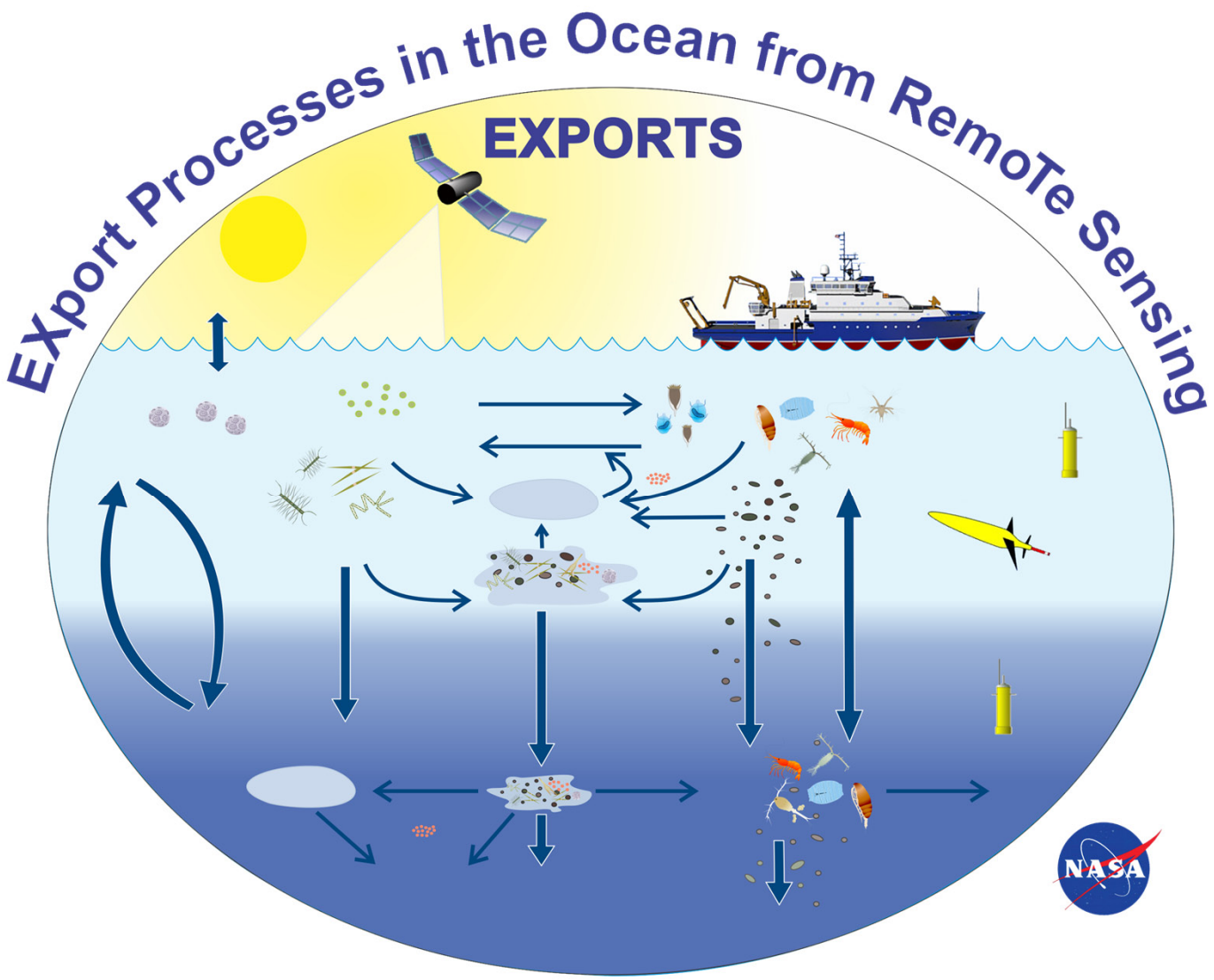


Science Plan

http://cce.nasa.gov/obb/exports/

What is EXPORTS?

