

# Biogeochemical Ocean Flux Study

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## The Biogeochemical Ocean Flux Study (BOFS)

### **BOFS: An Introduction**

The Biogeochemical Ocean Flux Study (BOFS) was a Community Research Project within the Marine and Atmospheric Sciences Directorate of the Natural Environment Research Council. The project provided a major United Kingdom contribution to the international Joint Global Ocean Flux Study (JGOFS).

The project ran from April 1987 until March 1992 but was extended through bridging funds until March 1993. The BOFS North Atlantic Data Set was collected during the initial five year period. Fieldwork in the bridging year focused on the Antarctic in late 1992. These data will form part of a subsequent electronic publication of Antarctic data and are not included on this CD-ROM.

The primary aims of the BOFS programme were:

To improve the understanding of the biogeochemical processes influencing the dynamics of the cycling of the elements in the ocean and related atmospheric exchanges with particular reference to carbon.

To develop, in collaboration with other national and international programmes, models capable of rationalising and eventually predicting the chemical and biological consequences of natural and man-induced changes to the atmosphere ocean system.

A Community Research Project brings together scientists from NERC institutes and UK universities to work on a common problem. In this way resources far beyond the scope of individual research groups may be brought to bear on a common problem. The project is coordinated through a host laboratory which has responsibility for financial management, organisation and logistics. The host laboratory for BOFS was the Plymouth Marine Laboratory.

The BOFS community included scientists scattered over the length and breadth of the UK. The following organisations were represented:

**NERC Laboratories**

Plymouth Marine Laboratory

IOS Deacon Laboratory

Dunstaffnage Marine Laboratory

**Universities**

Bristol

Cambridge

East Anglia

Edinburgh

Liverpool

Plymouth

Queen's Belfast

Royal Holloway and Bedford NC

Scottish Universities Research Reactor Centre

Southampton

University College of North Wales

The main themes and cross projects covered by these groups were:

Air sea interaction

Primary production

Particle production and fate

Benthic processes  
Modelling  
Organic and inorganic geochemistry  
Physical oceanography  
Remote sensing

It can be seen that BOFS considered a wide range of processes throughout the water column, in the air above and in the sediment below. This resulted in a large and diverse collection of data which are presented on the BOFS North Atlantic Data Set CD-ROM.

## **BOFS Fieldwork**

The BOFS North Atlantic Data Set was the result of three field seasons in 1989, 1990 and 1991. These incorporated 11 research cruises, five of which were undertaken by RRS Charles Darwin and six by RRS Discovery. A brief description of each field season follows.

### **The 1989 North Atlantic Bloom Experiment**

The 1989 field season was the United Kingdom contribution to the JGOFS pilot study in the North Atlantic, known generally as the North Atlantic Bloom Experiment (NABE). The objective of this was to provide the most complete time series possible along 20W from 47N to 60N by pooling resources from Canada, Germany, the Netherlands, United States and United Kingdom.

Each of the 1989 BOFS cruises worked the 20W transect and each cruise made measurements of the JGOFS Level 1 parameters, namely:

Meteorology and positioning  
CTD, oxygen probes and fluorometry  
Oxygen titration  
Nutrients  
Optics  
Carbon dioxide  
Particulate organic carbon and nitrogen  
Dissolved organic carbon  
Pigments (especially chlorophyll)  
Bacteria and cyanobacteria biomass  
Mesoplankton biomass  
Microplankton biomass  
Primary production by  $^{14}\text{C}$   
Oxygen production

New production by  $^{15}\text{N}$   
Bacterial production  
Mesoplankton grazing  
Microplankton grazing  
Sediment traps  
Phytoplankton composition

However, in addition to as many of these basic measurements as possible, the work of these cruises centred around three different themes.

Discovery 182 (May/June) concentrated on intensive measurements of the carbonate system and phytoplankton production. Discovery 183 (June/July) was focused towards understanding the roles of zooplankton and bacteria and the study of particulate material. Discovery 184 (July/August) was primarily a benthic cruise, collecting multicore, box core and Kasten core samples in addition to water column studies.

## **The 1990 Lagrangian Experiment**

In 1990, the BOFS community mounted a major two ship study in the North Atlantic. The study centred on a region just NE of the JGOFS 47N 20W station. The first cruise, Discovery 190 (April/May), undertook a physical and chemical survey around the JGOFS station in order to identify a suitable body of water for the experiment. Once found, the site was marked by a drifting buoy release.

The Lagrangian station was occupied by two cruises, Charles Darwin 46 (April/May) and Charles Darwin 47 (May/June). During the changeover between the two legs, the station was occupied by cruise Discovery 191. These process cruises continuously sampled the water column and ran a range of production experiments almost daily.

Once her station keeping duties were complete, Discovery embarked on a study of particulate material, zooplankton netting and a mooring recovery at 59N 20W. The final cruise, Discovery 192, repeated the physical and chemical survey around the position of the drogued buoy marking the Lagrangian station at the end of the experiment.

## **The 1990 BOFS Benthic Study**

The primary objective of this cruise was to collect a further set of cores to the south of the area sampled during Discovery 184. In addition, some JGOFS Level 1 parameters were measured, mostly by continuous sampling of the surface waters whilst the ship was underway. Core samples were collected from a number of sites along 20W between 18N and 47N.

