BIOGEOCHEMICAL VARIABILITY LINKED TO SEA SURFACE HEIGHT AND MESOSCALE DIPOLES IN THE NORTH PACIFIC SUBTROPICAL GYRE

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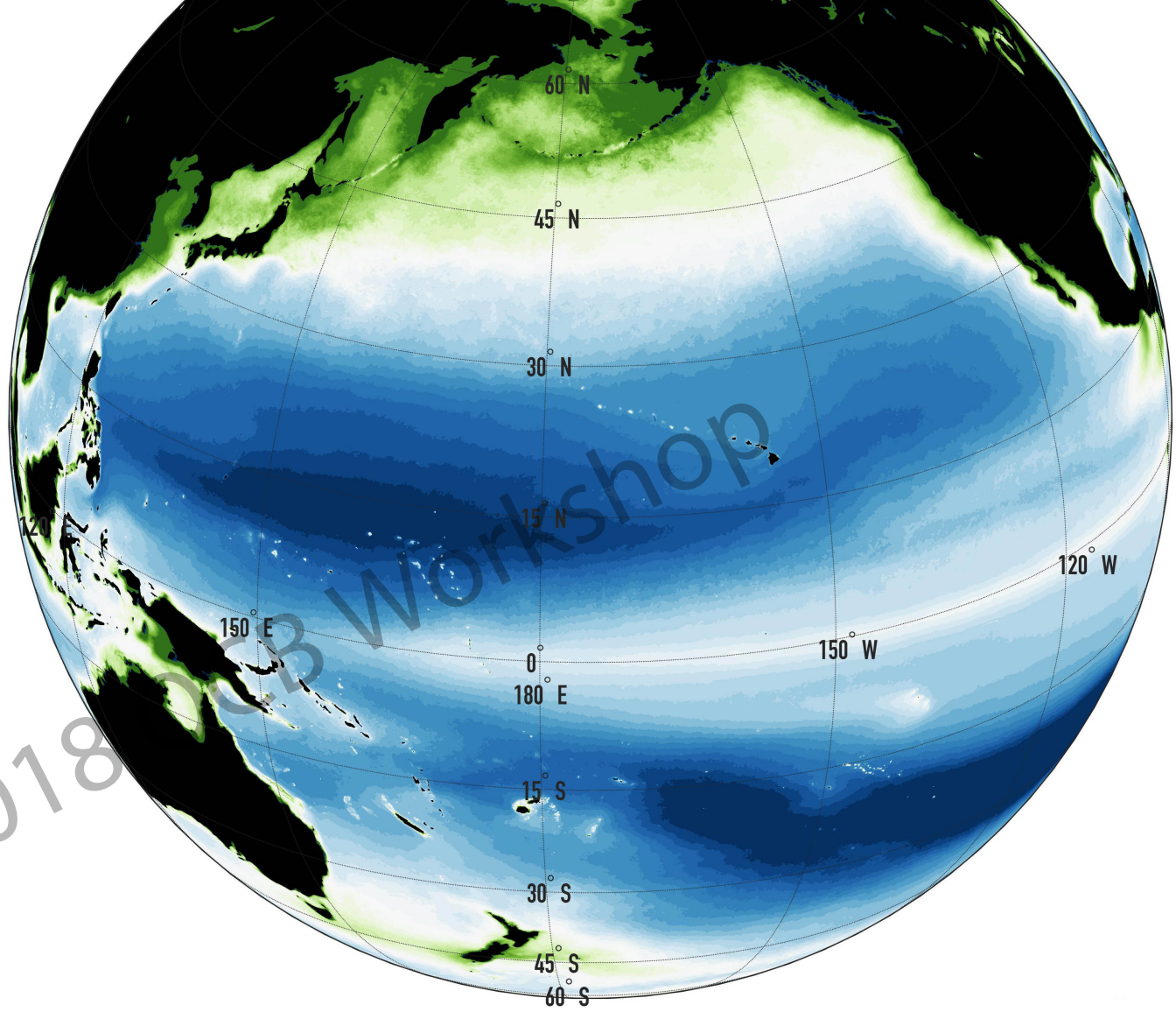
University of Hawaii

INTRO

THE NORTH PACIFIC SUBTROPICAL GYRE



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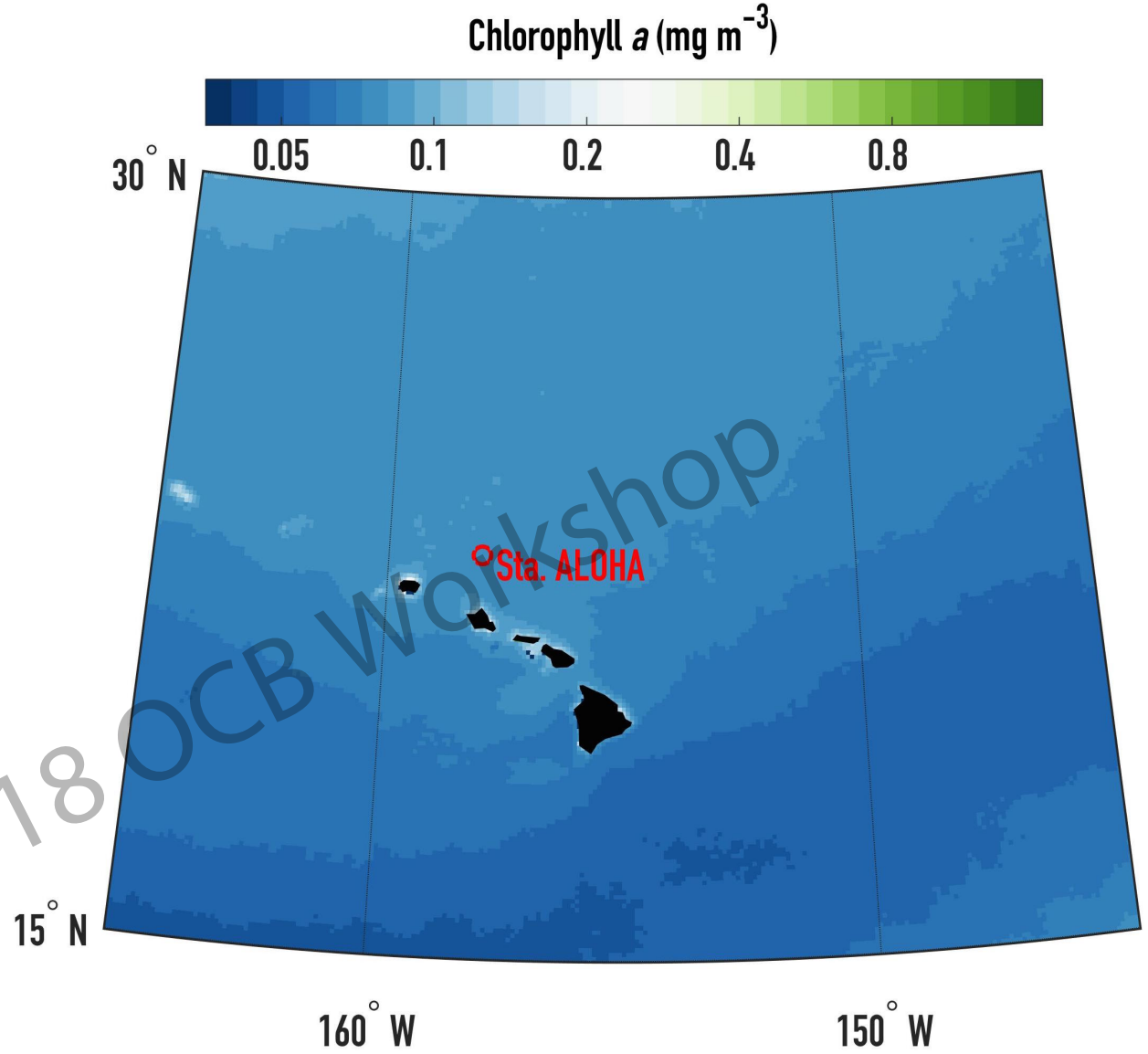
THE HAWAII OCEAN TIME-SERIES



- Seasonal variation
- Interannual variation
- Vertical variation

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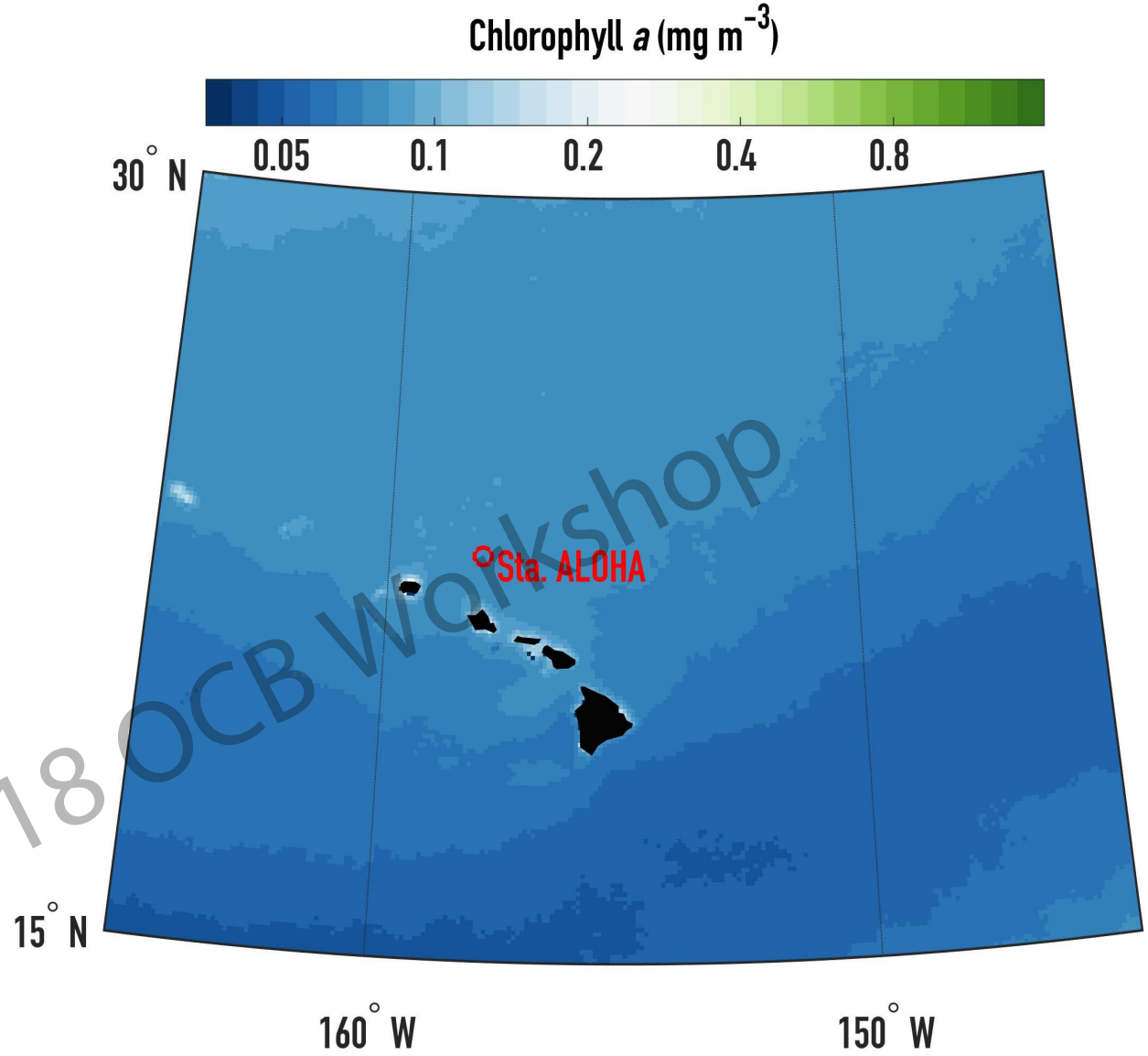
THE HAWAII OCEAN TIME-SERIES



How important is the horizontal variability?

