

**Cruise Report**

**Compiled by:** Thomas J. Müller

**F.S.Poseidon**

**Cruise No.: 259**

**Dates of Cruise:** 06.04. - 20.04.2000

**Areas of Research:** Physical; chemical, and biological oceanography

**Port Calls:** Las Palmas, GC, Spain, 09.04.-10.04. 2000

**Institute:** Institut für Meereskunde, Kiel, Germany

**Chief Scientist:** Dr. Thomas J. Müller

**Number of Scientists:** 10 during leg 259/1, 7 during leg P259/2

**Projects:**

- Long term observations in the subtropical Northeast Atlantic:  
Mooring sites ESTOC, EBC, K276/L1
- Alkenones in the Azores frontal zone
- Zoo- and phytoplankton alkenones in the Azores frontal zone

**Cruise Report**

This cruise report consists of 9 pages including cover; 3 appendices; 8 figures:

1. Scientific crew
2. Research programme
3. Narrative of cruise with technical details
4. Scientific report and first results
5. Scientific equipment, instruments and moorings
6. Additional remarks
7. Appendix of maps with cruise tracks, diagrammes, list of stations etc.
  - A. Station list
  - B. List of samples for Alkenones
  - C. Map with cruise track
8. References
9. Figure captions
10. Figure 1 - 8

**1. Scientific crew**

| Name                     | Institute | Function        | Leg 1     | Leg 2    |
|--------------------------|-----------|-----------------|-----------|----------|
| Müller, Thomas J.        | IFMK      | Chief scientist | -----     | -----    |
| Carlsen, Dieter          | IFMK      | Moorings        | -----     | -----    |
| Meyer, Peter             | IFMK      | CTD; moorings   | -----     | -----    |
| Schmidt, Sunke           | IFMK      | Student         | -----     | -----    |
| Cianca, Andres           | ICCM      | Chem., CTD      | -----     |          |
| Barrera, Carlos          | ICCM      | Chem., CTD      | -----     |          |
| Bravo, Marcos            | ULPGC     | Chem., CTD      | -----     |          |
| Hernandez-Guerra, Alonso | ULPGC     | Moorings        | -----     |          |
| Lopez-Laatzten, Federico | IEO       | Moorings        | -----     |          |
| Langer, Jens             | GeoB      | Particle traps  | -----     |          |
| Cziudaj, Gundula         | IFMK      | Particle traps  |           | -----    |
| Bayer, Margret           | UT        | Plankton        |           | -----    |
| Herrle, Jens             | UT        | Plankton        |           | -----    |
| <b>Total</b>             |           |                 | <b>10</b> | <b>7</b> |

*Institutions*

IFMK Institut für Meereskunde an der Universität Kiel, Kiel, Germany  
GeoB FB 5, Geowissenschaften, Univ. Bremen, Germany  
ICCM Instituto Canario de Ciencias Marinas, Telde, GC, Spain  
IEO Instituto Espanol de Oceanografia, Sta. Cruz, TF, Spain  
ULPGC Universidad de Las Palmas de Gran Canaria, Las Palmas, GC, Spain  
UT Universität Tübingen, Tübingen, Germany

*Chief scientist:*

Dr. Thomas J. Müller  
Institut für Meereskunde  
Düsternbrooker Weg 20  
24105 KIEL, Germany

phone: ++49 (0)431 597-3799  
fax: ++49 (0)431 597-3891  
e-mail: tmueller@ifm.uni-kiel.de

## 2. Research programme

The main objectives of POSEIDON cruise 259 in the area north and east of the Canary Islands were to investigate long-term variability of hydrographic and flow conditions near the time series station ESTOC by

- exchanging the ESTOC current meter mooring at 29°10'N, 15°40'W
- providing the April 2000 monthly station data for ESTOC at 29°10'N, 15°30'W
- recovering the particle trap mooring at site EBC3 in the upwelling region east of Lanzarote
- exchanging the two IEO current meter moorings east and west of Lanzarote, sites EBC4 and BC6, respectively
- obtaining additional CTD profiles in the ESTOC area

Crossing the Azores Front, the objectives were to

- exchange the long-term current meter and particle trap mooring at site K276/L1
- obtain vertical profiles of zoo- and phytoplankton down to 2000 m across the front together with CTD to investigate the spatial structure of Foraminifera and Pteropodes and Cocolithophorides as part of several year investigational programme.
- obtain underway samples for alkenones which may serve as marker for paleo surface temperatures

## 3. Narrative of cruise with technical details

The scientific crew of IFMK embarked 04 April in Las Palmas. On 05 April, the scientific equipment was set up in port.

After embarkation of the scientific crew of GeoB, ICCM and IEO, the vessel sailed on schedule on 06 April at 08:15 from Las Palmas. While heading towards the ESTOC mooring site of mooring V367 at 29°10'N, 015°40'W (App. A, B; Fig. 1), underway measurements began outside the 12 nm EEZ of Spain:

- precise navigational information from an Ashtech GG24 system
- heading, pitch and roll information from a 3-dimensional Ashtech ADU2 system
- sea surface temperature and salinity using a thermosalinograph
- standard meteorological parameters (note however: some sensors were out of order throughout the cruise)
- profiles of ocean currents down to ca. 300 m using a 150 kHz RDI ADCP system
- 6 XBT profiles down to 760 m every 10 latitudinal minutes starting at 28°20'N, 015°17.30'W until the ESTOC mooring position V367.

Within the ESTOC work, mooring V367-06, run by IFMK, was recovered with no problems in the afternoon the same day. Continuous current meter records are now available from that position since September 1994. Early evening the same day, we reached the nearby ESTOC hydrographic station position (15°10'N, 015°30'W) where the April 2000 CTD/rosette profile was taken sampling also the water column at 24 selected depths for oxygen, nutrients and chlorophyll concentrations. The station was completed by launching a NOAA drifting buoy.

Steaming eastwards, we reached mooring site EBC6 west of Lanzarote, run by IEO and ULPGC, on 07 April. Here, mooring EBC6\_2 was recovered early in the morning. The same day, mooring EBC4\_5 was recovered east of Lanzarote. One of the main aims here is to monitor the Canary Current near the islands and also the poleward undercurrent as manifested

in a nutrient maximum at mid-depths (Knoll et al., submitted). Data are now available since January 1997 (EBC4) and mid July (EBC6).

In the afternoon, particle trap mooring EBC3\_5 was recovered. It is located near the sill of the channel between Lanzarote and the African shelf within the upwelling regime.

During the night, a cross channel CTD-section was performed (Stat. 42 to 48) east of Lanzarote, partially repeating earlier sections from January 1997 (METEOR cruise 37/2a), September 1997 (P233) , April 1998 (P237/3) and July 1998 (M42/2).

While mooring site EBC3 was not occupied again, sites EBC4 and EBC6 were reoccupied with current meter moorings again (EBC4\_6, EBC6\_3). To cover also the undercurrent regime west of Lanzarote, some additional CTD-stations were taken (Stat. 50, 52 to 54).

On 09 April we again reached the ESTOC current meter mooring position where mooring V367\_07 was launched. On the way to Las Palmas, the *en-route* measurements were switched off outside the 12 nm zone of Spain. POSEIDON called in to Las Palmas where cruises first leg P259/1 finished on 09 April at 18:30 UTC.

Part of the scientific equipment was unloaded, and the scientists from GeoB, ICCM, IEO and ULPGC disembarked. Three scientists from IFMK and UT embarked on 10 April.

On 10 April at 17:00 UTC, POSEIDON sailed for leg P259/2 (App. A, B). En-route measurements were switched on outside the 12 nm zone of Spain at 19:00. At 29°s22'N, 018°03'W underway surface sampling for alkenones (App. C) began while the ship was heading to station 56 at 31°00'N, 023°00'W northwest of the Canary Islands. Here a section began across the Azores Front profiling 2000 m deep CTD (with salinity sampling for calibration) and multiple closing plankton net until station 62 at 36°00'N, 020°00'W.

The section was interrupted by mooring work at site K276/L1 near 22°N, 022°W. On 13 April in the afternoon, mooring K276\_19 with six current meters and two particle traps was recovered with no problems. During the night a deep CTD cast and multiple closing plankton net casts were obtained. Mooring V276\_20 was launched at the same position next day. However, a problem arose due to a broken Kevlar rope close to 300 m depth. The upper part of the mooring was recovered. The lower part of the mooring stayed at position up-side-down from 3000 m on due to lacking about 10 kg of buoyancy at depths larger than 3000 m. The exact position was determined using a 3-dimensional positioning programme based on measured distances between the vessel (hydrophone) and the acoustic release: 32°58.87'N, 021°59.18'W with the release's depth estimated as 3217 m depth, i.e., ca 2000 m above the bottom.

Finishing the section, on the way to Leixoes, the *en-route* measurements were switched off outside the 200 nm EEZ zone of Portugal.. POSEIDON called in to Leixoes where cruises first leg P259/2 finished on 20 April at 07:00 UTC.

## 4. Scientific report and first results

### 4.1 Water masses and currents north and east of the Canary Islands

The section east of Lanzarote (Fig. 1), shows one branch of the southward flowing Canary Current alongshore Lanzarote, with slightly higher temperature and higher salinity in the upper 200 m (Fig. 3a, 3b). The salinity minimum at 900 m depth (Fig. 3b) is less pronounced than the salinity at the same potential temperature at the ESTOC reference station (Fig. 4). In conjunction with the sharp increase to the higher salinity of the Mediterranean outflow water (Fig. 3b, 4), it may be associated with the poleward undercurrent (Knoll et al., *subm.*).

The vector time series of currents at ESTOC (Fig. 5) is dominated by mesoscale variability with rather high coherent structure throughout the water column. This indicates the dominance of barotropic and low order baroclinic modes on these time scales. In the upper layers, the mean flow seems to be southwards as expected for the Canary current.

### 4.2 Water masses, currents and plankton in the Azores frontal zone

During leg 2, a low resolution CTD section across the Azores Front was obtained. It shows the front between 34°N and 36°N (Fig. 6a, b). The northernmost station hit a lens of highly concentrated Mediterranean water (MEDDY) which was centered at 1200 dbar pressure level (Fig. 6 b, 7).

Currents near the front were measured at site K276/L1 since 1980 with a several months break in 1996/97 due to technical problems. The site was re-occupied in August 1997; current meters were exchanged and two particle traps added in January 1999. As in the years before (see Müller and Siedler, 1992), the flow is dominated by low order baroclinic eddies, but has a southeasterly mean component in the upper layers (Fig. 8).

