Physical data report by station

Station n°144

LMD / UMR 8539 / Paris / France
LPO / UMR 6523 / Brest / France
IBENS / INSERM 1024 stations/ CNRS 8197 / Paris / France

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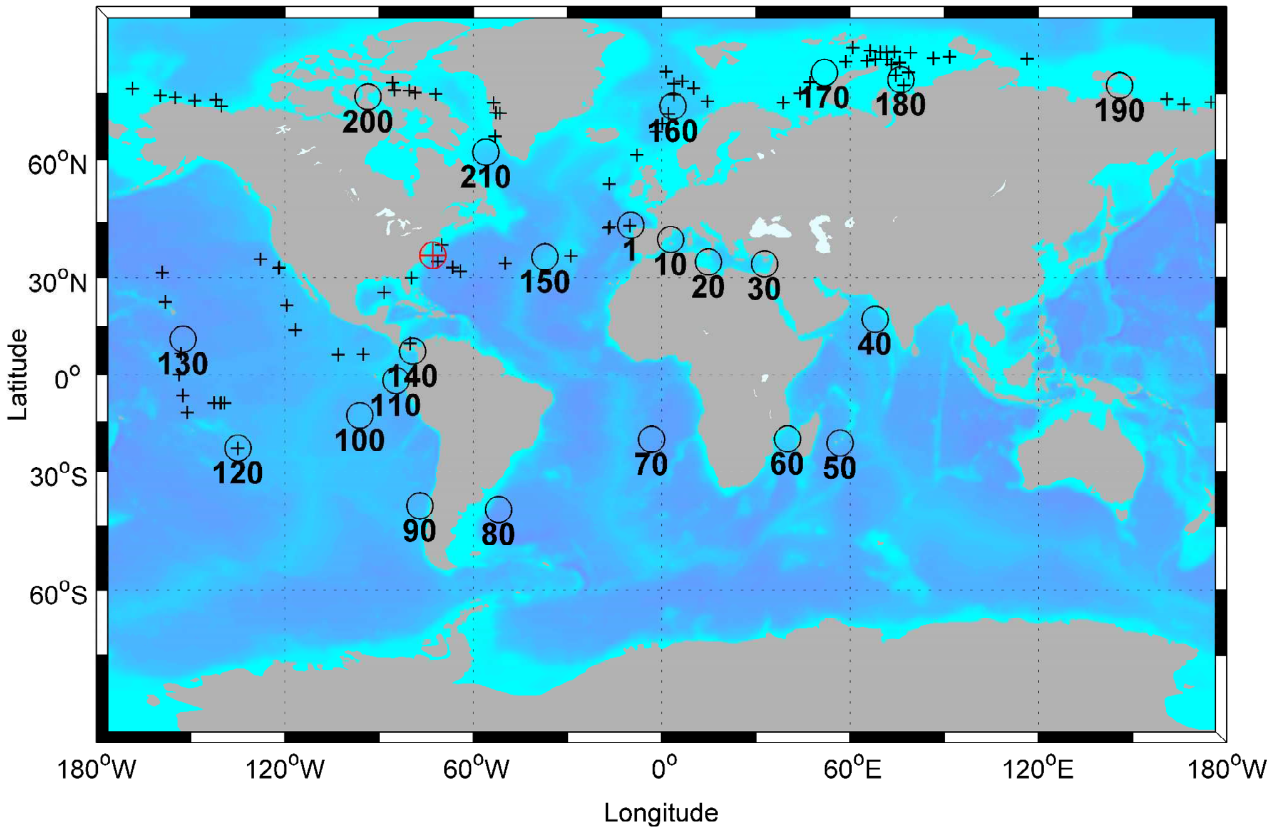
All Tara Stations



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Station overview

We present here the geographical situation of the station and a quick overview of the physical data available. For more information please see the next sections. About availability in the table below, 1 means "available" and 0 "not available".

Station n°	144
Location	North Pacific Ocean
Date	28/1/2012
Mean Longitude	-73.6278°
Mean Latitude	35.818°
CTDs profiles	10

Availability:	
UV Satellite fields	1
SST Satellite fields	1
SSS Satellite fields	1
SSH Satellite fields	1
CHL1 Satellite fields	1
Argo floats	1

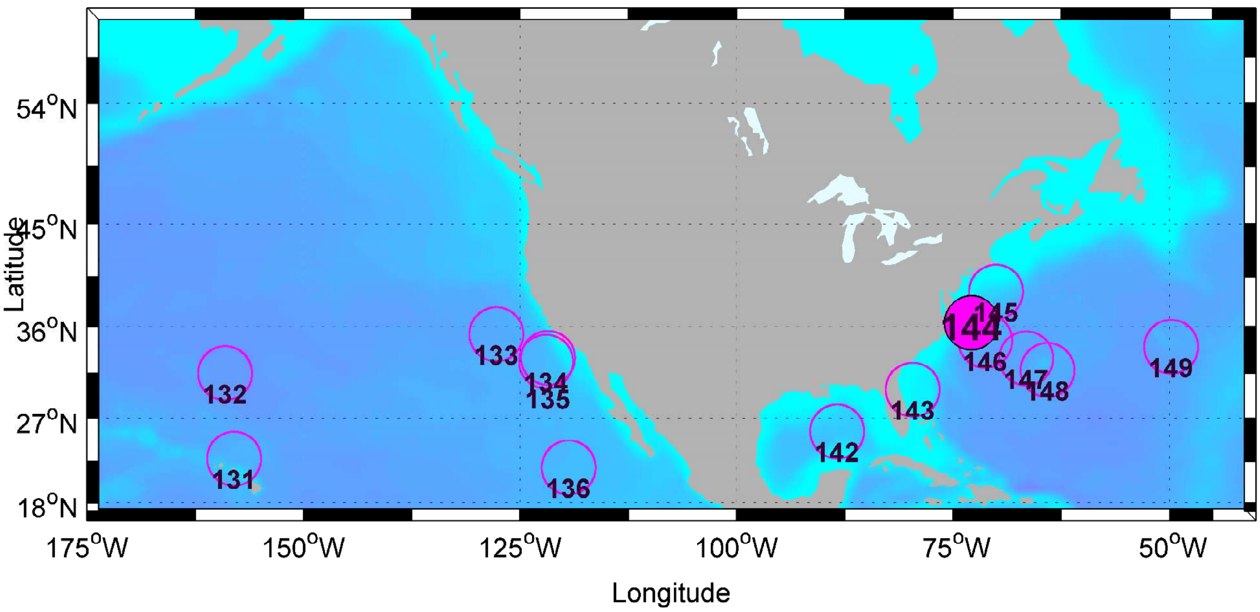

Figure 1: Filled magenta black circle indicate the station of this study.

1 Sea surface temperature, height and chlorophyll

1.1 Introduction

We present here several sea surface properties at the station position using satellite data (SSH $[m]$ in Fig.2 and Fig.3, the SST $[°C]$ in Fig.4 and Fig.5 and the CHL1 $[mg/m^3]$ in Fig.6 and Fig.7). We give definitions and information about these quantities below:

- Sea Surface Height (SSH): Maps of Absolute Dynamic Topography (MADT) from the global 1/4° (approx. $27km$) Daily Delayed Time Archiving Validation and Interpretation of Satellite Data in Oceanography (AVISO) field (Rio and Hernandez, 2004; Capet et al., 2014). The altimeter products were produced by Ssalto/Duacs and distributed by Aviso, with support from Cnes (`http://www.aviso.oceanobs.com/duacs/`).
- Sea Surface Temperature (SST): OSTIA uses satellite data provided by the GHRSST project, together with in-situ observations to determine the sea surface temperature. The analysis is performed using a variant of optimal interpolation (OI) described by Martin et al. (2007). The National Centre for Ocean Forecasting produces the analysis at a resolution of 1/20° (approx. $5km$). OSTIA data is provided in GHRSST netCDF format every day.
- Chlorophyll (CHL1): Weekly 1/10°Chlorophyll maps processed and distributed by ACRI-ST GlobColour service, supported by EU FP7 MyOcean & ESA GlobColour Projects, using ESA ENVISAT MERIS data, NASA MODIS and SeaWiFS data.

Legend In order to relieve figures we describe here their general legend:

- ● indicate the casts of Tara stations identified by their respective numbers.
- ○ are used to locate other Tara's stations around.
- □ refer to CTD profiles. When filled, each colour corresponds to a reference used in profiles plots (see CTD section) to make distinction between them.
- We indicate bathymetry by grey contours, horizontal geostrophic surface velocity field by dark arrows proportional to the current intensity, and SSH field by white contours.
- The ▼ is the nearest coast point (zlevel=0) of each ctd profile from etopo2 database
- When shown, $\bigtriangledown$ represent Argo's data available around the mean longitude and latitude position of CTDs. We defined a box around the mean position with $\Delta X \pm 4°$ $lat - lon$ and $\Delta t \pm 15$ $julian\ days$. Argo's numbers are only an index.
- Date refers to the day when SST, SSH or Chlorophyll maps are available.

