Quarterly Progress Report

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Near-Term Objectives

- Continue analysis of Hawaii Ocean Time-series (HOT) bio-optical mooring data, and Southern Ocean bio-optical drifter data
- Continue maintenance of documentation of MOCEAN algorithms and software for use by MOCEAN team and GLI team
- Recover instrumentation for JGOFS cruises to the Southern Ocean
- Use the Fast Repetition Rate (FRR) fluorometer during JGOFS survey
- Continue chemostat experiments on the relationship of fluorescence quantum yield to environmental factors.
- Continue to develop and expand browser-based information system for in situ bio-optical data

Task Progress

1) Analysis of HOT mooring data and Southern Ocean drifter data

As discussed in our semi-annual report last January, we have analyzed the Hawaii Ocean Time-series (HOT) bio-optical mooring data from the first deployment period. Of particular interest was a dramatic bloom following the injection of nitrate into the euphotic zone. We have revised the manuscript which will be ready for submission in the next few weeks.

The bio-optical data from the second HOT deployment were recovered last December. We experienced some data logger problems with two of the bands (downwelling irradiance at 670 and 683 nm), and the records also showed bio-fouling beginning late October. We have begun a more detailed analysis of these data although the loss of the fluorescence channel is disappointing. We redeployed the package, which will be recovered next week with a new sensor/logger design identical to the one used in the Southern Ocean.

We have completed analysis of the three bio-optical drifters that were deployed last

year in the Southern Ocean. A paper was presented at the 1998 Ocean Sciences meeting. Figure 1 below shows apparent quantum yield of fluorescence during two five-day periods for one of the drifters based on the slopes of the relationship between fluorescence/chlorophyll and solar irradiance. Note the dramatic decrease in slope, indicating that phytoplankton were growing more rapidly in this second period. Figure 2 is the time series of the apparent quantum yield from the same drifter. The oscillations early in the record are associated with meanders of the Polar Front. These meanders result in colder, higher chlorophyll and higher productivity (based on fluorescence quantum yield) on the northward portion of the meanders where the flow is divergent. The opposite characteristics prevail in the southward, convergent portion of the meander. The large-scale decline in quantum yield was apparently associated with a large-scale shift in phytoplankton community structure that perhaps was indicative of the spring bloom. A drifter 200 km away recorded the same shift in quantum yield.

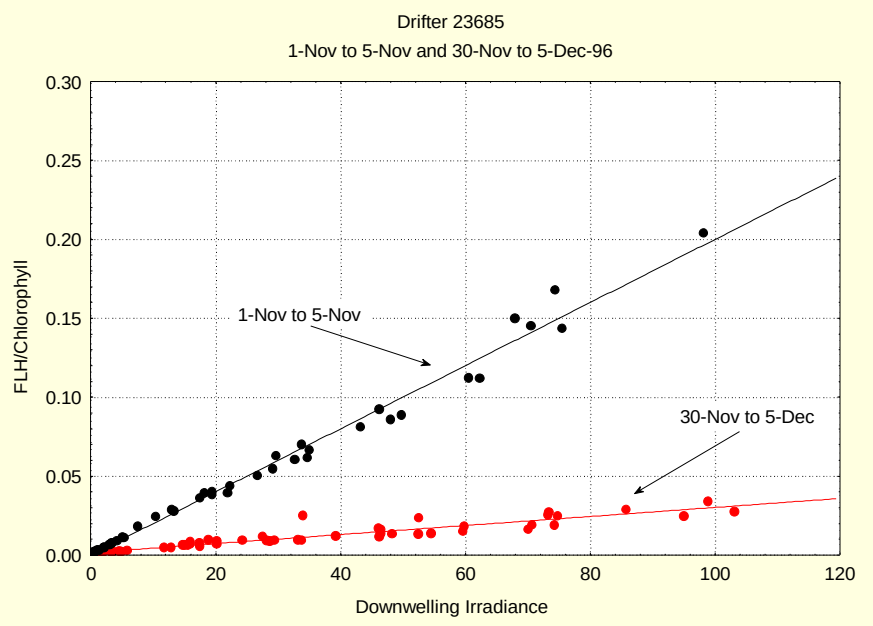

Figure 1. Relationship between fluorescence/chlorophyll and solar irradiance for two five-day periods as measured from a bio-optical drifter in the Southern Ocean in 1996.

