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KAIYO Cruise Report
KY08-09

Kuroshio Extension Region

September 2 - 18, 2008

A whale and K-TRITON Buoy on September 4, 2008

Japan Agency for Marine-Earth Science and Technology

(JAMSTEC)

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1. Cruise Information

1.1 Cruise number: KY08-09

1.2 Ship name: KAIYO

1.3 Title of the cruise: KAIYO Independent cruise for KEO buoy/ CTD/Sonde

1.4 Title of proposal: Kuroshio Transport and Surface Flux Observation Study

1.5 Cruise period: 2 - 18 September, 2008

1.6 Port call: From/To JAMSTEC Pier. No Port call.

1.7 Research Area: Kuroshio Extension Region

1.8 Research Map:

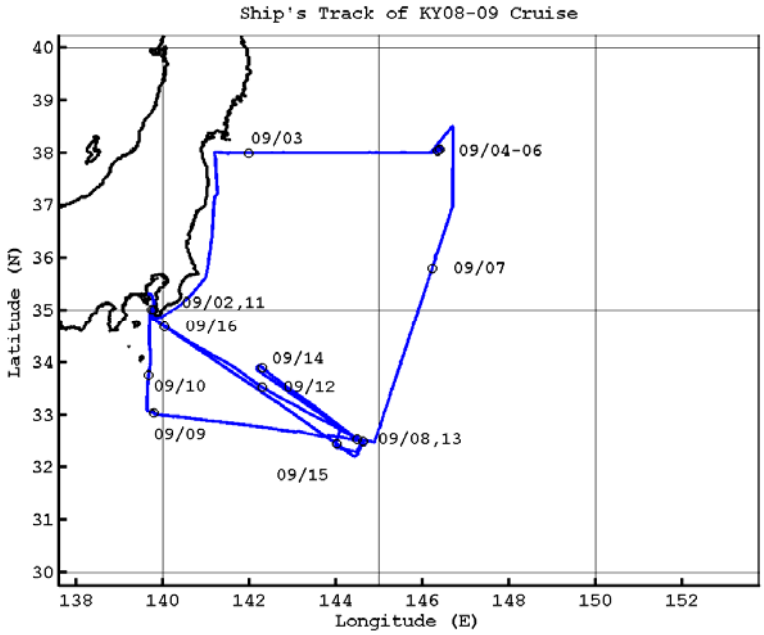


Figure 1: Cruise track with ships position at noon (circle) on each day.

2. Researchers

2.1 Chief Scientist: Hiroshi Ichikawa,
Institute of Observational Research for Global Change,
Japan Agency of Marine and Earth Science and Technology

2.2 Representative of Science Party:
Hiroshi Ichikawa,
Institute of Observational Research for Global Change,
Japan Agency of Marine and Earth Science and Technology

2.3 List of Science Party

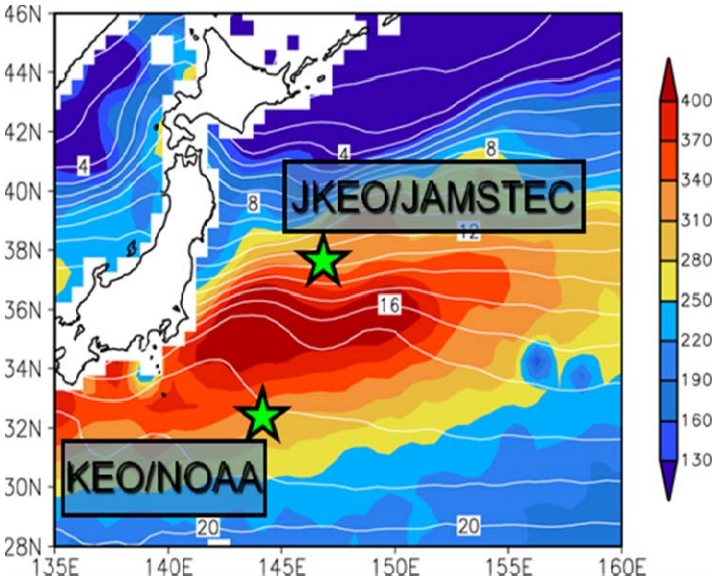
Masanori Konda	IORGC/JAMSTEC
Hiroyuki Tomita	IORGC/JAMSTEC
Katsuhiro Nomura	IORGC/JAMSTEC
Masayuki Yamaguchi	MARITEC/JAMSTEC
Yoshiyuki Nakano	MIO/JAMSTEC
Hitoshi Tamura	FRCGC/JAMSTEC
Robert Kamphaus	PMEL/NOAA
Michael J. Strick	PMEL/NOAA

3. Observation

3.1 Purpose and background

The amount of heat flux from the ocean to the atmosphere in the Kuroshio Extension (KE) region is the largest among the world oceans, as same as in the Gulf Stream region in the North Atlantic. For better understanding on the ocean circulations in the North Pacific including the KE and the climate change system, and for improving the accuracy of numerical model prediction, it is necessary to examine the spatial distribution of surface heat flux in the KE region and its temporal variations with high accuracy.

The present cruise was conducted in the KE region including the areas near the K-TRITON buoy deployed in February 2008 at JKEO to the north of KE and near the KEO buoy maintained by U.S. National Oceanic and Atmospheric Administration to the south of KE, for obtaining necessary oceanic and meteorological data for validation of sea surface turbulent heat flux estimated from satellite data and improvement of its estimation method. The replacement of sensors on the K-TRITON buoy was planed also because they had not been transmitting data due to the severe damage affected by fisheries activities there.



