

space-based and *in situ*, such as the Global Climate, Ocean and Terrestrial Observing Systems (GCOS/GOOS/GTOS), as are being advocated by the agencies collaborating in the Climate Agenda." The participants reaffirmed that wise investments by countries in monitoring and research into the climate system will benefit their citizens and economies.

The Conference commended the work that had been done by the scientists involved in planning the programme and concluded that the Implementation Plan provided a solid basis for work to begin. Reports by many countries demonstrated a willingness to participate in the programme and to become full partners in its implementation. Improved seasonal to interannual prediction, particularly for the monsoons, as well as longer-term variability, most notably in the Atlantic, could be singled out as foci for which strong support was indicated by many countries.

The Conference urged government sponsors of research, operational meteorological agencies, and satellite operators to marshal their best efforts to ensure the success of CLIVAR. In particular it called on a broad range of funding agencies to provide support for research, systematic observations, data systems and the infrastructure needed to co-ordinate the programme effectively. ♦

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OCEAN CO₂

♦ The Joint IOC JGOFS Advisory Panel on Ocean CO₂ held its eighth session in January in conjunction with the 2nd International Symposium on Ocean CO₂ held in Tsukuba, Japan, 16-22 January 1999. As with the first such conference held in Mayaguez Puerto Rico in January 1996, the Panel lent its full support to this conference. A number of current and past members of the Panel were keynote presenters. The 112 papers demonstrated striking progress in a number of areas including advances made in observing techniques, global carbon models, determining air-sea fluxes, quantifying biological processes, data management, and experiments in CO₂ sequestration.

The number of new young scientists present and making significant contributions to the Symposium, both via presented papers and posters, was encouraging.

Like WOCE, JGOFS has completed its field phase and its main efforts are shifting into data analysis. This shift poses the necessity for a reconsideration of the joint Panel's terms of reference which currently focus on obtaining a coherent global data set on ocean CO₂ and other components of the ocean carbon chemistry. Accordingly, IOC plans to negotiate new terms of reference with SCOR and JGOFS and to appoint a new membership with expertise consistent with a new focus for the Ocean CO₂ Panel. From the IOC standpoint, it has new ocean CO₂ interests as well. Such a Panel can assist GOOS in establishing ocean CO₂ observational requirements and provide a ready source of expertise to IOC on issues that are of increasing concern such as the sequestering of CO₂ in the deep ocean. Other unresolved issues remain that need continued attention by a restructured Panel, among them, the closing of the global carbon budget, determination of a set of universally accepted disassociation constants, and reduced error bars on global net uptake of CO₂ by the ocean. ♦

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TIME SERIES: FIVE YEARS OF ESTOC STATION OPERATION

♦ The time series station ESTOC (European Station for Time-series in the Ocean Canary Islands) started its operation in February 1994. The station is positioned at 29°10'N, 15°30'W, about 100km to the north of the islands of Gran Canaria and Tenerife at a depth of approximately 3600m, in the eastern boundary regime of the Northeast Atlantic (Figure 1). It is maintained in cooperation by four institutions: the Instituto Canario de Ciencias Marinas, Telde, Gran Canaria, Spain (ICCM), the Instituto Español de Oceanografía, Madrid, Spain (IEO), the Institut für Meereskunde, Kiel, Germany (IFMK) and the Fachbereich Geowissenschaften, Universität Bremen, Germany (UBG).

The interdisciplinary station work includes regular monthly observations and sampling from a research vessel and two long-term moorings which are usually recovered and relaunched once per year. These activities are supplemented by at least one research cruise per year to the region and XBT observations from ships of opportunity. The regular station work includes physical, chemical and biological

observations. One mooring carries current/temperature recorders, the other mooring mainly has particle traps at various depths. The research cruises with process studies have the task to check the representativeness of the single-point time series for the larger region.

The main goals for the ESTOC station work were specified as follows:

- to investigate the long-term changes of stratification and circulation on seasonal and interannual time scales in the southwestern approaches to Europe, with the aim of extending the data base which can be used for improving models of the eastern boundary circulation,
- to investigate the biogeochemical cycles in this region, with the aim to better understand the processes controlling the flux of carbon and associated elements in the ocean on seasonal and interannual time scales,
- to provide a focus for ocean studies by European and other research groups in the Canary Islands region,
- to strengthen the oceanographic research capabilities in the Canary Islands region and to improve the scientific interaction between the local institutions and other European ocean research institutions, particularly in Spain and Germany,
- to use the time series data from the first years as a contribution to the World Ocean

Circulation Experiment (WOCE) and to the Joint Global Ocean Flux Study (JGOFS).

