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LATEX10 - LAgrangian Transport EXperiment Data collection Cruise report 2010

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LABORATOIRE
D'OCEANOGRAPHIE
PHYSIQUE ET BIOGEOCHIMIQUE
UMR 6535

CENTRE
D'OCÉANOLOGIE
DE MARSEILLE
UNIVERSITÉ DE LA MÉDITERRANÉE
AIX-MARSEILLE II

LATEX10
LAgrangian Transport EXperiment

Data collection
Cruise report 2010

LATEX Project

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The chief scientist, the principal investigators and the scientific teams involved in LATEX are very grateful to the CIRMED for having made it possible for the cruise Latex10 to happen and, particularly, to occur simultaneously with the NO Suroît of GENAVIR.

We also thank the INSU and the PACA region for their support of the LATEX project.

We also thank the captains Renault Le Bourhis and Alain Stephan as well as the crews of the Téthys II for their help, their enthusiasm, and their collaboration in working in all kind of weather.

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Participants, measurements

Acronym : LATEX10
LAgrangian Transport Experiment 2010

Period:	**September 7th – September 24th, 2010**
Area:	**Western Gulf of Lion**
Research Vessel:	**Téthys II**
Chief scientist:	**Anne PETRENKO**
Starting at harbor:	**Port-Vendres**
Ending at harbor:	**La Seyne-sur-Mer**

Participants:

Andrea DOGLIOLI (M.C., LOPB, Marseille)
Ziyuan HU (PhD student, LOPB, Marseille)
Marion KERSALE (PhD student, LOPB, Marseille)
Deny MALENGROS (Technician, LOPB, Marseille)
Francesco NENCIOLI (Post-Doc, LOPB, Marseille)
Anne PETRENKO (Chief Scientist, LOPB, Marseille)
Anna ROUMYANTSEVA (Master Intern, LOPB, Marseille; University of Lomonossov, Moscow)

Organism:	**Université de la Méditerranée**
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<u>Goal :</u> The LATEX project aims to study the influence of the coupled physics and biochemistry dynamics at (sub) mesoscales on the matter and heat transfers between the coastal zone and the open ocean.
Project fouded by CNRS LEFE/IDAO/CYBER and Région PACA.

Equipment available on the Tethys II:

1) **Hull-mounted ADCPs**
2) **Thermosalinometer**
3) **Fluorimeter**

Other Equipments :

4) **Lagrangian floats**
5) **Eulerian moorings**
6) **SeaBird SBE 19 CTD**
7) **SCAMP**
8) **XBT**
9) **Satellite images**
10) **Gliders**

Crews:

1st period Sept 7 – Sept 16

Captain Renault Le Bourhis
Co-Captain Dany Deneuve

2nd period Sept 16 – Sept 24

Captain Alain Stephan
Co-Captain Vincent le Duvehat

I. Scientific presentation of the campaign LATEX10

1) General theme

Mesoscale and sub-mesoscale hydrodynamic features take place at the interface between the continental slope and the coastal margin. These processes are important for the understanding of heat and matter transfers between the coastal zone and the open ocean. Nonetheless, these processes are still not fully known, especially concerning their impact on biogeochemistry. In fact, at these scales, the influence of the physical processes on biogeochemistry starts to be clearly shown in numerical studies. But confirmations by experiments are difficult, because experiment strategies generally differ greatly whether they are oriented towards a physical study or a biogeochemical one.

2) LATEX Project

For the last 10 years, the LOPB has been the PI in a number of national projects which have included cruises in the Gulf of Lion (Moogli, Sarhygol, Golts, Golts/Argol, Ecolophy/Colargol). But the strategy of these cruises was oriented either towards physics or biogeochemistry. Now the LOPB has proposed a new experimental strategy to do a real coupled hydrodynamic and biogeochemical experiment. The LATEX strategy is based on a combined use of satellite data, numerical modelling and Eulerian and Lagrangian in situ measurements (Lagrangian buoys and a tracer experiment). The main objective of LATEX is to study the impact of a (sub) mesoscale structures –present in the western part of the Gulf of Lion- on the evolution of conservative or biogeochemical tracers' distributions.

3) Laboratories involved

- *Pôle d'Océanographie Côtière / Observatoire Midi-Pyrénées* POC/OMP (Toulouse)
- *Laboratoire de Physique des Océans / Institut Universitaire Européen de la Mer* LPO/IUEM (Brest)
- *Centre Armoricain de Recherche en ENvironnement* CAREN (Rennes)
- *Laboratoire d'Océanographie de Villefranche / Observatoire Océanologique de Villefranche-sur-mer* LOV/OOV (Villefranche-sur-Mer)
- *École Nationale Supérieure de Techniques Avancées* ENSTA (Paris)
- *Laboratoire d'Océanographie et du Climat: Expérimentations et Approches Numériques / Institut Pierre-Simon Laplace* LOCEAN/IPSL (Paris)
- *Laboratoire d'Etudes en Géophysique et Océanographie Spatiales / Observatoire Midi-Pyrénées* LEGOS/OMP (Toulouse)
- *Laboratoire d'Océanographie Biologique de Banyuls / Observatoire Océanologique de Banyuls sur Mer* LOBB/OOB (Banyuls)
- *Centre Européen de Recherche et d'Enseignement de Géosciences de l'Environnement* CEREGE (Aix-en-Provence)
- Division Technique de l'INSU

International:
CNR (Italie), ENEA de Rome (Italie), RSMAS Miami (USA), UCSB (USA), IMEDEA de Palma de Mallorca (Espagne) et AIEA (Monaco)

II. Materials and Methods

The strategy of the LATEX project combines use of data from satellite observation, in situ measurements and numerical modelling.
During the September 2010 campaign (= Latex10) we have numbered all the stations (Table n°I), which characterize the positions of the changes of paths or of sampling. According to this definition, CTD sampling has not been done at all the stations but at a subset of them, listed in Table n°II.

A **ship-mounted VMBB-150 kHz ADCP**, mounted at 3 m below the water surface, was used to measure current velocity. The ADCP configuration used during the cruise was: 60 cells of 4 m depth, an ensemble average of 1 min and bottom tracking when possible. Consequently, the depth range of current data extends from 11 to 247 m. The software for ADCP data analysis was provided by the French technical division (DT) of the Institut National des Sciences de l'Univers (INSU). The speed of the boat was, most of the time, limited to 8 knots to insure good quality for the ADCP data. The boat trajectory purposefully included small L figures (each transect of the L lasting about 1/2h and done twice) in order to evaluate A and phi with Pollard and Read method (1989). Additional processing was done to remove corrupted data (during the CTD casts and the changes of direction of the boat). The measured ADCP horizontal currents were treated and analyzed in near-real time during the entire cruise. The contributions of current and inertial oscillations in the velocity field can be evaluated by back and forth transects. This technique has been successfully tested during the Golts/Argol/Colargol cruise made to the eastern Gulf of Lion (Gatti, 2008). Daily figures of the ADCP data can be found in Annexe 1.

Hydrological vertical profiles were taken regularly with a **SBE 19 CTD** (9+), plus oxygen sensor(SBE43), a fluorimeter Wetlabs FLRTD ECO, and a transmissometer (Wetlabs CST) . The different CTD cast are listed in the Table n° II.
The SBE CTD treatment included the following steps:
Data conversion (Conductivity, Temperature, Pression, Oxygen, Transmission, Fluorescence)
Filter (Seabird values per default)
Seaplot (of data in volt for C, T et O to check the sensors' synchronization)
Align CTD (synchronization of oxygen data on C and T)
Cell Thermal mass (Seabird values per default)
Loop Edit (Seabird values per default)
Seaplot (check for potential problems or artifacts)
Wild Edit (artifacts suppression)
Seaplot (check for artifacts' disappearance)
Derive (Salinity, Depth Salt Water, Density, Oxygen in concentration)
Seaplot (final data check before averaging)
Bin Average (average on D=0.5m)
Seaplot (final data check before data export)
Ascii out (data export without header but with column header).
All the CTD profiles can be found in Annexe II.

In addition, surface temperature, salinity and fluorescence data were acquired continuously by the ship's surface pumping system (Annexe III).

When the sea state did not allow to use the CTD, temperature profiles were obtained using **XBTs (eXpendable BathyThermograph)** (Table N° IV).
A **Scamp (Self Contained Autonomous MicroProfiler)** was used to measure the turbulence in the

area. The different SCAMP casts are listed in Table n° III.

During the cruise, ocean color images (Annexe 4) and proxy of SST images (Annexe 5) were emailed to the R/V Téthys II to help us track the (sub) mesoscale features. Ocean color images (courtesy Emmanuel Bosc , IAEA) provided "near real time SeaWiFs chlorophyll concentration [mg·m-3] from the GSFC NASA (http://oceancolor.gsfc.nasa.gov/) before and during the Latex cruise.

Proxy of SST satellite images are provided by Météo France - OSIS archive (https://www.ifremer.fr/osis/catalogues/sat.php).
The data is the AVHRR Channel 4 (NOAA satellites) which is also called "brightness temperature", an non composite data best-fitted to detect physical structures such as eddies, filaments.

Three **ADCP moorings** had been deployed by the Latex09 cruise with the Tethys II at the end of August 2009. They were quasi-aligned cross-shelf, at depths from 60 m on the western side close to the coast to 600 m in the Lacaze-Duthiers canyon (between longitudes 42°27'N and 42°30'N). The goal of these cross-shelf locations was to obtain the flux across this potential entrance/exit zone of the Gulf of Lion. The alignment could not be perfect due to dragging and fishing activities in the zone and forbidden areas in the Lacaze-Duthiers canyon. The characteristics of the three moorings are listed in the Table N°VII. Mooring 3 were recovered by the Suroît. The Suroit did the acoustic releases of Moorings 1 and 2.; but the moorings did not come back to the surface. The Alain Stephan crew on the Téthys II tried to recover Mooring 2 dredging for 3 hours ½ without success. Finally the two Moorings (1 and 2) were recovered afterward by part of the LOBB/OOB team. RD Instruments WinADCP software was used to determine the bins of interest, to erase flagged data and to extract good quality data.

Finally two **gliders** were used during the Latex cruise : **Tenuse** and **Pythéas**.
Gliders are small autonomous underwater vehicles which were developed to carry out in-situ observations of the upper 1km of the ocean filling the gaps left by the existing observing systems. During each surfacing, a two-way communication system via satellite allows to download data in near real time and to send new commands in order to change the mission parameters (heading, angle of ascent/dive, max depth,...). In such a way, gliders can be steered remotely. More information on these gliders can be found on the EGO Web Site (http://www.ego-network.org).
The trajectory of these two gliders is shown in the Annexe 8. The gliders data can be downloaded from the following web site:
https://fileshare.dt.insu.cnrs.fr/file.php?h=Rc92dd597577b3cf7f36604f9fe4e0302

Matlab tools have been developed for the treatment of the data and are available on the cluster LATEX site (LATEX\Tethys_bak\LATEX\LATEX_MATLAB_tools). Contact Andrea Doglioli if interested (doglioli@univmed.fr).

Bibliography:

Gatti, 2008, Intrusions du Courant Nord Méditerranéen sur la partie est du plateau continental du Golfe du Lion, thèse Universiteé Aix-Marseille II, 156p.
Pollard and Read, 1989, A method for calibrating shipmounted acoustic Doppler profilers and the limitations of gyrocompasses, J. Atmos. Ocean. Tech. 6, 859-865.

Cruise strategy and planning

Whenever the Tethys II is cruising out of Port-Vendres harbor, continuous ADCP, surface temperature, salinity and fluorescence are measured.

Sept. 7-8th - ADCP transects looking for an eddy structure
- Absence of eddy shown by the ADCP analysis

Stop to Port-Vendres Sept. 8th from 3h00 to 12h00 (bad weather)

Sept. 8-9th - ADCP transects looking for an eddy structure
- Absence of eddy shown by the ADCP analysis
- Discussion on the choice of the release position of the SF6 since the release of a conservative tracer (SF6) in a strong current is to be avoided (leading to extremely rapid dispersion)

Stop to Port-Vendres from 9h00 on Sept. 9th to 15h30 on Sept. 10th (bad weather)

Sept. 10th - Analysis of the 8 years of simulation (SYMPHONIE)
- Release position of the SF6 at the point of current's speed minimum (42°45 N; 3°30 E)
- Test of the CTD and SCAMP
- ADCP mapping around the release point

Sept. 11th - Transects through the Northern Current (ADCP and XBT)
- SCAMP and CTD at the release point

Sept. 12th - SCAMP and CTD stations

Stop to Port-Vendres from 15h15 on Sept. 12th to 08h00 on Sept. 14th (bad weather)

Sept. 13th - Calculation of the future position of the barycenter of the Lagrangian buoys released by the Suroit around the SF6 patch.

Sept. 14th - ADCP, CTD and SCAMP around the projected barycenter.

Sept. 15th - Recovery of some of the Lagrangian buoys with CTD and SCAMP at each stop.
- CTD and SCAMP next to the Iridium buoy

Stop to Port-Vendres from 21h45 Sept. 15th to 05h45 Sept. 17th (change of crews + bad weather)

Sept. 17th - Right angle turns for calibrating ship-mounted ADCP
- SCAMP and CTD stations
- Reception of the position of the Finite Size Lyapunov Exponents (FSLE) *manifolds* calculated by F. d'Ovidio

Sept. 18th **- 1st FSLE experiment :** Transect through these FSLE *manifolds* with launch of XBTs and Lagragian buoys
- Check thermosalinometer for changes in temperature,

salinity or fluorescence

Stop to Port-Vendres from 14h45 on Sept. 18th to 18h00 on Sept. 19th (bad weather)

Sept. 19th - Mapping ADCP

Sept. 20th - Research glider Pytheas
- ADCP transects designed for inertial oscillations

Sept. 21th **- 2nd FSLE experiment :** Transect through these *manifolds* with launch of XBTs and Lagragian buoys
- Mapping ADCP

Sept. 22th - Unsuccesful attempt to recuperate Mooring n°2 by dredging during 3h30(acoustic release had been done by the Suroît)
- Meeting of the 2 R/Vs (42°30, 3°30) for the intercalibration of the O_2 measurements with the two CTDs (Téthys II and Suroît)
- Mapping ADCP

Sept. 23th - Mapping ADCP
- Right angle turns for calibrating ship-mounted ADCP

Table n°I : List of stations

Number	Latitude	Longitude	Number	Latitude	Longitude	Number	Latitude	Longitude
0	42.517	3,100	29	42,720	3,540	59	42,833	4,167
1	42,733	3,450	30	42,720	3,567	60	42,667	3,933
2	42,883	3,083	31	42,718	3,547	61	42,900	4,300
3	43,000	3,500	32	42,653	3,549	62	42,736	4,047
4	43,250	3,500	33	42,649	3,169	63	42,833	3,933
5	42,917	3,500	34	42,922	3,172	64	42,750	3,350
6	43,117	3,333	35	42,506	3,136	65	42,882	3,506
7	43,117	3,167	36	42,450	3,622	66	43,000	3,650
8	42,617	3,167	37	42,450	3,750	67	43,167	3,843
9	42,717	3,067	38	42,450	4,000	68	43,000	4,400
10	42,817	3,167	39	42,667	4,000	69	43,000	3,833
11	42,917	3,067	40	42,567	3,750	70	43,324	4,145
12	43,017	3,167	41	42,136	3,567	71	42,500	3,500
13	43,117	3,500	42	42,380	3,615	72	42,467	3,500
14	42,833	3,408	43	42,397	3,699	73	42,367	3,375
15	42,833	3,067	44	42,439	3,703	74	42,267	3,500
16	42,750	3,250	45	42,442	3,701	75	42,267	3,375
17	42,417	3,167	46	42,619	3,789	76	42,367	3,875
18	42,750	3,500	47	42,500	3,250	77	42,467	3,375
19	42,450	3,500	48	42,523	3,335	78	42,567	3,875
20	41,967	4,133	49	42,585	3,227	79	42,667	3,375
21	42,717	3,500	50	42,302	3,726	80	42,667	3,250
22	42,750	3,567	51	42,250	3,917	81	42,717	3,500
23	42,751	3,555	52	42,250	3,650	82	42,933	4,050
24	42,750	3,550	53	42,392	3,917	83	43,983	4,000
25	43,117	4,000	54	42,392	3,650	84	43,033	3,933
26	42,737	3,538	55	42,392	3,333	85	43,200	3,750
27	42,753	3,540	56	42,600	3,550	86	43,162	3,677
28	42,737	3,567	57	42,600	4,000	87	43,040	4,667