Location map of JKEO and KEO sites over winter mean sensible heat flux in color bar and surface water temperature by white contours.

3.2 Observations, activities and instruments

1) Oceanographic surveys using XCTD.
   Vertical profiles of water temperature and salinity were obtained at grand total of 57 sites (Fig. 2a), i.e., 14 sites along N-line and near K-TRITON buoy, 24 sites along E-line, and 19 sites near KEO buoy and along W- and X-lines using MK-130NW system (Tsurumi Seiki Ltd.).

2) Oceanographic surveys using CTD with LADCP.
   Vertical profiles of water temperature, salinity, and current velocity were obtained at 3 sites (Fig. 2b), i.e., at N08 and W08, and near K-TRITON using SBE9 plus CTD system (S/N 0786, Sea Bird Electronics Inc.) equipped with Lowered ADCP (150kHz Work Horse, RD Instruments).

3) Atmospheric soundings using Radiosondes.
   Vertical profiles of air temperature, relative humidity and wind velocity were obtained at grand total of 40 sites (Fig. 2c), i.e., 8 sites near K-TRITON buoy, 15 sites along E-line, 10 sites near KEO buoy, and 7 sites in other areas, using RS92-SGP sensors with MW15 system (Vaisala).

4) 10 Argo floats were deployed at 6 sites along E-line and 4 sites along W-line and near KEO buoy (Fig. 2d) in collaboration with Prof. Bo Qiu at University of Hawaii and Prof. Steve Riser at University of Washington.

5) Water sampling was conducted near K-TRITON buoy for CO2 measurement by MIO.

6) Recovery of K-TRITON buoy.
   It was planned to have the buoy hull and top 20m wire rope on deck without releasing the acoustic releaser (A/R) only for replacing sensors, and then to redeploy the buoy hull. However, due to malfunction of A/R, a set of grass-spheres with A/R was found at sea surface, and we recovered all the mooring line and instruments at K-TRITON buoy (Fig. 3). By these works, we have confirmed the procedure having the buoy hull on deck without releasing the A/R. While not planned, we have recovered the high resolution data stored at the buoy since 29 February 2008 which is publicly available at JKEO web site at the following URL.
   http://www.jamstec.go.jp/iorgc/ocorp/ktsfg/data/jkeo/JKEO2data.htm

7) Recovery and deployment of KEO (Fig. 4) buoy were conducted by PMEL/NOAA.

8) Underway marine meteorological measurements of short and long wave radiations, air temperature and relative humidity, wind speed and direction, precipitation, and barometric pressure were conducted.

9) Underway measurement of current velocity in the surface layer was conducted using ship-mounted ADCP using Ocean Surveyor ADCP VM-38 system (RD Instruments).

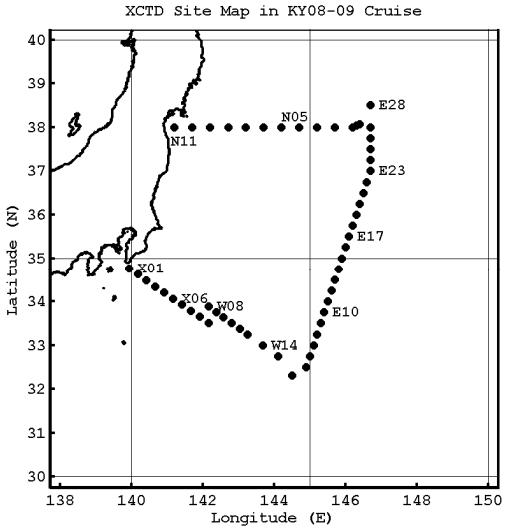


Figure 2a: Location map showing the XCTD sites.

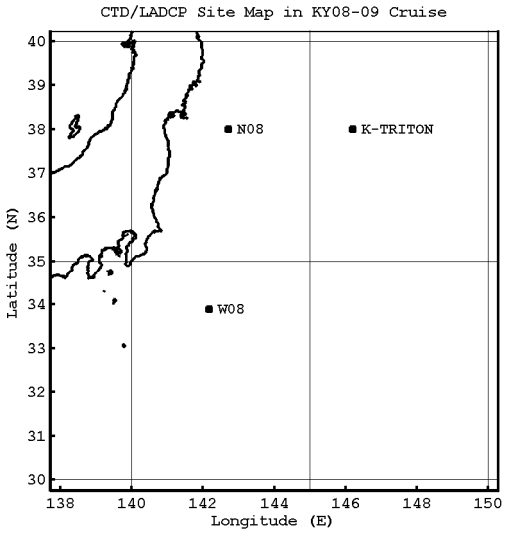


Figure 2b: Location map showing the sites of CTD with LADCP lowerings.

