"*In Situ Archive*, Data Policy and Workshop Report "

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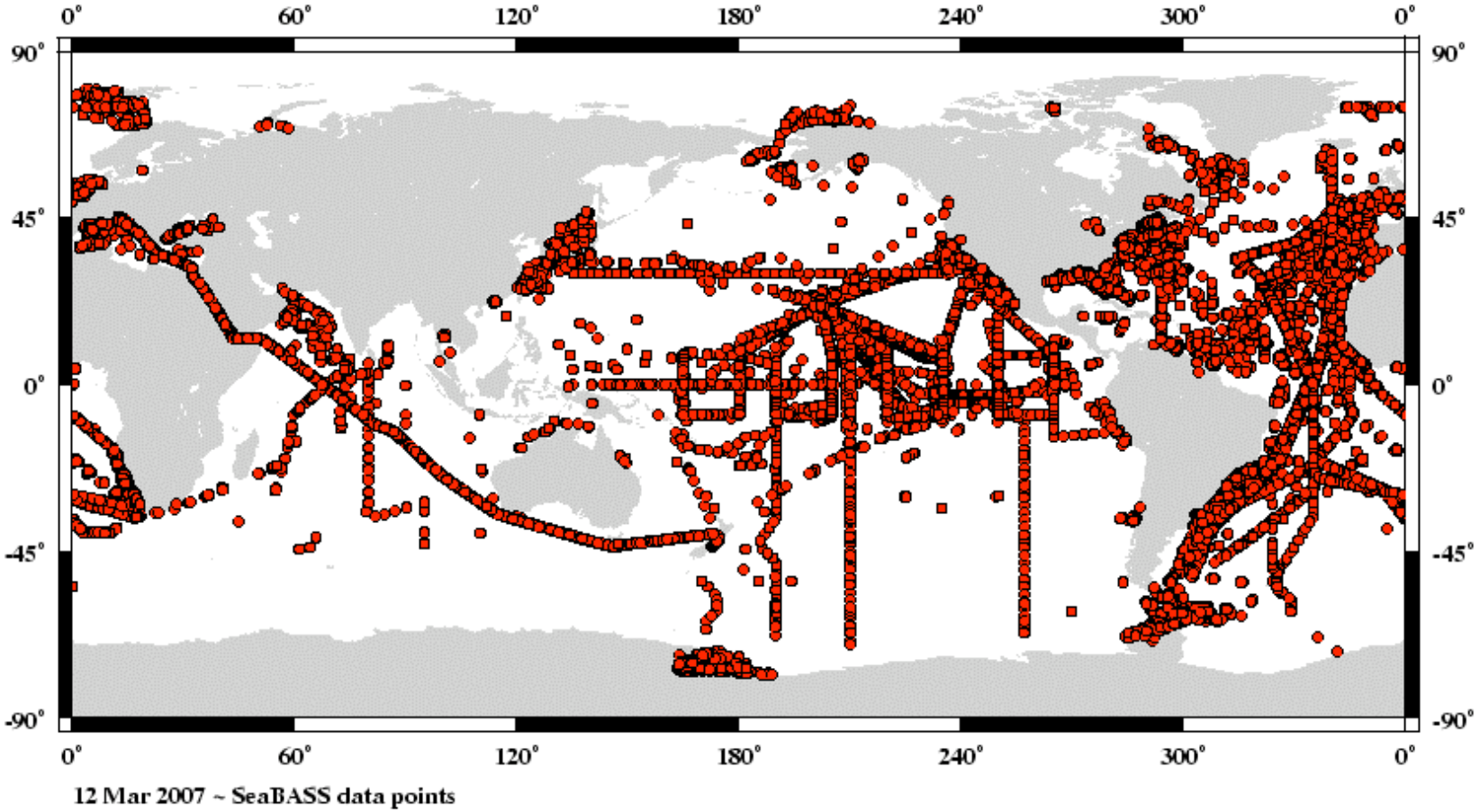
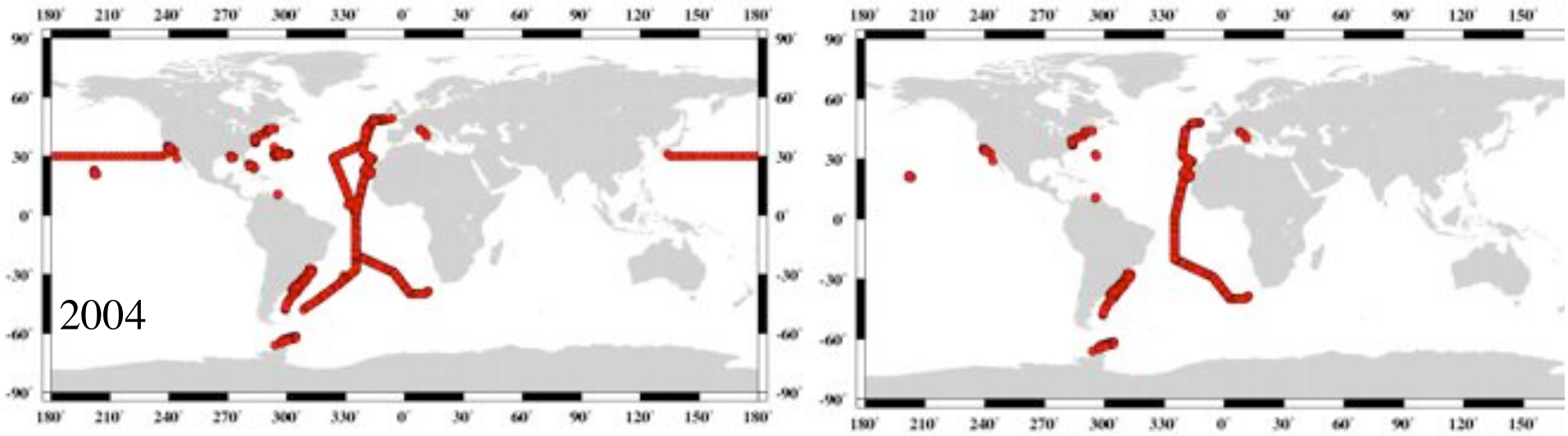
OCRT
April 11, 2007

