Cruise report
Atlantic Circulation and Climate Experiment
PALACE deployment cruise

1 Cruise narrative

1.1 Highlights

1.1.1 Expedition

R/V Seward Johnson 2000-01

1.1.2 Chief scientist

Claudia Schmid

1.1.3 Ship

R/V Seward Johnson, Captain V. Seiler

1.1.4 Ports of call

Fortaleza, Brazil

1.1.5 Cruise dates

10 January – 26 January 2000

1.2 Principal Investigators

Silvia Garzoli	AOML	garzoli@aoml.noaa.gov
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Claudia Schmid	CIMAS/ AOML	schmid@aoml.noaa.gov

1.3 Cruise participants

Douglas Anderson	CTD watch, PALACE	AOML	anderson@aoml.noaa.gov
Claudia Schmid	Chief scientist	AOML/ CIMAS	schmid@aoml.noaa.gov
Ryan Smith	CTD watch, ADCP	AOML	rsmith@aoml.noaa.gov
Derrick Snowden	CTD watch	AOML	snowden@aoml.noaa.gov
Greg Thomas	CTD watch, XBT	AOML	thomas@aoml.noaa.gov

1.4 Abbreviations and addresses

AOML National Oceanic and Atmospheric Administration
Atlantic Oceanographic and Meteorological Laboratory
4301 Rickenbacker Cswy, Miami 33149, FL, USA

CIMAS Cooperative Institute of Marine and Atmospheric Science
4600 Rickenbacker Cswy, Miami 33149, FL, USA

1.5 Primary objective

This cruise represents one of NOAA's contributions to the Atlantic Circulation and Climate Experiment (ACCE). ACCE is directed at increasing our understanding of the interaction between the Atlantic Ocean and the global climate. One objective is a follow up deployment of PALACE floats in the tropical Atlantic. This region is NOAA's area of interest which was seeded with PALACE floats in mid 1997. The PALACE floats drift freely at about 1000m depth and surface every 10 days to take a temperature profile. These data can be used to monitor the variability of the mixed layer heat content and the flow field at 1000m depth. Surface drifters are launched to increase the coverage of sea surface temperatures (SST) and to obtain more data about the surface circulation. The drifting buoys are part of the ENSO program.

Additionally a closed box of CTD/LADCP stations in 6°S-4°N, 25.5°W-23°W as well as a section at 28°W were taken. A higher resolution in the upper ocean is achieved by XBT drops and velocity measurements from a vessel-mounted ADCP. The data set will be used to estimate the budgets of the box and to study the structure of the equatorial current system.

This cruise is part of a multi-year program sponsored by NOAA and NSF. Funds to buy the Palace floats have been provided by NOAA/OGP.

1.6 Scientific program and methods

1.6.1 Cruise track

Fig. 1

1.6.2 CTD/LADCP and water sampling

44 CTD/14-bottle rosette stations (Table 1). All stations include LADCP. Water samples for salinity and oxygen were taken throughout the water column.

1.6.3 XBT's deployed

100 XBT with the Mark 12 system (Table 2).
71 XBT Mark 21 tests (Table 3).

1.6.4 PALACE floats and drifters deployed

12 PALACE (Table 4)
8 drifters (Table 5)

1.6.5 Underway measurements

Underway measurements included thermosalinograph (TSG) data and the various variables of the Seward Johnson's IMET system (surface temperature, conductivity, oxygen, meteorological parameters, GPS, ship speed, heading and bathymetry).

1.7 Problems with scientific equipment

One of the vessel-mounted ADCPs was not well secured in the well. It could move up and down and thus bang against the wall. The cause (two loose bolts) was quickly fixed on the second day at sea.

The Mark 12 XBT computer is not Y2K compliant. The date on the Mark 21 computer was wrong during the whole testing phase of the Sippican board and software (it was thought to be not Y2K compliant, but this was not the case). Therefore the dates in all XBT files have to be corrected according to the log sheets.

CTD station 1 (test station) had to be terminated near the surface because no data could be recorded. After the termination as well as the slider and the brush were fixed a test station could be taken (CTD station 2). The data recording worked well but the closing of the bottles did not function properly. Only 4 of the 14 bottles were closed and their depth was not consistent with the tripping depth. The software configuration was changed in an attempt to solve the problem.