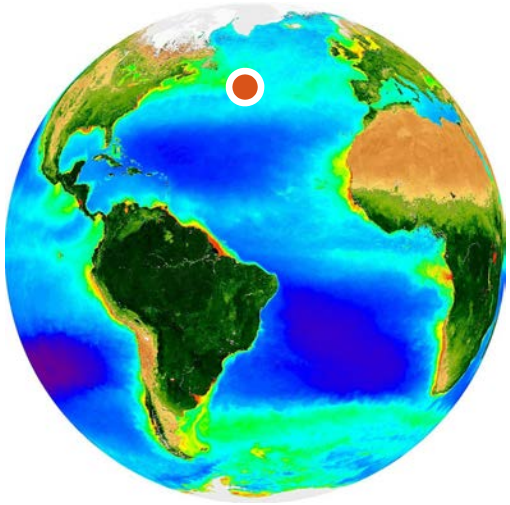
A community vetted science plan for a NASA field campaign

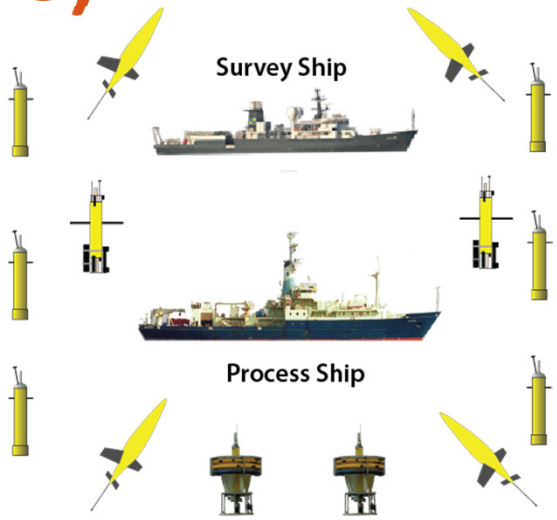
Goal: Predict the export and fate of ocean NPP from satellite & other observations

Hypothesis: Carbon export from the euphotic zone and its fate within the twilight zone can be predicted knowing characteristics of the surface ocean ecosystem

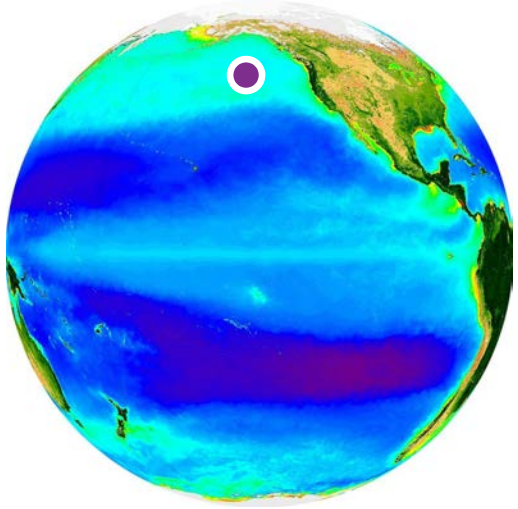
What is EXPORTS?

N. Atlantic (2018)





Station P (2020)



