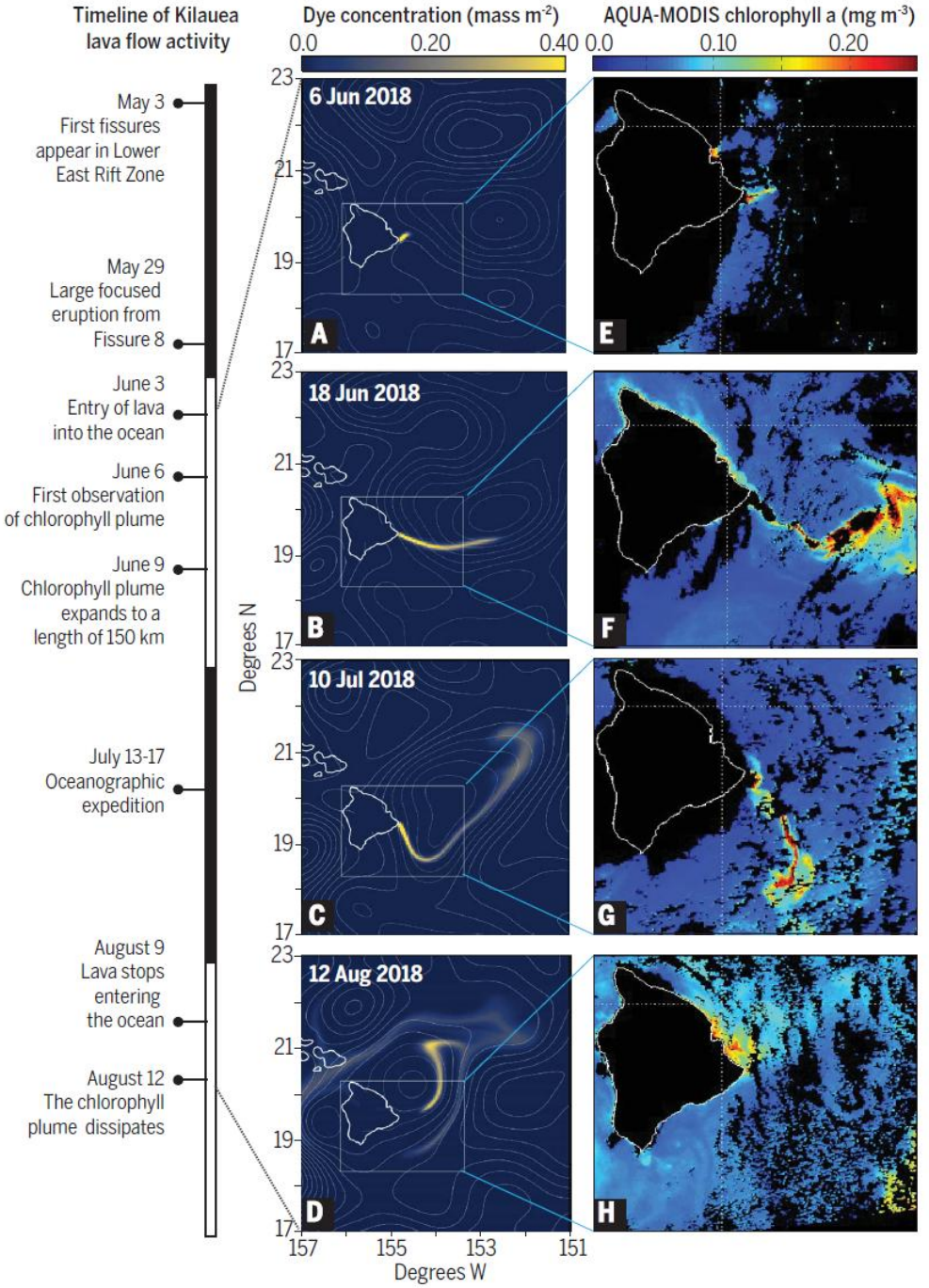
Science
AAAS

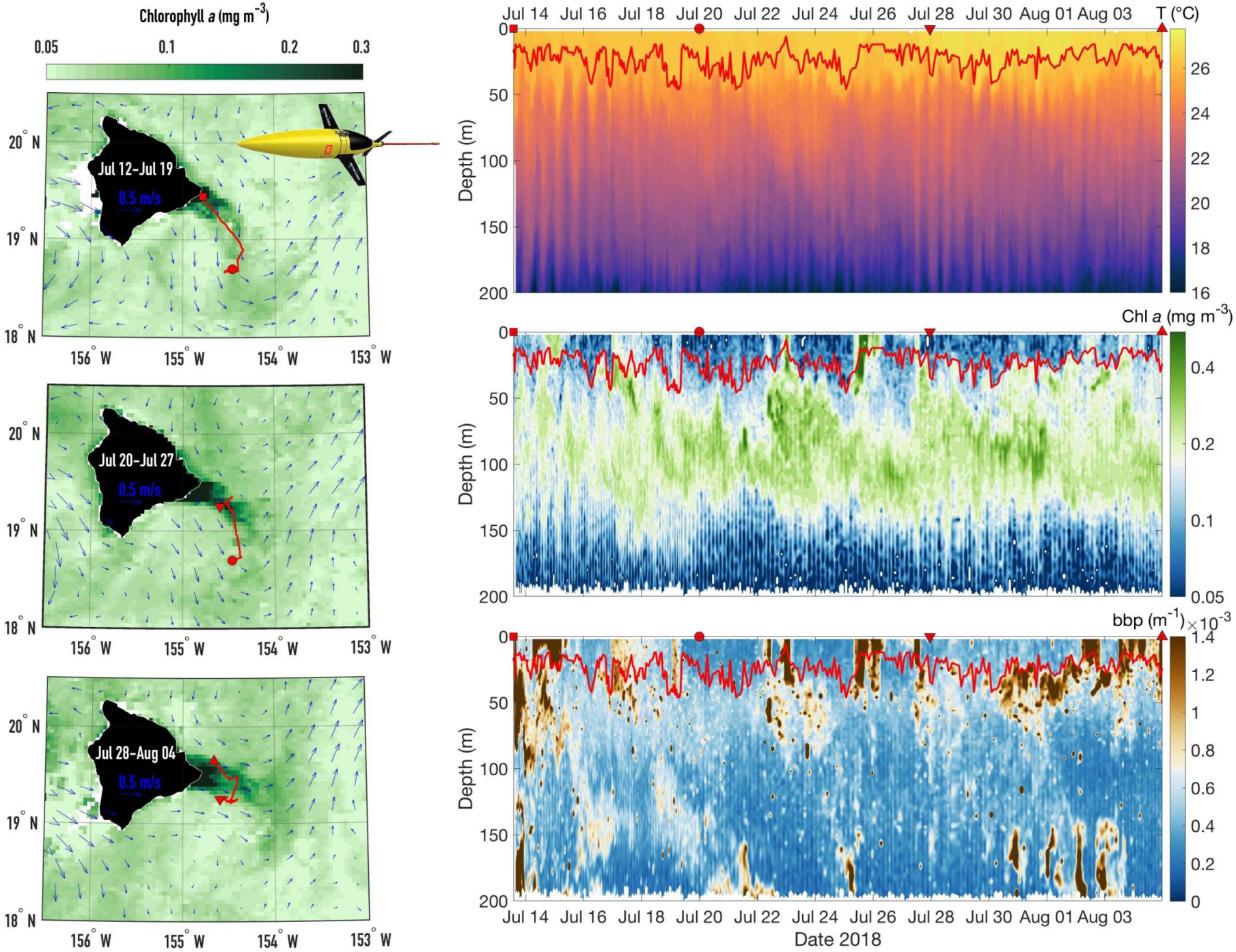
MARINE SCIENCE

