Stramski, Dariusz (2007): Documentation of methods , *Scripps Institution of Oceanography*

BACKSCATTERING PROFILES (H6 and a-Beta):

Vertical profiles of the backscattering coefficient (bb) in 6 spectral bands were obtained from measurements with a HobiLabs HydroScat-6 backscattering meter (S/N HS697074). In addition, the backscattering coefficient in two spectral bands was obtained from measurements with two HobiLabs a-beta meters (S/N AB990403 and AB990404). Backscattering data were processed with a method described originally by Maffione and Dana (1996) with refinements presented in Boss and Pegau (2001). The backscattering coefficient is considered to be the sum of contributions from pure seawater backscattering and particle backscattering. Initial data processing including conversion of volume scattering function (vsf) to bb was done with HobiLabs HydroSoft software ver. 2.71 utilizing post-cruise manufacturer's calibrations, with subsequent processing carried out using custom-written software.

For the data stored here in PANGAEA, the scattering values for pure seawater used in all calculations are derived from Morel (1974) (see also Stramski et al. 2008, Biogeosciences 5: 171-201).

For each wavelength, we used a value of 1.13 for the "chi" parameter that converts the particle volume scattering function (vsf) measured with the HOBI Labs sensors at a fixed backscattering angle of about 140 degrees to the particle backscattering coefficient. The total backscattering coefficient, bb, was then calculated as a sum of particle backscattering and pure seawater backscattering. Data were corrected for signal attenuation (so-called "sigma-correction") using the relationships:

corrected data = data * sigma ,

sigma = k1 exp(Kexp * Kbb)

where k1 and Kexp are instrument-specific calibration factors. The parameter Kbb was estimated from the relation Kbb = ap + aCDOM + 0.4bp using independent determinations of absorption coefficient by particles (ap), absorption coefficient by colored dissolved organic matter (aCDOM), and the particle scattering coefficient (bp). The magnitude of the sigma-correction was always <3% for all wavelengths, and generally <0.5%.

Profile data were subsequently split into down and upcasts, and averaged to 1 m depth bins. Separate data files for downcast and upcast are submitted. The submitted data files contain both the VSF measurement at 140 degrees (vsf) and the derived backscattering coefficient (bb). Because significant "noise" was observed at shallow depths, data in the near surface layer (<5m) were often rejected and not included in the submitted data files.

BEAM ATTENUATION (cnw):

Vertical profiles of the beam attenuation coefficient due to particles and dissolved substances (cnw = c - cw) were obtained using two single wavelength WET Labs C-Star transmissometers (488 and 660 nm). For calibration, the reference voltage for each instrument (maximum signal voltage assumed to

represent pure seawater) was estimated using the voltage measured in deep water (2000-3000 m) at five stations during the cruise.

Profile data were subsequently averaged to 1 m depth bins. Separate data files for downcast and upcast are submitted. Because significant "noise" was observed at shallow depths, data in the near surface (< 5m) were rejected and not included in the submitted data files.

PARTICLE ABSORPTION (ap):

Particles from discrete water samples were collected on 25 mm GF/F filters, and the filters were frozen in liquid nitrogen for transport back to the laboratory. Samples were analyzed within 4 months of the cruise. After thawing, filters were scanned in a double-beam bench-top spectrophotometer (Perkin-Elmer Lambda 18) equipped with a 15-cm Spectralon integrating sphere (RSA-PE-18, Labsphere). All measurements were done in the spectral range 300 to 850 nm with 1-nm resolution. Spectra were smoothed twice with a 5-nm moving average.

The absorption coefficient of total particulates, ap, and non-pigmented detritus, ad, were determined using the Transmittance-Reflectance (T-R) filter- pad technique (see Tassan and Ferrari, 1995, 2002). The appropriate corrections for baseline (i.e., wet blank filter) were applied. For ad, sample filters were extracted 10 minutes with a 2% solution of NaClO and then re-scanned. Correction for the pathlength amplification factor (beta) was applied according to Stramska et al. (2006): ODS=0.592(ODF)^2 + 0.4(ODF), where ODS is the calculated optical density in suspension, and ODF is the measured optical density of the sample filter. This formula for beta correction was established from special experiments in our laboratory using our Perkin-Elmer spectrophotometer and several types of particle assemblages (phytoplankton cultures, natural particle populations, and natural mineral-rich particle assemblages).

For ap spectra, values in the near-infrared were generally near zero or slightly positive, and no offset correction (so-called null point) was applied to these spectra. For 26 samples, negative values in the near-infrared were observed and these spectra were adjusted upwards so that the mean ap value between 840-850 nm equaled zero. The ad spectra were adjusted so that the mean ad(840-850) equaled the mean ap(840-850). This reflects the common assumption that phytoplankton have negligible absorption in this spectral region.

PARTICULATE ORGANIC CARBON (POC):

POC was measured with a method consistent with the JGOFS protocols. Particles were collected on pre-combusted 25 mm GF/F filters. After filtration, the filters were transferred to clean glass scintillation vials, dried at 55°C, and stored until post cruise analysis. The determination of POC was made with a standard CHN analysis based on high temperature combustion of sample filters. The CHN analysis was made at the UCSB MSI Analytical Lab. Before this analysis, for removal of inorganic carbon, 0.25 mL of 10% HCl was applied to each filter and the acid-treated filters were dried at 55 degC. Blank filters were also collected during the cruise to quantify background POC. The blank filters were processed the same way as regular sample filters with the exception that the sample filtration step was not applied. The final values of POC concentration were calculated by subtracting the mass

of organic carbon on blank filters from the mass of carbon determined on sample filters, and then dividing this result by the measured volume of filtered sample. Duplicate POC samples were taken and averaged to produce the final POC concentration. In addition to POC, particulate organic carbon (PON) was also determined from the CHN analysis. Both POC and PON data are included in the submitted data file.

RADIOMETRIC PROFILES (SPMR):

Vertical profiles of downwelling irradiance, Ed, and upwelling radiance, Lu, were measured in 13 spectral bands with a Satlantic SeaWiFS Profiling Multichannel Radiometer SPMR (S/N 0126) operating in free-fall mode. No surface reference sensor was available. The instrument was allowed to drift away from the ship to avoid ship-shadowing. Typically, 3-4 repetitive casts were taken at each station, with at least one deep cast to 150-200 m if water depth was sufficient. Special attention was paid to sky conditions to ensure that the data acquired during a cast represent stable irradiance incident on the ocean surface. The SPMR profiles with a doubtful quality of data, in particular the profiles that did not agree with other replicates and the profiles during which the sky conditions were changing (for example, a heterogeneous cloud over the Sun's disk) were rejected.

Data files were processed using Satlantic ProSoft ver. 7.7 software. Submitted data files represent output of Level 3a processing. The steps for SPMR data processing were: (i) apply dark offsets and manufacturer's calibration to convert raw data to physical units (cal file = Pro026m.cal); (ii) correct for atmospheric pressure tare and geometric offsets between Ed and Lu sensors; (iii) reject data with tilt > 5deg (typically near the surface within the first 5 m) and (iv) bin to 1 m depth interval. Data from each cast are submitted in a separate data file.

A problem with the Ed(490) channel developed starting at SIO Station 37 (05 Nov. 2005), and no reliable data were obtained from this channel for the remainder of the cruise.