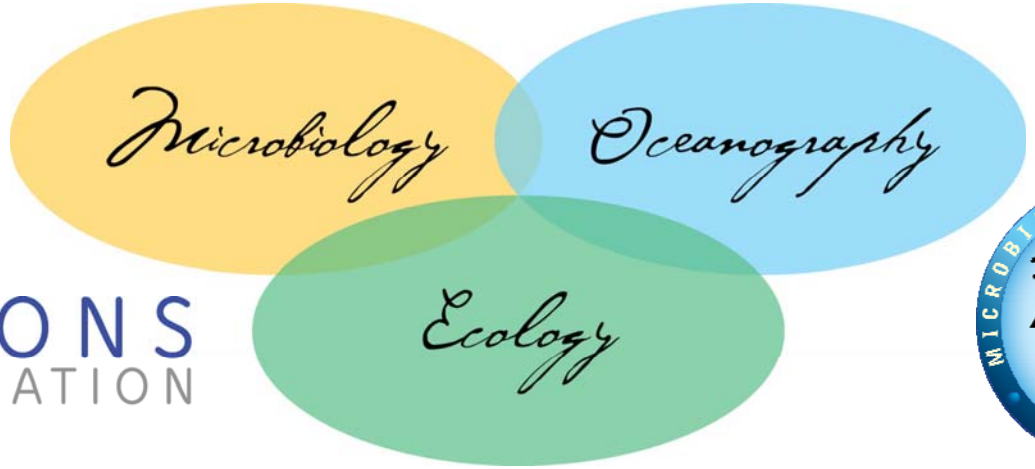


SIMONS FOUNDATION

MICROBIAL OCEANOGRAPHY SCOPE

The State of SCOPE

AMERICAN SOCIETY FOR MICROBIOLOGY

MILESTONES IN MICROBIOLOGY SITE

University of Hawaii at Manoa

Ocean Station ALOHA

2018 Annual Meeting • 3-5 December



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

SCOPE Investigators


Ginger Armbrust


Dave Caron


Penny Chisholm


★ Matt Church


Ed DeLong


Sonya Dyhrman


Mick Follows


Anitra Ingalls


Seth John


Dave Karl


Debbie Lindell


Dan Repeta


Ben Van Mooy

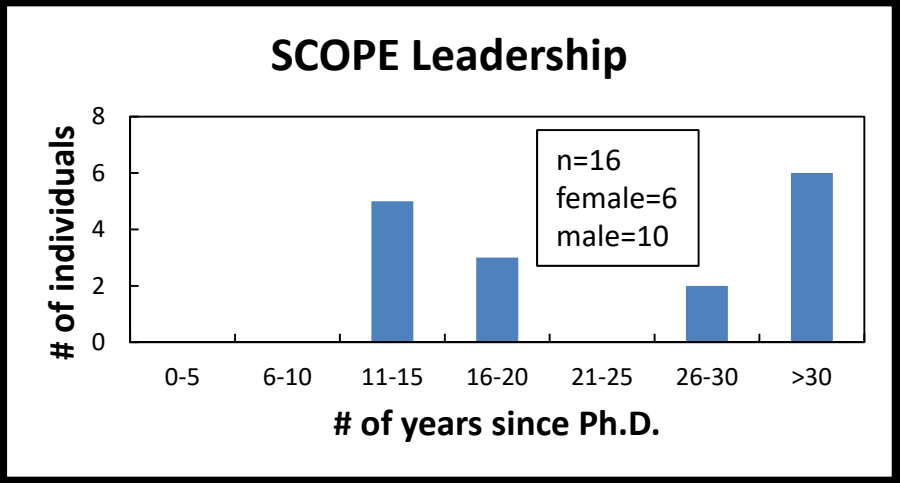

★ Joshua Weitz

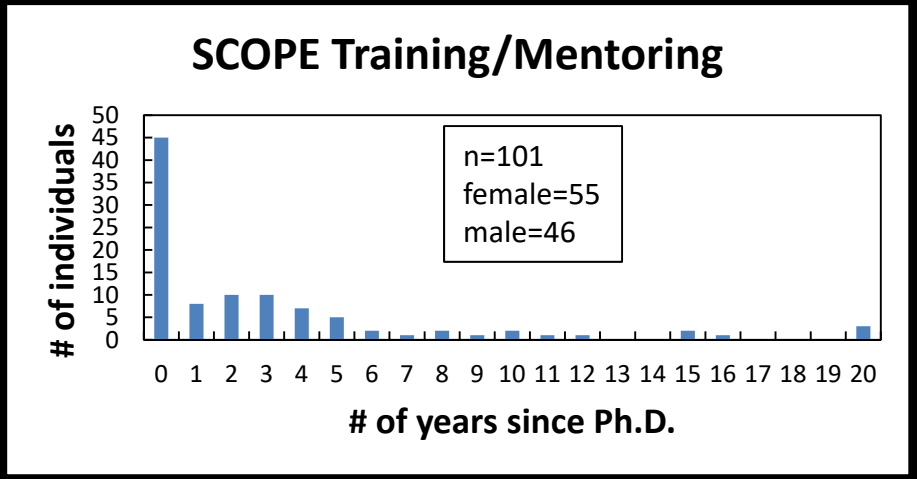

Angel White


★ Jon Zehr

SCOPE Demographics

contemporary challenges • future opportunities





- **PIs cover broad range of experience, from mid-career to "senior" with built-in leadership succession**
- **SCOPE research team (graduate students/post-docs/research associates) is poised for next generation leadership**

Building Our Legacy

Opportunity, respect, support and success:

It's all about people

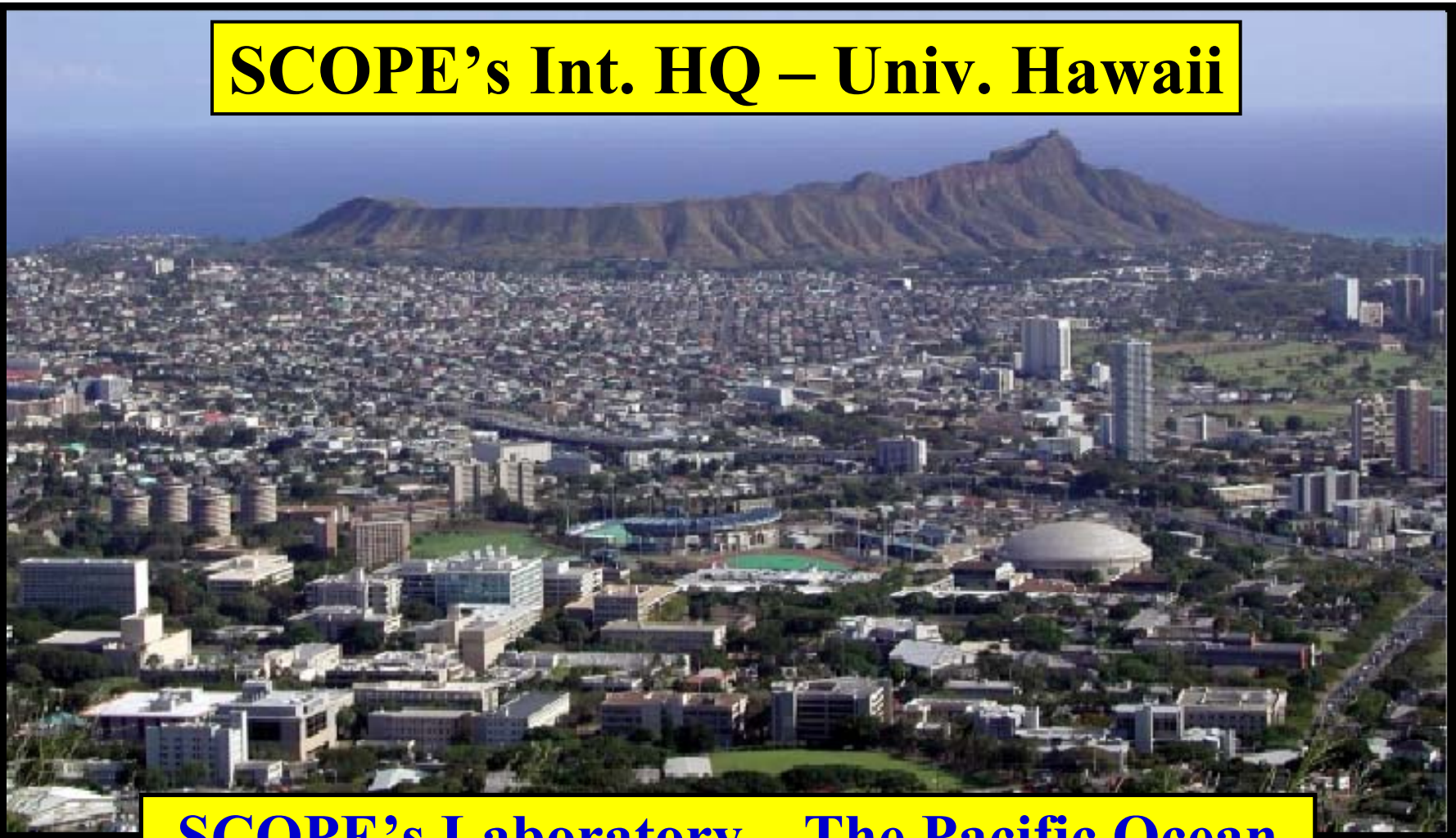
Team member: Angelicque White

- Ph.D., Oregon State University (2006)
- C-MORE post-doc scholar (2006-2009)
- Inaugural Agouron/C-MORE summer course student (2006), then course faculty member
- Assistant Professor, Oregon State University (2009)
- Inaugural SCOPE investigator (2014)
- HOT program PI-designate (1 Aug 2019)