How are we doing on data submission ?

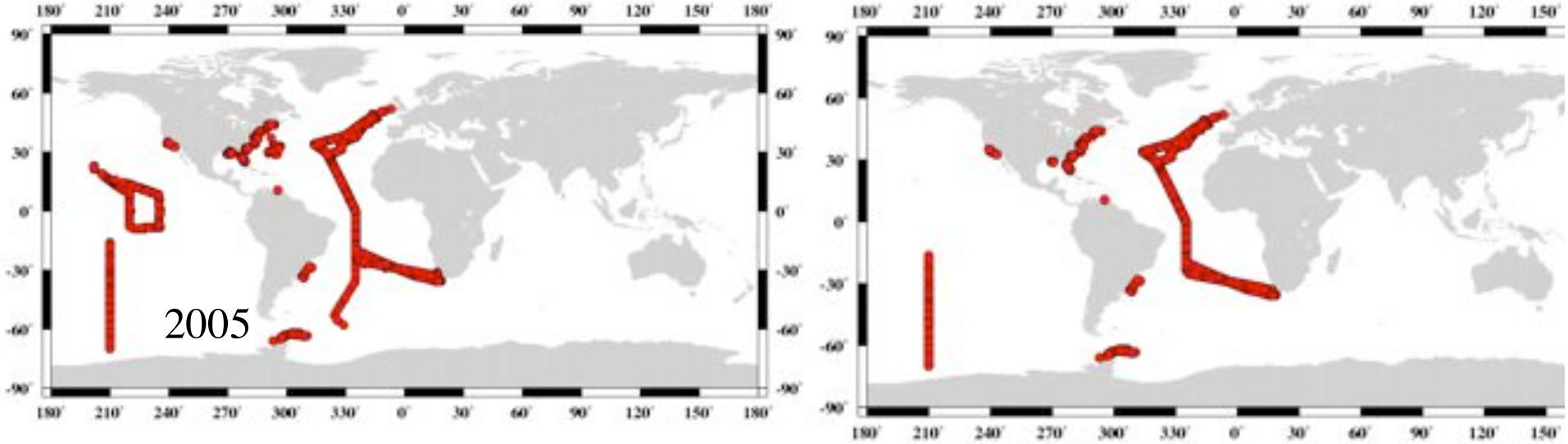


Total absorption coefficient (aw + ap + ag)