Table n°II : List of CTD casts

Cast	Stations	Day	Hours	Latitude	Longitude	Total depth	Profile depth
02	18	11	14H43	42,750	3,500	98	85
03	22	11	16H8	42,750	3,567	98	90
04	23	11	16H44	42,751	3,555	100	92
05	24	11	17H15	42,750	3,550	95	86
06	26	12	8H10	42,737	3,538	94	85
07	27	12	9H10	42,753	3,540	94	88
08	28	12	10H01	42,737	3,567	92	86
09	29	12	10H46	42,720	3,540	94	89
10	30	12	11H08	42,720	3,567	96	88
11	19	14	15H14	42,450	3,500	800	102
12	36	14	16H10	42,450	3,622	780	101
13	37	14	17H01	42,450	3,750	974	102
14	40	15	7H11	42,567	3,750	405	101
15	41	15	11H01	42,136	3,567	350	101
16	42	15	13H35	42,380	3,615	980	101
17	43	15	14H32	42,397	3,699	1130	101
18	44	15	15H50	42,439	3,703	800	102
19	46	15	18H00	42,619	3,789	570	101
20	50	17	13H03	42,302	3,726	975	102
21	51	17	14H38	42,250	3,917	1432	101
22	52	17	17H05	42,250	3,650	1161	103
23	61	20	13H31	42,900	4,300	108	96
24	61	20	14H30	42,900	4,300	107	98
25	61	20	14H47	42,900	4,300	110	96
26	61	20	15H38	42,900	4,300	108	98
27	71	22	14H34	42,500	3,500	149	141
28	72	22	15H12	42,467	3,500	644	301
29	73	22	16H42	42,375	3,375	350	101
30	74	22	18H15	42,267	3,500	162	101
31	79	23	7H00	42,667	3,375	89	81
32	80	23	8H04	42,667	3,250	84	77
33	81	23	9H49	42,717	3,500	100	96
34	82	23	14H48	42,933	4,050	116	107
35	83	23	15H48	43,983	4,000	92	85
36	84	23	16H38	43,033	3,933	93	87

Table n°III : List of SCAMP casts

Cast	Station	Day	Time	Lat	Long	Cast	Station	Day	Time	Lat	Long
01	21	11	14H58	42,720	3,500	25	51	17	16H16	42,250	3,917
02	21	11	15H34	42,717	3,500	26	52	17	18H07	42,250	3,650
03	21	11	16H22	42,717	3,500	27	52	17	18H19	42,250	3,650
04	18	11	16H52	42,750	3,500	28	61	20	15H02	42,900	4,300
05	22	11	17H56	42,750	3,567	29	61	20	15H30	42,900	4,300
06	22	11	18H09	42,750	3,567	30	61	20	15H48	42,900	4,300
07	23	11	18H46	42,751	3,555	31	61	20	15H58	42,900	4,300
08	24	11	19H19	42,750	3,550	32	61	20	16H09	42,900	4,300
09	26	12	10H11	42,737	3,538	33	61	20	16H46	42,900	4,300
10	26	12	10H31	42,737	3,538	34	61	20	16H56	42,900	4,300
11	27	12	11H13	42,753	3,540	35	61	20	17H07	42,900	4,300
12	27	12	11H30	42,753	3,540	36	61	20	17H17	42,900	4,300
13	28	12	12H08	42,737	3,567	37	71	22	15H56	42,500	3,500
14	40	15	9H14	42,567	3,750	38	71	22	16H05	42,500	3,500
15	41	15	13H03	42,136	3,567	39	71	22	16H14	42,500	3,500
16	42	15	15H39	42,380	3,615	40	72	22	16H53	42,467	3,500
17	42	15	15H51	42,380	3,615	41	73	22	18H21	42,367	3,375
18	43	15	16H32	42,397	3,699	42	79	23	8H41	42,667	3,375
19	43	15	16H48	42,397	3,699	43	80	23	9H44	42,667	3,250
20	44	15	17H50	42,439	3,703	44	81	23	11H29	42,717	3,500
21	44	15	17H56	42,439	3,703	45	82	23	16H48	42,933	4,050
22	46	15	20H01	42,619	3,789	46	83	23	17H30	43,983	4,000
23	46	15	20H10	42,619	3,789	47	84	23	18H19	43,033	3,933
24	50	17	14H40	42,302	3,726						

Table n°IV : List of XBT profiles

XBT	Time	Latitude	Longitude	Temperature	Salinity
XBT07#04	06H30	42,600	4,000	19,690	38,100
XBT07#05	06H43	42,620	3,972	19,530	38,040
XBT10#07	07H08	42,656	3,921	20,290	38,100
XBT10#08	07H30	42,690	3,874	20,240	38,130
XBT10#09	08H02	42,737	3,806	20,110	38,110
XBT10#11	09H45	42,751	3,349	18,802	37,860
XBT10#12	11H06	42,883	3,510	18,990	37,890
XBT10#13	12H16	42,999	3,649	19,695	37,770
XBT10#14	13H56	43,168	3,843	19,936	37,832

Table n°V : Argos Buoys launched

Buoy	Time	Latitude	Longitude	Temperature	Salinity
48863	06H27	42,600	3,994	0,000	38,110
48903	06H42	42,625	3,972	19,520	38,040
48920	07H07	42,656	3,921	20,280	38,090
48939	07H29	42,689	3,875	20,250	38,140
48940	08H01	42,737	3,806	20,780	38,150
48893	09H44	42,750	3,348	18,806	37,855
48942	11H04	42,881	3,507	18,979	37,893
93263	12H15	42,998	3,648	19,672	37,772

Table n°VI : Argos Buoys caught by the Téthys II

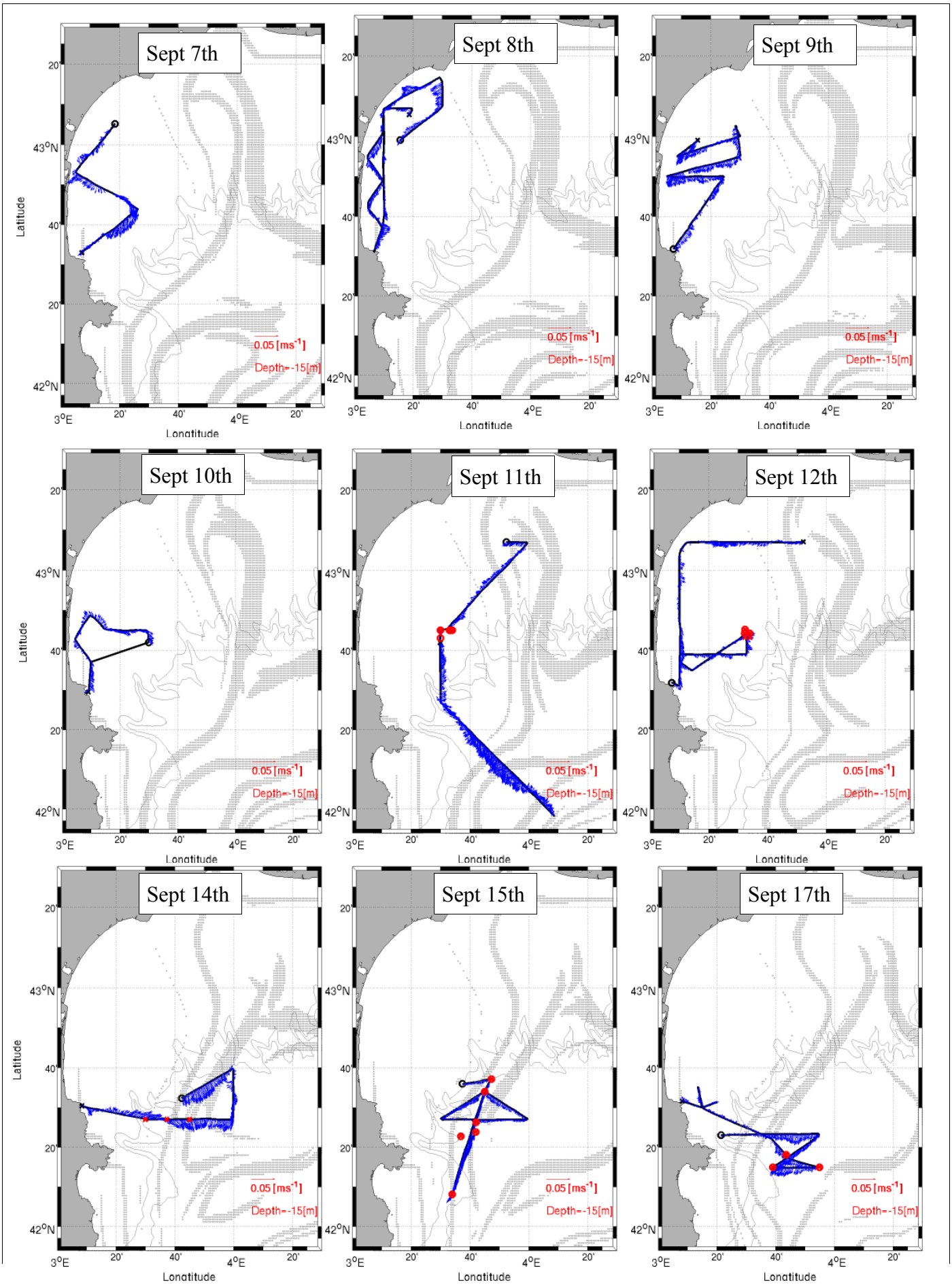
Buoy	Time	Latitude	Longitude	Temperature	Salinity
48940	10H55	42,136	3,567	19,900	37,970
48920	13H26	42,380	3,615	19,900	37,970
48863	14H24	42,397	3,699	20,100	37,670
48903	15H42	42,439	3,703	20,300	38,01
48939	16H19	42,442	3,701	20,100	38,020

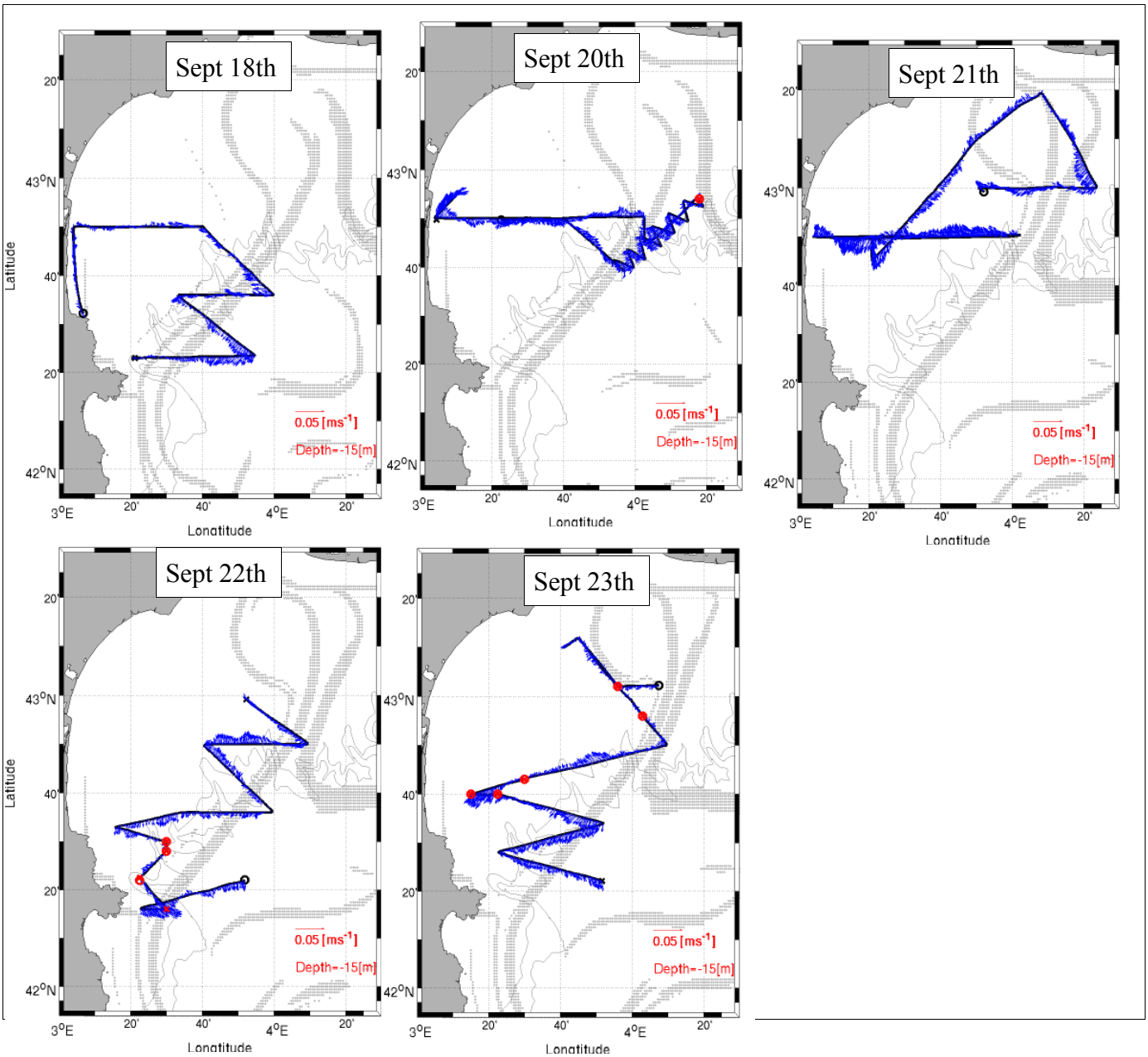
Table n°VII : Characteristics of the three moorings

Mooring	Latitude	Longitude	Depth	Frequency
Bouée au Nord de la Réserve Naturelle n°1	42,549	3,166	42 m	300 kHz
Zone des Canelottes n°2	42,549	3,257	85 m	300 kHz
Tête de Lacaze Duthiers n°3	42,606	3,401	214 m	75 kHz

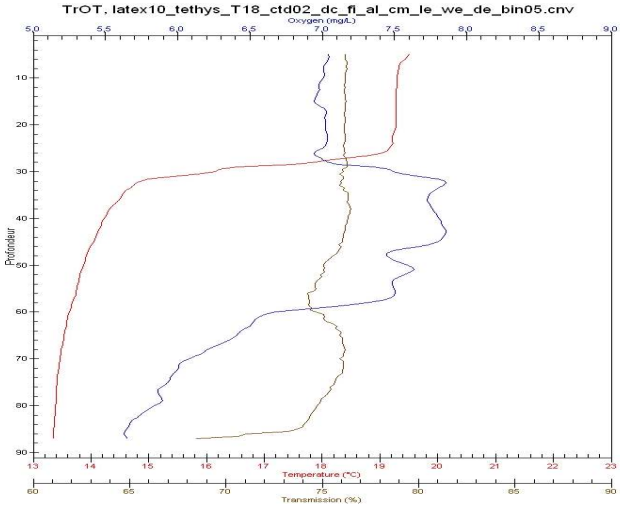
Annexe 1 – ADCP mapping per day of the Latex10 cruise

The ADCP horizontal currents (blue arrows) are plotted at depth – 15 m along the trajectory of the Téthys II. FSLE analysis (Nencioli et al., 2011) are indicated in grey colors. CTD stations (with Scamp measurements) are indicated by the red dots.

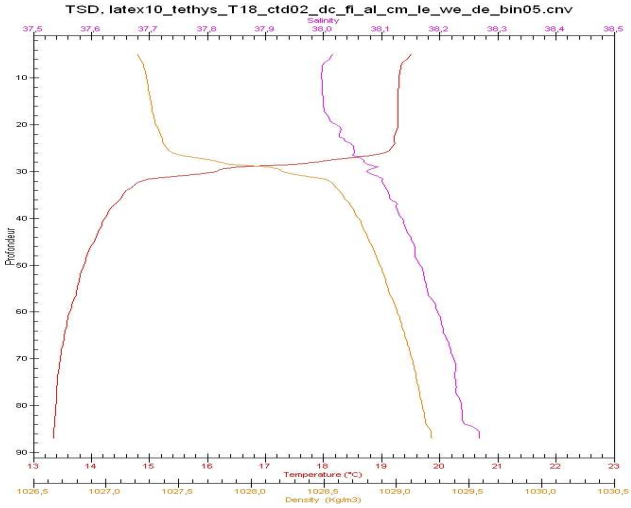

Sept 7th
Sept 8th
Sept 9th
Sept 10th
Sept 11th
Sept 12th
Sept 14th
Sept 15th
Sept 17th
0.05 [ms-1]
Depth=-15[m]
Latitude
Longitude
43°N
42°N
3°E
4°E
20'
40'


Sept 18th
Sept 20th
Sept 21th
Sept 22th
Sept 23th
Latitude
Longitude
43°N
42°N
3°E
4°E
20'
40'
0.05 [ms-1]
Depth=-15[m]

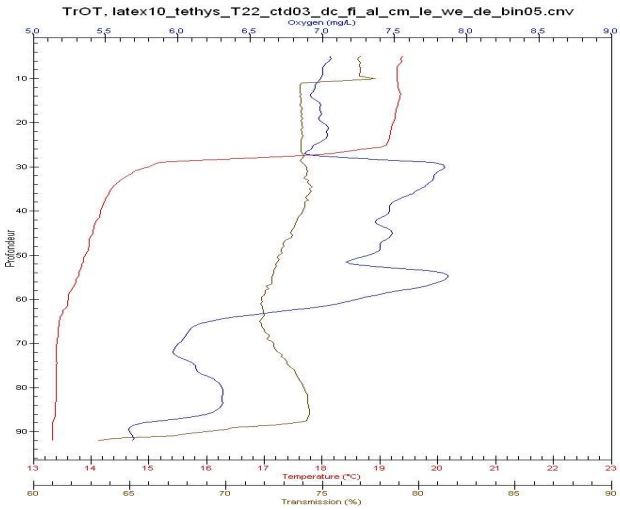
Annexe 2 – CTD profiles



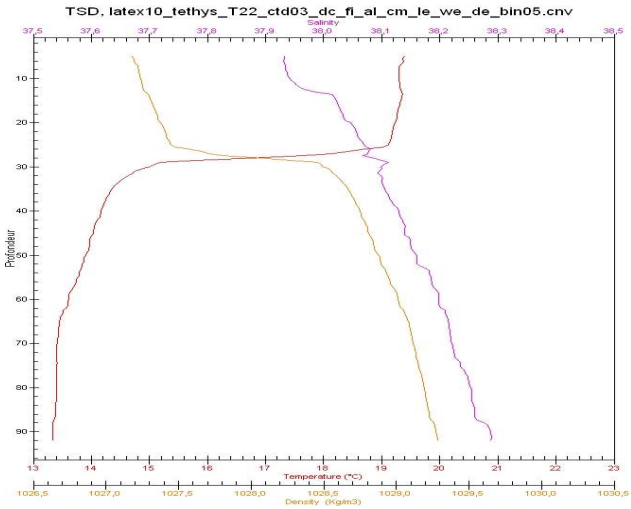
Cast 2 – Station 18
(oxygen/temperature/transmission)