During CTD stations 3 through 7 only 8 or 9 out of 14 bottles were closed. All of them tripped at the correct depth. Thus the changing of the software configuration was successful. Since working on the carousel had not lead to any changes we finally decided to replace it. This improved the things considerably: All except for one bottle closed. After firing that bottle a dozen times on deck it worked from station 14 on.

The software of the vessel-mounted ADCPs had problems with bad data cycles from the p-code GPS. Since this problem might lead to gaps in the data we decided to use the ship-GPS for the on-line processing. This proved to be a much more stable configuration. In the final processing the p-code GPS can be used. After finishing our survey we tried different ways to connect the p-code GPS to the computers. We found a channel which seems to work fine.

The NMEA was causing problems during the CTD casts. Thus it was turned off from CTD station 17 on. This does not pose any problems since the NMEA only adds GPS time and position to the file header. The time is also taken from the PC clock and the position is routinely typed in.

During CTD stations 43 and 44 the data quality deteriorated quickly. The profiles became increasingly spiky. After the spikes are filtered out the profiles are of good quality. The wiring of the CTD was thought to be the problem. After working on it we got much less error counts. We could not test it insitu since we already had reached the Brazilian waters.

1.8 Other incidents of note

The Seward Johnson had to stop in San Juan, Puerto Rico since the hydraulic of the A-frame leaked. A technician and spare parts had to be flown in and the ship had to stay in port for about 1 day. Thus they arrived in Fortaleza a couple of hours later than scheduled. The departure time from Fortaleza had to be rescheduled from mid-morning to 16:00 on January 10.

Nearly everybody caught the flu during this cruise. Due to the high motivation of everyone this did not cause any problems in keeping up with the workload.

2 Description of measurement techniques

2.1 CTD/LADCP/rosette

A CTD with two sensors of temperature, conductivity and oxygen was used. 14 Niskin bottles were available. After each cast water samples for oxygen and salinity were taken. These samples were analyzed on board and the resulting data will be used for the insitu calibration of the conductivity and oxygen sensors.

The LADCP is a RDI Broadband 150 kHz ADCP.

2.2 XBT

Two XBT systems were available on board. The Mark 12 system was used to achieve a higher resolution of the temperature field.

The Mark 21 system is a prototype which went through its first blue water test during this cruise. The XBTs were dropped adjacent to CTD casts to allow a comparison of the profiles. The system mostly worked well, but it was very sensitive and thus produced many loop resistance errors which are indicative for bad probes. These supposedly bad probes were later used with the Mark 12 system without any obvious problems.

2.3 Vessel-mounted ADCP

The data from two vessel-mounted ADCPs were recorded throughout the survey. The used instruments are a RDI Broadband Ocean Surveyor 38 kHz ADCP and a RDI Narrowband 150 kHz ADCP. Combining the data from the two ADCPs will result in velocity profiles over the upper nearly 1000 m with a higher resolution in the upper 350-400 m.

2.4 PALACE float deployments

The PALACE floats were programmed to surface after 10 day long periods of submerged drift to take pressure-temperature profiles. After an 18 hour long surface period, during which they transmit their data, they go back to their target pressure of 1000 dbar. The instruments were launched after selected CTD casts.

2.5 Drifter deployments

Each surface drifter was launched together with a PALACE float. The drifters measure the sea surface temperature and they are tracked by ARGOS. Their drogue is at 15 m.

2.6 Underway measurements

Underway measurements included thermosalinograph (TSG) data and the various variables of the Seward Johnson's IMET system (surface temperature, conductivity, oxygen, meteorological parameters, GPS, ships speed, heading and bathymetry).

3 Preliminary analysis

Preliminary data products generated on the R/V Seward Johnson are presented. The hydrographic sections show the major water masses (Figs. 2 - 4). Maps of LADCP velocity vectors at different levels are also presented.

The water masses in the upper 2000 m of the tropical Atlantic are the Tropical Surface Water (TSW), the Subtropical Underwater (SUW), the Central Water (CW), the Antarctic Intermediate Water (AAIW) and the North Atlantic Deep Water (NADW). The highest temperatures and lowest salinities of the TSW are observed north of the equator (1°N-3°N). At these latitudes the surface salinities at 23°W are lower than at 25.5°W due to heavy rain. Further down the thermocline with varying thickness is found. At 6°S it extends over 150 m whereas at 3°N the thermocline is only 50 m thick. The salinity maximum of the SUW is most pronounced at 6°S and in 2°S to 1°N (Fig. 5). It strengthens again from 3°N on northward. Around the equator the SUW coincides with the eastward Equatorial Undercurrent (EUC). North and south of the EUC the flow is weaker and the flow direction is more variable. Around 3°N to 4°N the flow is eastward at about 10 cm/s whereas it is mostly westward at and south of 3°S.

