SHORT CRUISE REPORT

RV L'ATALANTE : cruise CARIBINFLOW

by : Prof. Dr. Monika Rhein, chief scientist

Institut für Umweltphysik
Abt. Ozeanographie, Universität Bremen

from Fort de France, Martinique, France
to Fort de France, Martinique, France

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Prof. Dr. Monika Rhein
Institut für Umweltphysik, Abt. Ozeanographie
Universität Bremen
28334 Bremen, Germany
Phon: ++49 421 218 2408
Fax : ++49 421 218 7018
Email : mrhein@physik.uni-bremen.de

Short cruise report of L'Atalante cruise CARIBINFLOW

Introduction
The cruise CARIBINFLOW is part of the german contribution to the international CLIVAR (Climate Variability and Predictability) program. The objective of the CARIBINFLOW measurements is to estimate the climate relevant inflow of warm water masses from the South Atlantic into the Caribbean through the passages south of Guadeloupe. The first Bremen cruise in the frame of CLIVAR in this region was in June 2002 with the german research vessel Meteor (cruise M53-3, chief scientist: M. Rhein)

The distribution of temperature, salinity and oxygen in the passages and along several sections east of the passages were determined by CTDO measurements and on all stations water samples were taken to calibrate the conductivity- and the oxygen sensor. The velocity distribution in the upper 700m of the water column were measured continually with two vessel mounted ADCPs, one with 300kHz (vertical range to 140m) and one with 75 kHz . The full water depth velocity profiles were determined at the CTD stations by attaching two 300kHz LADCP workhorses (one upward and one downward looking) on the rosette. Besides from the velocity distributions, the ADCP data can also be used to estimate vertical turbulent diffusivity. Therefore, on several locations, the vertical velocity shear of the workhorses were compared with the shear measured by XCPs (Expendable Current Profilers). XCPs have a better vertical resolution, and the comparison with the ADCP shear spectra is done to check and improve the calulations of vertical turbulent diffusivity by ADCP data.

In order to get year long time series of the inflow, moored instruments are needed. During the cruise, three areas east of St. Lucia, north of Tobago and east of Barbados were surveyed with a Multibeam Echosounder in order to find a suitable location for moorings, which we plan to deploy in June 2003 with the german RV Sonne (cruise S-171, chief scientist: M. Rhein). The moorings will be equipped with several temperature, salinity, and pressure sensors allowing to calculate the vertical density stratification and thus the baroclinic geostrophic velocity. The barotropic fluctuations will be estimated with bottom pressure sensors, and Inverted Echosounders (PIES) will also be deployed. The planned moorings are so called ‚end point' moorings, i.e. they will not give the transport through individual channels, but rather the integral transport fluctuations between Tobago and St. Lucia. In conjunction with the moorings at 16°N off Guadeloupe, the transport variations between St. Lucia and Guadeloupe will also be obtained. Shipboard data are necessary in order to study the 3-dimensional distribution of hydrographic parameters and velocity in the research area and to estimate the fraction of southern hemispheric water on the inflow.

During the L'Atalante cruise Caribinflow, one mooring was deployed east of Martinique. The mooring contained the Bremen CFC sampler, capable of collecting 52 uncontaminated water samples. The sampler is a prototype and moored for the first time. The mooring will be retreived in June 2003 with the RV Sonne (cruise S-171).

Cruise narrative
L'Atalante departed from Fort de France, Sunday, April 13, 2003, in the morning, under favorable weather conditions. The vm-ADCP measurement began shortly after departure in the Martinique – St. Lucia channel at 14°22.35'N, 60°52.30'W along the section to 14°10.00' N, 60°54.30' W. After passing to the St. Lucia – St. Vincent channel, the section from 13°39.40' N, 60°54.00' W to 13°21.60' N, 61°07.00'W was repeatedly measured with the two

vm - ADCPs for 24 hours in order to check the method for removal of the tides. The repeat measurements ended at April, 14, 19:00 UTC. In the next hours, 6 CTDO stations were carried out in the channel on the same geographical positions than at the RV Meteor cruise M53-3 in June 2002, starting at 13°37‘N, 60°56‘W (CTD station 1) and CTD 6 at 13°23.40‘N, 61°05.60‘W. An all the stations, strong northwesterly currents prevailed. On CTD station 4, the ADCP workhorses failed to recorder. After exchange of the battery package, the ADCPs worked well during the following stations. At April, 15, 2:00 the work along the section St. Vincent – Tobago began at 13°10‘N, 61°04‘W. On stations 10-12, XCP profiles were carried out parallel to the CTD/LADCP cast about 500m away from the L’Atalante. After finishing CTD12 at 12°02.5‘N, 60°28.0‘W, the Bremen CFC sampler was tested by putting him for 1 hour in 1500m depth at April, 15, 21:30 UTC. The sampler, however, failed to work properly.