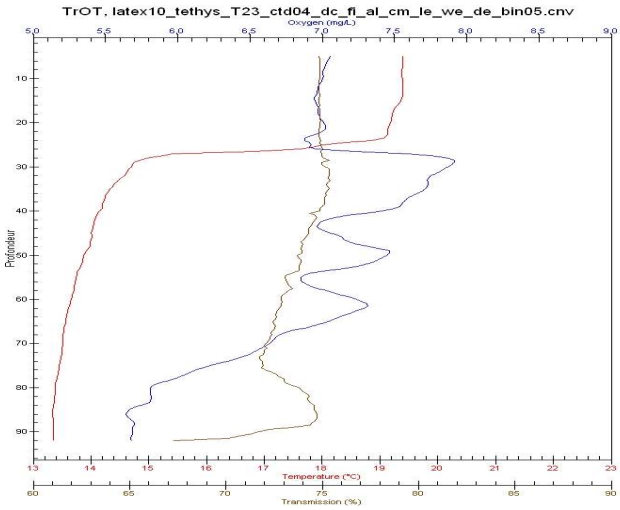
Cast 2 – Station 18
(salinity/temperature/density)



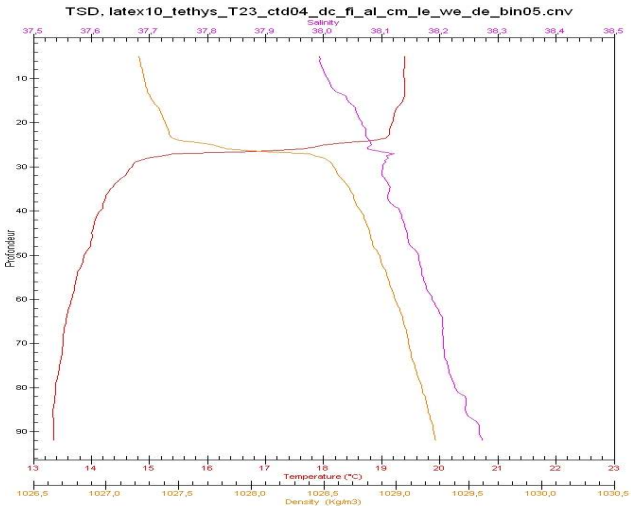
Cast 3 – Station 22
(oxygen/temperature/transmission)



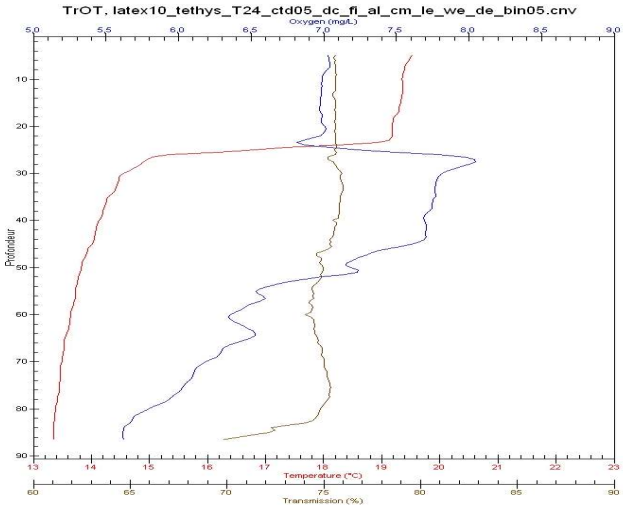
Cast 3 – Station 22
(salinity/temperature/density)



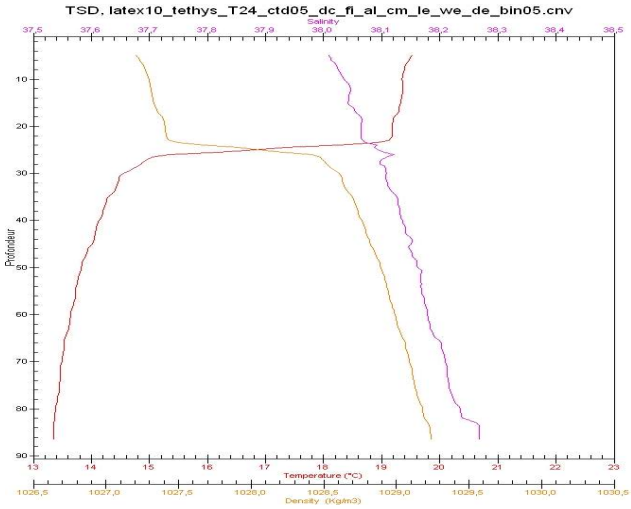
Cast 4 – Station 23
(oxygen/temperature/transmission)



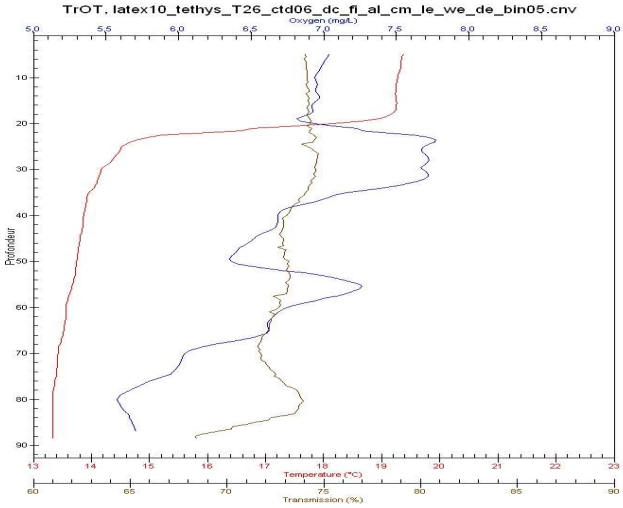
Cast 4 – Station 23
(salinity/temperature/density)



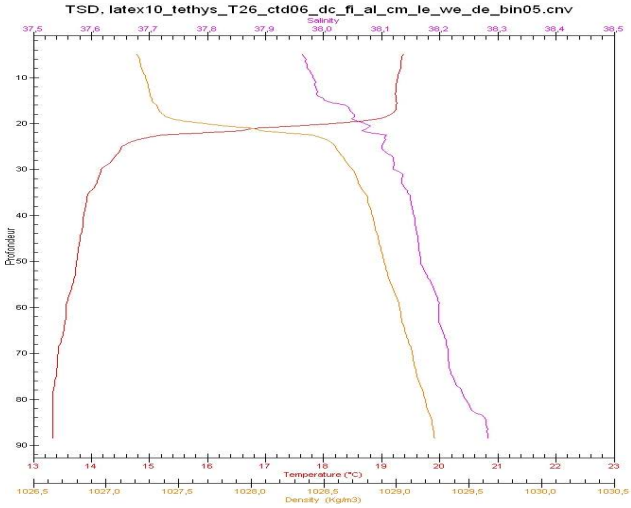
Cast 5 – Station 24
(oxygen/temperature/transmission)



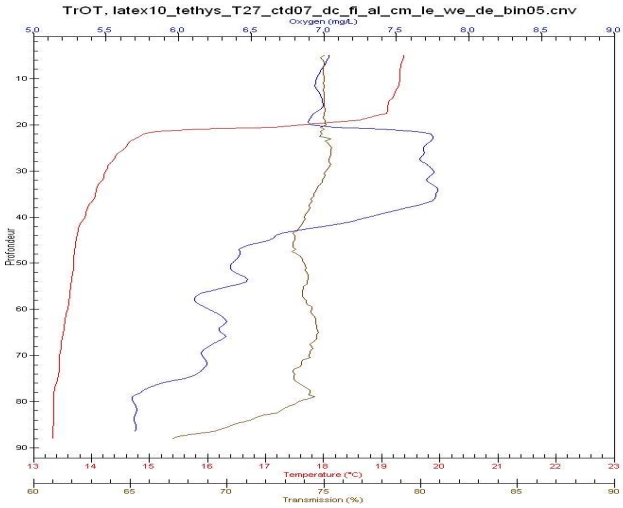
Cast 5 – Station 24
(salinity/temperature/density)



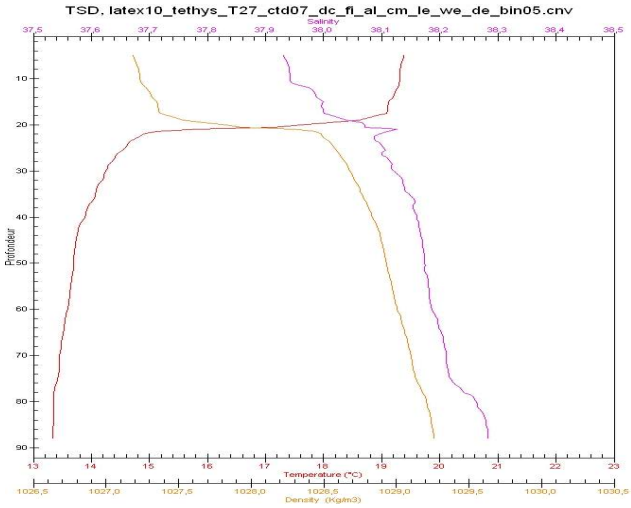
Cast 6 – Station 26
(oxygen/temperature/transmission)



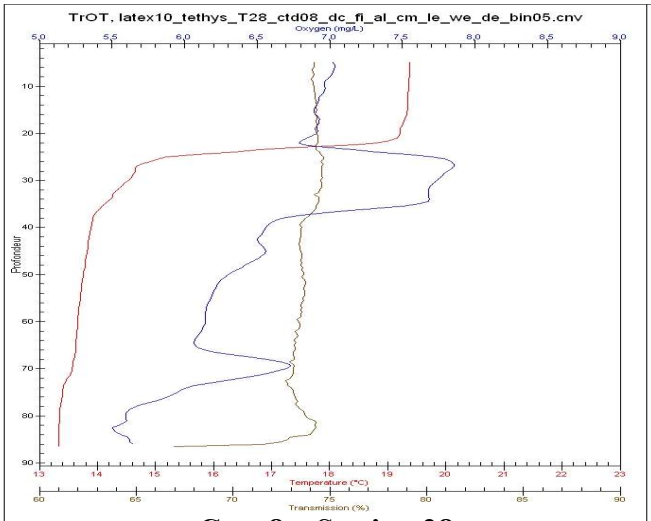
Cast 6 – Station 26
(salinity/temperature/density)



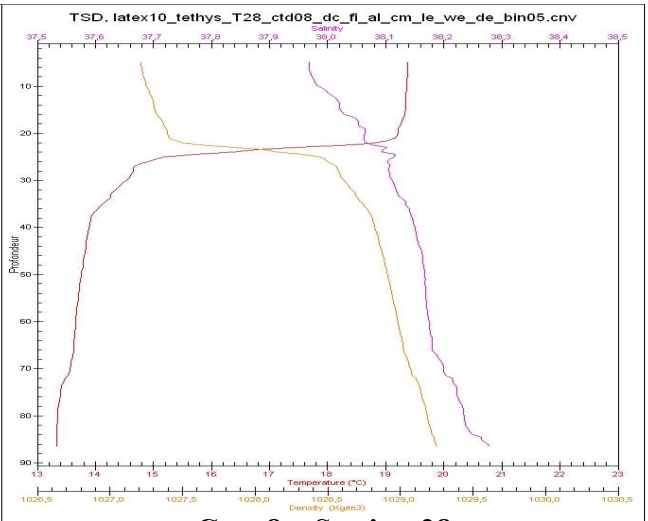
Cast 7 – Station 27
(oxygen/temperature/transmission)



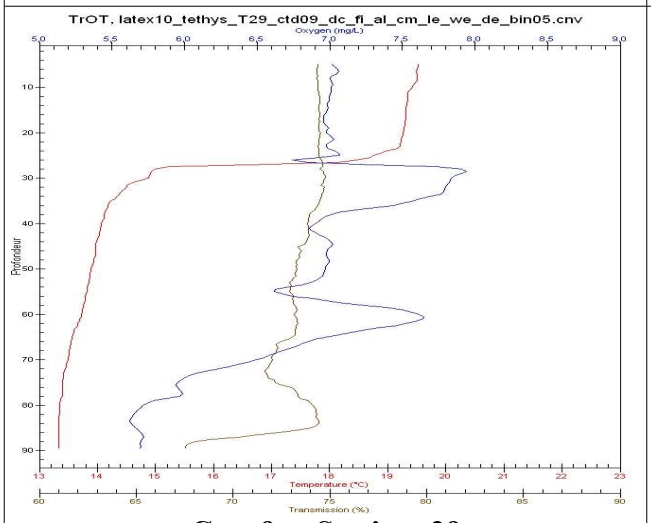
Cast 7 – Station 27
(salinity/temperature/density)



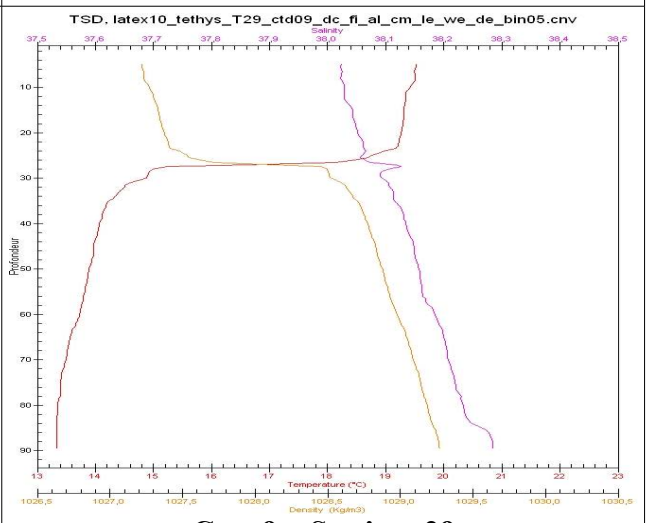
Cast 8 – Station 28
(oxygen/temperature/transmission)



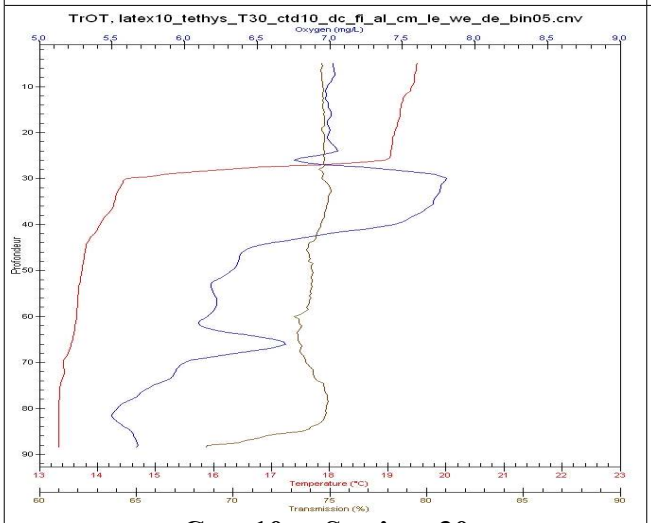
Cast 8 – Station 28
(salinity/temperature/density)



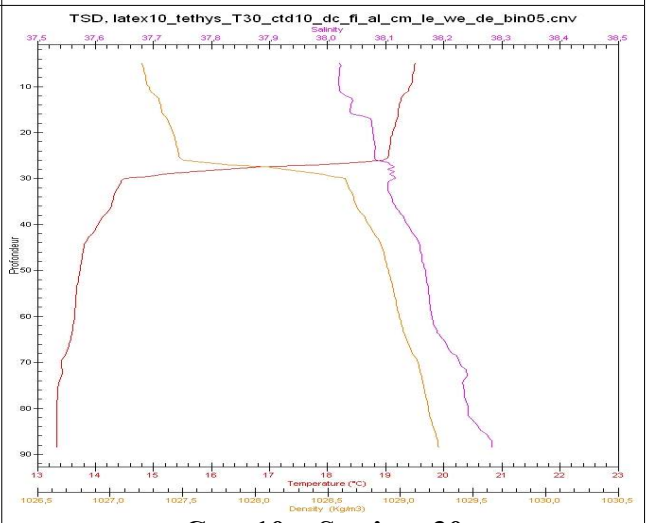
Cast 9 – Station 29
(oxygen/temperature/transmission)