Between 500 and 1000 m the AAIW is found (Figs. 2 - 4). It is characterized by a low salinity, which increases slightly towards the north. Salinities below 34.5 reach further north at 25.5°W than at 23°W (to 0° 40'N instead of 0°). The flow in this layer is quite variable when compared with the SUW flow (Figs. 5 - 6). Two currents can be identified easily. These are the Northern and Southern Intermediate Countercurrents (NICC, SICC) at 1°N to 2°N and at 2°S. There also is a westward flow band at 3°S (intermediate Southequatorial Current, SEC) and an eastward current at 6°S (intermediate Southequatorial Countercurrent, SECC). At the equator the upper part of the AAIW layer is governed by westward flow and the zonal velocities in the lower part are eastward (Figs. 2 - 4). The transition between west- and eastward flow is very close to the salinity minimum at 23°W and deepens toward the west, especially between 23°W and 25.5°W. This fact lies behind the change of the flow characteristics between 23°W and 25.5°W (Fig. 7).

All three sections show the surface SEC in the mixed layer (Figs. 2 - 4). Both at 25,5°W and at 28°W the current is split into two branches by the EUC. Only at 23°W the EUC is beneath a very thin layer of westward flow. South of the equator the eastward Southequatorial Undercurrent (SEUC) was found at 4°S to 5°S, 23°W and at 3°S and 4°S at the other two longitudes. It typically extends from the thermocline down to about 400 m with a westward current in and below the AAIW layer at the same latitudes. Only at 23°W the underlying intermediate depth flow is eastward underneath part of the SEUC. The geostrophic flow (not shown) at this location is not eastward and the eastward velocity derived from the LADCP is less than 5 cm/s. Thus it seems likely that this difference is due to a tidal current.

The equatorial flow at the target depth of the PALACE floats (1000 m) is eastward in 2°S to 2°N (Fig. 6). During a previous survey in the summer of 1997 the equatorial current was westward at this depth. This supports earlier studies which hypothesized that this current might be seasonal. At 3°S to 4°S the flow is westward, and at 6°S the velocities are eastward again. No preference of direction is observed at 3°N and 4°N.

4 Acknowledgements

We want to thank the officers and crew of the R/V Seward Johnson as well as the personnel at HBOI. Their expertise and high motivation were important for the successful completion of our work program. The excellent work of the University of Miami technicians and the AOML personnel made it possible to obtain a high quality data set. The help and instructions from employees in Miami before and during the cruise are much appreciated. The cruise was sponsored by NOAA and NSF.