After the CTD 13, the L’Atalante responded to an emergency call of a fishing boat from Barbados about 30 nm ahead. After repairing the engine of the boat, the scientific work continued about 7h later on April, 16, 11 UTC. The St. Vincent – Tobago section was finished one hour later. Along this section, mostly northwesterly currents were found, exceeding 1m/s near Tobago in the upper 200m. The bathymetry around the proposed location of the Tobago mooring (11°21.‘N, 60°27.‘W) was surveyed with the Multibeam Echosounder for about 1 hour. The measurements have a horizontal range of 5 times the water depth even at speeds around 10-11kn. It turned out that the preliminary location of the mooring was embedded in the steep topography of the shelf edge, and the planned position of the Tobago mooring was moved to 11°21.69‘N, 60°24.01‘W at a water depth of 1150m.

The CTD work continued at the mooring location (station CTD 15), starting the Tobago – Barbados section. On CTD stations 16 and 17, XCP profiles were successfully carried at the same time as the CTD cast. In total, 8 XCP profiles have been taken on this cruise. After CTD 17, the CFC sampler was tested in 1200m depth. The sampler was back on board on April, 17, 0:20 UTC, the test was successfull. The Tobago – Barbados section was finished after CTD 23 at 12°50‘N, 59°50‘W, April, 17, 16UTC. To find a suitable position for the Barbados mooring, again a Multibeam Echosounder survey was carried out and the position chosen was 13°01.47‘N, 59°47.72‘W at a water depth of 1030m. On the way to St. Lucia, 9 CTD stations were made as well as a Multibeam Echosounder survey east of St. Lucia. A suitable location of the planned St. Lucia mooring was found at 13°48.02‘ N, 60°41.49‘ W, water depth 1000m. After CTD 28, at April 18, 3:30 UTC, the third CFC sampler test was made by deploying the sampler for 3 hours in 1900m depth. Unfortunately, the sampler failed again and further tests were scheduled for the following days. The work along the Barbados-St. Lucia section ended after CTD 32 at April, 18, 15:40 UTC.

The L’Atalante headed north into the St. Lucia - Martinique passage. In this passage, 5 CTD stations (CTD 33-37) were done on the same positions than during the RV Meteor cruise M53-3 in June 2002. After the CTD work, the passage was repeatedly surveyed with the two vessel mounted ADCPs from 14°10.0‘N, 60°54.30‘W to 14°22.35‘N, 60°52.30‘W for about 6 hours. The L’Atalante reached the Martinique – Dominca passage on April, 20 . After surveying the passage with the vm-ADCPs (14°55.20‘N, 60°52.30‘W to 14°10.00‘N, 60°54.30‘W), the temperature, oxygen and salinity distributions were obtained by 6 CTD stations (CTD 38 – 43). At the deepest location in the channel (station CTD 41), the CFC sampler was lowered again to 1900m depth for several hours. The sampler was back on board at April 19, 20:30 UTC, but it did not work properly. The L’Atalante continued the CTD work in the Martinique – Dominica passage till April 19, 23:30. Dominica was passed leeward. The Dominica – Guadeloupe passage was surveyed with the two vm-ADCPs from 15°39.40‘N, 61°26.30‘W to 16°00.00‘N, 61°34.50‘W, and 5 CTD stations were carried out (CTD 44-48).

At April, 20, 13 UTC the L’Atalante headed to the 16°N section east of Guadeloupe and arrived at the westernmost CTD station (CTD 49) at 16°17.40‘N, 60°49.10‘W (500m depth) on April. 20, 19 UTC. After CTD 51, another CFC sampler test was made in 1300m depth

and successfully accomplished. To summarize the CFC sampler tests, the system worked at pressures around 1200 - 1300dbar, but failed when put to greater depths, although the system should be capable to work up to 400 bar . Therefore the CFC sampler will be deployed in shallower depths than anticipated before the cruise.

Since the continental slope off Guadeloupe at 16°N is very steep and thus the western boundary currents very narrow, the CTD station spacing at the slope was only 3-6 miles, west of 60°31.50‘W. When reaching the relatively flat abyssal plain, the spacing increased to 15 miles. Below 3000m depth, the weak performance of the downward looking LADCP workhorse decreased the vertical range of the instrument by half compared to the upward looking workhorse. This together with the low abundance of scatterers in these depths caused a serious deterioration of the data quality. The 16°N section ended at April 22, 20 UTC (CTD 62). On the section from 16°N to the location of the planned St. Lucia mooring, 9 CTD station were carried out with a station spacing of about 15 nm. At the same location as the last CTD station (CTD 71), the mooring releasers were successfully tested after lowering them to 900 m depth.