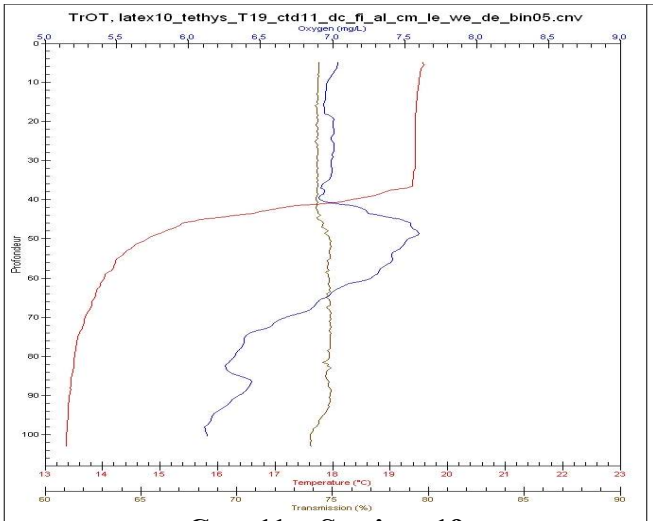
Cast 9 – Station 29
(salinity/temperature/density)



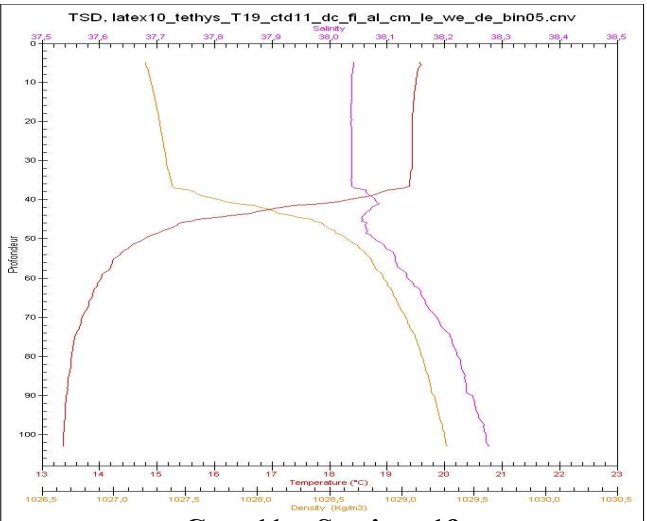
Cast 10 – Station 30
(oxygen/temperature/transmission)



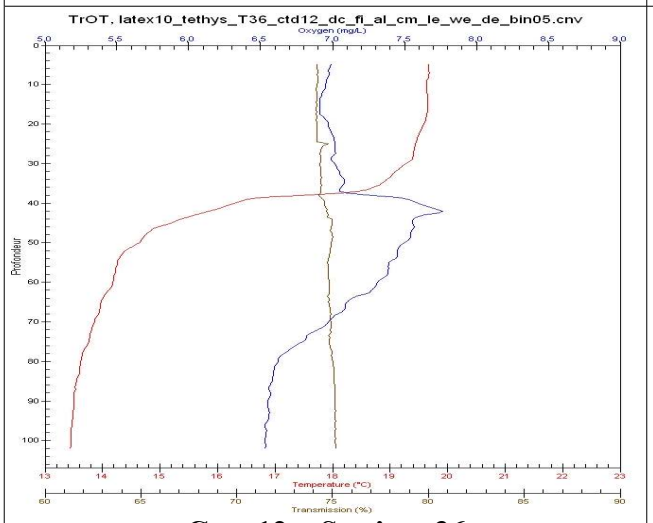
Cast 10 – Station 30
(salinity/temperature/density)



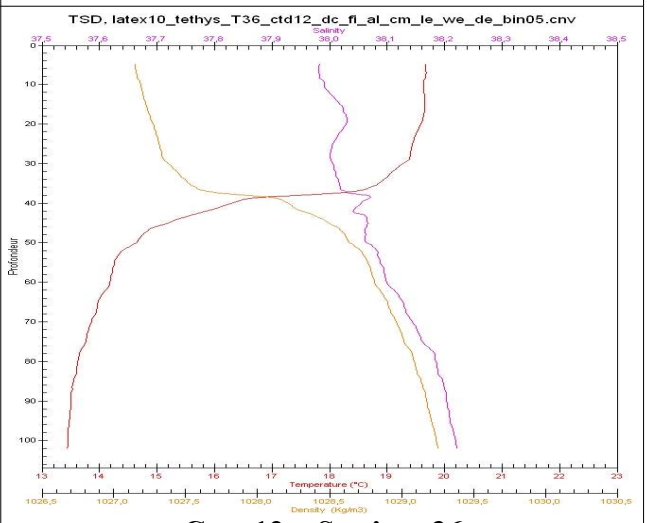
Cast 11 – Station 19
(oxygen/temperature/transmission)



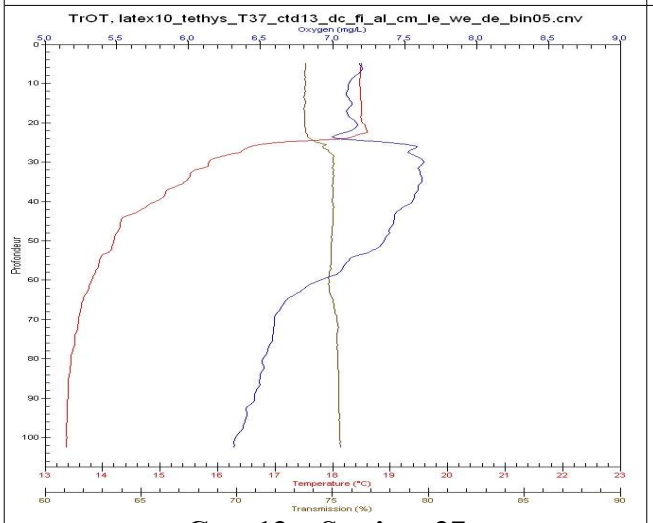
Cast 11 – Station 19
(salinity/temperature/density)



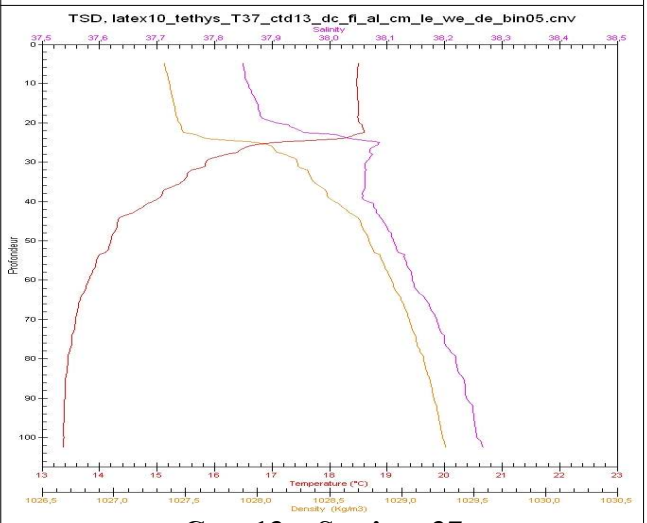
Cast 12 – Station 36
(oxygen/temperature/transmission)



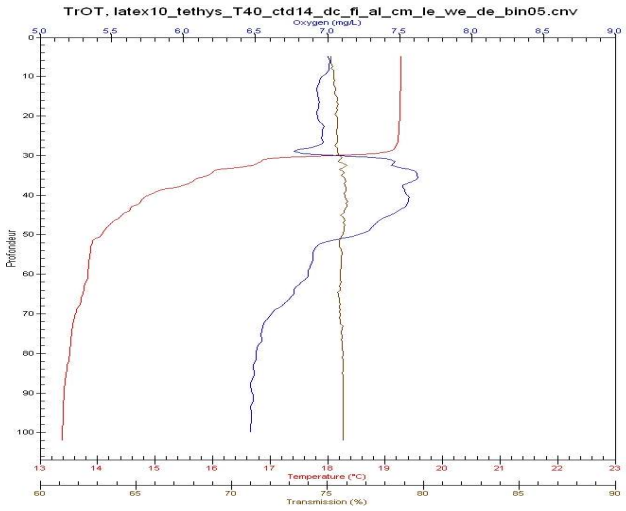
Cast 12 – Station 36
(salinity/temperature/density)

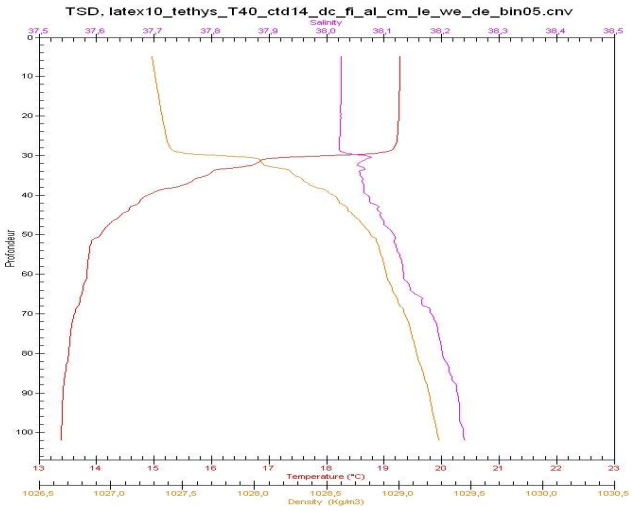


Cast 13 – Station 37
(oxygen/temperature/transmission)

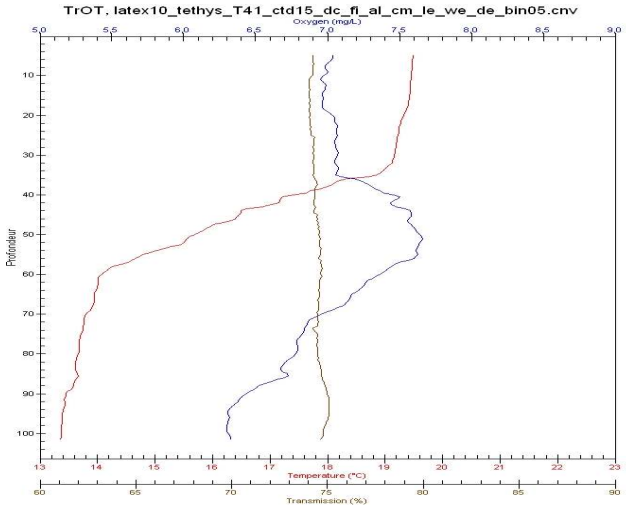


Cast 13 – Station 37
(salinity/temperature/density)

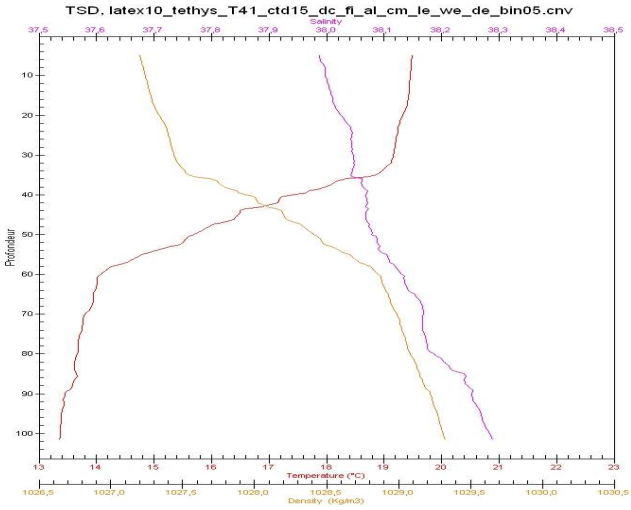




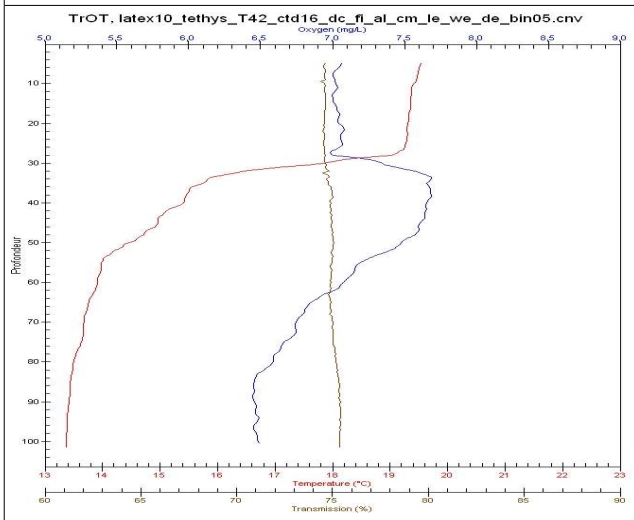
Cast 14 – Station 40
(salinity/temperature/density)



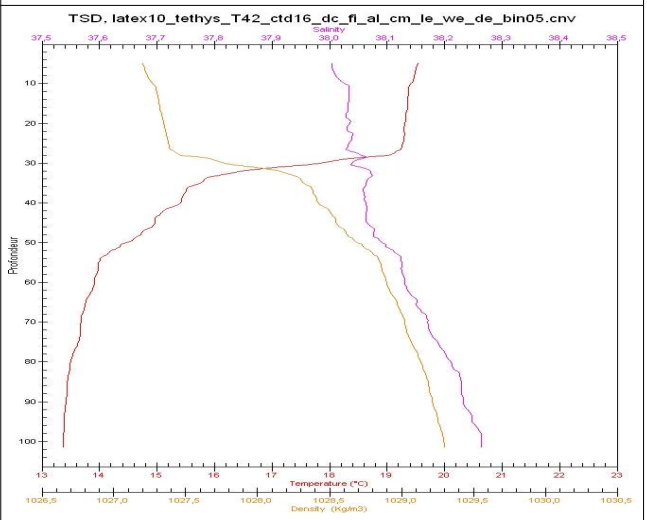
Cast 15 – Station 41
(oxygen/temperature/transmission)



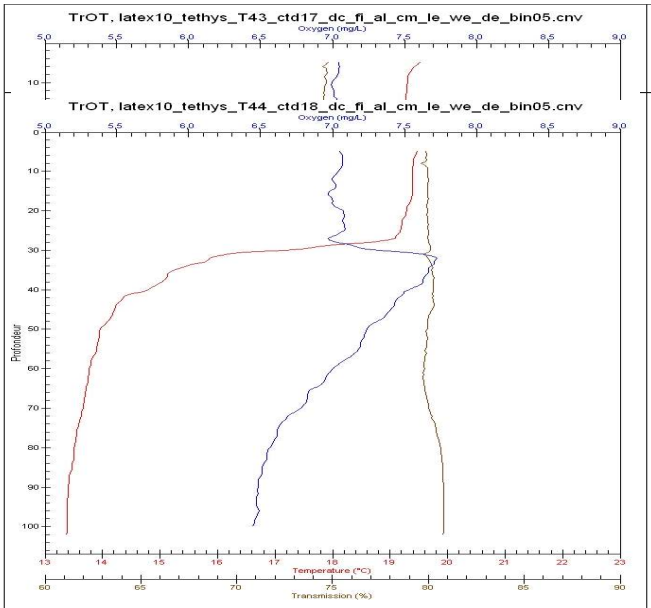
Cast 15 – Station 41
(salinity/temperature/density)



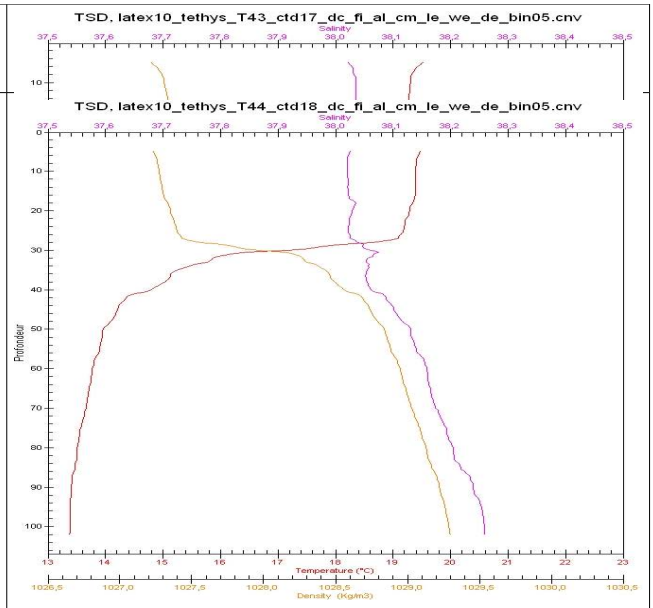
Cast 16 – Station 42
(oxygen/temperature/transmission)



