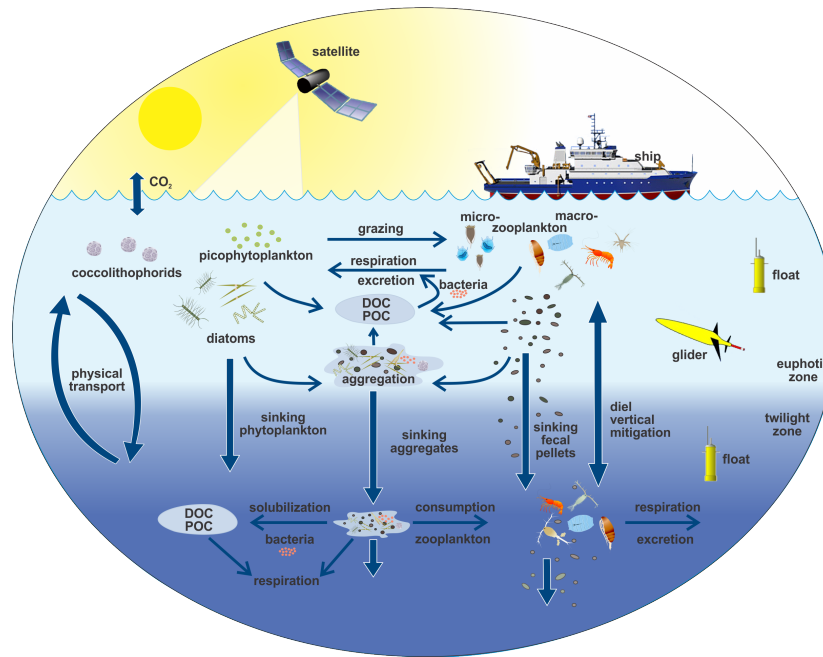


EXPORTS

Export Processes in the Ocean from Remote Sensing



EXPORTS Writing Team: Mike Behrenfeld (OSU), Claudia Benitez-Nelson (USoCar), Emmanuel Boss (UMaine), Mark Brzezinski (UCSB), Ken Buesseler (WHOI), Adrian Burd (UGA), Craig Carlson (UCSB), Eric D'Asaro (UW), Scott Doney (WHOI), Mary Jane Perry (UMaine), Dave Siegel (UCSB), Rachel Stanley (WHOI), Deb Steinberg (VIMS)

http://cce.nasa.gov/cce/ocean_exports_intro.htm

What is EXPORTS?

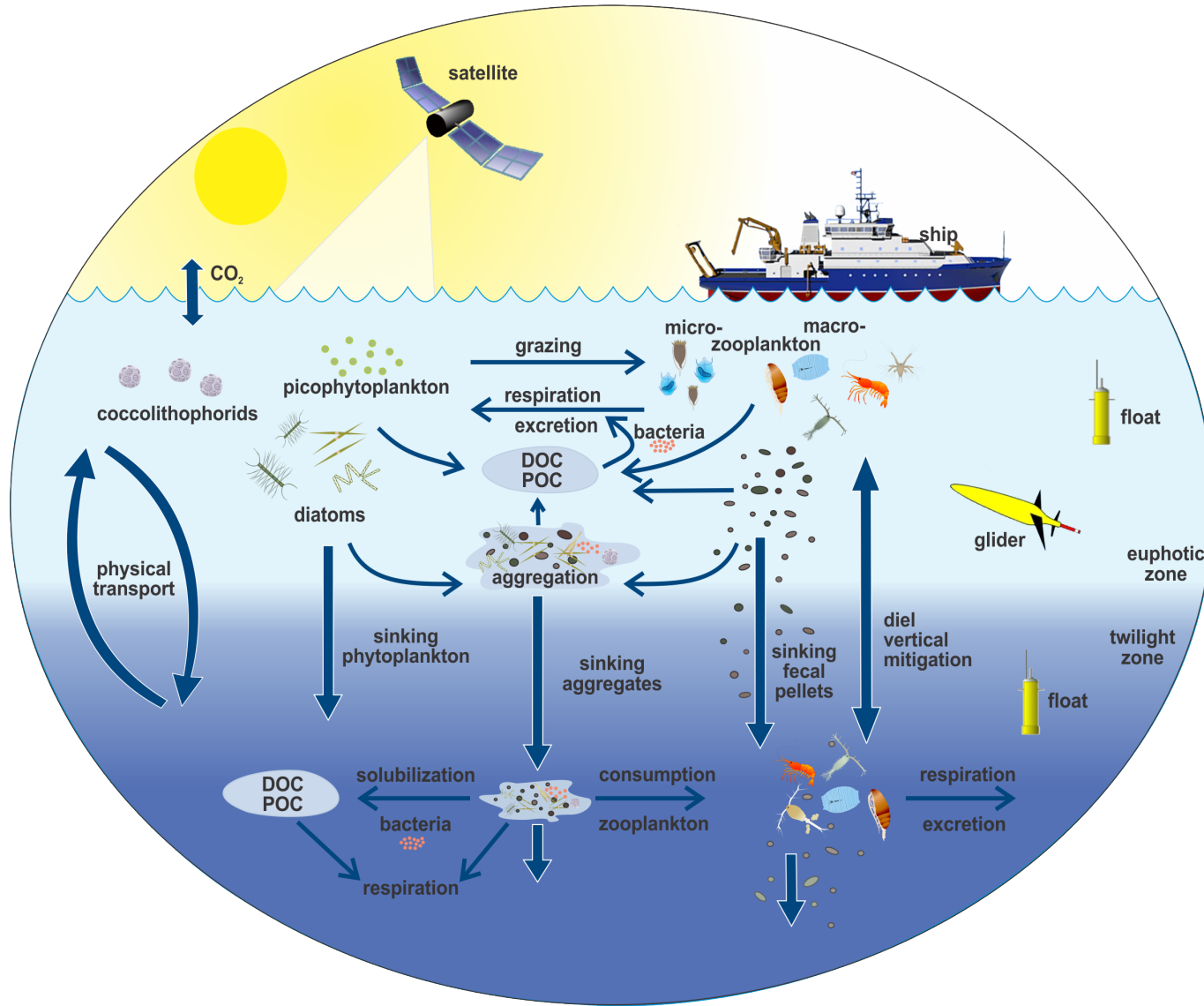
A community-vetted science plan for a NASA field campaign