1.2 SSH maps

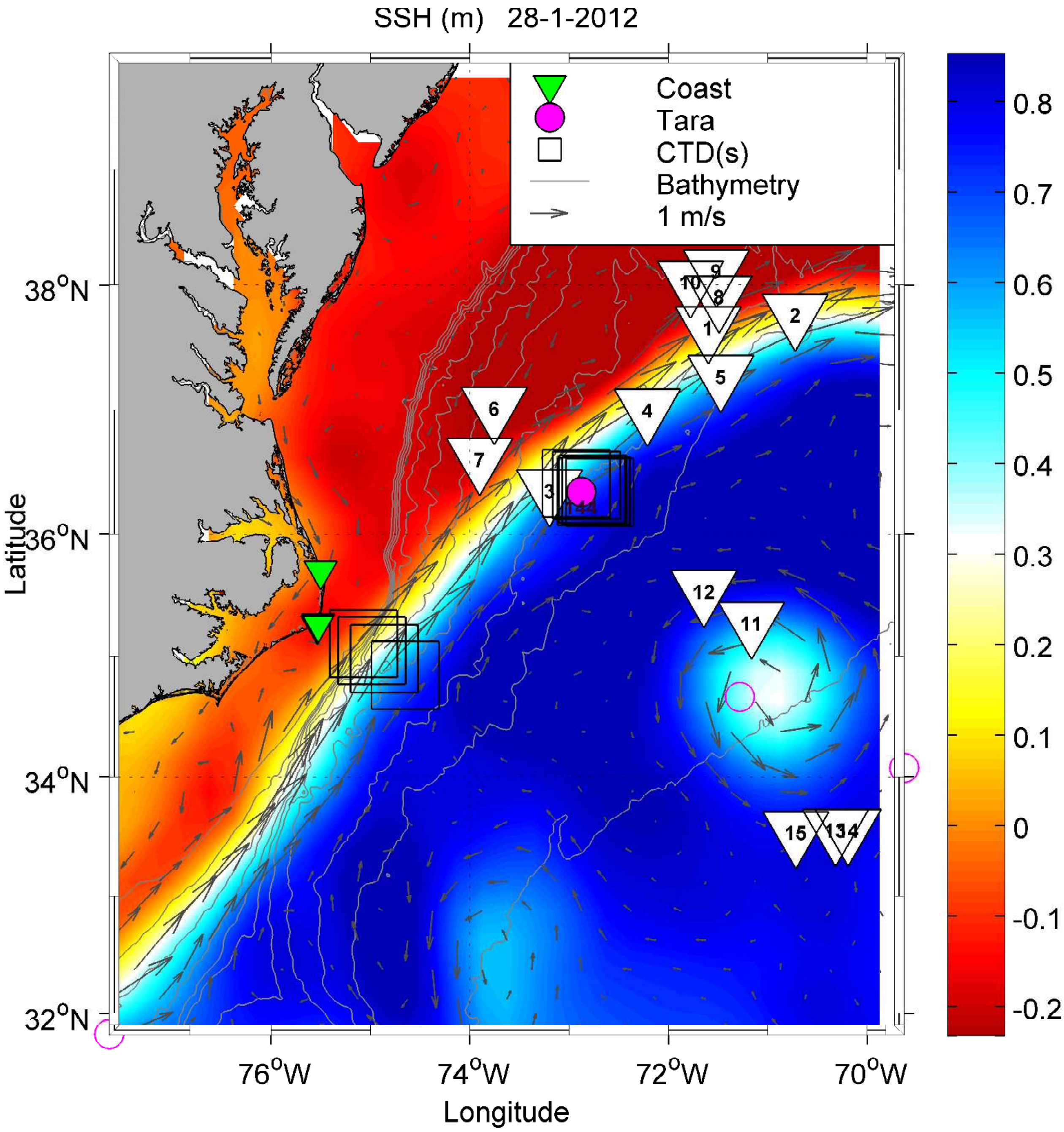

Figure 2: Description: see legend p. 14

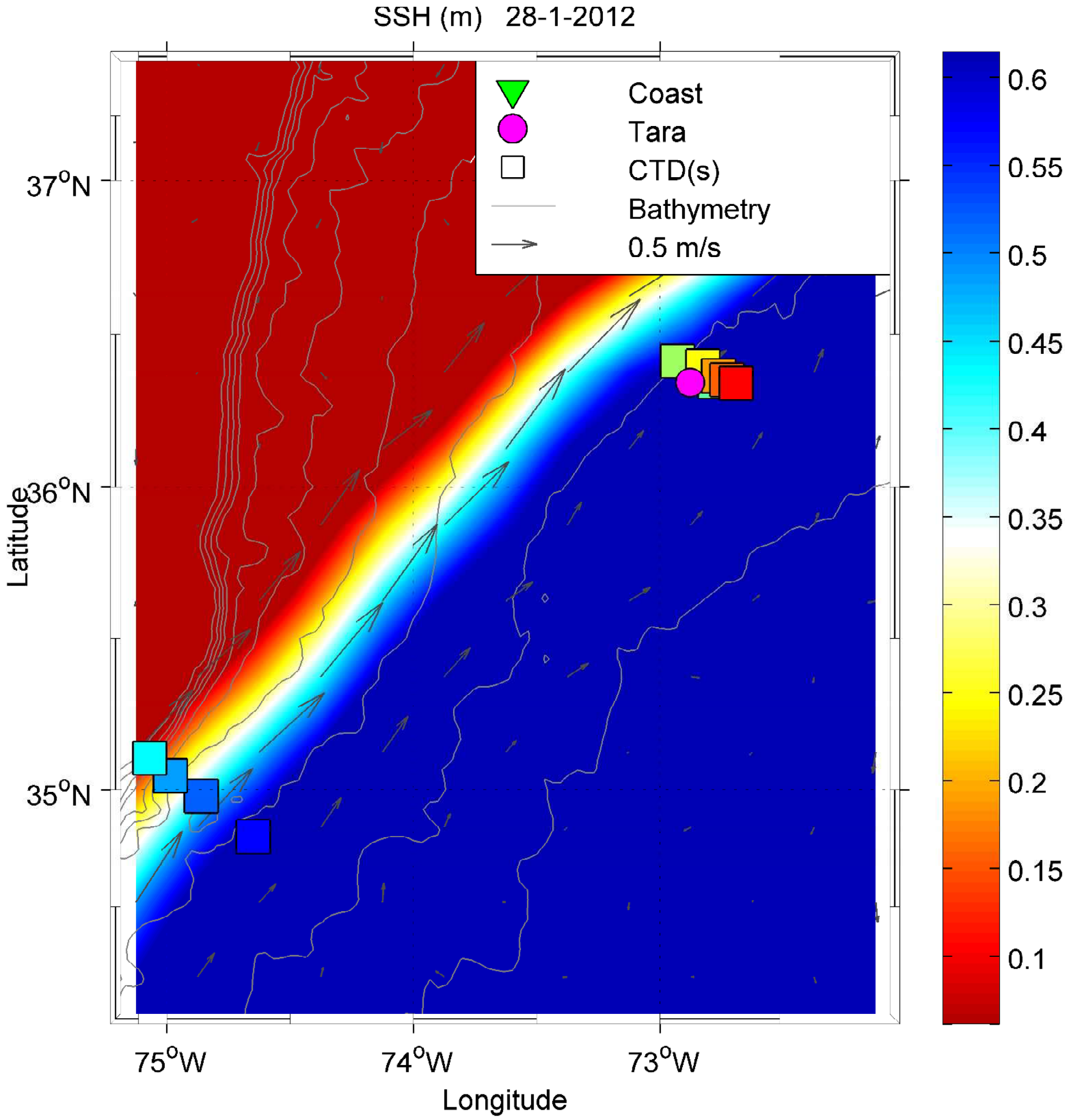

Figure 3: Description: see legend p. 14

1.3 SST maps

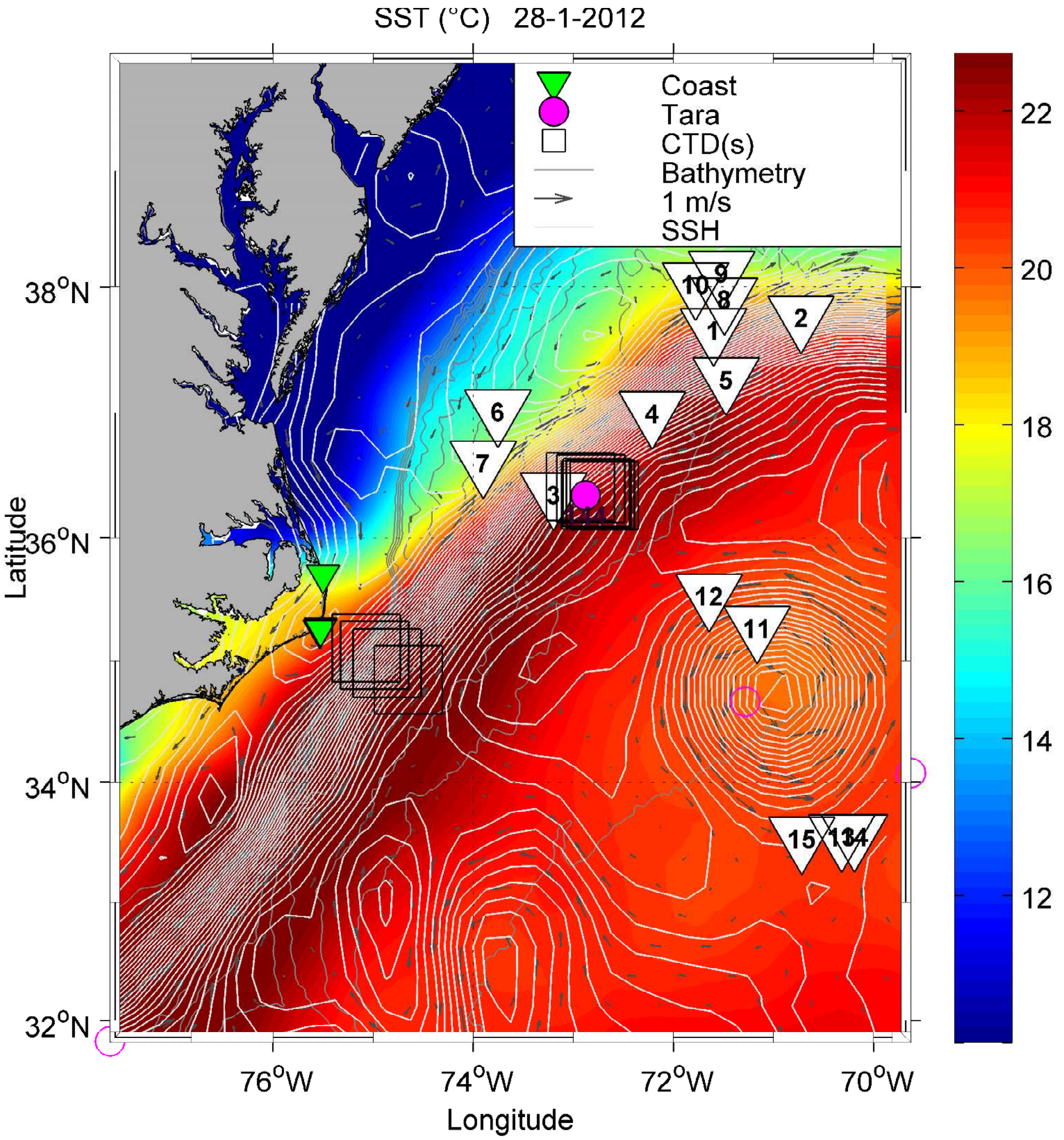

Figure 4: Description: see legend p. 14

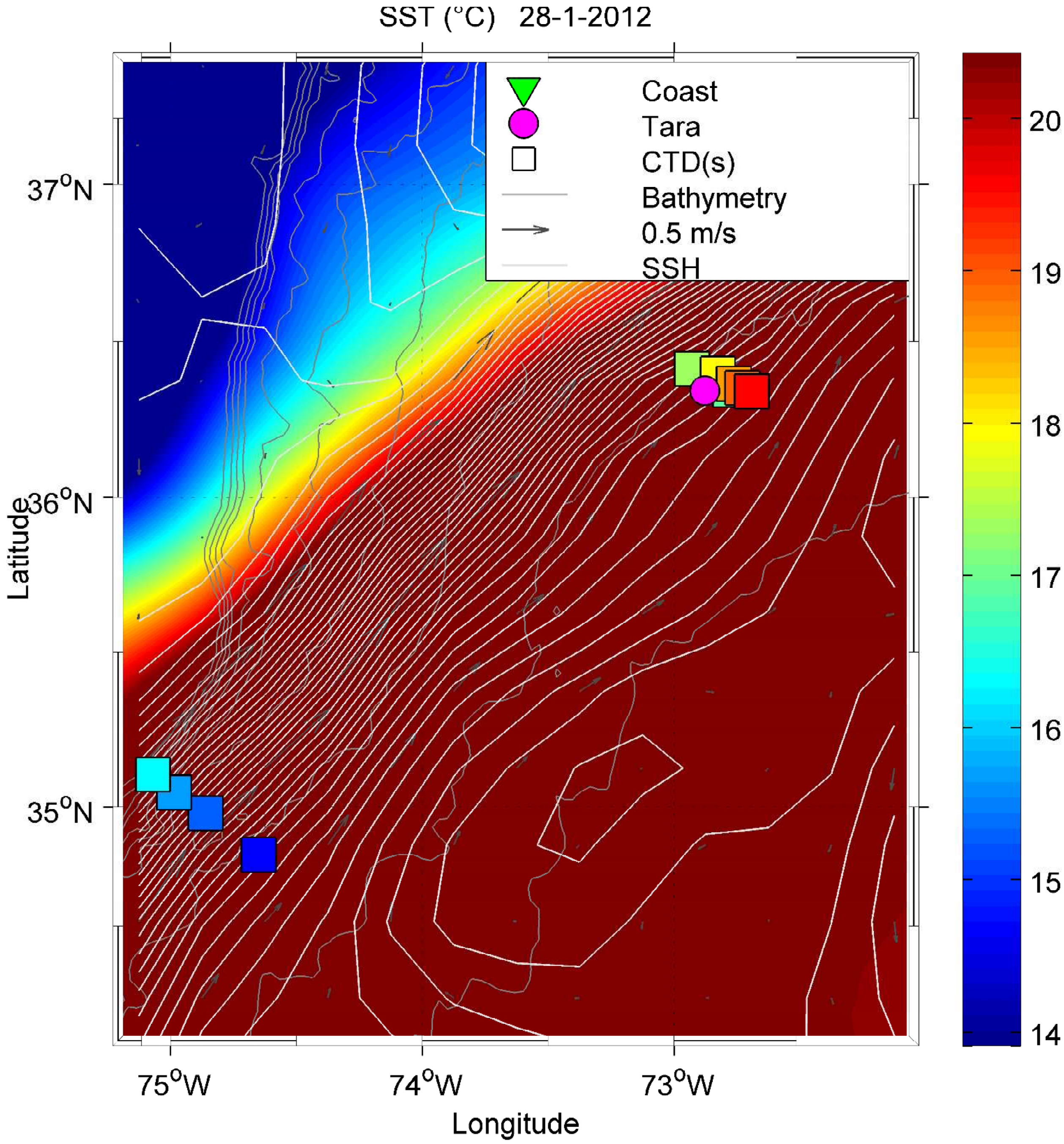

Figure 5: Description: see legend p. 14

1.4 Chlorophyl maps

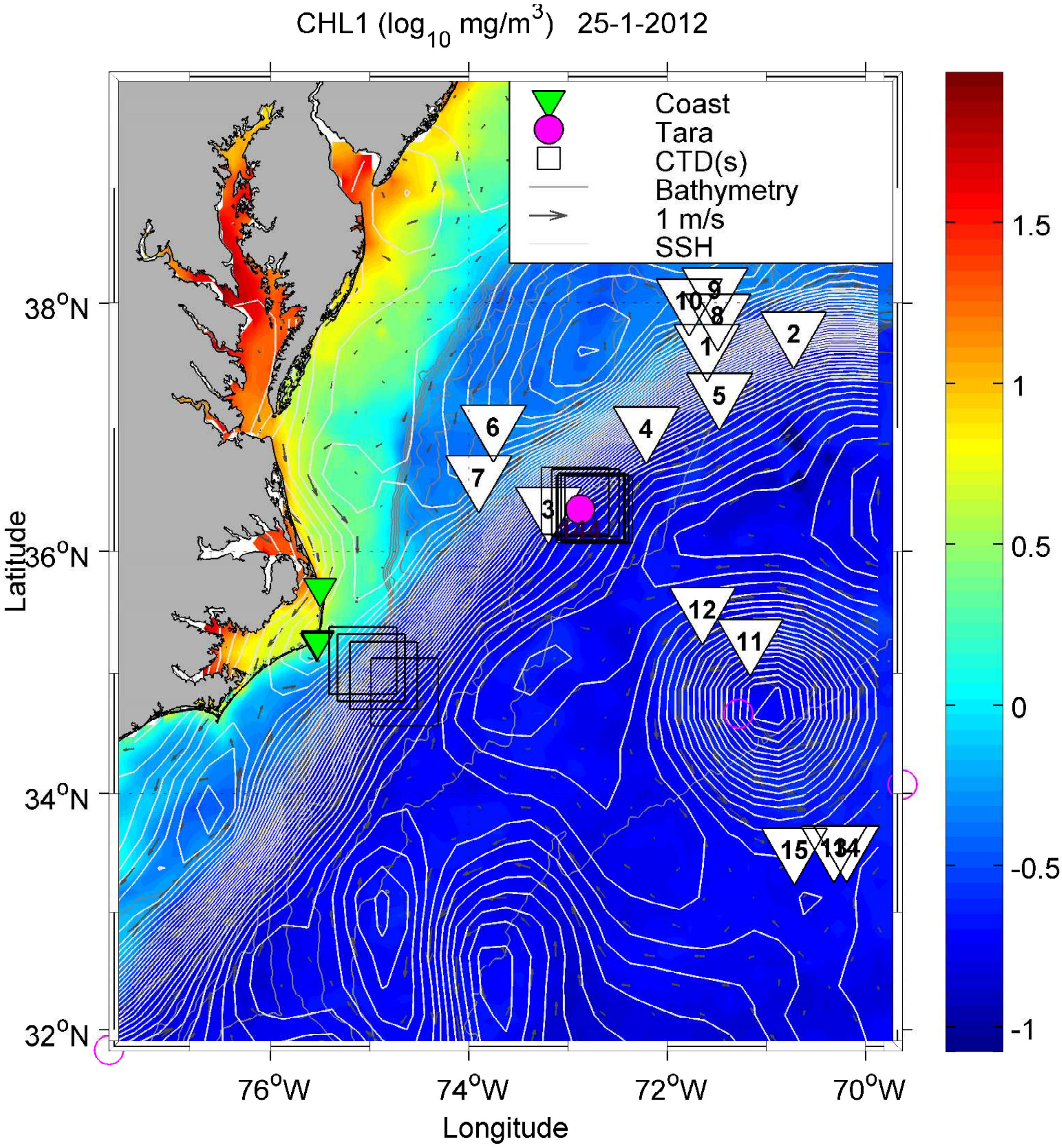

Figure 6: Description: see legend p. 14

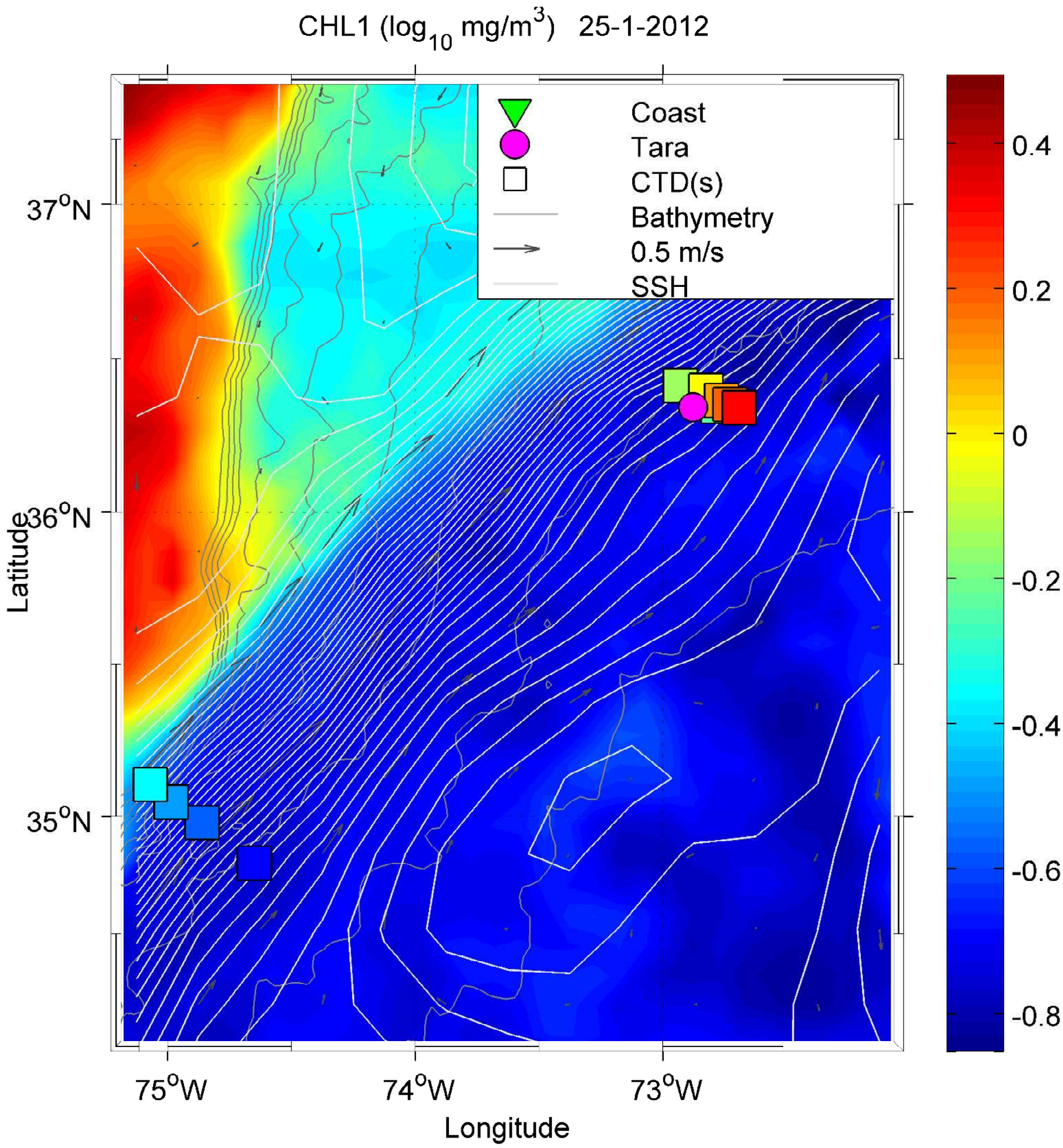

Figure 7: Description: see legend p. 14

2 TSG

2.1 Introduction

To complete the hydrological surface study, we use ThermoSalinoGraph (TSG) data measured by the Tara around the stations. Thermosalinographs are used to collect information about the sea surface, typically in flow-through systems operating continuously throughout a cruise.

We looked for the nearest TSG data available at $\Delta t \pm 15$ *julian days* around Tara stations. TSG data from the TARA OCEAN project (station 1 to 151) are validated but this is not the case of TSG data recorded during the TARA Porlar Cicle project that might present errors.24597 records satisfy these conditions. It is important to emphasize that TSG data are measure along the boat path whereas satellite data are snapshots.

TSG surface temperature is plotted over the Sea Surface Temperature measured by satellite and provided by OSTIA in figure 8.

TSG absolute salinity is plotted over the weekly Sea Surface Salinity data measured by Soil Moisture and Ocean Salinity (SMOS) mission in figure 9. The L3 SMOS data are available on the LOCEAN website (via a request form) but they still experience large biases and noise on various time and space scales. Nicolas KOLODZIEJCZYK work with a team at the LOCEAN to reduce these errors (see Hernandez et al. (2014), Kolodziejczyk et al. (2015b) and Kolodziejczyk et al. (2015a) for more information). These products are not perfect and large biases still exist but they are very promising. He gracefully gave us two types of corrected data for the context of this study:

- The most accurate set of data is composed of weekly map over the Atlantic (between 42N and 42S) with a resolution of 75 km for the period spanning from 2011 to 2013. Corrections are applied to reduce costal, large scale and seasonal orbit biases. An Optimal Interpolation using ISAS Argo interpolated products is performed.
- The other product is the 1/4 2days L3 SMOS data spanning from 30-Jun-2010 to 30-Aug-2014 on which a monthly filter and a systematic coastal bias correction are applied.

The Optimal interpolation product is not available for this station so the L3 band + coastal biais correction is ploted.