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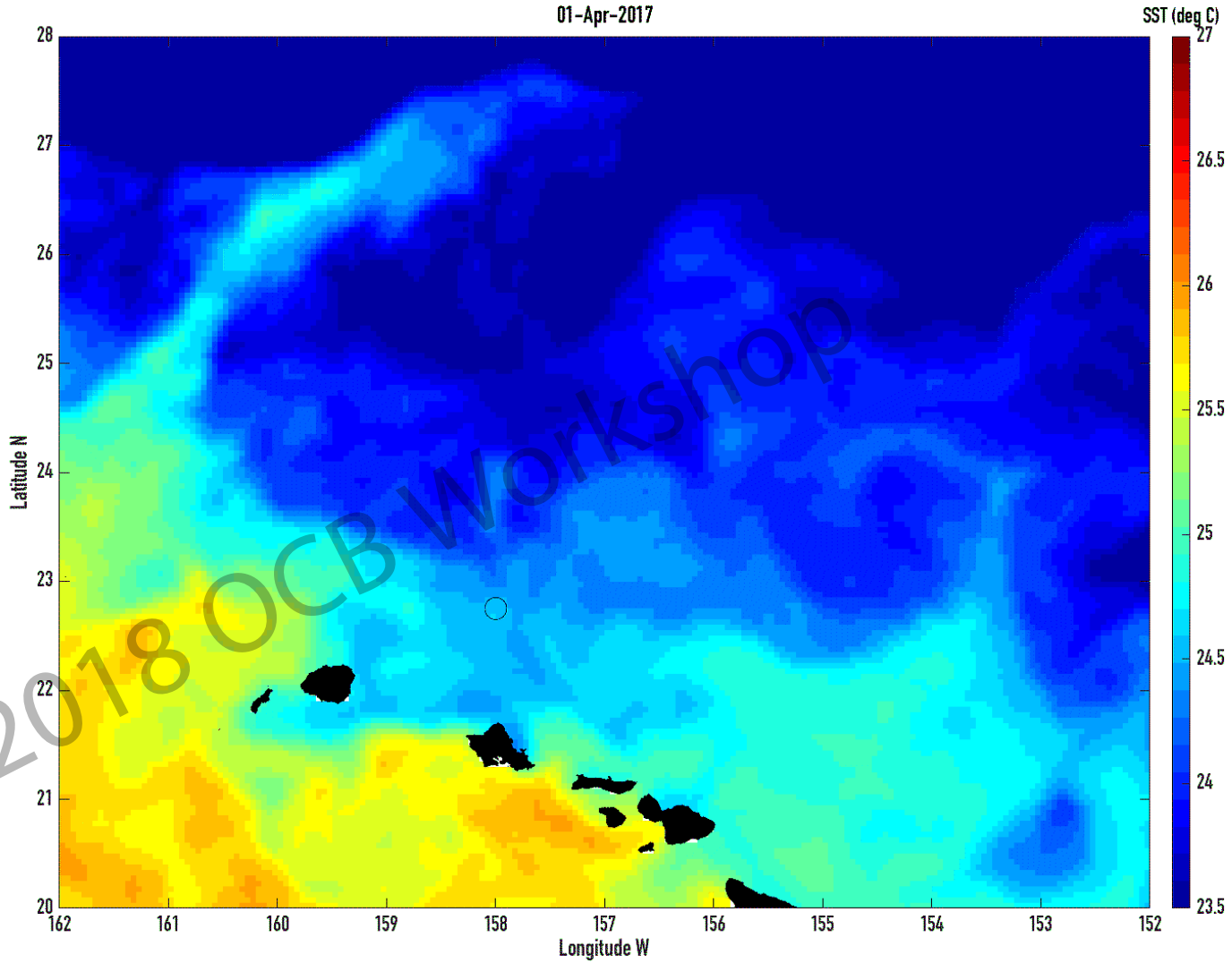
MESOSCALE DYNAMICS NORTH OF HAWAII



NASA, Geo-Polar Blended Nighttime SST

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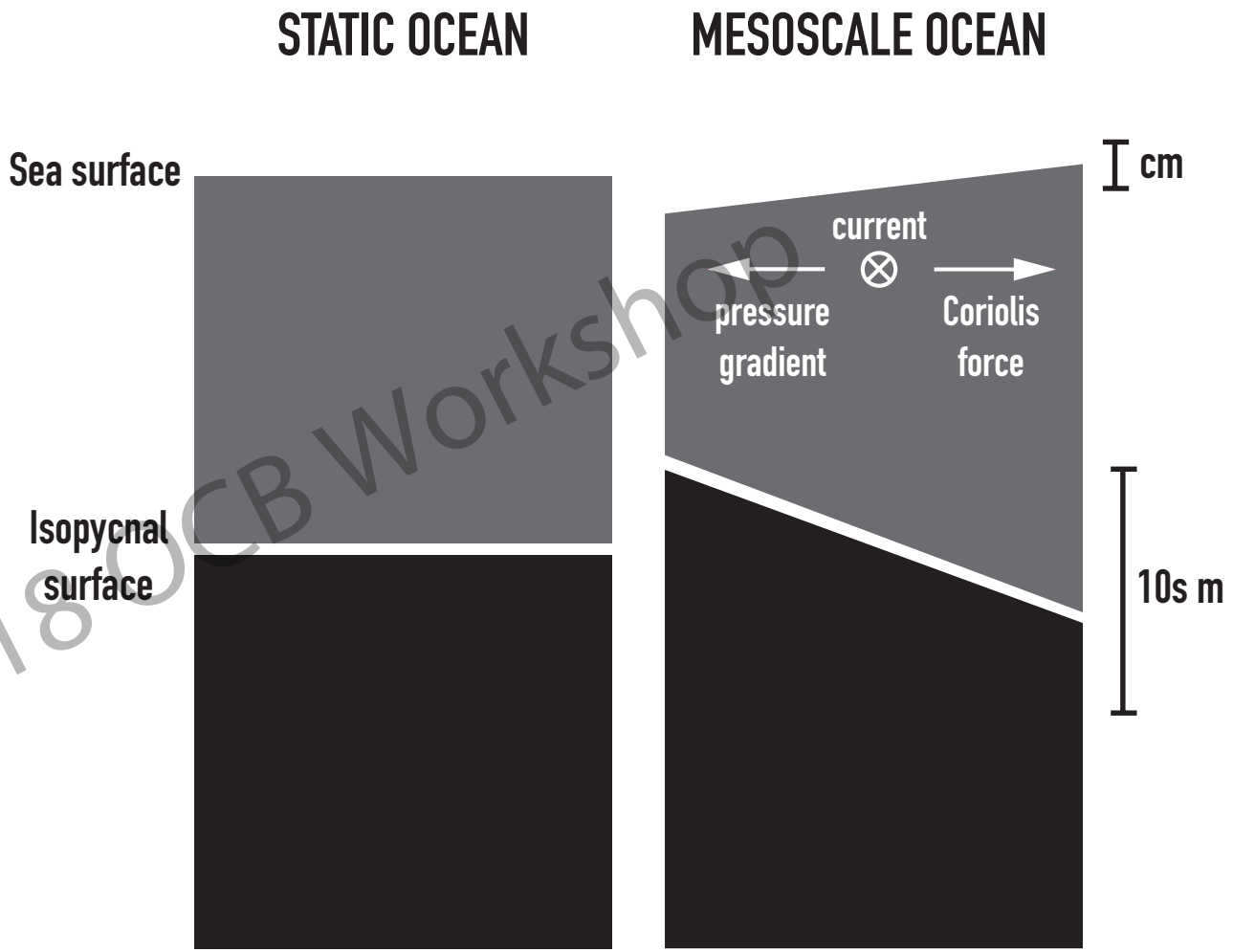
CHARACTERISTICS OF MESOSCALE MOTIONS