4 generations!

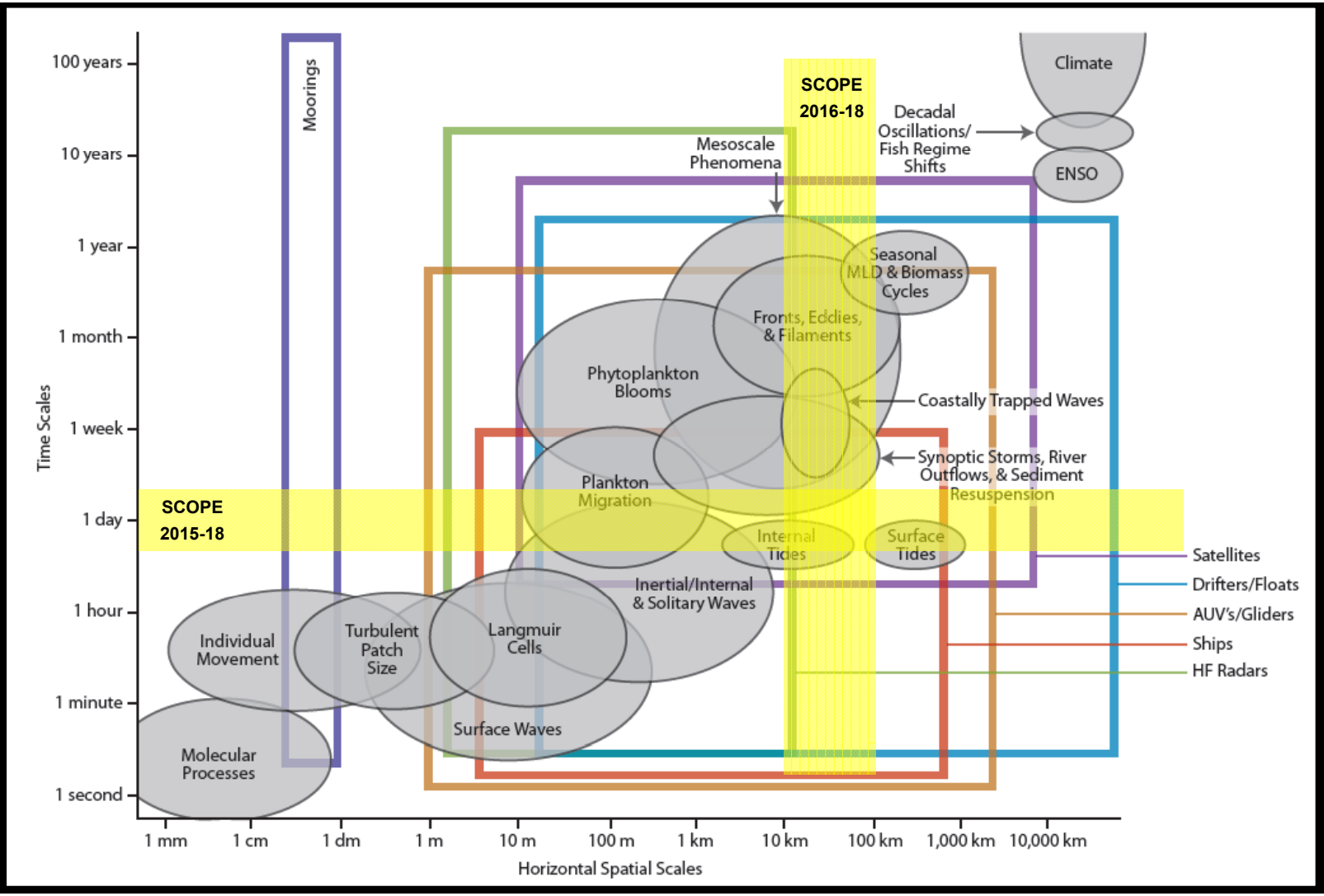


SCOPE's Int. HQ – Univ. Hawaii



SCOPE's Laboratory – The Pacific Ocean

Time/Space Continuum



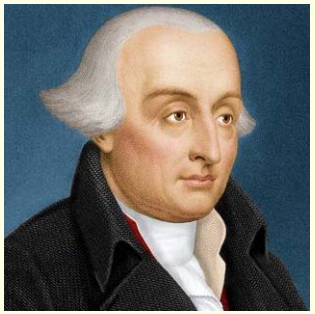
Ocean Currents, Flow Fields and Ecological Frames of Reference



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

Leonhard Euler (1707-1783)



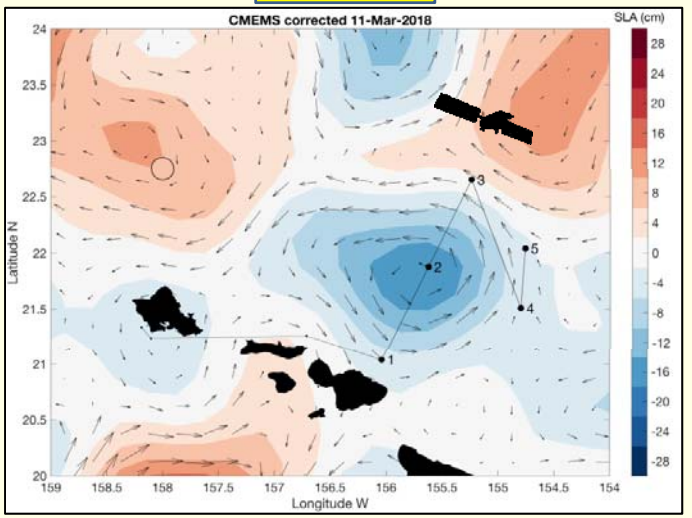


Observer follows an individual fluid parcel as it moves in time and space

Joseph-Louis Lagrange (1736-1813)

ocean eddies

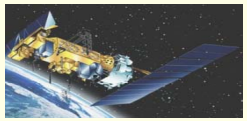




Modes of Field Observations in SCOPE



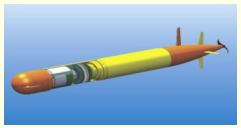
Ship: sample collection • underway SeaFlow / Flow Cytobot • incubation experiments • arrays



Satellite: ocean color • temperature • altimetry



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



LR-AUV: autonomous drone • as above for Seaglider plus nucleic acid sampling

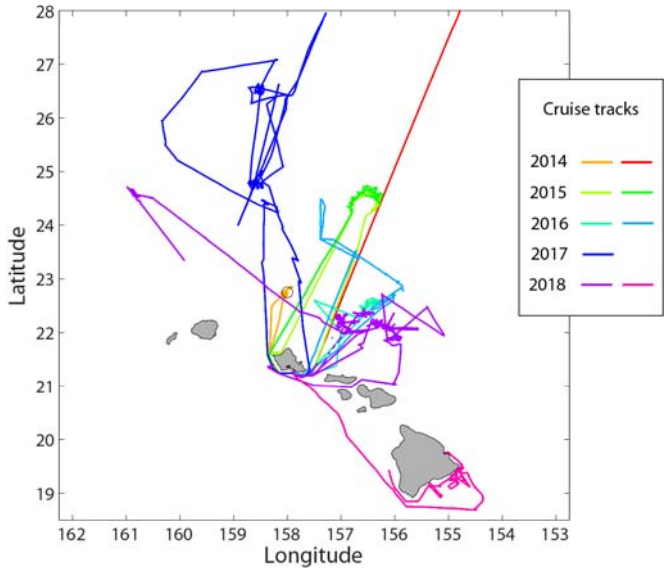


Wirewalker: high-resolution surface profiler • as above for Seaglider • wave powered