2.2 TSG Temperature maps

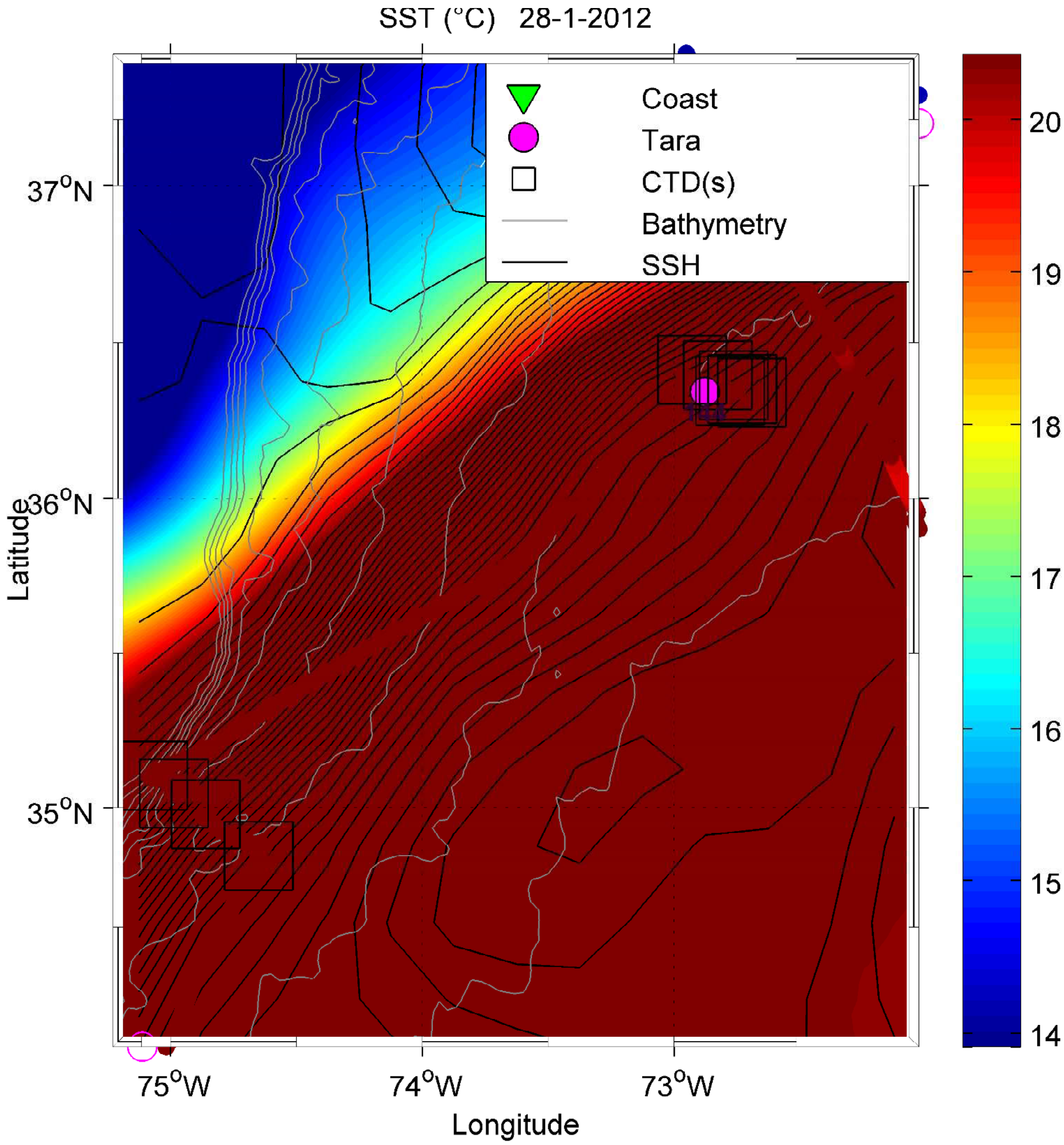

Figure 8: Description: see legend p. 14

2.3 TSG Salinity maps

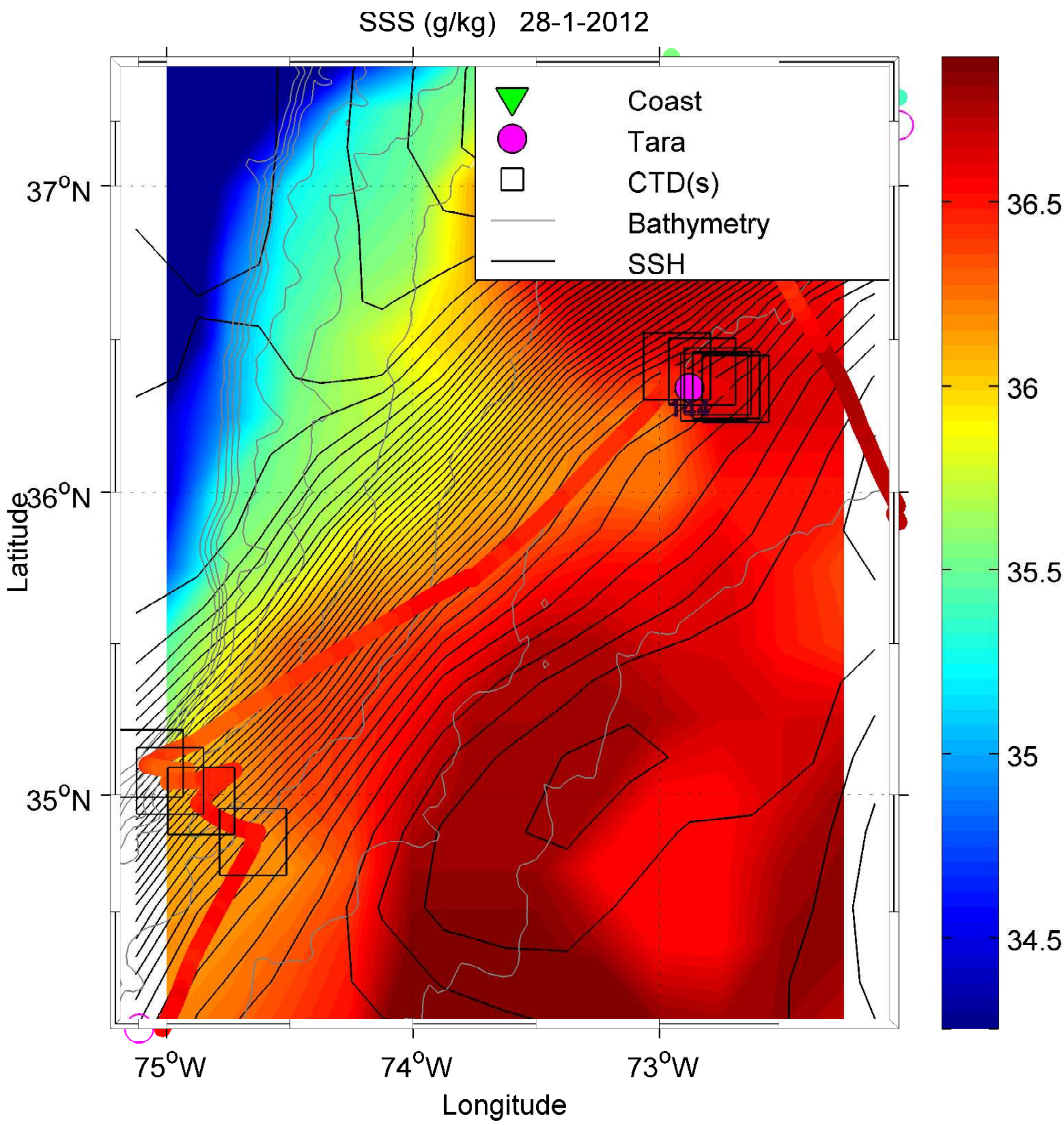

Figure 9: Description: see legend p. 14

3 Conductivity, Temperature and Depth (CTD) measurements

3.1 Introduction

In this study, CTD's measurements have been realized by a `Seabird vertical profiler`. The CTD profiles shown here are provided by the Villefranche Oceanographic Laboratory (LOV), Villefranche-Sur-Mer, France (http://www.obs-vlfr.fr/LOV/ZooPart/Portal/). Moreover, vertical profiles of Nitrate and Oxygen are provided. Additional quantities like salinity or density are then inferred using the Gibbs SeaWater (GSW) Oceanographic Toolbox (`http://www.teos-10.org/pubs/gsw/html/gsw_contents.html`).

For the Tara station n144, 10 CTD profiles are available. We calculate the potential density σ_0 referred to surface and the Brunt-Vaisala frequency (N^2). This one is a pulsation known as the "Brunt-Vaisala frequency" (s^{-2}), and given by:

$$N^2(z) = -\frac{g}{\rho_*}\frac{d\sigma}{dz} \tag{1}$$

where g is the vertical component of gravity, ρ_* a constant density value, d/dz the vertical derivative operator and σ the potential density (we use here σ_0). For more information please refer to Gerkema and Zimmerman (2008) (Eq. 3.18, p. 48 in the book). For each profile, $N^2(z)$ is calculated with a finite differences numerical scheme using $dz = 1m$. When calculated, $N^2(z)$ is averaged with a running median window on $30dbar$ (± 5 $dbar$, centred) to filter noise at small vertical scales (~ 1 m).

We calculate the depth of mixed layer using two definitions given by De Boyer Montégut et al. (2004) to determine the MLD (m). Given a potential temperature profile $\theta(z)$ or a potential density profile $\sigma(z)$, we calculate z for which:

$$|\theta(z) - \theta(10m)| \leq 0.2\ {}^\circ C \tag{2}$$

$$|\sigma(z) - \sigma(10m)| \leq 0.03\ kg/m^3 \tag{3}$$

Profiles and $\theta - S$ diagrams are presented on Fig. 10 and 11. Colors are used to distinct each CTD profile (dark blue for the first to red for the last one, "jet colorbar-like": dark blue, blue, light blue, cyan, green, yellow, orange, dark orange, red, dark red). Filled circles represent the bottle depths. We give bottles depths, and we calculate the N^2 and fluorescence maximum depths. We give the values of N^2 at all these different depths. Results are given in the Tab. 1

Several indices were computed to describe the context of CTD sampling. A season flag and a position in the season are given for each ctd sample. 4 "submesoscale" structures indices were computed at each ctd location from Satellite data. The intensity of the STT gradient and the intensity of the geostrophic currents are directly understandable. Strain rate is linked to the derivative of geostrophic current [see Waugh et al. (2006)] and Lyapunov exponent (computed by F.D'Ovidio [see d'Ovidio et al. (2004)])is a measure of the presence of a transport front where values in excess of 0.1 day-1 are typically fronts.

Legend In order to relieve figures we describe here their general legend:

- For each CTD we give the Tara's cast's number, CTD number, the bottom depth inferred from `eTopo2` bathymetry product, the distance, azimuth and position of nearest coast point (also inferred from etopo).
- Time information are then presented by giving the date in classic and julian format. Two season indices are presented: the season and the position in this season
- We give the fluo value at Max_{Fluo} depth, and a simple sum of fluo along vertical profile (from 1 to 200m, when possible).
- "Submesoscale" indices computed from satellite data are then presented.

- Ctd properties are then computed at precise depths: MLD_θ, MLD_σ, Max_{Fluo}, Max_{N^2} and each bottle depth.

3.2 CTD profiles

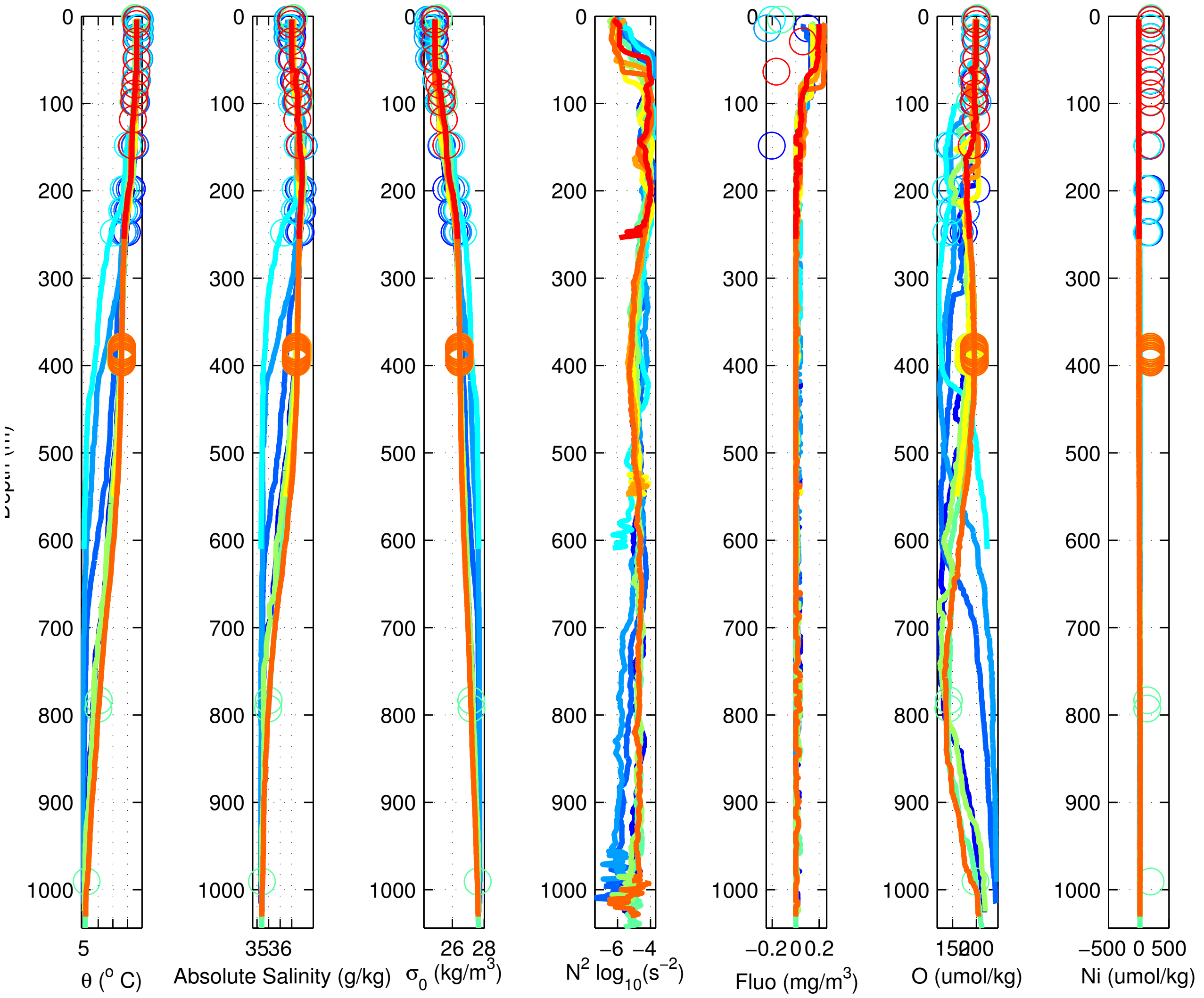

Figure 10: Description: see paragraph p. 14

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3.3 CTD $\theta - S$ diagrams