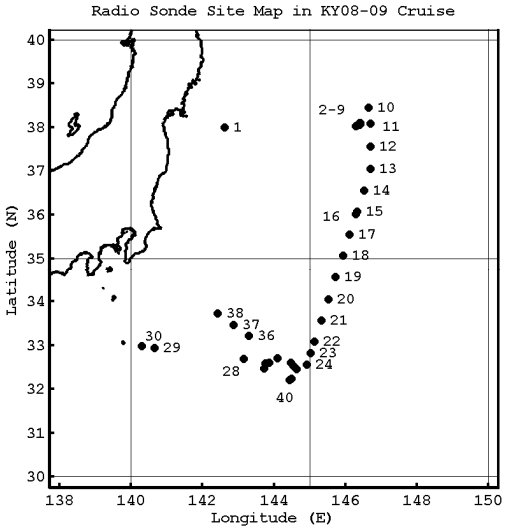


Figure 2c: Location map showing the Radio sonde sites.

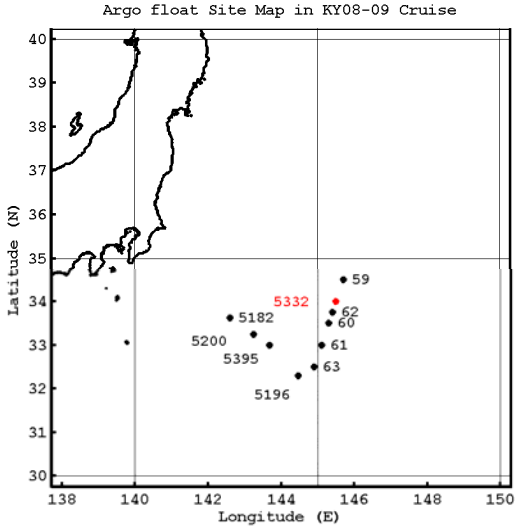


Figure 2d: Location map showing the deployment sites of Argo floats (red: with DO sensor).