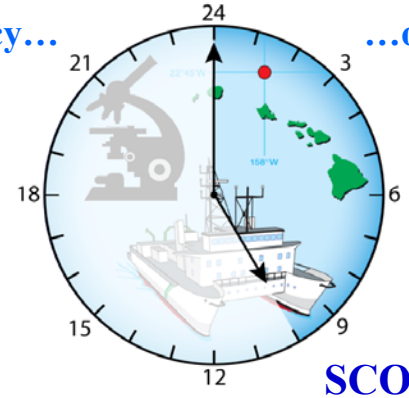


Optical floats: autonomous profiling instrument • as above for Seaglider plus bio-optics

SCOPE Field Expeditions: 2014-2020



building the SCOPE legacy…



…one hour at a time

SCOPE 2020

HOT-LAVA



Eddies (*Falkor*)

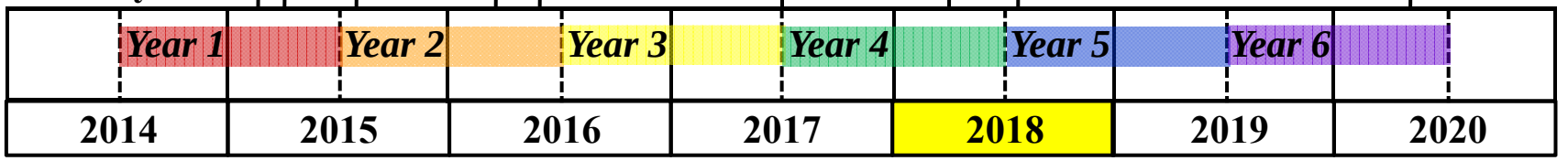
MESO-SCOPE

PDX-HNL transit

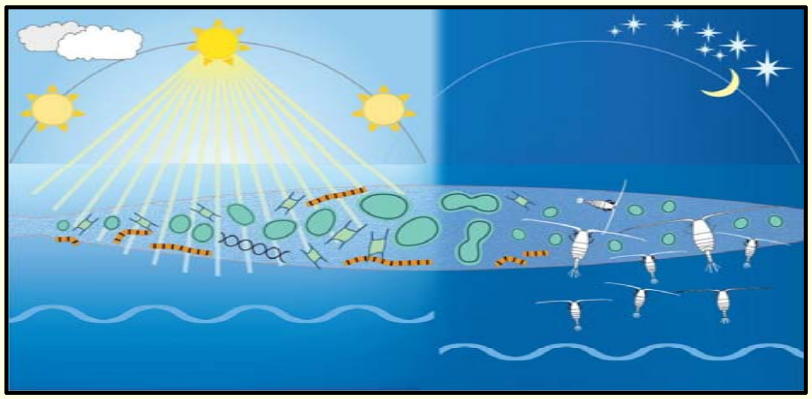
HOE-Legacy Series

I II III IV

July



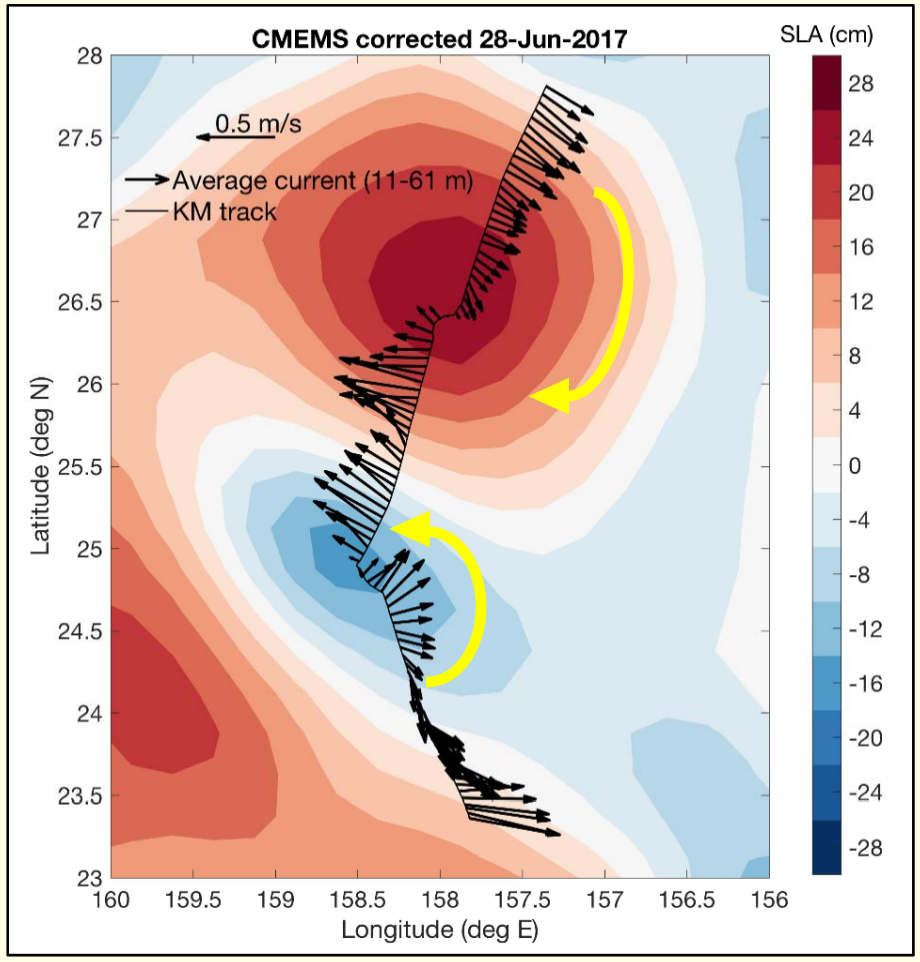
SCOPE: HOE-Legacy II Expedition Jul-Aug 2015



- **Focus on diel processes**
  productivity • respiration • export • N_2 fixation • community composition • growth/death • microbe interactions • 'omics • synthesis and modeling
- **12 manuscripts already published with more in preparation**
- **Modeling ALOHA via Hierarchical Analysis of the Light-driven Ocean (MAHALO) project is underway under leadership of J. Weitz and M. Follows**

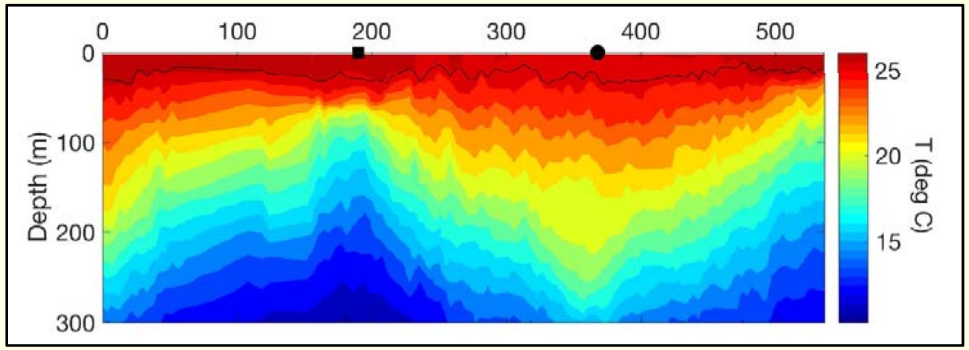
Later today!