The preliminary investigation of the planktic spatial distribution across the Azores Front is summarized as follows: In the upper 700 m at all stations, the dominant alive species were: *Globorotalia truncatulinoides* (alive) just south of the Azores Front (#059), and together with *Globigerinoides ruber*, *Globigerinoides sacculifer*, and *Globorotalia sictula* also at all other stations, all also alive. Also found, but with less abundant, were *Globigerinella siphonifera* and *Globoturborotalita tenella* at all all stations in that depth region. *Orbulina universa* was found only as dead fauna. At depths larger than 700 m the same fauna as in the upper layers was observed, but dead.

Pteropodes (*Diacria quadridentata*, *Limacina inflata*, *Limacina trochiformis*, *Diacria trispinosa*, *Cavolina inflexa*) were found at all stations and depths. *C. inflexa* was dominant in the upper layers down to 500 m north of the front (#062). Pteropodes and Gastropodes in all samples were more often found than Foraminifera.

## 5. Scientific equipment, instruments and moorings

### 5.1 Moorings

During P259, the ESTOC current meter mooring V367\_6/7 (IFMK) and two moorings east and west of the Island of Lanzarote (EBC4\_4/5 and EBC6\_2/3; IEO and ULPGC) were exchanged. One particle trap mooring east of Lanzarote was recovered (EBC3\_5). Recovery or exchange of IFMK mooring at the ESTOC site is scheduled for early 2002 with POSEIDON. Mooring K276\_19 in the Azores frontal zone at 33°N, 022°W was recovered. Launching of mooring K276\_20 at the same site failed (see narrative of the cruise).

**Table 1:** P259, moorings recovered (R) and launched (L) with number of Aandearaa RCM9/8/5/4 current meters and particle traps (PT)

| Site      | Set/<br>Recov.<br>2000 | Position                  | W.-<br>Depth | ID      | Instruments,<br>depth/m  | Remarks                     |
|-----------|------------------------|---------------------------|--------------|---------|--|-----------------------------|
| ESTOC     | 27Jan99<br>06Apr00     | 29°09.50'N<br>015°40.60'W | 3616         | V367_06 | RCM9: 232<br>RCM8: 292, 522,<br>822, 1222, 2022,<br>3572       | L<br>R                      |
|           | 09Apr00                | 29°10.3'N<br>015°40.6'W   | 3618         | V367_07 | RCM9: 232<br>RCM8: 292, 522,<br>822, 1222, 2022,<br>3572       | L                           |
| EBC3      | 28Oct99<br>07Apr00     | 28°44.09'N<br>013°18.44'W | 1287         | V377_05 | PT: 469, 664   | L<br>R                      |
| EBC4      | 02Feb99<br>07Apr00     | 28°44.30'N<br>013°28.10'W | 1192         | EBC4_05 | RCM4: 170<br>RCM8: 320, 540,<br>890, 1250                      | L<br>R                      |
|           | 08Apr00                | 28°44.2'N<br>013°28.0'W   | 1285         | EBC4_06 | RCM4: 170<br>RCM8: 320, 540,<br>890, 1250                      | L                           |
| EBC6      | 03Feb99<br>07Apr00     | 29°00.30'N<br>013°58.60'W | 1600         | EBC6_02 | RCM5: 160<br>RCM8: 310, 530,<br>880, 1240, 1560                | L<br>R                      |
|           | 08Apr00                | 29°00.3'N<br>013°58.9'W   | 1644         | EBC6_03 | RCM5: 160<br>RCM8: 310, 530,<br>880, 1240,                     | L                           |
| K276 / L1 | 25Jan99<br>13Apr00     | 32°58.1'N<br>022°00.5'W   | 5216         | K276_19 | RCM8: 270, 500,<br>1000, 1600,<br>3000, 5185<br>PT: 2000, 3050 | L<br>R                      |
|           | 14Apr00<br>14Apr00     | 32°58.87'N<br>021°59.18'W | 5211         | K276_20 | RCM8: 270, 500,<br>1000, 1600,<br>3000, 5185<br>PT: 2000, 3050 | L<br>R, part less<br>3000 m |

## 5.2 CTD/rosette and salinometer

### 5.2.1 CTD and bottle salinity

For the CTD-measurements, an ICTD of Falmouth Scientific Inc. was used (IFMK code FSI1). Calibration for pressure and temperature sensors was performed at IFM Kiel in November 1995 and December 1998, respectively. Water samples for CTD salinity calibration routinely were taken from near the bottom and near the surface. The samples were analysed on a Guildline AUTOSAL model 8400A (IFMK internal code AS4) using IAPSO standard seawater batch P134 ( $K_{15}=0.99989$ ,  $S=34.996$ ) for instrumental calibration. As the laboratories onboard are not stable in temperature, the estimated accuracy of individual bottle salinities after removing outliers is not better than 0.005 on the ISS78 scale, slightly worse than usual.

Due to a failure in the electronics of the ICTD later ashore, no post-cruise laboratory calibration of the pressure and temperature sensors was possible before publishing this report. Therefore, the expected accuracies of these sensors (as known from observed possible drifts in the calibration history) maybe less than usual, 0.005 K in temperature and 5 dbar at full pressure scale, respectively. Salinity calibration as compared to bottle salinities will be not affected by these small scale uncertainties in pressure and temperature accuracies; it is expected to better 0.003 on the IPSS78-scale.

### 5.2.2: Oxygen, nutrients and chlorophyll sampling on the ESTOC station (#038)

Standard ESTOC depths and procedures were used. All samples were analyzed after the cruise at the ICCM according to the ESTOC standards (Llinas et al, 1999).

## 5.3 Underway measurements

### 5.3.1 Navigational data

An Ashtech made GG24 unit merges positionings from high rate GPS data with high precision GLONASS data. A problem occurred with the date from GG24 which is offset into the past. This offset is constant and can be removed. The UTC time is ok.

Three dimensional GPS data from an Ashtech ADU2 are used to estimate heading, pitch and roll. A check of the September 1997 antenna calibration while in port during a later cruise, between P261 and P262 in July 2000, gave no corrections.

Both, GG24 and ADU2 data are input for the standard vmADCP data acquisition and for the underway logging system PC-Log (see 5.3.2)

### 5.3.2 PC-Log

A PC-based programme package, PC-Log, is used to log consecutively the data streams from navigational units, the ship's meteorological sensors, the deep sea echosounder, and from the thermosalinograph. Standard output format is binary, but ASCII transformation is an option .

### 5.3.3 Meteorological data

The meteorological sensors have not been served since almost two years because the vessel was out of home port since January 1999 and no regular service is provided. Only the wind and the dry temperature sensors on the starboard side, and the water temperature sensor were working. The digital output is transferred to the PC-Log system.

#### **5.3.4 Deep sea echosounder**

A 12 kHz echosounder by ELAC provides depth information, both as standard graph and as digital output. The sound velocity converting travel times to sounding depths was 1500 m/s. The digital output was input to the PC-Log system.

#### **5.3.5 Thermosalinograph**

The digital output of the thermosalinograph raw data is transferred to the PC-Log system where it is converted to physical units for temperature and salinity. The accuracy is 0.1 K and 0.2 for temperature and salinity, respectively. Corrections with near surface CTD data while on station, improve the accuracy estimates to 0.05 K and 0.15 for temperature and salinity, respectively.

#### **5.3.6 vmADCP**

The vessel mounted ADCP used *en route*, was a standard 150 kHz instrument made by RDI. Data from the ADCP were merged with the navigational data from the GG24 and the 3-dimensional ADU2, using RDI's data acquisition software DAS (RDI, 1990). Final processing will use the CODAS programme package (Firing et al., 1993).

#### **5.4 Plankton sampling**

A multiple closing net (MSN), 100 µm mesh, was used. Sampling depths on the 5 cross frontal stations with 3 casts each were: 2, 20, 40, 60, 80, 100, 200, 300, 500, 700, 1000, 1500, 2000 m on all stations, and additionally at 2500 m on station #059.

From each sample, the compound of Foraminifera and and Pteropodes were was determined qualitatively before conserving it in a 4% formalin solution at pH 8.2.

#### **5.5 Underway alkenone sampling**

Particle were filtered out of several hundred of liters surface water each probe to be analyzed later ashore for C37 Methylketones (Alkenones), in particular for coccolithophorides, which may serve a bio-marker for the temperature under which they have been formed.

The number of filter probes and sampling areas is listed in Appendix C..

### **6. Additional remarks**

We would like to thank Captain Klaatzen and his crew for their advise and help during this cruise.



## 7. Appendices

### A. Station list

POSEIDON cruise 259, 06 APR 2000 - 20 APR 2000  
Las Palmas - Leixoes

Stat\_lst.txt

Station and sample log

Status: 30-JUN-2000

#### List of abbreviations:

St : Station no.  
C : CTD cast no., monotonically increasing during the cruise;  
all casts to near bottom if not indicated else  
Wd : Water Depth  
Wl : length of wire, instrumental depth  
Instr : Type of instrumentation or mooring or equipment with symbol  
It  
VXXX : 1 mooring  
NB2 : 2 Neil Brown CTD, IFMK code NB2 with 12x12 l bottle rosette  
FSI : 2 Falmouth Scientific CTD; IFMK code FSI with a 24x10 l bottle  
GO rosette  
XBT : 3 Sippican Deep Blue, 760 m  
MN : 5 Multiple closing plankton net  
TSG : 4 Ship's thermasalinograph, 4 m, made by Meerestechnik  
Elektronik, Kiel, Germany  
vADCP : 4 vessel mounted RDI ADCP, 150 KHz, 4 m  
PC-LOG: 4 on-line log of GPS date, time, position, pitch & roll  
(ASHTEC GPS/GLONASS & ADU2), near-surface T, S by TSG;  
meteorological data of the ship's meteorological sensors

Additional sensors on, and samples taken from CTD/rosette:

OC : 2 oxygen sensor on CTD (Beckmann type with oxygen current and  
temperature)  
F : 3 Fluorometer attached to CTD  
O2 : 4 dissolved oxygen samples  
N : 5 nutrient samples  
Cl : 6 chlorophyll samples  
S : 7 salinity samples  
CO2: 8 Alkalinity profile for CO2 system

| Year 2000 |      | St | C  | Latitude | Longitude   | Wd   | Wl   | It | Instrument / Remarks                     |
|-----------|------|----|----|----------|-------------|------|------|----|--|
| Date      | Time |    |    | North    | East        |      |      |    |  |
| UTC       | UTC  |    |    | GG MM.MM | GGG MM.MM   | m    | m    |    |  |
| MM DD     | hhmm |    |    |          |             |      |      |    |  |
| 04 06     | 0815 | -9 | -9 | 28 09    | -015 -25    | -9   | -9   | 4  | sail from Las Palmas;<br>begin of P259/1 |
| 04 06     | 0900 | -9 | -9 | 99 99.99 | 999 99.99   | -9   | 4    | 4  | start PC-LOG;                            |
| 04 06     | 0900 | -9 | -9 | 99 99.99 | 999 99.99   | -9   | 4    | 4  | start TS-graph                           |
| 04 06     | 0900 | -9 | -9 | 99 99.99 | 999 99.99   | -9   | 4    | 4  | start vADCP, 150 Khz                     |
| 04 06     | 0909 | -9 | 1  | 28 20    | -015 -17.3  | -9   | 750  | 3  | XBT                                      |
| 04 06     | 1012 | -9 | 2  | 28 30    | -015 -22.0  | -9   | 750  | 3  | XBT                                      |
| 04 06     | 1115 | -9 | 3  | 28 40    | -015 -26.6  | -9   | 750  | 3  | XBT                                      |
| 04 06     | 1217 | -9 | 4  | 28 50    | -015 -31.2  | -9   | 750  | 3  | XBT                                      |
| 04 06     | 1324 | -9 | 5  | 29 00    | -015 -36.0  | -9   | 750  | 3  | XBT                                      |
| 04 06     | 1416 | -9 | 6  | 29 08    | -015 -40.1  | -9   | 750  | 3  | XBT                                      |
| 04 06     | 1430 | 37 | -9 | 29 09.50 | -015 -40.60 | 3618 | -9   | 1  | mooring V367-06<br>recovery              |
| 04 06     | 1853 | 38 | 1  | 29 09.3  | -015 -29.93 | 3609 | 3629 | 2  | FSI, O2, nuts, Cl,<br>ESTOC APR 2000     |
| 04 06     | 2231 | -9 | -9 | 29 10.5  | -015 -30.30 | -9   | 0    | 4  | NOAA drifting buoy<br>launched           |
| 04 07     | 0720 | 39 | -9 | 29 00.30 | -013 -58.60 | 1600 | -9   | 1  | mooring EBC6-2<br>recovery               |
| 04 07     | -999 | -9 | -9 | 28 46.36 | -013 -50.77 | -999 | -9   | 4  | Estrecha                                 |
| 04 07     | 1215 | 40 | -9 | 28 44.30 | -013 -28.10 | 1192 | -9   | 1  | mooring EBC4-5<br>recovery               |
| 04 07     | 1405 | 41 | -9 | 28 44.09 | -013 -18.44 | 1287 | -9   | 1  | mooring EBC3-5<br>recovery               |
| 04 07     | 1655 | 42 | 2  | 28 39.90 | -013 -06.00 | 788  | 781  | 2  | FSI                                      |
| 04 07     | 1820 | 43 | 3  | 28 41.98 | -013 -12.01 | 790  | 1039 | 2  | FSI                                      |
| 04 07     | 1954 | 44 | 4  | 28 42.98 | -013 -17.07 | 1007 | 1005 | 2  | FSI                                      |
| 04 07     | 2120 | 45 | 5  | 28 44.05 | -013 -22.10 | 1272 | 1301 | 2  | FSI                                      |
| 04 07     | 2313 | 46 | 6  | 28 44.96 | -013 -29.03 | 1277 | 1283 | 2  | FSI                                      |
| 04 08     | 0050 | 47 | 7  | 28 45.00 | -013 -34.04 | 1183 | 1189 | 2  | FSI                                      |
| 04 08     | 0244 | 48 | 8  | 28 48.02 | -013 -43.04 | 842  | 847  | 2  | FSI                                      |
| 04 08     | 0745 | 49 | -9 | 28 44.2  | -013 -28.0  | 1285 | -9   | 1  | mooring EBC4-6<br>launched               |

| Year | Date | Time | St | C  | Latitude | Longitude   | Wd   | Wl   | It | Instrument / Remarks                |
|------|------|------|----|----|----------|-------------|------|------|----|-------------------------------------|
| 2000 | UTC  | UTC  |    |    | North    | East        |      |      |    |                                     |
| MM   | DD   | hhmm |    |    | GG MM.MM | GGG MM.MM   | m    | m    |    |                                     |
| 04   | 08   | 0859 | 50 | 9  | 28 44.44 | -013 -28.65 | 1279 | 1287 | 2  | FSI                                 |
| 04   | 08   | 1340 | 51 | -9 | 29 00.3  | -013 -58.9  | 1644 | -9   | 1  | Estrecha mooring EBC6-3 launched    |
| 04   | 08   | 1503 | 52 | 10 | 28 59.68 | -013 -58.63 | 1659 | 1644 | 2  | FSI                                 |
| 04   | 08   | 1815 | 53 | 11 | 29 00.91 | -014 -03.01 | 2281 | 1500 | 2  | FSI                                 |
| 04   | 08   | 2010 | 54 | 12 | 29 02.79 | -014 -09.28 | 2924 | 1487 | 2  | FSI                                 |
| 04   | 09   | 0700 | 55 | -9 | 29 10.3  | -015 -40.6  | 3618 | -9   | 1  | mooring V367-07 launched            |
| 04   | 09   | 1730 | -9 | -9 | 28 20    | -015 -17.30 | -9   | -9   | 4  | vADCP, TSG, PC-LOG off              |
| 04   | 09   | 1830 | -9 | -9 | 28 09    | -015 -25    | -9   | -9   | 4  | Las Palmas; end P259/1              |
| 04   | 10   | 1700 | -9 | -9 | 28 09    | -015 -25    | -9   | -9   | 4  | L. Palmas, start 259/2              |
| 04   | 10   | 1900 | -9 | -9 | 28 20    | -015 -17.30 | -9   | -9   | 4  | PC-LOG on                           |
| 04   | 10   | 1900 | -9 | -9 | 28 20    | -015 -17.30 | -9   | 4    | 4  | TS-graph on                         |
| 04   | 10   | 2012 | -9 | -9 | 28 30    | -015 -30.   | -9   | 4    | 4  | vADCP on, 150 kHz                   |
| 04   | 12   | 1038 | 56 | 13 | 31 00.2  | -022 -59.9  | 5204 | 2009 | 2  | FSI                                 |
| 04   | 12   | 1200 | 56 | 1  | 31 00.8  | -022 -59.6  | 5204 | 100  | 5  | MN                                  |
| 04   | 12   | 1225 | 56 | 2  | 31 00.8  | -022 -59.6  | -9   | 700  | 5  | MN                                  |
| 04   | 12   | 1325 | 56 | 3  | 31 02.3  | -023 -00.0  | 5213 | 2000 | 5  | MN                                  |
| 04   | 12   | 2335 | 57 | 14 | 32 00.1  | -022 -29.8  | 5152 | 1959 | 2  | FSI                                 |
| 04   | 13   | 0130 | 57 | 1  | 32 00.1  | -022 -30.0  | 5152 | 100  | 5  | MN                                  |
| 04   | 13   | 0150 | 57 | 2  | 32 00.1  | -022 -30.1  | 5152 | 700  | 5  | MN                                  |
| 04   | 13   | 0253 | 57 | 3  | 32 00.1  | -022 -30.6  | 5159 | 2000 | 5  | MN                                  |
| 04   | 13   | 1158 | 58 | -9 | 32 58.1  | -022 -00.5  | 5216 | -9   | 1  | mooring V276-19 recovery            |
| 04   | 13   | 1647 | 59 | 15 | 32 58.7  | -021 -56.0  | 5213 | 5261 | 2  | FSI                                 |
| 04   | 13   | 2055 | 59 | 1  | 32 58.6  | -021 -56.0  | 5212 | 100  | 5  | MN                                  |
| 04   | 13   | 2117 | 59 | 2  | 32 58.6  | -021 -56.0  | 5212 | 700  | 5  | MN                                  |
| 04   | 13   | 2217 | 59 | 3  | 32 58.3  | -021 -56.1  | 5212 | 2500 | 5  | MN                                  |
| 04   | 14   | 1300 | -9 | -9 | 33 00    | -22 -00     | -9   | 4    | 4  | TS_graph with bad data;             |
| 04   | 14   | 1300 | 60 | -9 | 32 58.87 | -021 -59.18 | 5211 | -9   | 1  | V276-20 launched                    |
| 04   | 14   | 2015 | 60 | -9 | 32 58.87 | -021 -59.18 | 5211 | -9   | 1  | mooring V276-20, recover upper part |
| 04   | 15   | 0500 | 60 | -9 | 32 58.87 | -021 -59.18 | 5210 | -9   | 1  | V276-20, position of deep part      |
| 04   | 15   | 1842 | 61 | 16 | 34 00.0  | -021 -20.0  | 5216 | 1986 | 2  | FSI                                 |
| 04   | 15   | 2004 | 61 | 1  | 34 00.4  | -021 -19.6  | -9   | 100  | 5  | MN                                  |
| 04   | 15   | 2100 | 61 | 2  | 34 00.4  | -021 -19.4  | -9   | 700  | 5  | MN                                  |
| 04   | 15   | 2145 | 61 | 3  | 34 00.8  | -021 -18.9  | 5210 | 2000 | 5  | MN                                  |
| 04   | 16   | 1719 | 62 | 17 | 36 00.0  | -020 -00.0  | 5286 | 1993 | 2  | FSI                                 |
| 04   | 16   | 1906 | 62 | 1  | 36 00.7  | -020 -00.0  | 5282 | 100  | 5  | MN                                  |
| 04   | 16   | 1928 | 62 | 2  | 36 00.9  | -020 -00.0  | 5270 | 700  | 5  | MN                                  |
| 04   | 16   | 2030 | 62 | 3  | 36 01.7  | -020 -00.1  | -9   | 2000 | 5  | MN                                  |
| 04   | 18   | 1554 | -9 | -9 | 39 29.4  | -012 -25.8  | -9   | -9   | 4  | vADCP, PC-Log, TSG off;             |
| 04   | 20   | 0700 | -9 | -9 | 41 10    | -008 -43    | -9   | -9   | 4  | Leixoes, end P259/2                 |

**B. List of alkenone samples taken underway**  
**POSEIDON cruise 259/2**  
**10.04.-19.04.**  
**Las Palmas - Lisbon**

Alkenone sampling; date and times are UTC; temperature and salinity from thermosalinograph (TSG).