5 Appendix

Table 1: CTD stations

Station	*Date*	*Time(UTC)*	*Latitude*	*Longitude*	*Bottom*	*Max Pres.*	*comment*
1	12-Jan-2000	23:16	5.283 S	29.000 W	5281	-	test
2	13-Jan-2000	14:43	5.824 S	26.334 W	5411	2002	test
3	13-Jan-2000	20:59	6.000 S	25.501 W	5698	2000	
4	14-Jan-2000	3:46	4.999 S	25.501 W	4913	2003	
5	14-Jan-2000	10:14	4.002 S	25.502 W	5493	2001	
6	14-Jan-2000	16:55	3.001 S	25.500 W	5206	2000	
7	14-Jan-2000	23:31	2.002 S	25.498 W	5217	2000	
8	15-Jan-2000	6:10	0.999 S	25.497 W	3560	2002	
9	15-Jan-2000	9:40	0.666 S	25.499 W	3620	2001	
10	15-Jan-2000	12:50	0.334 S	25.499 W	3317	1999	
11	15-Jan-2000	16:00	0.002 N	25.502 W	3576	2001	
12	15-Jan-2000	19:42	0.333 N	25.500 W	2670	2002	
13	15-Jan-2000	23:20	0.667 N	25.496 W	2374	2001	
14	16-Jan-2000	3:01	1.000 N	25.499 W	3645	2003	
15	16-Jan-2000	9:38	2.001 N	25.502 W	3911	2002	
16	16-Jan-2000	15:58	3.000 N	25.498 W	4407	2000	
17	16-Jan-2000	22:25	4.001 N	25.498 W	3903	2000	
18	17-Jan-2000	6:06	4.001 N	24.249 W	3923	2004	
19	17-Jan-2000	13:59	4.002 N	23.004 W	4189	2000	
20	17-Jan-2000	21:29	3.005 N	23.001 W	4596	2001	
21	18-Jan-2000	4:34	2.001 N	23.001 W	4308	2000	
22	18-Jan-2000	11:50	1.001 N	23.001 W	3247	2002	
23	18-Jan-2000	15:18	0.666 N	23.002 W	3821	2002	
24	18-Jan-2000	18:54	0.333 N	23.001 W	3871	2004	
25	18-Jan-2000	22:35	0.002 S	23.000 W	3928	1999	
26	19-Jan-2000	1:58	0.335 S	23.000 W	4573	2004	
27	19-Jan-2000	5:10	0.667 S	23.001 W	3519	2003	
28	19-Jan-2000	8:25	1.002 S	23.000 W	3250	2004	
29	19-Jan-2000	15:10	2.001 S	23.000 W	5198	2001	
30	19-Jan-2000	21:39	3.002 S	23.001 W	5390	1999	
31	20-Jan-2000	4:05	4.001 S	23.001 W	5580	2003	
32	20-Jan-2000	10:33	5.000 S	22.999 W	5101	2003	
33	20-Jan-2000	16:56	6.000 S	23.001 W	5089	2003	
34	21-Jan-2000	0:38	6.000 S	24.252 W	5785	2003	
35	21-Jan-2000	8:16	6.001 S	25.498 W	5691	2004	
36	22-Jan-2000	2:43	5.999 S	28.000 W	5520	2002	
37	22-Jan-2000	9:11	4.999 S	27.999 W	5373	2002	
38	22-Jan-2000	15:40	4.000 S	28.001 W	5171	2000	
39	22-Jan-2000	21:58	3.001 S	27.999 W	5031	2000	
40	23-Jan-2000	4:30	2.002 S	27.998 W	4969	2003	
41	23-Jan-2000	10:52	1.000 S	28.001 W	3694	2002	
42	23-Jan-2000	13:50	0.623 S	27.999 W	4055	2002	
43	23-Jan-2000	16:58	0.335 S	28.002 W	3895	2004	
44	23-Jan-2000	20:28	0.001 S	27.999 W	3935	2000	