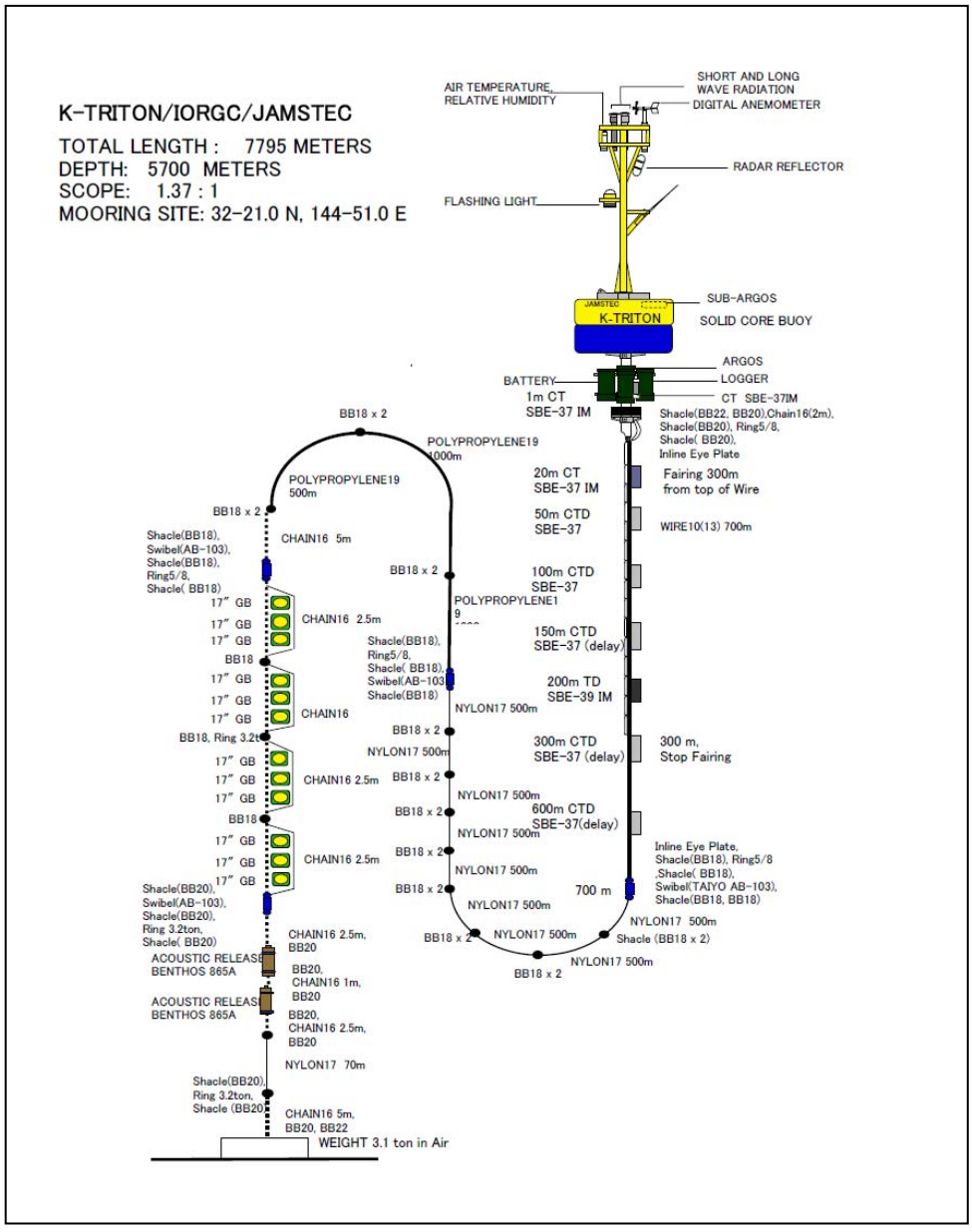


Figure 3: Schematic view of K-TRITON Buoy recovered on September 5

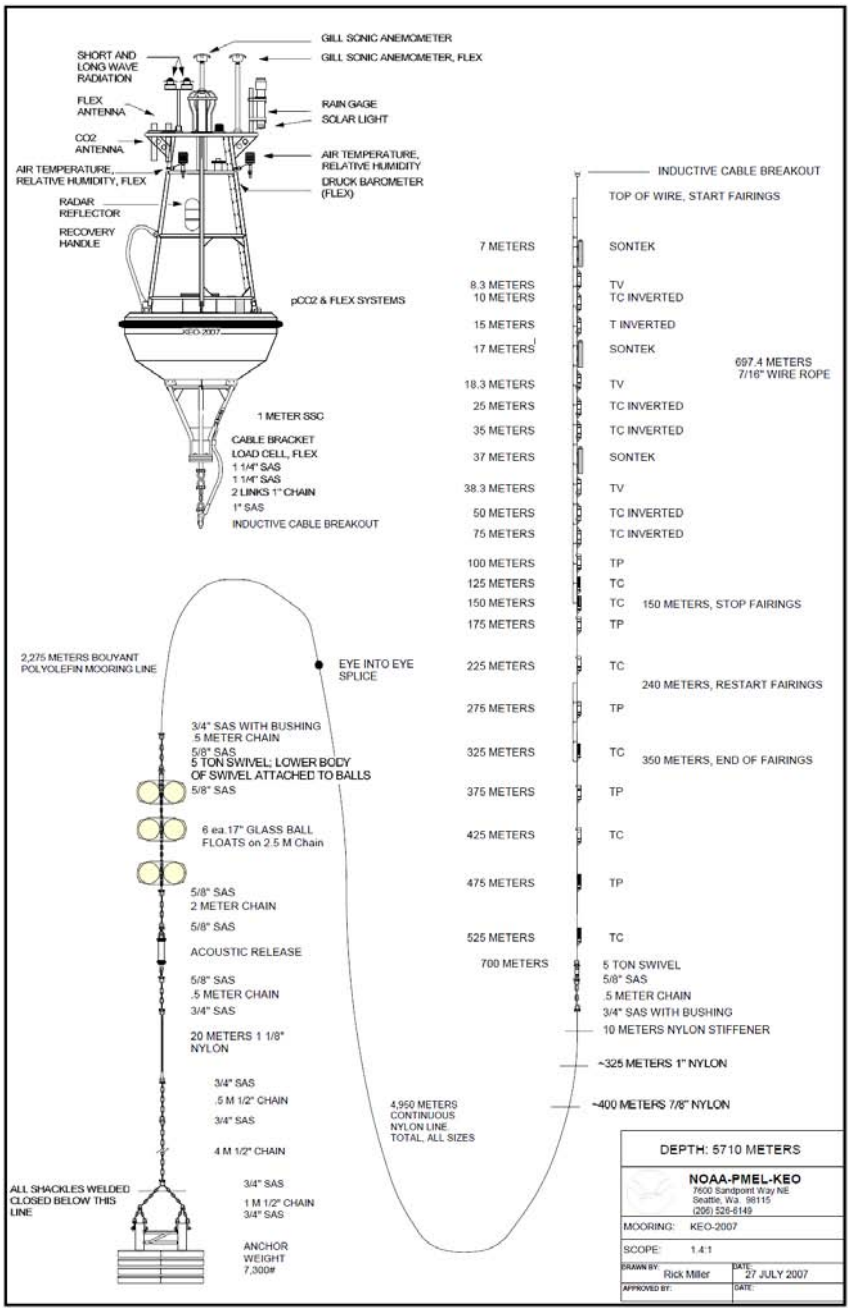


Figure 4: Schematic view of KEO Buoy recovered on September 14

3.3 Results

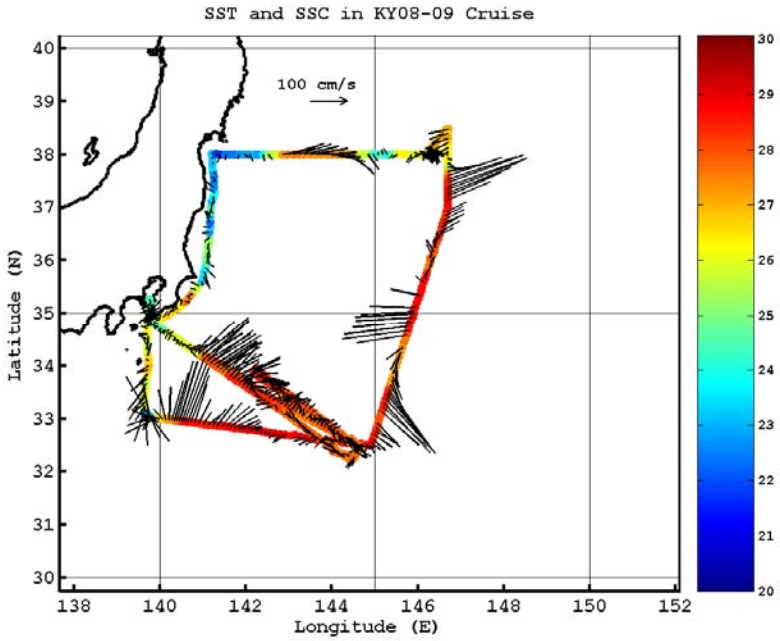


Figure 5: Sea surface temperature and sea surface drift current derived from navigation data.