Cr\_rep\_app\_c.rtf

**11.04.00**

Filter No.1

Start: 8:00, 29°22,900N T=19,035°C  
 18°02,690W S=36,904PSU  
 End : 13:30, 29°41,883N  
 19°02,343W 380 Liter

Filter No.2

Start: 13:30, 29°41,883N T=19,25°C  
 19°02,343W S=?  
 End : 19:30, 30°08,740N  
 20°18,491W 368 Liter

Filter No.3

Start: 19:30, 30°08,740N T=18,983°C  
 20°18,491W S=36,743PSU  
 End : 23:20, 30°18,747N  
 20°53,596W 263 Liter

**12.04.00**

Filter No.4

Start: 23:20, 30°18,747N T=18,983°C  
 20°53,596W S=36,743PSU  
 End : 4:20, 30°37,844N 333 Liter  
 21°50,610W

Filter No.5

Start: 4:20, 30°37,844N T=18,906°C  
 21°50,610W S=36,715PSU  
 End : 10:20, 30°59,350N  
 22°57,525W 383 Liter

Station : CTD, Plankton Netze von ca. 10:40 bis 17:30

Filter No. 6

Start: 18:40, 31°16,361N T=18,885°C  
 22°32,578W S=35,774PSU  
 End : 23:00, 31°55,416N T=18,646  
 22°32,578W S=36,774  
 273 Liter

Station: CTD and plankton nets from ca. 23:00 bis 7:00

**13.04.00**

Filter No.7

Start: 8:00, 32°33,983N T=18,452°C  
 22°18,933W S=36,597PSU  
 End : 10:30, 32°45,390N  
 22°05,683W 179 Liter

Filter No.8

Start: 10:30, 32°45,390N T=18,468°C  
 22°05,683W S=36,597PSU  
 End : 12:00, 32°58,144N  
 21°59,824W 108 Liter

Station: K276/L1 from 12:00, 13.04.00 bis 9:00, 15.04.00  
 Mooring work and CTD

**15.04.00**

pump until 12:00

Filter No.9  
 Start: 12:00, 33°19,743N T=21,012°C !! TSG failure, T is  
 bad  
 21°46,185W S=36,398PSU  
 End : 17:02, 33°49.939N T=18,32°C  
 21°26.619W S=36,000PSU  
 176 Liter

Station: CTD and plankton nets from 18:00 to 3:00.

**16.04.00**

Filter No.10  
 Start: 8:41, 34°57,905N T=18,51°C  
 20°41,201W S=36,390PSU  
 End : 12:20, 35°24,085N  
 20°24,295W 253 Liter

Filter No.11  
 Start: 12:20, 35°24,085N T=18,80°C  
 20°24,295W S=36,375PSU  
 End : 17:22, 36°00,113N  
 20°00,018W 300 Liter

Station:CTD and plankton nets from 17:25 until 02:00

**17.04.00**

Filter No.12  
 Start: 8:02, 36°47.908N T=18,15°C  
 18°20.305W S=36,144PSU  
 End : 12:22, 37°09,569N  
 17°31,875W 315 Liter

Filter No.13  
 Start: 12:22, 37°09,569N T=18,14°C  
 17°31,875W S=36,452PSU  
 End : 16:42 37°31,450N  
 16°43,950W 387 Liter

Filter No. 14  
 Start: 16:42 37°31,450N T=15,16°C  
 16°43,950W S=36,453PSU  
 End : 20:20 37°48,900N 208 Liter  
 16°05,738W

Filter No.15  
 Start: 20:20 37°48,900N T=15,60°C  
 16°05,738W S=36,525PSU  
 End : 24:00 38°08,001N  
 15°25,098W 196 Liter

Filter No.16  
 Start: 24:00 38°08,001N T=15,34  
 15°25,098W S=36,407PSU  
 End : 8:21 38°50,894N  
 13°48,232 759 Liter

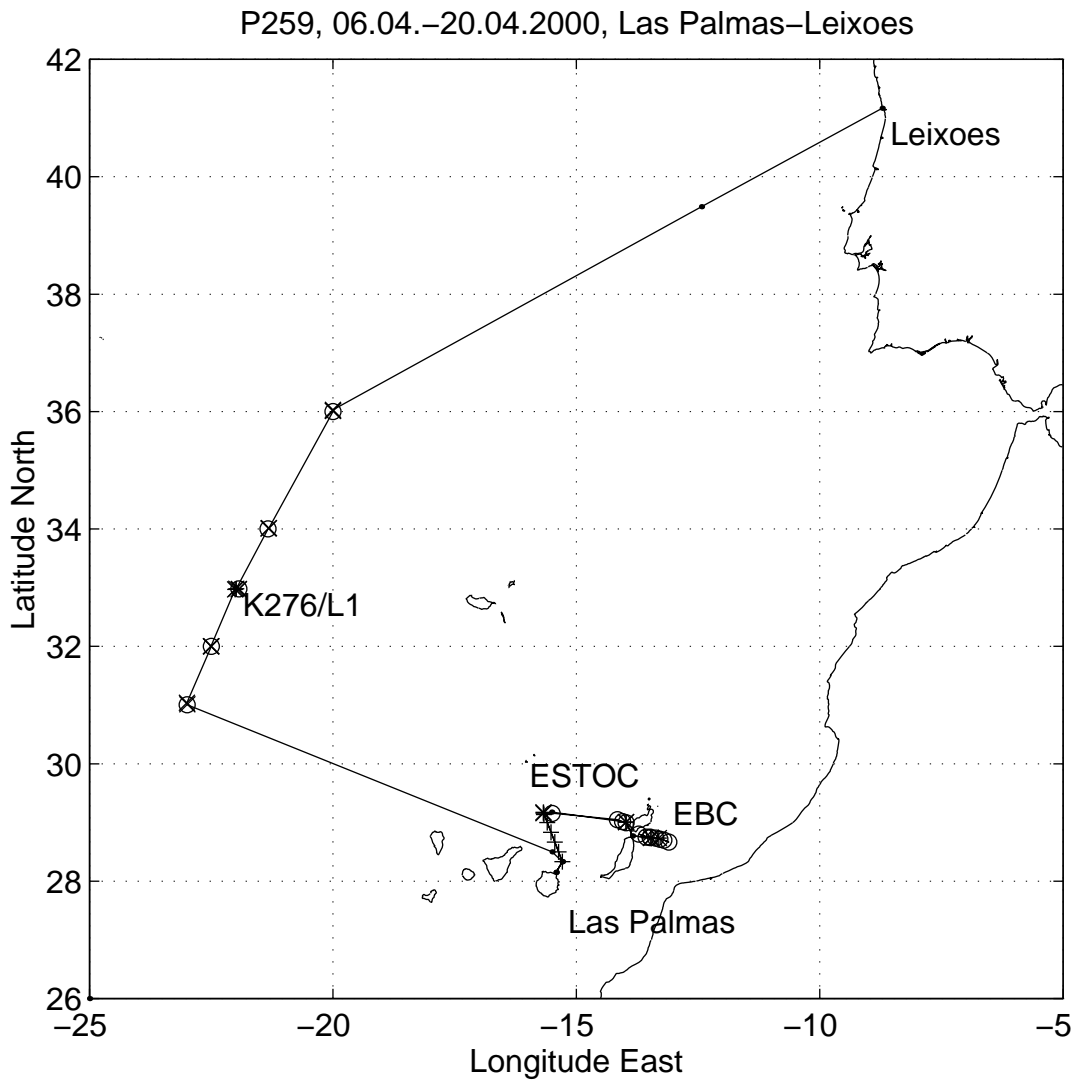
Filter No.17  
 Start: 8:21 38°50,894N T=15,34°C  
 13°48,232W S=36,407PSU  
 End : 12:30 39°12,546N  
 13°02,896W 261 Liter

Filter No.18  
 Start: 12:30 39°12,546N T=14,748°C (TSG ok again)  
 13°02,896W S=36,108PSU  
 End : 16:57 39°34,834N  
 12°13,563W 300 Liter

Filter No.19  
 Start: 16:57 39°34,834N T=14,712°C  
 12°13,563W S=36,009PSU

|              |                          |                           |           |
|--------------|--------------------------|---------------------------|-----------|
| End :22:14   | 40°01,057N<br>11°15,343W |                           | 29 Liter  |
| Filter No.20 |                          |                           |           |
| Start: 22:14 | 40°01,057N<br>11°15,343W | T=14,616°C<br>S=36,112PSU |           |
| End : 1:43   | 40°19,374N<br>10°35,509W |                           | 128 Liter |
| Filter No.21 |                          |                           |           |
| Start: 1:43  | 40°19,374N<br>10°35,509W | T=14,575°C<br>S=34,078PSU |           |
| End : 9:00   | 40°54,078N<br>9°16,465W  |                           | 167 Liter |
| Filter No.22 |                          |                           |           |
| Start: 9:00  | 40°54,078N<br>9°16,465W  | T=14,225°C<br>S=35,875PSU |           |
| End : 14:56  | as start                 |                           | 525 Liter |

## C. Map with cruise track:



**App. C:** Track of Poseidon cruise 259, 06.04.-20.04., Las Palmas – Las Palmas – Leixoes; XBT launches on the way from Las Palmas to ESTOC; mooring work at ESTOC; (exchanged), EBC and K276 (recovered); CTD stations (o); plankton hauls across the Azores Front (x).

## 8. References

- Firing, E., Ranada, J. and P. Caldwell (1993): Processing ADCP Data with the CODAS Software System, Version 3.1. Intern. Rep. Univ. Hawaii & NODC.
- Llinas, O., A. Rodriguez de Leon, G. Siedler, G. Wefer (editors, 1999): ESTOC data report 1995/1996. Informes Tecnicos del Instituto Canario de Ciencias Marinas.
- Knoll, M., A. Hernandez-Guerra, B. Lenz, F. Lopez Laatzén, F. Machín, T.J. Müller, G. Siedler (2001, subm.): The Eastern Boundary Current System between the Canary Islands and the African Coast.
- Müller, T.J. (1999): Determination of salinity. *In: Grasshoff, K., K. Kremling and M Ehrhardt (editors), Methods of Seawater Analysis, 3<sup>rd</sup> rev, Wiley-CH, 600 pp.*
- RD Instruments (1990): User's Manual for the RD Instruments Data Acquisition Software (DAS). RD Instruments, San Diego, CA, U.S.A.

## 9. Figure captions

**App. C:** Track of Poseidon cruise 259, 06.04.-20.04., Las Palmas – Leixoes  
XBT launches on the way from Las Palmas to ESTOC; mooring work at ESTOC (exchanged), EBC and K276 (recovered); CTD stations (o); plankton hauls across the Azores Front (x).

**Fig. 1:** Cruise track in the Canary Islands region during P259/1, 06.04.-09.04.2000. XBT launches (+) on the way from Las Palmas to ESTOC; mooring work (\*) at sites ESTOC (exchanged), EBC 3 (recovered), and EBC4 and EBC6 (both exchanged). CTD stations (o).