Table 2: Mark 12 XBT deployments

XBT	*Date*	*Time(UTC)*	*Latitude*	*Longitude*	*comment*
201	12-Jan-2000	22:27	5.274 S	29.134 W	test
202	12-Jan-2000	23:03	5.294 S	29.030 W	test
1	13-Jan-2000	19:03	-	-	test
2	13-Jan-2000	19:08	5.942 S	25.799 W	test
3	13-Jan-2000	23:56	5.700 S	25.501 W	
4	14-Jan-2000	1:02	5.510 S	25.500 W	
5	14-Jan-2000	2:19	5.248 S	25.498 W	
6	14-Jan-2000	6:16	4.763 S	25.500 W	
7	14-Jan-2000	7:31	4.513 S	25.500 W	
8	14-Jan-2000	8:56	4.232 S	25.500 W	
9	14-Jan-2000	13:04	3.763 S	25.503 W	bad
10	14-Jan-2000	13:08	3.747 S	25.503 W	
11	14-Jan-2000	14:22	3.495 S	25.500 W	
12	14-Jan-2000	15:38	3.257 S	25.500 W	
13	14-Jan-2000	19:48	2.752 S	25.501 W	
14	14-Jan-2000	20:54	2.507 S	25.500 W	
15	14-Jan-2000	22:15	2.240 S	25.500 W	
16	15-Jan-2000	2:16	1.748 S	25.498 W	
17	15-Jan-2000	3:26	1.500 S	25.500 W	
18	15-Jan-2000	4:42	1.263 S	25.500 W	
19	15-Jan-2000	8:40	0.840 S	25.500 W	
20	15-Jan-2000	11:51	0.515 S	25.502 W	
21	15-Jan-2000	14:59	0.174 S	25.501 W	
22	15-Jan-2000	18:34	0.183 N	25.501 W	
23	15-Jan-2000	22:13	0.492 N	25.500 W	
24	16-Jan-2000	1:52	0.821 N	25.500 W	
25	16-Jan-2000	5:48	1.254 N	25.502 W	
26	16-Jan-2000	7:02	1.490 N	25.498 W	
27	16-Jan-2000	8:16	1.738 N	25.498 W	
28	16-Jan-2000	12:13	2.248 N	25.498 W	
29	16-Jan-2000	13:21	2.487 N	25.498 W	
30	16-Jan-2000	14:37	2.743 N	25.501 W	
31	16-Jan-2000	19:10	3.333 N	25.501 W	bad
32	16-Jan-2000	19:13	3.380 N	25.501 W	
33	16-Jan-2000	19:51	3.517 N	25.500 W	
34	16-Jan-2000	21:01	3.750 N	25.500 W	
35	17-Jan-2000	0:03	4.000 N	25.253 W	
36	17-Jan-2000	2:16	4.000 N	25.003 W	
37	17-Jan-2000	3:28	4.000 N	24.758 W	
38	17-Jan-2000	4:42	4.000 N	24.508 W	
39	17-Jan-2000	8:50	3.998 N	24.028 W	
40	17-Jan-2000	10:09	3.998 N	23.757 W	
41	17-Jan-2000	11:21	3.998 N	23.512 W	
42	17-Jan-2000	12:34	4.000 N	23.267 W	
43	17-Jan-2000	17:09	3.760 N	23.002 W	
44	17-Jan-2000	18:33	3.500 N	23.000 W	
45	17-Jan-2000	19:50	3.249 N	23.000 W	
46	18-Jan-2000	0:23	2.756 N	23.001 W	
47	18-Jan-2000	1:42	2.500 N	23.000 W	
48	18-Jan-2000	3:02	2.263 N	23.002 W	
49	18-Jan-2000	7:33	1.760 N	23.002 W	
50	18-Jan-2000	8:56	1.513 N	23.000 W	
51	18-Jan-2000	10:16	1.267 N	23.007 W	

52	18-Jan-2000	-	-	-	software
53	18-Jan-2000	18:00	0.482 N	23.005 W	
54	18-Jan-2000	21:40	0.161 N	22.999 W	
55	19-Jan-2000	1:00	0.160 S	23.003 W	
56	19-Jan-2000	4:10	0.490 S	23.002 W	
57	19-Jan-2000	7:28	0.823 S	23.498 W	
58	19-Jan-2000	11:04	1.237 S	23.000 W	
59	19-Jan-2000	12:24	1.502 S	23.000 W	
60	19-Jan-2000	13:41	1.735 S	23.000 W	
61	19-Jan-2000	17:52	2.259 S	23.000 W	
62	19-Jan-2000	19:02	2.498 S	23.000 W	
63	19-Jan-2000	20:21	2.750 S	23.000 W	
64	20-Jan-2000	0:41	3.253 S	23.000 W	
65	20-Jan-2000	1:32	3.500 S	23.000 W	
66	20-Jan-2000	2:42	3.738 S	23.000 W	
67	20-Jan-2000	6:44	4.237 S	23.000 W	
68	20-Jan-2000	8:14	4.540 S	23.000 W	
69	20-Jan-2000	9:13	4.738 S	22.983 W	
70	20-Jan-2000	13:02	5.238 S	23.000 W	
71	20-Jan-2000	14:24	5.514 S	22.995 W	
72	20-Jan-2000	15:33	5.750 S	22.990 W	
73	20-Jan-2000	19:47	6.000 S	23.250 W	
74	20-Jan-2000	21:00	6.000 S	23.500 W	
75	20-Jan-2000	22:09	6.000 S	23.751 W	
76	21-Jan-2000	23:17	6.000 S	24.000 W	no log
77	21-Jan-2000	3:13	5.998 S	24.483 W	
78	21-Jan-2000	4:40	5.998 S	24.777 W	
79	21-Jan-2000	5:53	6.000 S	25.023 W	
80	21-Jan-2000	6:56	6.000 S	25.242 W	
81	22-Jan-2000	5:14	5.762 S	28.000 W	
82	22-Jan-2000	6:28	5.512 S	28.000 W	
83	22-Jan-2000	7:40	5.260 S	28.000 W	bad
84	22-Jan-2000	7:45	5.258 S	28.000 W	
85	22-Jan-2000	11:40	4.777 S	27.998 W	
86	22-Jan-2000	13:00	4.500 S	28.017 W	
87	22-Jan-2000	14:21	4.235 S	28.000 W	
88	22-Jan-2000	18:25	3.750 S	28.000 W	
89	22-Jan-2000	19:30	3.487 S	28.000 W	
90	22-Jan-2000	20:35	3.268 S	28.000 W	
91	23-Jan-2000	0:32	2.750 S	28.000 W	
92	23-Jan-2000	1:52	2.500 S	27.999 W	
93	23-Jan-2000	3:08	2.262 S	28.000 W	
94	23-Jan-2000	7:06	1.747 S	28.000 W	
95	23-Jan-2000	8:25	1.507 S	28.000 W	
96	23-Jan-2000	9:38	1.267 S	28.000 W	
97	23-Jan-2000	13:06	0.833 S	28.000 W	
98	23-Jan-2000	16:07	0.500 S	28.000 W	
99	23-Jan-2000	19:26	0.167 S	28.000 W	no log

