

Primary Production
and
Irradiance Data
for
U.S. JGOFS (Leg2)
ATLANTIS II (Cruise 119-4)
(25 April - 10 May 1989)

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INTRODUCTION

This report is a compilation of primary production and optics data collected as part of the U.S. component of the JGOFS North Atlantic Bloom Experiment. The data is from the ship Atlantis II, Leg 119-4, and leg 2 of the U.S. JGOFS experiment.

METHODS

1. Primary Production.

Primary production measurements were made using the ^{14}C technique. Water samples were collected before dawn each day from acid-cleaned 20 and 30 liter Go-Flo sampling bottles. Each sample was inoculated with $9.0 \mu\text{Ci}$ sterile $\text{NaH}^{14}\text{CO}_3$ solution and incubated in 265 ml polystyrene tissue culture flasks. New sterile flasks were used for each sample and a teflon liner was placed in the cap of each flask prior to incubation. Dawn to dusk incubations were carried out in situ. The samples that were incubated for 24 h were then stored in an on deck surface water-cooled incubator from dusk to the following dawn. After the incubation period the samples were filtered onto Millipore HA filters. The filters were then soaked in a few drops of 10% HCl in scintillation vials. After 3-4 h, fluor was added, and the samples were counted on the ship's Beckman LS 100 scintillation counter. A subsequent count was conducted at L-DGO.

2. Surface and Submarine Optics.

a. Surface Irradiance. Total downwelling irradiance (PAR) at the surface was measured using a cosine collector, in this case a LICOR LI-190S quantum sensor (calibrated 6 February, 1989), with a LI-550 Printing Integrator. Output from the sensor was totaled and recorded as counts by the integrator at 1 h time intervals. Using the calibration constant for the sensor, the counts were converted to Einsteins $\text{m}^{-2} \text{h}^{-1}$.

b. Subsurface Optics. A submersible radiometer, named Pokey (in reference to its data acquisition rate of $0.5 \text{ samples s}^{-1}$), was designed and constructed at L-DGO to measure scalar irradiance of photosynthetically available radiation (PAR) and the upwelled radiance at 683 nm (Lu683), the natural fluorescence of chlorophyll a. This instrument, in conjunction with a sensor for measuring scalar irradiance of PAR above the sea surface, was routinely deployed at local apparent noon during the North Atlantic Bloom Experiment.

The instrument consisted of an underwater PAR/depth sensor (QSP-200D, Biospherical Instruments, Inc.) and a 683 nm radiance sensor (QMR-200, BSI), attached to opposite extensions of a \perp -shaped metal frame. The surface PAR sensor (QSR-240, BSI) was mounted in a shadow-free location near the top-deck of the ship and used during the optics profile. The instrument was lowered at a nominal rate of 5 m min^{-1} to a depth where underwater PAR was <

1.0% of surface PAR (typically from 40-80 m). Signals from the underwater sensors (3 channels measuring PAR, depth, and Lu683) were transmitted to the surface through a conducting cable. All signals were digitized using a Metrabyte M1132 A/D converter (15 bit resolution, 0.1% accuracy), and stored on a personal computer.

Values for the diffuse attenuation coefficient of PAR were calculated according to Siegel and Dickey (1987). Briefly, the data were binned at 1 m intervals, log-transformed, and smoothed using a 9-point moving average. $K(\text{PAR}, z)$ ('kpar' in the data listing) was calculated according to

$$K_{\text{PAR}}((z_1 + z_2)/2) = (\ln \text{PAR}(z_1) - \ln \text{PAR}(z_2)) / (z_2 - z_1)$$

where z_1 and z_2 represent depth intervals of 10 m starting from the surface and advancing through the water column (at 10 m intervals) to the maximum depth of the cast.

Values of natural fluorescence from the Lu683 sensor are not part of this data listing. Our surface irradiance data (continuously recording) suffered from acquisition problems, and we were only able to recover 4 d of data. W. Broenkow of Moss Landing Marine Laboratory kindly supplied us with his data. Given the different data acquisition systems, and different integration time periods, the agreement between the two sensors is very good.

REFERENCES

Siegel, D.A. and T.D. Dickey. 1987. Observations of the vertical structure of the diffuse attenuation coefficient spectrum. Deep-Sea Research 34, 547-563.