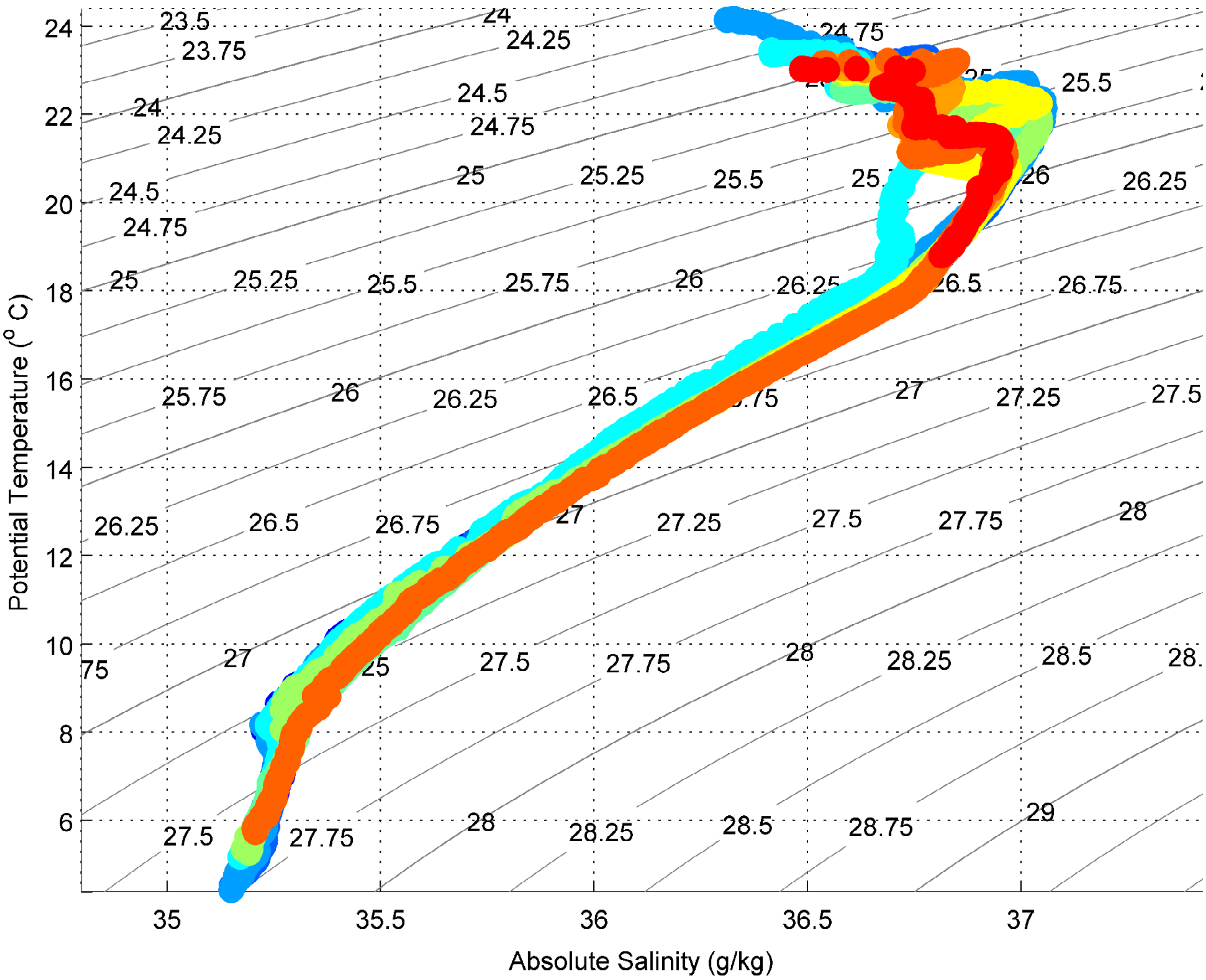

Figure 11: Description: see paragraph p. 14

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3.4 Water column characterization from CTD measurements

$Profil$	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	1	-74.6494	34.8431	1026	-3070	93/300	-75.5333	35.2533

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
28	1	2012	2455955	0	Winter	Early

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.14357	77	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
0.51502	0.79885	0.00021875	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	23.271	36.5158	24.8779	1.5805e-06	0.1299	199.9601	-3.7239
Max	1026	5.4361	35.2047	27.666	NaN	0	217.2448	16.9661
MLD_σ	50	23.239	36.5374	24.906	2.767e-05	0.1299	199.8176	-4.5624
MLD_θ	72	23.0929	36.5898	24.9895	5.1539e-05	0.13896	198.7125	-3.8134
Max_{N2}	208	21.1273	36.9882	25.8553	3.9341e-05	0.016777	174.2268	-0.77219
Max_{Fluo}	77	22.9851	36.6095	25.036	8.8103e-05	0.14357	199.1634	-3.7454
Max_O	1026	5.4361	35.2047	27.666	NaN	0	217.2448	16.9661
Min_O	703	10.3653	35.4252	27.1081	4.5221e-06	0.015892	118.7621	22.1727
$Depth\ Nitro$	310	18.5922	36.7901	26.3801	7.5179e-06	0.034124	185.9514	0.082671
B i1	250	19.641	36.8745	26.1709	3.0637e-05	0.015433	164.521	0.051137
B i2	225	20.2762	36.9394	26.0504	5.2235e-05	0.01678	169.5321	-2.5499
B i3	200	21.7279	37.0097	25.7043	0.00027045	0.040949	161.1372	-1.3822
B i4	150	22.526	36.854	25.3575	9.3236e-05	0.039875	190.4595	-3.9708
B i5	100	22.8868	36.7112	25.1427	5.3981e-06	0.070524	197.141	-3.2677
B i6	75	23.045	36.5973	25.0093	8.2557e-05	0.14169	198.5182	-4.2742
B i7	50	23.239	36.5374	24.906	2.767e-05	0.1299	199.8176	-4.5624
B i8	25	23.2757	36.5188	24.8797	6.7369e-07	0.13133	199.6179	-3.6501
B i9	15	23.274	36.5158	24.8774	2.9533e-07	0.1299	199.9312	-4.2278
B i10	5	23.2612	36.5157	24.8804	1.9198e-06	NaN	200.0841	-4.533

Table 1:

$Profil$	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	2	-74.8602	34.979	1016	-2840	68/298	-75.525	35.2667

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
28	1	2012	2455955	0	Winter	Early

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.14195	51	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
1.3763	1.392	8.1911e-05	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	23.3926	36.4476	24.7908	6.8016e-07	0.065502	200.8369	-2.3237
Max	1016	4.583	35.1504	27.7209	NaN	0	240.9487	16.0552
MLD_σ	49	23.4071	36.4887	24.82	3.6609e-05	0.14235	199.8325	-2.7116
MLD_θ	93	23.2287	36.7817	25.096	7.8094e-05	0.079653	194.5469	-2.711
Max_{N2}	173	21.9596	36.9664	25.6048	9.185e-05	0.033497	181.8359	-1.2567
Max_{Fluo}	51	23.4021	36.5007	24.8306	1.6552e-05	0.14195	199.6867	-2.8949
Max_O	1016	4.583	35.1504	27.7209	NaN	0	240.9487	16.0552
Min_O	543	11.9832	35.6624	26.9937	7.8567e-05	0.037699	124.6323	18.4952
$Depth\ Nitro$	323	17.2342	36.5294	26.5176	2.507e-05	0.0074209	151.0479	3.8724
B i1	250	18.8838	36.8057	26.3149	2.5549e-05	0	177.199	2.3462
B i2	225	19.6362	36.8804	26.1754	5.5905e-06	0.014807	171.784	-0.44845
B i3	200	20.5883	36.9606	25.9811	0.00012163	0.02631	168.3213	-0.59081
B i4	150	22.4749	36.831	25.3548	3.0977e-05	0.040949	199.0882	-2.9227
B i5	100	22.9368	36.7503	25.1577	8.9775e-05	0.079653	195.5749	-1.9998
B i6	75	23.0966	36.6455	25.0307	2.2887e-05	0.13051	196.856	-1.5815
B i7	50	23.4036	36.4969	24.8272	4.8003e-05	0.14196	199.8022	-3.3279
B i8	25	23.4019	36.4491	24.7901	2.2031e-06	0.11119	200.3826	-1.0807
B i9	15	23.393	36.4476	24.791	1.9711e-06	0.066985	201.351	-1.8707
B i10	5	23.3927	36.4472	24.7902	6.2283e-07	NaN	200.7942	-3.2703

Table 2:

$Profil$	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	3	-74.9857	35.0464	991	-2386	55/297	-75.525	35.2667

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
28	1	2012	2455955	0	Winter	Early

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.20759	38	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
3.8563	1.4648	0.00014223	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	24.1353	36.3111	24.4678	1.6376e-06	0.18188	198.4116	-1.9504
Max	991	4.4987	35.1501	27.7296	NaN	0	242.8645	18.5553
MLD_σ	43	24.1212	36.3386	24.4949	2.6731e-05	0.19574	196.1987	-1.2815
MLD_θ	52	23.951	36.4096	24.5997	0.00026435	0.18188	196.4155	-1.4521
Max_{N^2}	56	23.6114	36.5074	24.7744	0.00061152	0.16973	195.7379	-1.9529
Max_{Fluo}	38	24.1601	36.3306	24.4769	8.6436e-06	0.20759	196.0558	-1.8513
Max_O	990	4.4993	35.1501	27.7296	2.727e-07	0	243.1913	17.9268
Min_O	423	9.9313	35.3941	27.1524	3.4448e-06	0.00060722	122.6617	23.7139
$Depth\ Nitro$	331	15.5134	36.2176	26.6805	5.731e-05	0.019255	137.7397	14.1586
B i1	250	18.3163	36.6935	26.3733	9.0755e-06	0	154.2702	6.0678
B i2	225	18.8409	36.7637	26.2928	7.553e-06	0.019911	151.4113	4.4993
B i3	200	19.4873	36.845	26.1863	4.5464e-05	0.01052	149.6768	4.8386
B i4	150	21.2481	37.0142	25.8385	3.7833e-05	0.03938	145.4523	3.9043
B i5	100	22.3877	36.6927	25.2722	9.197e-06	0.10035	201.7654	-1.2524
B i6	75	22.913	36.6138	25.0601	0.00014122	0.14045	200.9429	-2.4821
B i7	50	24.009	36.3989	24.5742	0.00010939	0.18995	195.4784	-1.2886
B i8	25	24.1626	36.3248	24.4709	2.1874e-06	0.19388	196.6896	-1.4362
B i9	15	24.1403	36.3107	24.4664	4.5188e-06	0.18188	198.5273	-2.3569
B i10	5	24.1388	36.311	24.4664	2.8431e-07	NaN	198.455	-0.74669

Table 3:

$Profil$	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	4	-75.0689	35.1042	610	-570	45/294	-75.525	35.2667

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
29	1	2012	2455956	0	Winter	Early

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.24256	13	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
5.8407	1.3567	0.0001776	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	23.4455	36.4157	24.7512	2.2824e-06	0.24269	199.5769	-0.12803
Max	610	5.2159	35.171	27.661	NaN	0	222.8977	19.0602
MLD_σ	45	23.36	36.4161	24.7788	3.4575e-05	0.19743	197.9685	-0.0088537
MLD_θ	56	23.3543	36.5899	24.9122	0.000395	0.16394	186.0819	0.47901
Max_{N^2}	106	22.4811	36.8712	25.3807	0.00042315	0.073535	152.545	2.979
Max_{Fluo}	13	23.4441	36.4158	24.7519	NaN	0.24256	199.8714	-0.35348
Max_O	608	5.2181	35.1714	27.661	1.6881e-06	0	222.97	18.8916
Min_O	321	10.7701	35.483	27.0731	3.8636e-05	0.040949	120.2824	24.1391
$Depth\ Nitro$	226	16.8314	36.3975	26.5092	0.00017788	0.02128	138.9964	11.1316
B i1	250	14.519	36.026	26.7499	0.00011169	0.040949	132.6948	15.958
B i2	225	17.0234	36.4328	26.4904	0.00021098	0.021356	139.6239	10.2761
B i3	200	18.6542	36.6984	26.2895	3.0605e-05	0.012229	143.4834	7.5274
B i4	150	19.9323	36.7038	25.9594	0.00023173	0.063145	135.8452	6.3365
B i5	100	22.6697	36.7378	25.2255	7.581e-05	0.074993	169.4448	1.2059
B i6	75	22.7011	36.5859	25.1002	1.2041e-05	0.091086	193.0673	-0.74422
B i7	50	23.3946	36.4539	24.7975	4.5874e-05	0.16578	195.1572	0.89309
B i8	25	23.4449	36.4169	24.7532	NaN	0.2279	199.0334	-0.98019
B i9	15	23.4506	36.4162	24.7505	1.249e-06	0.24256	199.3513	-0.2212
B i10	5	23.445	36.416	24.7513	1.7855e-06	NaN	200.0902	-0.31566

Table 4:

Profil	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	5	-72.7769	36.3448	1044	-3585	255/254	-75.5	35.7

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
29	1	2012	2455956	1	Winter	Early

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.18188	14	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
2.3039	0.52243	0.0010927	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	22.5619	36.5826	25.1339	4.3574e-07	0.19743	202.4875	-0.18491
Max	1044	5.6063	35.1967	27.6393	NaN	0	211.797	20.1116
MLD_σ	66	22.5289	36.6002	25.1599	4.1335e-05	0.16578	200.361	-0.23838
MLD_θ	76	22.4265	36.7588	25.3097	0.00015565	0.066985	198.6195	0.67962
Max_{N^2}	77	22.3704	36.7553	25.3231	8.5873e-05	0.063329	198.5516	-0.11539
Max_{Fluo}	14	22.5659	36.5832	25.1334	5.6822e-08	0.18188	202.2689	0.62947
Max_O	1044	5.6063	35.1967	27.6393	NaN	0	211.797	20.1116
Min_O	791	10.0847	35.4839	27.2039	1.0849e-05	0	139.9713	22.686
$Depth\ Nitro$	613	14.4026	36.0622	26.8148	4.1185e-05	0	143.0358	13.5564
B i1	1055	NaN	NaN	NaN	NaN	NaN	NaN	NaN
B i2	1000	6.0119	35.2079	27.5973	1.1265e-05	0	200.5778	20.2501
B i3	800	9.8826	35.459	27.2189	1.2576e-05	0	140.2646	22.738
B i4	790	10.0903	35.4825	27.2018	9.2525e-06	0	140.5443	21.9705
B i5	400	17.9532	36.7232	26.4932	1.3854e-05	0	192.0445	4.8896
B i6	390	18.0084	36.7314	26.4852	5.9886e-06	0	194.2025	3.1977
B i7	100	21.8706	36.7924	25.4942	4.6417e-05	0.040949	201.1307	0.82019
B i8	90	22.1837	36.7853	25.3997	NaN	0.040949	196.3688	0.78012
B i9	5	22.5505	36.5831	25.1373	7.1087e-07	NaN	202.64	0.34399
B i10	2	NaN	NaN	NaN	NaN	NaN	NaN	NaN

