Ocean Carbon and Biogeochemistry Data System

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EDDIES cruise: 2004 and 2005 R/V Weatherbird II Transect cruises
Satlantic profiling radiometer system (SPMR/SMSR) processing notes

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Methodology

It is important to note that two different light-profiling systems were used for the EDDIES experiment. The Weatherbird II used a Satlantic profiling radiometer system (SPMR/SMSR), which has been a standard operating procedure for BBOP over the past 8 years. The Oceanus used a Satlantic Micro-Profiler II.

R/V Weatherbird II Satlantic Light-Profiler Description

SPMR

The profiler used aboard the Weatherbird II is a SeaWiFS Profiling Multi- Channel Radiometer (SPMR). It is a free-falling instrument that is equipped with two sensors, collecting the upwelling irradiance (Ed) and downwelling (Lu) radiance at the following 11 wavelengths: 324, 340, 380, 412, 443, 490, 510, 555, 565, 665, and 683nm. The unit is protected in a long case that contains the majority of the system's electronics, while the optical sensors are located at either end of the case and face in opposite directions (i.e., up and down). These sensors measure the irradiance in units of uW/cm2/nm and the radiance in units of uW/cm2/nm/sr. Tilt and pressure are recorded at the same frequency as the irradiance measurements (6Hz).

SMSR

The SPMR is accompanied by a deck reference sensor, called the SeaWiFS Multichannel Surface Reference (SMSR). This sensor is equipped with the same 11 wavelengths as the SPMR, and is based on the same electronics. Data acquisition is synchronized between the SPMR and the SMSR and is performed at the same (6Hz) frequency.

CALIBRATION

The system is calibrated with respect to NIST standards three times a year at UCSB and variation from those standards has been less than 2%. However, most of this variation has occurred within the UV and blue channels (as opposed to the red) and is partly due to the lower output of calibration lamps at lower wavelengths. All other changes in sensitivity were most likely due to the replacement of the sensors' cosine collectors.

DATA COLLECTION

An SPMR profile begins after the instrument has been deployed and reaches a distance of approximately 50 meters from the ship's stern (to avoid ship shadow). The instrument is then released and falls at approximately 0.5 m/s and is synchronized with the SMSR on the deck of the ship.

DATA PROCESSING

The Weatherbird radiometric data were processed using a series of standardized BBOP processing scripts written by research members at ICESS. This system creates a quality controlled and quality assessed 1m binned data set. The irradiance values at "just below the surface" or "(0-)" are obtained as the intercept of a least squares regression fit of each profile. The calculated intercept is a product of the diffuse attenuation coefficient (Kd) calculation. As a result, if the optical properties are propagated to the surface, the Kd profile for each optical variable (Ed, Lu) will be calculated as well.

i.e. $Kd = -dlnEd(ed,lu,etc)/d(z)$

while the intercept is determined by: $lnEd(0-) = lnEd(z)+Kd(z)$

Derived surface products include remote sensing reflectances (Rrs), down-welled attenuation coefficients (Kd) and up-welled attenuation coefficients (Kl). The units are 1/sr, 1/m and 1/m respectively.

Rrs is calculated as the ratio of the upwelling irradiance just below the surface (0-) to downwelling radiance just below the surface (0-). The "above surface" (or "0+") values are derived by simply multiplying a constant of 0.5238.

The attenuation coefficients (Kd & Kl) for the surface were derived by calculating the average of the top 25 meters of the profiles.

Suspicious data values (i.e. low signals or "spiking") were corrected (or "flagged") so that users of the data set could determine their usefulness for their own applications.

These data are a collection of in-situ measurements gathered from the Weatherbird II research vessel during the EDDIES experiment (2004 and 2005).

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