Predict the **state** of the biological carbon pump from satellite & other observations

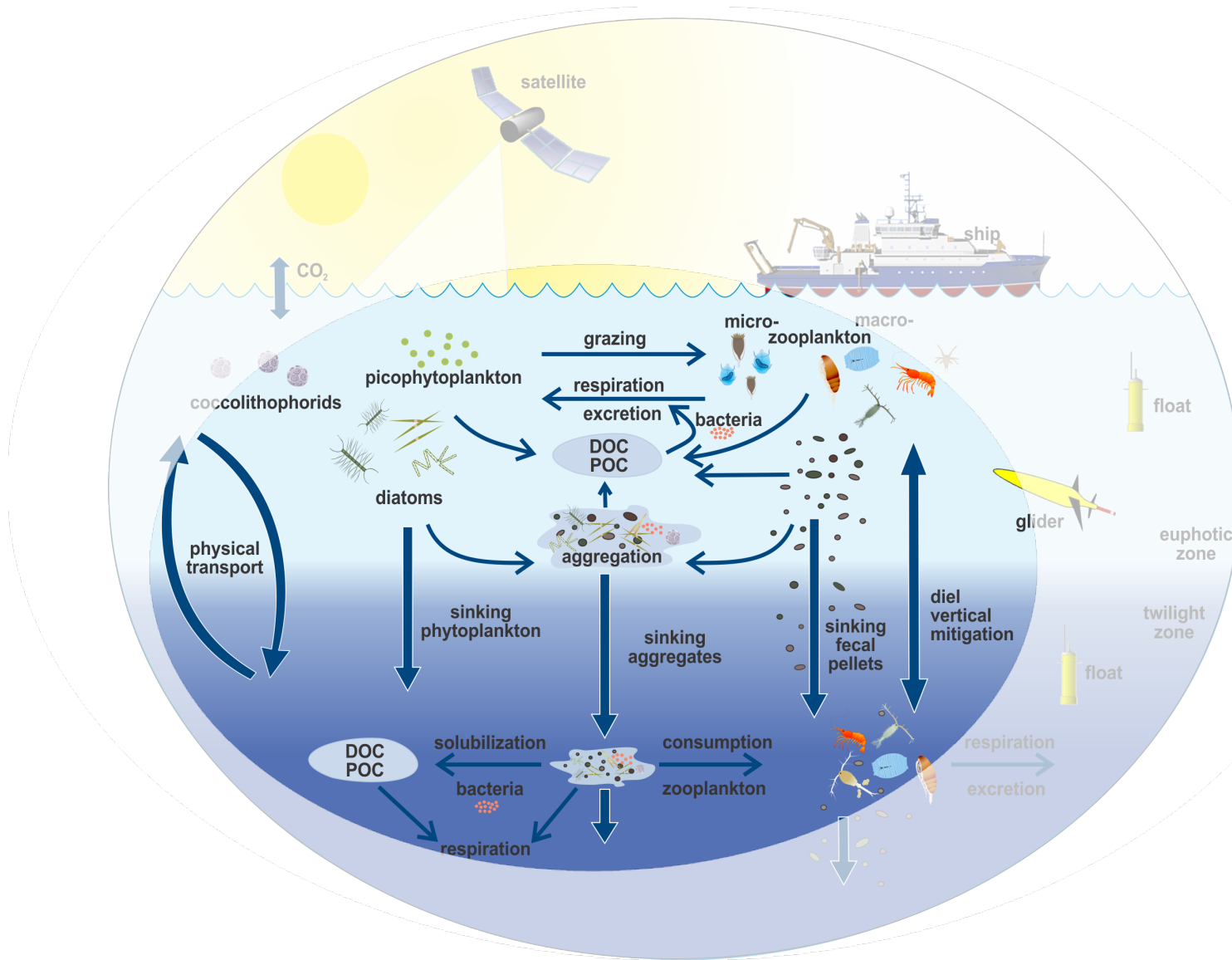