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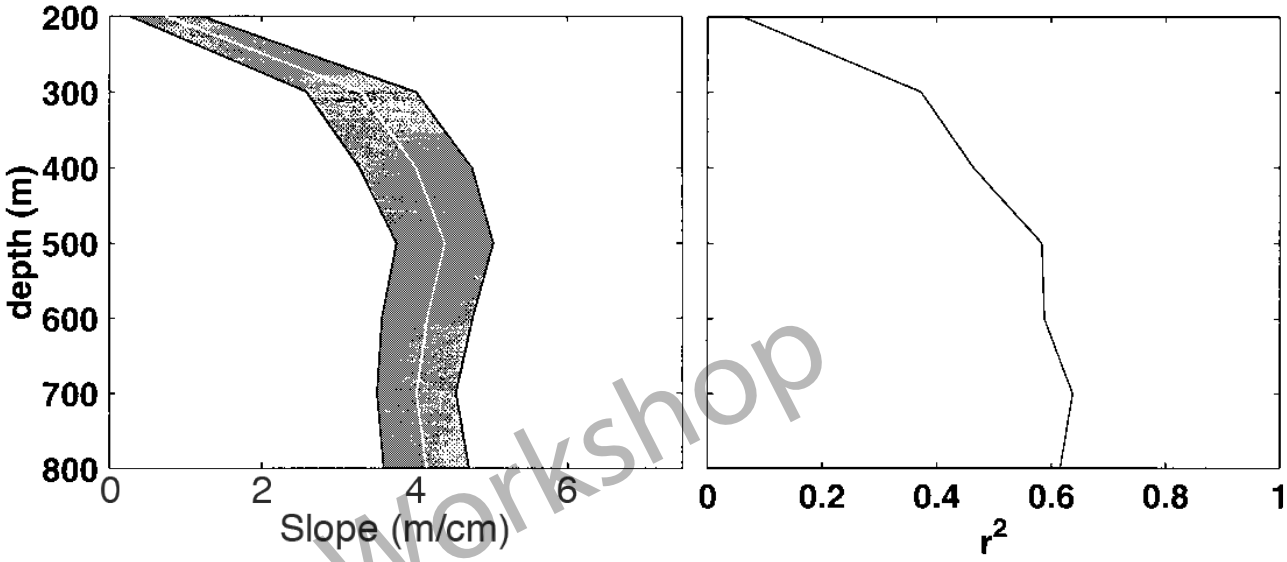
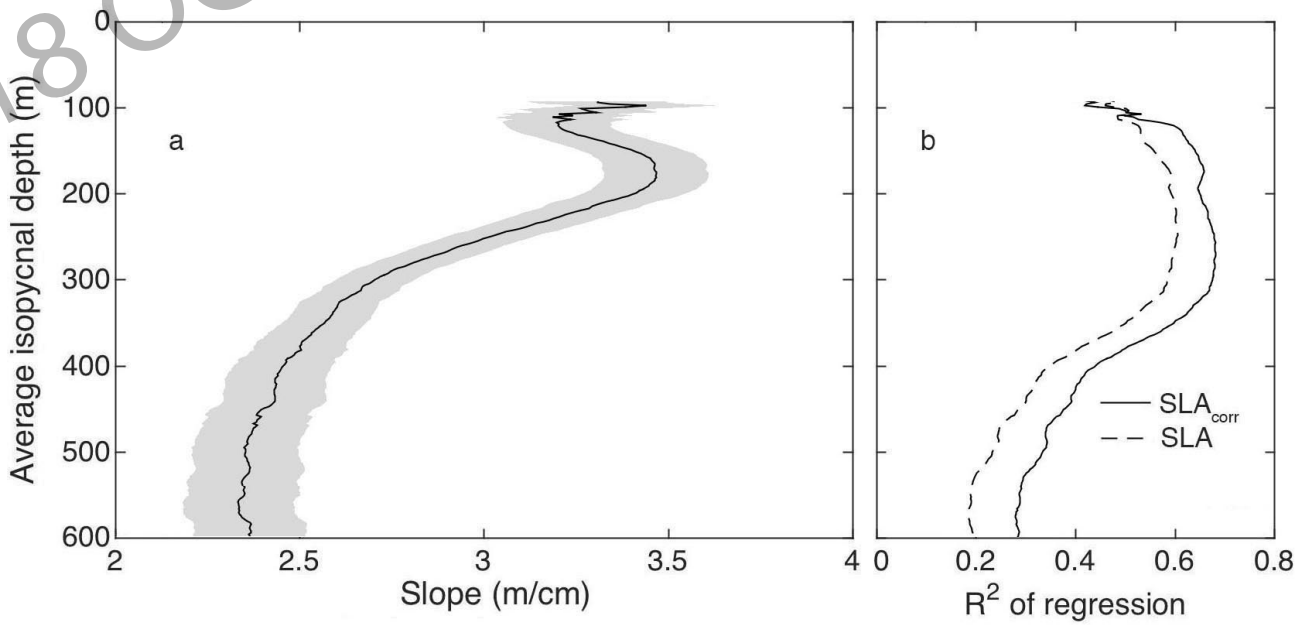
SEA SURFACE HEIGHT LINKED TO THE DEPTH OF WATER LAYERS

BATS

Adapted from Siegel et al. (1999)



HOT



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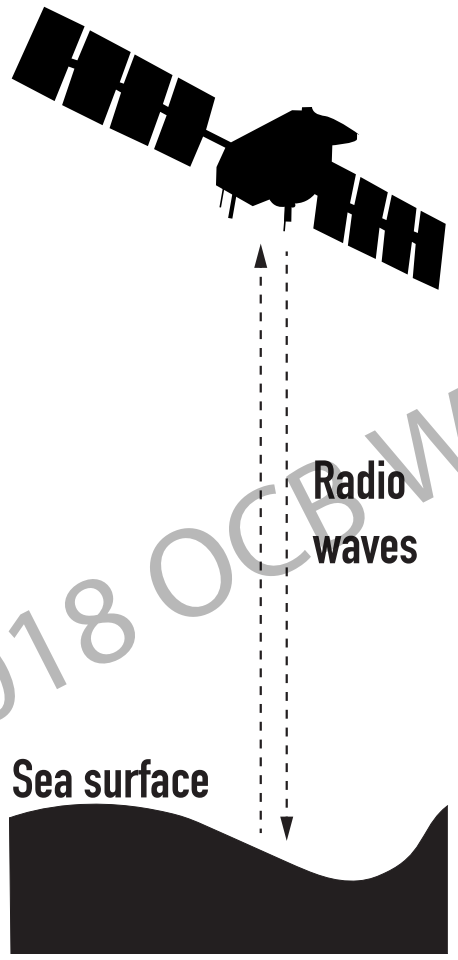
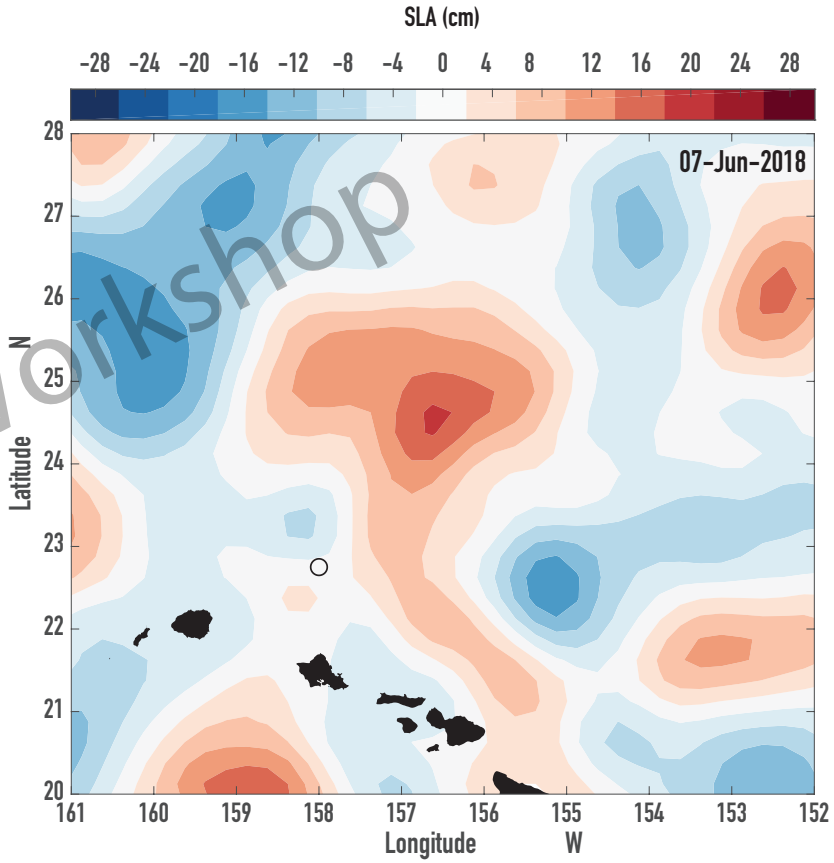
SEA SURFACE HEIGHT IS MEASURED FROM SATELLITE





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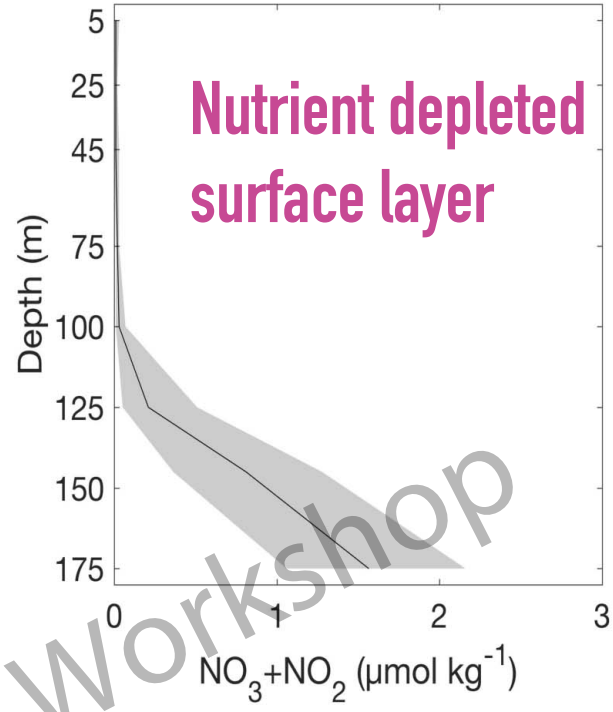
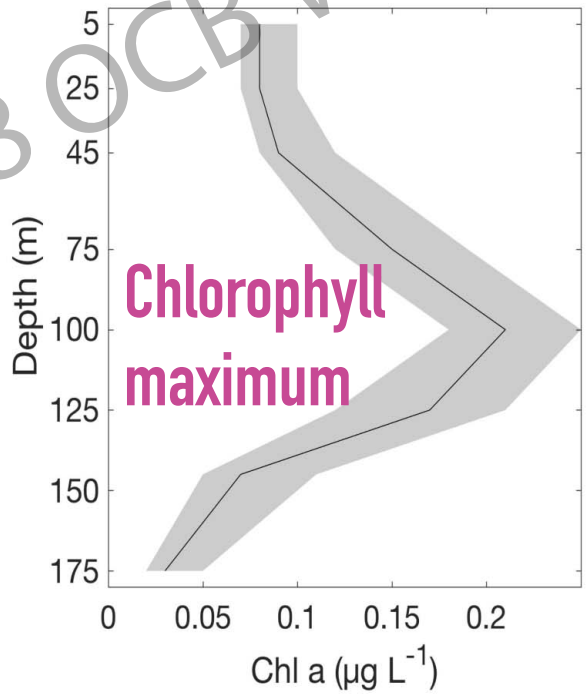
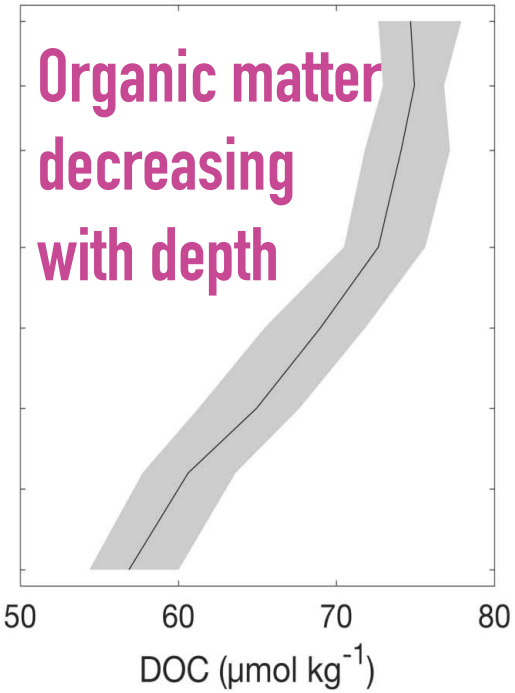
BIOGEOCHEMICAL CHARACTERISTICS OF STATION ALOHA