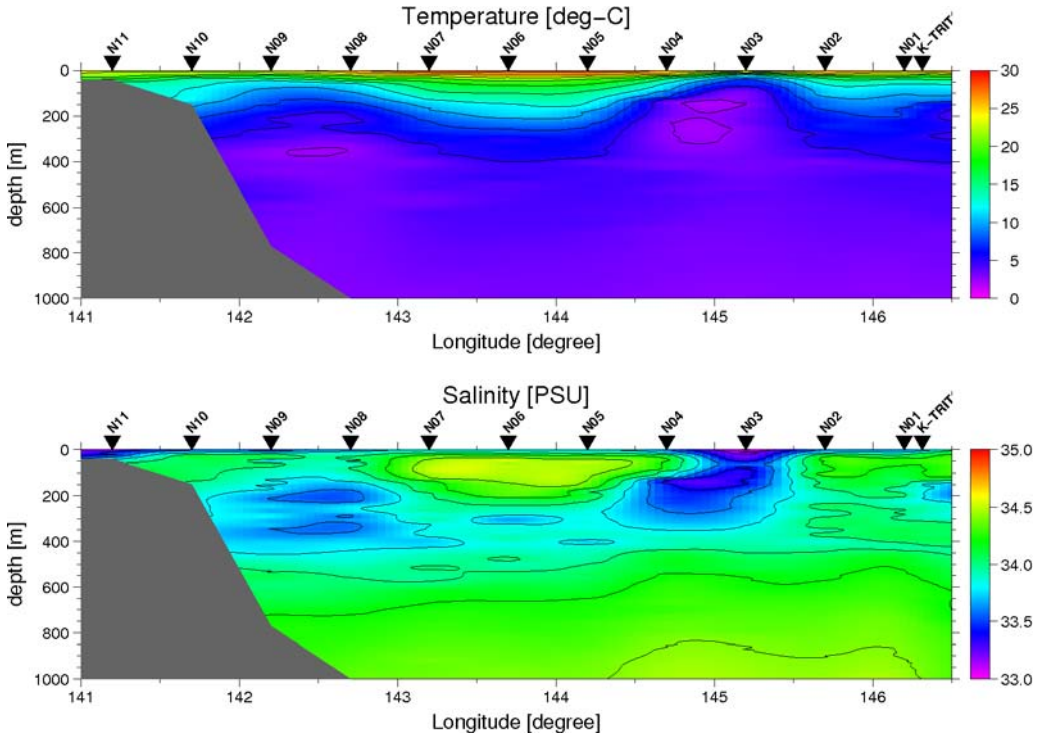


Figure 6: Vertical sections of temperature and salinity along N-line to the east of Sendai city.

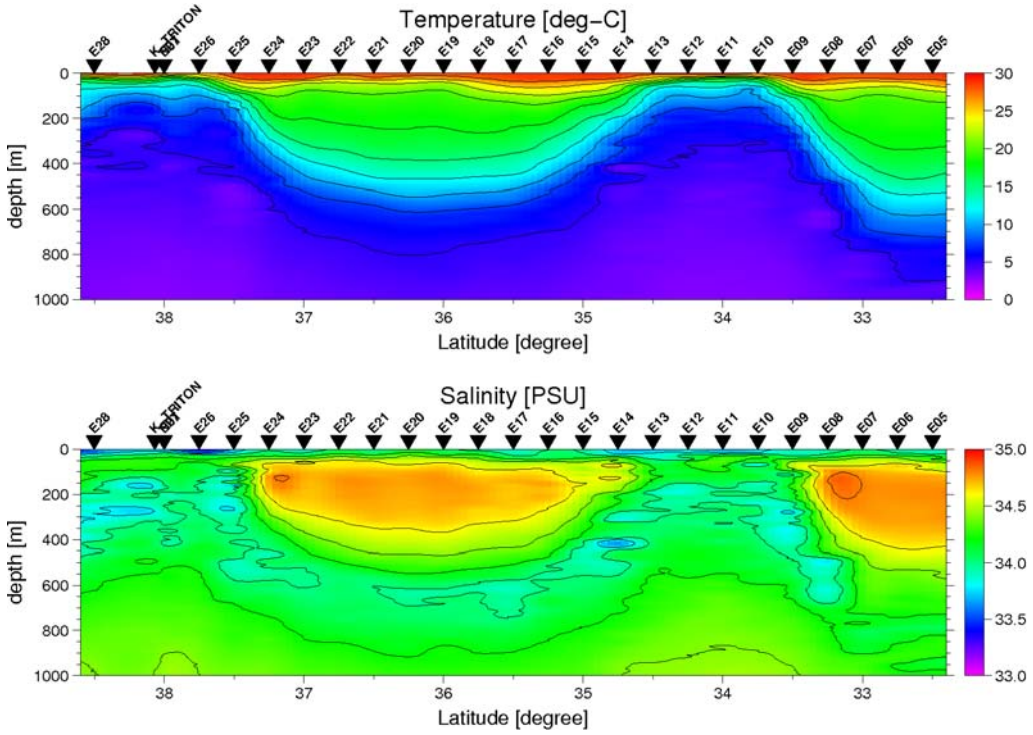


Figure 7: Vertical sections of temperature and salinity along E-line across the Kuroshio Extension.