EXPORTS presently under review by NASA

Projected start date (if approved): 2017

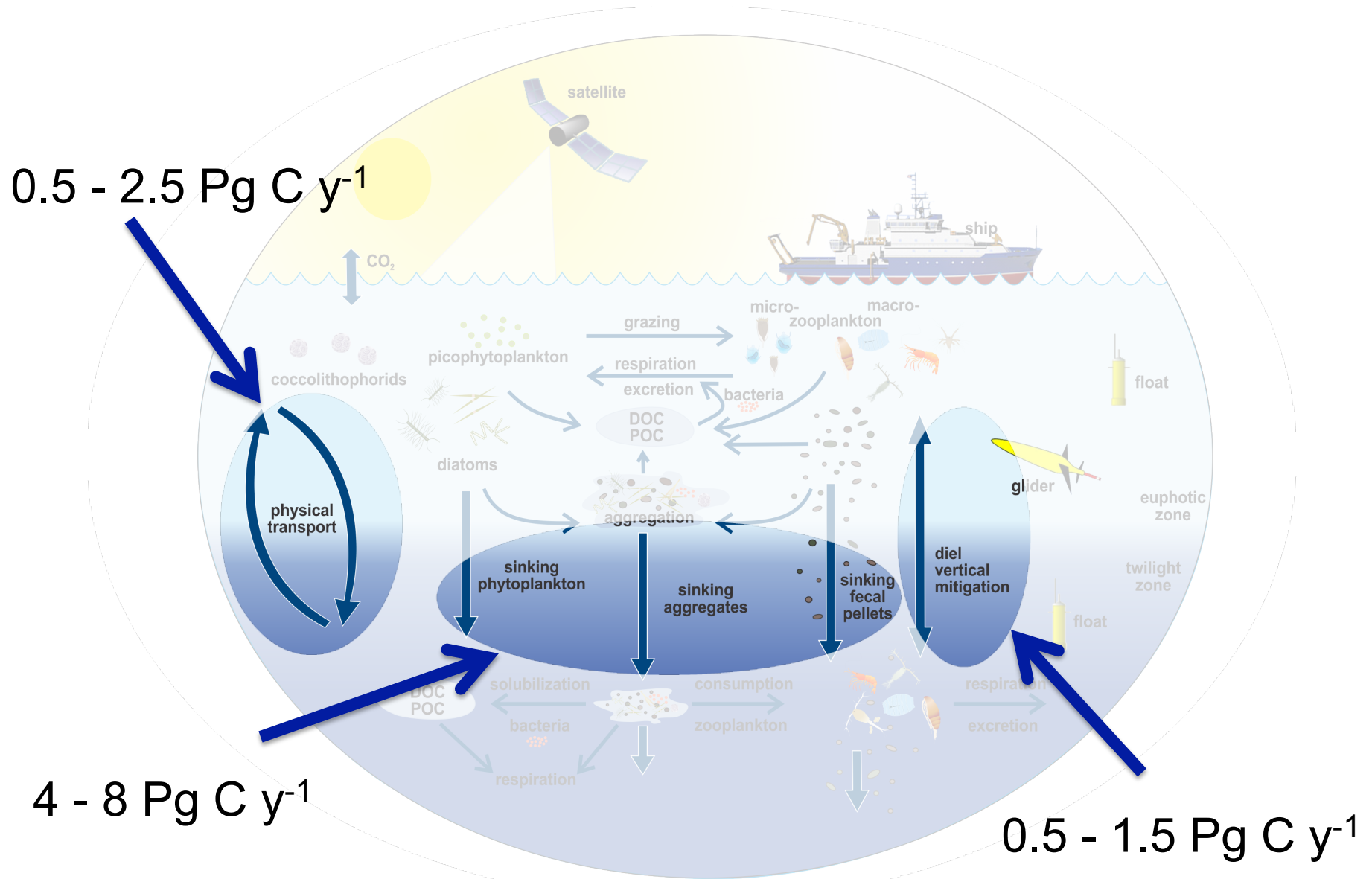
Why EXPORTS?



