1 INTRODUCTION

The interdisciplinary time series station ESTOC (European Station for Time-series in the Ocean Canary Islands, Estación Europea de Series Temporales Oceánicas de Canarias) has been in operation since 1994. It is positioned at about 3600m depth at 29º10'N, 15º30'W, about 100 km north of the islands of Gran Canaria and Tenerife. Regular station observations once per month on a research vessel comprise measurements of physical, chemical and biological properties and include water sampling. In addition to these regular measurements other observations are performed during the monthly cruises on the initiative of individual researchers. The regular ship measurements are complemented by moored instrument observations.

In order to obtain an improved understanding of the processes governing the region and thereby to gain information on the representativeness of the time series data, repeated process studies are also carried out. These interdisciplinary experiments with research vessels combine hydrographic measurements, chemical and biological sampling, productivity experiments and drifting surface-tethered particle trap observations. The cruises are also used to exchange ESTOC moorings and to carry out the standard observations when appropriate. As a further contribution to the process studies, XBT lines were established between Gran Canaria and the station and also between Gran Canaria and Tenerife.

ESTOC is a Spanish-German joint project, with the participating institutions indicated on the cover of this report, and is coordinated by an international ESTOC Committee. Several Spanish and German ships have been used to carry out the observations. The funding for the German contribution is provided by the Ministry for Education, Science, Research and Technology (BMBF, Fkz. : 03F0108D) as part of the German JGOFS programme. The Spanish institutions obtain their funding from local and national government sources.

More information on the goals of ESTOC and the organisational structure can be found in the introduction to the first ESTOC annual report (Llinas et al., 1997) and on the web pages neptuno.iccm.rcanaria.es, www.ifm.uni-kiel and www.allgeo.uni-bremen.de. The annual reports for the periods 1995 and 1996 were prepared simultaneously and have therefore been combined here in one volume.

2 CRUISE SUMMARIES AND DEPLOYMENT INFORMATION

2.1 Regular Station Observations

2.1.1 Monthly Observations

(O. Llinás, R. Reuter, G. Siedler, T.J. Müller, S. Neuer, A. Spitzy)

The position of the ESTOC station is shown in Figure 1. The aim is to occupy the station regularly each month for two days. The list of cruises during the reporting period is presented in Table 1. The measurements are carried out by scientific and technical groups varying from cruise to cruise, with different people from the participating institutions (see Table 3). The journey from Las Palmas to the ESTOC position takes about 8 hours. The water depth of the station is 3600m and the work on station lasted approximately 9 hours.

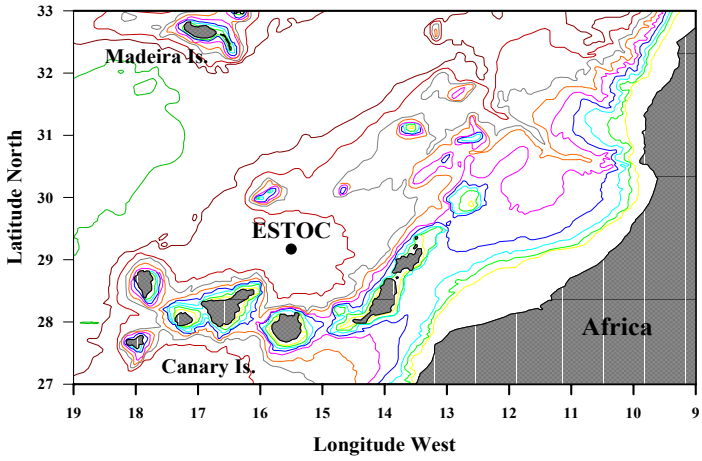


Figure 1. Map of the Canary-Madeira region with the position of ESTOC.

This report presents a summary of the station activities during the second and third year of operation. Due to some problems with BO "Taliarte" gaps occurred in the monthly sampling during 1995. During that year the station was occupied four times by BO "Taliarte" and several times during two periods by FS "Victor Hensen" and FS "Poseidon" The problems were overcome in 1996, with only one gap in November. A total of 8 cruises were done by BO "Taliarte", two by FS "Victor Hensen" and one by FS "Poseidon" (Table 1). On BO "Taliarte" the sampling was performed with Niskin bottles of 5 litres capacity fitted with reversing thermometers. Each bottle carried three thermometers and was mounted on stainless-steel hydrowire. A General Oceanics Rosette and a Neil Brown CTD were used on FS "Victor Hensen" and on FS "Poseidon".

Table 1. Summary of ESTOC cruises in 1995 and 1996.