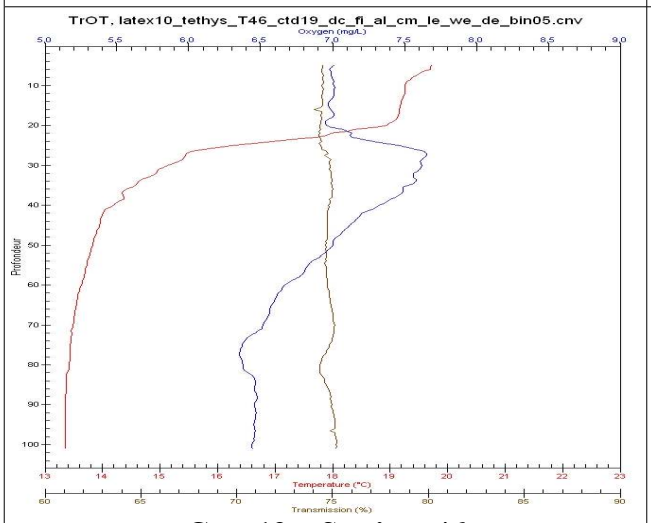
Cast 16 – Station 42
(salinity/temperature/density)



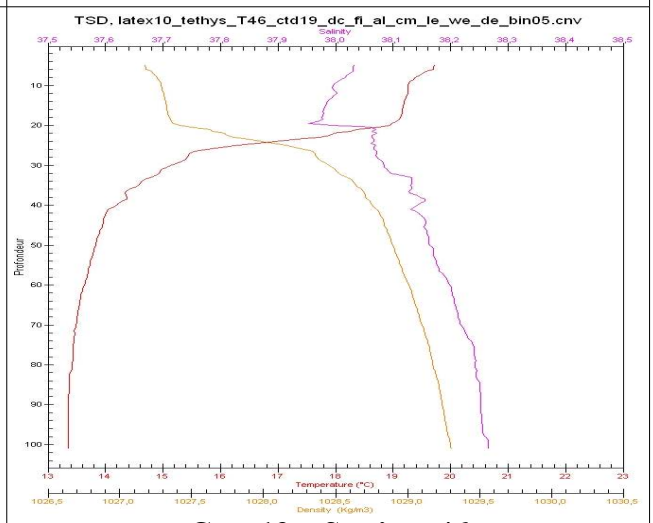
Cast 18 – Station 44
(oxygen/temperature/transmission)



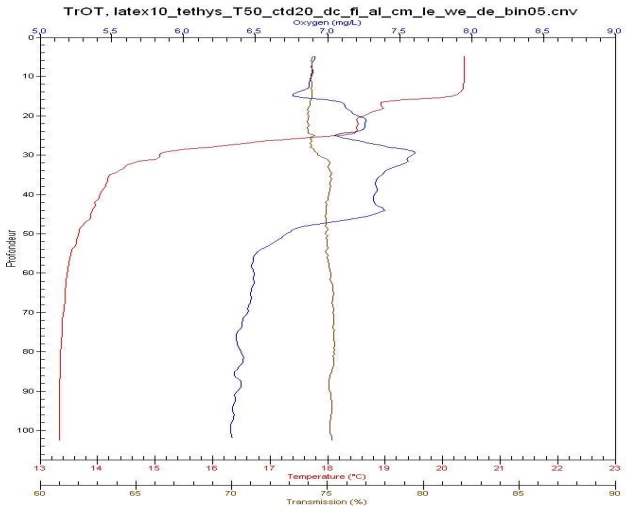
Cast 18 – Station 44
(salinity/temperature/density)



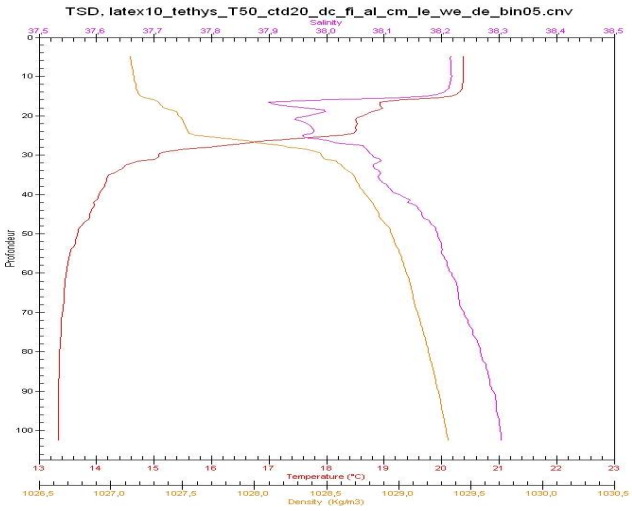
Cast 19 – Station 46
(oxygen/temperature/transmission)



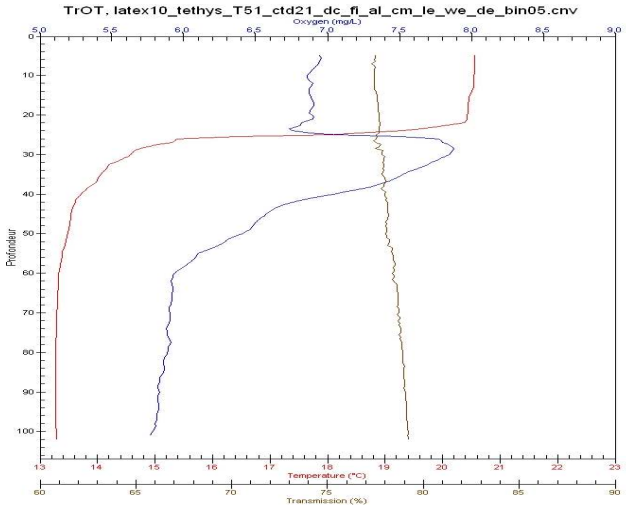
Cast 19 – Station 46
(salinity/temperature/density)



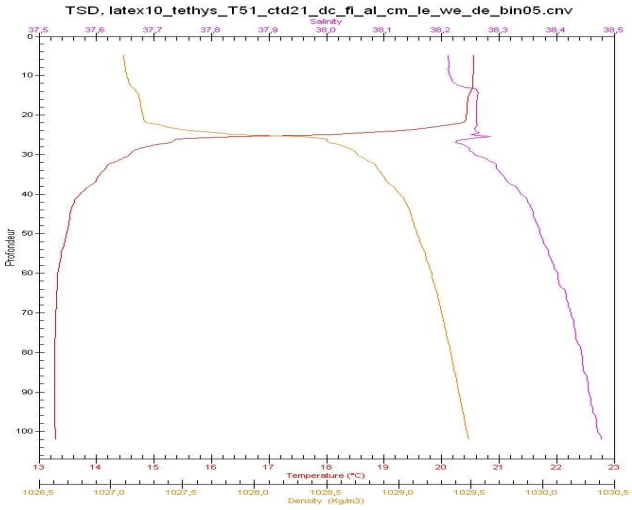
Cast 20 – Station 50
(oxygen/temperature/transmission)



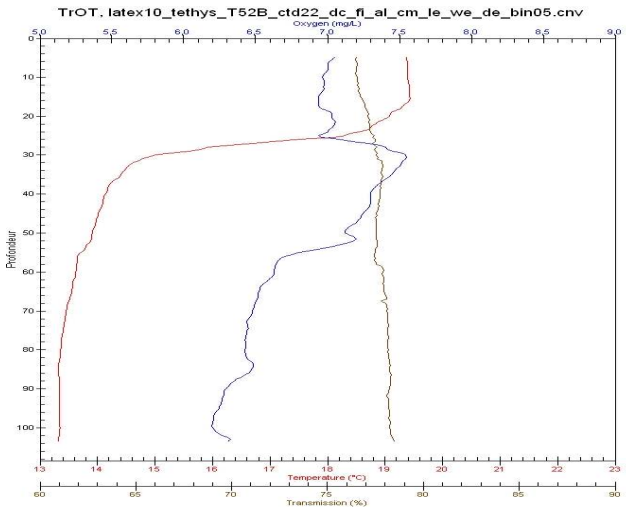
Cast 20 – Station 50
(salinity/temperature/density)



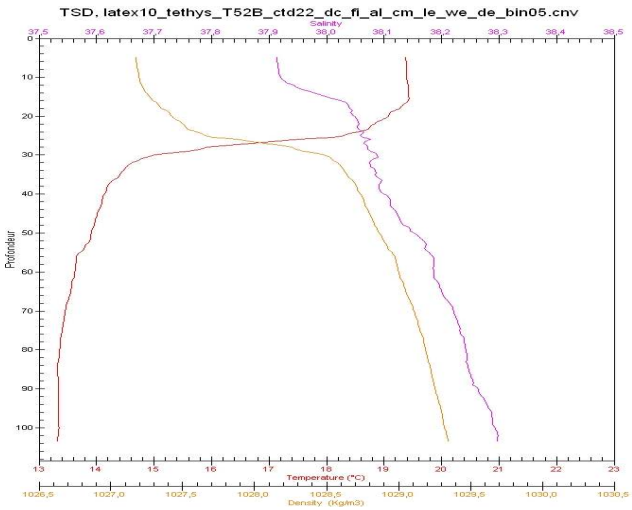
Cast 21 – Station 51
(oxygen/temperature/transmission)



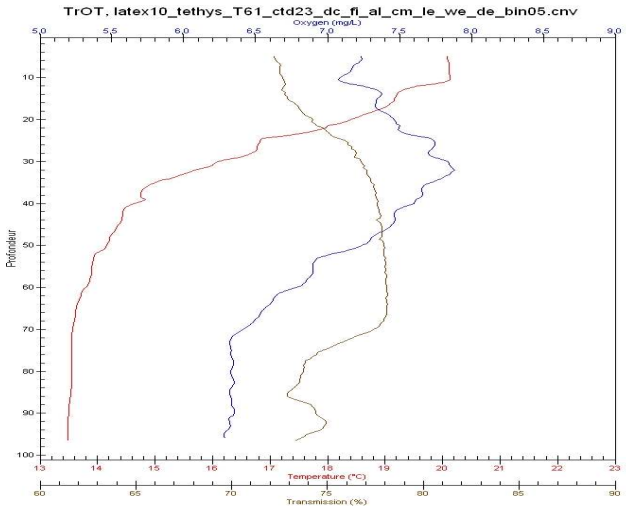
Cast 21 – Station 51
(salinity/temperature/density)



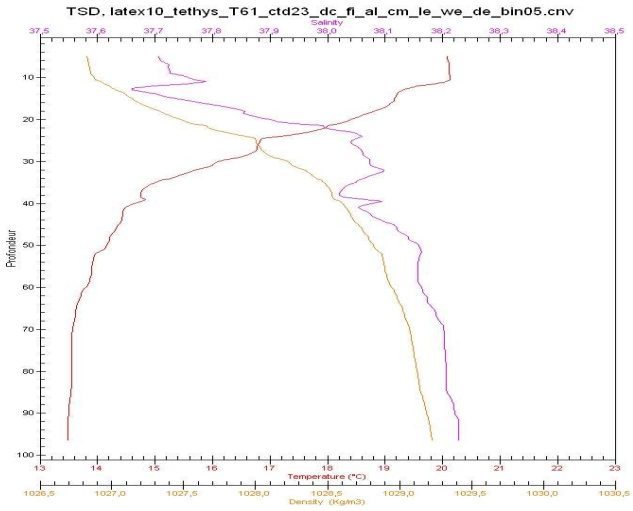
Cast 22 – Station 52
(oxygen/temperature/transmission)



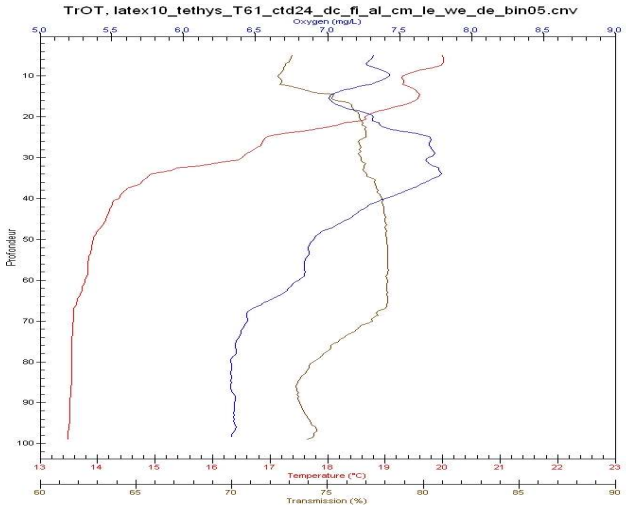
Cast 22 – Station 52
(salinity/temperature/density)



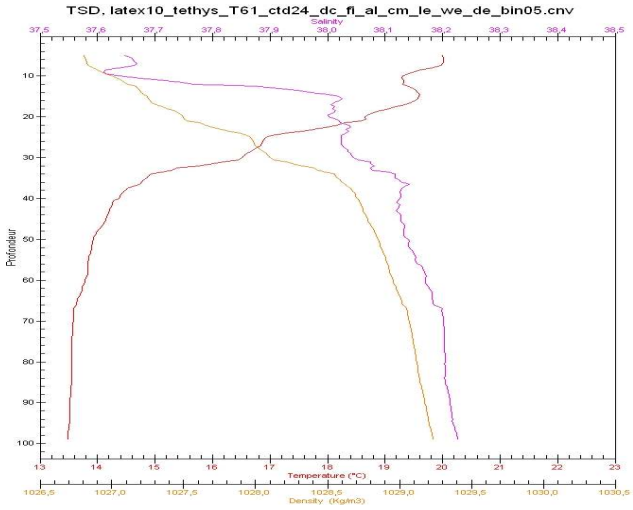
Cast 23 – Station 61
(oxygen/temperature/transmission)



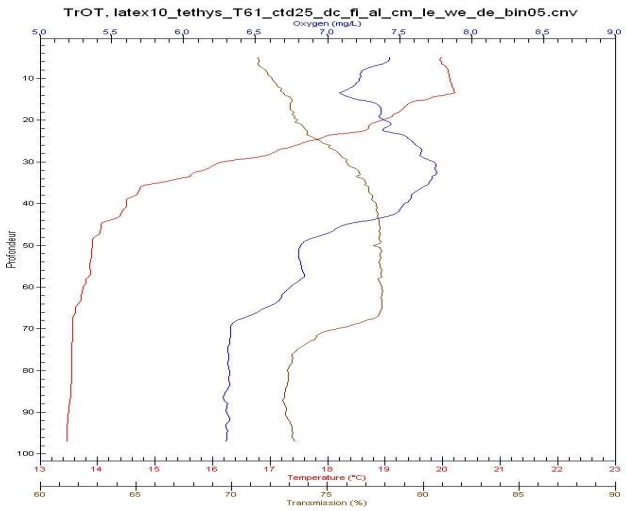
Cast 23 – Station 61
(salinity/temperature/density)



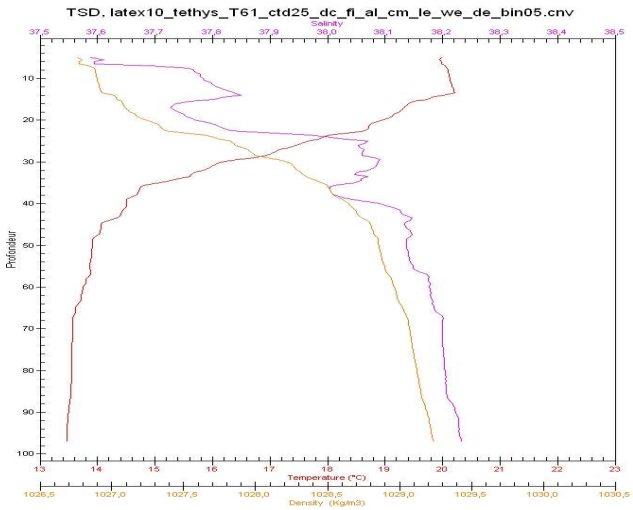
Cast 24 – Station 61
(oxygen/temperature/transmission)



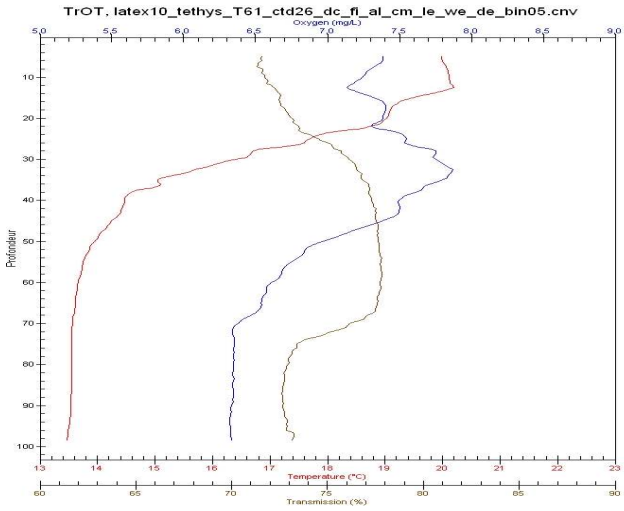
Cast 24 – Station 61
(salinity/temperature/density)



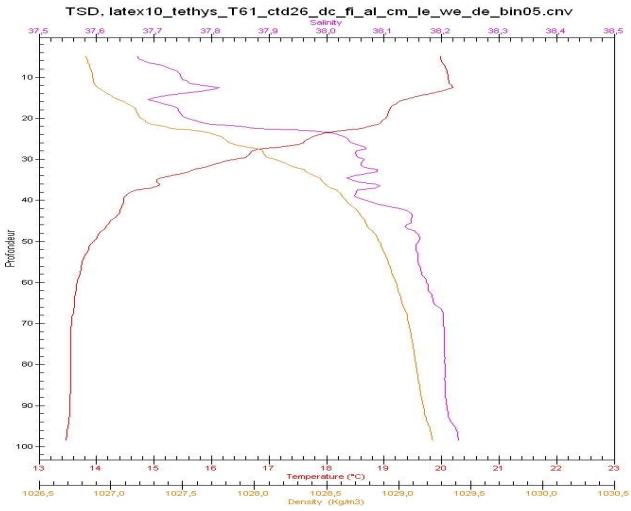
Cast 25 – Station 61
(oxygen/temperature/transmission)