3.4 Cruise log

No.	Name	Date	Time	Lat. (N)		Lon.(E)		Dep.	Obs.[1)]	Item[2)]	Memo
		mm/dd	hh:mm	deg	min	Deg	min	m			
1	N11	2008/09/02	23:18:35	38	00.09	141	11.99	42	XCT	BGN	Max: 39m
2	N10	2008/09/03	01:44:16	37	60.00	141	42.07	156	XCT	BGN	Max: 150m
3	N09	2008/09/03	03:59:07	37	60.00	142	12.07	797	XCT	BGN	Max: 771m
4	N08	2008/09/03	06:06:04	38	00.00	142	37.02		RSD	BGN	
4	N08	2008/09/03	06:25:00	37	59.94	142	42.21	1419	CLP	BGN	
4	N08	2008/09/03	06:37:20	37	60.00	142	42.30	1414	XCT	BGN	Max: 1098m
4	N08	2008/09/03	06:49:00	37	59.94	142	42.20	1411	CLP	BTM	Max: 1370m, 5min
4	N08	2008/09/03	07:14:00	37	59.98	142	42.10	1409	CLP	END	LADCP Surface
5	N07	2008/09/03	09:20:57	37	60.00	143	12.05	2627	XCT	BGN	Max: 1098m
6	N06	2008/09/03	11:17:24	37	59.99	143	42.04	5693	XCT	BGN	Max: 1098m
7	N05	2008/09/03	13:16:57	37	60.00	144	12.03	6409	XCT	BGN	Max: 1098m
8	N04	2008/09/03	15:23:53	37	59.99	144	42.04	5590	XCT	BGN	Max: 1098m
9	N03	2008/09/03	17:42:00	38	00.01	145	12.04	5354	XCT	BGN	Max: 1098m
10	N02	2008/09/03	19:57:58	37	60.00	145	42.05	5332	XCT	BGN	Max: 1098m
11	N01	2008/09/03	22:14:30	38	00.00	146	12.02	5334	XCT	BGN	Max: 1098m
12	JKEO2	2008/09/03	23:25:57	38	01.93	146	17.40		RSD	BGN	
12	JKEO2	2008/09/03	23:29:00	38	02.43	146	18.75	5404	CLP	BGN	
12	JKEO2	2008/09/03	23:46:00	38	02.44	146	18.87	5401	XCT	BGN	Max: 1098m
12	JKEO2	2008/09/04	00:56:00	38	02.62	146	19.17	5406	CLP	BTM	Max: 5348m, 5min
12	JKEO2	2008/09/04	02:07:00	38	02.92	146	19.35	5407	CLP	END	LADCP Surface
12	JKEO2	2008/09/04	02:46:11	38	03.28	146	19.74		RSD	BGN	
12	JKEO2	2008/09/04	05:58:37	38	06.12	146	24.90		RSD	BGN	
13	JKEO2	2008/09/04	22:13:00	38	04.82	146	25.21	5407	SBY	ENB	
13	JKEO2	2008/09/04	22:23:00	38	04.82	146	25.21	5407	SBY	RNG	575?m, 5760m
13	JKEO2	2008/09/04	22:52:14	38	03.55	146	23.34		RSD	BGN	
13	JKEO2	2008/09/05	00:38:00	38	04.82	146	25.21	5407	SBY	LFT	LIFT by A-Flame
13	JKEO2	2008/09/05	00:53:00						SBY	RET	Buoy hull
13	JKEO2	2008/09/05	01:40:00						SBY	RLL	Wire
13	JKEO2	2008/09/05	03:00:00						SBY	RLL	Start Recovery Wire (25m-700m)
13	JKEO2	2008/09/05	04:07:00						SBY	RLL	Nylon rope
13	JKEO2	2008/09/05	05:43:00						SBY	RLL	Polypropylene