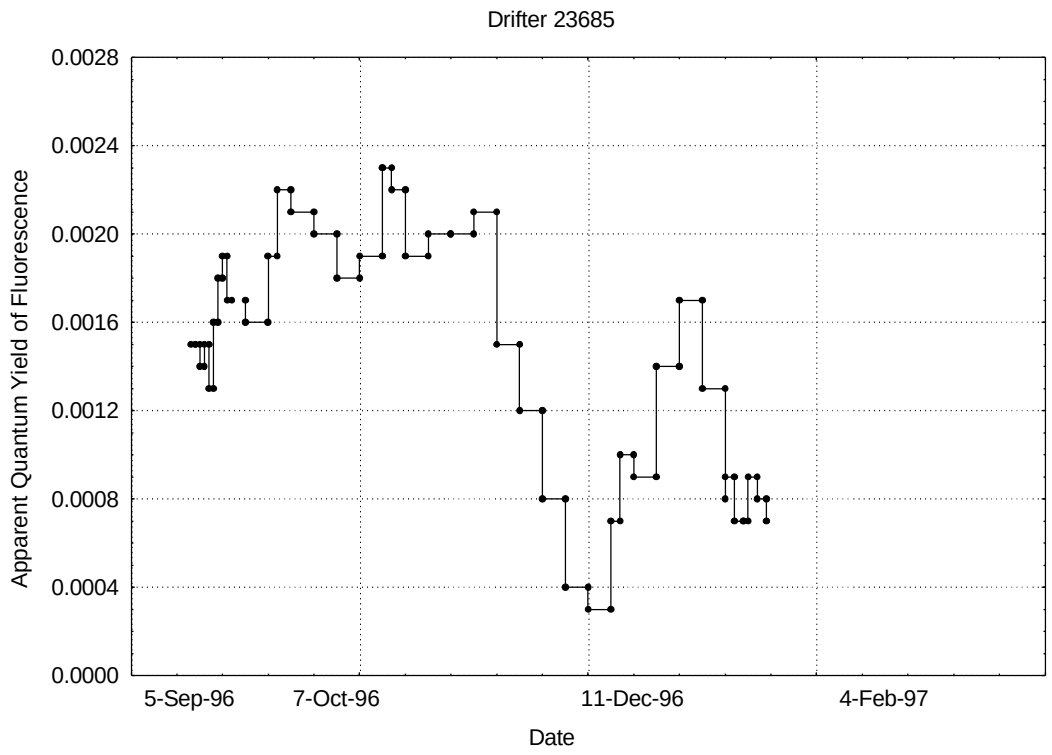

Figure 2. Apparent quantum yield of fluorescence from a bio-optical drifter in the Southern Ocean in 1996

2) MOCEAN algorithms documentation

Jasmine Bartlett continues to update the MODIS Ocean Data Processing Web page. She delivered new versions of the code to our GLI colleagues in Japan.

3) JGOFS cruise

We deployed 12 bio-optical moorings (11 of which were recovered last month) and twenty drifters (10 bio-optical and 15 surface velocity drifters). Ten more drifters were deployed in January 1998. Figure 3 shows the drifter tracks as of April 10. Each mooring included a Satlantic irradiance sensor and data logger, and an Oregon Environmental Instruments current meter and data logger. Six of the moorings also included a SeaBird Microcat conductivity/temperature sensor and data logger. One mooring was lost due to a collision with an iceberg. Two of the radiometer loggers were damaged during recovery, and we are working with the vendor to recover the data. The other data sets appear to be in good shape. The next step is to send the instrumentation back to the vendors for recalibration so that we can apply the proper corrections to the raw data. Figure 4 shows a map of SST derived from the SeaSoar survey during the deployment cruise. The locations of the moorings are also shown as are the drifter tracks during the survey period. Note that the tracks show strong divergence on the northward portion of the meander, indicating upwelling. There was

also high chlorophyll associated with this meander, as expected. The Tethered Spectral Radiometer Buoy II performed flawlessly on both cruises. We are using a new algorithm by Ron Zaneveld to calculate specific absorption using these data.

4) Test of FRR fluorometer

The Chelsea FRR was used during the second survey in January. The instrument performed better, but data recovery was problematic. We are working with the vendor on these issues. Chelsea has promised to replace our existing instrument with an improved model later this year.

4) Chemostat experiments

The chemostat has been modified to included an embedded PC104 computer to handle data logging and transmission. We are using a Java-based approach which will support downloading new acquisition and processing algorithms into the chemostat sensor systems using a Web browser. Data will be visualized as well as loaded into the data base using Java applications as well. This will allow on the fly data reduction and sampling.

5) Browser and data base development

We have made our Java applications CORBA-compliant. A paper on this work is in press in one of the journals of the Association for Computing Machinery. The paper was presented at a Java workshop this past month. We hope to continue this work using prototyping funds from ESDIS.

Anticipated Activities

1) Bio-Optical Mooring and Drifters

As noted earlier, we will redeploy the HOT mooring next week. Three bio-optical drifters are still returning data from the Southern Ocean. We will focus on processing and analysis of the mooring, TSRB, and drifter data from the Southern Ocean.

2) Laboratory Work

We will continue the chemostat experiments on fluorescence quantum yield and primary productivity.

3) Information Management

We will continue to develop Web-based browser and data analysis systems for the drifter data base and the satellite imagery data base.

Problems/Corrective Actions

Approvals for purchases have improved somewhat, but are still taking nearly 5 weeks. Increasing the threshold to $5000 would greatly simplify matters and would bring the system into conformity with other Federal regulations that define equipment as costing over $5000. We are concerned with the launch delay of AM-1, as it may severely impact science budgets. We have assembled a high quality team, and it would be difficult to replace them.