**Fig. 2:** Location of the remainder of mooring V276\_20.

**Fig. 3:** Hydrographic section east of Lanzarote; potential temperature (a) and salinity (b)

**Fig. 4:** Correlation of potential temperature and salinity east of Lanzarote (green light) and at the ESTOC site (red)

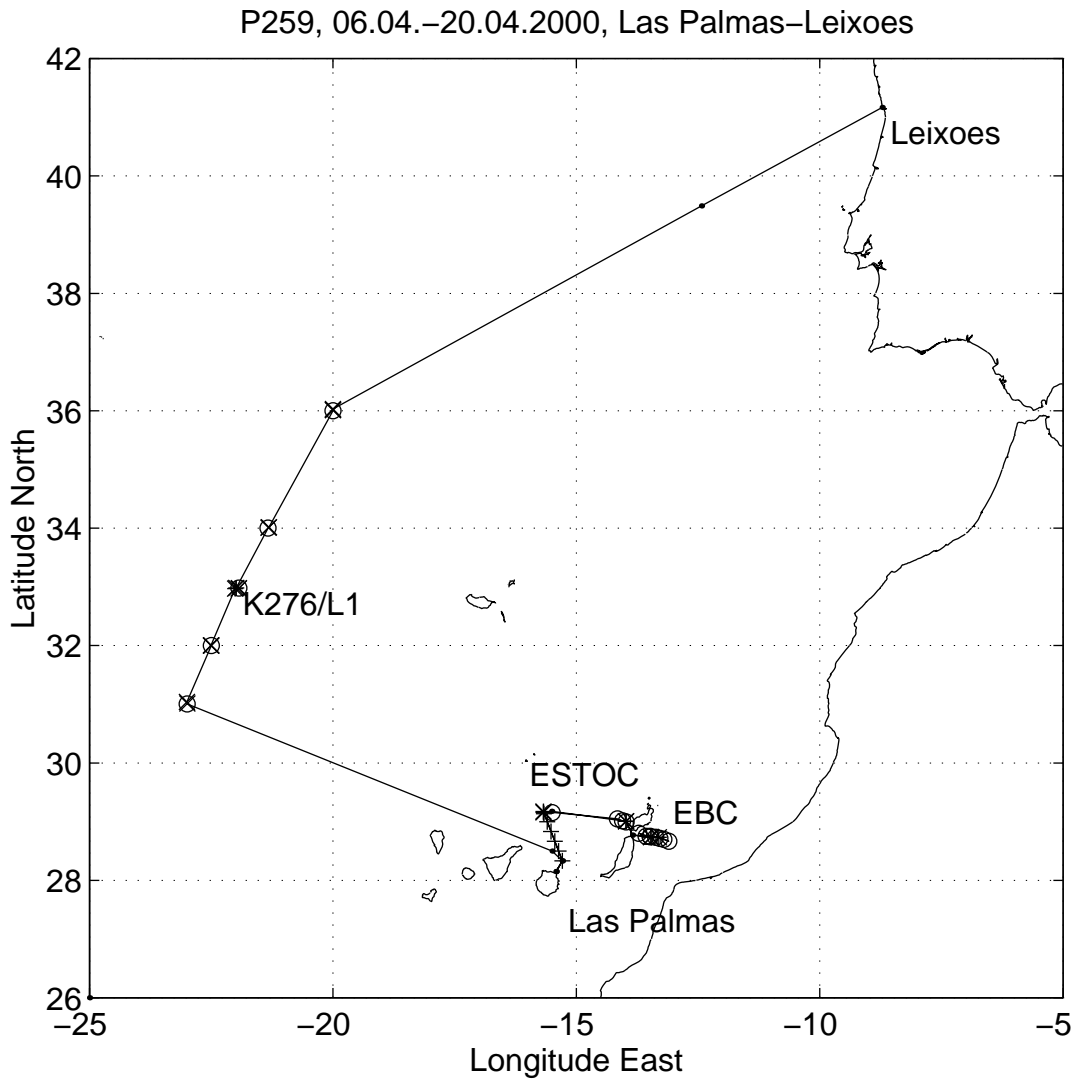
**Fig. 5:** Vertical distribution of daily averaged current vectors at the ESTOC site. Depths are indicated. Note the offsets

**Fig. 6:** Hydrographic section across the Azores Front; potential temperature (a) and salinity (b); note the Mediterranean Water lense (MEDDY) north of the front (#62).

**Fig. 7:** Correlation of potential temperature and salinity across the Azores Front (green light) with the MEDDY in the north (red)

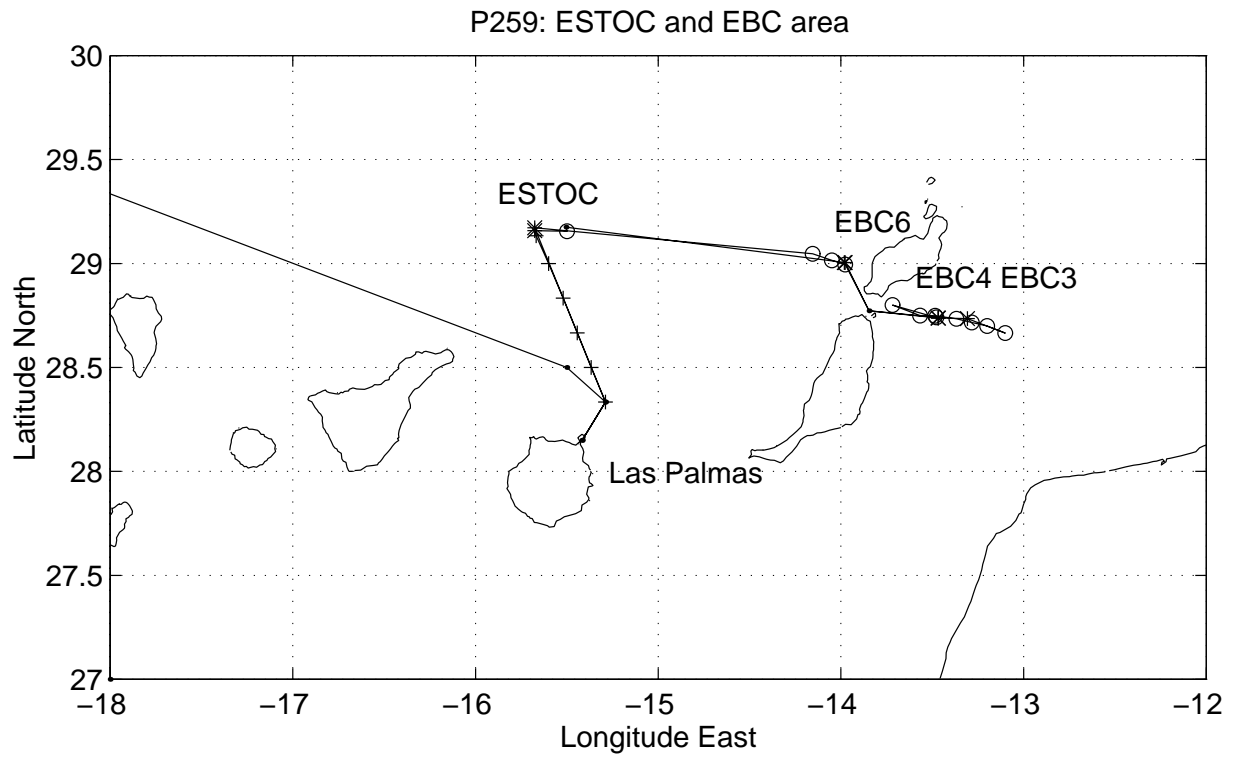
**Fig. 8:** 2 ½ year vertical distribution of daily averaged current vectors at the K276/L1 site (33°N, 022°W). Depths are indicated. Note the offsets

## 10 Figures

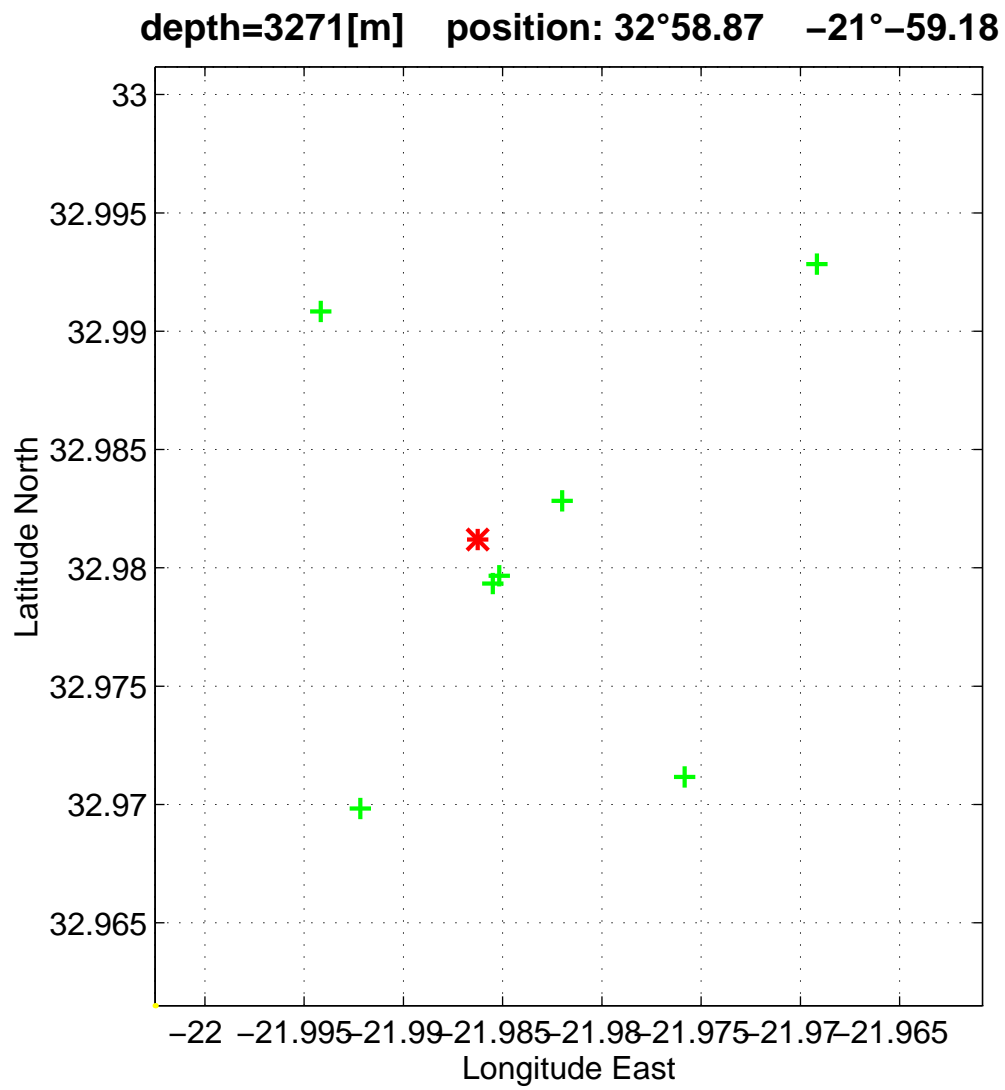


**App. C:** Track of Poseidon cruise 259, 06.04.-20.04., Las Palmas – Leixoes  
XBT launches on the way from Las Palmas to ESTOC; mooring work at ESTOC  
(exchanged), EBC and K276 (recovered); CTD stations (o); plankton hauls across the  
Azores Front (x).