Table 5:

Profil	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	6	-72.9289	36.4121	1025	-3477	245/252	-75.5	35.7

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
30	1	2012	2455957	1	Winter	Early

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.14223	16	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
3.8816	0.90294	0.00037486	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	22.9594	36.5772	25.0151	2.4732e-07	0.13347	199.8544	-0.2369
Max	1025	5.3444	35.1915	27.6665	NaN	0.012708	219.4746	19.738
MLD_σ	80	22.961	36.6106	25.044	6.9239e-05	0.11231	198.4036	1.4723
MLD_θ	131	22.7887	36.783	25.2271	5.4915e-05	0.037823	194.5773	0.30312
Max_{N^2}	190	21.5369	37.029	25.7717	3.079e-05	0.00086501	146.6029	5.1165
Max_{Fluo}	16	22.9692	36.578	25.0132	4.6475e-07	0.14223	200.5586	0.11157
Max_O	1025	5.3444	35.1915	27.6665	NaN	0.012708	219.4746	19.738
Min_O	671	11.6442	35.6392	27.043	1.7768e-05	0.003727	121.5673	19.1562
$Depth\ Nitro$	544	14.8064	36.1358	26.7819	4.9118e-05	0.00057473	150.1462	10.9583
B i1	400	17.5833	36.6396	26.5203	2.2992e-05	0	181.7805	4.552
B i2	398	17.6398	36.6496	26.514	2.4689e-05	0	181.4515	3.9751
B i3	396	17.6683	36.6536	26.51	1.3791e-05	0	181.8838	5.5282
B i4	394	17.691	36.6576	26.5074	1.2433e-05	0	182.7503	6.2769
B i5	392	17.7287	36.6638	26.5028	2.273e-05	0.01428	182.6408	5.8151
B i6	390	17.7338	36.6644	26.5019	4.7441e-06	0.01428	183.0663	5.4341
B i7	388	17.7446	36.6658	26.5003	5.8113e-06	0	182.8788	4.8294
B i8	386	17.7556	36.6677	26.4989	8.2095e-06	0	183.1801	4.3913
B i9	384	17.7737	36.6709	26.4968	2.0657e-05	0	183.2771	4.8472
B i10	382	17.8355	36.6819	26.4899	3.9553e-05	0	183.2175	6.6366

Table 6:

Profil	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	7	-72.8261	36.3955	550	-3547	253/253	-75.5	35.7

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
30	1	2012	2455957	1	Winter	Early

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.14757	51	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
3.2782	0.72011	0.00013088	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	22.9684	36.5906	25.0226	1.088e-06	0.13208	199.6957	1.073
Max	550	15.2804	36.2255	26.7465	NaN	0	160.0604	10.2841
MLD_σ	91	22.9843	36.6182	25.0437	0.00012462	0.1299	197.7736	1.2857
MLD_θ	109	22.7905	36.7211	25.1785	6.2087e-06	0.040949	196.6314	-0.094768
Max_{N^2}	147	22.509	36.8713	25.3752	0.00011692	0.0058879	173.8982	0.94148
Max_{Fluo}	51	22.9845	36.5941	25.023	1.9438e-07	0.14757	199.396	0.8797
Max_O	191	20.9803	36.7947	25.7481	1.5038e-06	0.039735	204.5317	0.76222
Min_O	546	15.4078	36.2489	26.7359	3.3423e-05	0.040949	160.008	10.2624
$Depth\ Nitro$	547	15.3719	36.2473	26.7428	4.1767e-05	0.00098415	160.298	10.154
B i1	400	17.7945	36.6741	26.4949	5.6781e-06	0	182.8657	5.9959
B i2	398	17.7951	36.675	26.4953	1.921e-06	0.011328	182.7037	3.7113
B i3	396	17.8261	36.6818	26.4927	1.8863e-05	0.010863	182.8961	5.8982
B i4	394	17.8471	36.6861	26.4908	5.6697e-06	0.011328	183.2501	4.7113
B i5	392	17.8763	36.6913	26.4874	1.7023e-05	0.012857	183.9822	3.7762
B i6	390	17.882	36.6911	26.4858	7.8376e-06	0.026355	184.6545	7.6211
B i7	388	17.879	36.6884	26.4844	3.0592e-06	0.025321	185.0937	3.9049
B i8	386	17.8779	36.6877	26.484	1.5901e-06	0.015963	184.3597	4.1977
B i9	384	17.8929	36.6914	26.4831	5.7921e-06	0.013542	183.3574	6.9758
B i10	382	17.9076	36.6944	26.4816	1.3533e-05	0	183.3582	4.6673

Table 7:

Profil	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	8	-72.7629	36.3642	548	-3594	257/254	-75.5	35.7

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
31	1	2012	2455958	1	Winter	Middle

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.20085	23	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
2.6731	0.61097	0.00067062	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	23.1255	36.543	24.941	3.9541e-07	0.19743	199.3113	2.2459
Max	548	16.2712	36.4049	26.659	NaN	0.035557	175.8774	9.6435
MLD_σ	71	23.104	36.5661	24.9683	0.00014461	0.16977	198.1354	1.7704
MLD_θ	94	23.0499	36.8345	25.1881	0.00015785	0.040949	193.8504	1.5979
Max_{N^2}	196	20.7912	36.9426	25.9121	0.00010058	0.029346	179.7854	2.1575
Max_{Fluo}	23	23.1075	36.5432	24.9471	6.3961e-07	0.20085	199.1334	1.2722
Max_O	149	21.2014	36.7422	25.6453	1.4211e-05	0.066985	204.4021	1.2851
Min_O	546	16.2853	36.4101	26.6596	1.7081e-05	0	175.484	8.5456
$Depth\ Nitro$	544	16.3158	36.413	26.6547	5.3895e-06	0	175.7972	8.4633
B i1	400	18.0215	36.7393	26.4885	NaN	0	195.4328	4.511
B i2	398	18.0286	36.7404	26.4875	7.7815e-06	0	195.5986	3.9913
B i3	396	18.0394	36.7425	26.4863	2.8072e-06	0	195.8253	4.0854
B i4	394	18.0466	36.7438	26.4855	6.2951e-06	0	196.3069	4.2488
B i5	392	18.0503	36.7432	26.484	4.512e-06	0	196.426	5.4548
B i6	390	18.0509	36.743	26.4836	1.5184e-06	0	196.3333	5.1289
B i7	388	18.0565	36.7441	26.483	3.0141e-06	0	195.941	3.6499
B i8	386	18.064	36.7456	26.4821	7.068e-06	0	195.3116	4.2268
B i9	384	18.0654	36.7446	26.4809	3.3406e-06	0.012434	195.3426	2.3681
B i10	382	18.0738	36.7464	26.4801	4.9895e-06	0	195.4386	3.9178

Table 8:

$Profil$	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	9	-72.7286	36.3511	1031	-3628	260/255	-75.5	35.7

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
31	1	2012	2455958	1	Winter	Middle

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.24414	51	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
2.3602	0.56378	0.00064875	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	23.1399	36.54	24.9345	8.599e-07	0.24303	197.6979	1.3419
Max	1031	5.824	35.2065	27.6201	NaN	0	204.9051	19.0715
MLD_σ	80	23.184	36.5411	24.9267	0.00015108	0.22713	186.2913	-0.17263
MLD_θ	96	22.9917	36.8168	25.1918	6.7817e-05	0.052422	189.0897	2.0095
Max_{N^2}	119	21.8877	36.7358	25.4476	9.8493e-05	0.072363	199.9439	2.3035
Max_{Fluo}	51	23.1696	36.5388	24.9273	5.2539e-07	0.24414	196.7762	0.7248
Max_O	1029	5.8404	35.2076	27.6189	1.1685e-05	0	205.0801	20.3628
Min_O	748	11.2819	35.6089	27.0883	2.2047e-05	0	133.7704	21.1471
$Depth\ Nitro$	1027	5.8649	35.2068	27.6152	1.4262e-05	0	203.6078	21.4295
B i1	400	17.9572	36.7311	26.4981	1.0721e-05	0	196.5097	5.5399
B i2	398	17.9693	36.7326	26.4962	1.6093e-06	0	196.0075	5.1489
B i3	396	17.972	36.7341	26.4966	2.0127e-06	0	195.7771	4.4785
B i4	394	17.9867	36.7368	26.4949	NaN	0	196.0054	3.7601
B i5	392	17.9934	36.7382	26.4942	5.1386e-06	0	196.2852	5.5293
B i6	390	18.0028	36.7388	26.4923	1.101e-05	0	196.7687	4.9134
B i7	388	18.0087	36.7388	26.4907	NaN	0	196.0045	4.8271
B i8	386	18.0102	36.7383	26.4899	3.2283e-06	0	196.7239	4.408
B i9	384	18.0205	36.7392	26.4879	8.1291e-06	0	195.3033	5.0954
B i10	382	18.0253	36.7408	26.4879	4.8282e-06	0	195.981	4.8393

Table 9:

$Profil$	CTD	Lon	Lat	CTD Depth max (m)	Bathy (m)	Dist[km]/azimuth[°] coast	Lon coast	Lat coast
144	10	-72.6908	36.3396	255	-3657	263/255	-75.5	35.7

Day	Month	Year	Julian day	Core biology Flag	Season	Season part (early-middle-late)
31	1	2012	2455958	1	Winter	Middle

$Max_{Fluo}(mg/m^3)$	Depth (m)	Sum $Fluo$ $1-200m(mg/m^3)$
0.19876	14	57.841

Intensity SST Gradient $(°/100km)$	Intensity Geostrophic current (m/s)	Strain $rate$ (s^{-2})	Lyapunov exponent $(1/days)$
2.1983	0.51857	0.00062478	0.26876

	Depth (m)	T $(°C)$	AS (g/kg)	σ_0 (kg/m^3)	N^2 (s^{-2})	$Fluo$ (mg/m^3)	O $(\mu mol/kg)$	Ni $(\mu mol/kg)$
$10m$	10	23.0304	36.487	24.9264	5.4722e-07	0.19743	200.0199	3.7885
Max	255	18.8385	36.813	26.3323	NaN	0	186.0289	5.5069
MLD_σ	59	23.0114	36.5073	24.9501	5.7199e-05	0.17148	195.256	1.5394
MLD_θ	66	22.8875	36.728	25.1531	0.00016395	0.12252	194.9388	3.315
Max_{N^2}	65	22.9543	36.739	25.1421	8.5038e-05	0.1299	193.8353	2.7805
Max_{Fluo}	14	23.0313	36.4873	24.9266	9.5128e-07	0.19876	199.7676	2.231
Max_O	21	23.0302	36.4871	24.9271	2.1353e-06	0.19743	200.1283	1.3837
Min_O	164	21.5443	36.9306	25.6938	0.00021222	0.005584	177.787	3.5962
$Depth\ Nitro$	254	18.8401	36.8133	26.332	1.2514e-06	0	185.4765	4.5933
B i1	150	21.5599	36.8594	25.6347	1.1791e-05	0.040949	189.094	2.8107
B i2	120	21.7772	36.7505	25.4898	0.00010352	0.047692	198.7292	1.7748
B i3	100	22.2879	36.7694	25.3587	0.00011668	0.040949	196.5078	3.3122
B i4	90	22.3696	36.7454	25.3166	3.1183e-05	0.057019	196.7544	2.6301
B i5	80	22.6188	36.6872	25.2007	3.326e-05	0.091086	195.9023	3.1863
B i6	65	22.9543	36.739	25.1421	8.5038e-05	0.1299	193.8353	2.7805
B i7	50	23.0265	36.4904	24.9325	8.6852e-06	0.18878	199.7339	1.1245
B i8	30	23.0205	36.4874	24.9307	5.2975e-07	0.1902	199.5213	0.58398
B i9	10	23.0304	36.487	24.9264	5.4722e-07	0.19743	200.0199	3.7885
B i10	5	23.018	36.4873	24.9299	9.4241e-07	NaN	200.6549	3.2008

Table 10:

4 ARGO

4.1 Introduction

To complete the CTD study, we use ARGO data available around Tara's stations. ARGO is a global array of autonomous profiling floats that observe pressure, temperature and salinity in the upper $2000m$ of the ocean. These data were collected and made freely available by the International Argo Program and the national programs that contribute to it (http://www.argo.ucsd.edu, http://argo.jcommops.org).