Microbial Ecology of the Surface Ocean (MESO-SCOPE)

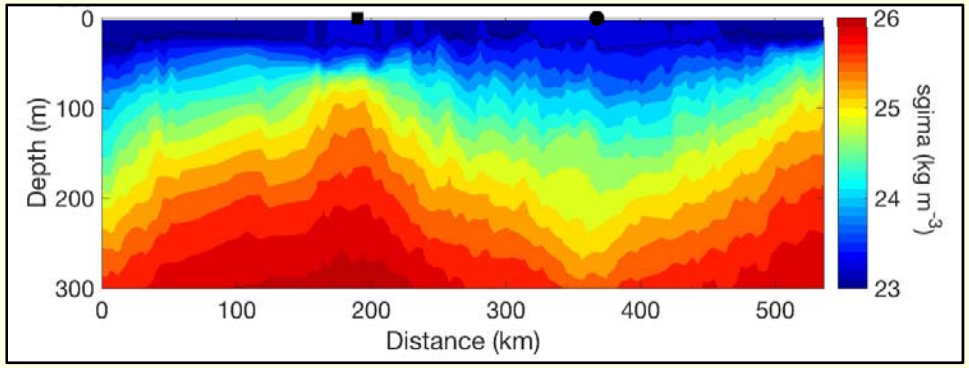


June-July 2017

- **Eddy dipole**
  anticyclone • ***cyclone***
- **Water samples and experiments**
- **12 sediment trap arrays**
- **Wirewalkers, Sea Flow, IFCB**

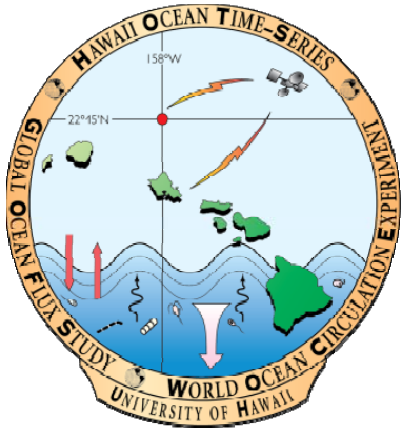


C **AC**



2018: An Exceptional SCOPE Field Year

- **10 HOT cruises: HOT-299 → HOT-308, including HOT-300 (Feb 2018)** ***monthly sample collection for DeLong, Caron, Repeta, Church, Armbrust, White and Karl labs***
- **R/V *Falkor* SCOPE Eddies project** ***March-April 2018***
- **HOT-LAVA expedition** ***July 2018***

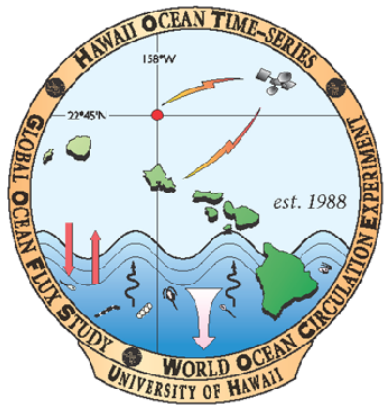






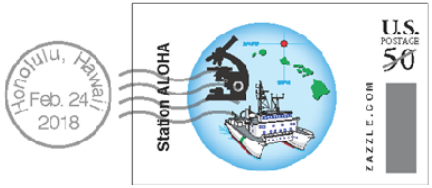
Dual benchmark

HOT-300 and 30-year Anniversary of Station ALOHA



Celebrating
HOT-300
24–28 February 2018



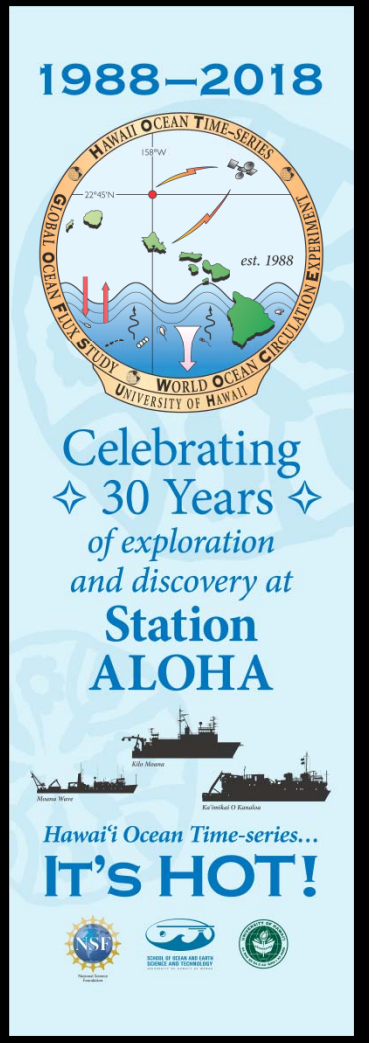


Your Name
FPO Station ALOHA
University of Hawaii
Department of Oceanography
1000 Pope Rd.
Honolulu, HI 96822

SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY

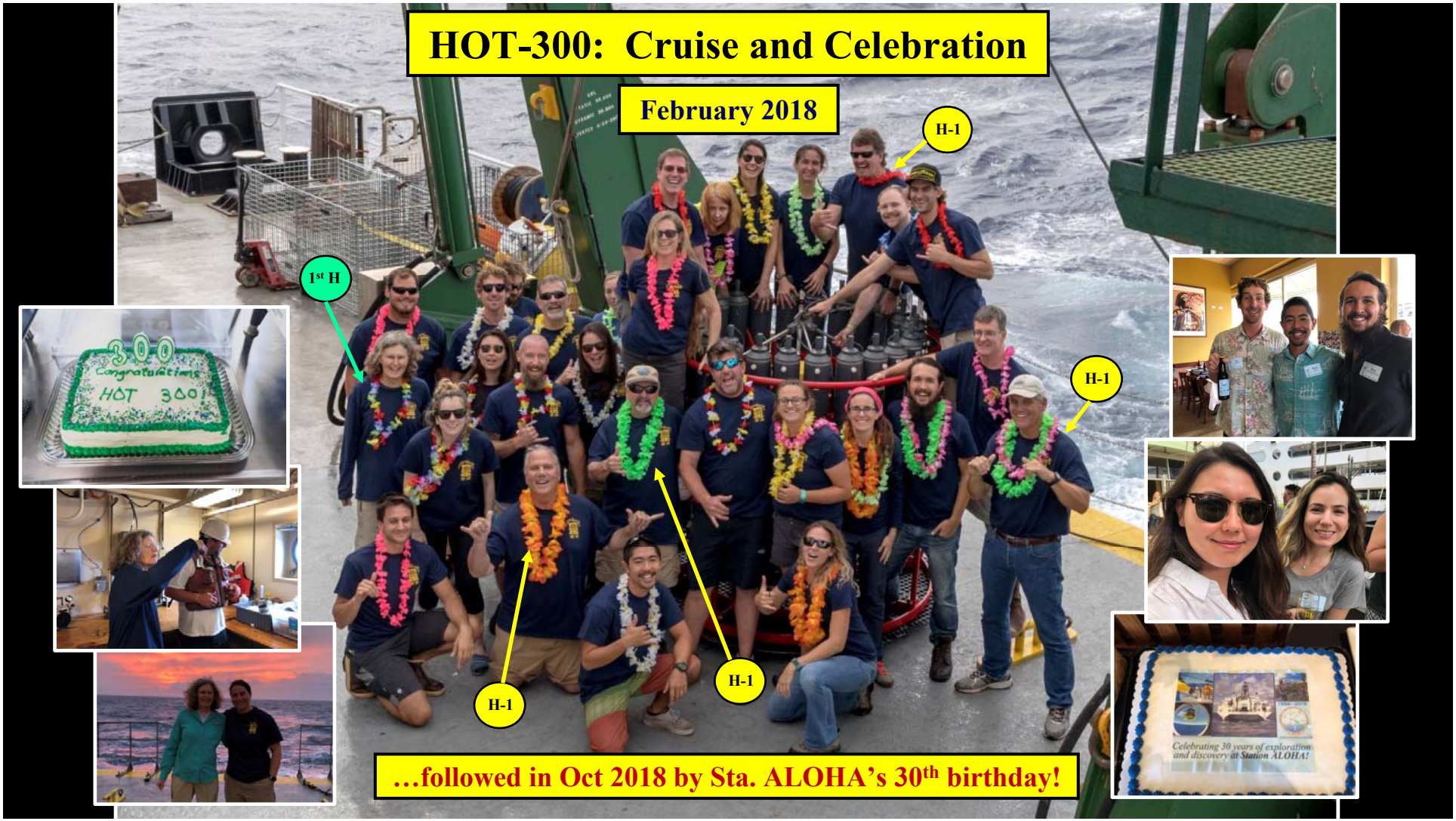
AMERICAN SOCIETY FOR MICROBIOLOGY | MILESTONES IN MICROBIOLOGY SITE
University of Hawai'i at Mānoa
Ocean Station ALOHA