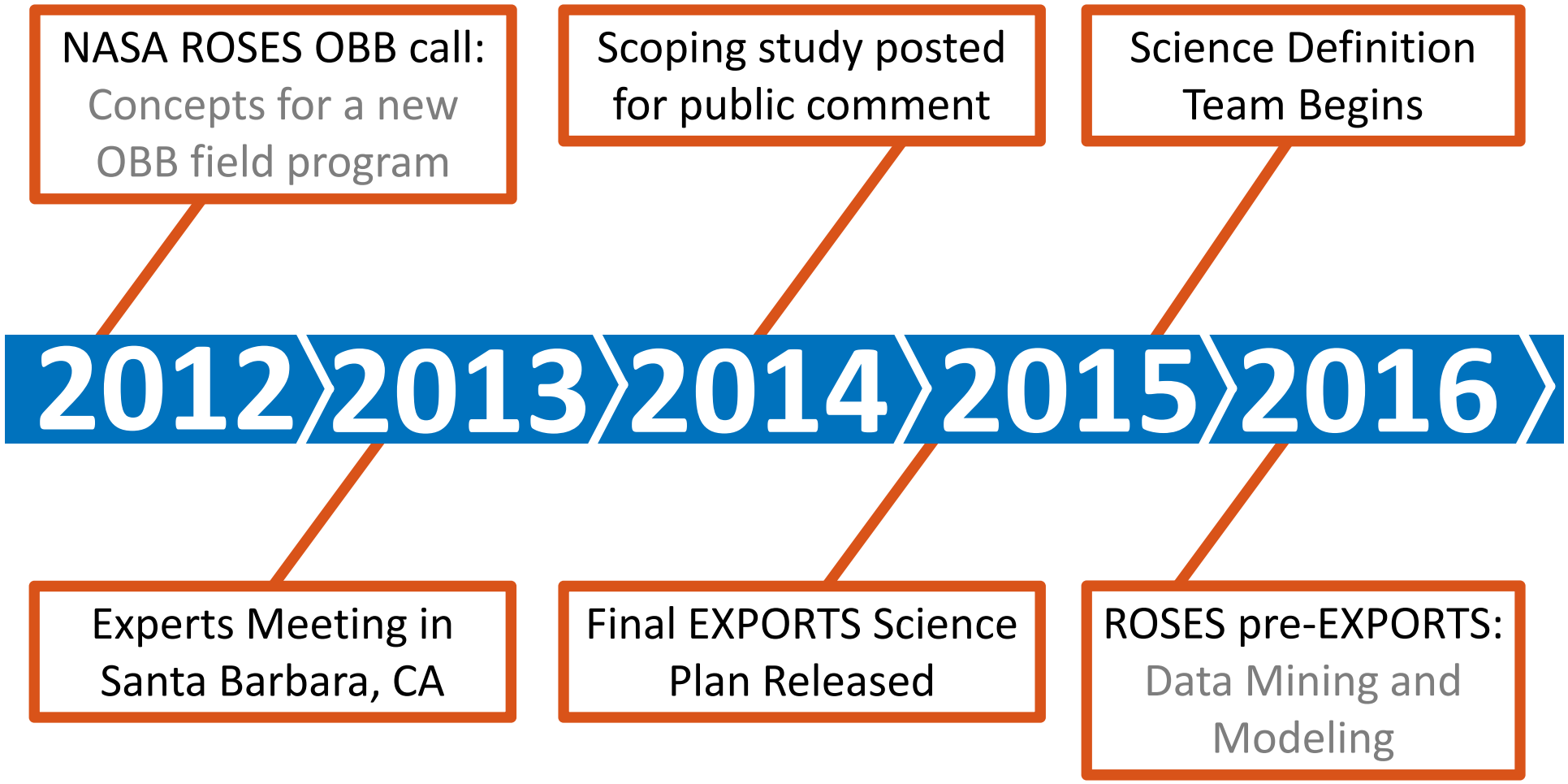
Bloom: Apr/May 45d
Non-bloom: Aug, 30d
Leverage: Internationals

Cruise 1: Apr/May 30/45d
Cruise 2: Aug, 30d
Leverage: OOI node, LineP

Collect ≥ 10 ecosystem/C-cycling states

Data mining and modeling (ROSES 2015)

When? EXPORTS Milestones:



Who is EXPORTS?

Writing Team

David Siegel, UCSB, Ken Buesseler, WHOI, Mike Behrenfeld, OSU, Claudia Benitez- Nelson, U. South Carolina, Emmanuel Boss, U. Maine, Mark Brzezinski, UCSB, Craig Carlson, UCSB, Scott Doney, WHOI, Mary Jane Perry, U. Maine, Rachel Stanley, WHOI, Deborah Steinberg, VIMS

Experts Meeting Participants

Barney Balch, Bigelow, Mike Behrenfeld, Oregon State, Claudia Benitez- Nelson, Univ. South Carolina, Paula Bontempi, Mark Brzezinski, UCSB, Ken Buesseler, WHOI Craig Carlson, UCSB Dave Checkley, UCSD/SIO Curtis Deutsch, UCLA Scott Doney, WHOI Kim Halsey, Oregon State, Debora Iglesias- Rodriguez, UCSB, George Jackson, Texas A&M Ken Johnson, MBARI Mike Landry, UCSD/SIO Craig Lee, Univ. Washington, Stephane Maritorena, UCSB, Norm Nelson, UCSB Uta Passow, UCSB, Mary Jane Perry, Univ. Maine Paul Quay, Univ. Washington David Siegel, UCSB Heidi Sosik, WHOI Rachel Stanley, WHOI Deborah Steinberg, VIMS Dariusz Stramski, UCSD/SIO.