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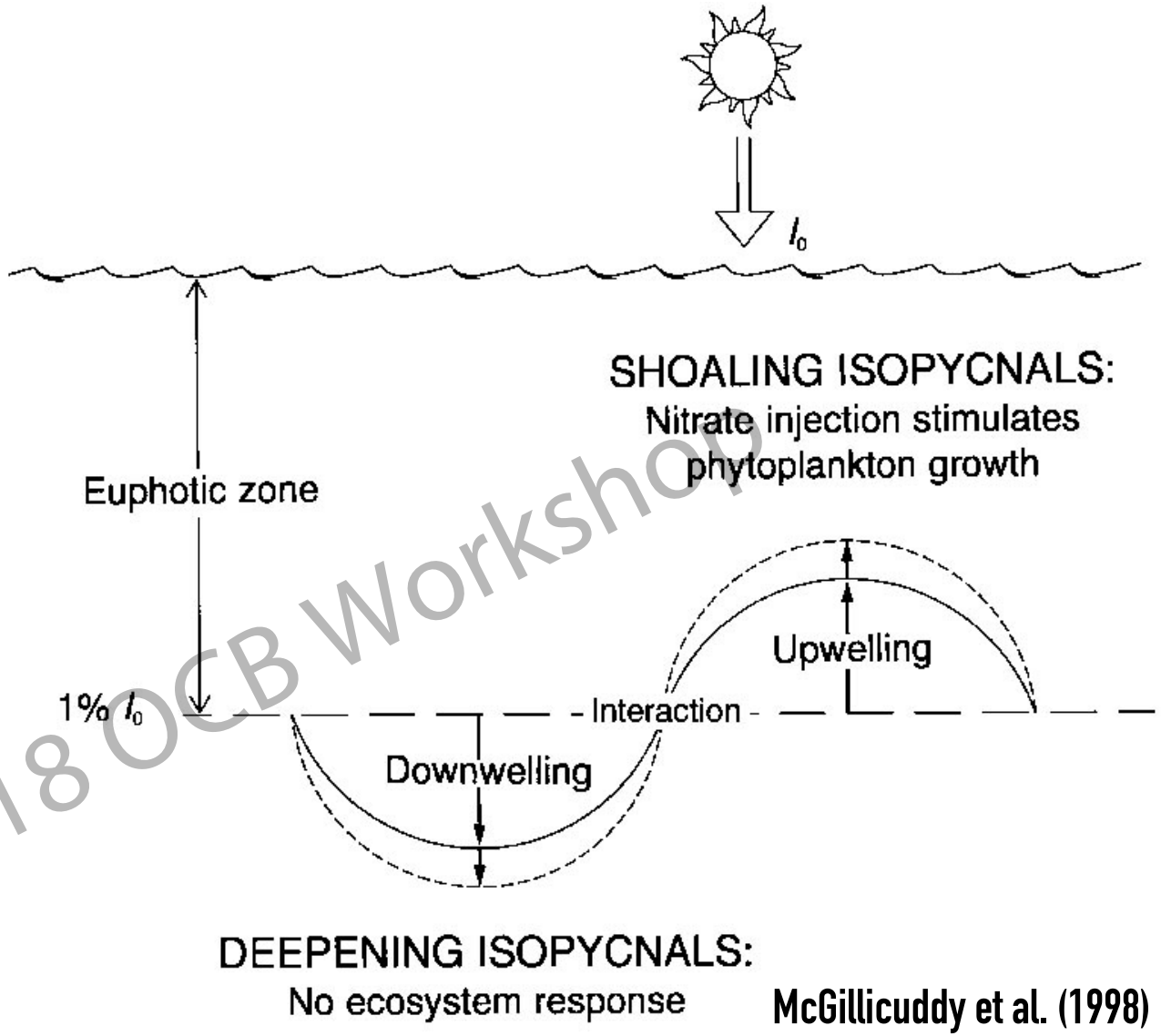
NEW PRODUCTION WHEN DEEP LAYERS ARE EXPOSED TO LIGHT



McGillicuddy et al. (1998)

Blooms not usually observed because ecosystem responds faster than nutrient supply

QUESTIONS

ARE THERE TRANSIENT EVENTS OF ENHANCED NEW PRODUCTION NORTH OF HAWAII?

WHAT ARE THE BIOGEOCHEMICAL CHANGES LINKED TO SEA SURFACE HEIGHT?

METHOD

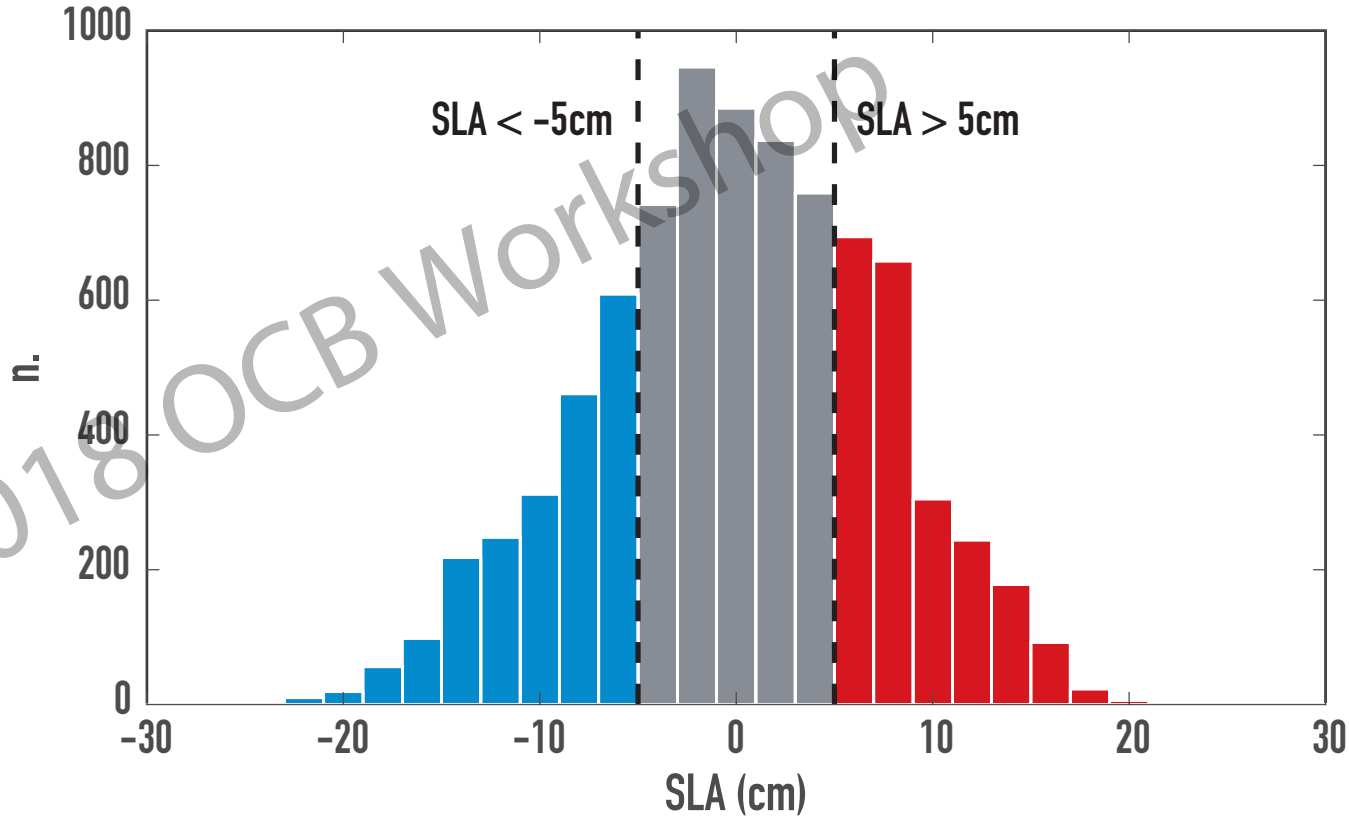
PART 1 Changes of Station ALOHA biogeochemistry with SSH

PART 2 Targeted observations of mesoscale dipoles

PART 1

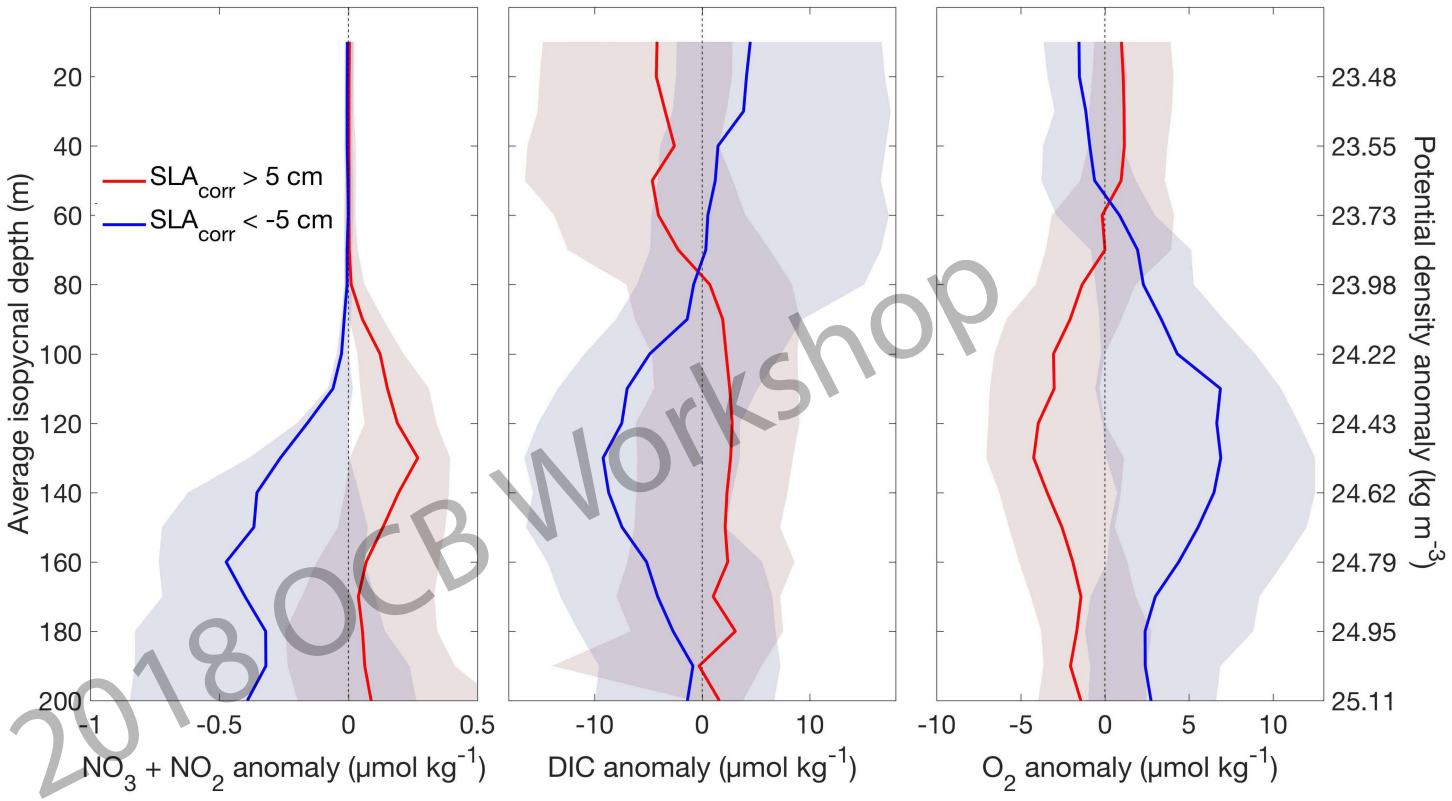
CHANGES OF STA. ALOHA BIOGEOCHEMISTRY WITH SSH