Fluorometrically/spectrophotometrically-derived chlorophyll a

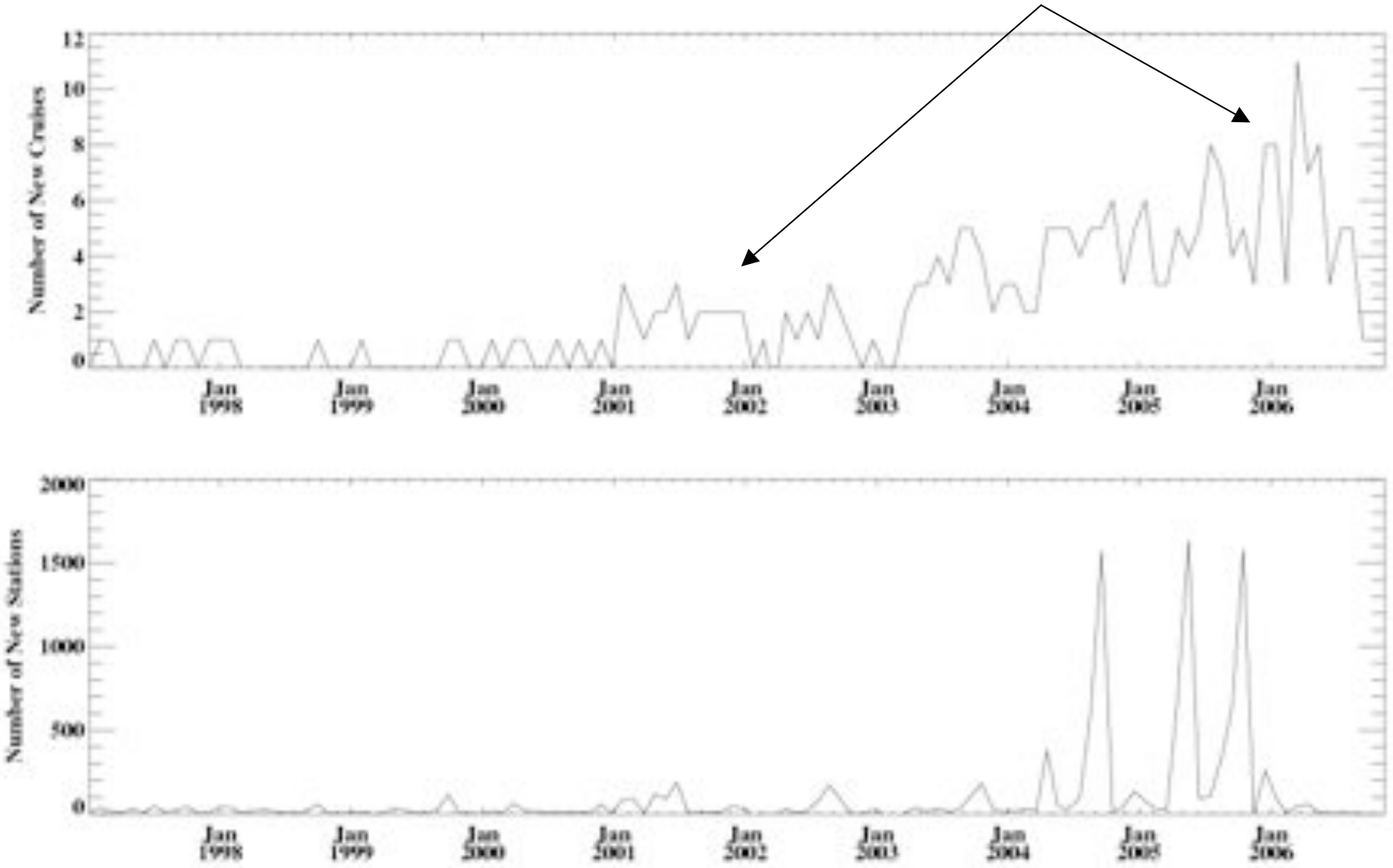


Spatial distribution of stations, but does not reflect what measurements were made