Table 3: Mark 21 XBT deployments

Profile	Date	Time(UTC)	Latitude	Longitude	at CTD	comment
0	10-Jan-2000	-	-	-	-	bucket
1	12-Jan-2000	17:36	-	-	-	no probe
2	12-Jan-2000	22:23	5.271 S	29.149 W	-	test
3	12-Jan-2000	23:11	5.298 S	29.006 W	-	test
4	13-Jan-2000	20:47	6.000 S	25.500 W	3	
5	13-Jan-2000	22:26	5.992 S	25.506 W	3	
6	14-Jan-2000	3:36	5.000 S	25.500 W	4	
7	14-Jan-2000	5:00	5.000 S	25.500 W	4	
8	14-Jan-2000	10:05	4.000 S	25.500 W	5	bad probe
9	14-Jan-2000	10:07	4.000 S	25.500 W	5	
10	14-Jan-2000	11:40	4.000 S	25.500 W	5	
11	14-Jan-2000	16:46	3.022 S	25.501 W	6	
12	14-Jan-2000	17:01	-	-	-	loop res.
13	14-Jan-2000	18:20	2.997 S	25.505 W	6	
14	14-Jan-2000	23:23	2.005 S	25.500 W	7	
15	15-Jan-2000	0:53	2.005 S	25.498 W	7	bad probe
16	15-Jan-2000	0:59	2.005 S	25.498 W	7	loop res.
17	15-Jan-2000	1:02	2.005 S	25.498 W	7	bad probe
18	15-Jan-2000	6:02	1.000 S	25.500 W	8	
19	15-Jan-2000	7:34	1.000 S	25.500 W	8	bad probe
20	15-Jan-2000	7:39	1.000 S	25.500 W	8	bad probe
21	15-Jan-2000	7:50	1.000 S	25.500 W	8	
22	15-Jan-2000	9:32	0.666 S	25.500 W	9	
23	15-Jan-2000	10:59	0.666 S	25.500 W	9	loop res.
24	15-Jan-2000	11:00	0.666 S	25.500 W	9	loop res.
25	15-Jan-2000	11:02	0.666 S	25.500 W	9	loop res.
26	15-Jan-2000	11:03	0.666 S	25.500 W	9	
27	15-Jan-2000	12:45	0.333 S	25.500 W	10	
28	15-Jan-2000	14:12	0.333 S	25.500 W	10	
29	15-Jan-2000	15:53	0.001 S	25.499 W	11	
30	15-Jan-2000	17:27	0.015 N	25.509 W	11	bad probe
31	15-Jan-2000	17:34	0.015 N	25.509 W	11	
32	15-Jan-2000	19:15	0.332 N	25.500 W	12	
33	15-Jan-2000	21:18	0.335 N	25.517 W	12	
34	15-Jan-2000	23:08	0.667 N	25.496 W	13	
35	16-Jan-2000	0:57	0.664 N	25.508 W	13	
36	16-Jan-2000	2:53	1.000 N	25.500 W	14	
37	16-Jan-2000	4:19	1.000 N	25.500 W	14	
38	16-Jan-2000	9:31	2.000 N	25.500 W	15	
39	16-Jan-2000	10:55	2.000 N	25.500 W	15	
40	16-Jan-2000	15:46	2.979 N	25.500 W	16	
41	16-Jan-2000	17:23	3.014 N	25.495 W	16	
42	16-Jan-2000	22:01	3.958 N	25.501 W	17	
43	16-Jan-2000	23:45	4.001 N	25.495 W	17	
44	17-Jan-2000	5:58	4.000 N	24.250 W	18	
45	17-Jan-2000	7:31	4.000 N	24.250 W	18	loop res.
46	17-Jan-2000	7:32	4.000 N	24.250 W	18	loop res.
47	17-Jan-2000	7:34	4.000 N	24.250 W	18	
48	17-Jan-2000	13:51	4.000 N	23.000 W	19	
49	17-Jan-2000	15:19	4.014 N	23.006 W	19	loop res.
50	17-Jan-2000	15:23	4.014 N	23.006 W	19	
51	17-Jan-2000	21:08	3.001 N	23.000 W	20	
52	17-Jan-2000	22:49	3.015 N	23.015 W	20	loop res.

