CNR ISMAR - Istituto di
Scienze Marine

SESAME-KM3 Cruise Report

11 – 25 March 2008

Edited by K. Schroeder and M. Borghini

Consiglio Nazionale delle Ricerche - IAMC

Consiglio Nazionale delle Ricerche - IBF

Stazione Zoologica Anton Dohrn

Ente Nazionale Energia e Ambiente

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Cruise Details

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DATE	*11 – 25 MARCH 2008*
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Scientific Objectives

This report presents the preliminary results obtained during the SESAME-KM3 cruise, carried out from 11th – 25th March 2008, on board of the Italian R/V URANIA in the Western Ionian Sea and in the Strait of Sicily.

The cruise was addressed to acquire information on physical, biological and geochemical processes of the water column. It was planned in the framework of two different projects:

1. KM3Net: During the last years, the European Commission has approved the funding for the project stage of an enormous astronomic telescope, based on the detection of the neutrino. The Italian collaboration Nemo has the aim to present a competitive solution of the whole detector, called Nemo Km3. There are also other European proposals, like Nestor in Greece and Antares in France, which lay on the same physical principle and has developed for the past ten years the independent project VLVNT (very large volume neutrino telescope). Only recently a European collaboration has started, which is called Km3net, in which the research experiences of the three solution are integrated and which is funded by the EC.

2. SESAME – Southern European Seas: Assessing and Modelling Ecosystem changes: SESAME aims to assess and predict changes in the Southern European Seas (Mediterranean and Black Sea) ecosystems and in their ability to provide key goods and services with high societal importance, such as tourism, fisheries, ecosystem biodiversity and mitigation of climate change through carbon sequestration in water and sediments. In particular we are involved in the workpackage WP3, which deals with data collection for model definition and validation in sub-regional seas. In this particular case the area investigated was the Sicily Strait.

In this two frameworks, the cruise was planned in order to achieve the following objectives:

1. The physical cruise in the western Ionian is intended to provide updated information on the hydrology in the KM3 area and to recover for maintenance three moorings, and to redeploy them immediately.

2. The multidisciplinary cruise along a transect from Tunisia to Sicily is intended to provide CTD, nutrients, chlorophyll, phytoplankton, zooplankton and ichthyoplankton data. Current-meter moorings along the western sill of the Sicily Straits, which permit continuous monitoring of the surface and the deep currents, had to be recovered and re-deployed.

Scientific Background

General Description

The Ionian Sea

The Ionian Sea is one of the eastern basins. It is bordered by Italy, Greece, Libya and Tunisia and has a volume of 10.8 x 104 km3. The basin is connected to the Cretan Sea through the Straits of Kithira (depth 160 m and width 33 km) and of Antikithira (depth 700 m and width 32 km), to the Levantine Basin through the Cretan Passage, to the Adriatic Sea through the Otranto Strait (depth 780 m and width 75 km) and to the Western Mediterranean through the Sicily Strait.

The thermohaline circulation of the eastern basin is composed of two cells. The first one is an internal cell, deep and vertical, which involves the Ionian and the Levantine Basins. This deep thermohaline cell, the "conveyor belt" of the Eastern Mediterranean, is maintained by a deep water source in the Adriatic Sea, with the Eastern Mediterranean Deep Water (EMDW) reaching the Levantine Basin with a renewal time of 126 years (Roether and Schlitzer 1991; Schlitzer et al., 1991; Roether et al., 1994). During the 90's it was observed also an other deep water source, located in the Aegean Sea (Roether et al. 1996). The external cell comprises water exchanges between the eastern and the western basin and with the North Atlantic. The Atlantic Water (AW), which enters the Mediterranean through the Strait of Gibraltar, moves eastward, spreading through the entire Mediterranean Se, after passing the Sicily Strait, occupying a layer of about 200 m depth. At the same time, the Levantine Intermediate Water (LIW), which forms mainly in the north-eastern Levantine Basin, moves westward, in a layer between 200 and 600 m depth, exiting the Mediterranean towards the North Atlantic, where it constitutes the well-known MOW (Mediterranean Outflow Water). In the Ionian Sea there are water and property exchanges with the Levantine Basin, in the East, and with the Aegean Basin, in the North. It is therefore considered a transition basin for all eastern water masses, where they are subject to important mixing and transformation processes during their pathway.