National Science Foundation

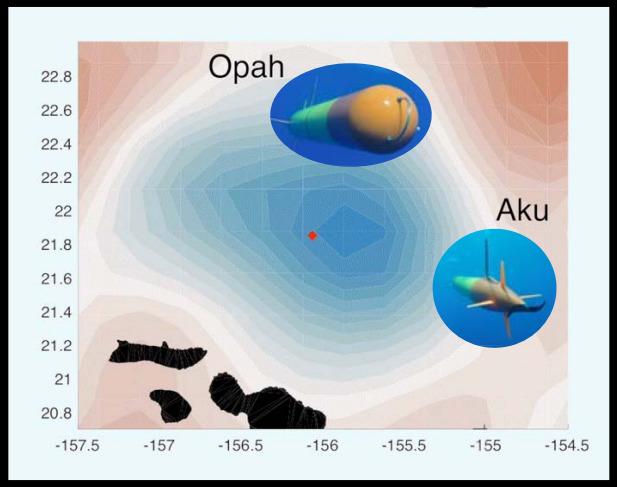


HOT-300: Cruise and Celebration

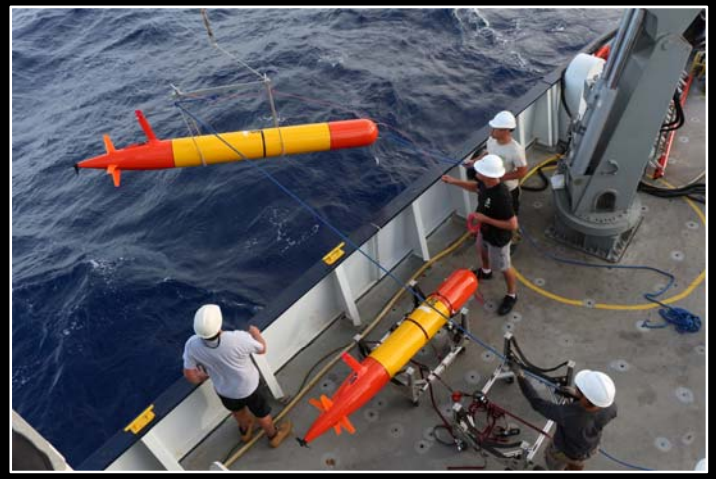
February 2018

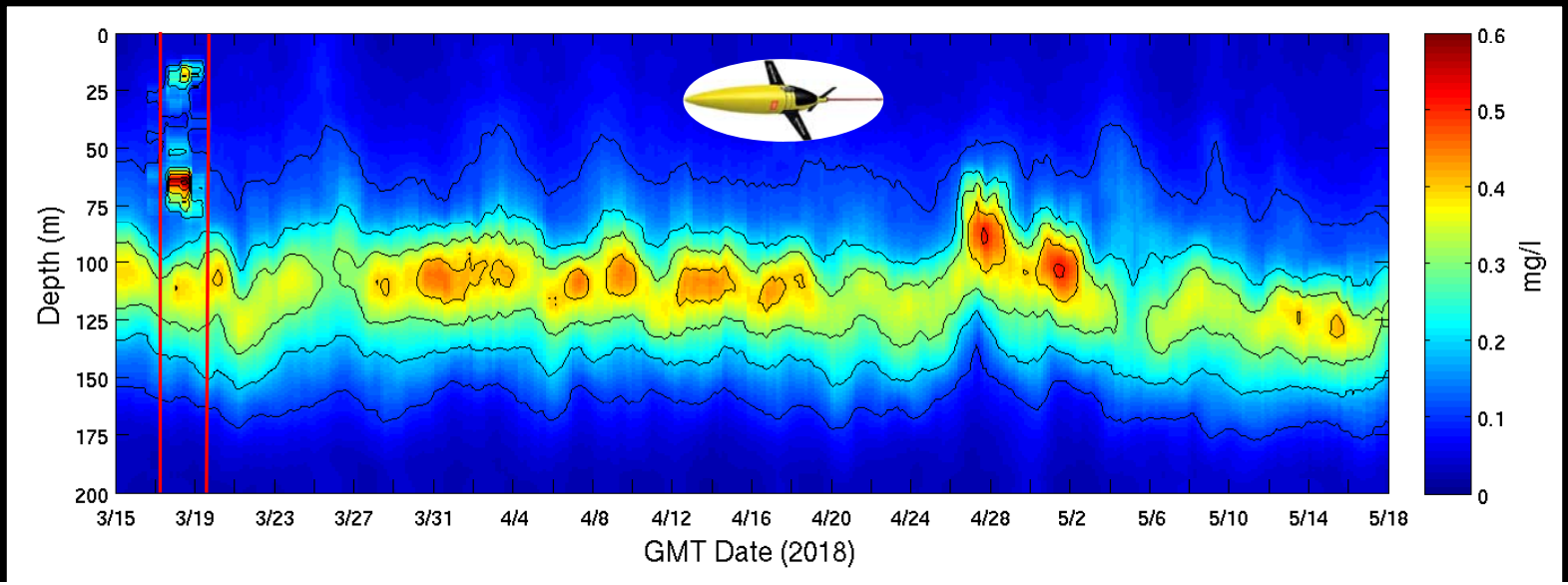


…followed in Oct 2018 by Sta. ALOHA's 30th birthday!