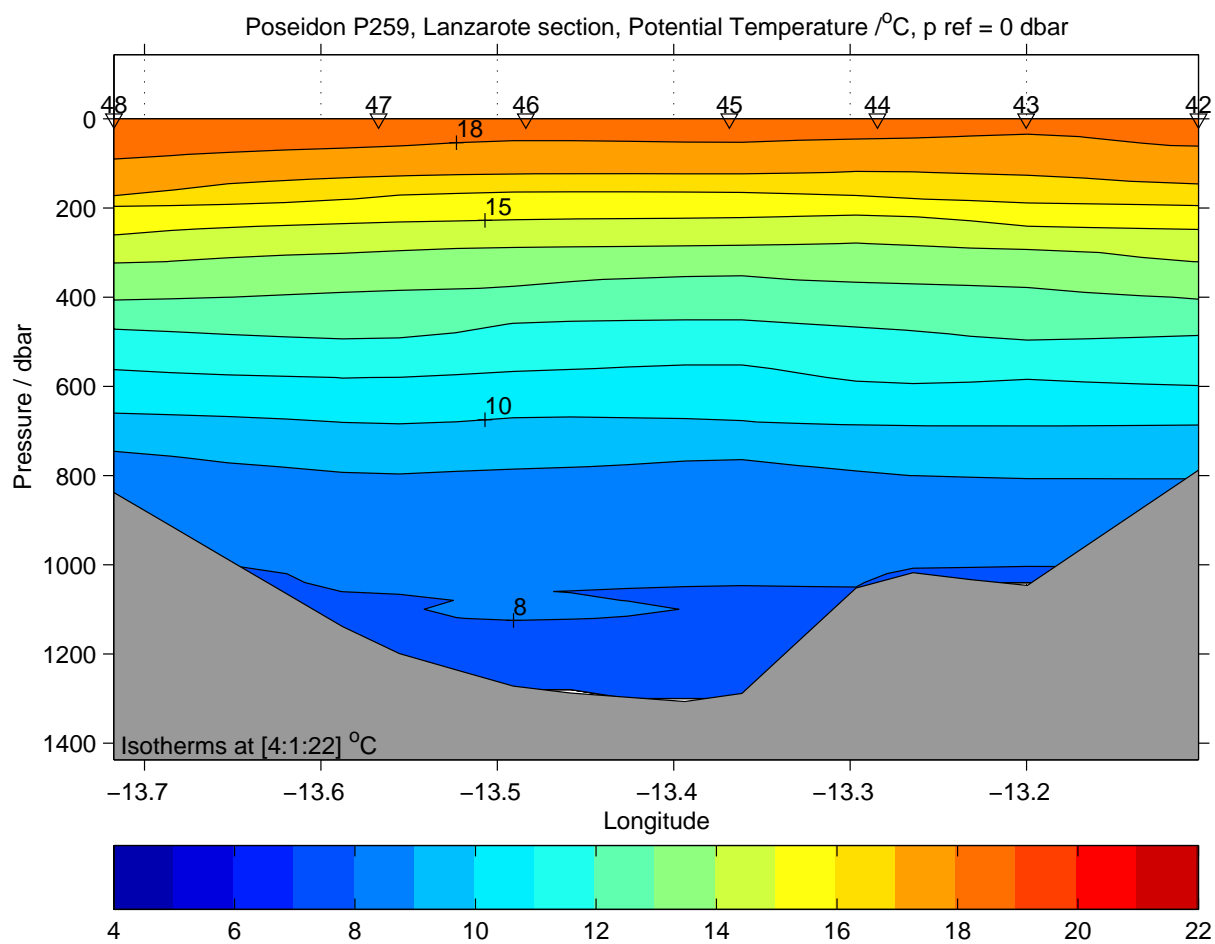




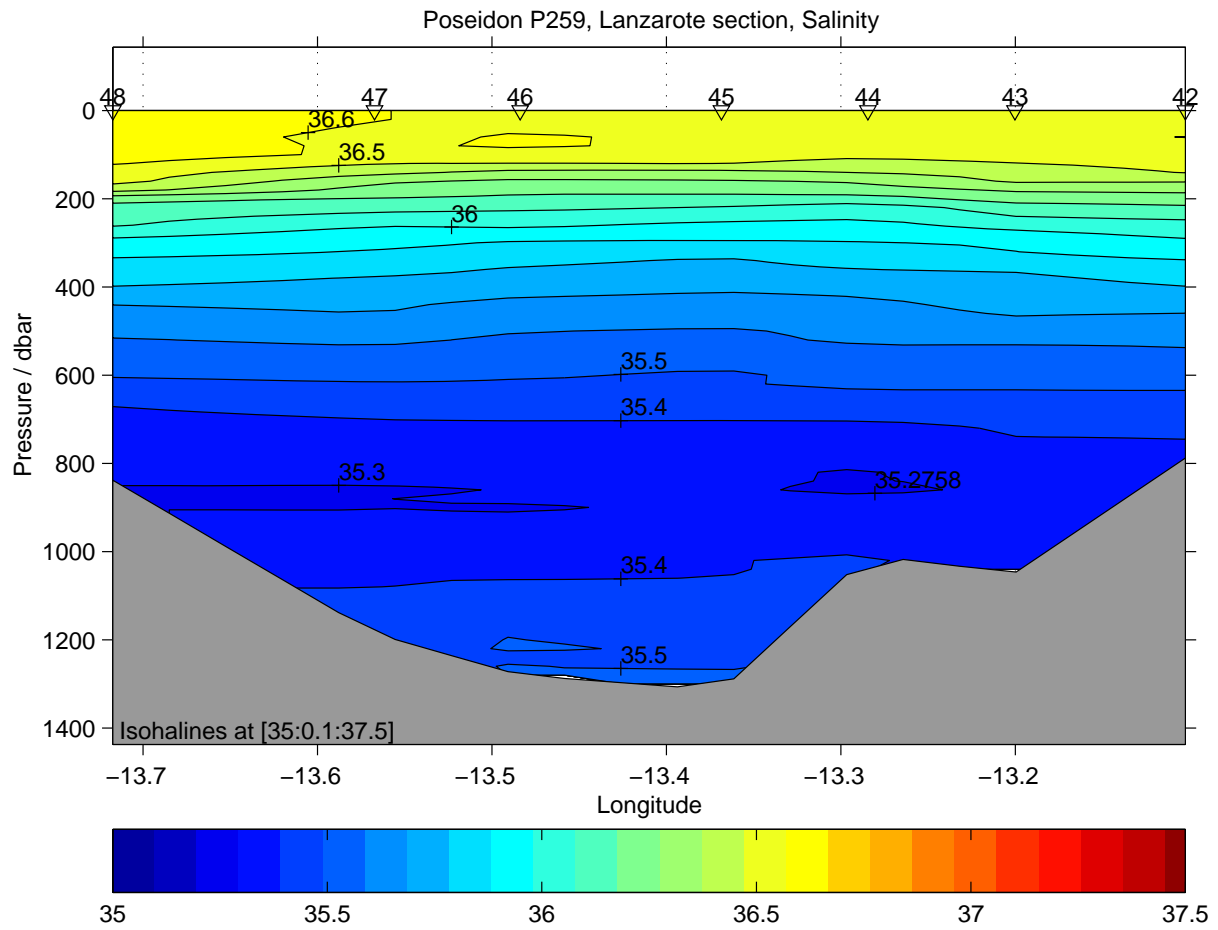
**Fig. 1:** Cruise track in the Canary Islands region during P259/1, 06.04.-09.04.2000. XBT launches (+) on the way from Las Palmas to ESTOC; mooring work (\*) at sites ESTOC (exchanged), EBC 3 (recovered), and EBC4 and EBC6 (both exchanged). CTD stations (o).



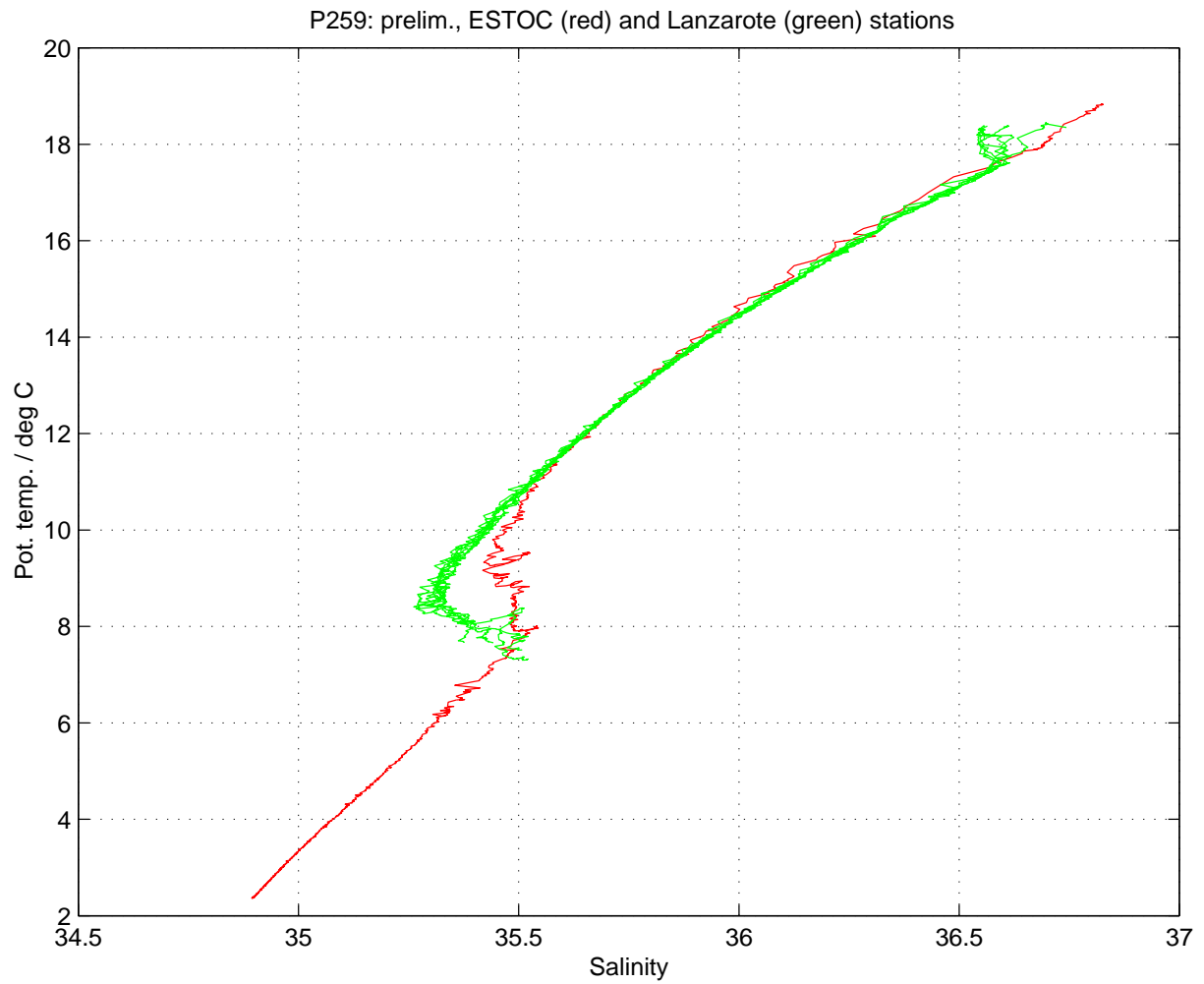
**Fig. 2:** Location of the remainder of mooring V276\_20.