Public Commenters on Science Plan

NASA Panel Review

Science Definition Team

Quincy Allison, NASA, Barney Balch, Bigelow, Mike Behrenfeld, Oregon State, Paula Bontempi, Ken Buesseler, WHOI Craig Carlson, UCSB Nicholas Cassar, Duke, Ivona Cetinic, NASA GSFC, Scott Doney, WHOI, Margaret Estapa, Skidmore, Peter Griffith NASA GSFC, Bethany Jenkins, URI, Ken Johnson, MBARI, Craig Lee, Univ. Washington, Adrian Martin, NOC, Susanne Menden-Deuer, URI, David Nicholson, WHOI, Uta Passow, UCSB, Mary Jane Perry, Univ. Maine, Anastasia Romanou, NASA GISS, David Siegel, UCSB, Mike Sieracki, NSF, Deborah Steinberg, VIMS, Andrew Thompson, CalTech, Jeremy Werdell, NASA GSFC

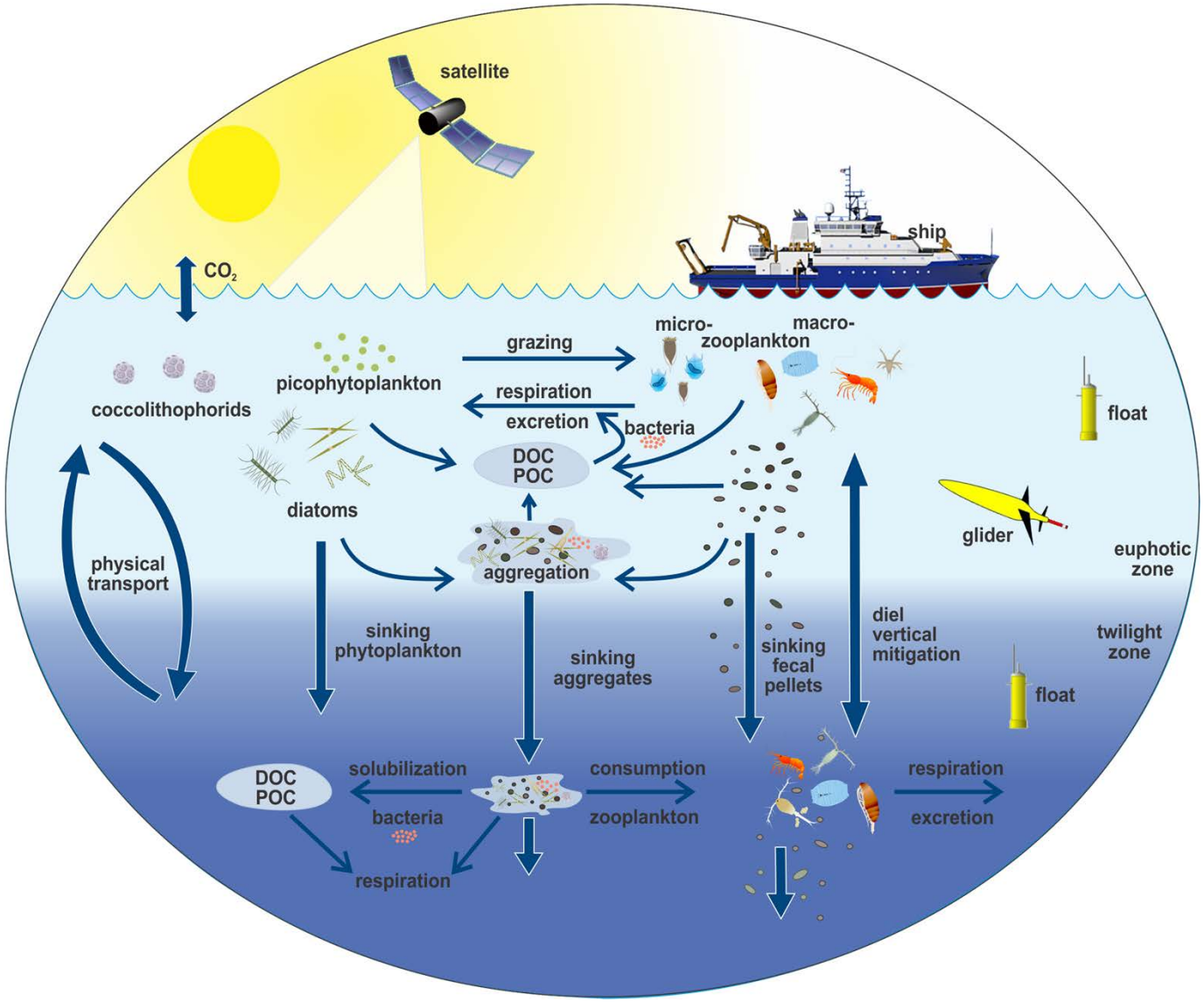
‘Pre-EXPORTS’ Modeling and Data Mining

Public Commenters

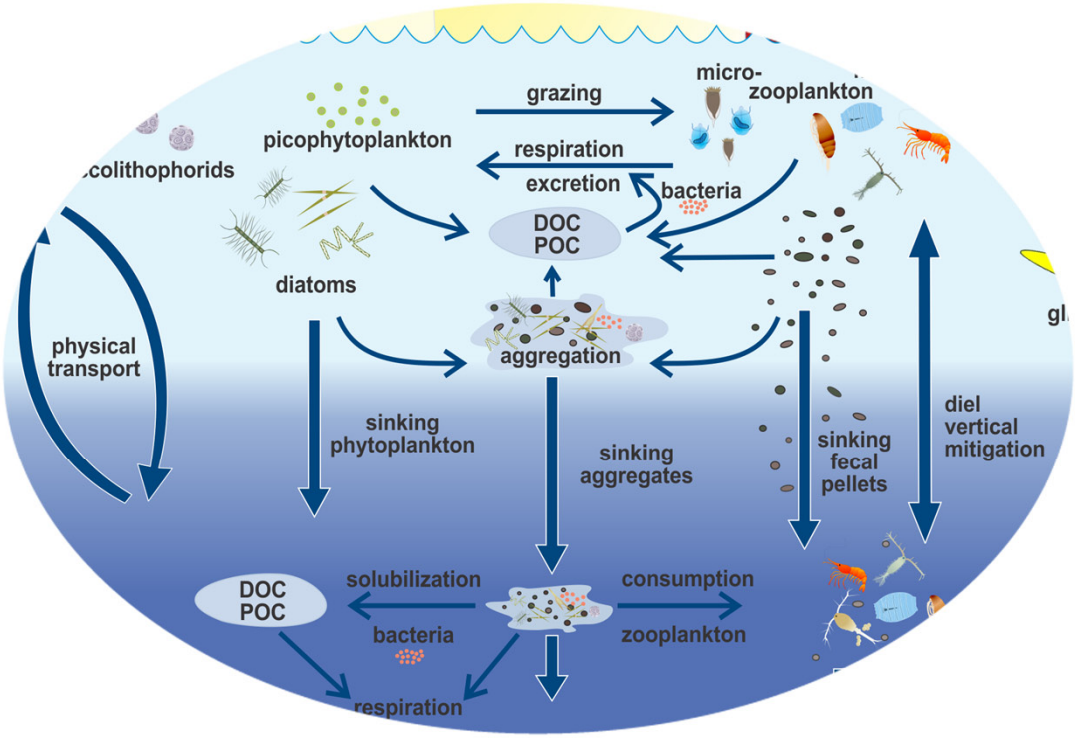
Future NASA ROSES: Every role will be competed!

When? EXPORTS Milestones:

Why EXPORTS?