ESTOC Month/year	**Ship**	**Date**	**Max. depth (m) of observation**
0195	Taliarte	25.01.95	2,800
0395	Taliarte	28.03.95	2,800
0595	Victor Hensen	01.06.95	1,000
0695	Victor Hensen	04.06.95	1,000
0895	Taliarte	30.08.95	2,750
0995	Poseidon	01.10.95	3,600
1095	Poseidon	03.10.95 06.10.95	3,600 3,600
1195	Taliarte	25.11.95	2,750
0196	Victor Hensen	24.01.96 28.01.96	1,000 1,000
0296	Victor Hensen	04.02.96 10.02.96	1,000 1,000
0396	Taliarte	15.03.96	2,500
0496	Taliarte	24.04.96	2,500
0596	Poseidon	15.05.96 20.05.96 22.05.96	3,600 3,600 3,600
0696	Taliarte	12.06.96	2,500
0796	Taliarte	09.07.96	2,500
0896	Taliarte	29.08.96	-
0996	Taliarte	27.09.96	1,000
1096	Taliarte	30.10.96	1,000
1296	Taliarte	17.12.96	1,000

Table 2. Basic parameters measured at ESTOC in 1994-1996.

Parameters/Instruments	1994	1995	1996
Salinity (bottle)	------	------	------
Temperature (reversing thermometer)	------	------	------
CTD	------	------	------
XBT	------	------	------
Oxygen	------	------	------
Nitrate+Nitrite	------	------	------
Phosphate	------	------	------
Silicate	-----	-----	-----
Yellow substance			
Metal		------	------
Chlorophyll-a	------	------	------
Carbon dioxide			------
Isotopes			------

Table 3. Personnel participating in the monthly ESTOC cruises in 1995 and 1996.

Participant		Function during the cruise																								
Name	Inst.	Year 1995												Year 1996												
		1	2	3	4	5*	6*	7	8	9+	10+	11	12	1*	2*	3	4	5+	6	7	8	9	10	11	12	
Betancor, J.	ICCM			T								T					T		T		T	T				T
Calderín, P.	ICCM								T										T	T						
Cianca, A.	ICCM											S		S	S	S	S	S	S	S	S		S			S
Delgado, E.	ICCM	S		S		S	S			S	S															
Escánez, J.	IEO	T																								
García-Ramos, C.	IEO			T																						
Godoy, J.	ICCM																					S	S			S
González, M.	ULPGC									S	S	S			S	S	S			S		S				
Haag, C.	IfMK					S	S			S	S															
Koy, U.	IfMK									T	T			T	T								T			
Langleras, L.	ULPGC																		S		S		S			S
López-Laatzen, F.	IEO	S																								
Luzardo, F.	ICCM														T	T	T	T	T	T	T	T	T			T
Martínez, D.	ICCM	S		S																						
Neuer, S.	GeoB					S	S				S				S			S					S			
Peña, F.	ICCM																		T	T	T					
Pérez, J.	ICCM																					S				S
Ramos, S.	ICCM	T		T					T			T				T	T			T	T	T	T			T
Rodríguez, C.	ICCM									S	S															
Rueda, M.J.	ICCM	S		S					S			S				S	S						S			
Santana, R.	ICCM	S		S						S	S	S				S	S					S	S			S

Hatched columns indicate months without sampling. Cruises were perfomed with BO "Taliarte" unless specified: * =Victor Hensen cruise, + = Poseidon cruise.

Participating institutes:

GeoB : FB5, Geowissenschaften, Universität Bremen, Germany
ICCM : Instituto Canario de Ciencias Marinas, Telde de Gran Canaria, Spain
IEO : Instituto Español de Oceanografia, COC, Sta. Cruz, TF, Spain
IfMK : Institut für Meereskunde an der Universität Kiel, Germany
ULPGC : Universidad de Las Palmas, Gran Canaria, Spain

Functions:

S : scientist
T : technician

2.1.2 Moorings

2.1.2.1 Current/temperature measurements (J. Reppin, T.J. Müller)

During the FS "Poseidon" cruise 202, a current meter mooring (see Figure D1 in data report 1994) was deployed on 22.09.1994 at 29°10.09'N and 15°40.25'W at a water depth of 3620m. The mooring was equipped with 7 Aanderaa current meters at 270, 500, 800, 1200, 1600, 2500, and 3500m depth. An upward looking ADCP was installed at 180m depth. The mooring was recovered during FS "Poseidon" cruise 212 on 17.09.1995.