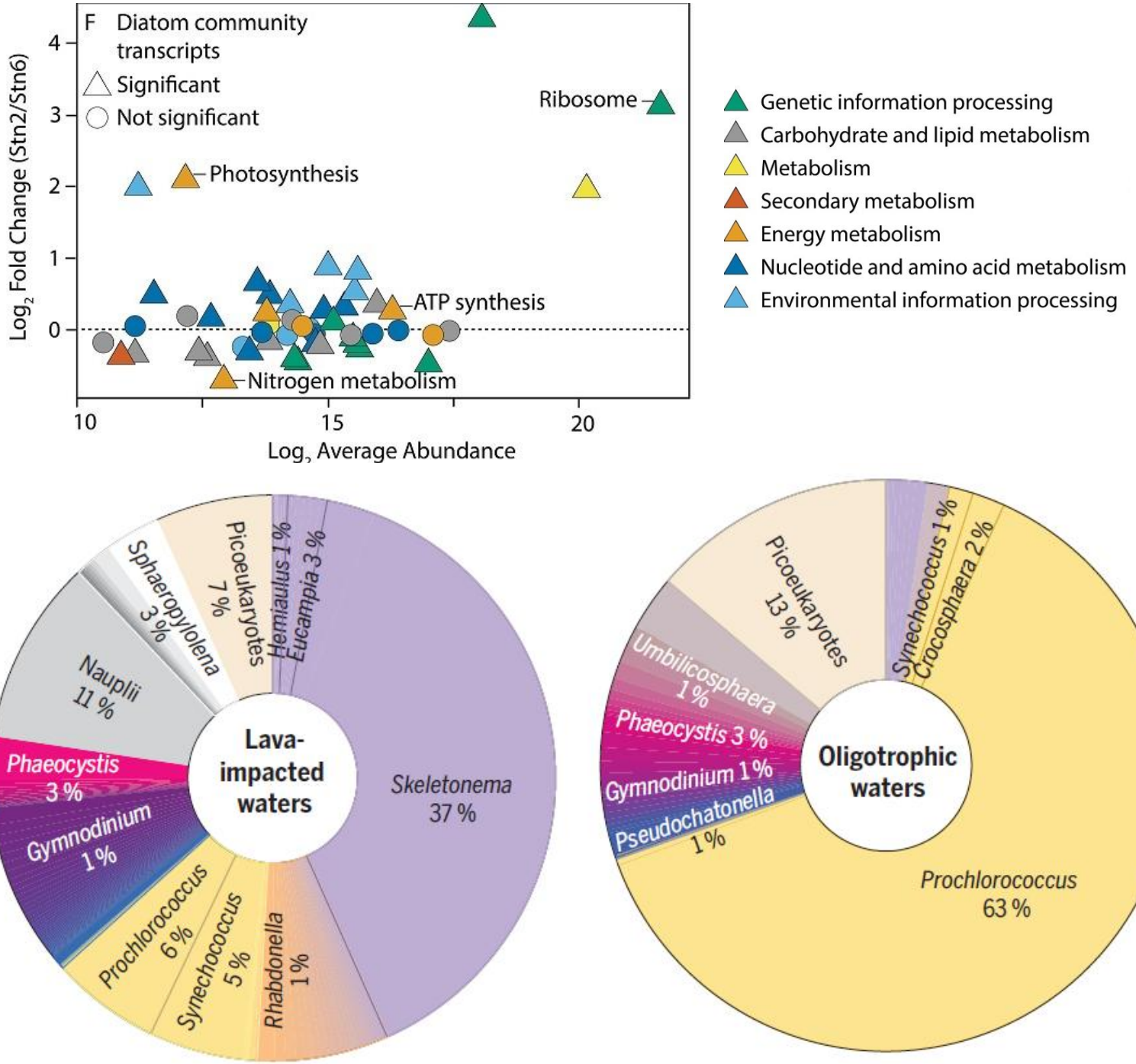
Kīlauea lava fuels phytoplankton bloom in the North Pacific Ocean