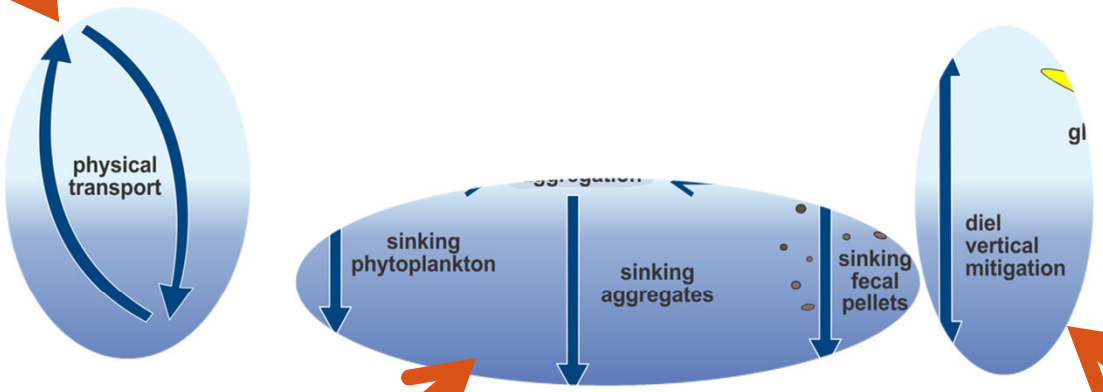

satellite
ship
CO_2
micro-
zooplankton
macro-
grazing
picophytoplankton
respiration
excretion
bacteria
coccolithophorids
DOC
POC
diatoms
float
glider
physical
transport
aggregation
euphotic
zone
sinking
phytoplankton
sinking
aggregates
sinking
fecal
pellets
diel
vertical
mitigation
twilight
zone
float
DOC
POC
solubilization
consumption
bacteria
zooplankton
respiration
excretion
respiration

Why?: Need to understand, quantify & predict how ecosystem processes transfer organic matter to depth



Why?: Need to improve estimates of carbon export from the euphotic zone (4 to 13 Pg C y^{-1})

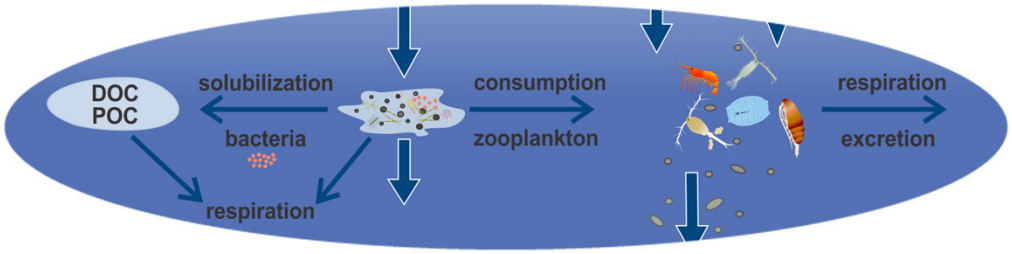
Physical Transport
0.5 - 2.5 Pg C y^{-1}



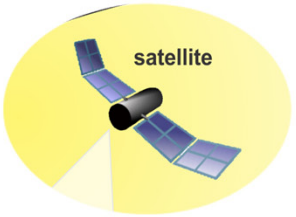
Sinking Flux
4-8 Pg C y^{-1}

Migration Flux
0.5 - 1.5 Pg C y^{-1}

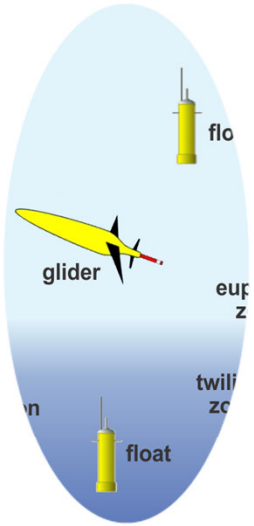
Why? Need to quantify the attenuation of export below euphotic zone (the twilight zone)



Why Now? Advances in remote sensing (& PACE!!) & autonomous tools make it time!