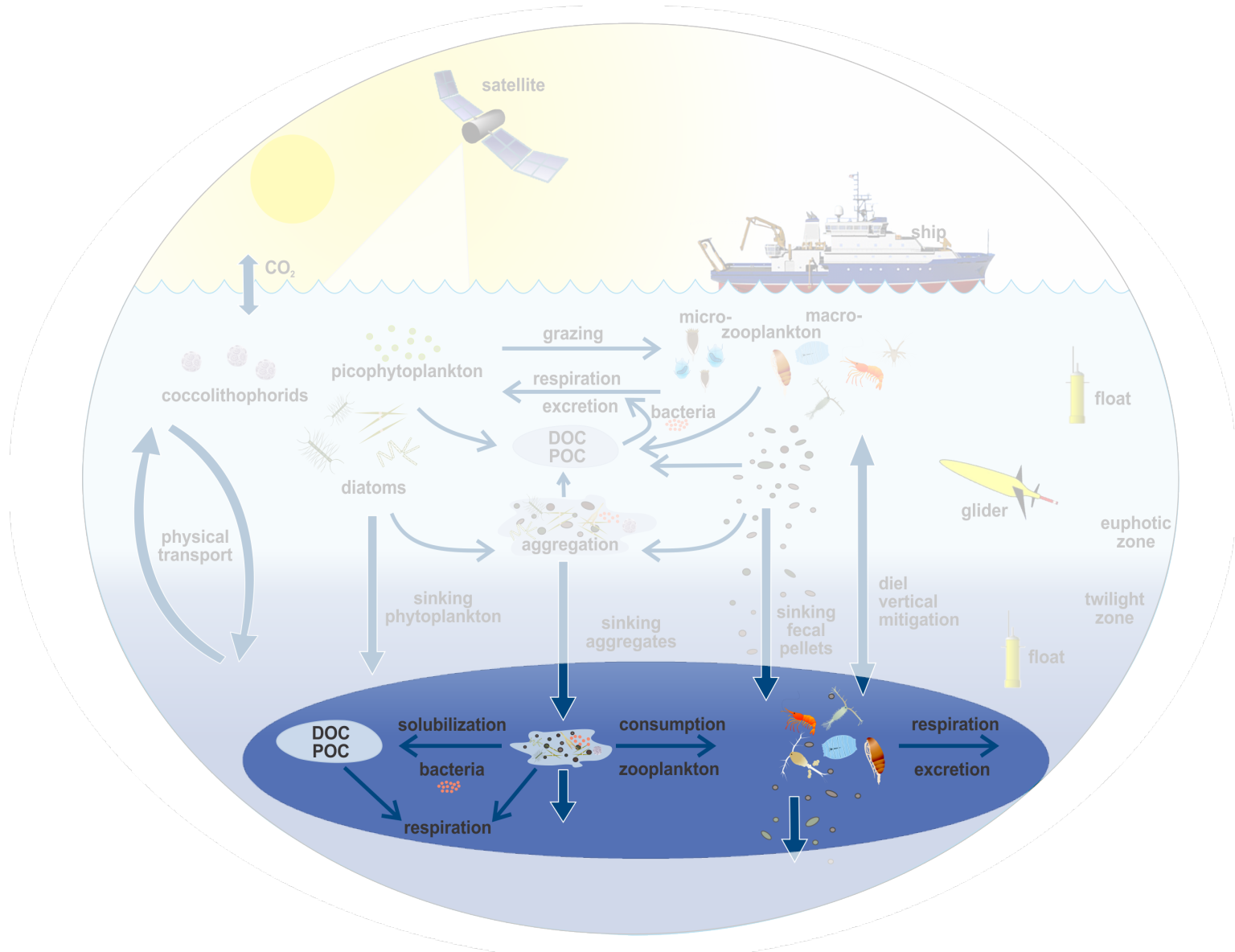
Why? Need to understand, quantify & predict how ecosystem processes transfer organic matter to depth