Comparison of biogeochemical characteristics of extreme SSH quartiles



PART 1

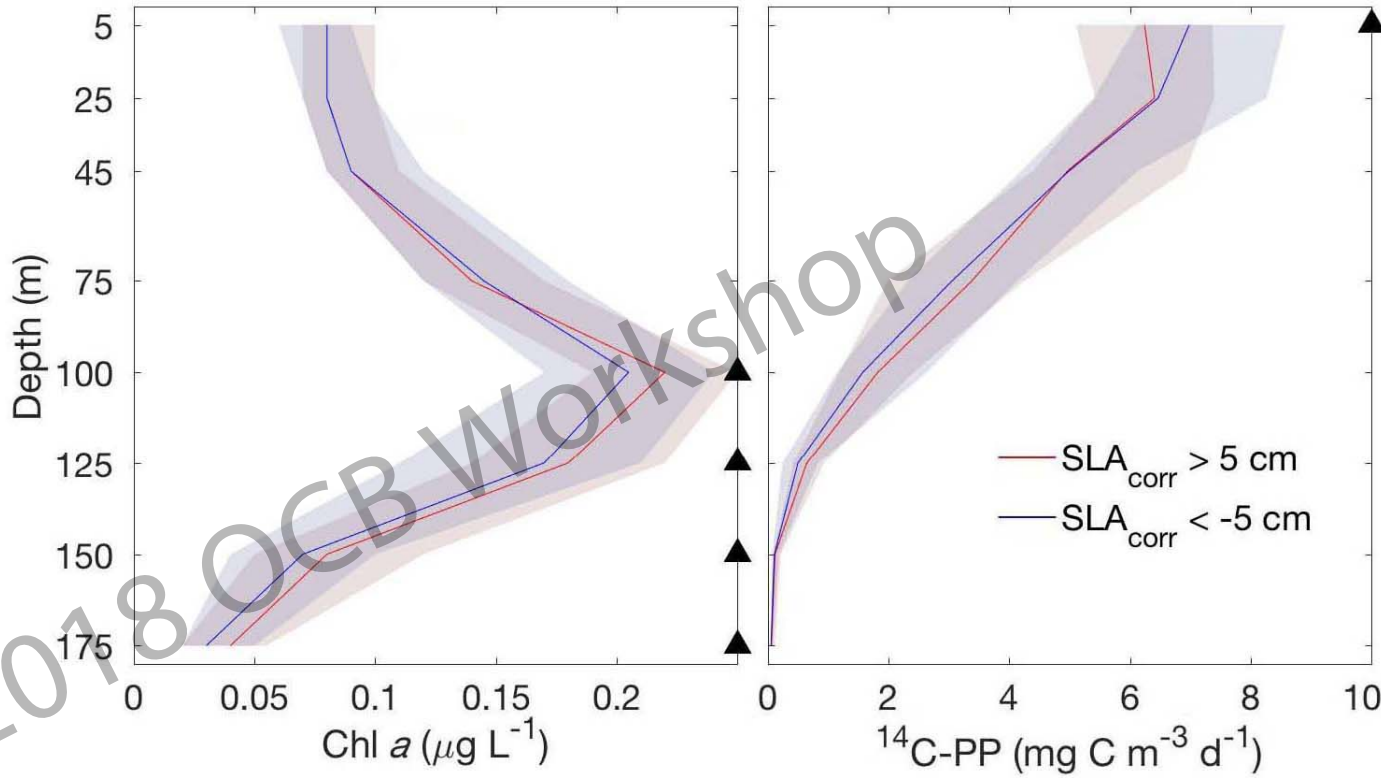
ENHANCED NEW PRODUCTION EVENTS



Isopycnal anomalies of NO_3^-, DIC, and O_2 indicate past new production events at low SLA

PART 1

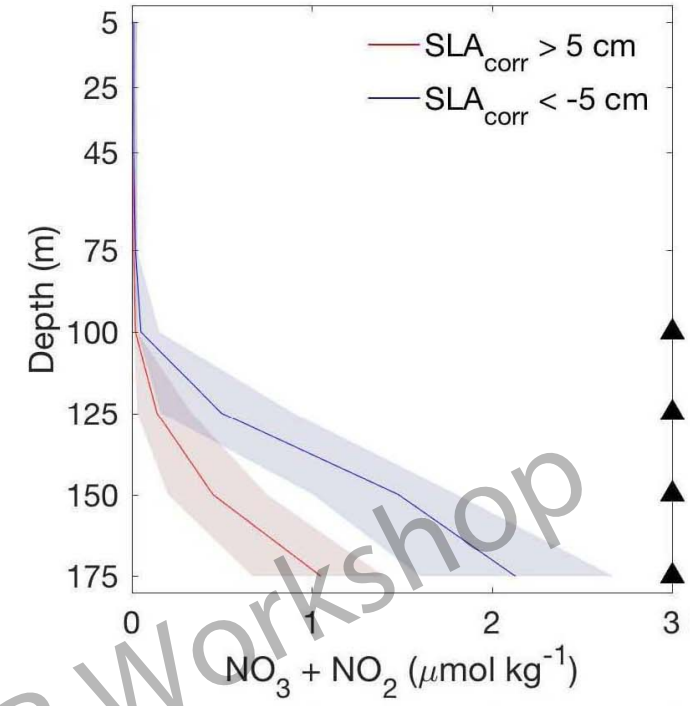
WE MISSED THE ACTION!

