Data Management Plan (version 2020.02.11)

Data sets imagery generated by CFE, CFE-Cal, and OCO will total ~200 GB. Berkeley will provide metadata, data and imagery. Project data will be archived using WHOI's BCODMO. Timing of public data availability will take into account consideration of Ph.D. dissertation research consistent with NSF policy.

Responsibilities:
UC Berkeley: PI (Jim Bishop) - Oversee and coordinate data dissemination.
LBNL: Todd Wood and UCB (Bishop) - maintain cruise data bases and imagery on LBNL server. Facilitate data transfer to BCODMO data archive.

Disposition of data:
OCO data and imagery: Available through LBNL on Project's Web Server and BCODMO.

Metadata standards.

Methodology, examples of images and reduced images are documented in supplemental materials accompanying Bishop et al. (2016). Key elements are reproduced here.

CFE, CFE-Cal image data: Files names are self-documenting,

Table: File naming convention for CFE, CFE-Cal imagery.

YYYYMMDD_HHMMSS_IMGR_EXPOS_BG_GG_RG_type_ID_DIV_TEMP 20160820_183045_4443_00200_14_11_14_bckr_82_213_15.1C.bmp … 20160820_193837_4443_00200_14_11_14_bckc_82_213_13.7C.bmp
20160820_183119_4443_02000_14_11_14_pl2r_82_213_15.0C.bmp … 20160820_193908_4443_02000_14_11_14_pl2c_82_213_13.7C.bmp
20160820_183035_4443_02000_13_10_13_ledr_82_213_15.1C.bmp … 20160820_193828_4443_02000_13_10_13_ledc_82_213_14.0C.bmp

Date (year_month_day), UTC time (h_min_s), and imaging type (dark field (led), transmitted (bck), transmitted cross-polarized (pl2), fluorescence (flu), imager ID (imgr), imager gains (Blue/green/red) and exposure times (milliseconds), instrument temperature (celcius), dive number, and identity (ID). We will also include latitude, longitude and depth.

Data Quality: CFE, CFE-Cal and OCO data
Attenuance (ATN).

Transmitted light (TRA) images are normalized by an in-situ particle free image of the sample stage area under transmitted light illumination. Image attenuance (ATN), the sum of both light scattering loss and particle absorption of the primary beam, is calculated as the negative $\log_{10}$ of transmittance and is a measure of both aggregate thickness and transparency. The effects of overlaying particles are additive in attenuance units.

In order to detect particles, we set the lowest threshold of pixel attenuance to be 20 milli attenuance units. The particle attenuance is integrated across sample stage and then divided by the total number of pixels of the stage area to yield the average particle load (in milli-attenuance units). The stage load, when

multiplied by sample stage area yields units of mATN-cm^2, the optical 'volume' of material on the sample stage. Attenuance flux (in units of mATN-cm^2 cm^{-2} d^{-1}) is calculated by taking differences of successive stage loads, divided by the mouth opening of the trap, and further divided by the time (in days) between image sets. Stability of Attenuance product ± 10 milli-Attenuance units, range 0 – 2500.

Cross-Polarized Photon Yield (POL).

Following correction, image counts are integrated across all particle pixels and normalized by the total number of pixels covering the stage area. Sample counts are normalized to lamp brightness and scaled by the difference in exposure time for POL vs. TRA images to yield the quantity cross-polarized photon yield, expressed as a fraction of incident beam intensity. Data are reported in ppm. The optical measure of flux is in units of ppm-cm^2 cm^{-2} d^{-1}.

Particle Concentration Sensor data from CTD casts.

Protocols for transmissometer, scattering sensor deployment and data reduction will follow protocols established by the GEOTRACES (Cookbook, Chapters VIII and VI-Sec. 10). Details of optics data processing are summarized for beam attenuation coefficient and seapoint Turbidity by Bishop and Wood (2008) and Bishop et al. (2012). This include methods for spike detection.

Beam attenuation coefficient accuracy (precision) better than 0.002 (0.001) m^{-1} is achievable (Bishop and Wood, 2008, Bishop et al., 2012, Boss et al., 2015) independent of depth. Conversion to POC units will use a calibration factor of 27, typical of C-Star instruments we have deployed (Bishop and Wood, 2008). Calibration by cross comparing in-situ pump POC values if available. Protocols follow GEOTRACES methodology that we helped develop and prove.

Seapoint scattering sensor results will be reported to an accuracy of 2 mFTU (Bishop and Wood, 2008). These sensors have few issues and are rated to 5000 m.

The PIC sensor detects birefringent particles in the water column (Guay and Bishop, 2002, Bishop, 2009). Most recently, two sensors were at sea during GEOTRACES GP15 transect. UC Santa Cruz has measured PIC in size fractionated particulates collected by in-situ large volume sampling.

The PIC sensor's signal (V_{PIC}) is calculated as outlined in Equation 1.

$$\mathbf{V}_{PIC} = \mathbf{(}(V_{meas} - V_{zero}) \,/\, \mathbf{R}_{PIC} - V_{cross} \text{ x } \mathbf{Tr}\,\mathbf{)} \,/\, \mathbf{Tr^{0.5}} - \mathbf{E} \qquad (1)$$

V_{meas} is the primary signal from the CTD. V_{zero} is the output of the sensor with beam blocked. R is the source response to temperature – normalized to 1.000 at 20°C. The magnitude of $\mathbf{R}_{PIC}$ is different on down and up profiles due to thermal lag and leads of the instrument temperature relative to water. V_{cross} is the polarizer crossing blank (e.g. photons out of the plane of polarization of the source) in water (at 20°C) and is scaled by transmittance (**Tr**). The resultant signal is normalized by $\mathbf{Tr^{0.5}}$ (Guay and Bishop, 2002) to compensate for the scattering and absorption loss of birefringent photons excited in the beam. Finally, **E** is a small empirical correction proportional to the difference between ambient seawater and the body of the instrument (e.g. Bishop, 1986).

The terms Vzero , Vcross, RPIC and E are as follows: Vzero (~0.07V) for PIC001 varies with instrument temperature. The more recent digital sensors (PIC006 and later) have a constant Vzero (near 0.002V). $\mathbf{R}_{PIC}$ varies linearly between 0.92 at 38°C to 1.07 at 0°C and is similar for both PIC001 and the newer digital instruments. V_{cross} is almost invariant at 0.04V for digital PIC sensors.

The project personnel will QC/QA CTD cast data. The PI has extensive experience with this. Obviously bad data will not be reported. Other data will be QC/QA'd using the principle of "oceanographic consistency".

C-SNOW Data Management Plan (version 2015.02.04)

From proposal funded by NSF-OTIC as an engineering development project:

From 2009 through 2014 we have generated ~1TB of image data from the CFEs in both raw and processed state collected over the eight expeditions to coastal California waters; San Clemente Basin, Santa Catalina Basin, Santa Cruz Basin, and in the vicinity and offshore of Monterey Bay and in the subarctic North Pacific. We are in a quandary regarding how to provide access and archival storage of the 1TB of CFE images. They document both the particle structures and organism associations with aggregates. These data are presently stored on a server at Lawrence Berkeley National Labs but transferring reduced data to an archive is needed. The PI has had preliminary discussions with Cindy Chandler at WHOI regarding this need. Meta data and synthesized results will be made available to BCO-DMO – in particular of reduced data usable in publications. Ship generated data (MET, ADCP, …) have been released through routine channels. All real time status information on Carbon Flux Explorer deployments will be available through the web at LBNL.