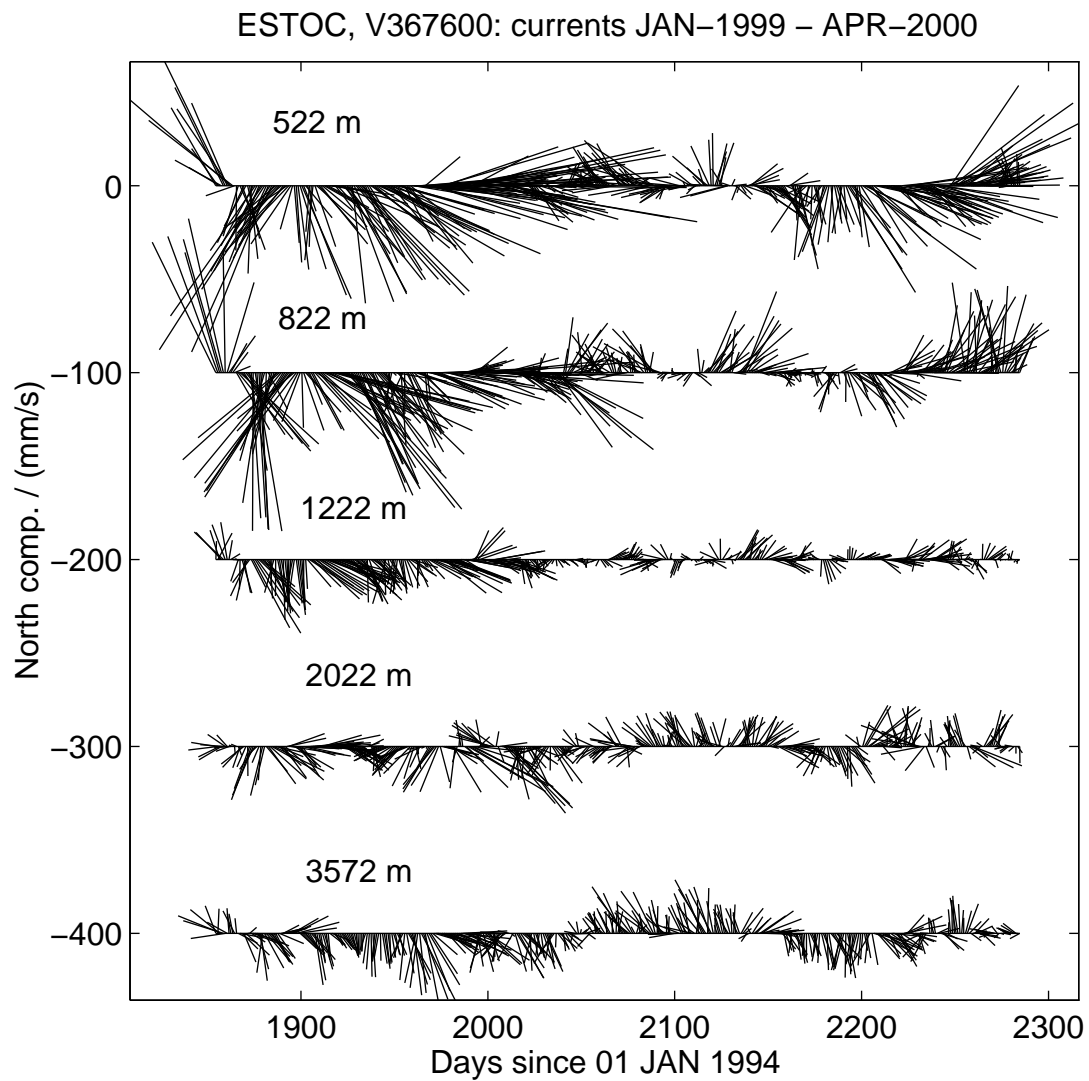
**Fig. 3a:** Hydrographic section east of Lanzarote; potential temperature



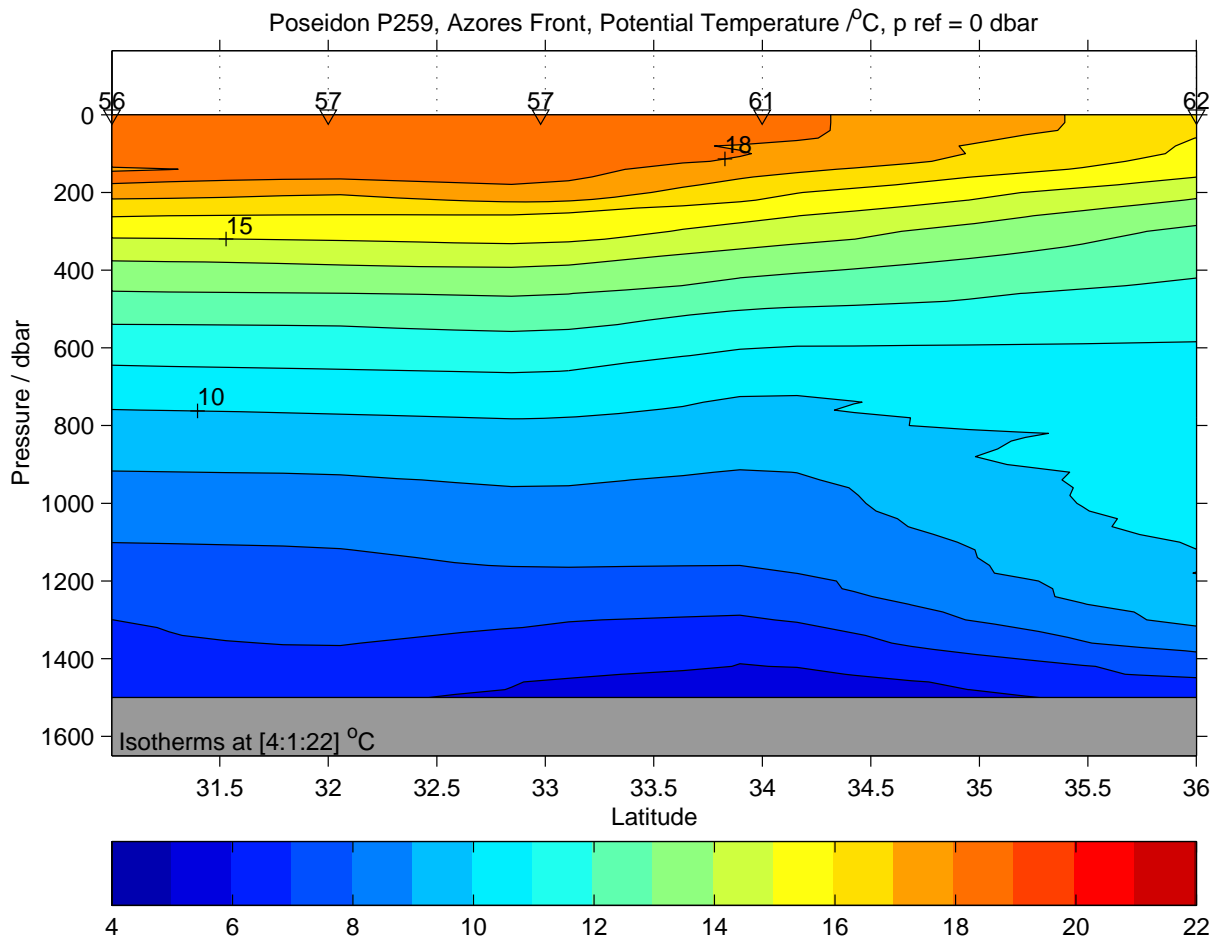
**Fig. 3b:** Hydrographic section east of Lanzarote; salinity