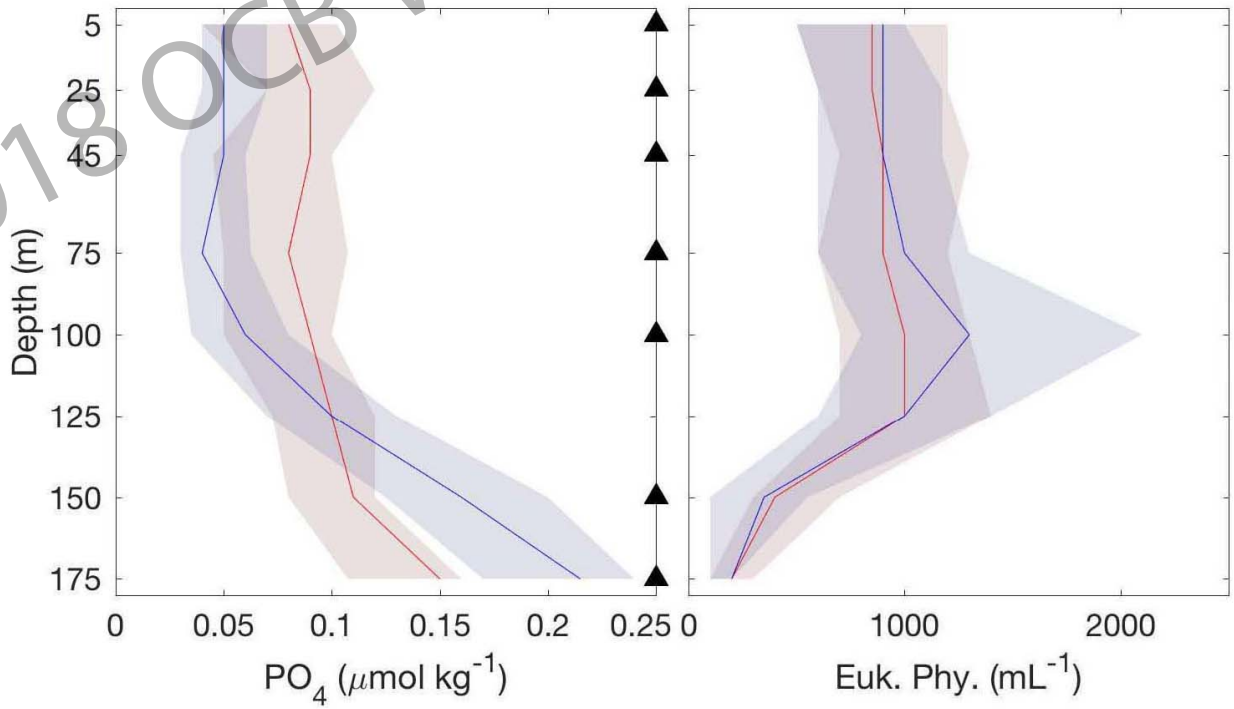


There is no evidence of enhanced production or biomass at the time of sampling

PART 1

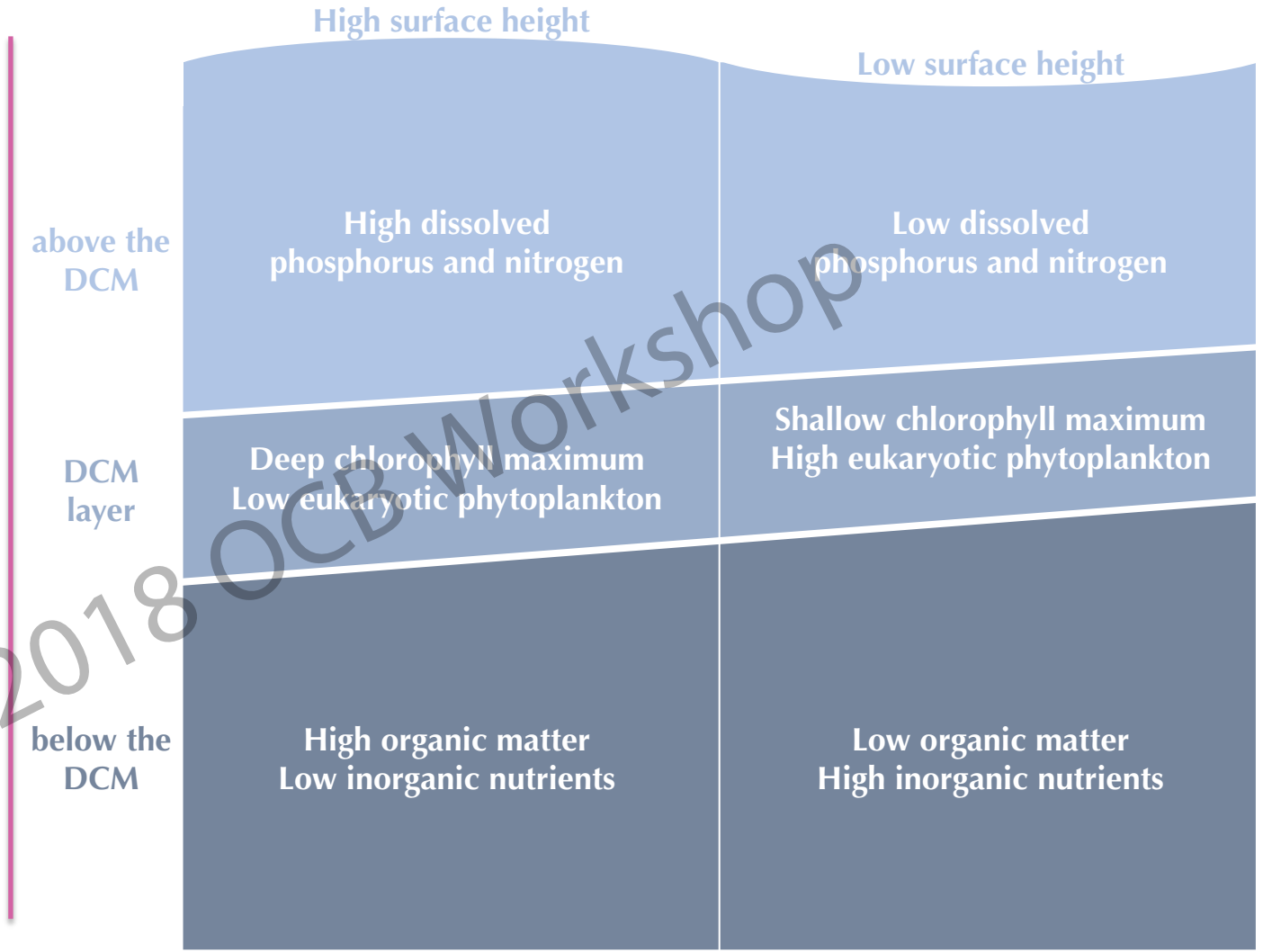
CHANGES IN THE BIOGEOCHEMICAL STATE





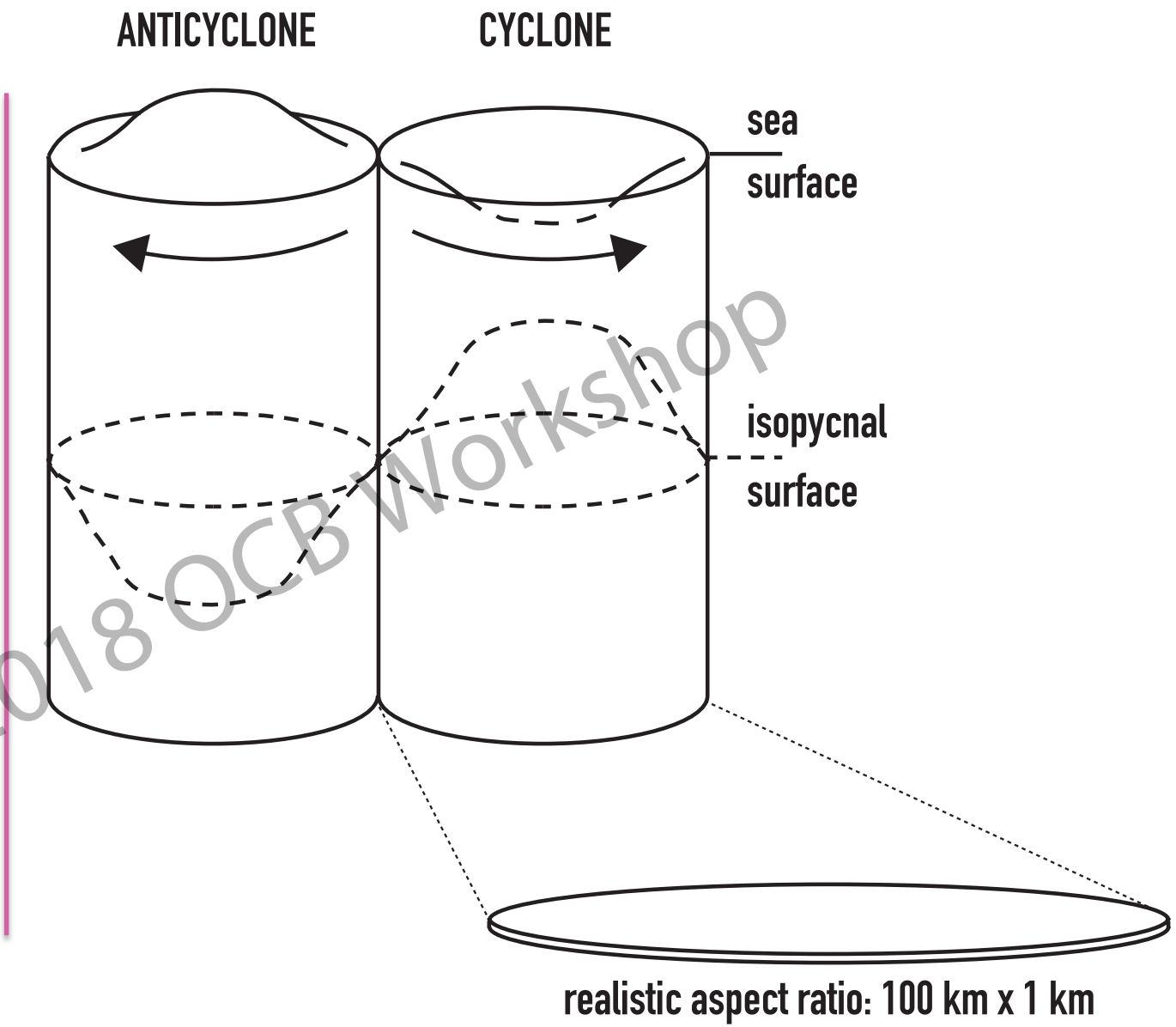
PART 1

SUMMARY: DEPTH-SPECIFIC CHANGES WITH SSH



PART 2

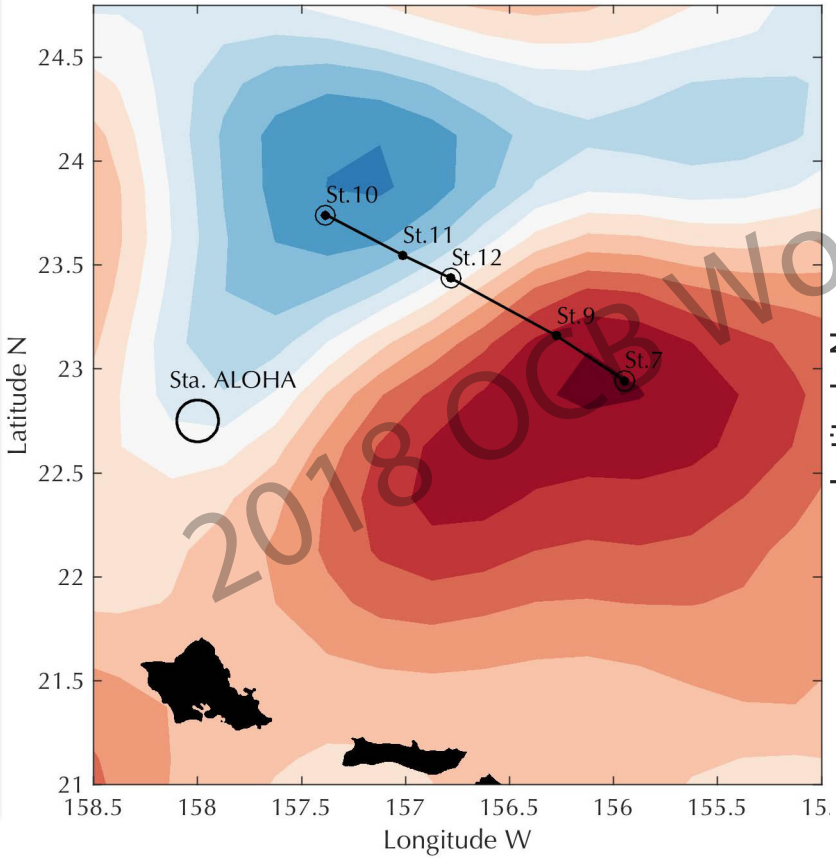
TARGETED OBSERVATIONS OF MESOSCALE DIPOLES



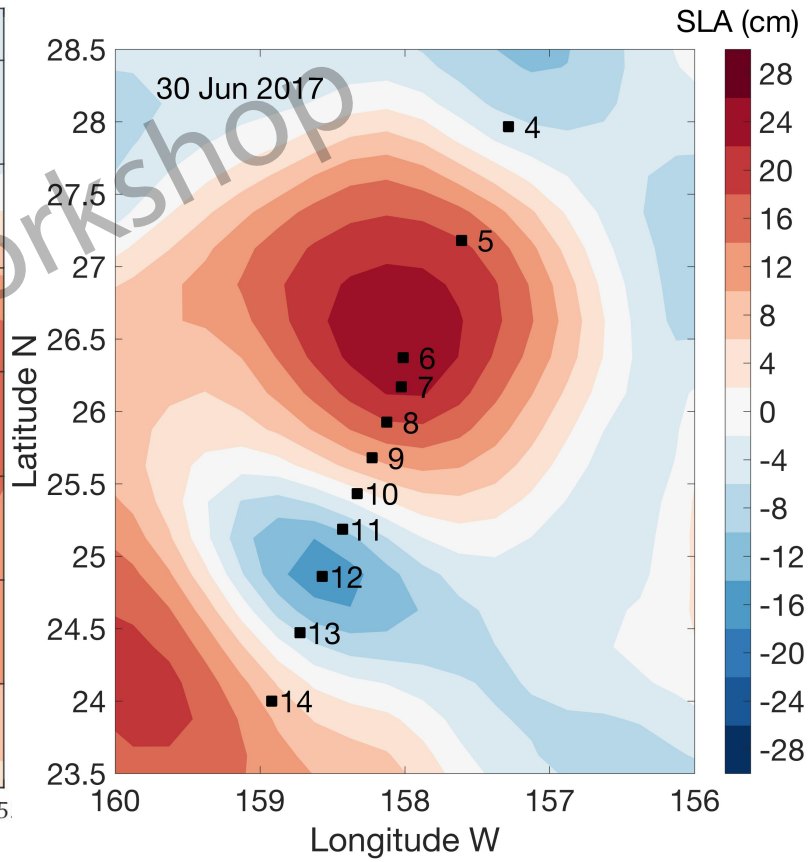
PART 2

CRUISES

SCOPE Dipole cruise (May 2016)