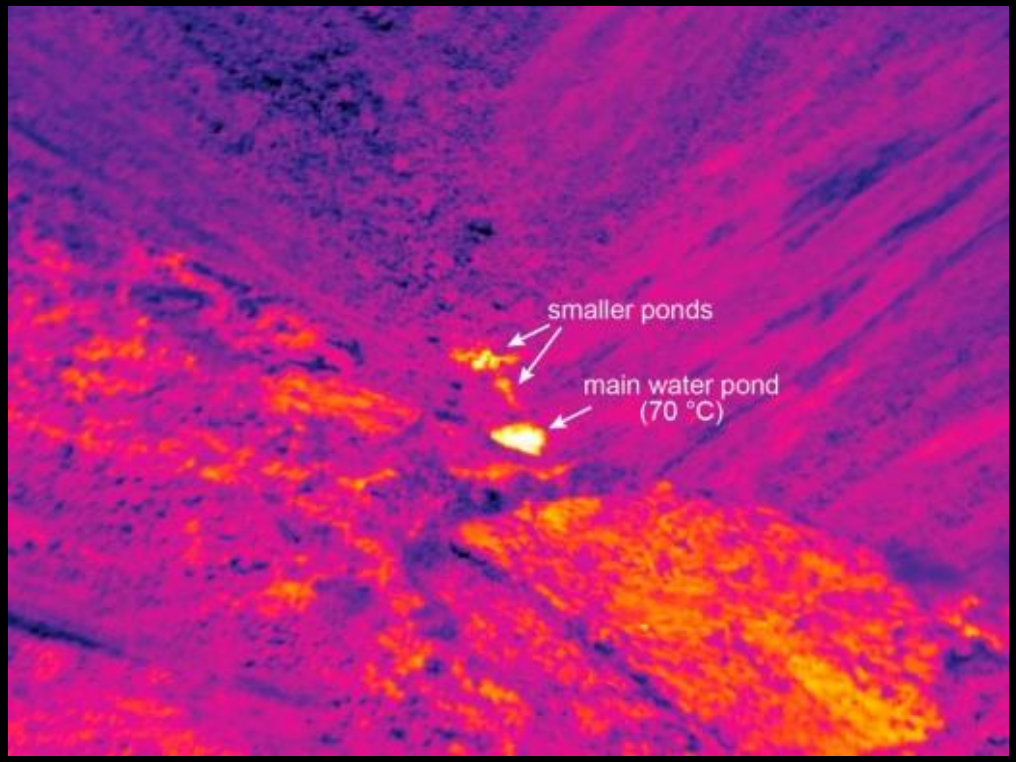
Samuel T. Wilson[1]*†, Nicholas J. Hawco[2]*†, E. Virginia Armbrust[3], Benedetto Barone[1], Karin M. Björkman[1], Angela K. Boysen[3], Macarena Burgos[1], Timothy J. Burrell[1], John R. Casey[1,4], Edward F. DeLong[1], Mathilde Dugenne[1], Stephanie Dutkiewicz[4], Sonya T. Dyhrman[5,6], Sara Ferrón[1], Michael J. Follows[4], Rhea K. Foreman[1], Carolina P. Funkey[1], Matthew J. Harke[6], Britt A. Henke[7], Christopher N. Hill[4], Annette M. Hynes[3], Anitra E. Ingalls[3], Oliver Jahn[4], Rachel L. Kelly[2], Angela N. Knapp[8], Ricardo M. Letelier[9], Francois Ribalet[3], Eric M. Shimabukuro[1], Ryan K. S. Tabata[1], Kendra A. Turk-Kubo[7], Angelicque E. White[1], Jonathan P. Zehr[7], Seth John[2], David M. Karl[1]





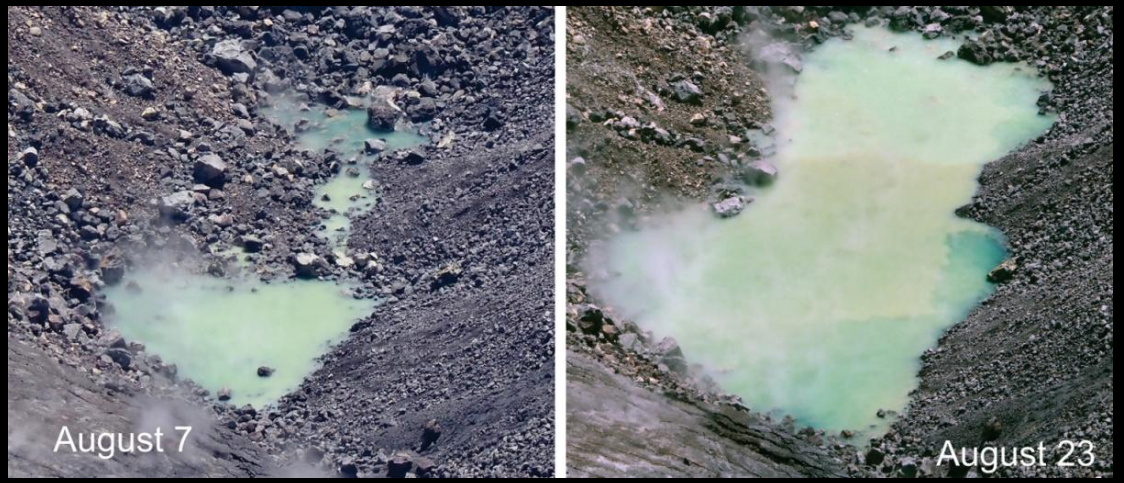

Chlorophyll a (mg m-3)
0.05
0.1
0.2
0.3
Jul 12–Jul 19
0.5 m/s
Jul 20–Jul 27
0.5 m/s
Jul 28–Aug 04
0.5 m/s
20° N
19° N
18° N
156° W
155° W
154° W
153° W
Jul 14 Jul 16 Jul 18 Jul 20 Jul 22 Jul 24 Jul 26 Jul 28 Jul 30 Aug 01 Aug 03
T (°C)
Chl a (mg m-3)
bbp (m-1) ×10-3
Depth (m)
0
50
100
150
200
Date 2018


F Diatom community transcripts
Significant
Not significant
Ribosome
Photosynthesis
ATP synthesis
Nitrogen metabolism
Log2 Fold Change (Stn2/Stn6)
Log2 Average Abundance
Genetic information processing
Carbohydrate and lipid metabolism
Metabolism
Secondary metabolism
Energy metabolism
Nucleotide and amino acid metabolism
Environmental information processing
Lava-impacted waters
Skeletonema 37 %
Rhabdonella 1 %
Synechococcus 5 %
Prochlorococcus 6 %
Gymnodinium 1 %
Phaeocystis 3 %
Nauplii 11 %
Sphaeropylolena 3 %
Picoeukaryotes 7 %
Hemiaulus 1 %
Eucampia 3 %
Oligotrophic waters
Prochlorococcus 63 %
Pseudochatonella 1 %
Gymnodinium 1 %
Phaeocystis 3 %
Umbilicosphaera 1 %
Picoeukaryotes 13 %
Crocosphaera 2 %
Synechococcus 1 %