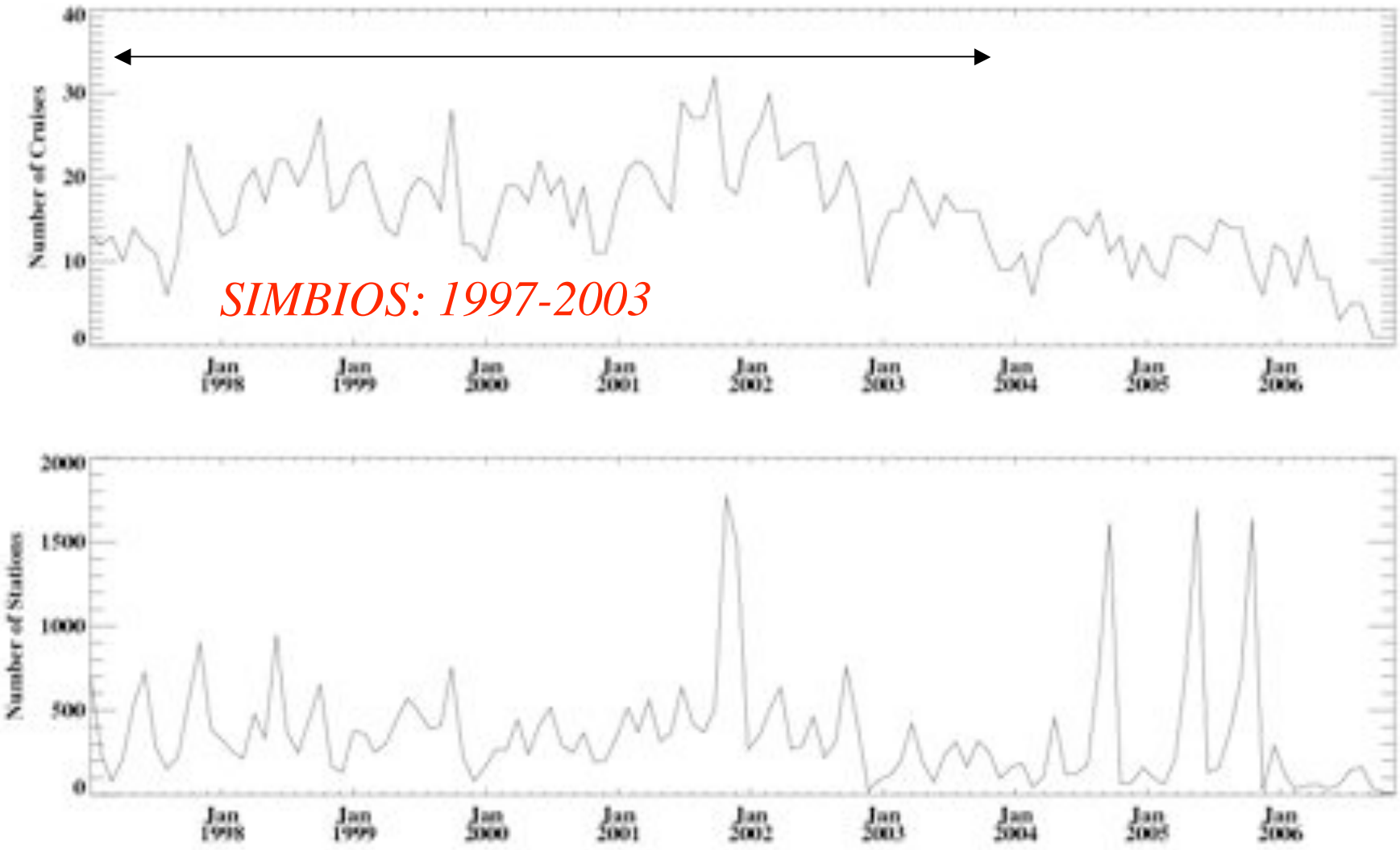


as 3/12/07

SeaBASS Data Observations Per Month (Contributed Jun 2006 - Mar 2007)



SeaBASS Data Observations Per Month



as 4/5/07

SeaBASS Experiments and Cruises

Arnone
Bach
Behrenfeld
Boss
Carder
Hooker
Letelier
Mannino
Moline
Muller-Karger
Nelson N.
Siegel
Sosik
Stramski
Stumpf

Total Cruises 59 for 2006

Arnone
Bach
Behrenfeld
Boss
Carder
Chekalyuk
Garcia
Hooker
Letelier
Lohrenz
Mannino
Moline
Muller-Karger
Nelson J.
Nelson N.
Siegel
Sosik
Stramski
Stumpf
Zimmerman

Total Cruises 87 for 2005

Total Cruses 80 for 2004

Antoine
Arnone
Bach
Dennis
Garcia
Harding
Letelier
Mannino
Moline
Muller-Karger
Nelson N.
Siegel
Sosik
Stramski
Subramaniam
Zimmerman

Total Cruises 135 for 2003

Total Cruises 194 for 2002

Total Cruises 201 for 2001

Total Cruises 79 for 1996

Total Cruises 362 from 1975-1995

Note: additional data may have been submitted that have yet to be archived (as 4/9 there was additional data from Subramaniam, Letelier, Mueller-Karger and Siegel)

PI "BOLD"= confirmed	available 9/07	HPLC Samples FY06-07	DONE by HPL as3/30/07	upcoming
D. Siegel/D. McGillicuddy		0		
N. Nelson	40	70	41	70
D. Siegel	200	450	195	30
M. Moline		500		
G. Mitchell	400	550	506	
A. Mannino	499	225	516	
F. Chavez		250	288	
H. Dierssen		160	121	
D. Stramski		50		
(G. Cota)Victoria Hill	285	300	296	29
F. Muller-Karger		315	56	117
D. Clark		0		
A. Subramaniam	300	400	206	150
S. Hooker		347	44	300
S.Hoocker/Russ				48
H. Sosik	12	100	22	
N. Nelson		20		
R. Gould	11	50	20	
R. Stumpf	35	100	58	
J. Marra		160		100
J. Campbell		40		
K. Carder		50		
R. Letelier		100		100
S Lohrenz		0		
B. Balch		0		
TOTAL	**1,782**	**4,237**	**2,369**	**944**
M. Behrenfield/Roesler	217	150	209	
McClain/V. Garcia		50		
A. Chekaluk	26	280	26	
TOTAL	**2,025**	**4,717**	**2,604**	

Oct. 06-March 07

5 PIs used HPL but have not yet submitted data to SeaBASS

5 PIs have not used HPL but have submitted data to SeaBASS

NASA Earth Science Data Policy

The data collected by NASA represent a significant U.S. public investment in research. NASA holds these data in a public trust to promote comprehensive, long-term Earth science research. NASA developed policy consistent with existing international polices, such as the CEOS Data Principles, to maximize access to data and to keep user costs as low as possible. These policies apply to all data archived, maintained, distributed or produced by NASA data systems.