13	JKEO2	2008/09/05	06:15:00						SBY	LFT	Lift the Glass ball
13	JKEO2	2008/09/05	06:20:00						SBY	RET	Glass ball, A/R
13	JKEO2	2008/09/05	06:20:00						SBY	END	
13	JKEO2	2008/09/05	06:14:37	38	05.57	146	23.82		RSD	BGN	
13	JKEO2	2008/09/05	08:56:15	38	3.91	146	23.34		RSD	BGN	
13	JKEO2	2008/09/05	23:55:39	38	04.73	146	24.96		RSD	BGN	
13	JKEO2	2008/09/06	02:47:12	38	04.58	146	25.26		RSD	BGN	
13	JKEO2	2008/09/06	03:01:03	38	03.96	146	23.97	5402	XCT	BGN	Max: 1098m
14	N01	2008/09/06	04:00:18	37	59.98	146	11.97	5307	XCT	BGN	Max: 1098m
15	E28	2008/09/06	8:05:43	38	27.31	146	39.24				
16	E28	2008/09/06	08:31:36	38	30.01	146	42.02	5326	XCT	BGN	Max: 1098m
17	E27	2008/09/06	11:19:37	38	04.96	146	42.12				
18	E27	2008/09/06	11:50:15	37	59.97	146	42.00	5404	XCT	BGN	Max: 1098m
19	E26	2008/09/06	13:21:36	37	44.97	146	42.00	5530	XCT	BGN	Max: 1098m
20	E25	2008/09/06	14:49:13	37	33.54	146	42.06				
20	E25	2008/09/06	15:05:42	37	29.99	146	42.01	5748	XCT	BGN	Max: 1098m
21	E24	2008/09/06	17:03:44	37	14.99	146	41.98	5688	XCT	BGN	Max: 1098m
22	E23	2008/09/06	18:37:36	37	03.14	146	42.00				
22	E23	2008/09/06	18:47:55	36	59.98	146	42.00	5586	XCT	BGN	Max: 1098m
23	E22	2008/09/06	20:31:55	36	44.97	146	35.98	5533	XCT	BGN	Max: 1098m
24	E21	2008/09/06	22:06:34	36	32.99	146	31.20				
24	E21	2008/09/06	22:16:54	36	29.99	146	30.00	5685	XCT	BGN	Max: 1098m
25	E20	2008/09/06	23:57:15	36	14.97	146	23.99	5652	XCT	BGN	Max: 1098m
26	E19	2008/09/07	1:21:49	36	03.73	146	22.32				
26	E19	2008/09/07	01:44:11	35	59.98	146	18.00	5643	XCT	BGN	Max: 1098m
26	E19	2008/09/07	01:54:28	36	00.92	146	18.00				
27	E18	2008/09/07	03:23:52	35	44.98	146	11.99	5751	XCT	BGN	Max: 1098m
28	E17	2008/09/07	04:54:48	35	32.65	146	07.02				
28	E17	2008/09/07	05:02:00	35	29.98	146	05.99	5827	XCT	BGN	Max: 1098m
29	E16	2008/09/07	06:38:25	35	14.98	146	00.00	5855	XCT	BGN	Max: 1098m
30	E15	2008/09/07	08:32:40	34	59.98	145	53.97	5942	XCT	BGN	Max: 1098m
31	E14	2008/09/07	10:01:55	34	44.98	145	48.00	5955	XCT	BGN	Max: 1098m
32	E13	2008/09/07	11:37:51	34	29.98	145	41.97	5921	XCT	BGN	Max: 1098m
32	E13	2008/09/07	11:38:00	34	30.01	145	41.97	5916	ARG	BGN	S/N 59
33	E12	2008/09/07	00:00:00	34	14.99	145	35.99	5885	XCT	BGN	Max: 1098m

34	E11	2008/09/07	14:54:00	34	00.00	145	29.99	5800	ARG	BGN	C/N5332 with DO
34	E11	2008/09/07	14:54:46	33	59.96	145	30.00	5802	XCT	BGN	Max: 1098m
35	E10	2008/09/07	16:25:54	33	44.97	145	24.01	5802	XCT	BGN	Max: 1098m
35	E10	2008/09/07	16:27:00	33	44.94	145	24.02	5810	ARG	BGN	C/N 62
36	E09	2008/09/07	18:13:00	33	29.99	145	18.00	5640	ARG	BGN	C/N 60
36	E09	2008/09/07	18:13:20	33	29.99	145	17.98	5645	XCT	BGN	Max: 1098m
37	E08	2008/09/07	19:51:49	33	14.98	145	12.00	5754	XCT	BGN	Max: 1098m
38	E07	2008/09/07	21:30:00	33	00.16	145	06.02	5700	ARG	BGN	C/N 61
38	E07	2008/09/07	21:33:18	32	59.99	145	05.98	5700	XCT	BGN	Max: 1098m
39	E06	2008/09/07	23:14:17	32	44.99	144	59.99	5582	XCT	BGN	Max: 1098m
40	E05	2008/09/08	01:03:00	32	29.98	144	53.98	5508	ARG	BGN	C/N 63
40	E05	2008/09/08	01:03:49	32	29.93	144	54.01	5509	XCT	BGN	Max: 1098m
41	KEO5	2008/09/12	19:42:00	32	37.13	144	27.27	5749	SBY	BGN	
41	KEO5	2008/09/12	19:50:00	32	37.07	144	27.33	5745	SBY	LFT	Buoy hull
41	KEO5	2008/09/12	19:55:00	32	37.05	144	27.34	5738	SBY	RLL	Wire
41	KEO5	2008/09/12	21:47:00	32	35.28	144	28.85	5473	SBY	RLL	Nylon rope
41	KEO5	2008/09/12	22:51:00						SBY	RLL	Polyolefin
41	KEO5	2008/09/12	23:18:00	32	31.53	144	33.00	5635	SBY		
41	KEO5	2008/09/13	00:39:00	32	29.03	144	35.50	5593	SBY	ARV	Deployment point
41	KEO5	2008/09/13	01:03:00	32	28.49	144	36.05	5706	SBY	LFT	Glass ball
41	KEO5	2008/09/13	01:20:00	32	27.88	144	36.61	5732	SBY	END	Drop the anchor
42	KEO4	2008/09/13	04:56:31	32	18.72	144	29.59	5618	XCT	BGN	Max: 1098m
42	KEO4	2008/09/13	05:23:00	32	18.11	144	27.77	5618	ARG	BGN	C/N 5196
43	W15	2008/09/13	09:37:06	32	45.01	144	06.91		XCT	BGN	Max: 1098m
44	W14	2008/09/13	12:39:00	33	00.01	143	40.78	5285	ARG	BGN	C/N 5395
44	W14	2008/09/13	12:39:52	33	00.03	143	40.78		XCT	BGN	Max: 1098m
45	W13	2008/09/13	15:34:00	33	14.99	143	14.67	5404	ARG	BGN	C/N 5200
45	W13	2008/09/13	15:34:45	33	14.99	143	14.68	2236	XCT	BGN	Max: 1098m
46	W12	2008/09/13	17:01:47	33	22.53	143	01.67	3997	XCT	BGN	Max: 1098m
47	W11	2008/09/13	18:26:57	33	30.02	142	48.57	4534	XCT	BGN	Max: 1098m
48	W10	2008/09/13	19:56:00	33	37.41	142	35.75	6191	ARG	BGN	C/N 5182
48	W10	2008/09/13	20:00:59	33	37.51	142	35.59	4401	XCT	BGN	Max: 730m
48	W10	2008/09/13	20:09:32	33	38.02	142	34.71	4398	XCT	BGN	Max: 1098m
49	W09	2008/09/13	21:33:20	33	45.01	142	22.50		XCT	BGN	Max: 1098m
50	W08	2008/09/13	23:09:00	33	52.69	142	09.71	8547	CLP	BGN	