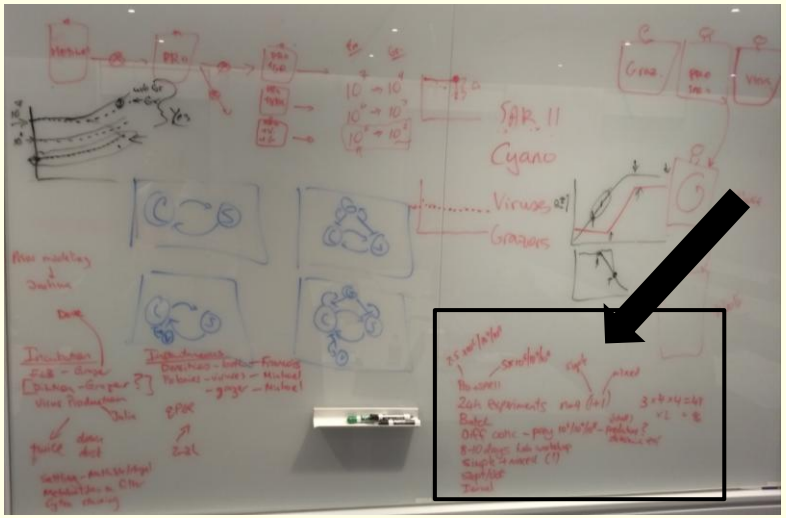
- **Emergence of an unprecedented lake in Halemaumau Crater in the aftermath of Kilauea eruption**
- **SCOPE (with USGS) has applied for a sampling permit**
- **Awaiting approval from NPS *…stay tuned!***



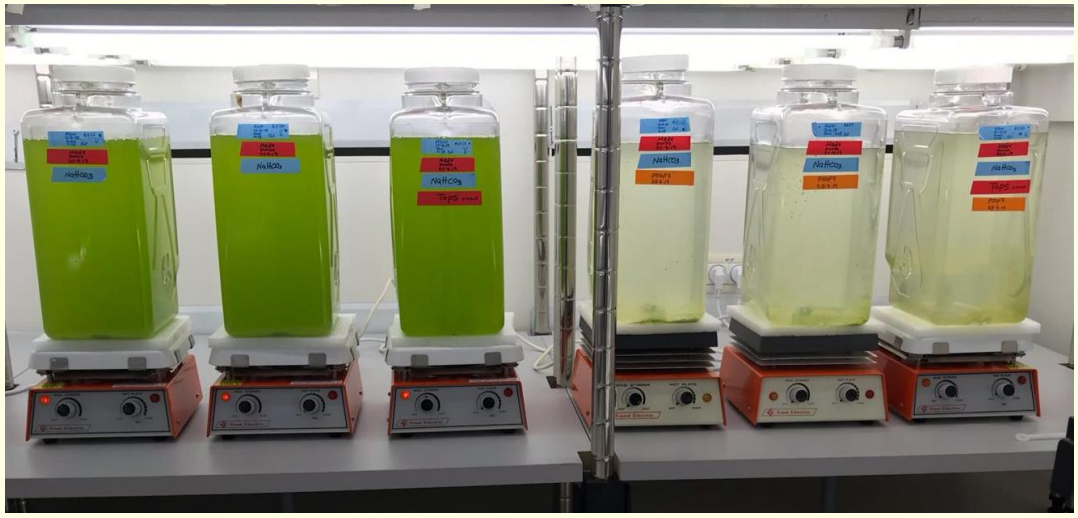


Other Recent/Planned SCOPE Activities

- ***Prochlorococcus*** **Growth-Mortality experimental workshop, Haifa, Israel, Sept 2019**
  - ***8 laboratories / 15 individuals***
  - ***Experimental determination of growth, grazing, viral lysis***
- **D. Lindell / D. Caron – lead investigators**



Dec 2018
NYC - vision



Sept 2019
Haifa - execution

Prochlorococcus: Growth & Mortality

Mother culture

MED 4

Prochlorococcus
1-2x10^8/ml

Treatments

1-C — *Pro:* 10^7/ml

2-LG — *Pro:* 10^7/ml + grazer at low mortality

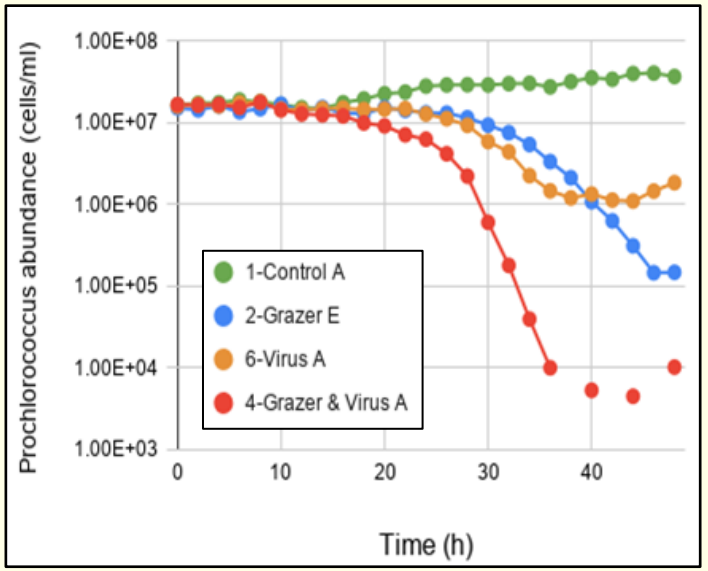
3-LV — *Pro:* 10^7/ml + virus at low mortality