The main Ionian water masses are the Atlantic Water (AW), which moves eastward from the Sicily Strait, in the surface layer and is normally identified by a subsurface salinity minimum, between 30 m and 200 m depth. Below the AW, there is the Levantine Intermediate Water (LIW), which enters the Ionian Sea through the Cretan Passage, spreading westward from its formation site, the north-eastern Levantine Basin. The LIW is identified by its salinity maximum, between 200 and 600 m depth. The abyssal layer, below 1600 m, is occupied by the Eastern Mediterranean Deep Water (EMDW), colder and less saline, that forms mainly in the Adriatic Sea. In the layer comprised between 700 m and 1600 m, we find a transition water mass, with intermediate properties between the LIW and the EMDW. To these water masses, we have to add the Ionian Surface Water, ISW, which is clearly distinguishable from the AW in summer in the surface layer, being warmer and saltier than the AW.

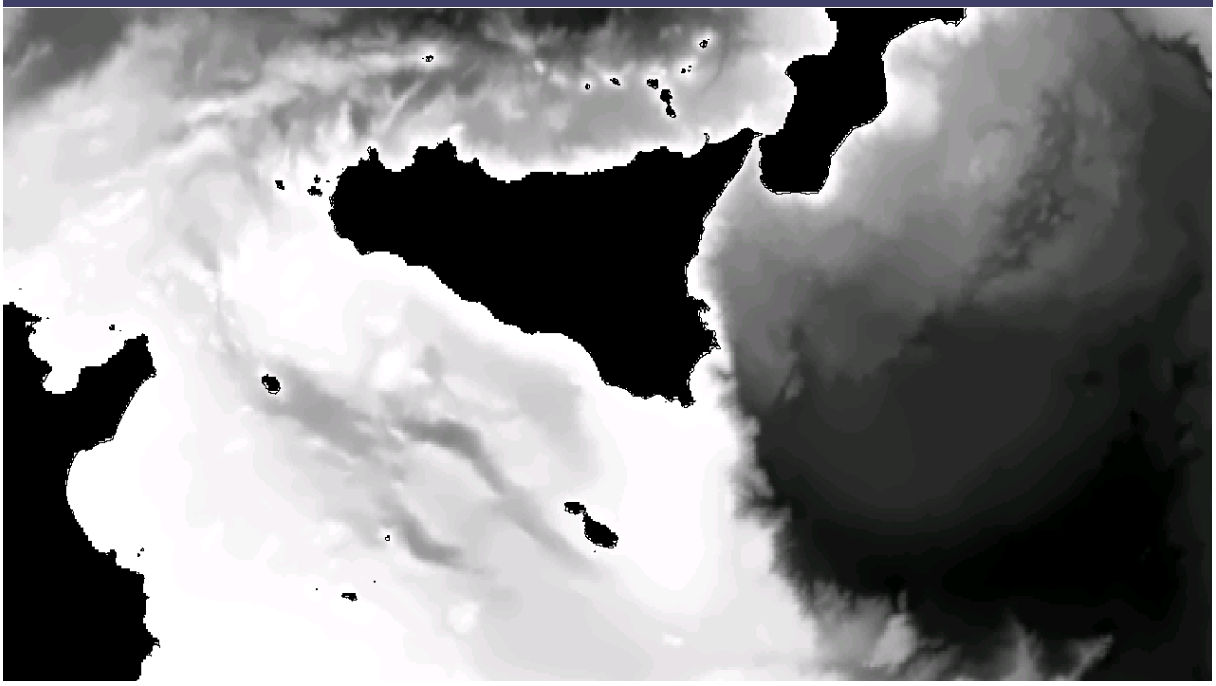
The deep EMDW has well-defined core properties, because it is less influenced by the transformation processes. On the other hand, the distinguishing properties of the AW and the LIW has modified during their pathway, and depend on the distance from their formation sites. In the table, the AW and LIW properties in the eastern sub-basins are indicated (from literature, Manzella et al., 1988; De Maio et al., 1990; Moretti et al., 1993; Ozsoy et al., 1993; Theocharis et al., 1993; Malanotte-Rizzoli et al., 1997).