The work is monitored by an international ESTOC Committee with the following tasks:

- to co-ordinate the scientific programmes,
- to ensure high data quality and appropriate data dissemination,
- to relate the observations to WOCE and JGOFS and other programmes,
- to co-ordinate meetings and the publication of documents, and
- to encourage the joint evaluation and publication of obtained data.

The monthly measurements are usually performed on the Spanish research vessel "Taliarte" which is operated by the ICCM in Telde, Gran Canaria. In the monthly station observations the team of the ICCM collaborates with the IEO Tenerife and several groups from the University of Las Palmas. An example of measurements from the first three years is shown in Figure 2. The German groups are occasionally participating in the monthly station observations, and provide input to this part of the programme mostly with respect to technology, methods and calibration. When a German or other Spanish vessel operates in the region, it usually takes over the regular station observations for that period.

The repeated interdisciplinary process studies were carried out on the German research vessels "Meteor", "Poseidon" and "Victor Hensen", combining groups from the ESTOC partner institutions, from the University of Las Palmas and from other institutions in several countries. During the years 1996-1998 the work was performed in joint cruises of ESTOC and the European MAST-III project CANIGO. The interdisciplinary experiments with research vessels combined hydrographic measurements, chemical and biological sampling, productivity experiments and drifting surface-tethered particle trap observations. The