4-LGV — *Pro:* 10^7/ml + grazer + virus at low mortality

5-HG — *Pro:* 10^7/ml + grazer at high mortality

6-HV — *Pro:* 10^7/ml + virus at high mortality

7-HGV — *Pro:* 10^7/ml + grazer + virus at high mortality



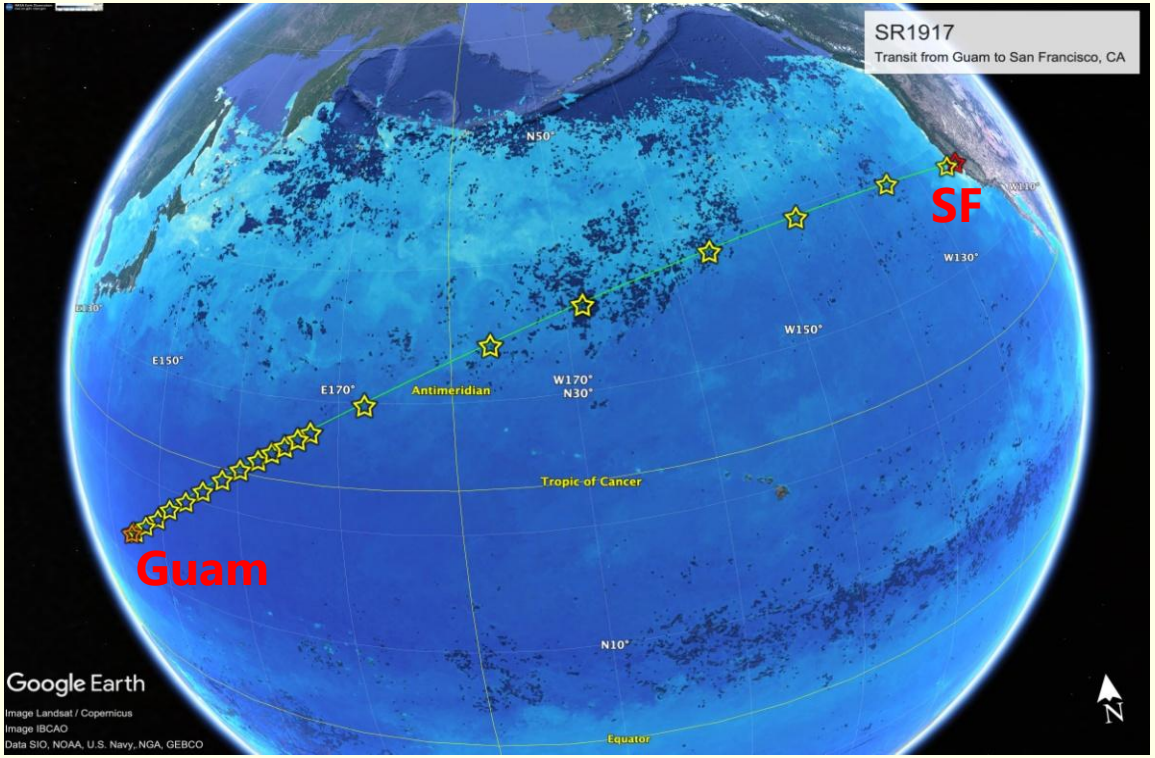


- **Cell/virus abundances**
- **Virus production/ infection %**
- **Grazing rates**
- **DOM dynamics**
- **Transcriptomics, metabolomics, lipidomics**

Other Recent/Planned SCOPE Activities

- **Pacific Cyanobacteria Mortality & ucyn-A and Heterotrophic Nitrogen-fixation: *PaCMAHN* expedition**



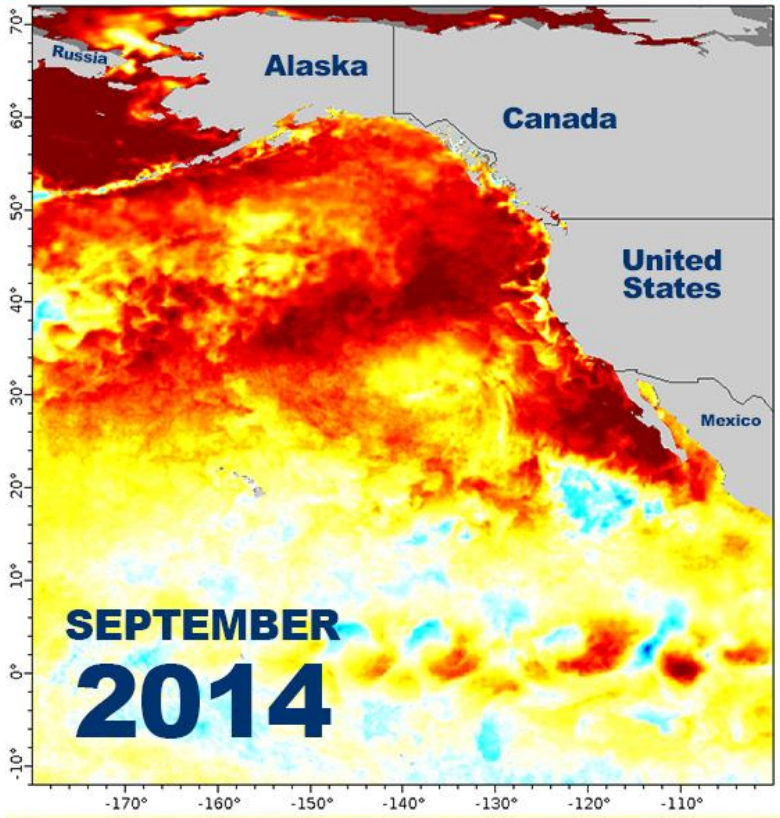


6-28 Nov 2019

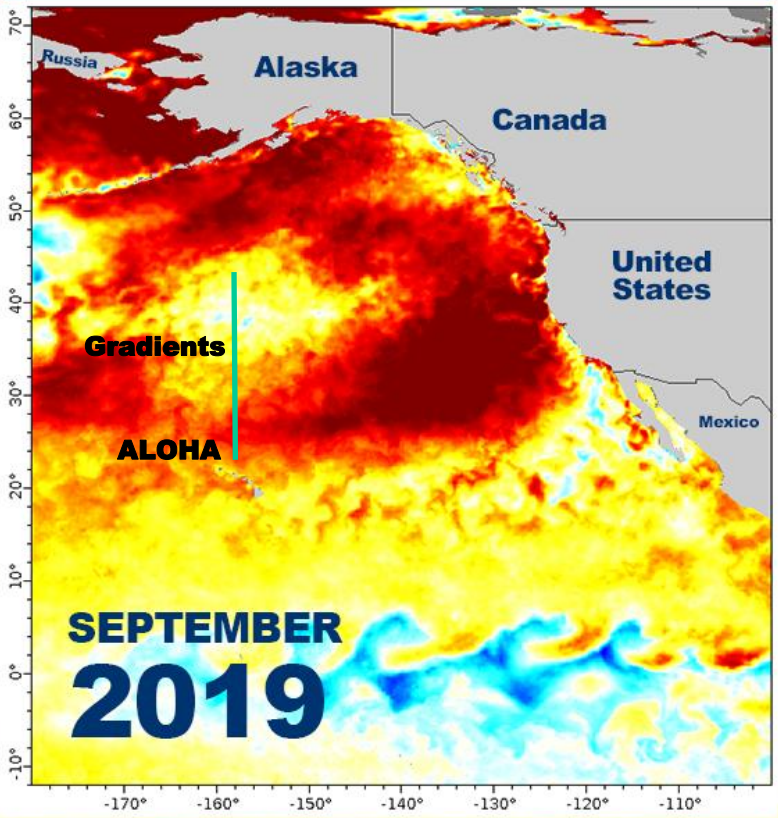
Objectives: **Distribution, rates and controls of N_2 fixation**

