

COOPEX – Controls on Open Ocean Productivity & EXport

*Writing a Science & Implementation Plan
for a Major NASA Field Campaign*

Dave Siegel (UCSB) & Ken Buesseler (WHOI)

What is COOPEX?

- COOPEX will be a community-vetted, science & implementation plan for a major field campaign in open ocean carbon cycling
- This presentation is the start of the vetting
- Plan will be delivered to NASA HQ ~Feb 2014
- NASA HQ will decide which from their portfolio which major field effort to implement
- Selected from 2012 ROSES (note: 2013 ROSES OBB)
- Path for bottom-up planning of field campaigns

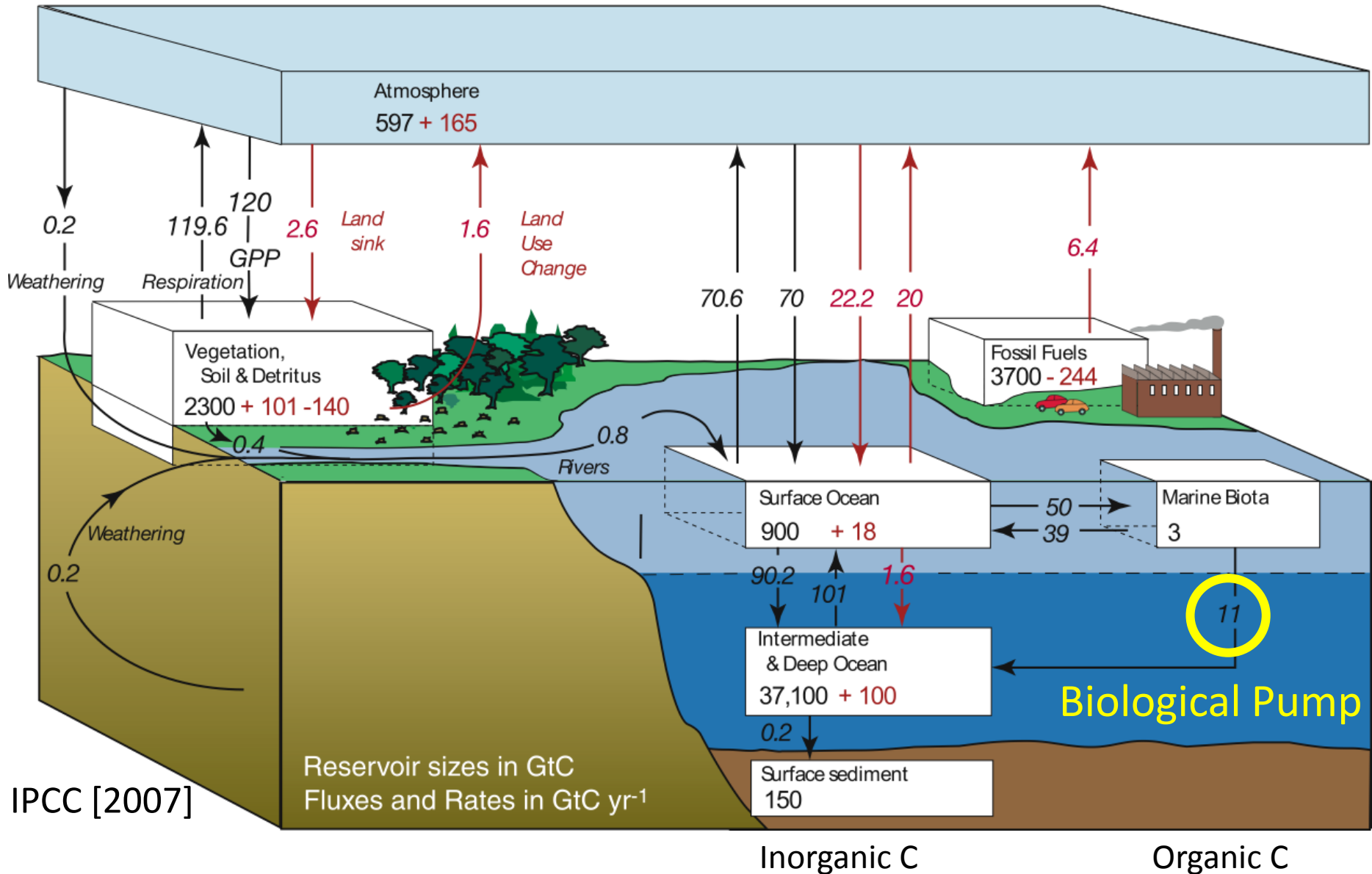
Science & Implementation Plan?

- A science & implementation plan include:
 - Motivation & Goals
 - Science Questions
 - Required Measurements
 - Experimental Approach
 - Experimental Plan
 - Implementation
 - Costs
- Consider both campaign baseline & goals

COOPEX Progress to Date

- Advanced team formed at proposal stage
 - Responsible for setting initial agenda & completion of the Science & Implementation Plan
 - Behrenfeld, Benitez-Nelson, Boss, Brzezinski, Buesseler, Burd, Carlson, D'Asaro, Doney, Perry, Siegel, Stanley, Steinberg
 - Telecoms every other week or so
 - Progress thru Experimental Approach
- Larger meeting to vet progress and address Experimental Plan (~25, early June, invite only)