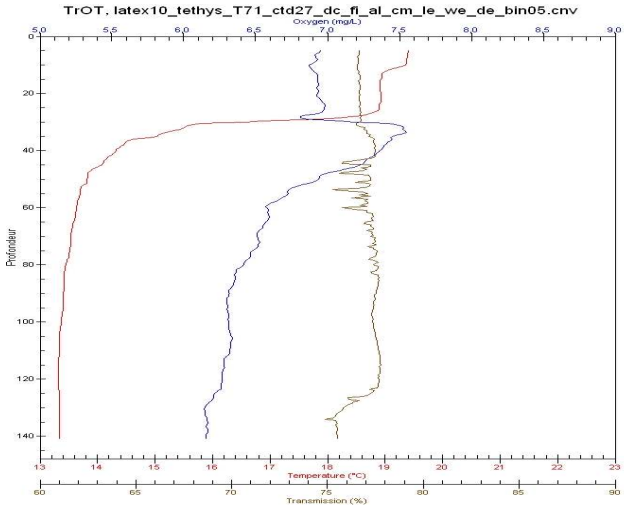
Cast 25 – Station 61
(salinity/temperature/density)



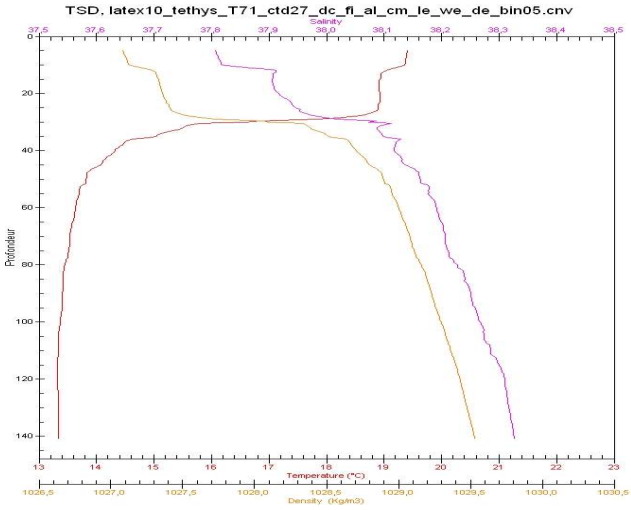
Cast 26 – Station 61
(oxygen/temperature/transmission)



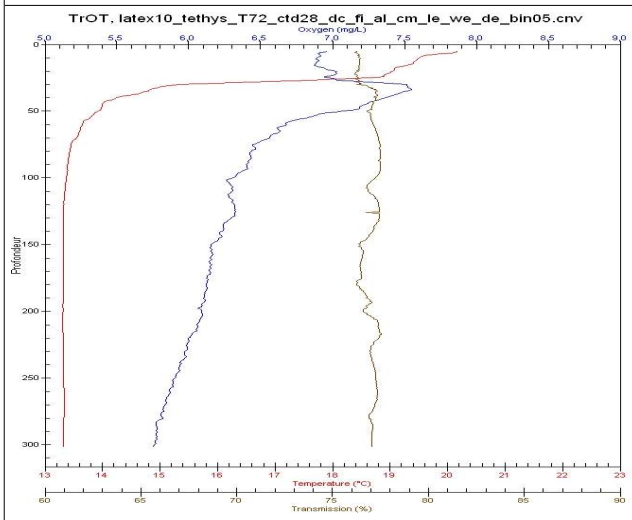
Cast 26 – Station 61
(salinity/temperature/density)



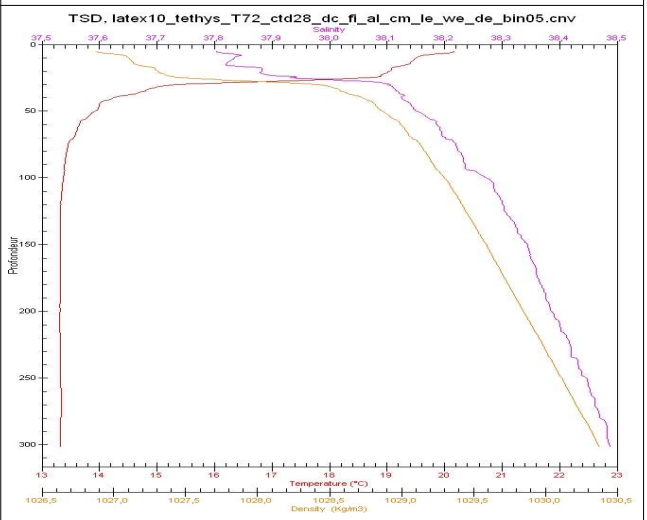
Cast 27 – Station 71
(oxygen/temperature/transmission)



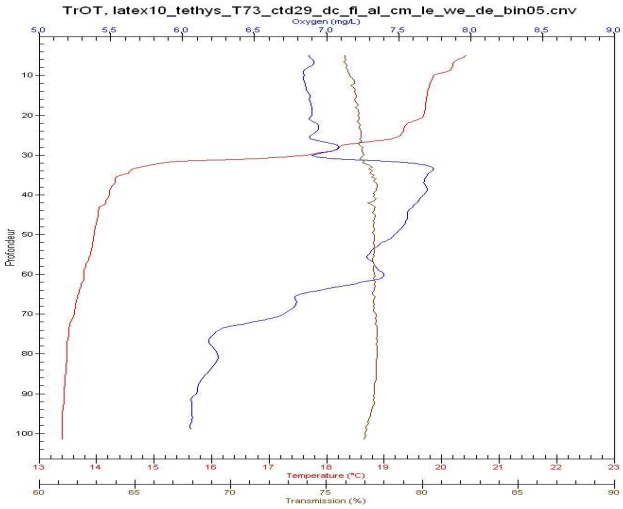
Cast 27 – Station 71
(salinity/temperature/density)



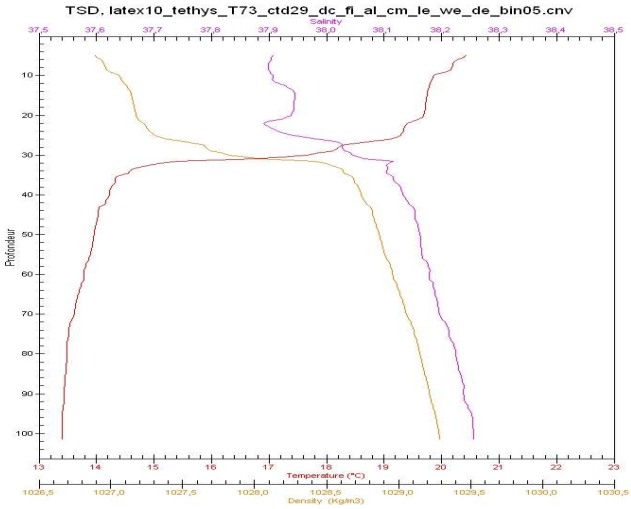
Cast 28 – Station 72
(oxygen/temperature/transmission)



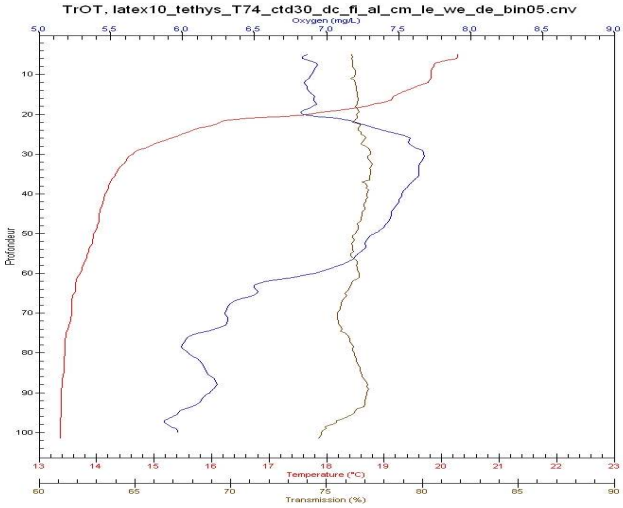
Cast 28 – Station 72
(salinity/temperature/density)



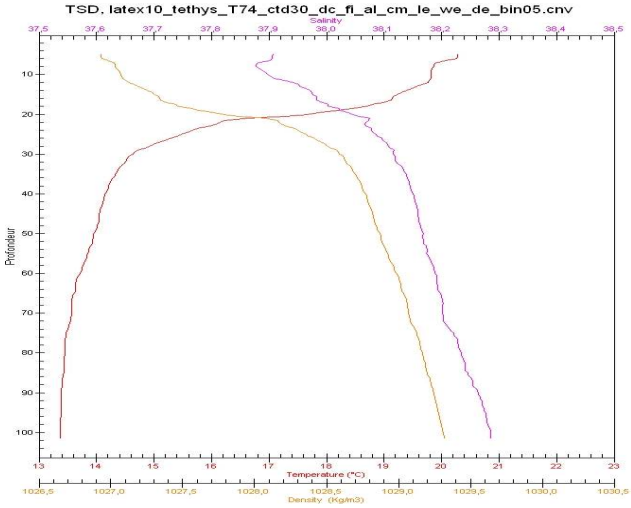
Cast 29 – Station 73
(oxygen/temperature/transmission)



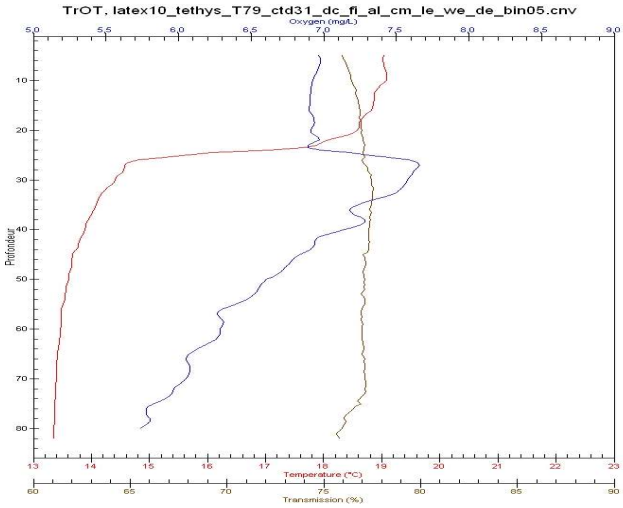
Cast 29 – Station 73
(salinity/temperature/density)



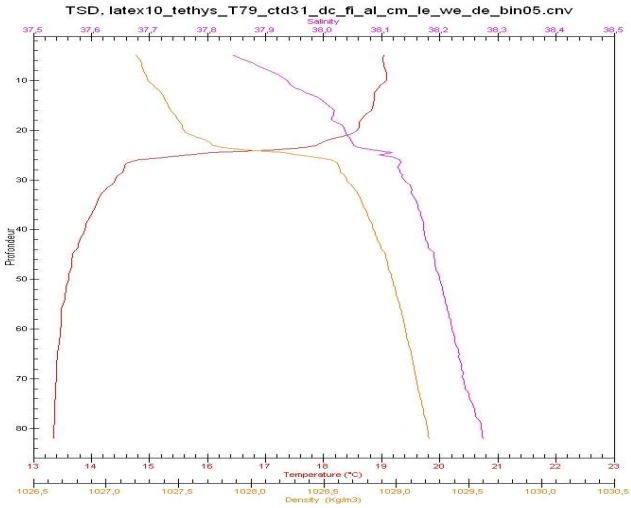
Cast 30 – Station 74
(oxygen/temperature/transmission)



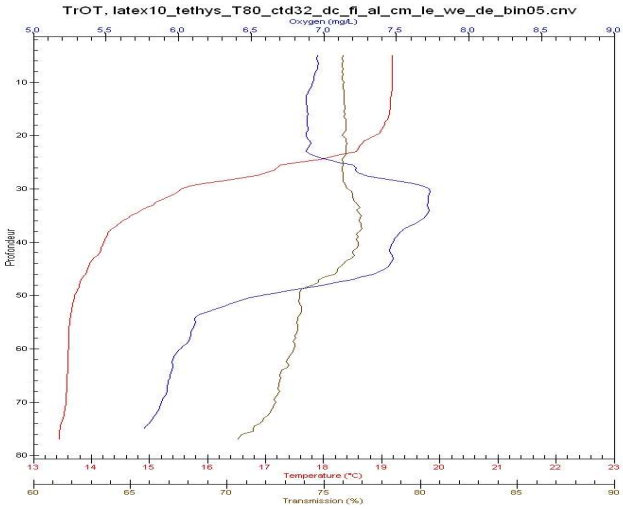
Cast 30 – Station 74
(salinity/temperature/density)



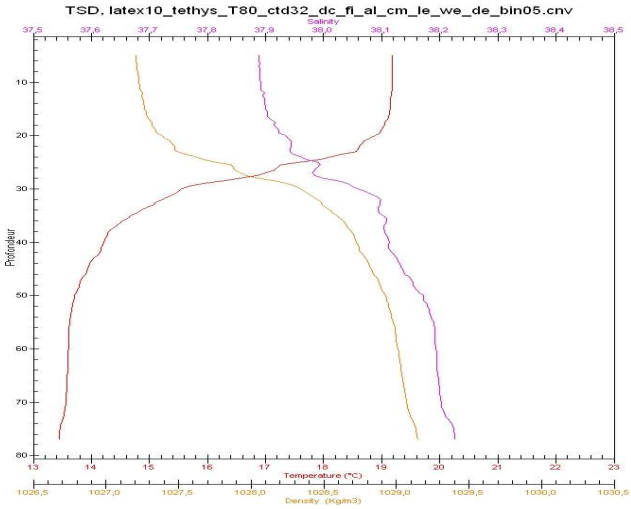
Cast 31 – Station 79
(oxygen/temperature/transmission)



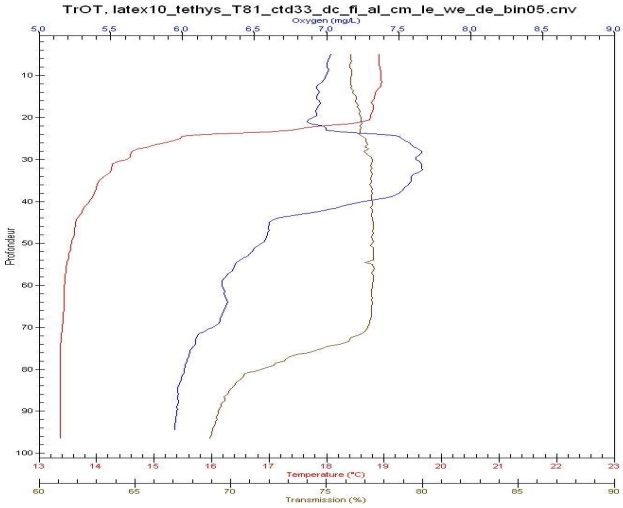
Cast 31 – Station 79
(salinity/temperature/density)



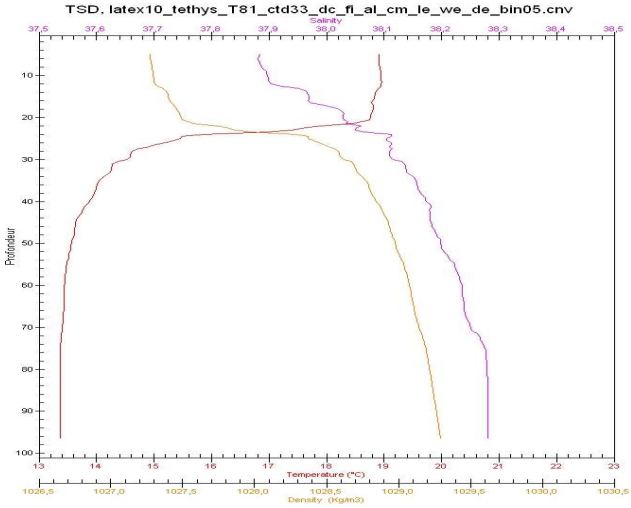
Cast 32 – Station 80
(oxygen/temperature/transmission)



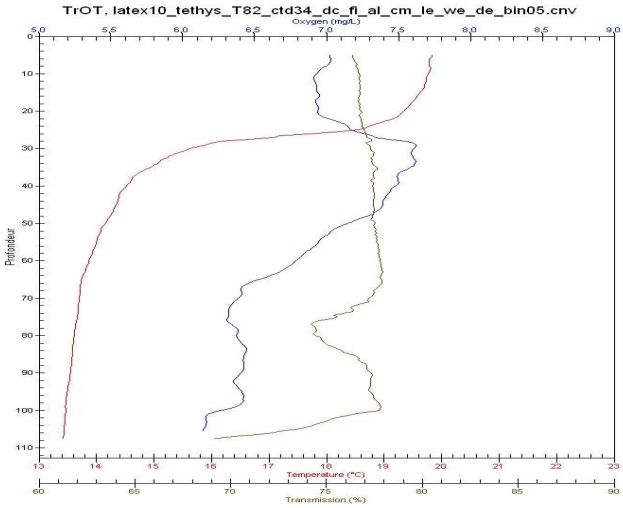
Cast 32 – Station 80
(salinity/temperature/density)