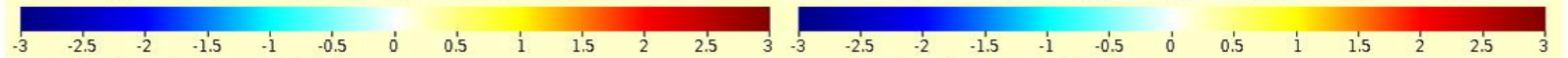
Personnel: **K. Turk-Kubo (C.S.), Zehr, Armbrust, White labs**

As "the Blob" took shape



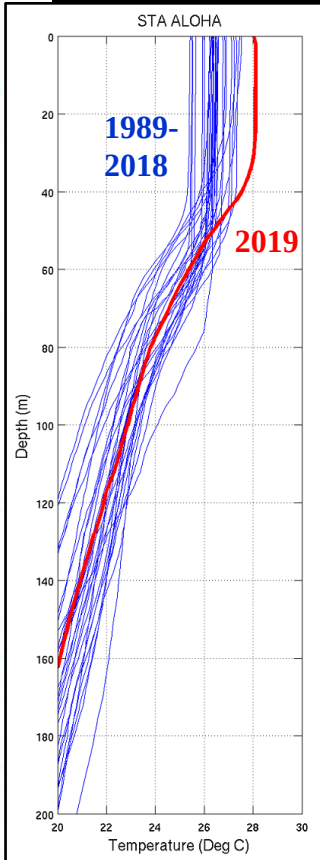
Current

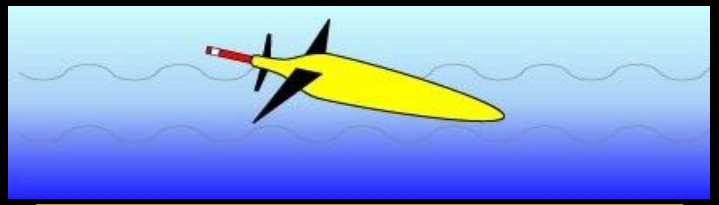




sea surface temperature anomaly (Celsius)
NOAA Global Coral Bleaching Monitoring Products: Daily 5-km
(2014-09-01T12:00:00Z)
Data courtesy of NOAA Coral Reef Watch

sea surface temperature anomaly (Celsius)
NOAA Global Coral Bleaching Monitoring Products: Daily 5-km
(2019-09-02T12:00:00Z)
Data courtesy of NOAA Coral Reef Watch



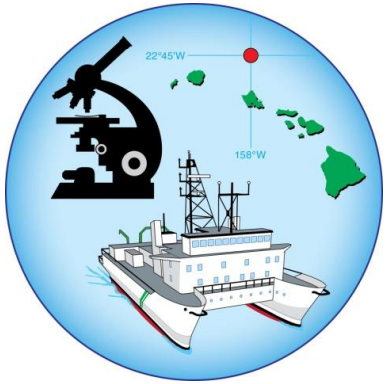


"…chance favors the prepared mind!"

SG 512 will be deployed on Oct HOT cruise







Big surprise –
this is also a BIG DATA challenge

Genomes-to-Biomes

Publicly Available Data

SIMONS FOUNDATION

SCOPE

Simons Collaboration on Ocean Processes and Ecology

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Home » Data

Data

Field Projects

2018 Life Aquatic in the Vo

Kilauea volcano on the island of Hav
both at the summit caldera and at se
unique opportunity to investigate hy
Bay region) and the impacts of volca
ecosystems. We propose to conduc
west (downwind) of the summit to c
comprehensive understanding of the

2018 SCOPE Falkor Cruise

The Falkor cruise will build on the ob
2015-2017 by looking at diel variabil
the impact of mesoscale eddies on t
A unique aspect to the expedition is
(LRAUVs) which will be integrated i
equipment.

2017 Microbial Ecology of t

The MESO-SCOPE (Microbial Ecolo
Processes and Ecology) expedition
Hawaiian Islands with the aim of ide
North Pacific Subtropical Gyre. The
to characterize: 1) the horizontal var
eddies; and 2) Lagrangian temporal
processes.

2016 SCOPE Hawaii Ocea
in the NPSG

In spring of 2016, SCOPE had two c
March) targeted an anticyclonic edd
ecosystems inside. HOE-Legacy 4 (
anticyclonic and cyclonic eddy syste
specifically in terms of biogeochemi
transcriptomics, and metabolomics.

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Home » Data » 2018 SCOPE Falkor Cruise

2018 SCOPE Falkor Cruise

What's New

- Added PC/PN Data
- Created Core Water Column Data File

Overview

- Cruise Plan (3/9/18)
- Schmidt Ocean Institute - Falkor cruise Website
- Cruise Blog
- Chief Scientist Report
- Cruise Binder
- Event Log
- Photo Gallery

Data

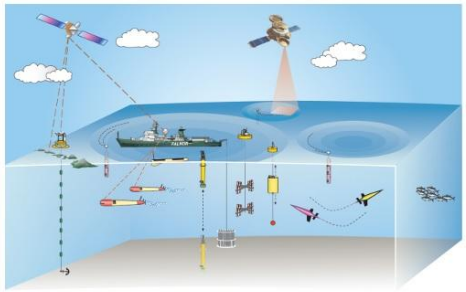
- SCOPE Data Inventory (Restricted)
- SCOPE Data Format Document (Readme.txt)
- Cruise Summary
- Up & Downcast CTD
- Core Water Column data
- Surface PAR: Leg 1, Leg 2
- Imaging FlowCytobot (IFCB) Dashboard
- SeaGlider 148: Mission 15
- SeaGlider 626: Mission 2
- Underway CTD (uCTD) Data

Plots

- Up & Downcast CTD
- CTD Potential Density
- CTD Temperature
- CTD Salinity
- CTD Oxygen
- CTD Chloropigment



The 2018 SCOPE-Falkor Cruise was built on the observations of the SCOPE expeditions conducted during 2015-2017 by looking at diel variability associated with the deep chlorophyll maximum and quantifying the impact of mesoscale eddies on the ecology and functioning of the North Pacific Subtropical Gyre. An unique aspect to the expedition was the use of Long-Range Autonomous Underwater Vehicles (LRAUVs) which were integrated into the science operations in conjunction with other oceanographic equipment.