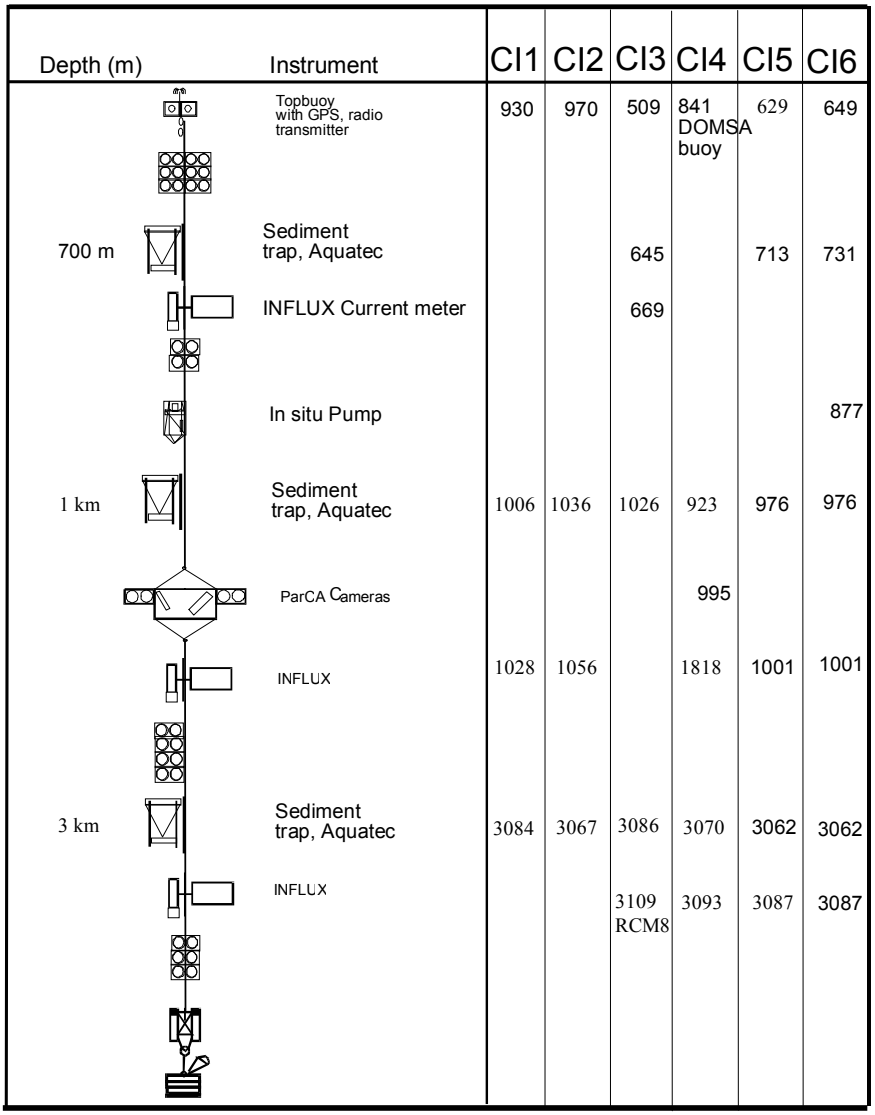
The mooring was redeployed on 18.09.1995 at 29°09.75'N and 15°40.15'W during the same cruise. The number of Aanderaa current meters was reduced by one instrument (270, 540, 840, 1240, 2240, and 3590m). It was recovered during FS "Meteor" cruise 37 on 01.01.1997 and redeployed again on 04.01.1997.

2.1.2.2 Particle traps
(S. Neuer)

The particle trap mooring had already been deployed on FS "Meteor" cruise M20 on 25.11.1991 and was subsequently exchanged according to the schedule outlined in Table 4. The moorings carried up to three particle traps, current meters and a particle camera. The instruments and deployment depths are shown in Figure 2.

Table 4. Trap depths, mooring intervals and collection periods of the particle trap deployments CI 1-6 at the ESTOC station. No data are available from the 1 km trap of CI 3, and the 0.7 and 3 km traps of CI5.

Mooring	Trap depth (m)			Total collection period		Deployment	Sample
	0.7 km	1 km	3km	Start	End	(Days)	interval (Days)
CI 1		1006	3084	25.11.91	25.11.92	305	15
CI 2		1036	3067	01.10.92	09.04.93	190	10
CI 3		1026	3086	12.04.93	07.06.94	430	21
CI 4		923	3070	09.06.94	02.09.94	86	8
CI 5	713	976	3062	05.09.94	12.11.95	415	22
CI 6	731	976	3062	04.11.94	16.11.95	415	22



Depth (m)	Instrument	CI1	CI2	CI3	CI4	CI5	CI6
	Topbuoy with GPS, radio transmitter	930	970	509	841 DOMSA buoy	629	649
700 m	Sediment trap, Aquatec			645		713	731
	INFLUX Current meter			669			
	In situ Pump						877
1 km	Sediment trap, Aquatec	1006	1036	1026	923	976	976
	ParCA Cameras				995		
	INFLUX	1028	1056		1818	1001	1001
3 km	Sediment trap, Aquatec	3084	3067	3086	3070	3062	3062
	INFLUX			3109 RCM8	3093	3087	3087

Figure 2. Design of the particle flux mooring at the ESTOC station. CI 1-6 refer to the mooring intervals described in Table 4.