- NASA commits to the full and open sharing of Earth science data obtained from NASA Earth observing satellites, sub-orbital platforms and field campaigns with all users as soon as such data become available.
- There will be no period of exclusive access to NASA Earth science data. Following a post-launch checkout period, all data will be made available to the user community.
- NASA will make available all NASA-generated standard products along with the source code for algorithm software, coefficients, and ancillary data used to generate these products.
- NASA will enforce a principle of non-discriminatory data access so that all users will be treated equally. For data products supplied from an international partner or another agency, NASA will restrict access only to the extent required by the appropriate Memorandum of Understanding (MOU).
- The applicable U.S. policy Office of Management and Budget (OMB) CircularA-130 states that its Departments and Agencies will charge for distribution of data “no more than the cost of dissemination”. NASA believes such dissemination cost would unduly inhibit use, and therefore does not charge distribution costs for NASA-produced data. NASA does, in some cases, charge these marginal distribution costs for data NASA distributes in partnership with international partners, according to the particular international agreement.
- NASA data archives include easily accessible information about the data holdings, including quality assessments, supporting relevant information, and guidance for locating, obtaining, and using data.

- **1. Policy**

  a. Purpose:

  This NASA Policy Directive (NPD) establishes the policy and responsibilities for the conduct of NASA's Scientific Research (SR) programs. This policy is meant to be flexible, adaptable, and conformable to the many types of SR programs and related activities that NASA conducts and manages.

  d. Policy*:*

  (7) “Duty to the Public, Data Availability, Outreach, and Education: Within the limitations of its budget, NASA strives to support the scientific and technical investigations it has selected and to sponsor the full range of data analysis, theoretical, and laboratory investigations required to derive scientific, technical, and other broad benefits from public investments in NASA's research programs and missions. It is, therefore, NASA’s policy that unclassified scientific data and other results from NASA science programs and missions that are not subject to export control and intellectual property agreements shall be made publicly available in usable form."

The 2007 NRA Proposers Guidebook:

http://www.hq.nasa.gov/office/procurement/nraguidebook/proposer2007.pdf

- "F.13 What is NASA's policy about releasing data and results derived through its sponsored research awards?

  As a Federal Agency, NASA requires prompt public disclosure of the results of its sponsored research and, therefore, expects significant findings from supported research to be promptly submitted for peer reviewed publication with authorship(s) that accurately reflects the contributions of those involved. Likewise, as a general policy and unless otherwise specified, NASA no longer recognizes a "proprietary" period for exclusive use of any new scientific data that may be acquired through the execution of the award; instead, all data collected through any of its funded programs are to be placed in the public domain at the earliest possible time following their validation and calibration. …… In any case, NASA may require that any data obtained through an award be deposited in an appropriate public data archive as soon as possible after calibration and reduction. If so, NASA will negotiate with the organization for appropriate transfer of the data and, as necessary, may provide funds to convert the data into an easily used format using standard units".

- PIs are required to submit data to the NASA archive (SeaBASS) between 6 months - 1 year after the data collection time.

http://seabass.gsfc.nasa.gov

seabass@seabass.gsfc.nasa.gov

Supporting In situ and Space Based Measurements

NASA Workshop-06,
Ocean Optics Conference 2006 (Montreal)

Draft document at:

http://oceancolor.gsfc.nasa.gov/MEETINGS/

Workshop Participants:

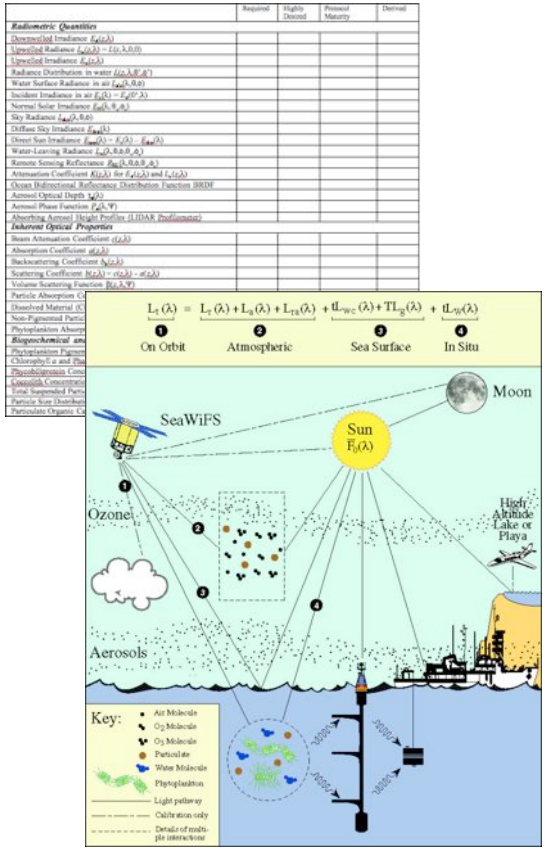
Robert Arnone, Naval Research Laboratory
William M. Balch, Bigelow Laboratory for Ocean Sciences
Michael J. Behrenfeld, Oregon State University
Paula Bontempi, NASA Headquarters
Francisco Chavez, MBARI
Giulietta S. Fargion, San Diego State University
Bryan A. Franz, SAIC, Ocean Biology Processing Group
Ricardo M Letelier, Oregon State University
Stéphane Maritorena, UCSB
Charles R. McClain, GSFC, NASA
B. Greg Mitchell, Scripps Institution of Oceanography
Andre Morel, Observatoire Océanologique de Villefranche
Cyril Moulin, Laboratoire des Sciences du Climat et de l'Environnement
Alexander Smirnov, AERONET, GSFC
Dariusz Stramski, Scripps Institution of Oceanography
Kenneth J. Voss, Physics Department University of Miami
P. Jeremy Werdell, SSAI, Ocean Biology Processing Group
J. Ronald V. Zaneveld, WetLabs

Scientific Questions

Observational Requirements

Observational Strategies

Satellite Missions



Over the past ten years, synoptic ocean color research discoveries have raised new scientific questions and research challenges

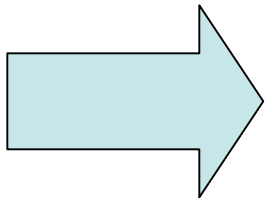
	Required	Highly Desired	Protocol Maturity	Derived
Radiometric Quantities				
Downwelled Irradiance $E_d(z,\lambda)$				
Upwelled Radiance $L_u(z,\lambda) = L(z,\lambda,0,0)$				
Upwelled Irradiance $E_u(z,\lambda)$				
Radiance Distribution in water $L(z,\lambda,\theta',\phi')$				
Water Surface Radiance in air $L_w(\lambda,\theta,\phi)$				
Incident Irradiance in air $E_s(\lambda) = E_d(0^+,\lambda)$				
Normal Solar Irradiance $E_{sol}(\lambda,\theta_s,\phi_s)$				
Sky Radiance $L_{sky}(\lambda,\theta,\phi)$				
Diffuse Sky Irradiance $E_{sky}(\lambda)$				
Direct Sun Irradiance $E_{sun}(\lambda) = E_s(\lambda) - E_{sky}(\lambda)$				
Water-Leaving Radiance $L_w(\lambda,\theta,\phi,\theta_s)$				
Remote Sensing Reflectance $R_{rs}(\lambda,\theta,\phi,\theta_s)$				
Attenuation Coefficient $K(z,\lambda)$ for $E_d(z,\lambda)$ and $L_u(z,\lambda)$				
Ocean Bidirectional Reflectance Distribution Function BRDF				
Aerosol Optical Depth $\tau_a(\lambda)$				
Aerosol Phase Function $P_a(\theta,\Psi)$				
Absorbing Aerosol Height Profiles (LIDAR Profilometer)				
Inherent Optical Properties				
Beam Attenuation Coefficient $c(z,\lambda)$				
Absorption Coefficient $a(z,\lambda)$				
Backscattering Coefficient $b_b(z,\lambda)$				
Scattering Coefficient $b(z,\lambda) = c(z,\lambda) - a(z,\lambda)$				
Volume Scattering Function $\beta(z,\lambda,\Psi)$				
Particle Absorption Coefficient $a_p(z,\lambda)$				
Dissolved Material (CDOM) Absorption Coefficient $a_g(z,\lambda)$				
Non-Pigmented Particle Absorption Coefficient $a_d(z,\lambda)$				
Phytoplankton Absorption Coefficient $a_\phi(z,\lambda)$				
Biogeochemical and Bio-Optical Quantities				
Phytoplankton Pigment Composition (HPLC method)				
Chlorophyll *a* and Phaeopigments Conc. (fluorometric method)				
Phytoplankton Concentrations				
Coccolith Concentrations				
Total Suspended Particulate Material (SPM)				
Particle Size Distribution				
Particulate Organic Carbon (POC)				

The workshop participants worked on a "revised" priority list of in situ parameters across the NASA OBB Program

- Recommended *in situ* parameters should go beyond a purely calibration/validation satellite program
- The group discussed and identified the following updates for the parameter list:
  - PP, POC, PIC, DOC, carbon export, TSM and TOM, T, S, oxygen, PAR, PFTs (phyto and non-algal) – diatoms, pico, cocco, tricho, dino. CDOM, pCO2 – DIC/alkalinity, land-ocean exchange, beam-c particles, particle size distribution (PSD) and nutrients.