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Home » Collaborators » Data Inventory

Data Inventory

Restricted Data – SCOPE Only

Cruise	PI	Data Type
Any	Any	Any
HOT	Armbrust, Virginia	(meta)genomes
2015Transect	Caron, David	(meta)transcriptomes
HOE-Legacy 1	Chisholm, Sallie	CTD
HOE-Legacy 2B	Church, Matthew	SeaGlider
HOE-Legacy 2A	DeLong, Edward	Wirewalker
HOE-Legacy 3	Dyhrman, Sonya	abundance
HOE-Legacy 4	Follows, Michael	carbon
MESO-SCOPE	Ingalls, Anitra	cruise documents
SCOPE-Falkor	John, Seth	culture

Submit Reset

Request for J. Zehr Lab

KEY: data | docs | muSCOPE | HOT | contact

Search Results

Research Group	Cruise/Region	Dataset	Data Links
Zehr Lab	HOE-Legacy 2A	Diazotroph Depth Profiles, qPCR	
Zehr Lab	HOE-Legacy 2B	FCM Abundance (75-140m)	
Zehr Lab	HOE-Legacy 2B	Growth Experiment 2, Flow Cytometry	
Zehr Lab	HOE-Legacy 2B	Growth Experiment 2, qPCR	
Zehr Lab	HOE-Legacy 2B	Growth Experiment 3, Flow Cytometry	
Zehr Lab	HOE-Legacy 2B	Growth Experiment 3, qPCR	
Zehr Lab	HOE-Legacy 2B	Size fractionated 16S rRNA gene sequences	
Zehr Lab	HOE-Legacy 2B	Size fractionated nifH tag sequences	
Zehr Lab	HOE-Legacy 3	Growth Experiment 4, Flow Cytometry	
Zehr Lab	HOE-Legacy 3	Growth Experiment 4, qPCR	
Zehr Lab	HOT	Growth Experiment 1, HOT-269, Flow Cytometry	
Zehr Lab	HOT	Growth Experiment 1, HOT-269, qPCR	
Zehr Lab	HOT	HOT-269 FCM Abundance (75-140m)	
Zehr Lab	HOT	HOT-269 Size fractionated 16S rRNA gene sequences	
Zehr Lab	HOT	HOT-269 Size fractionated nifH tag sequences	

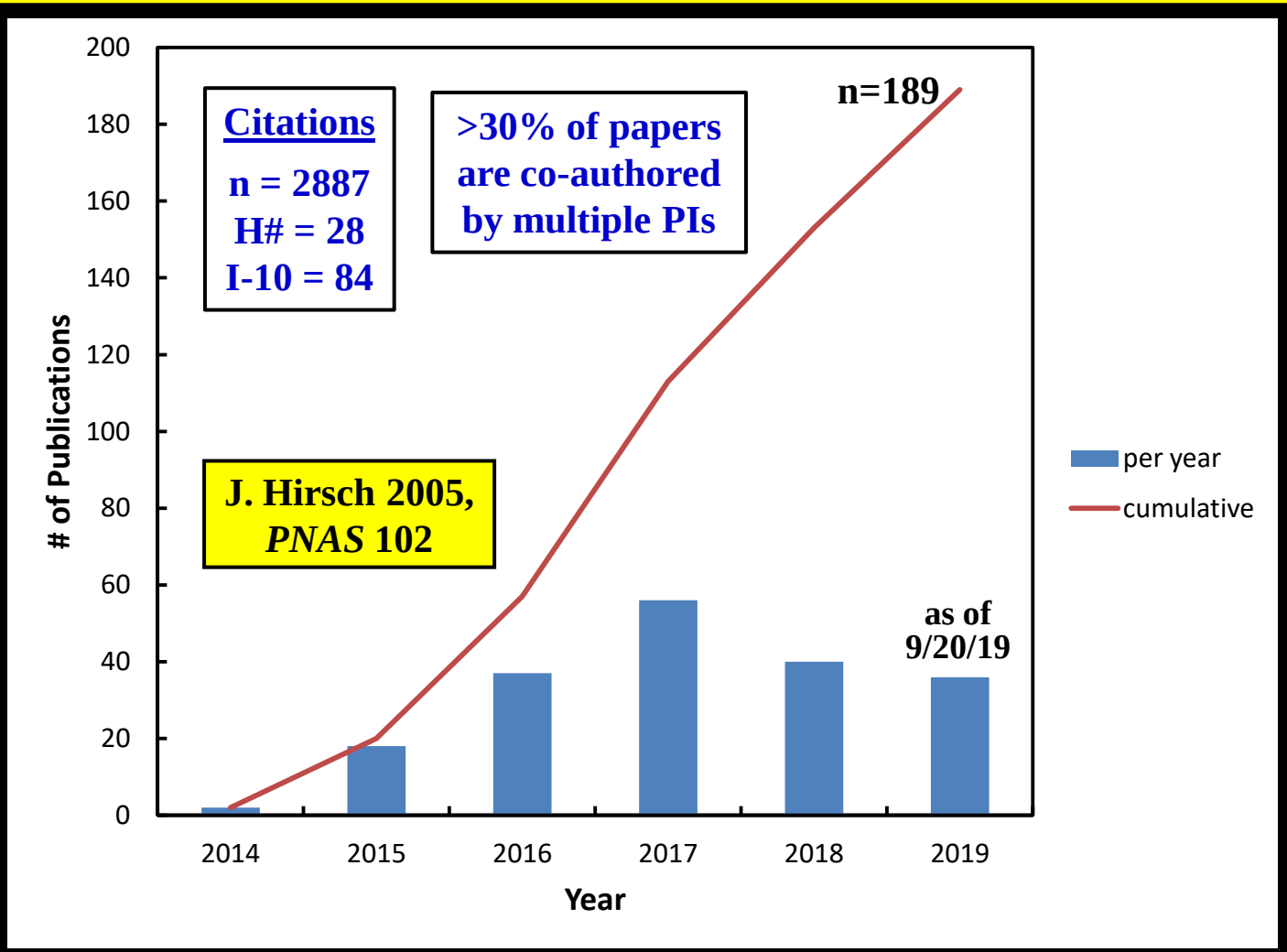
Data Management, Analysis and Discovery

New for 2019

- **iMicrobe • µSCOPE 'omics data sets now publicly available**
  - ***Co-located with other global 'omics data***
  - ***Data served via massively parallel, HPCF for use on CyVerse***
- **Most SCOPE data also available via C-MAP, U. Washington (Armbrust)**
- **All SCOPE data sets also backed up at Fermi National Laboratory for long-term "cold" storage**