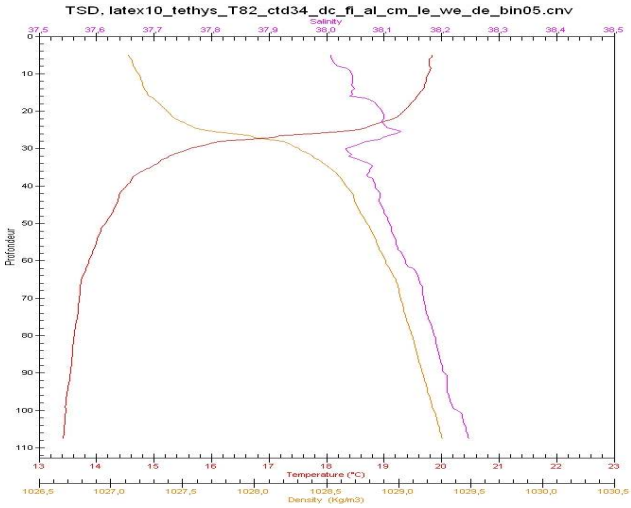
Cast 33 – Station 81
(oxygen/temperature/transmission)



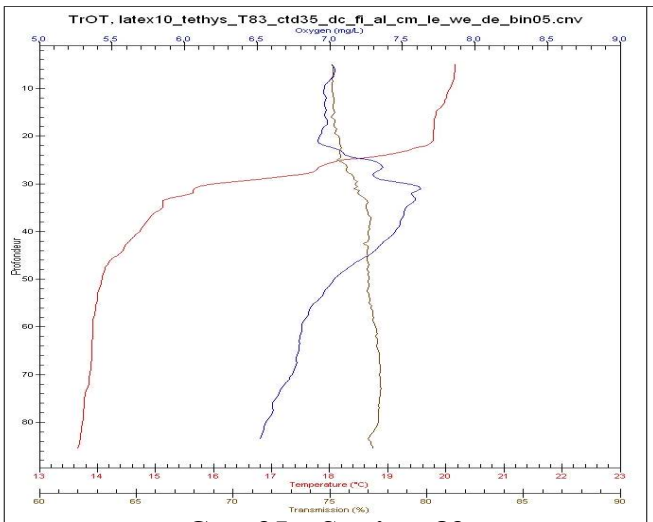
Cast 33 – Station 81
(salinity/temperature/density)



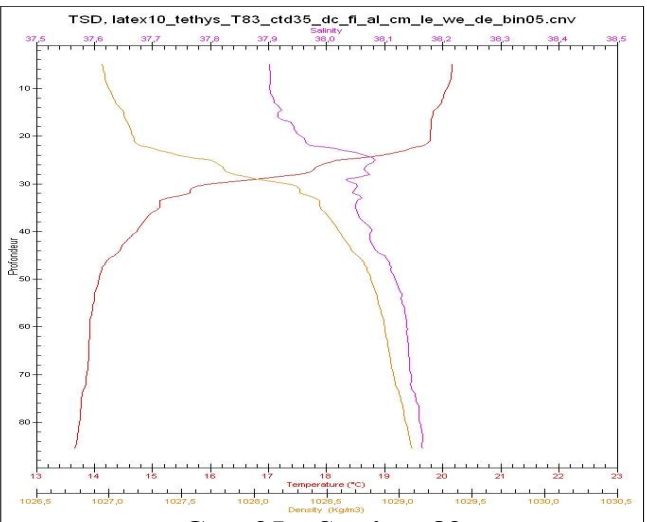
Cast 34 – Station 82
(oxygen/temperature/transmission)



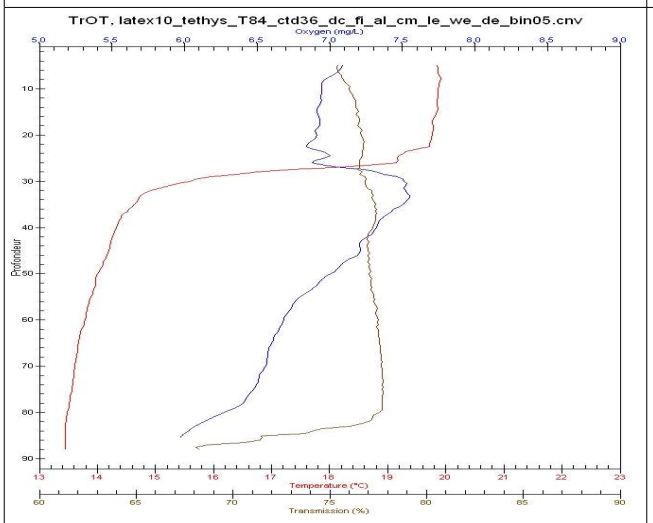
Cast 34 – Station 82
(salinity/temperature/density)



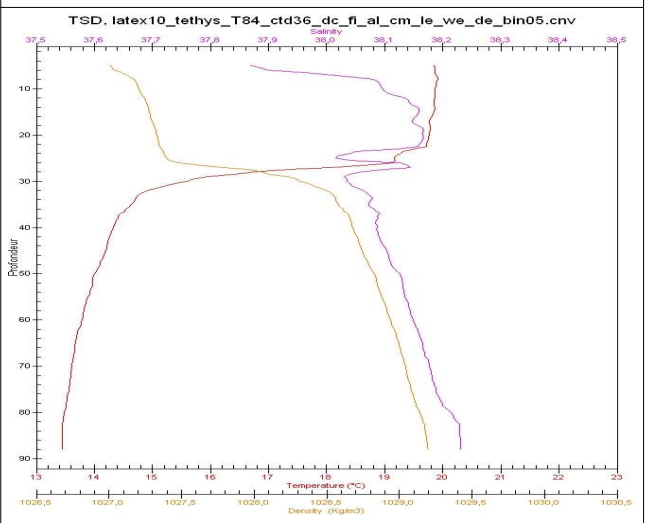
Cast 35 – Station 83
(oxygen/temperature/transmission)



Cast 35 – Station 83
(salinity/temperature/density)

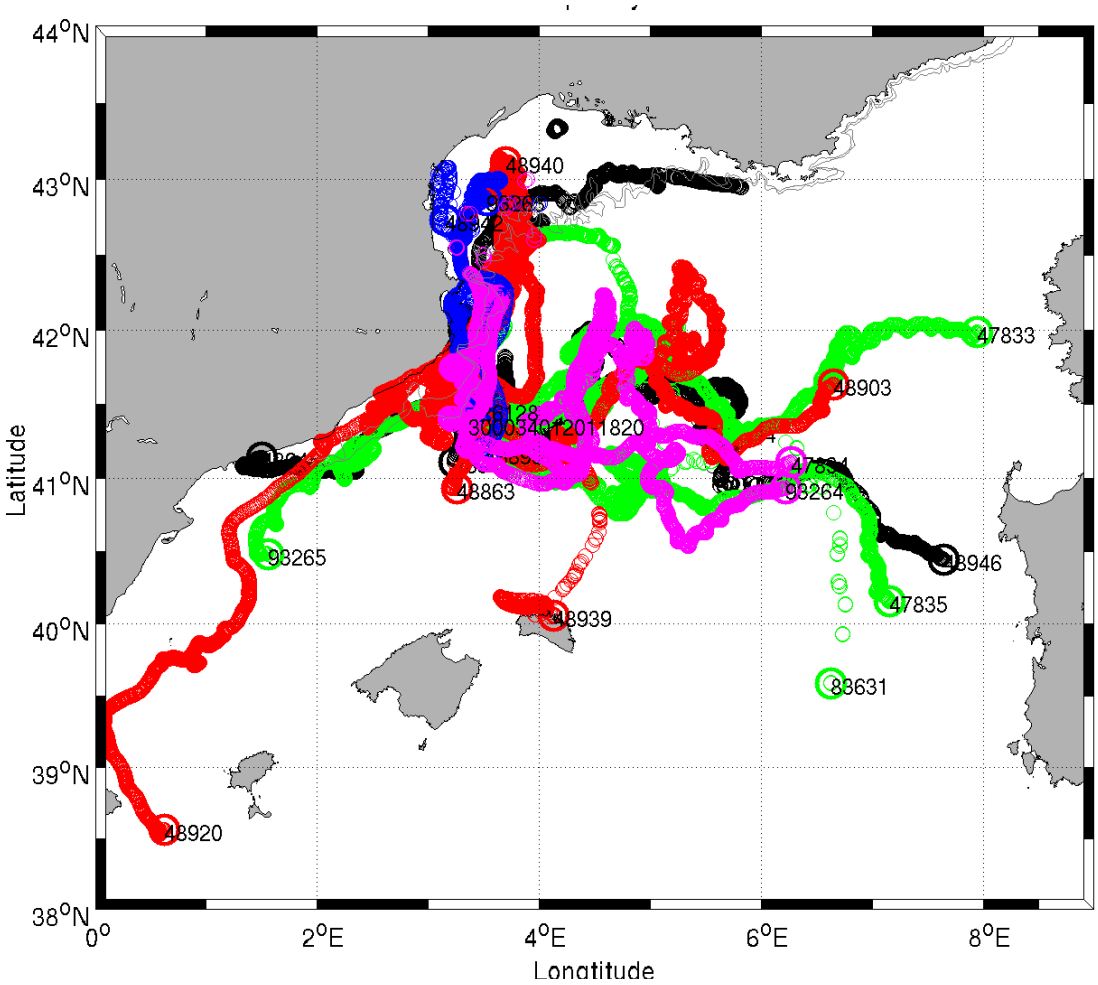


Cast 36 – Station 84
(oxygen/temperature/transmission)

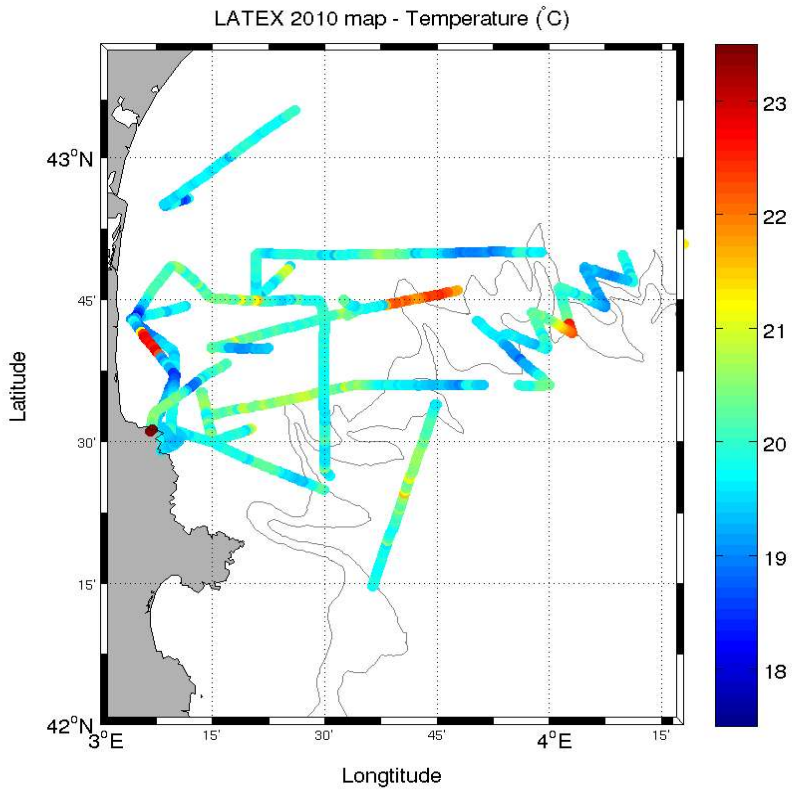


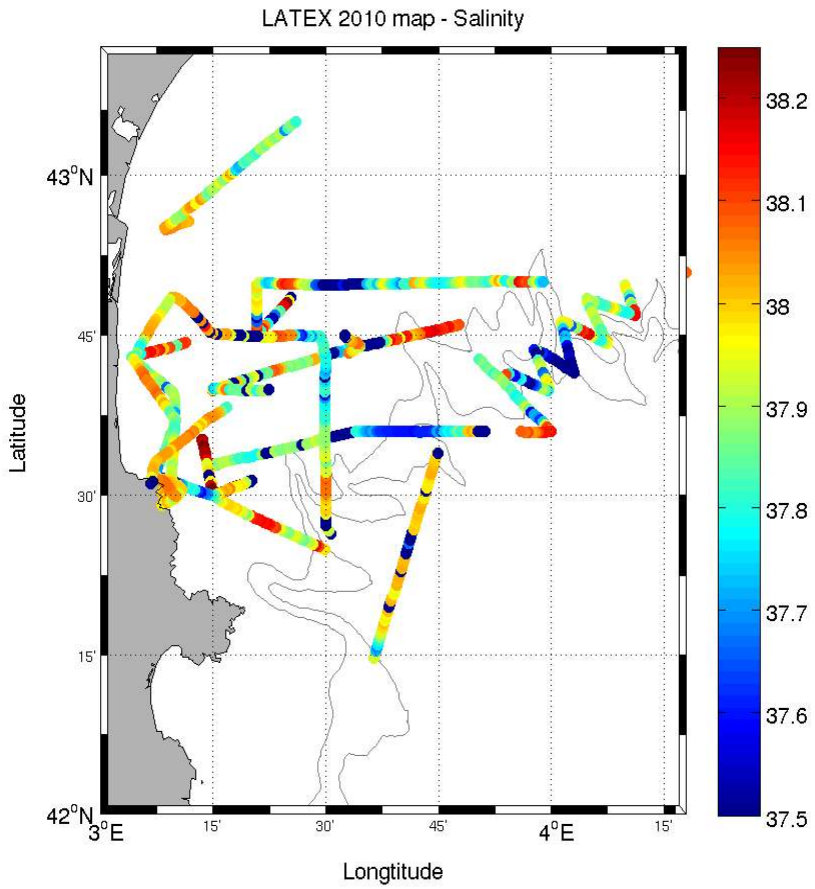
Cast 36 – Station 84
(salinity/temperature/density)

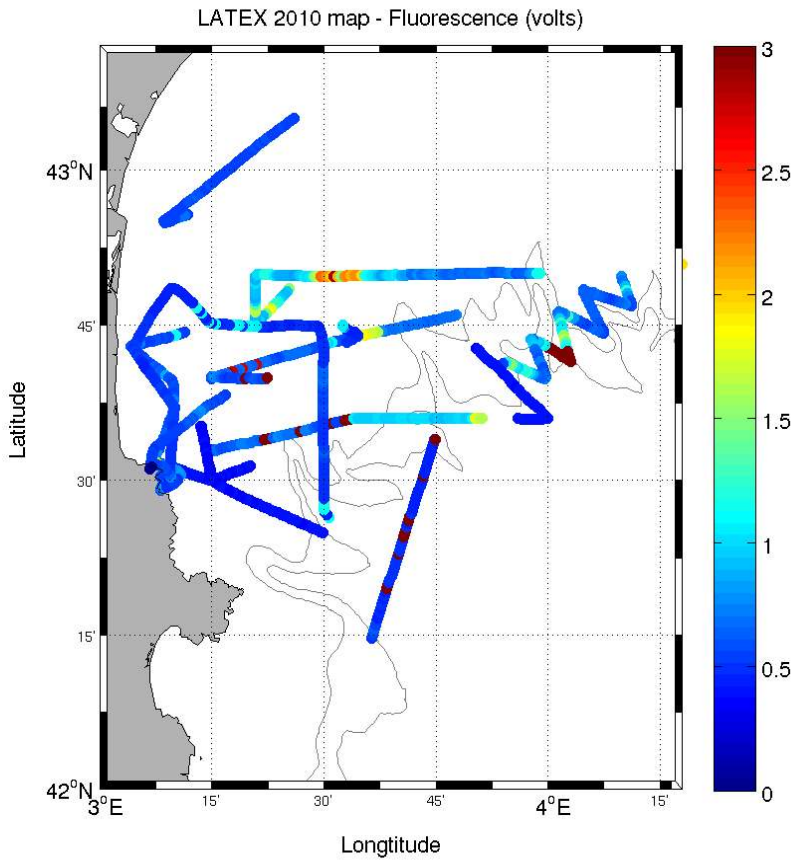
Annexe 3 - Map of the trajectories of the buoys from September 1 to October 31, 2010