The group made the following overall recommendations:

- Collect a_cdom with all chlorophyll samples;
- Collect species counts with HPLC pigments;
- Collect apparent and inherent optical properties (AOPs and IOPs) into the UV (300-800nm);
- Need full radiance distributions; and
- Need volume-scattering functions.



All in situ data collected must be submitted to the NASA database holdings (SeaBASS)

The participants broke-up into three groups:

1) Apparent and inherent optical properties measurements,
2) Primary Production, and
3) Characterizing standing stocks of seawater constituents including particle functional types.

Each group discussed the feasibility/accuracy of the *in situ* measurement methods for each parameter; and the time frame within which we can hope to have "reliable" measurements (immediate, short- mid- long-term) for the parameters.

1) AOP and IOP Measurements Group

Contributions from
Arnone, Maritorena, McClain, Morel, Stramski, Voss and Zanaveld

Recommendations:

- apparent and inherent optical properties be measured in the 300-900 nm range with the highest possible spectral resolution to take advantage of:
  - the better separability of absorption components in the UV;
  - the use of NIR in coastal waters; and
  - to support advanced atmospheric correction schemes.
  - vertical profiles are measured rather than just sub-surface measurements;
- AOP & IOP protocols should be updated
- data submitted to SeaBASS must contain metadata that would allow reprocessing

Recommendations (cont.):

- Suggested workshops:
  - on acdom measurement and protocols (waveguide, spectrophotometry and fluorescence) and associated issues (i.e., sensitivity in oligotrophic waters and derivation of slopes)
  - on backscattering instruments and measurement protocols. During such a workshop the participants should look into VSF and PSD measurements;
- Operational definitions of the component absorption terms and backscattering should be revisited to take into account the fact that the filtering techniques involved in these determinations are not fully consistent (the 0.7 to 0.2 micron fraction is not accounted for)

It is highly recommended that as many as possible of the properties listed below are measured together:

- AOPs
  - Lu, Ed, Es, Eu, Kd, KPAR.
    - KPAR can be obtained with either a PAR sensor with a cosine collector or by integrating the Ed spectra if the spectral resolution of the measurements is sufficient
  - the upward spectral radiance distribution is also required to address BRDF issues and to validate existing BRDF correction schemes …but only a few investigators will be able to make this measurement.

IOP	Instrument/method	Issues - comments
a total	AC-9 AC-S Spectrophotometry Integrating cavity	• Calibrations • Post-processing information (Salinity, temperature, corrections, volume filtered) must be in SeaBASS metadata • Vertical distribution (spectrophotometry covers the whole wavelength range from UV to NIR but samples at discrete depths. AC-9 like instruments do not cover the whole spectral range but make complete vertical profiles).
a_p, a_{phi}, a_d	AC-9 (w/ filter) AC-S (w/ filter) Spectrophotometry Integrating cavity	• Methods for a_d: Kishino et al., (1985), Tassan & Ferrari (1995) and spectral decomposition. • Beta value or correction scheme, filtered volume must be in SeaBASS metadata
a_{CDOM}	Fluorometry Capillary waveguide Spectrophotometry AC-9 (w/ filter) AC-S (w/ filter) Integrating cavity	• Calibration. • Protocols. • Sensitivity in oligotrophic waters • Pure water • Slope calculation, zero value, how far in the UV.
b	AC-9 (w/ filter) AC-S (w/ filter) Transmissometer	• Calibrations • It is recommended that VSF and/or PSD is also measured with b or b_b. • Pathlengths • Post-processing information (Salinity, temperature, corrections, volume filtered) must be in SeaBASS metadata
b_b	Hydroscat ECoVSF VST (?) B. Balch's method LISST	• Method for b_b: Balch et al. (2004) • Calibrations • It is recommended that VSF and/or PSD is also measured with b or b_b. • Spectral characteristics, measurement angle(s) should be specified. • When reporting c-meter data one should always report the aperture of the instrument. For example the LISST and the c-star have very different apertures and will give different results.
c	AC-9 AC-S Transmissometer	• Calibrations • Path-lengths

2) Primary Production Group

Contributions from
Balch, Behrenfeld, Chavez, Letelier and Mitchell.