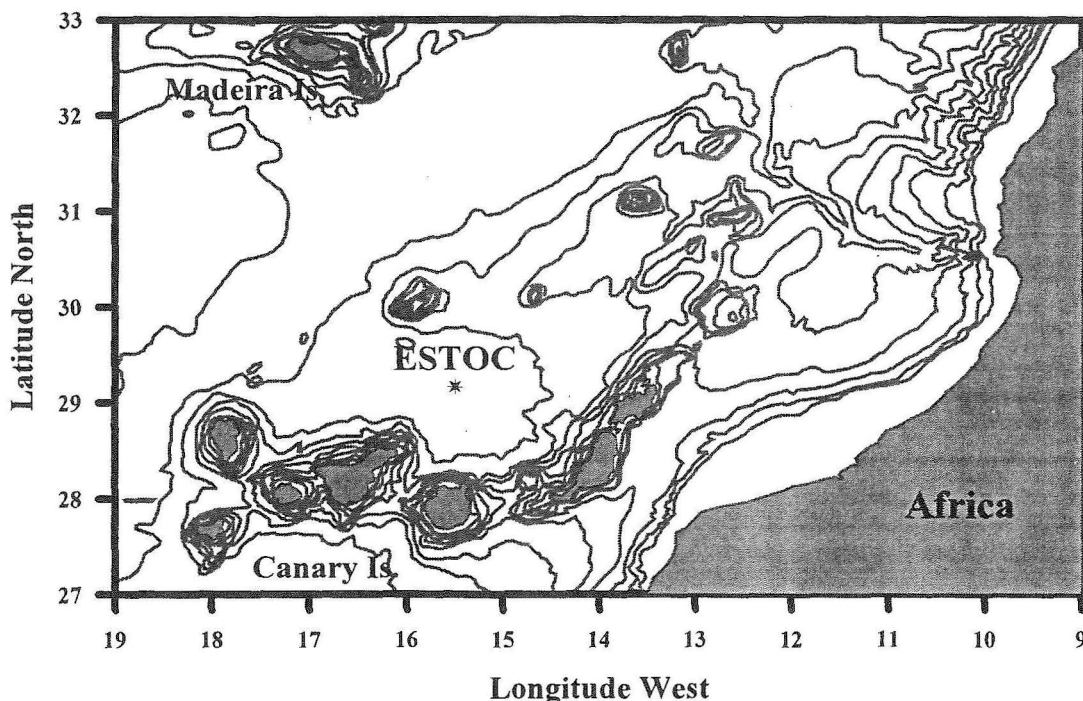


Figure 1: Position of the ESTOC time series station

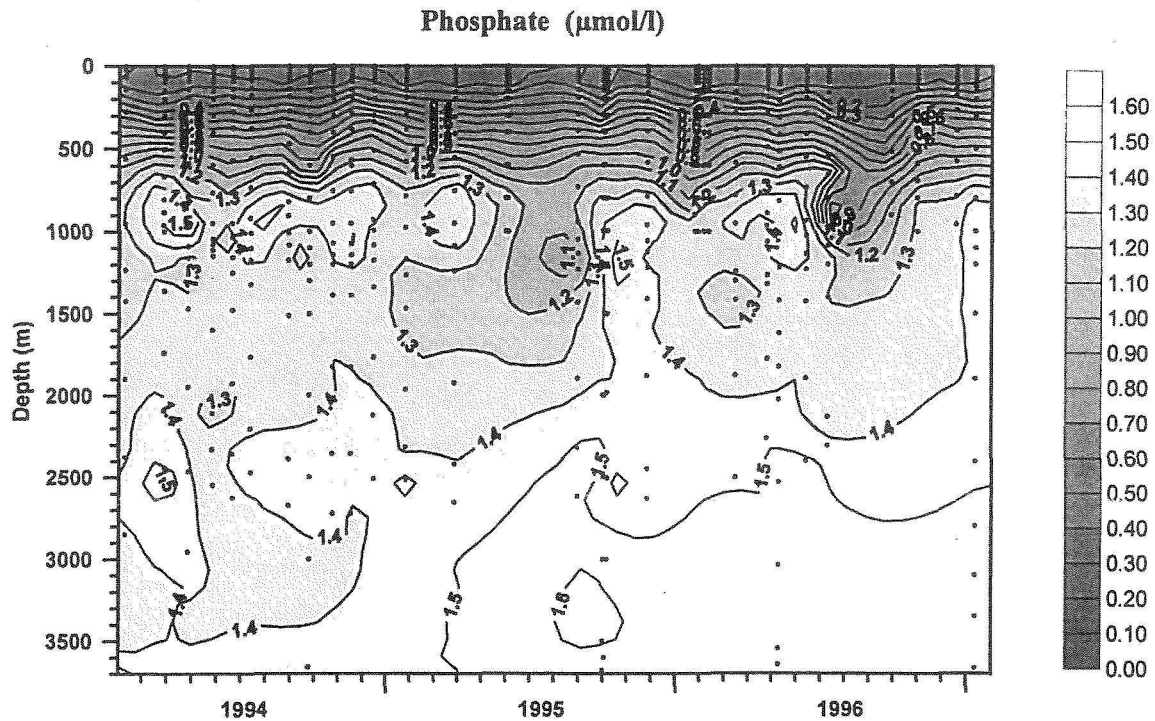


Figure 2: Time series of phosphate concentration at the ESTOC station from the first 3 years

cruises were also used to exchange ESTOC moorings and to carry out the standard observations when appropriate.

The wealth of environmental data becoming available and the logistic advantages of working in the ESTOC area have prompted several international groups to carry out tests of new ocean technology equipment in the region and to perform satellite ground truth observations. It is anticipated that the station activities can be continued on a long-term basis and will at some time become part of the European and the global observing network in GOOS.

Further information on ESTOC can be obtained from the following Internet pages:

- <http://www.iccm.rcanaria.es/estocing.htm>
- <http://www.ifm.uni-kiel.de/general/estoc.htm>
- <http://www.allgeo.uni-bremen.de>

and from the first ESTOC annual report:
 Llinás, O., A. Rodríguez de León, G. Siedler and G. Wefer: ESTOC DATA REPORT 1994, Inf. Téc. Inst. Canario Cienc. Mar., Telde, 72 pp., 1997. ♦

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CORAL REEFS AND GOOS

♦ 1998 was important for the coral reefs of the world because a major 'natural' coral bleaching event was added to increasing degradation from human activities. It was also important because there has been considerable progress in raising public and political awareness on the declining status of reefs and the need for sustainable solutions.

Increasing Reef Degradation

Throughout the 1980s and 1990s, reports of major degradation to coral reefs increased in many parts of the world. This degradation coincided with increases in human populations, exploitation and development in tropical countries. Reefs were being damaged by the release of sediments and nutrients from excessive land clearing and deforestation in the tropics, along with pollution from towns and industries. In addition, excessive fishing was stripping fish off reefs around centres of population, leading fishermen to use explosives to catch enough fish to feed their families. A new destructive method of fishing was introduced. Cyanide was squirted into holes in the reef to catch attractive fish for the aquarium trade. This was expanded to satisfy the massive demand for large attractive reef fish for the live fish markets in Hong Kong and other Chinese centres. The insidious side of this cyanide fishing is