The Argo Program is part of the Global Ocean Observing System. The ARGO profiles were downloaded on the Aviso ftp web site where only pressure (P), temperature (T), and salinity (S) data. However, some of these profiles were still suspicious so applied another analysis in the same way that Chaigneau et al. (2011) using the following conditions:

- Data flagged as good and probably good (Argo quality flag 1 and 2)
- The shallowest data above 15 dbar and the deepest data below 300m
- A difference of pressure level inferior than 25 dbar between 0-100dbar and inferior than 50 dbar between 100-300dbar

We looked for the nearest ARGO floats available in box defined by $\Delta X \pm 4^\circ\ lat-lon$ and $\Delta t \pm 15\ julian\ days$ around Tara stations. For each CTD profile we search for the best matching ARGO profile. We computed distance dx, delay time dt, and radius $r = \sqrt{dx^2 + dt^2}$ between each ARGO and CTD profiles. We add correlations calculations between CTD-ARGO salinity and temperature. Correlations are calculated using the `corrcoef` function in `Matlab`. To make correlations calculation possible we interpolate ARGO profiles (defined on the 152 levels vertical grid) on a CTD-compatible 1 decibar vertical grid. We present the results in Tab. 13 with the ARGO profiles we kept after tests. We show the CTD and **all** ARGO profiles on Fig. 12, and a $\theta - S$ diagram on Fig. 13.

4.2 Correlations with CTD profiles

CTD	Argo	*Radius*	*dt (jul)*	*dx (km)*	θ correl.	S correl.	Lon Argo	Lat Argo
1	1	417.6619	8	417.5852	0.87946	0.60127	-71.599	37.676
1	2	480.0565	4	480.0398	0.90728	0.71332	-70.725	37.776
1	3	214.7517	10	214.5187	0.99571	0.99507	-73.197	36.366
1	4	326.8021	6	326.7471	0.99632	0.99598	-72.212	37.016
1	5	394.4186	2	394.4135	0.9913	0.98775	-71.474	37.286
1	6	256.6582	9	256.5004	0.86578	0.60253	-73.753	37.03
1	7	209.1351	5	209.0753	0.88345	0.64102	-73.9	36.62
1	8	444.3944	-7	444.3393	0.84829	0.63684	-71.49	37.92
1	9	460.6129	-11	460.4815	0.79485	0.47557	-71.518	38.126
1	10	439.0264	-15	438.7701	0.8194	0.52111	-71.779	38.038
1	11	321.4595	8	321.3599	0.98557	0.98733	-71.164	35.286
1	12	284.5087	-7	284.4225	0.97251	0.95442	-71.643	35.545
1	13	423.1514	4	423.1325	0.96394	0.93884	-70.32	33.566
1	14	434.2107	-6	434.1692	0.9608	0.93184	-70.192	33.568
1	15	389.9249	-16	389.5965	0.95523	0.93726	-70.718	33.548
2	1	419.1549	8	419.0785	0.91979	0.71565	-71.599	37.676
2	2	483.9684	4	483.9519	0.9406	0.81631	-70.725	37.776
2	3	215.7688	10	215.5369	0.97505	0.95664	-73.197	36.366
2	4	329.115	6	329.0603	0.97378	0.95485	-72.212	37.016
2	5	398.245	2	398.24	0.96489	0.93695	-71.474	37.286
2	6	249.2918	9	249.1293	0.90199	0.69197	-73.753	37.03
2	7	202.2581	5	202.1963	0.92167	0.75375	-73.9	36.62
2	8	445.2393	-7	445.1843	0.89161	0.75418	-71.49	37.92
2	9	460.5429	-11	460.4115	0.83828	0.57619	-71.518	38.126
2	10	438.327	-15	438.0703	0.8618	0.61691	-71.779	38.038
2	11	338.3015	8	338.2069	0.94864	0.93463	-71.164	35.286
2	12	299.1987	-7	299.1168	0.92336	0.86687	-71.643	35.545
2	13	446.2529	4	446.235	0.91005	0.83991	-70.32	33.566
2	14	457.2274	-6	457.188	0.90509	0.83352	-70.192	33.568
2	15	413.3001	-16	412.9903	0.8959	0.84132	-70.718	33.548
3	1	421.7559	8	421.68	0.96657	0.8009	-71.599	37.676
3	2	487.804	4	487.7876	0.97287	0.8667	-70.725	37.776
3	3	218.6777	10	218.449	0.90978	0.82373	-73.197	36.366
3	4	332.327	6	332.2728	0.90672	0.82034	-72.212	37.016
3	5	402.1433	2	402.1384	0.89927	0.79462	-71.474	37.286
3	6	247.2876	9	247.1237	0.94729	0.75345	-73.753	37.03
3	7	200.7771	5	200.7148	0.96767	0.84954	-73.9	36.62
3	8	447.449	-7	447.3942	0.95324	0.85289	-71.49	37.92
3	9	462.228	-11	462.0971	0.90734	0.64306	-71.518	38.126
3	10	439.6908	-15	439.4349	0.92744	0.68038	-71.779	38.038
3	11	348.8767	8	348.785	0.86993	0.79651	-71.164	35.286
3	12	308.8039	-7	308.7245	0.83899	0.70479	-71.643	35.545
3	13	459.5492	4	459.5318	0.82893	0.66458	-70.32	33.566
3	14	470.4897	-6	470.4514	0.81805	0.65752	-70.192	33.568
3	15	426.6991	-16	426.399	0.80303	0.67388	-70.718	33.548
4	1	422.7042	9	422.6084	0.97794	0.89175	-71.599	37.676
4	2	489.6142	5	489.5887	0.96521	0.88918	-70.725	37.776
4	3	220.1332	11	219.8582	0.95775	0.67228	-73.197	36.366
4	4	333.7964	7	333.723	0.95667	0.66287	-72.212	37.016
4	5	404.0458	3	404.0346	0.9454	0.64481	-71.474	37.286
4	6	245.1049	10	244.9008	0.95756	0.76578	-73.753	37.03
4	7	199.0685	6	198.9781	0.98862	0.88797	-73.9	36.62
4	8	448.0599	-6	448.0198	0.99015	0.9436	-71.49	37.92
4	9	462.439	-10	462.3308	0.949	0.73677	-71.518	38.126
4	10	439.6704	-14	439.4475	0.96272	0.76526	-71.779	38.038
4	11	355.8957	9	355.7819	0.92597	0.63429	-71.164	35.286
4	12	315.0424	-6	314.9853	0.96355	0.46693	-71.643	35.545
4	13	468.8736	5	468.8469	0.98209	0.32544	-70.32	33.566
4	14	479.7572	-5	479.7312	0.98158	0.34675	-70.192	33.568
4	15	436.0944	-15	435.8363	0.96712	0.53164	-70.718	33.548

Table 11: Description: see paragraph p. 22

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CTD	Argo	$Radius$	dt (jul)	dx (km)	θ correl.	S correl.	Lon Argo	Lat Argo
5	1	181.6702	9	181.4471	0.83817	0.58628	-71.599	37.676
5	2	242.1342	5	242.0826	0.86958	0.67829	-70.725	37.776
5	3	39.3029	11	37.7322	0.99632	0.99274	-73.197	36.366
5	4	90.4199	7	90.1485	0.99667	0.9933	-72.212	37.016
5	5	156.4265	3	156.3978	0.99788	0.99658	-71.474	37.286
5	6	116.231	10	115.8	0.83192	0.60696	-73.753	37.03
5	7	105.2545	6	105.0833	0.84042	0.63572	-73.9	36.62
5	8	209.3492	-6	209.2632	0.79968	0.62897	-71.49	37.92
5	9	227.7351	-10	227.5155	0.75792	0.46619	-71.518	38.126
5	10	208.6958	-14	208.2257	0.77972	0.51219	-71.779	38.038
5	11	187.5373	9	187.3212	0.99564	0.99344	-71.164	35.286
5	12	135.6676	-6	135.5348	0.99064	0.98606	-71.643	35.545
5	13	382.0143	5	381.9816	0.98583	0.97852	-70.32	33.566
5	14	388.7993	-5	388.7672	0.98418	0.97607	-70.192	33.568
5	15	363.9138	-15	363.6046	0.98139	0.97823	-70.718	33.548
6	1	184.0018	10	183.7298	0.87299	0.60307	-71.599	37.676
6	2	247.7433	6	247.6707	0.90054	0.71857	-70.725	37.776
6	3	27.3413	12	24.5672	0.99661	0.99563	-73.197	36.366
6	4	93.1443	8	92.8001	0.99703	0.99682	-72.212	37.016
6	5	162.0968	4	162.0474	0.99265	0.99002	-71.474	37.286
6	6	101.2881	11	100.689	0.85997	0.60002	-73.753	37.03
6	7	90.182	7	89.91	0.87746	0.63835	-73.9	36.62
6	8	210.9302	-5	210.8709	0.84153	0.63762	-71.49	37.92
6	9	228.2559	-9	228.0784	0.7876	0.47894	-71.518	38.126
6	10	208.1226	-13	207.7162	0.81174	0.5244	-71.779	38.038
6	11	202.9087	10	202.6622	0.98818	0.98996	-71.164	35.286
6	12	150.8638	-5	150.7809	0.97629	0.96054	-71.643	35.545
6	13	396.2248	6	396.1794	0.96823	0.94683	-70.32	33.566
6	14	403.1368	-4	403.117	0.96539	0.94024	-70.192	33.568
6	15	377.4799	-14	377.2202	0.96021	0.9444	-70.718	33.548
7	1	179.742	10	179.4636	0.97475	0.1755	-71.599	37.676
7	2	241.7845	6	241.7101	0.95042	0.32736	-70.725	37.776
7	3	35.4931	12	33.403	0.98359	0.91856	-73.197	36.366
7	4	88.5357	8	88.1735	0.9864	0.93806	-72.212	37.016
7	5	156.0496	4	155.9984	0.96317	0.89158	-71.474	37.286
7	6	109.3215	11	108.7667	0.9524	0.1903	-73.753	37.03
7	7	99.5304	7	99.2839	0.98879	0.40701	-73.9	36.62
7	8	207.0587	-5	206.9983	0.98856	0.3409	-71.49	37.92
7	9	224.9854	-9	224.8054	0.94217	-0.024414	-71.518	38.126
7	10	205.4614	-13	205.0497	0.95406	0.0080899	-71.779	38.038
7	11	194.5492	10	194.292	0.97007	0.87659	-71.164	35.286
7	12	142.6526	-5	142.5649	0.98107	0.89718	-71.643	35.545
7	13	389.1887	6	389.1425	0.98096	0.65755	-70.32	33.566
7	14	395.9501	-4	395.9299	0.98009	0.45009	-70.192	33.568
7	15	370.9899	-14	370.7257	0.98193	0.67265	-70.718	33.548
8	1	179.289	11	178.9512	0.99061	-0.057421	-71.599	37.676
8	2	239.8034	7	239.7012	0.9661	0.05917	-70.725	37.776
8	3	41.0318	13	38.9179	0.98626	0.81497	-73.197	36.366
8	4	88.1103	9	87.6495	0.98313	0.8226	-72.212	37.016
8	5	154.0892	5	154.008	0.97258	0.74857	-71.474	37.286
8	6	115.9635	12	115.3409	0.97745	0.14339	-73.753	37.03
8	7	105.9785	8	105.6762	0.98937	0.29596	-73.9	36.62
8	8	206.8001	-4	206.7614	0.98511	0.15211	-71.49	37.92
8	9	225.1544	-8	225.0122	0.97527	-0.23413	-71.518	38.126
8	10	206.0829	-12	205.7332	0.97947	-0.23485	-71.779	38.038
8	11	188.0167	11	187.6947	0.94341	0.73394	-71.164	35.286
8	12	136.0684	-4	136.0096	0.95743	0.85154	-71.643	35.545
8	13	383.0326	7	382.9686	0.96273	0.65677	-70.32	33.566
8	14	389.7072	-3	389.6956	0.96148	0.35481	-70.192	33.568
8	15	365.0176	-13	364.786	0.96212	0.45141	-70.718	33.548