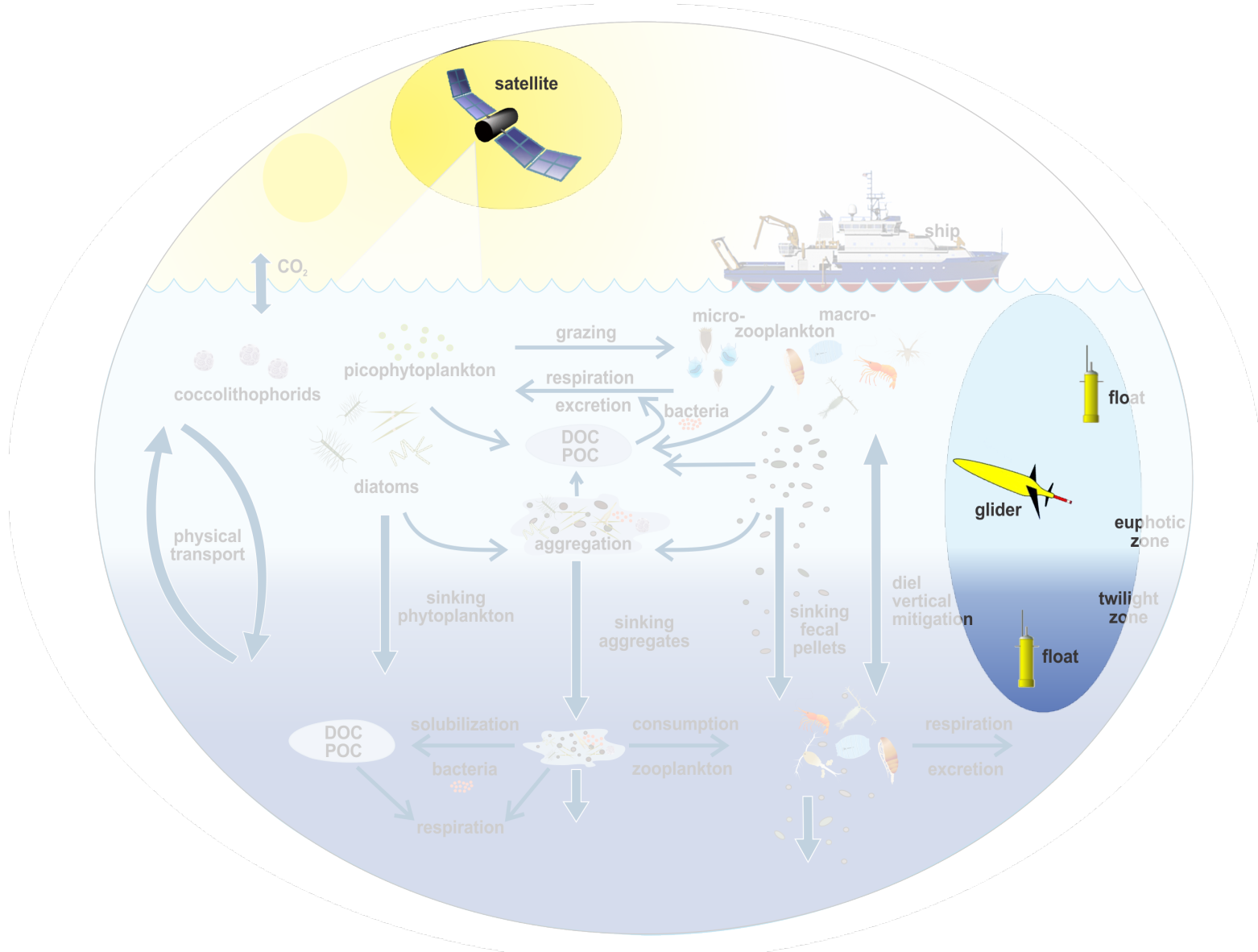
Why? Improve global estimates of carbon export from the euphotic zone (4 to >12 Pg C y^{-1})



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!