Global Carbon Cycle



The Biological Pump

Food web processes transfer organic matter to depth

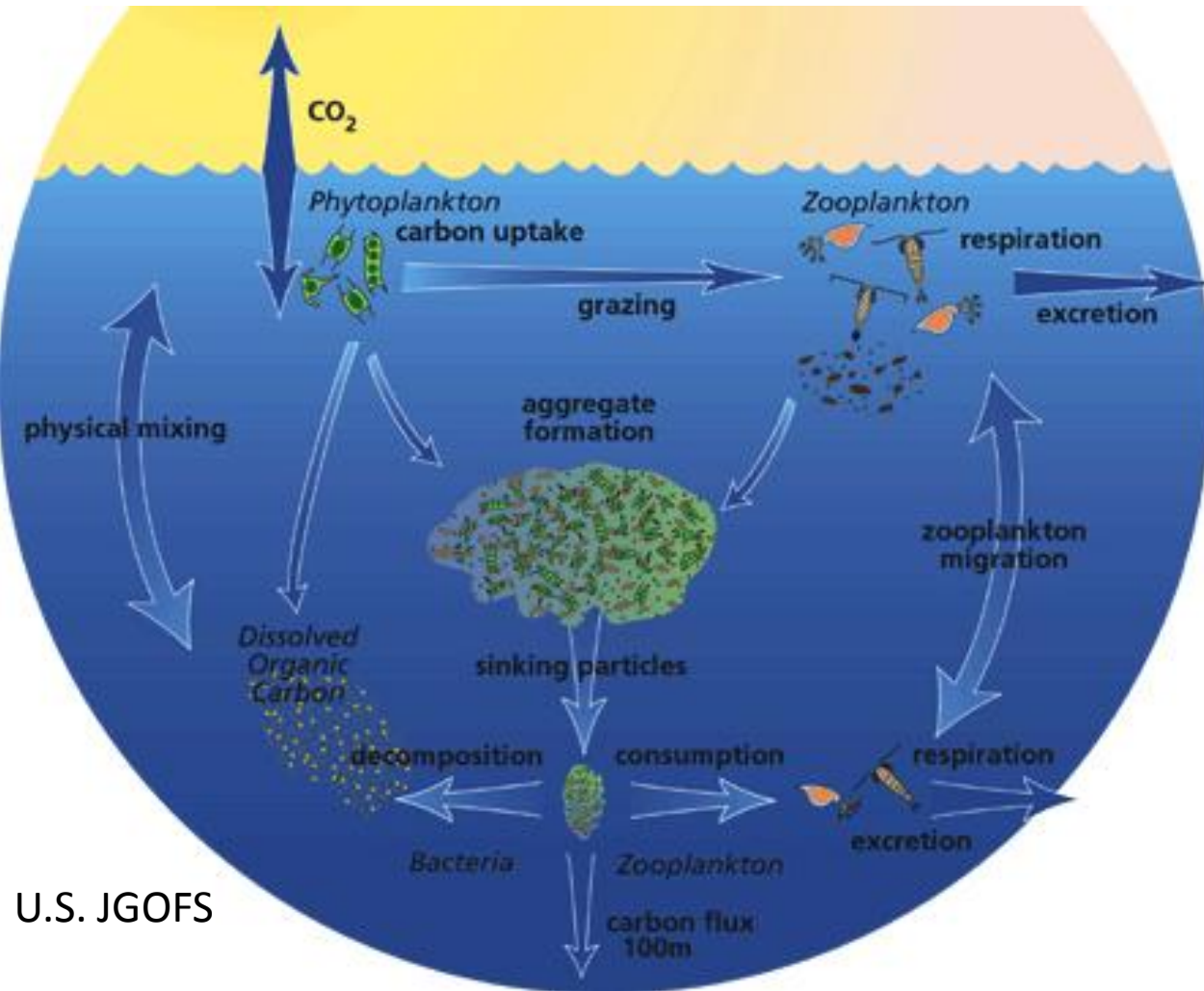
-pathway for rapid C sequestration

Quickly remove C from surface ocean

-turn off bio pump and 200 ppmv increase atm. CO₂

Global C Export estimates range from 5 to $\geq 20 \text{ GtC y}^{-1}$

-we must do better



U.S. JGOFS

COOPEX Goals

- Field campaign will provide critical information for assessing the biological pump from satellite obs
- Science plan will greatly improve understanding of upper ocean carbon cycle & the functioning of the biological pump
- Implementation plan efficiently addresses science questions by integrating field, satellite & modeling
- Integrated approach will provide path for C cycle research for PACE & other future missions

COOPEX Science Questions

- What are the controls on the ocean's biological carbon pump?
- Q1: How do plankton community structure and particle characteristics regulate C export? (Who?)
- Q2: What are the controls on plankton / particle stocks that create carbon export? (How?)
- Q3: What happens to exported carbon once it leaves the euphotic zone? (Where?)

COOPEX Required Observables

- **Phytoplankton** (C stock, size, PFT, NPP, etc.)
- **Particles** (export w/ vertical profile, PSD, sinking rate, rates of turnover, ballast, etc.)
- **Biogeochemistry** (O₂, DIC, Nuts, DOC, etc.)
- **Food Web Interactions** (grazing, fecal flux, sinking particle degradation, energy flow, etc.)
- **Scales** (patch to experimental, trap funnels, etc.)
- **Context** (R_{rs}(λ), IOP's, physics, etc.)

COOPEX Approach

- Constraints: \$'s, sampling time & analyses, aliasing, submesoscale physics, etc.
- Resolve range of conditions (multiple sites/times)
- Multiscale sampling using BGC proxies (floats, gliders, ship, satellite)
- Measure the “right things” too (need ship support)
- Integrate with modeling (eco/bgc, SMS & process)
- Document measurement protocols & uncertainties

COOPEX Next Steps

- Develop experimental plan
 - Larger face-to-face meeting
- Continue vetting COOPEX with the community
 - U.S. OCB meeting (WHOI, late July)
- Develop a web site
 - This summer...
- Write the #@\$^*& report...
- Questions / comments??
 - davey@eri.ucsb.edu