## **The 1991 Cocolithophore Study**

Two cruises, Charles Darwin 60 (June) and Charles Darwin 61 (July), studied the coccolithophore bloom to the south of Iceland. This included a reworking of the 20W line north of 55N. Both cruises undertook intensive physical, chemical and biological measurements, including primary production. A stronger emphasis was placed on studies of grazing by mesozooplankton and microzooplankton during the second cruise.

## **BOFS Data Management**

Project data management for BOFS was the responsibility of the British Oceanographic Data Centre (BODC). Automatically logged data were supplied in their raw form directly from the ships for calibration and quality control. This work was carried out in close collaboration with the principal investigators.

These data were combined with individual submissions of sample data into a coherent data base under the Oracle RDBMS following the procedures established for another MASD Community Research Project, the North Sea Project. Project participants were provided with on-line access to these data over the UK academic wide area network, JANET.

The BOFS North Atlantic Data Set CD-ROM represents the electronic publication of this database.

## **The BOFS North Atlantic Data Set**

The most noticeable characteristic of the BOFS North Atlantic Data Set is its diversity. This diversity manifests itself in several ways. First, there is the range of parameters measured. A browse through sections D2 and D3 of this manual is the best way to appreciate just how wide this range is.

Secondly, there is diversity in the media studied. These range from atmospheric measurements, through most types of property of the water column to properties of the sediments underlying the water column.

Thirdly, there is a dramatic diversity in the volume of the different components of the data set. At one end of the scale are the automatically logged underway data: typically 10 Mbytes per cruise. At the other are hard won experimental data where the results from an entire cruise may be presented on a single sheet of paper.

The following set of seven organograms give a rapid overview of the CD-ROM contents and directory structure

# BOFS North Atlantic Data Set CD-ROM

**CTD Profile  
Plots  
(CTDPLOT)**

**Satellite  
Images  
(SATIMG)**

**Kasten Core  
X-Ray Images  
(KASCORE)**

**BODC Software  
Support Files  
(IDX & BATHY)**

**Surface Data  
Set  
(UNDERWAY)**

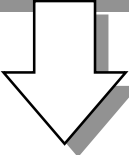
**Kit Form  
Database  
(DBKIT)**

**Data  
Documentation  
(DOCU)**

# **CTD Profile Plots Directory CTDPLOT**



**Subdirectory names based on the cruise mnemonics.  
One subdirectory per cruise.  
For example, subdirectory DI182 contains the CTD profiles for cruise Discovery 182.  
There is one type of file in each subdirectory.**



**File type is part of the file name.  
Contains the CTD profile plots in PostScript format.  
One plot file per CTD cast.  
Files names are based on the originator's identifier (OID).  
File DBKIT\INDEX\EVENT.CSV may be used as an index.**

# **Satellite Images Directory SATIMG**

**No subdirectories.  
Filenames are based on the date when image was obtained.  
There are three types of file in the directory.**

**README.TXT  
Methodology description  
in ASCII text format.**

**.PCX Files  
Images in PCX  
graphics format.**

**.TIF Files  
Images in compressed  
Tagged Image Format.**

# **Kasten Core X-Ray Images Directory KASSCORE**

```
graph TD; A["Kasten Core X-Ray Images  
Directory KASSCORE"] --> B["Subdirectory names based on the Cambridge University BOFS core naming scheme.  
One subdirectory per core.  
For example, subdirectory K5 contains the images for BOFS core 5K.  
There are four types of file in each subdirectory."]; B --> C[".TIF Files  
Images in Tagged Image Format.  
PART1.TIF is the top of the core."]; B --> D[".TXT File  
Core description in ASCII text format."]; B --> E[".WP File  
Core description in WordPerfect 5.1 format."]; B --> F[".PS file  
Core description in PostScript format."];
```

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**.TXT File**  
Core description in ASCII text format.

**.WP File**  
Core description in WordPerfect 5.1 format.

**.PS file**  
Core description in PostScript format.

# Data Documentation Directory DOCU

```
graph TD; A[Data Documentation Directory DOCU] --> B[Each subdirectory contains metadata documents pertaining to the data in the subdirectory of that name. For example, documents for DBKIT\PROD are in DOCU\DBKIT\PROD. There are three types of file in the directory.]; B --> C[.TXT Files  
Methodology description in ASCII text format.]; B --> D[.WP Files  
Methodology description in WordPerfect 5.1 format.]; B --> E[.PS Files  
Methodology description in PostScript format.];
```

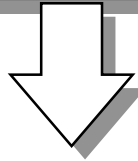
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in ASCII text format.

**.WP Files**  
Methodology description  
in WordPerfect 5.1  
format.

**.PS Files**  
Methodology description  
in PostScript format.

# **Surface Data Set Directory UNDERWAY**



**No Subdirectories.**

**One file per cruise (file type .BMM) containing the surface underway data logged every 30 seconds during the cruise. These files are stored in binary merge format (Section A) and should be accessed by users through the programs UWPLOT and UWLIST described in section S. Files are named using the cruise mnemonic. For example, subdirectory D1182 contains the data for cruise Discovery 182. Parameters present in these files include:**

**Navigation and bathymetry  
Surface temperature and salinity  
Surface dissolved oxygen and CO<sub>2</sub> parameters  
Surface chlorophyll, attenuation and nutrients  
Meteorological measurements**

# Kit Form Database: directory DBKIT

## 11 Subdirectories containing data in comma separated format