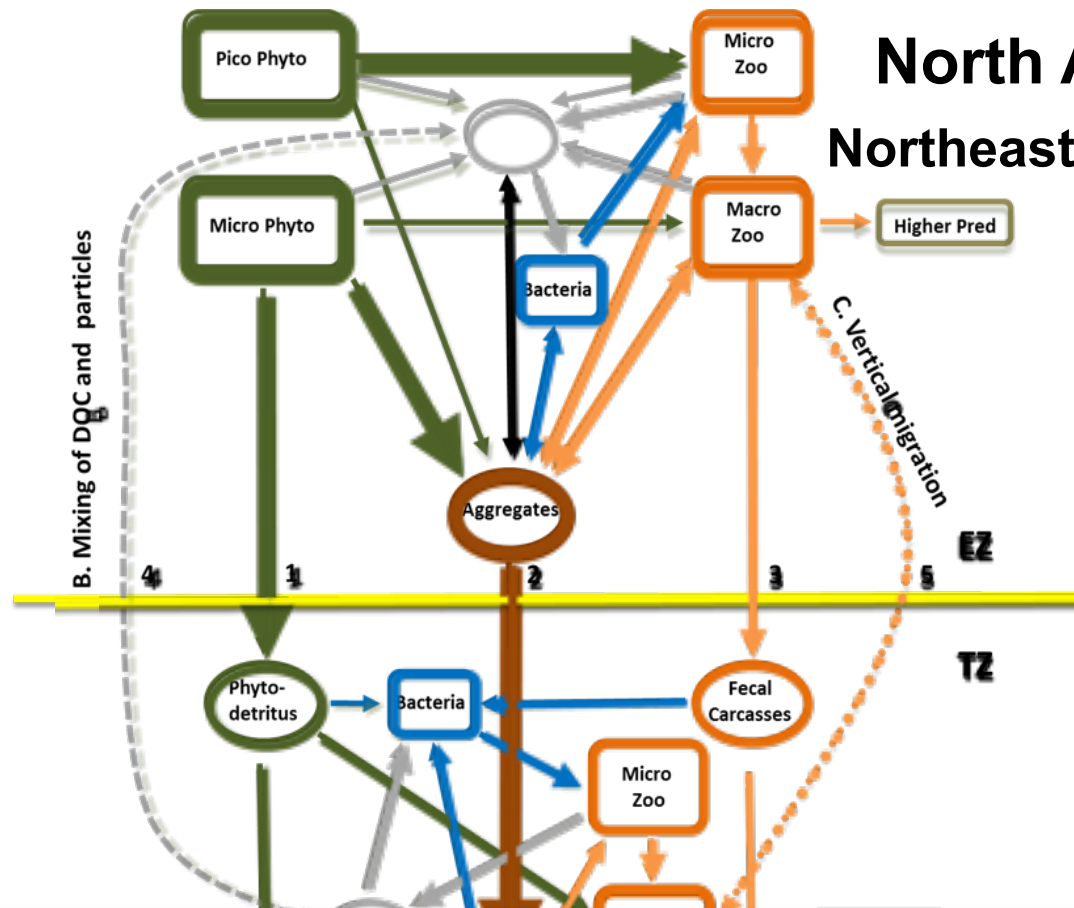
EXPORTS: Three Science Questions

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

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

How can the knowledge gained be used to reduce uncertainties in contemporary & future estimates of the biological pump?

EXPORTS: Focus on Pathways

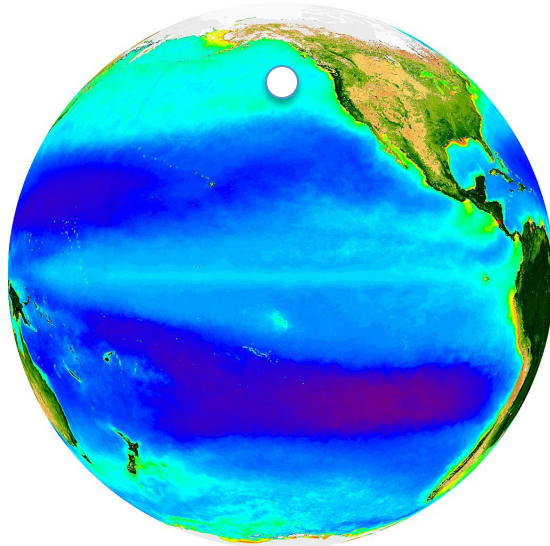


North Atlantic Bloom
Northeast Pacific Summer

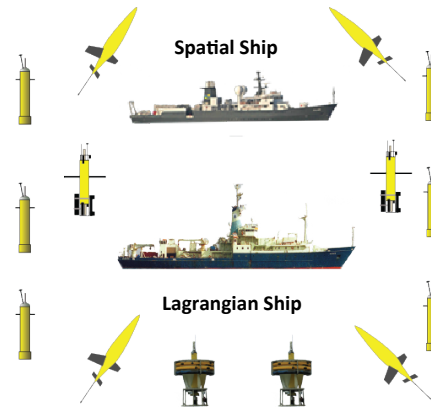
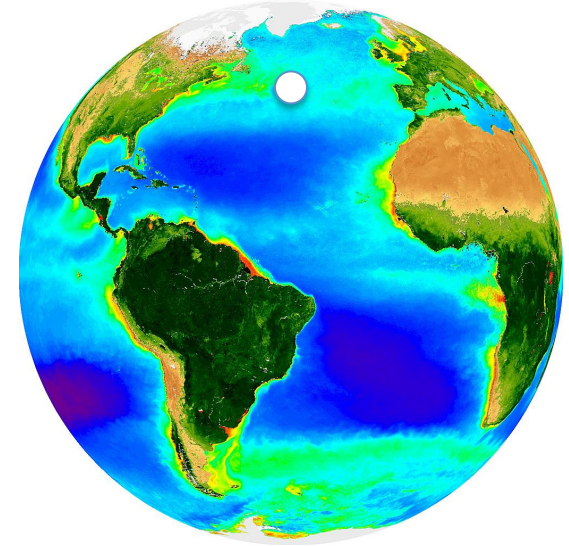
Goal: Predict the state of the biological pump given surface ecosystem characteristics

EXPORTS: Experimental Plan

Station P



North Atlantic



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

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

Will collect ~8 states of the biological pump
Supplement by data mining existing results

EXPORTS: Experimental Plan

Water-following

follow instrumented mixed layer float(s?)