50	W08	2008/09/13	23:22:57	33	52.97	142	09.84		XCT	BGN	Max: 1098m
50	W08	2008/09/14	00:35:00	33	54.26	142	11.01	7839	CLP	BTM	Max: 5003m
50	W08	2008/09/14	00:45:00							ENB	AR test
50	W08	2008/09/14	02:24:00	33	56.10	142	13.11	7441	CLP	END	LADCP Surface
51	KEO5	2008/09/14	17:10:00						SBY	RNG	5642m, AR sleeps
52	KEO4	2008/09/14	19:00:00	32	19.14	144	32.08		SBY	ENB	
52	KEO4	2008/09/14	19:00:00						SBY	RNG	5610m
52	KEO4	2008/09/14	19:04:00						SBY	RLS	5551,5481,5410,5344
52	KEO4	2008/09/14	20:43:00	32	16.37	144	30.51		SBY	LFT	LIFT by A-Flame
52	KEO4	2008/09/14	20:58:00	32	16.11	144	30.35		SBY	RET	Buoy full
52	KEO4	2008/09/14	21:26:00	32	15.67	144	30.08		SBY	RLL	The Wire
52	KEO4	2008/09/14	22:51:00	32	14.21	144	28.90		SBY	RLL	Nylon rope
52	KEO4	2008/09/15	00:17:00	32	13.07	144	27.38		SBY	RLL	Polyolefin rope
52	KEO4	2008/09/15	00:48:00	32	12.62	144	26.56		SBY	LFT	Lift the Glass ball
52	KEO4	2008/09/15	00:50:00	32	12.60	144	26.51		SBY	RET	Glass ball, A/R
52	KEO4	2008/09/15	00:50:00	32	12.60	144	26.51		SBY	END	
53	X10	2008/09/15	12:22:00	33	30.54	142	09.96	8918	XCT	BGN	Max: 1098m
54	X09	2008/09/15	13:54:00	33	38.83	141	54.98	9219	XCT	BGN	Max: 1098m
55	X08	2008/09/15	15:32:00	33	46.91	141	39.99	7966	XCT	BGN	Max: 1098m
56	X07	2008/09/15	17:08:00	33	55.29	141	24.98	6412	XCT	BGN	Max: 1098m
57	X06	2008/09/15	18:55:00	34	03.80	141	09.98	5047	XCT	BGN	Max: 1098m
58	X05	2008/09/15	20:44:00	34	12.39	140	54.97	4200	XCT	BGN	Max: 1098m
59	X04	2008/09/15	22:30:00	34	20.40	140	39.99	3725	XCT	BGN	Max: 1098m
60	X03	2008/09/16	00:25:00	34	28.83	140	24.99	3526	XCT	BGN	Max: 1098m
61	X02	2008/09/16	02:10:00	34	37.39	140	09.99	2665	XCT	BGN	Max: 1098m
62	X01	2008/09/16	03:56:00	34	45.55	139	54.97	2156	XCT	BGN	Max: 1098m

1) Obs.: CLP CTD with LADCP
XCT XCTD observation
SBY Recovery or deployment of the surface buoy
ARG Release of the ARGO float
RSD Radio sonde

2) Item: RET Retrieve instruments on the deck
FIX Find instruments at sea surface
ENB Send Enable Command to Acoustic Releaser

RLS	Send Release Command to Acoustic Releaser
RNG	Ranging of Acoustic Releaser
BGN	Begin CTD/LADCP lowering, XCTD Obs., radio sonde, or releasing the float
BTM	CTD/LADCP fish at the maximum depth
END	End CTD/LADCP lowering, deployment and recovery of the surface buoy
LFT	Lifting the buoy hull for recovery, or deployment
RLL	Start rolling up or unrolling the wire or rope
LEV	Leave site
ARV	Arrive to sea surface or site

4. Notice on using

"This cruise report is a preliminary documentation as of the end of the cruise. It may not be corrected even if changes on content (i.e. taxonomic classifications) are found after publication. It may also be changed without notice. Data on the cruise report may be raw or not processed. Please ask the Chief Scientist for the latest information before using.

Users of data or results of this cruise are requested to submit their results to Data Integration and Analysis Group (DIAG), JAMSTEC."