

Standardization of Methods
PM Tuesday notes

Interesting and Important measurements for New Studies for Cross Comparison

-- Groups should commit to at least collecting the water samples that would allow other groups to measure the parameters they can't measure

Physics:

- 1) CTD – temp, salinity, depth, PAR
- 2) ADCP - currents
- 3) Vertical mixing - not a standardized measurement and you need a person involved in project who will agree to do this.
Questions:
 - At what depth should the vertical mixing coefficient be measured?
 - How deep should it be?
 - What is the scale length for vertical mixing within the time scale of the bloom? If sub-surface maximum, then clearly use that depth, but if no clear maximum, may have to go deeper. 100 - 250 m? Need to know within an order of magnitude: 10^{-3} , 10^{-4} , or 10^{-5} .
- 4) Turbulent mixing: Radium
- 5) Horizontal mixing –
 - Radium
 - Drifters: if can get enough of them to define horizontal velocities/floats
 - If altimeter with a higher spatial resolution (10 – 20 km), then it would be useful
 - Gliders? Where possible might be useful, but not absolutely necessary. Use their transmissometers to survey area to decide on sampling areas.
- 6) Meteorological data: to obtain wind and buoyancy fluxes: need to be sure the ship keeps it well calibrated; radiometers

Chemistry: focus on spatial coverage?

Primary Importance:

- 1) dFe, within the methods used, be sure they are inter-calibrated (part of GEOTRACES methods) (shipboard, primary importance)
- 2) dMn (shipboard, 2nd importance, source trace)
- 3) Al (shore-based, source trace)
- 4) Co, Zn, Cu (shore-based, micronutrients, secondary importance?)
- 5) Particulates of everything! PFe...(determined by other group)
- 6) Radium (key parameter, see also Physics section)
- 7) Thorium
- 8) CO₂-etc (CO₂ system measurements)

- 9) POC and DOC
- 10) Macronutrients (nitrate, ammonium, phosphorus, silicate)
- 11) Biogenic silica (not discussed, but probably should be included)

Biology (detailed, see below for Richard's summary points):

- 1) Primary production: Net Community Production – respiration/oxygen
- 2) Carbon biomass from microscopy/other methods (cell counts, biovolumes of cells from microscopy)
- 3) Biomass spectrum: from small to large (POC) (LISST, Meng)
- 4) HPLC: standard suite of pigments plus phycoerythrin if *Synechococcus* in system.
- 5) Growth rates of the phytoplankton (how? Can get from seawater dilution methods, but also could use ^{14}C incorporation, other methods?)
- 6) Mortality rates of the phytoplankton (community rates)
 - micro and meso-zp: seawater dilution experiments, gut turnover measurements, any other measurements?
- 7) Elemental ratios (C, N, Si, others?)
- 8) Uptake of Fe: differential recycling of C/Fe: ^{55}Fe
- 9) Fv/Fm? Physiological status of the community: FRRF
 - To find out what causes the end of the bloom...monitor status of bloom, etc.
- 10) Grow-out experiments? Need to establish that the community is Fe limited? Co-limitation by other elements
- 11) Export of Carbon: Th, need to standardize pumping depths, work on getting good carbon numbers. Other methods weren't mentioned (didn't really discuss export much at all...)

Richard's summary points of biological parameters to measure:

BOX MODEL OF IT ALL, for cross comparisons to be made later

Inputs: Fe, CO_2

Outputs: POC (Th, standardize pumping depths for getting good C number)/ CO_2

Inside box:

Ecosystem processes

- 1) primary production
- 2) growth of phytoplankton
- 3) mortality by microzooplankton and mesozooplankton
- 4) Fe uptake ("Fe demand")
- 5) Biomass of different compartments, size structure (autotrophs, heterotrophs – the latter including heterotrophic bacteria and micro and mesozp consumers)

OTHER POINTS covered in general discussion:

***Stefan suggested we should make recommendations on when the experiments should be made (I assume he meant the season/stage of the bloom). And, find a way to extrapolate the data to a longer time scale...*

Another group recommendation: Literature review of other So. Ocean fertilization experiments (artificial) (meta-analyses) to see what the key parameters were there that were useful to explain the system...