At April, 24, 3 UTC the l’Atalante headed to the St. Lucia – Martinique channel and repeated the ADCP section across the channel (14°10.00‘N, 60°54.30‘W – 14°22.35‘N, 60°52.30‘W) several times in order to estimate the tidal component of the flow. At 11 UTC, the repeat section ended and the L’Atalante drove to the deployment position of the CFC sampler at 14°33‘N, 60°41‘W. The mooring contains one CFC sampler, buoyant floats and releasers. The mooring was set at 14°32.75‘N, 60°41.22‘W and was finished at 13:20 UTC. Afterwards the ADCP section repeat work was resumed till April, 24, 20 UTC. The L’Atalante arrived Fort de France at April, 24, 22:30 UTC.

We thank Captain M. Houmard, his officers and his crew from the RV L’Atalante for the excellent cooperation and their invaluable assistance with this project.

Measurements

CTD-O_2 The measurements as well as the calibration of the conductivity and the oxygen sensors were successfull. Temperature and pressure sensors have been calibrated prior to the cruise. The finalized data set will be finished soon.

LADCP The two 300kHz workhorses attached to the rosette (one upward, one downward looking) worked well during the cruise. Below 3000m depth, the weak performance of the downward looking LADCP workhorse decreased the vertical range of the instrument by half compared to the upward looking workhorse. This together with the low abundance of scatterers in these depths caused a serious deterioration of the data quality

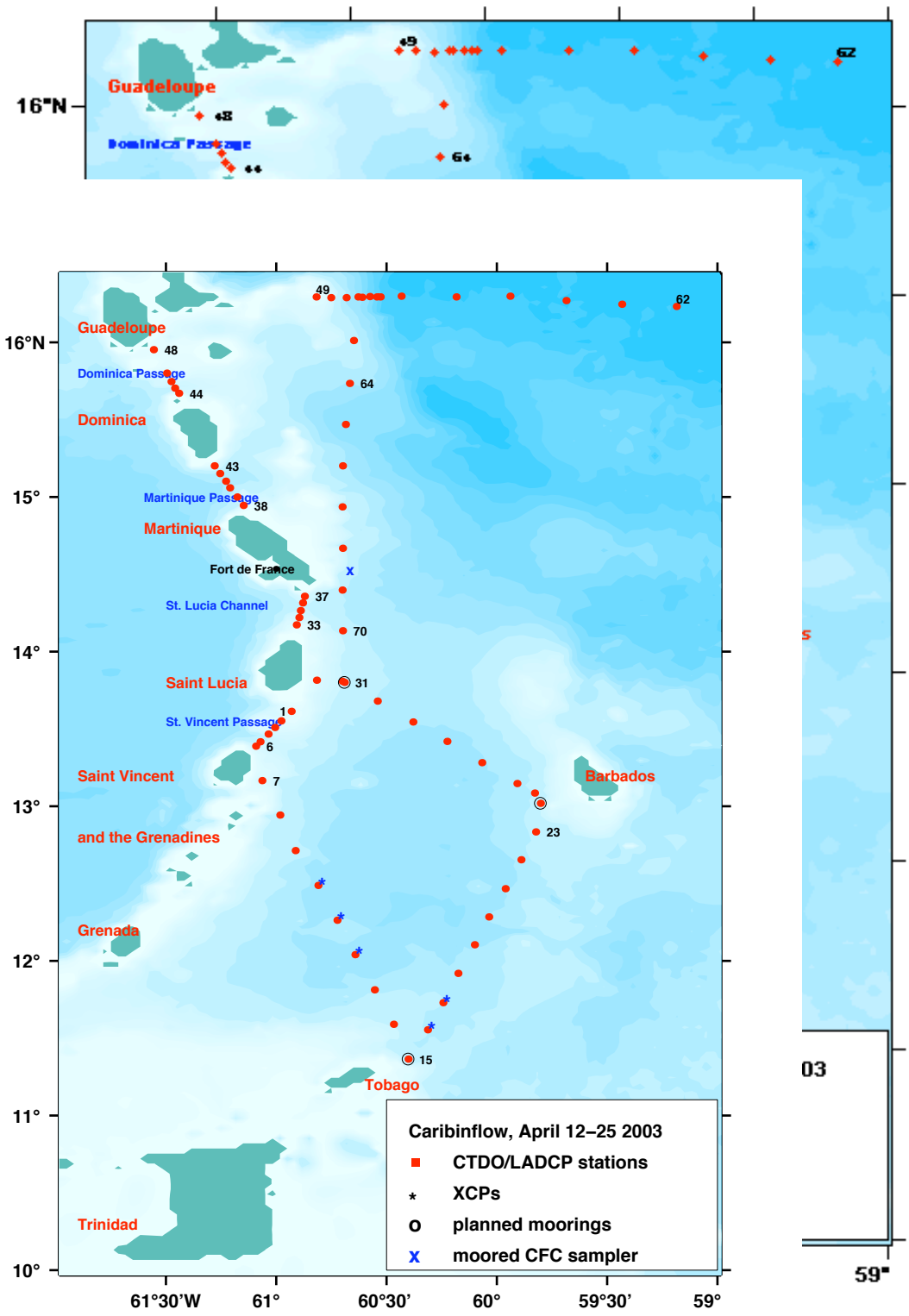
XCPs In total, 8 profiles on 5 different locations have been obtained during this cruise.