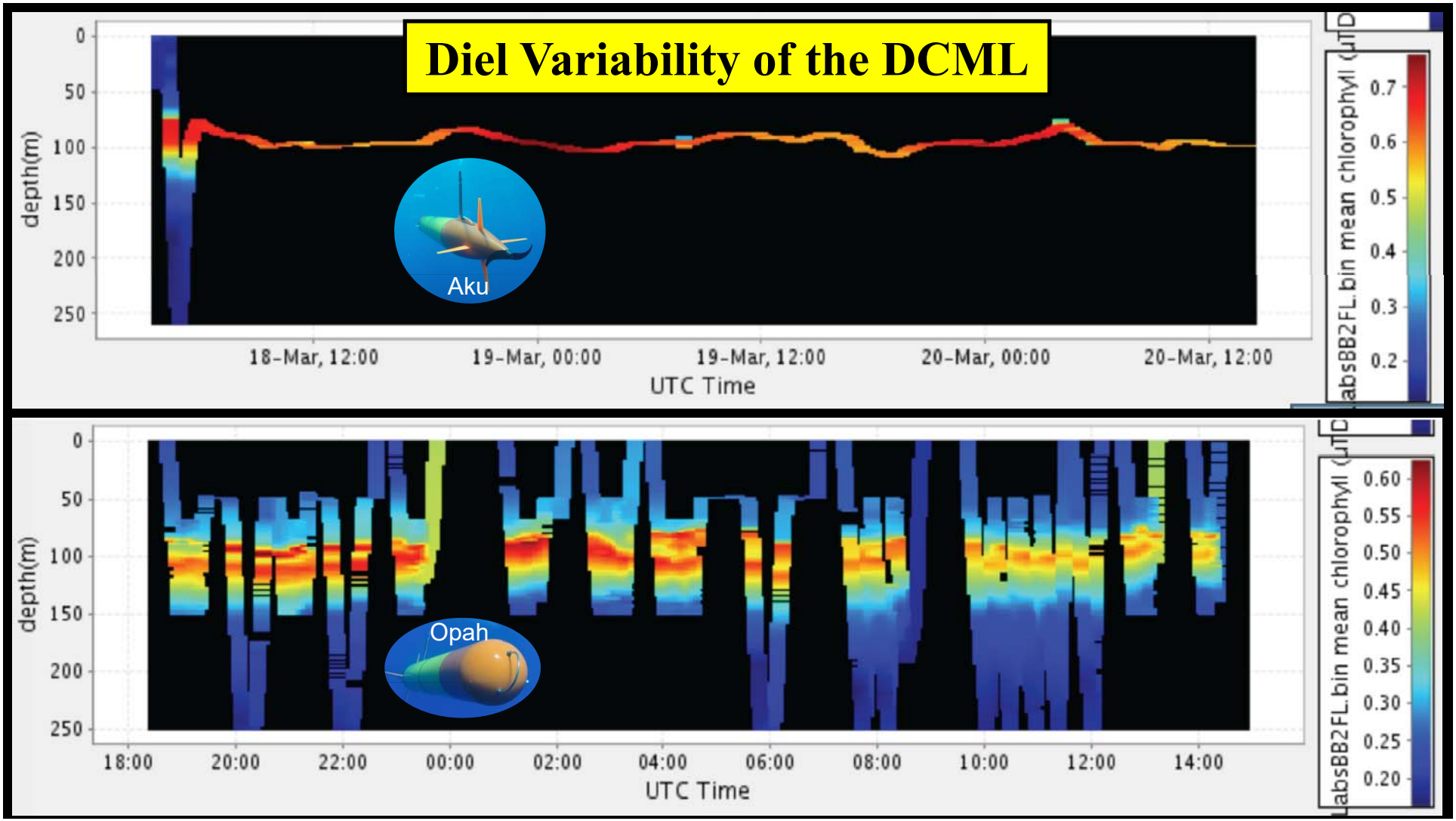


SCOPE-*Falkor* Eddies Expedition

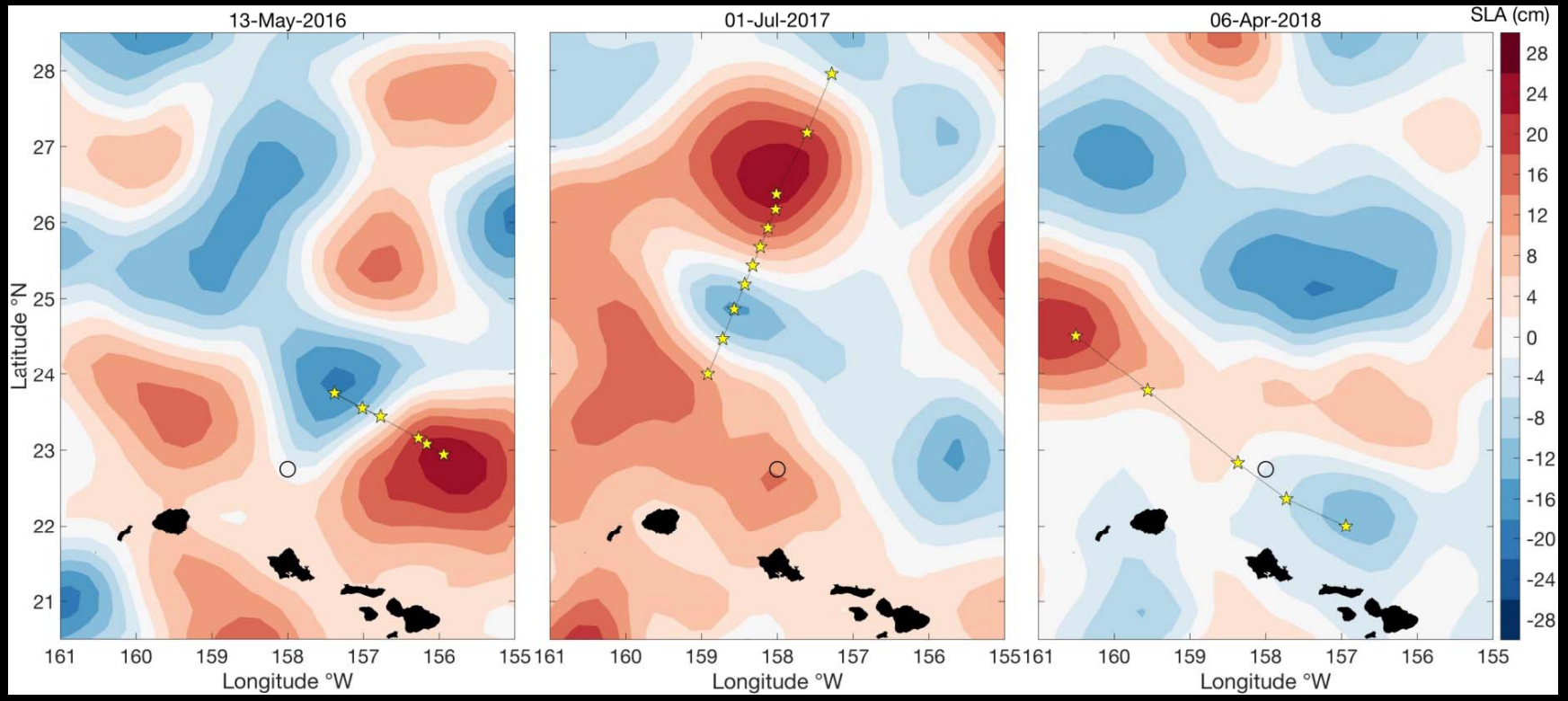




Diel Variability of the DCML



MESO-SCOPE Synthesis and Modeling Project



HOE-Legacy IV • 2016

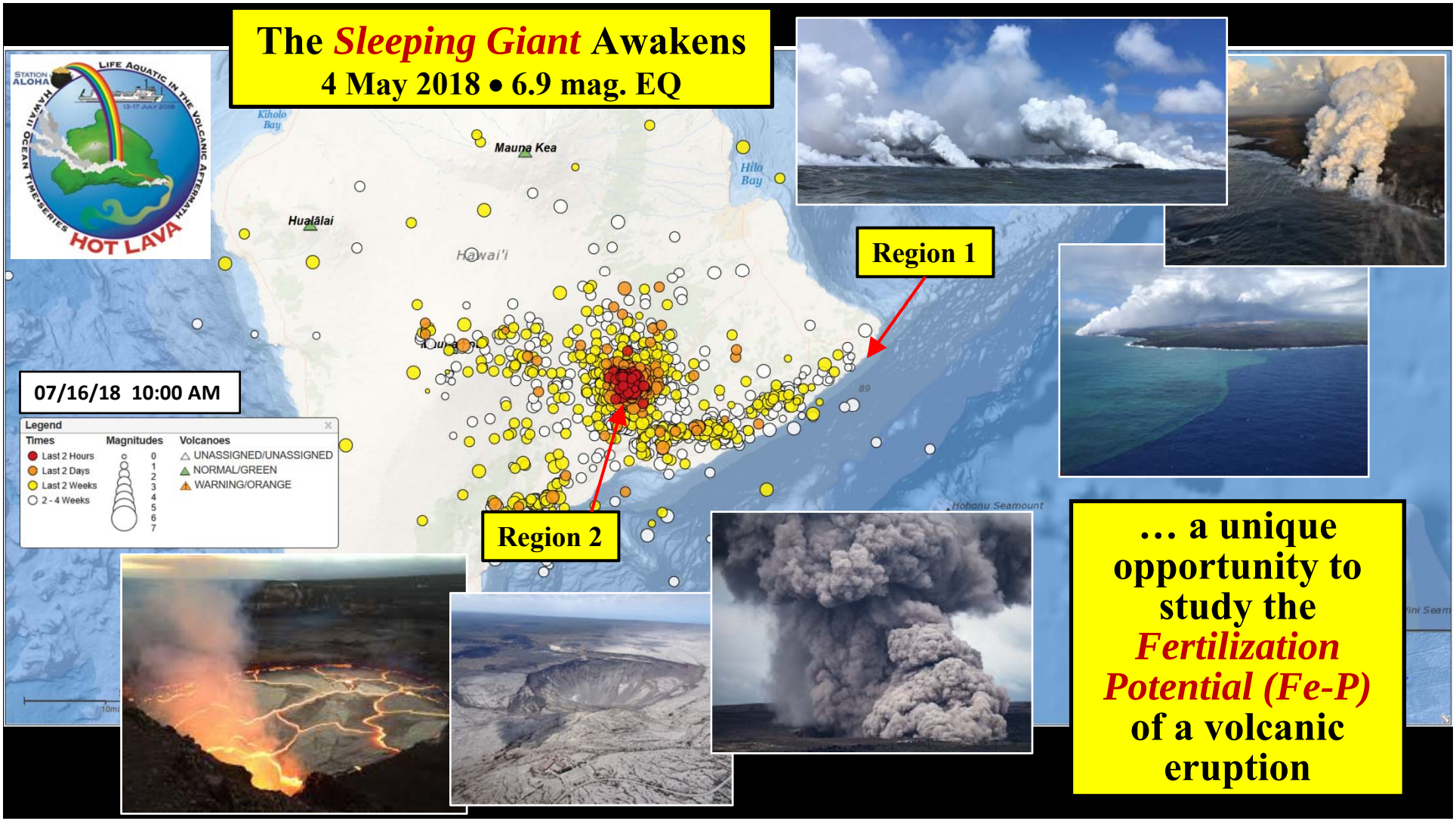
MESO-SCOPE • 2017

SCOPE-*Falkor* • 2018

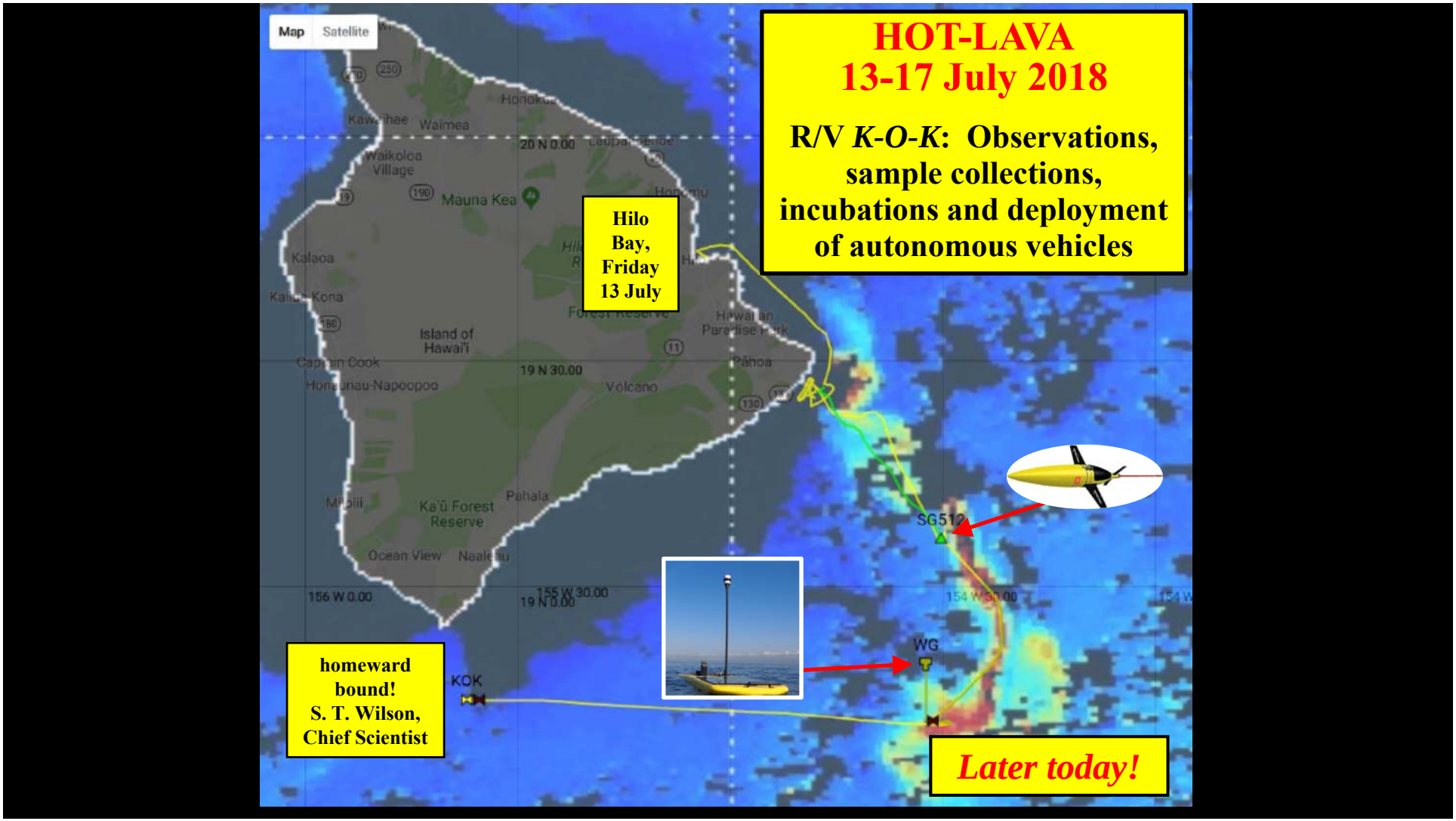
Later today!

The *Sleeping Giant* Awakens

4 May 2018 • 6.9 mag. EQ



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


HOT-LAVA
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
Later today!
Map
Satellite
Waimea
Waikoloa Village
Mauna Kea
Kalaoa
Island of Hawai'i
Volcano
Pāhoa
Pahala
Ka'ū Forest Reserve
Ocean View
20 N 0.00
19 N 30.00
19 N 0.00
156 W 0.00
155 W 30.00
SG512
WG
KOK


Big surprise – this is also a BIG DATA challenge
Genomes-to-Biomes

Publicly Available Data

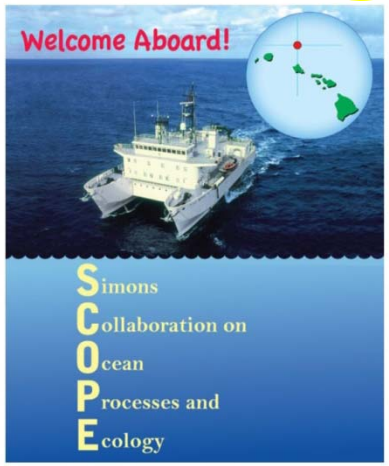
SIMONS FOUNDATION

SCOPE

Simons Collaboration on Ocean Processes and Ecology

Publications | Multimedia | Investigators (Restricted) | Collaborators (Restricted)

About Us | News | Data | People | Funding | Contact Us