Particle-Following

from production to trap
Measure C cycling fluxes
from 0 to 500 m (over 10 d)

Lagrangian Ship

Measure rates &
transformations

Spatial Ship

Submeso- & meso-scale
surveys (5-200 km)
Deploy short-term assets

Long Term Presence

Profiling Floats & Satellites

BioARGO, PSD & export proxy

Annual BGC budgeting

O₂, NO₃, DOC, DIC, etc.

Optimize Spatial Sampling

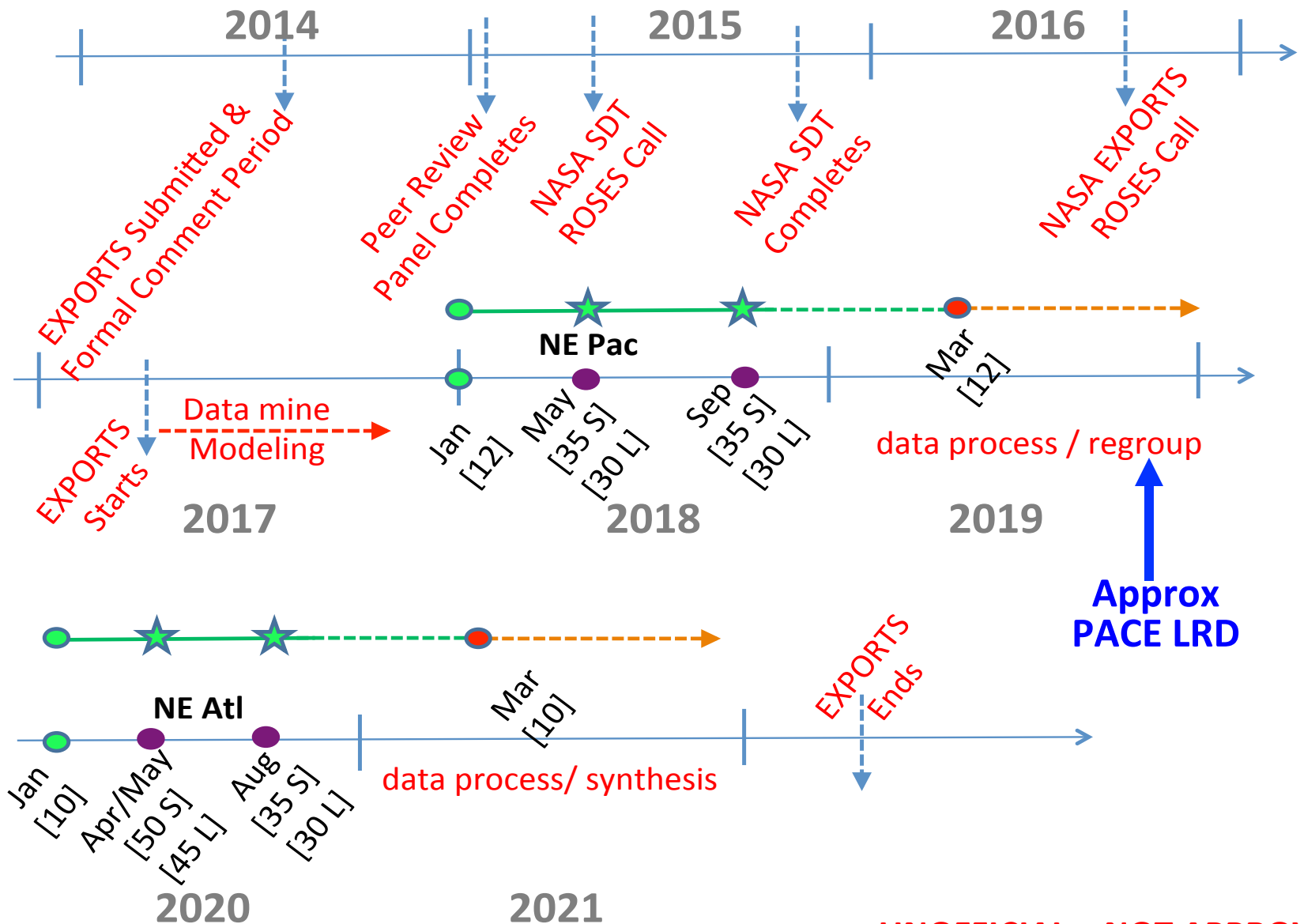
Gliders surveying (5-100 km)

Bio-optical proxies

Satellite sampling

Ocean color & supporting info

EXPORTS: *Notional* Timeline



UNOFFICIAL – NOT APPROVED!!!