Vm ADCPs :Ocean Surveyor 300kHz and 75kHz. Both instruments worked continually during the cruise. The vertical range of the 300 kHz ADCP was mostly 150m , the 75kHz had valid data to about 700m depth.

Thermosalinograph. The instrument recorded continually temperature and salinity of the ocean surface during the cruise. The data were calibrated against the CTD data at the locations of the CTD stations.

Next page:
Figure 1 Cruise track of CARIBINFLOW, RV L’Atalante, 12.4.-24.4. 2003

CTD station list of the cruise



Cruise track, RV L'Atalante, April 12-25, 2003

Atalante CARIBINFLOW		CTD Stations						Page 1
Profile	Station	Date	Time	Latitude	Longitude	Water Depth	Profile Depth	Comment
1	1	2003/04/14	19:02	13° 36.86' N	60° 55.96' W	330	338	
2	2	2003/04/14	20:27	13° 33.05' N	60° 58.75' W	332	335	
3	3	2003/04/14	21:23	13° 30.56' N	61° 0.36' W	392	363	
4	4	2003/04/14	22:22	13° 27.92' N	61° 2.23' W	871	848	
5	5	2003/04/15	00:20	13° 24.98' N	61° 4.41' W	905	1098	
6	6	2003/04/15	01:59	13° 23.30' N	61° 5.58' W	431	462	
7	7	2003/04/15	04:15	13° 9.97' N	61° 3.84' W	465	444	
8	8	2003/04/15	06:29	12° 56.59' N	60° 59.01' W	1090	1053	
9	9	2003/04/15	09:24	12° 42.72' N	60° 54.77' W	1405	1380	
10	10	2003/04/15	12:05	12° 29.32' N	60° 48.64' W	2266	2242	
11	11	2003/04/15	15:31	12° 15.70' N	60° 43.43' W	2312	2301	
12	12	2003/04/15	18:51	12° 2.42' N	60° 38.54' W	2294	2271	
13	13	2003/04/16	01:44	11° 48.77' N	60° 33.31' W	1521	1537	
14	14	2003/04/16	11:05	11° 35.41' N	60° 28.15' W	103	1018	
15	15	2003/04/16	15:30	11° 21.83' N	60° 24.08' W	1367	1133	
16	16	2003/04/16	17:52	11° 33.27' N	60° 18.83' W	1531	1498	
17	17	2003/04/16	20:07	11° 43.70' N	60° 14.67' W	1532	1513	
18	18	2003/04/17	02:28	11° 55.09' N	60° 10.53' W	1791	1779	
19	19	2003/04/17	05:00	12° 6.16' N	60° 6.10' W	2010	1991	
20	20	2003/04/17	07:49	12° 17.06' N	60° 2.15' W	1868	1877	
21	21	2003/04/17	10:31	12° 28.04' N	59° 57.75' W	2096	2080	
22	22	2003/04/17	13:05	12° 39.17' N	59° 53.42' W	1743	1719	
23	23	2003/04/17	15:22	12° 50.06' N	59° 49.48' W	1321	1297	
24	24	2003/04/17	17:52	13° 1.06' N	59° 48.09' W	1122	1085	
25	25	2003/04/17	19:18	13° 5.11' N	59° 49.70' W	1349	1349	
26	26	2003/04/17	21:07	13° 8.84' N	59° 54.48' W	1683	1664	
27	27	2003/04/17	23:33	13° 16.92' N	60° 4.08' W	2155	2147	
28	28	2003/00/18	02:02	13° 25.13' N	60° 13.56' W	2134	2124	
29	29	2003/04/18	08:35	13° 32.72' N	60° 22.87' W	1949	1926	
30	30	2003/04/18	11:01	13° 40.81' N	60° 32.52' W	1501	1483	
31	31	2003/04/18	13:46	13° 48.00' N	60° 41.48' W	1000	980	
32	32	2003/04/18	15:18	13° 48.93' N	60° 48.99' W	486	486	
33	33	2003/04/18	17:41	14° 10.42' N	60° 54.52' W	250	338	
34	34	2003/04/18	18:27	14° 13.22' N	60° 53.82' W	794	785	
35	35	2003/04/18	19:30	14° 15.91' N	60° 53.44' W	925	936	
36	36	2003/04/18	20:33	14° 18.82' N	60° 52.87' W	853	934	