EXPORTS builds on decades of NASA research to quantify NPP from space



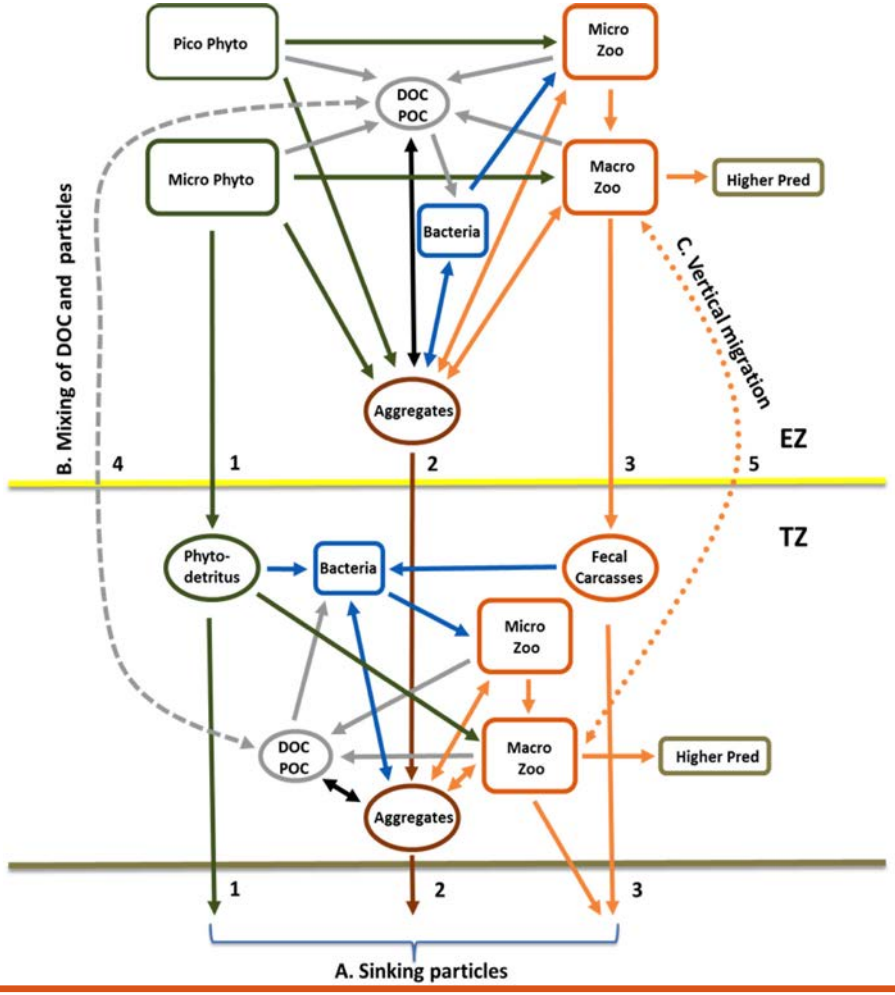
EXPORTS: Three Science Questions

1:How do upper ocean ecosystem characteristics determine the vertical transfer of organic matter from the well-lit surface ocean?

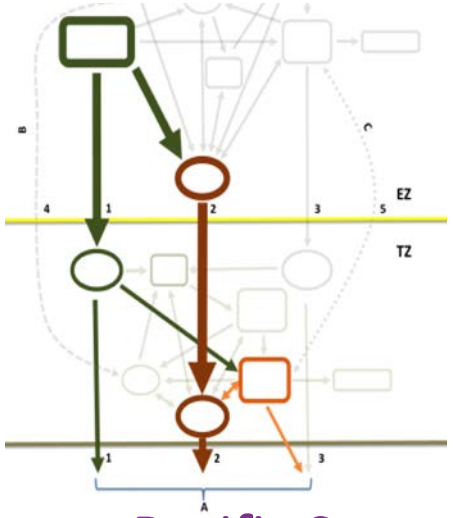
2: What controls the efficiency of vertical transfer of organic matter below the well-lit surface ocean?

3: How can the knowledge gained be used to reduce uncertainties in contemporary & future estimates of the export and fates of NPP?