Home | About Us | News

SCOPE

Simons Collaboration on Ocean Processes and Ecology

Publications | Multimedia | Investigators (Restricted) | Collaborators (Restricted)

About Us | News | Data | People | Funding | Contact Us

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 co
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 in
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

SCOPE

Simons Collaboration on Ocean Processes and Ecology

Publications | Multimedia | Investigators (Restricted) | Collaborators (Restricted)

About Us | News | Data | People | Funding | Contact Us

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



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.

SCOPE

Simons Collaboration on Ocean Processes and Ecology

Publications | Multimedia | Investigators (Restricted) | Collaborators (Restricted)

About Us | News | Data | People | Funding | Contact Us

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

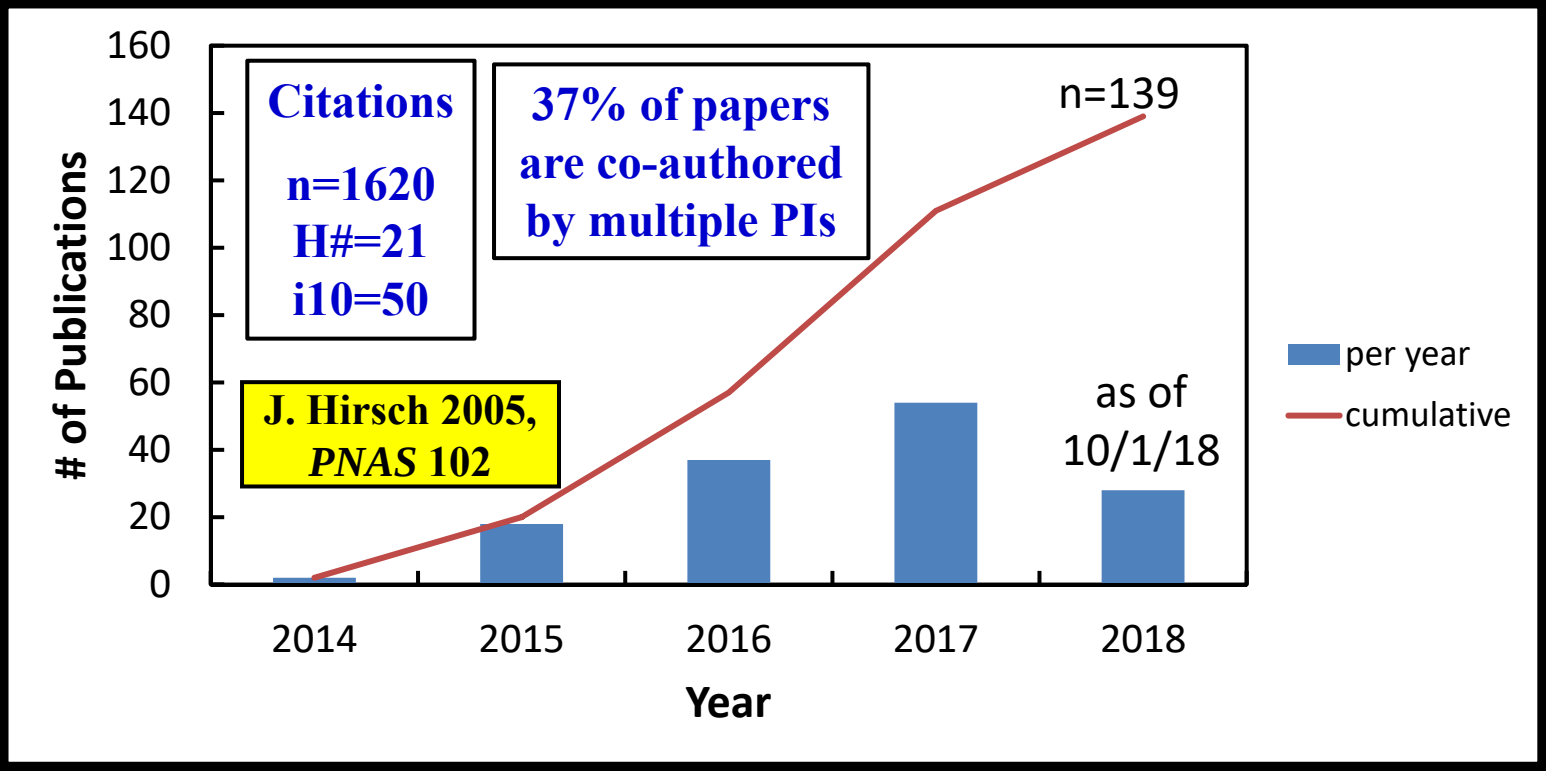
KEY: data | docs | muSCOPE | HOT | contact