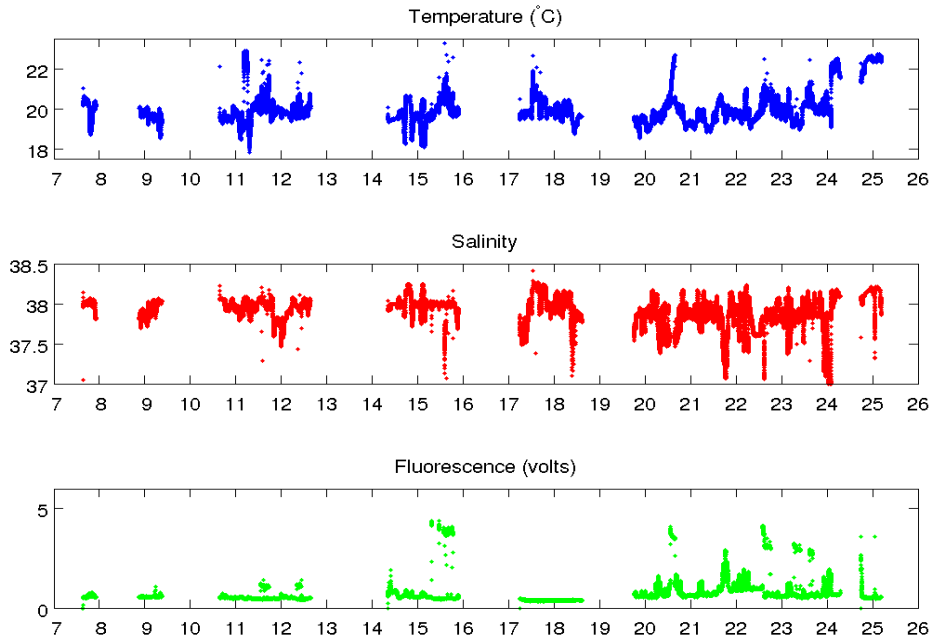


Annexe 4 - Figures of on-going surface T, S and fluorescence



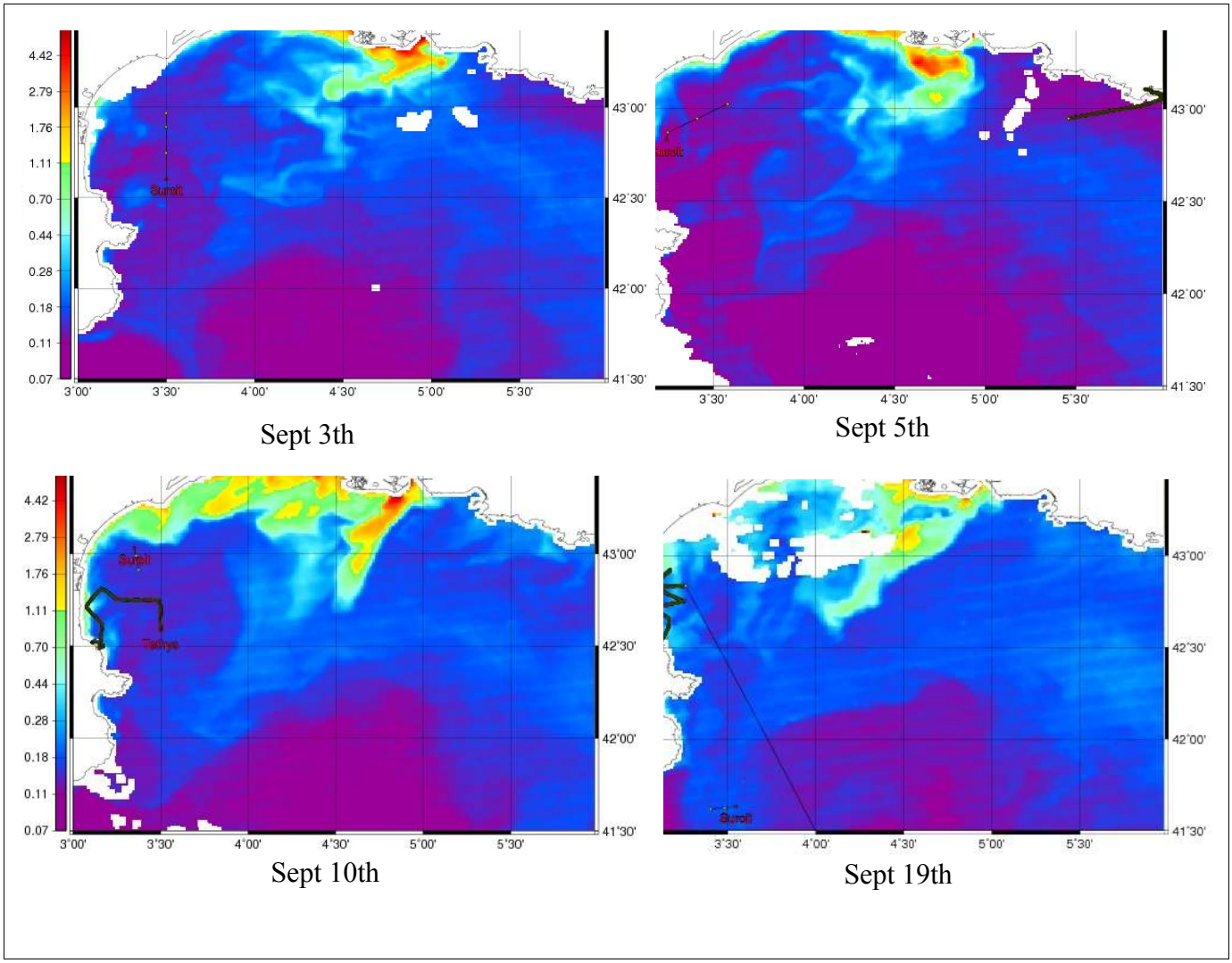



LATEX 2010 map - Fluorescence (volts)
Latitude
Longtitude
43°N
45'
30'
15'
42°N
3°E
15'
30'
45'
4°E
15'
3
2.5
2
1.5
1
0.5
0


Temperature (°C)
22
20
18
Salinity
38.5
38
37.5
37
Fluorescence (volts)
5
0
7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26

Annexe 5 - Ocean color images [Chl_a]

The trajectory of the Suroît is indicated by the thin line, the one of the Téthys II by a bold line.



Sept 3th

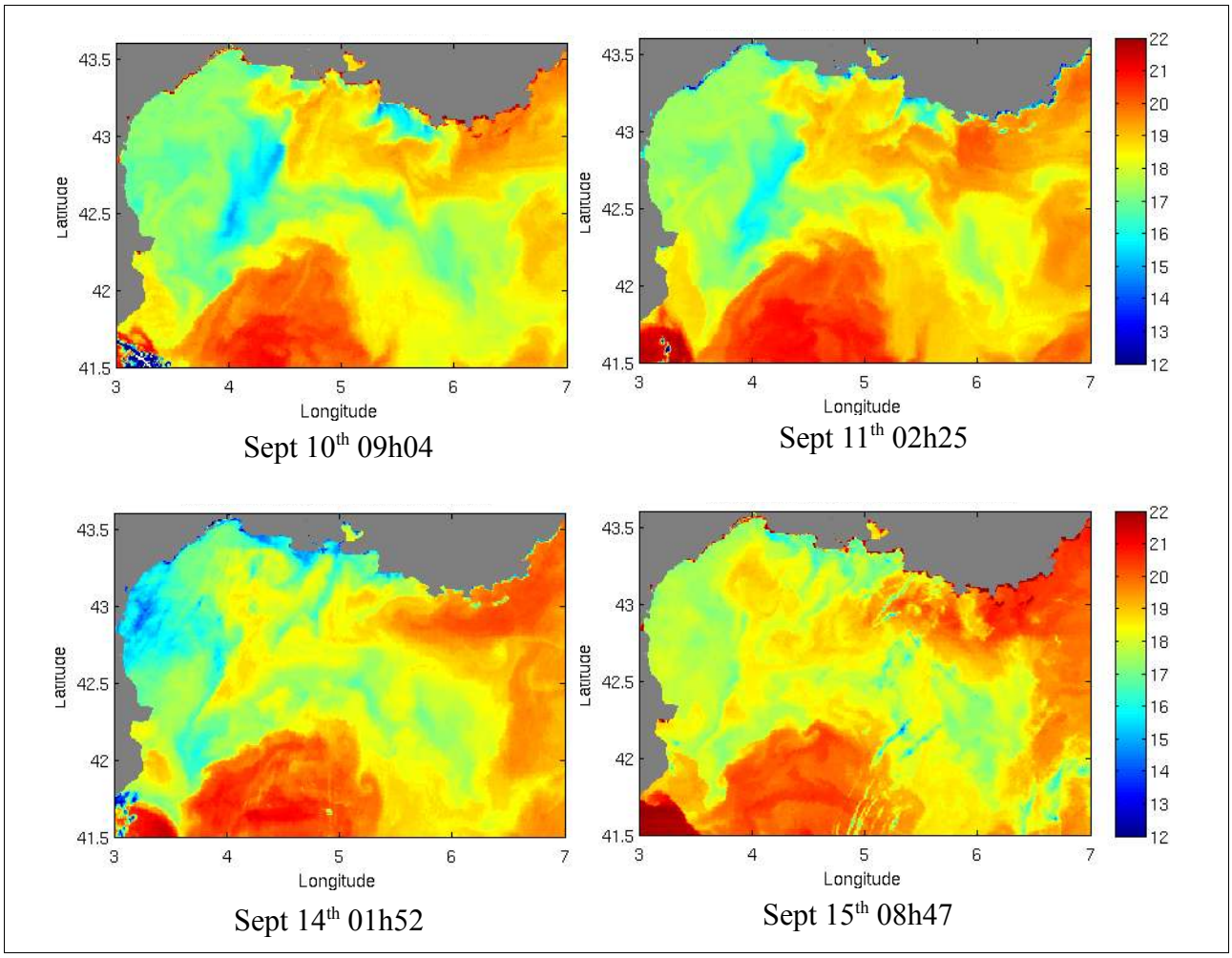
Sept 5th

Sept 10th

Sept 19th

Note: only the nicest figures are shown in this report

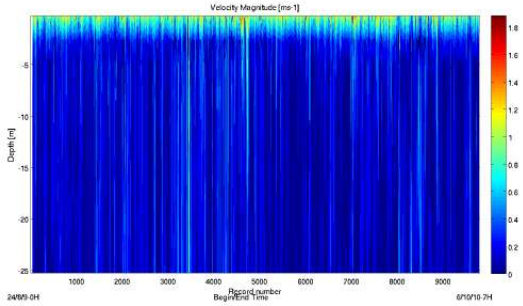
Annexe 6 – Proxy of Sea Surface Temperature (AVHRR – Canal 4)



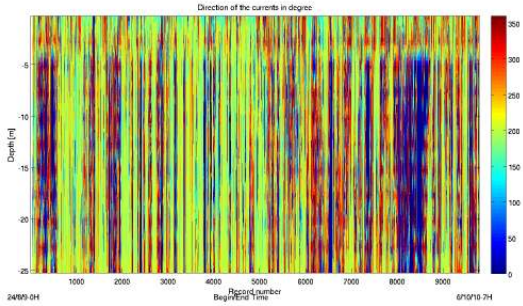
Note: only the nicest figures are shown in this report

Annexe 7 – Time series of the velocity magnitude (left) and the velocity direction (right) of the three moorings (only the first 25m are shown for moorings n°2 and n°3) from August 24, 2009 to i) October 6, 2010 for Mooring n°1, ii) October 4, 2010 for Mooring n°2, and iii) September 22, 2010 for Mooring n°3.

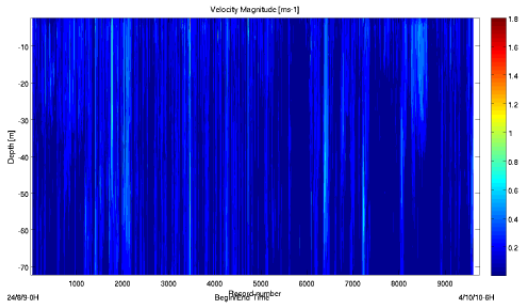
Mooring n°1



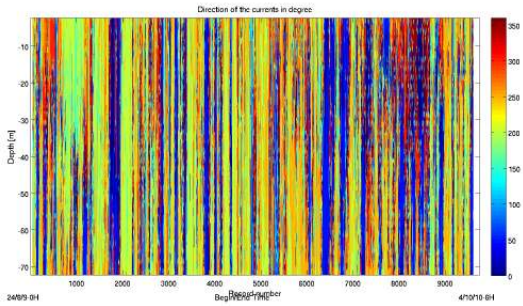
Mooring n°1



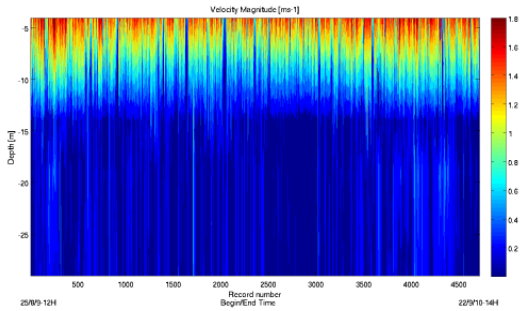
Mooring n°2



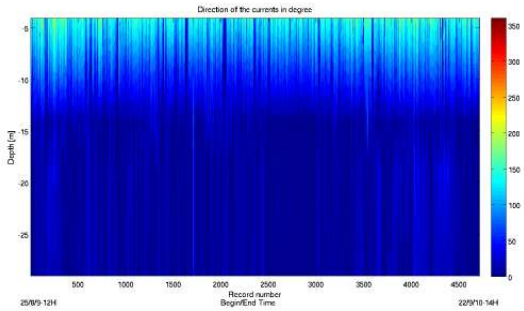
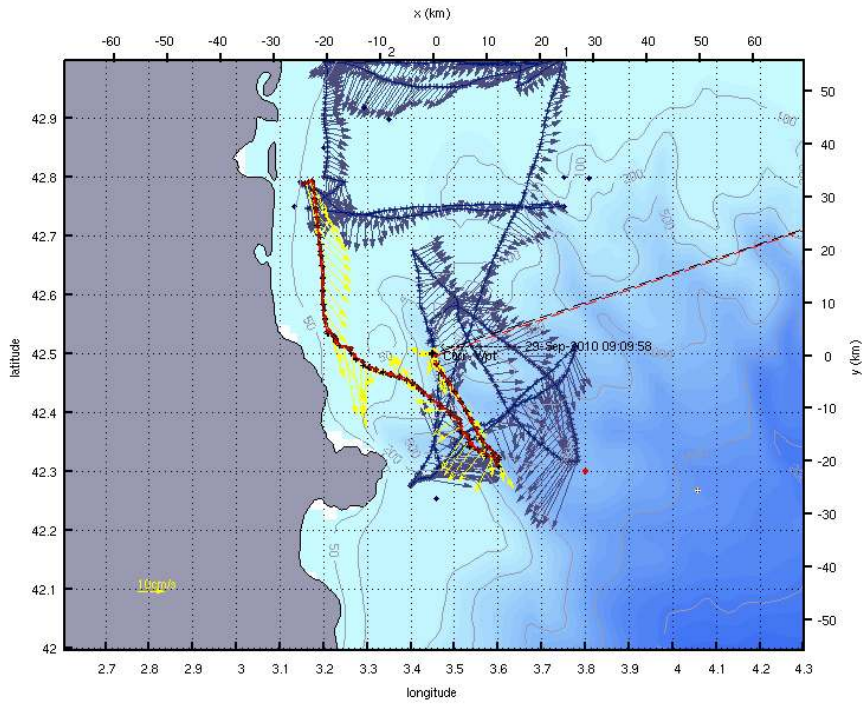
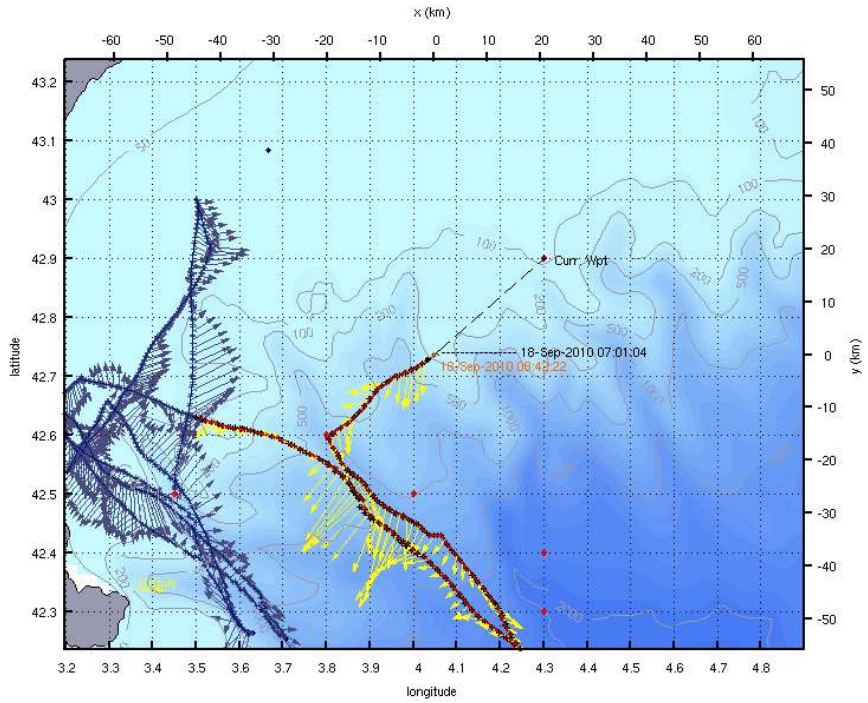
Mooring n°2



Mooring n°3



Mooring n°3



Annexe 8 : Trajectory of the gliders Tenuse (top) and Pythéas (bottom) (http://www.ego-network.org)