Table 12: Description: see paragraph p. 22

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CTD	Argo	*Radius*	*dt* (*jul*)	*dx* (*km*)	θ correl.	*S* correl.	Lon Argo	Lat Argo
9	1	178.7518	11	178.413	0.84671	0.52708	-71.599	37.676
9	2	238.491	7	238.3883	0.87591	0.62871	-70.725	37.776
9	3	43.9885	13	42.0237	0.99522	0.98089	-73.197	36.366
9	4	87.6664	9	87.2032	0.99508	0.9829	-72.212	37.016
9	5	152.8208	5	152.739	0.99641	0.98805	-71.474	37.286
9	6	119.2311	12	118.6257	0.84177	0.55791	-73.753	37.03
9	7	109.3224	8	109.0293	0.8484	0.57271	-73.9	36.62
9	8	206.3891	-4	206.3503	0.80908	0.56324	-71.49	37.92
9	9	224.9625	-8	224.8202	0.77143	0.41434	-71.518	38.126
9	10	206.1415	-12	205.7919	0.79159	0.45784	-71.779	38.038
9	11	184.728	11	184.4002	0.99164	0.98701	-71.164	35.286
9	12	132.8159	-4	132.7556	0.98793	0.99108	-71.643	35.545
9	13	380.0486	7	379.9841	0.98459	0.98599	-70.32	33.566
9	14	386.6824	-3	386.6708	0.98259	0.98314	-70.192	33.568
9	15	362.1865	-13	361.9531	0.97907	0.98369	-70.718	33.548
10	1	177.9648	11	177.6245	0.9289	-0.74986	-71.599	37.676
10	2	236.8741	7	236.7707	0.88544	-0.80215	-70.725	37.776
10	3	47.2954	13	45.4736	0.96103	0.94324	-73.197	36.366
10	4	87.0511	9	86.5846	0.98676	0.97851	-72.212	37.016
10	5	151.2744	5	151.1918	0.94249	0.78252	-71.474	37.286
10	6	122.6404	12	122.0519	0.90864	-0.069485	-73.753	37.03
10	7	112.9225	8	112.6387	0.93747	0.38631	-73.9	36.62
10	8	205.7258	-4	205.6869	0.94427	0.043198	-71.49	37.92
10	9	224.5266	-8	224.3841	0.91477	-0.85312	-71.518	38.126
10	10	205.9774	-12	205.6275	0.93255	-0.8574	-71.779	38.038
10	11	181.3108	11	180.9768	0.91504	0.66782	-71.164	35.286
10	12	129.4548	-4	129.393	0.87194	0.57191	-71.643	35.545
10	13	377.0256	7	376.9606	0.87392	0.28554	-70.32	33.566
10	14	383.6087	-3	383.597	0.86136	-0.23667	-70.192	33.568
10	15	359.3507	-13	359.1154	0.84404	-0.56987	-70.718	33.548

Table 13: Description: see paragraph p. 22

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4.3 ARGO and CTD profiles

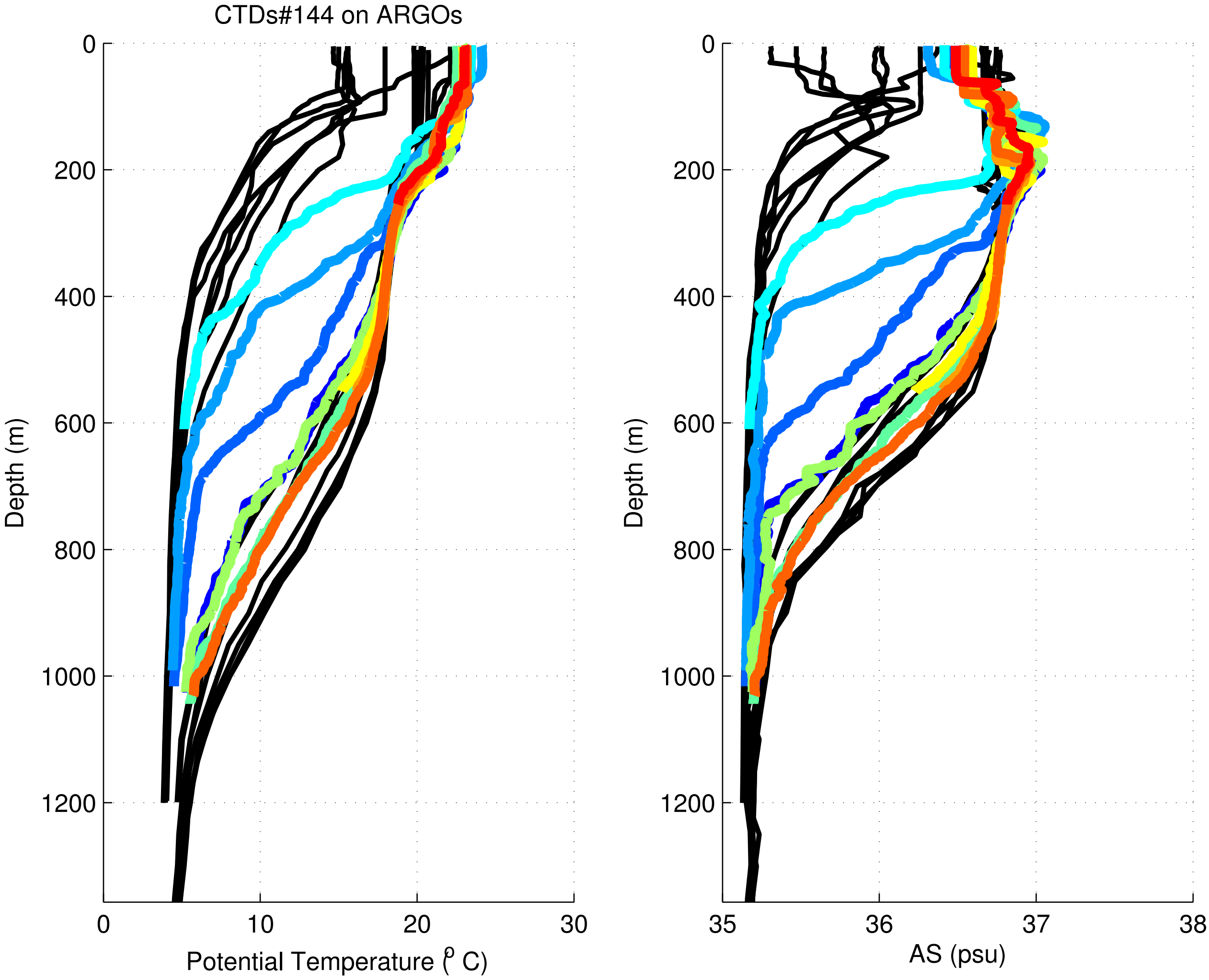

Figure 12: Description: see paragraph p. 22

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4.4 ARGO and CTD $\theta - S$ diagrams

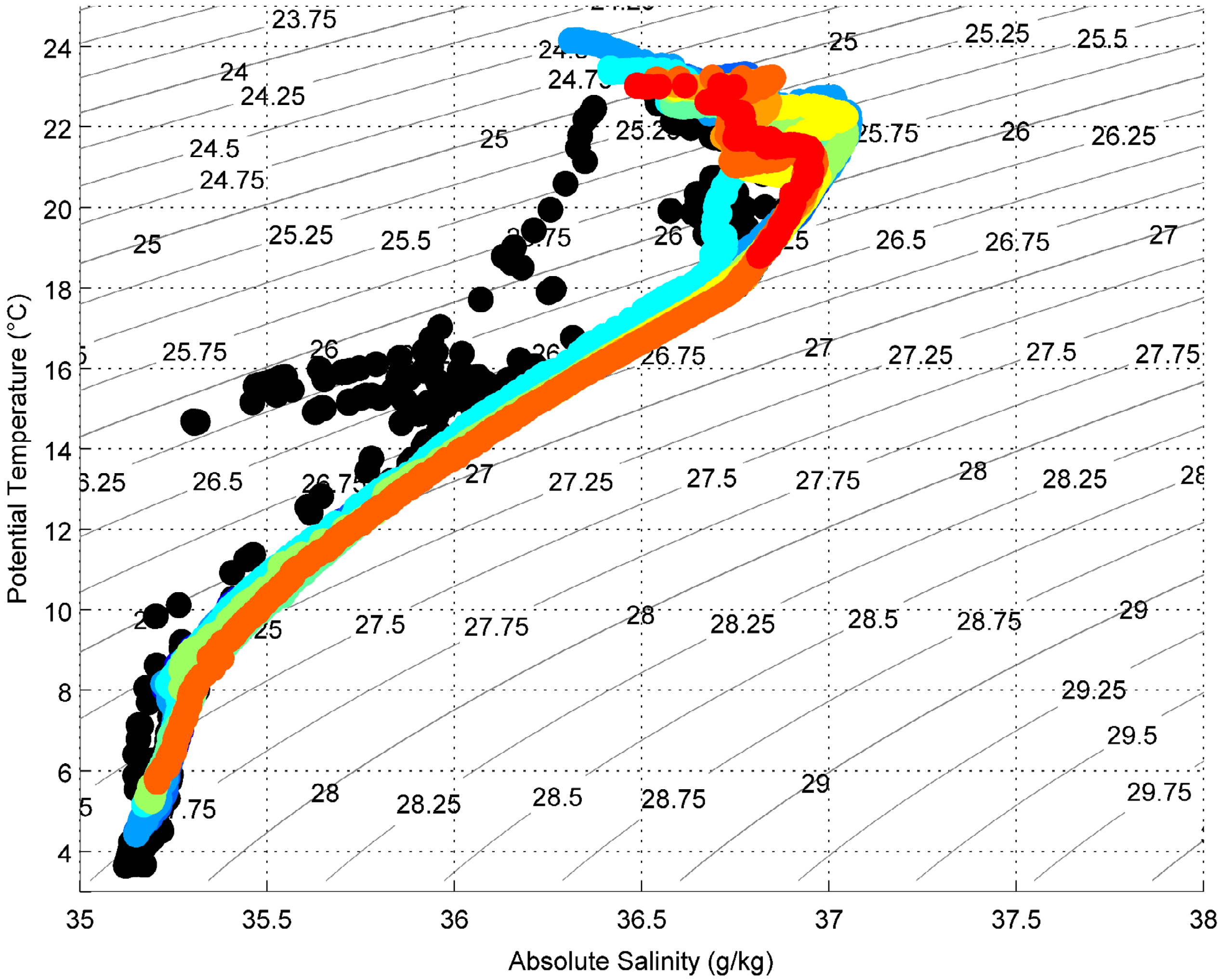

Figure 13: Description: see paragraph p. 22

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References

A Capet, E Mason, V Rossi, C Troupin, Y Faugère, I Pujol, and A Pascual. Implications of refined altimetry on estimates of mesoscale activity and eddydriven offshore transport in the eastern boundary upwelling systems. *Geophysical Research Letters*, 41(21):7602–7610, 2014. ISSN 1944-8007.

A Chaigneau, M Le Texier, G Eldin, C Grados, and O Pizarro. Vertical structure of mesoscale eddies in the eastern south pacific ocean: A composite analysis from altimetry and argo profiling floats. *Journal of Geophysical Research: Oceans*, 116(C11):n/a–n/a, 2011. ISSN 2156-2202. doi: 10.1029/2011JC007134.

C De Boyer Montégut, G Madec, A S Fischer, A Lazar, and D Iudicone. Mixed layer depth over the global ocean: An examination of profile data and a profilebased climatology. *Journal of Geophysical Research: Oceans (1978–2012)*, 109(C12), 2004. ISSN 2156-2202.

F d'Ovidio, V Fernández, E HernándezGarcía, and C López. Mixing structures in the mediterranean sea from finitesize lyapunov exponents. *Geophysical Research Letters*, 31(17), 2004. ISSN 1944-8007.

T Gerkema and JTF Zimmerman. An introduction to internal waves. *Lecture Notes, Royal NIOZ, Texel*, 2008.

O Hernandez, Jacqueline Boutin, Nicolas Kolodziejczyk, Gilles Reverdin, Nicolas Martin, Fabienne Gaillard, Nicolas Reul, and JL Vergely. Smos salinity in the subtropical north atlantic salinity maximum: 1. comparison with aquarius and in situ salinity. *Journal of Geophysical Research: Oceans*, 2014. ISSN 2169-9291.

N Kolodziejczyk, J Boutin, O Hernandez, A Sommer, G Reverdin, S Marchand, N Martin, J-L Vergely, and X Yin. Argo and smos sss combination helps monitoring sss variability from basin scale to mesoscale. 2015a.

Nicolas Kolodziejczyk, Olga Hernandez, Jacqueline Boutin, and Gilles Reverdin. Smos salinity in the subtropical north atlantic salinity maximum: 2. twodimensional horizontal thermohaline variability. *Journal of Geophysical Research: Oceans*, 2015b. ISSN 2169-9291.

MJ Martin, A Hines, and MJ Bell. Data assimilation in the foam operational shortrange ocean forecasting system: A description of the scheme and its impact. *Quarterly Journal of the Royal Meteorological Society*, 133(625):981–995, 2007. ISSN 1477-870X.

MH Rio and F Hernandez. A mean dynamic topography computed over the world ocean from altimetry, in situ measurements, and a geoid model. *Journal of Geophysical Research: Oceans (1978–2012)*, 109(C12), 2004. ISSN 2156-2202.

D W Waugh, E R Abraham, and M M Bowen. Spatial variations of stirring in the surface ocean: A case study of the tasman sea. *Journal of Physical Oceanography*, 36(3):526–542, 2006. ISSN 1520-0485.