Search Results

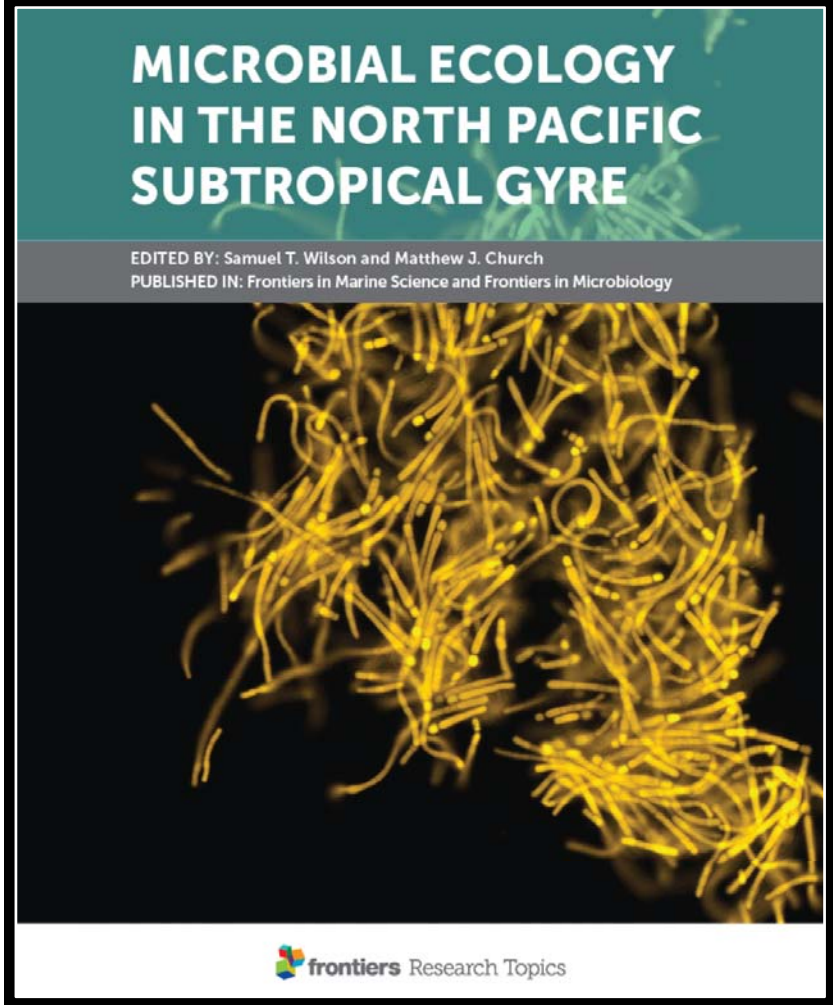
Research Group	Cruise/Region	Dataset	Data Links
Zehr Lab	HOE-Legacy 2A	Diazotroph Depth Profiles, qPCR	
Zehr Lab	HOE-Legacy 2B	FCM Abundance (75-140m)	
Zehr Lab	HOE-Legacy 2B	Growth Experiment 2, Flow Cytometry	
Zehr Lab	HOE-Legacy 2B	Growth Experiment 2, qPCR	
Zehr Lab	HOE-Legacy 2B	Growth Experiment 3, Flow Cytometry	

Create and Disseminate Knowledge

bibliometrics • productivity • impacts



…including 27 in *Nature*-series/*Science*/*PNAS*



Special Issue: 2018
Frontiers in Marine Science

Topics include:

Fe cycling, DOM, seascape ecology, export, nutrients, phosphonate metabolism, diazotrophy, *Prochlorococcus* & *Trichodesmium*… and more!

Table of Contents

05 ***Editorial: Microbial Ecology in the North Pacific Subtropical Gyre***
Samuel T. Wilson and Matthew J. Church

08 ***Distinct Siderophores Contribute to Iron Cycling in the Mesopelagic at Station ALOHA***
Randelle M. Bundy, Rene M. Boiteau, Craig McLean, Kendra A. Turk-Kubo, Matt R. McIlvin, Mak A. Saito, Benjamin A. S. Van Mooy and Daniel J. Repeta

23 ***Light-Enhanced Microbial Organic Carbon Yield***
John R. Casey, Sara Ferrón and David M. Karl

32 ***ALOHA From the Edge: Reconciling Three Decades of* in Situ *Eulerian Observations and Geographic Variability in the North Pacific Subtropical Gyre***
Maria T. Kavanaugh, Matthew J. Church, Curtiss O. Davis, David M. Karl, Ricardo M. Letelier and Scott C. Doney

46 ***Bacterial Succession on Sinking Particles in the Ocean's Interior***
Erik A. Pelve, Kristina M. Fontanez and Edward F. DeLong

61 ***Differential Responses of Eukaryotic Phytoplankton to Nitrogenous Nutrients in the North Pacific Subtropical Gyre***
Yoshimi M. Rii, Robert R. Bidigare and Matthew J. Church

78 ***Isolation and Characterization of Bacteria That Degrade Phosphonates in Marine Dissolved Organic Matter***
Oscar A. Sosa, Daniel J. Repeta, Sara Ferrón, Jessica A. Bryant, Daniel R. Mende, David. M. Karl and Edward F. DeLong

94 **In Situ *Diazotroph Population Dynamics Under Different Resource Ratios in the North Pacific Subtropical Gyre***
Kendra A. Turk-Kubo, Paige Connell, David Caron, Mary E. Hogan, Hanna M. Farnelid and Jonathan P. Zehr

112 ***Dynamics of* Prochlorococcus *and* Synechococcus *at Station ALOHA Revealed Through Flow Cytometry and High-Resolution Vertical Sampling***
Ger J. van den Engh, Joseph K. Doggett, Anne W. Thompson, Martina A. Doblin, Carla N. G. Gimpel and David M. Karl

126 ***Temporal Variability of* Trichodesmium *spp. and Diatom-Diazotroph Assemblages in the North Pacific Subtropical Gyre***
Angelicque E. White, Katie S. Watkins-Brandt and Matthew J. Church



article

Station ALOHA: A Gathering Place for Discovery, Education, and Scientific Collaboration

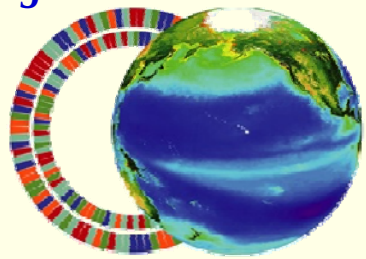
David M. Karl, and Matthew J. Church

***L&O Bulletin*, current issue**

- **Collection of 60 *L&O* publications on biogeochemical and ecological processes at Station ALOHA**
- **Includes contributions from several SCOPE investigators and many team members**
- **Published on 30 Oct 2018, ALOHA's 30th birthday!**

SCOPE: Years 1-4

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 microbial ecosystems**
- **VALIDATE NEW THEORY and build/improve comprehensive ecosystem models**

Looking Forward to 2019, and Beyond

- **Continued HOT-SCOPE collaborations: 10 cruises scheduled for 2019 (NSF leverage)**
- **Continue MAHALO and MESOSCOPE synthesis and modeling efforts**
- **Complete analyses, synthesize and publish SCOPE field, laboratory and modeling efforts**
- **Complete planning for SCOPE 2020 expedition**

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

2019 should be another exciting year!



“In essence, science is a perpetual search for an intelligent and integrated comprehension of the world we live in”

C. B. van Niel

(1897-1985)

Pioneer of General Microbiology and unsurpassed educator