PRIMARY PRODUCTION

(Carbon Assimilation)

NORTH ATLANTIC BLOOM EXPERIMENT

Atlantis II(Cruise 119-4), JGOFS Leg 2

April 25-May 7, 1989

Date	Depth(m)	Inc.Time(h)	C Assim.(umols/l)	
4/25/89	3	14	2.69	
	3	24	2.20	
	10	14	2.88	
	10	24	2.21	
	20	14	2.33	
	20	24	1.75	
	30	14	1.73	
	30	24	1.41	
	40	14	0.99	
	40	24	0.75	
	55	14	0.56	
	55	24	0.43	

	4/26/89	3	14	3.74
3		24	2.67	
10		14	3.29	
10		24	2.31	
20		14	2.26	
20		24	1.74	
30		14	1.21	
30		24	1.09	
40		14	0.59	
40		24	0.45	
50		14	0.31	
50		24	0.27	

4/27/89	3	14	3.10	
	3	24	2.25	

Date	Depth(m)	Inc.Time(h)	C Assim.(umols/l)
	10	14	2.92
	10	24	2.20
	20	14	1.79
	20	24	1.22
	30	14	0.78
	30	24	0.66
	40	14	0.40
	40	24	0.27
	50	14	0.24
	50	24	0.16

4/28/89

3	4	1.56
10	4	1.46
20	4	0.89
30	4	0.41
40	4	0.19
50	4	0.12

4/29/89

3	14	4.24
3	24	3.24
10	14	3.73
10	24	3.00
20	14	2.15
20	24	1.90
30	14	0.95
30	24	0.67
40	14	0.32
40	24	0.28
50	14	0.15
50	24	0.11

4/30/89

3	14	4.27
3	24	3.77
10	14	4.59

Date	Depth(m)	Inc.Time(h)	C Assim. (umols/l)
	10	24	3.75
	20	14	3.58
	20	24	2.73
	30	14	1.43
	30	24	1.49
	40	14	0.62
	40	24	0.59
	50	14	0.27
	50	24	0.31

5/01/89

	3	14	4.51
	3	24	3.86
	10	14	3.00
	10	24	2.60
	20	14	1.43
	20	24	1.10
	30	14	0.54
	30	24	0.47
	40	14	0.12
	40	24	0.16
	50	14	0.09
	50	24	0.06

5/02/89

	3	14	5.64
	3	24	4.48
	10	14	5.57
	10	24	4.63
	20	14	3.39
	20	24	3.12
	30	14	1.15
	30	24	1.17
	40	14	0.41
	40	24	0.34
	50	14	0.15
	50	24	0.15

Date	Depth(m)	Inc. Time(h)	C Assim. (umols/l)
5/03/89	5	14	5.89
	5	24	4.72
	10	14	5.07
	10	24	3.71
	15	14	2.79
	15	24	2.25
	20	14	1.30
	20	24	1.02
	30	14	0.27
	30	24	0.21
	40	14	0.16
	40	24	0.12

5/04/89

3	14	5.82
3	24	4.73
10	14	4.10
10	24	3.19
15	14	2.47
15	24	1.79
20	14	1.29
20	24	1.09
30	14	0.37
30	24	0.29
40	14	0.13
40	24	0.11

5/05/89

3	14	6.60
3	24	4.99
10	14	6.30
10	24	4.69
15	14	5.48
15	24	3.95
20	14	4.06
20	24	3.25
30	14	1.20
30	24	1.03

Date	Depth(m)	Inc. Time(h)	C Assim. (umols/l)
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	40	14	0.42
	40	24	0.41

5/06/89

	3	14	5.08
	3	24	4.10
	10	14	4.11
	10	24	3.45
	15	14	3.28
	15	24	2.43
	20	14	2.66
	20	24	1.97
	25	14	1.71
	25	24	1.28
	30	14	1.11
	30	24	0.86

5/07/89

	3	14	7.59
	3	24	5.70
	10	14	6.18
	10	24	4.69
	15	14	3.80
	15	24	3.43
	20	14	2.37
	20	24	2.00
	25	14	1.87
	25	24	1.54
	30	14	0.71
	30	24	0.60



Total Daily Irradiance (PAR) at the surface

NORTH ATLANTIC BLOOM EXPERIMENT

Atlantis II (Cruise 119-4), JGOFS Leg 2

April 25-May 9, 1989

DATE	E1(o)	E2(o)	Kpar
4/25/89		37	0.069
4/26/89		9	0.076
4/27/89		13.8	0.083
4/28/89		19.9	
4/29/89		30.4	0.091
4/30/89		45.9	0.093
5/01/89		13.9	0.109
5/02/89		53.6	0.106
5/03/89		24.8	0.106
5/04/89		13.7	0.111
5/05/89		50.3	0.128
5/06/89	24.5	27.1	0.104
5/07/89	32.4	37.9	0.105
5/08/89	19.9	21.8	0.13
5/09/89	17.6	19	

E1(o): data from L-DGO (Einsteins/m²/d)

E2(o): data from W. Broenkow, Moss Landing Marine Laboratory

Kpar : diffuse attenuation coefficient for PAR (/m)