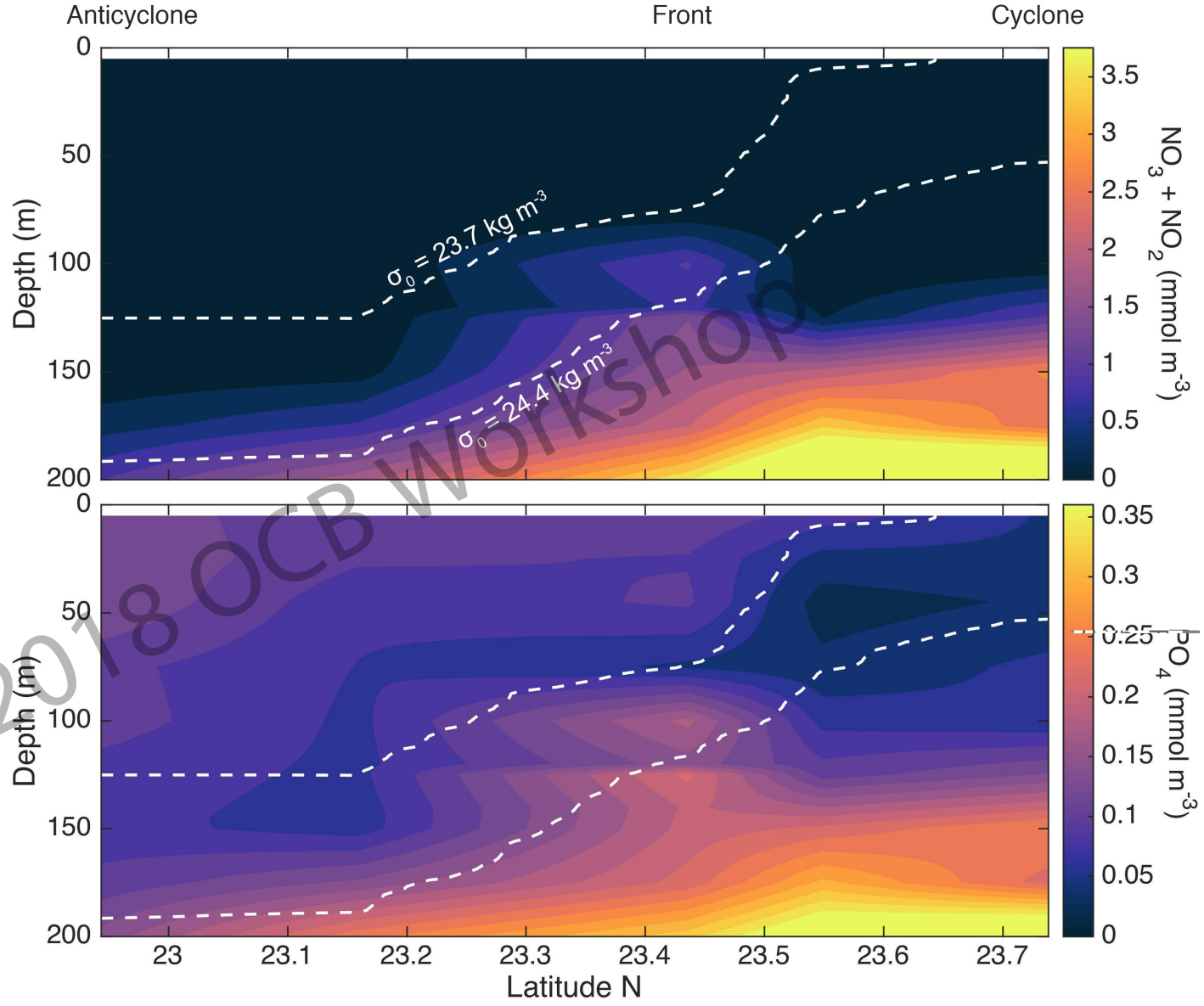


MESO-SCOPE (June-July 2017)