Improvements to modeling production will require information on, or observations of:

- mixed layer light levels, which are a function of the physiological mixing depth, spectral downwelling sunlight, and spectral attenuation,
- phytoplankton absorption,
- temperature, and
- nutricline depth, which is helpful for describing changes in photosynthetic efficiencies, subsurface structure of phytoplankton pigment and biomass, and export or 'new' production

Recommendations (cont.):

- Field observations should aim to measure all of the presented properties simultaneously and should obviously be accompanied by measurements of carbon fixation (^{14}C);
- Recommended measurements:
  - photosynthetic energy invested into calcium carbonate structure (which influence ^{14}C measurements and are an important factor in carbon export from the photic zone to depth);
  - solar simulated fluorescence or variable fluorescence in support of developing productivity algorithms and for understanding observed physiological variability;
  - chlorophyll per cell or fluorescence per cell for specific phytoplankton groups from flow cytometric systems;
  - estimation of phytoplankton growth rates and environmental forcing factors (e.g., nutrients, light, temperature)

3) Parameters for Characterizing Standing Stocks of Seawater Constituents Including Particle Functional Types

Contributions from Stramski and Moulin

Standing Stock Parameters considered:

1) Chlorophyll a and Other Pigments;
2) DOC (Dissolved Organic Carbon)
3) POC (Particulate Organic Carbon)
4) PIC (Particulate Inorganic Carbon)
5) TSM (Total Suspended Matter)
6) PIM (Particulate Inorganic Matter defined as a non-combustible fraction of TSM);
7) POM (Particulate Organic Matter derived as a difference TSM-PIM);
8) DIC (Dissolved Inorganic Carbon) and Alkalinity;
9) PSD (Particle Size Distribution); and
10) PFTs (Particle Functional Types).

- Status of measurement techniques and protocols:
  - Chl a, DOC, POC, PIC, POM, DIC, Nutrients measurement techniques are available and have been used for a number of years;
  - Total Suspended Matter (TSM) and Particulate Inorganic Matter (PIM) is not necessarily obvious or known which treatment is best. These issues must be taken into account when preparing revised or new protocols for the purposes of the OBB program at NASA;
  - Particle Size Distribution (PSD) the current status of measurement methodology appears not to be standardized; and
  - The PFTs remain to be an active area of research in the years to come.

- We recommend to broaden the concept of PFTs from Phytoplankton Functional Types to Particle Functional Types. The enhanced concept of Particle Functional Types includes not only the Phytoplankton Functional Types but also Non-Phytoplankton Particle Types (such as various kinds of non-living particle types, heterotrophic microorganisms, and viruses)

Particle Size Distribution (PSD):

- As a short-term goal (~3 - 5 years) we recommend to focus our efforts on developing consistent protocols for sizing particles with several types of instrumentation that are already available commercially and used by a number of labs within our research community;
  - a workshop to examine PSD measurements and methods with these different instruments in conjunction with the use of different instrumentation/methods for light scattering measurements; and
  - development of guidelines for submitting the PSD data to the NASA database
- In the mid- and long-term (>5-30 years), the most significant challenges in PSD measurements appear to exist on both ends of the particle size spectrum:
  - that is within the submicrometer size range (colloids) and within the largest suspended particles being > hundreds of micrometers in size (particles such as large flocs, aggregates, fecal pellets).

Phytoplankton Functional Types (PFT):

- We expect that IOCCG Working Group on PFTs will provide a useful synthesis of concepts related to Phytoplankton Functional Types, measurement methods for characterizing or quantifying these types, and the present status of our capabilities for retrieving information about these types from ocean color.
- Non-phytoplankton particle types will not be addressed in the IOCCG report.
- Our present recommendation is to continue collecting data on the suite of pigments with HPLC method. At this time we do not suggest the submission of information about PFT derived from HPLC pigments to the NASA database because there is no unified or unambiguous methodology for converting pigment data into PFTs.
- Various instruments such as flow cytometers, FlowCam or microscopes as an important source of information on PFTs, and possibly initiating the submission of these data to the NASA database.
- The PFTs remain to be an active area of research in the years to come.

Draft document at:

http://oceancolor.gsfc.nasa.gov/MEETINGS/

Agenda:

October 6, 2006

14:10 Welcome. P. Bontempi
14:20 Opening Remarks and Goals. G. Fargion
14:40 AERONET & Upcoming Measurements Over the Oceans. A. Smirnov
14:45 Phytoplankton Functional Types. C. Moulin
15:05 Road Map for Integrating Ocean Color into Models. B. Arnone
15:25 European Ocean Color Climate Data Sets. A. Morel
15:50 Open discussion focusing on scientific questions, observational requirements, satellite missions and other
18:30 Adjourn

October 7, 2006

8:15 Open discussion focusing on which *in situ* parameters, possible ranking as required, recommended,
13:30 Lunch
14:30 Break out group discussion: focusing on feasibility/accuracy of the in situ measurement methods for each parameter; the time frame within which we can hope to have "reliable" measurements (immediate, short- mid- long-term) for the parameters.
16:00 Group reporting & discussion
16:30 Closing comments. P. Bontempi
17:25 Adjournment