53	18-Jan-2000	4:26	2.000 N	23.000 W	21	
54	18-Jan-2000	5:55	2.000 N	23.000 W	21	loop res.
55	18-Jan-2000	5:57	2.000 N	23.000 W	21	loop res.
56	18-Jan-2000	6:00	2.000 N	23.000 W	21	
57	18-Jan-2000	11:45	1.000 N	23.000 W	22	
58	18-Jan-2000	13:08	1.000 N	23.000 W	22	
59	18-Jan-2000	15:10	-	-	23	loop res.
60	18-Jan-2000	15:14	0.666 N	23.001 W	23	
61	18-Jan-2000	-	-	-	23	no probe
62	18-Jan-2000	16:40	0.671 N	23.001 W	23	
63	18-Jan-2000	18:48	0.333 N	22.999 W	24	
64	18-Jan-2000	20:27	0.338 N	23.027 W	24	
65	18-Jan-2000	22:33	0.001 N	22.999 W	25	
66	18-Jan-2000	0:00	0.000	23.003 W	25	
67	19-Jan-2000	1:54	0.330 S	23.000 W	26	
68	19-Jan-2000	3:30	0.330 S	23.000 W	26	loop res.
69	19-Jan-2000	3:30	0.330 S	23.000 W	26	loop res.
70	19-Jan-2000	3:30	0.330 S	23.000 W	26	loop res.

Table 4: PALACE floats deployed

ARGOS id	Date	Time (UTC)	Latitude	Longitude	at CTD
16408	13-Jan-2000	22:31	5.990 S	25.508 W	3
16411	14-Jan-2000	11:41	4.000 S	25.512 W	5
12279	15-Jan-2000	7:37	0.997 S	25.497 W	8
12281	15-Jan-2000	17:31	0.015 S	25.510 W	11
16416	16-Jan-2000	4:26	1.004 N	25.506 W	14
16417	18-Jan-2000	6:02	2.022 N	23.000 W	21
16409	18-Jan-2000	13:08	1.010 N	23.001 W	22
16414	19-Jan-2000	0:05	0.006 S	23.000 W	25
16415	19-Jan-2000	9:50	1.003 S	22.998 W	28
16412	19-Jan-2000	16:30	2.000 S	22.998 W	29
16410	20-Jan-2000	5:28	3.998 S	23.002 W	31
16413	20-Jan-2000	18:20	5.991 S	22.993 W	33

Table 5: Drifters deployed

ARGOS id	Date	Time (UTC)	Latitude	Longitude	at CTD
18309	13-Jan-2000	22:31	5.990 S	25.508 W	3
18311	16-Jan-2000	5:25	1.183 N	25.500 W	-
18789	18-Jan-2000	6:02	2.022 N	23.000 W	21
18790	18-Jan-2000	13:08	1.010 N	23.001 W	22
18310	19-Jan-2000	0:05	0.006 S	23.000 W	25
20353	19-Jan-2000	9:50	1.003 S	22.983 W	28
20369	19-Jan-2000	16:30	2.000 S	22.998 W	29
20348	20-Jan-2000	18:20	5.991 S	22.993 W	33