PART 2

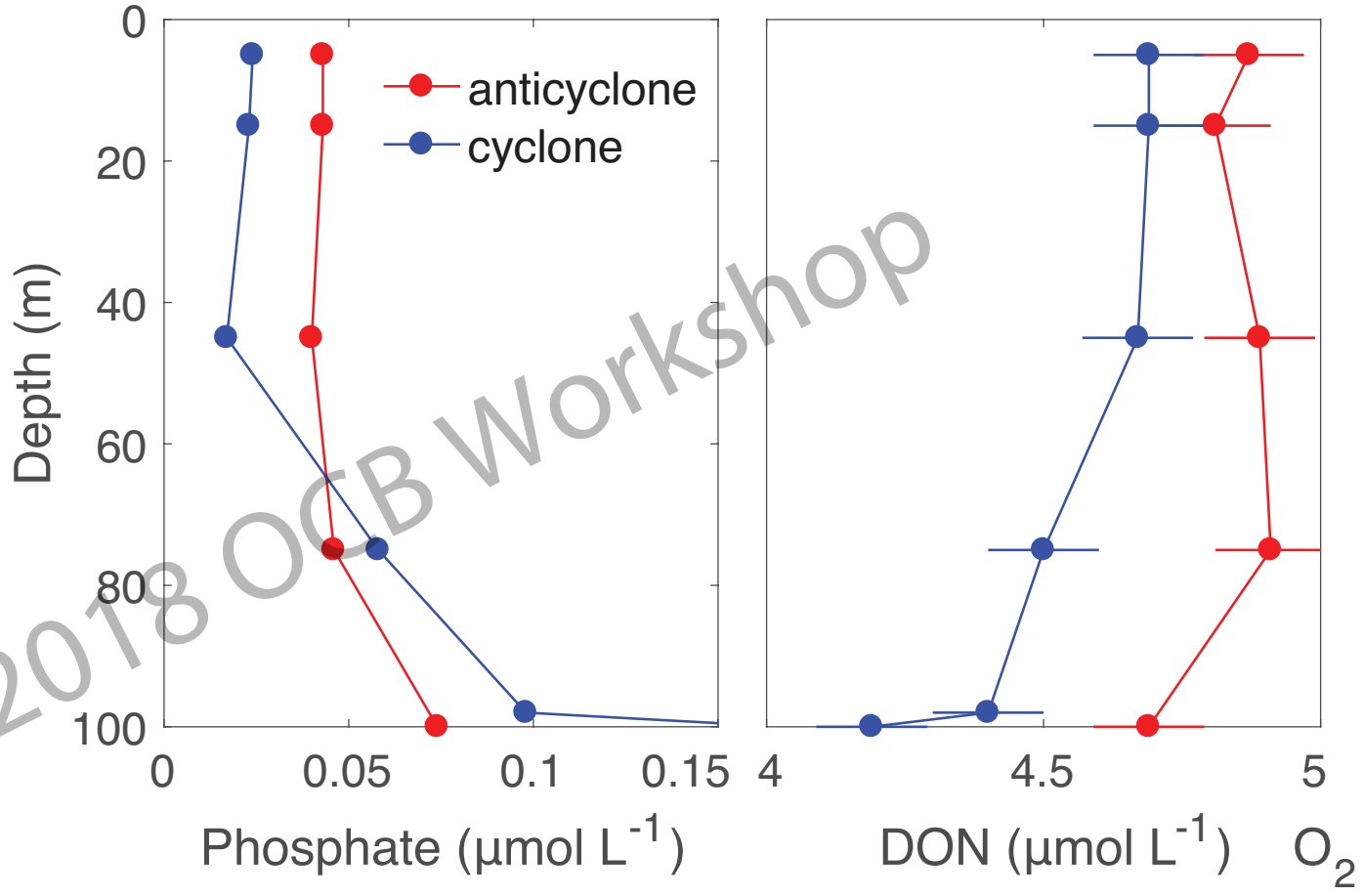
INORGANIC NUTRIENTS IN THE DIPOLES



PART 2

INORGANIC NUTRIENTS IN THE DIPOLES

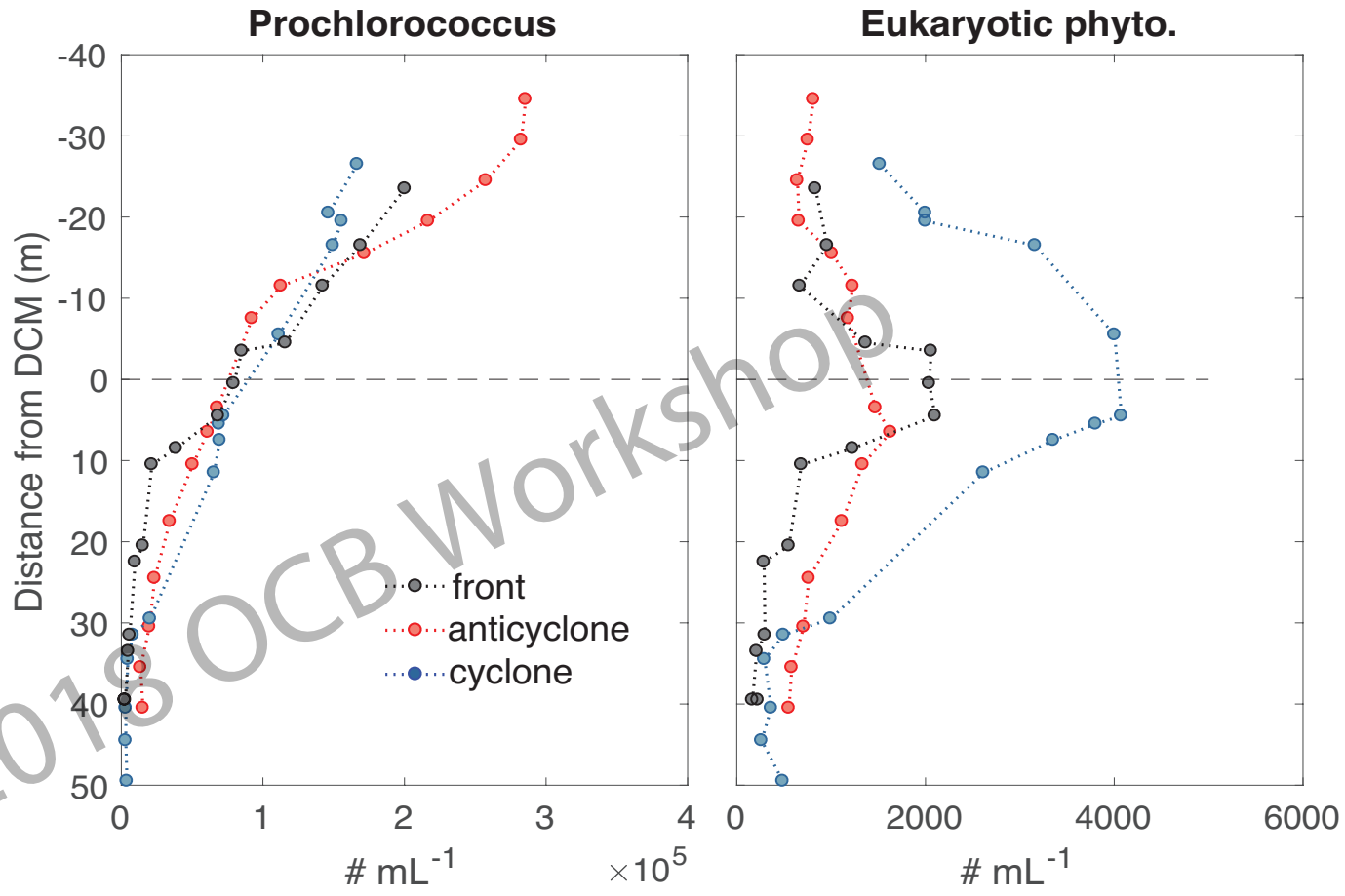
Courtesy of Karin Björkman & Rhea Foreman



Surface concentration of N and P is lower in cyclones

PART 2

DCM PHYTOPLANKTON COMMUNITY



Two-fold change in eukaryotic phytoplankton abundance at the DCM

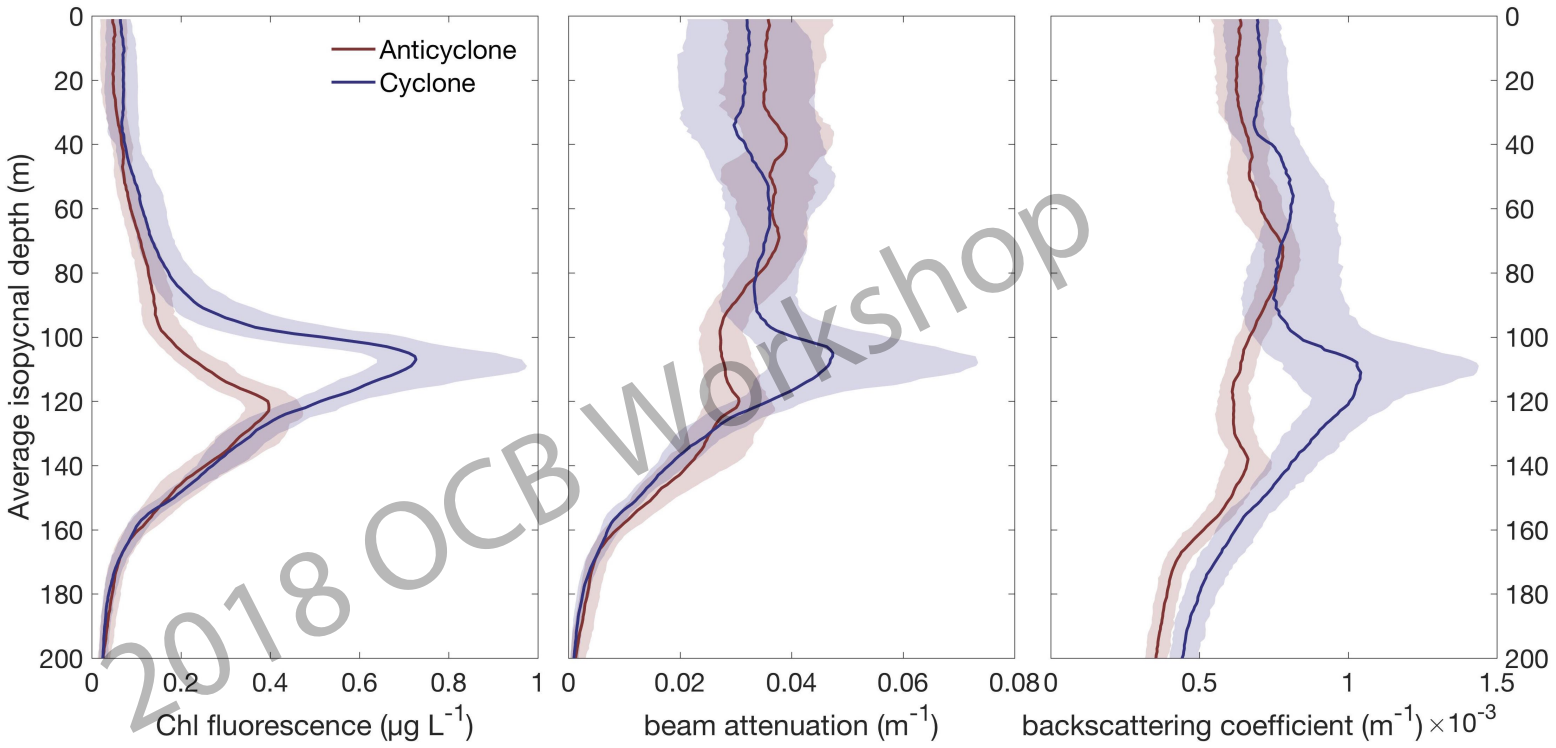
PART 2

AUTONOMOUS PROFILERS

What do we observe when we sample eddies with autonomous vehicles?

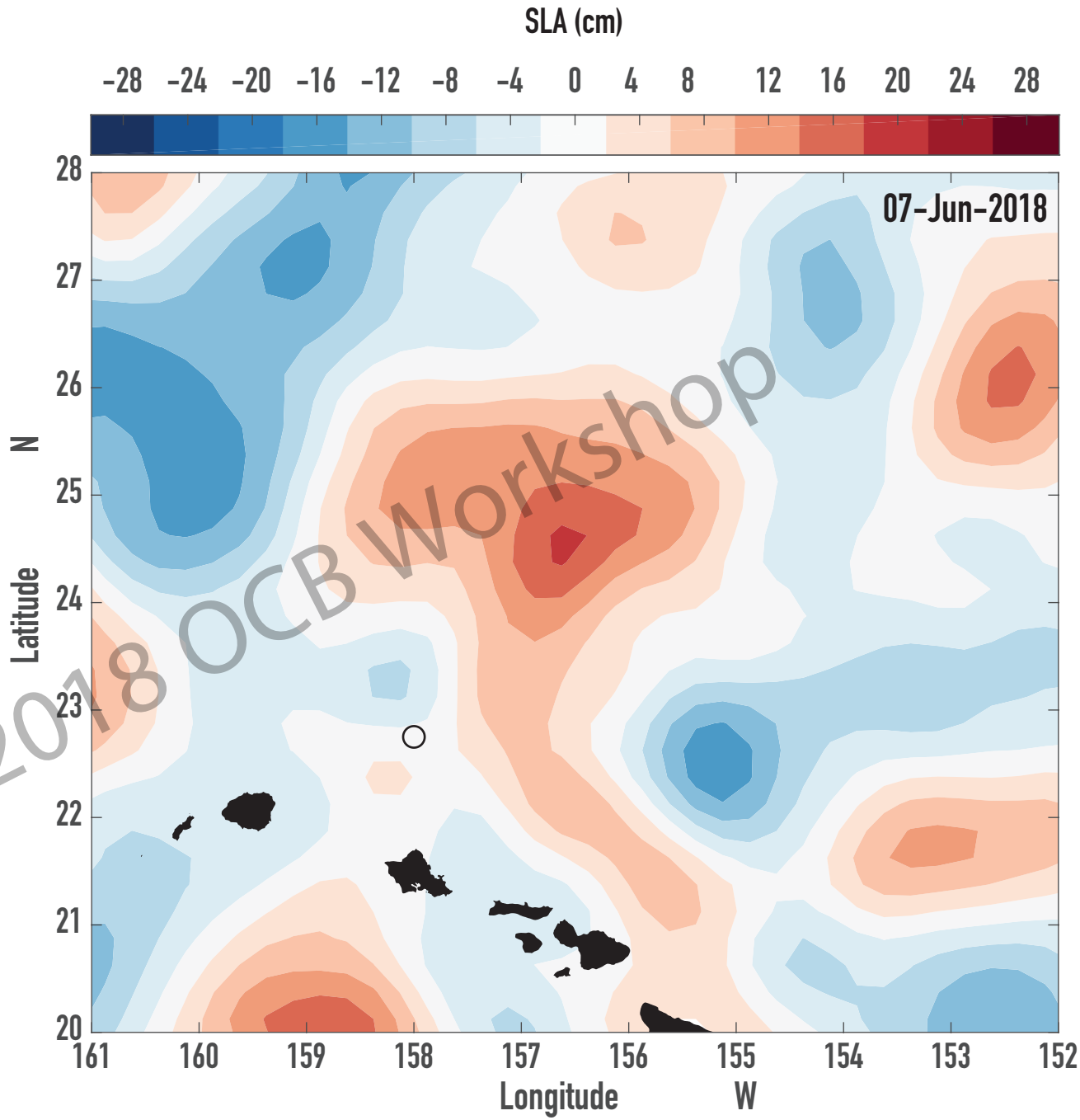
PART 2

IN SITU BIO-OPTICS



Increases in pigments and biomass at the DCM of cyclones that don't always match filter-based measurements

CONCLUSIONS



CONCLUSIONS

REPEATED EVENTS OF ENHANCED NEW PRODUCTION at Station ALOHA linked to mesoscale dynamics

EUKARYOTIC PHYTOPLANTON DECREASES WITH SSH (in anticyclones) together with nutrient gradients

SURFACE CONCENTRATION OF N AND P INCREASES WITH SSH (in anticyclones)

OPTICAL OBSERVATIONS SHOW INCREASED BIOMASS IN CYCLONIC DCM not always matched by filtration-based measurements

ACKNOWLEDGEMENTS

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Steve Poulos

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