Create and Disseminate Knowledge

bibliometrics • productivity • impacts



…including 37 in *Nature*-series/*Science*/*PNAS*

Collaboration and Productivity in Scientific Synthesis

***BioScience* 2011**

STEPHANIE E. HAMPTON AND JOHN N. PARKER

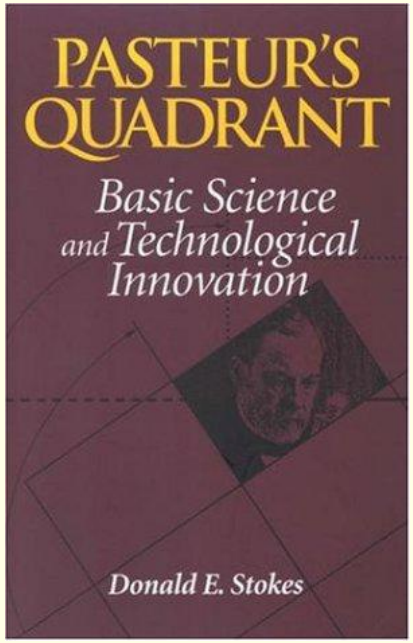
Scientific synthesis has transformed ecological research and presents opportunities for advancements across the sciences; to date, however, little is known about the antecedents of success in synthesis. Building on findings from 10 years of detailed research on social interactions in synthesis groups at the National Center for Ecological Analysis and Synthesis, we demonstrated with large-scale quantitative analyses that face-to-face interaction has been vital to success in synthesis groups, boosting the production of peer-reviewed publications. But it has been about more than just meeting; the importance of resident scientists at synthesis centers was also evident, in that including synthesis-center residents in geographically distributed working groups further increased productivity. Moreover, multi-institutional collaboration, normally detrimental to productivity, was positively associated with productivity in this stimulating environment. Finally, participation in synthesis groups significantly increased scientists' collaborative propensity and visibility, positively affecting scientific careers and potentially increasing the capacity of the scientific community to leverage synthesis for enhanced scientific understanding.

Keywords: synthetic science, sociology of collaboration, interdisciplinary science, scientific metrics, research productivity and impact

SCOPE, a multi-institutional collaboration, is "positively associated with productivity in this stimulating environment"

SCOPE Mission

Create and disseminate knowledge

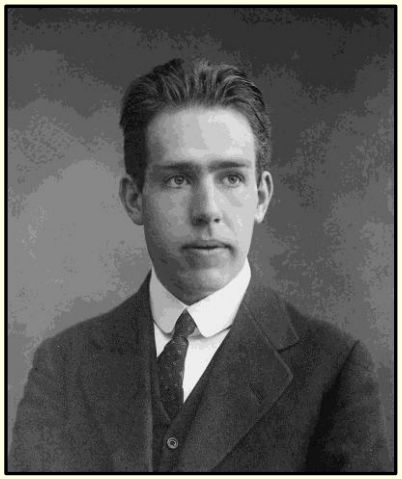


Improve models, inform society, protect the sea

high

Quest for fundamental understanding

low

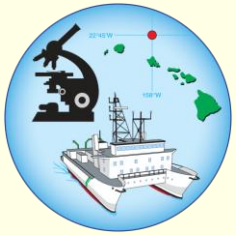


PURE BASIC RESEARCH



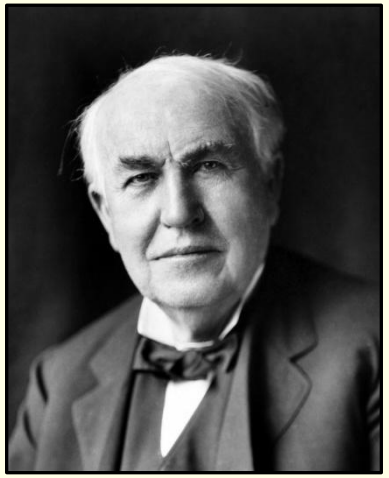
USE-BASED BASIC RESEARCH

Bohr



Pasteur's Quadrant

Edison



PURE APPLIED RESEARCH

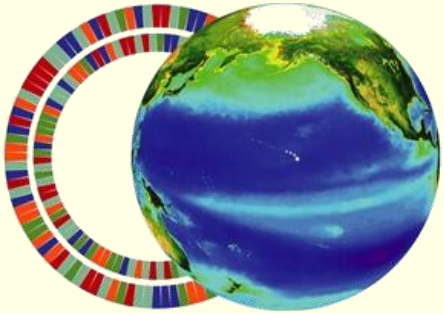
low

Consideration of use

high

SCOPE: Years 1-5

genomes-to-biomes



- **CREATE A COLLABORATIVE environment**
- **UNDERSTAND EMERGENT PROPERTIES of ecosystems through highly resolved, nested spatial/temporal scale field experiments**
- **GENERATE AND TEST HYPOTHESES that focus on inputs and outputs of energy and matter through euphotic zone (0-200 m) microbial ecosystems**
- **VALIDATE NEW THEORY and build/improve comprehensive ecosystem models**

Looking Forward to 2020, and Beyond

- **CONTINUE HOT-SCOPE partnerships:**
  8 cruises in 2020 (NSF leverage)

- **CONTINUE MAHALO, MESO•SCOPE and Gradients synthesis and modeling efforts and publish the results**

- **COMPLETE analyses, synthesize and publish field and laboratory data**

- **COMPLETE planning for SCOPE 2021 expedition, and successfully execute it**

The State of SCOPE Could Not Be Much Stronger

- A stable, diverse, interactive team
- Intellectual capital and enabling technologies
- Important scientific questions
- Generous funding
- Global interest and relevance



Welcome Aboard!



Simons
Collaboration on
Ocean
Processes and
Ecology