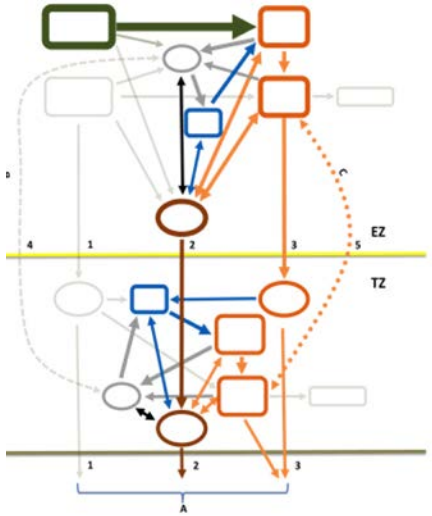
Focus on Pathways



North Atlantic Bloom

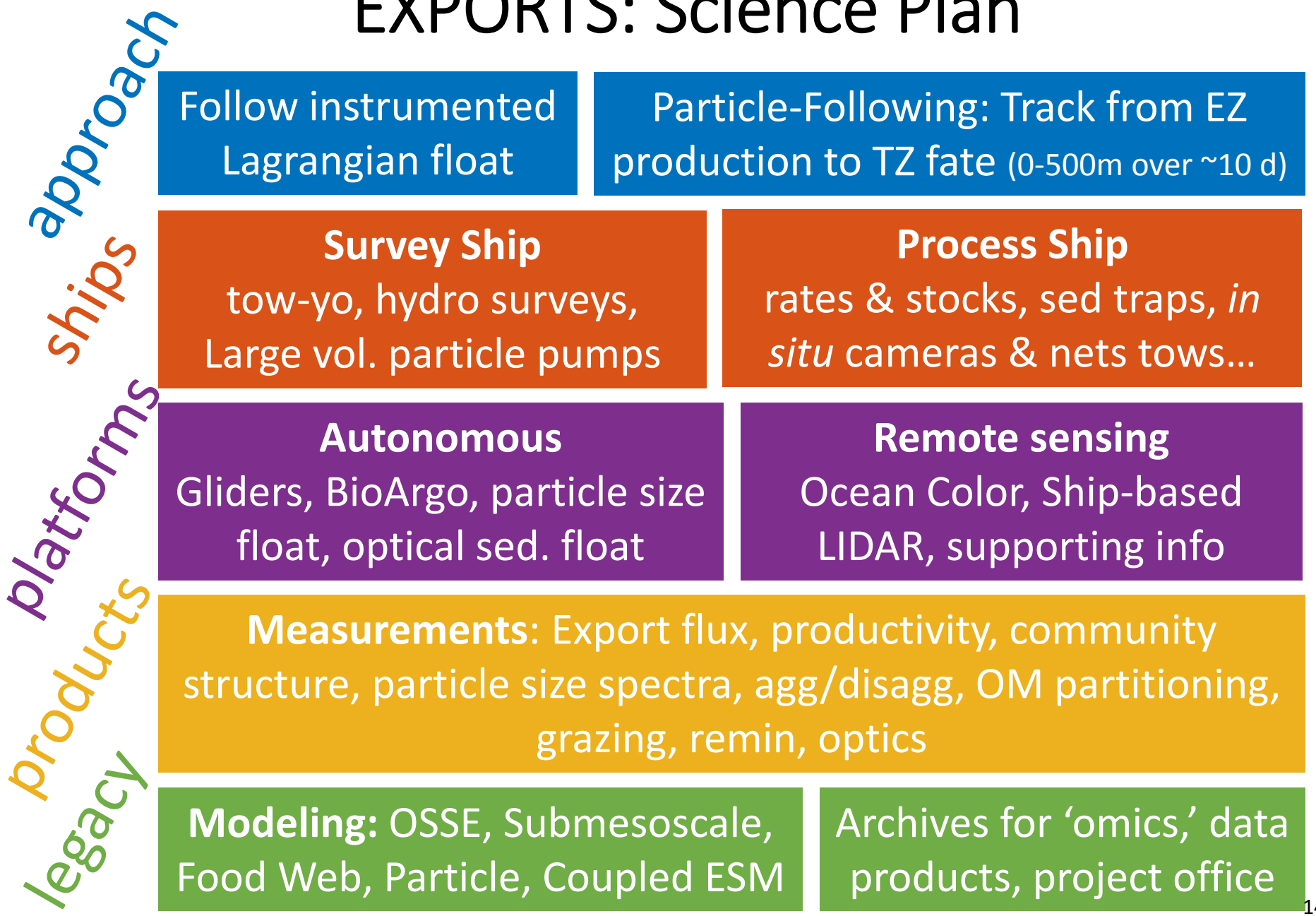


Northeast Pacific Summer



Needed for building models & predicting present & future states of NPP export & fate

EXPORTS: Science Plan



Science Plan in a nutshell

Goal: Predict the export and fate of ocean NPP from satellite & other observations

Approach: Compare observations over a range of ecosystem / C cycling states (incl. data mined results)

Modularity: Focus on assessing "states" creates flexibility for de/rescoping & partnering

Vetting: Science Plan underwent two community comment periods & peer review panel

Science Plan: http://cce.nasa.gov/obb/exports

(also Siegel et al. *Frontiers in Marine Science,* 2016)