Profile	Station	Date	Time	Latitude	Longitude	Water Depth	Profile Depth	Comment
37	37	2003/04/18	21:40	14° 21.40' N	60° 52.35' W	494	400	
38	38	2003/04/19	13:01	14° 56.76' N	61° 8.96' W	413	412	
39	39	2003/04/19	13:58	15° 0.01' N	61° 10.71' W	615	586	
40	40	2003/04/19	14:58	15° 3.55' N	61° 12.62' W	1458	1502	
41	41	2003/04/19	16:22	15° 6.16' N	61° 13.73' W	2034	2022	
42	42	2003/04/19	21:33	15° 9.09' N	61° 15.34' W	1435	1438	
43	43	2003/04/19	23:10	15° 12.12' N	61° 16.80' W	719	698	
44	44	2003/04/20	07:12	15° 40.18' N	61° 26.48' W	734	709	
45	45	2003/04/20	08:30	15° 42.22' N	61° 27.59' W	1088	1074	
46	46	2003/04/20	09:48	15° 44.77' N	61° 28.60' W	702	670	
47	47	2003/04/20	10:48	15° 48.02' N	61° 29.81' W	477	467	
48	48	2003/04/20	12:11	15° 57.13' N	61° 33.38' W	256	245	
49	49	2003/04/20	19:15	16° 17.58' N	60° 49.17' W	538	531	
50	50	2003/04/20	20:22	16° 17.40' N	60° 45.19' W	1041	1049	
51	51	2003/04/20	21:42	16° 17.33' N	60° 40.99' W	1706	1747	
52	52	2003/04/21	02:51	16° 17.66' N	60° 37.81' W	2593	2587	
53	53	2003/04/21	05:04	16° 17.49' N	60° 36.72' W	2864	2917	
54	54	2003/04/21	07:35	16° 17.71' N	60° 34.56' W	3486	3485	
55	55	2003/04/21	10:35	16° 17.63' N	60° 32.70' W	4214	4190	
56	56	2003/04/21	14:07	16° 17.63' N	60° 31.70' W	4823	4696	
57	57	2003/04/21	17:40	16° 17.89' N	60° 26.04' W	4771	4742	
58	58	2003/04/21	22:15	16° 17.65' N	60° 11.05' W	5182	5192	
59	59	2003/04/22	02:52	16° 17.86' N	59° 56.44' W	4920	4889	
60	60	2003/04/22	07:18	16° 16.16' N	59° 41.15' W	5026	5015	
61	61	2003/04/22	12:05	16° 14.84' N	59° 25.99' W	5160	5085	
62	62	2003/04/22	16:32	16° 13.94' N	59° 11.12' W	5298	5301	
63	63	2003/04/23	03:22	16° 0.67' N	60° 38.99' W	1340	1320	
64	64	2003/04/23	06:05	15° 44.08' N	60° 40.04' W	2065	2035	
65	65	2003/04/23	09:20	15° 28.07' N	60° 41.15' W	2426	2409	
66	66	2003/04/23	12:35	15° 12.10' N	60° 41.95' W	1936	1947	
67	67	2003/04/23	15:22	14° 56.14' N	60° 42.09' W	1016	1030	
68	68	2003/04/23	17:52	14° 40.00' N	60° 41.96' W	584	572	
69	69	2003/04/23	20:12	14° 23.92' N	60° 42.05' W	1407	1396	
70	70	2003/04/23	22:55	14° 8.09' N	60° 41.99' W	1094	1079	
71	71	2003/04/24	01:34	13° 48.49' N	60° 42.07' W	958	943	