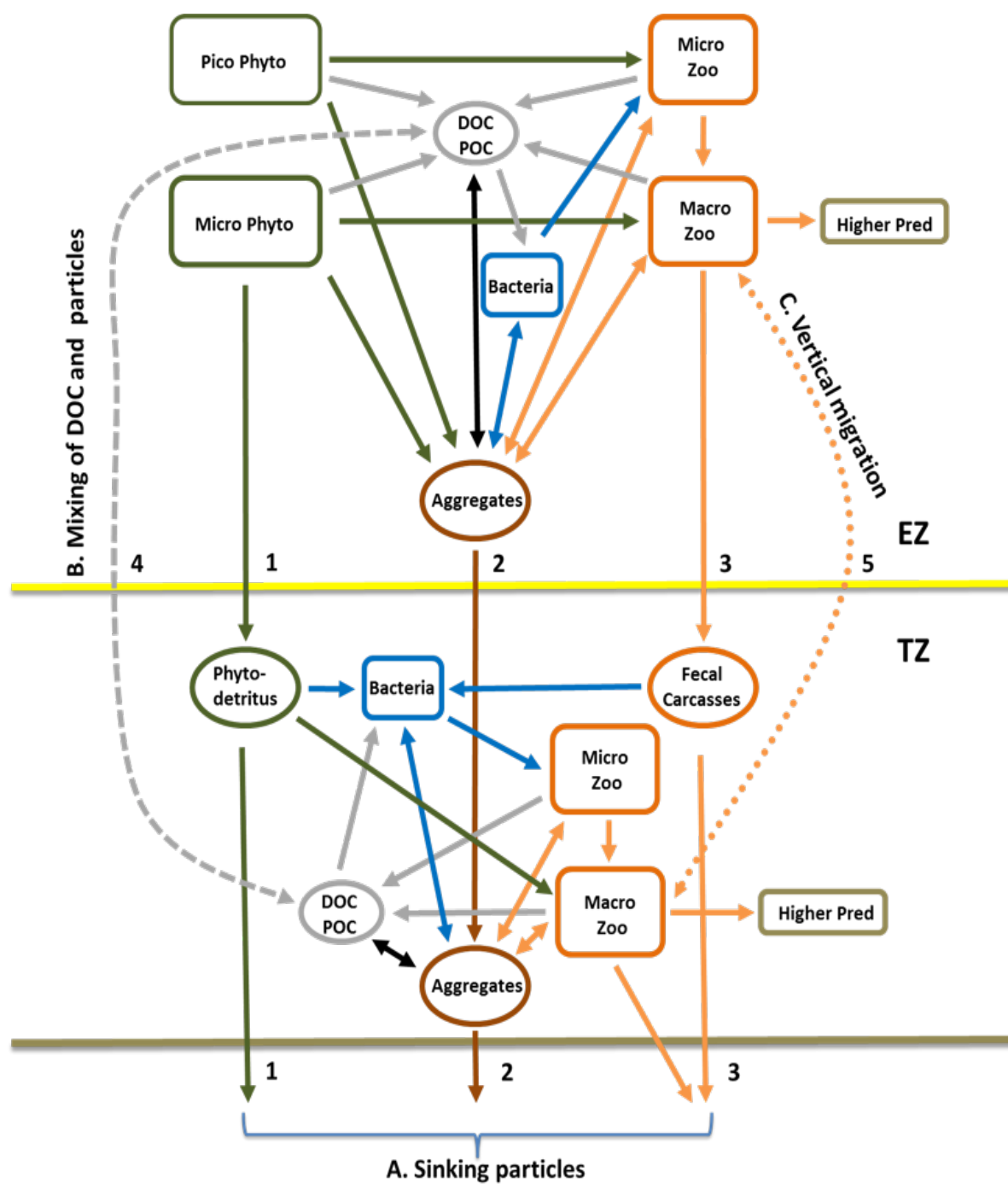
EXPORTS: Next Steps

The EXPORTS Science plan is available on line
Google the words - “NASA EXPORTS Science Plan”

NASA will consider comments in a peer review panel to decide whether EXPORTS will be conducted

If selected: A Science Definition Team will be competed (early next year?) to write the Implementation Plan & the EXPORTS field campaign would start 2017

Important: Every role in EXPORTS will be competed!!



Role of Scale in Ocean Carbon Fluxes

- Net community production (NCP) & export production (EP) **must** balance over large space & time scales
- Coincident NCP & EP observations made on eight ~30 km transects from the Sargasso Sea do **not** balance
- However averaged over the transects, an excellent correspondence is found
- NCP & EP are out of balance on submesoscales (≤ 30 km)
- Sets minimum spatial scale (~30 km) to observe the state of biological pump