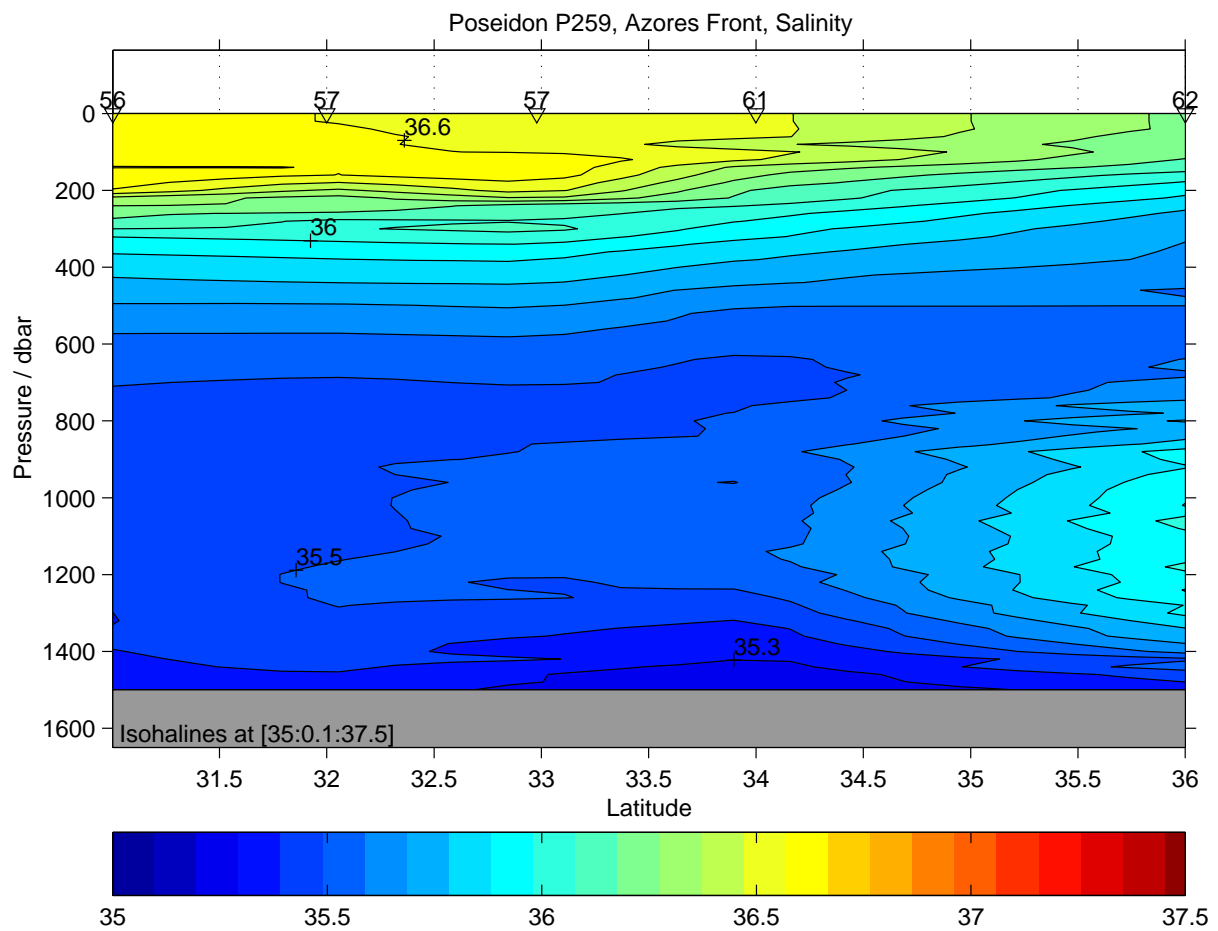
**Fig. 4:** Correlation of potential temperature and salinity east of Lanzarote (green light) and at the ESTOC site (red)



**Fig. 5:** Vertical distribution of daily averaged current vectors at the ESTOC site. Depths are indicated. Note the offsets

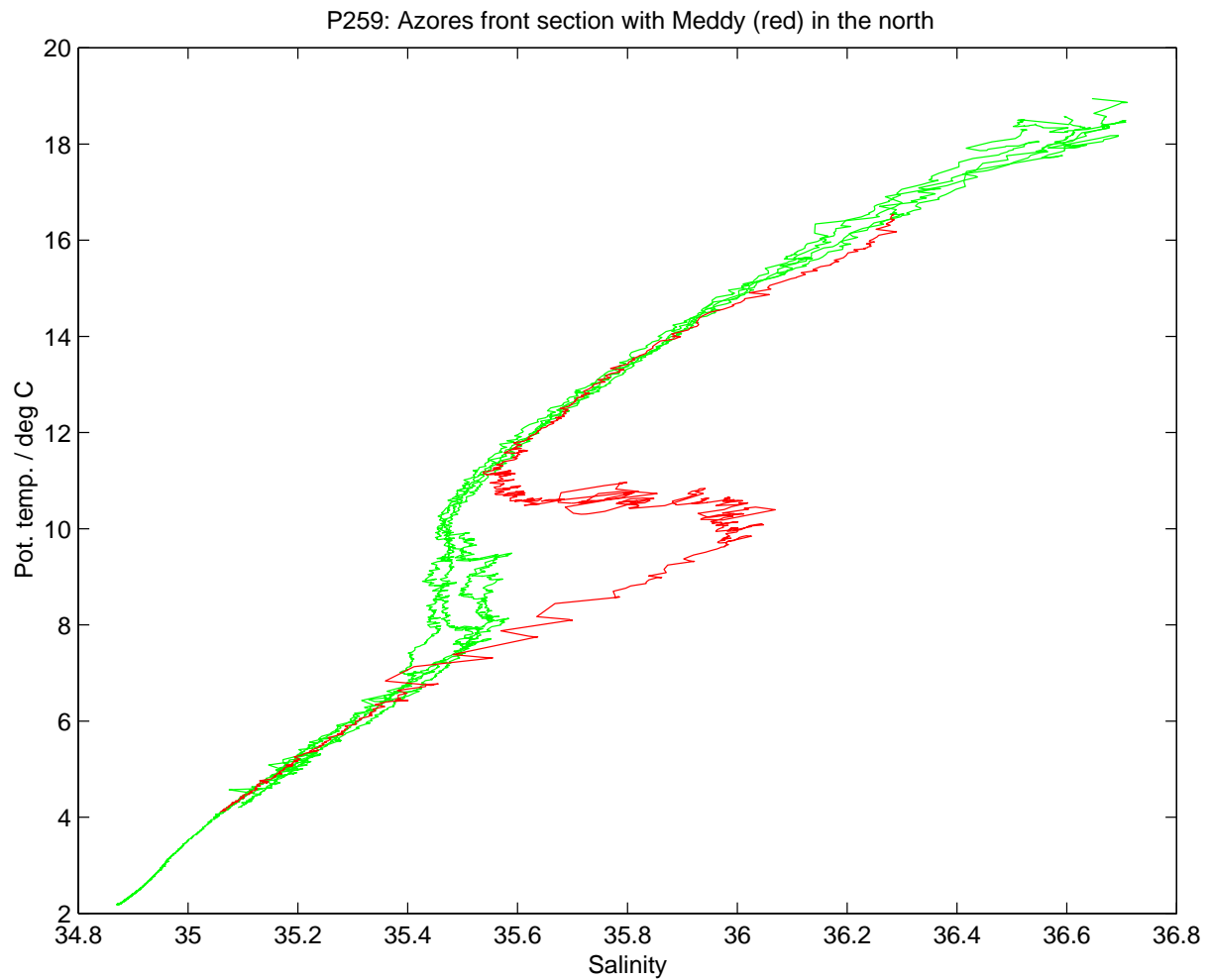


**Fig. 6a:** Hydrographic section across the Azores Front; potential temperature; note the Mediterranean Water lense (MEDDY) north of the front (#62).

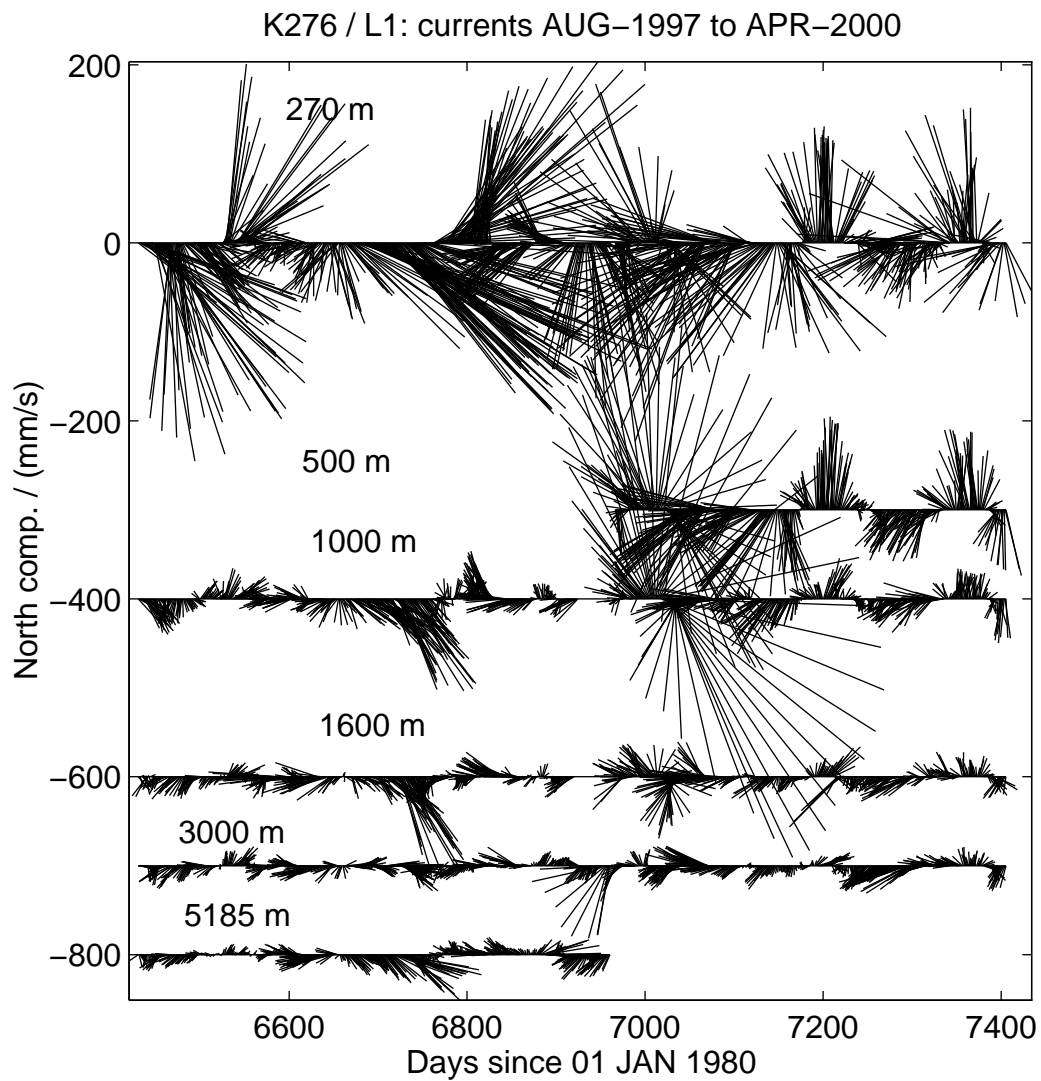


**Fig. 6b:** Hydrographic section across the Azores Front; salinity (b); note the Mediterranean Water lense (MEDDY) north of the front (#62).





**Fig. 7:** Correlation of potential temperature and salinity across the Azores Front (green light) with the MEDDY in the north (red)



**Fig. 8:** 2 ½ year vertical distribution of daily averaged current vectors at the K276/L1 site (33°N, 022°W). Depths are indicated. Note the offsets