2.1.3 XBT Lines
(E. Pérez-Martell, A. Cianca)
2.1.3.1 Methodology

Measurements are made using Sparton T5 (Deep Blue) probes, capable of measuring down to 1800 m for ship speeds up to 12 knots. In practice the launchings are made at ship speeds below 10 knots. Following WALSH (1996) the data in the upper 5 m are removed from the files because of the finite response time of the probes (0.63 s) generating unrealistic temperature values during the transition from air to water temperatures. A rate of fall of 6.5 m s^{-1} corresponds to a depth of 4.08 m.

Several computer routines have been written at the ICCM for the treatment and analysis of XBT data, using IDL as programming tool. These include:

- Quality control with rejection of poor data caused by failures of the insulation of wires, by resistance changes due to the stretching or by the breaking of the wires.
- The criteria used for data rejection is based on the establishment of thresholds for the maximum vertical temperature derivatives.
- Interpolation to standard depths, usually with 2m or 5m spacing.
- Processing routines including spatial and temporal averaging, calculation of anomalies, determinations of isotherm depths, determinations of inverse vertical gradients as a measure of stratification, and
- Comparisons with other XBT data sets and satellite-derived data sets.

2.1.3.2 XBT Line ESTOC-Gran Canaria

The observations started in March 1996 with typically 6 XBT probes launched on every monthly ESTOC cruise of BO "Taliarte". Usually these deployments are made during the way from ESTOC to Gran Canaria, with a nominal spacing between samples of 10 nautical miles (Figure 3). The numbers of observations are summarized in Table 5.

Table 5. XBT launches on ESTOC-Gran Canaria line.

Month	No. of XBTs (1996)
January	-
February	-
March	6
April	6
May	6
June	6
July	5
August	6
September	-
October	6
November	-
December	6

2.1.3.3 XBT Line Agaete-Sta.Cruz

The observations started in November 1995. The launches are made from Fred Olsen Line ferries cruising between Agaete/Gran Canaria and Sta.Cruz/Tenerife. Measurements began at 28º 10' N, 15º 50' W and ended at 28º 25' N, 16º 09' W. Positions were typically 8 nautical miles apart. The observations were performed monthly until February 1997, and bimonthly after that time. Table 6 summarizes the XBT launches on that route.

Table 6. XBT launches on Agaete-Sta.Cruz line.

Month	1995 No. of XBTs	1996 No. of XBTs
January	-	5
February	-	-
March	-	5
April	-	5
May	-	5
June	-	5
July	-	5
August	-	5
September	-	4
October	-	5
November	5	5
December	5	5

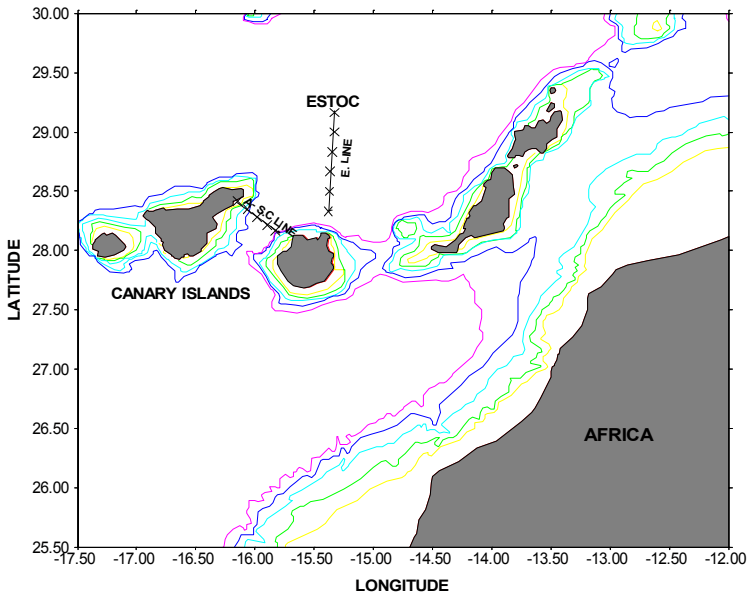


Figure 3. Positions of XBT observations**.**