The Sicily Strait

The Sicily Strait, which present the connection between western and eastern sub-basins has a central role in the Mediterranean circulation. The Strait is a topographically complex region consisting of two sill systems separated by an internal deep basin (fig. 1): the eastern sill with a maximum depth of about 540 m connects the Strait with the Ionian Basin, the central basin presents deep trenches deeper than 1700 m, while the western sill is composed of two narrow passages, which have a maximum depth of 530 m. The entire region has a minimum width of 140 km and a total length of 600 km. The width of the Strait, significantly large at the surface, sensibly reduces in depth.

Dynamically, the Strait is a two layer system: the surface layer (about 200 m thick) is occupied by the Atlantic Water (AW), moving eastward, while the deep layer, occupied by the Levantine Intermediate Water (LIW), flows in the opposite direction. The dynamics of the Strait is rather complex: the surface layer (AW) is dominated by mesoscale processes, while for the underlying layers the topography plays a key role. The Bernoulli effect associated to the high LIW velocity permits the Ionian deep water, laying at a greater depth, to cross the eastern and the western sills and to reach the western basin (Astraldi et al., 2001). In literature this water mass is called the transitional Eastern Mediterranean Deep Water (tEMDW). The high depth permits the central region to act as an intermediate reservoir between the eastern and the western sills, especially for the subsurface waters. Important mixing is also observed in correspondence of the sills, where high velocities induce significant entrainment effects with the surrounding waters (Iudicone et al., 2003; Stansfield et al., 2003).

Figure 1 Bathymetry of the investigated area (data from GEBCO, British Oceanographic Data Centre).



Cruise Plan

The following table summarizes the parameters that have been measured and the sampling group involved in the operation, while table 2 lists the sampling equipment and the methods of analysis.

Parameters/Instruments	**Working Group**
CTD/O2/Fluorescence/Trasmissometer/rosette	CNR-ISMAR
Salinity	CNR-ISMAR
Dissolved Oxygen	CNR-ISMAR
NO3, PO4, SiO4	ENEA
DOC-CDOM	CNR-IBF
Chlorophyll a	Stazione Zoologica
HPLC pigments	Stazione Zoologica
POC	ENEA
PON, POP	ENEA
DON, DOP	ENEA
mesozooplankton abundance, biomass and biodiversity	Stazione Zoologica
phytoplankton abundance and composition	Stazione Zoologica
Optical profiles (absorption m^{-1})	Stazione Zoologica
Ichtyoplankton	CNR-IAMC
Caesium-137	ENEA
ADCP	CNR-ISMAR
LADCP	CNR-ISMAR
Meteo station on board	CNR-ISMAR

Table 1 Measured Parameters

Small-Volume Sampling	General Oceanics 24-place rosette with 10-liter bottles
CTD System	CTD SBE 911 plus
Salinometer	GUILDLINE AUTOSAL
Dissolved Oxygen	Winkler titration
NO3, Po4, SiO4	Samples only, no on board analyses
DOC-CDOM	Water samples and filtration only, no on board analyses
Chlorophyll a	Water samples and filtration only, no on board analyses
HPLC pigments	Water samples and filtration only, no on board analyses
POC	Water samples and filtration only, no on board analyses
PON, POP	Water samples and filtration only, no on board analyses
DON, DOP	Water samples and filtration only, no on board analyses
mesozooplankton	Net cast
phytoplankton	Net cast
Optical profiles (absorption m^{-1})	AC9 - Satlantic
Ichtyoplankton	Net cast
Caesium-137	Water samples and fixation
ADCP	RDI WH 300 kHz, RDI OS 75 kHz
LADCP	RDI WH 300 kHz
Meteo station on board	AANDERAA

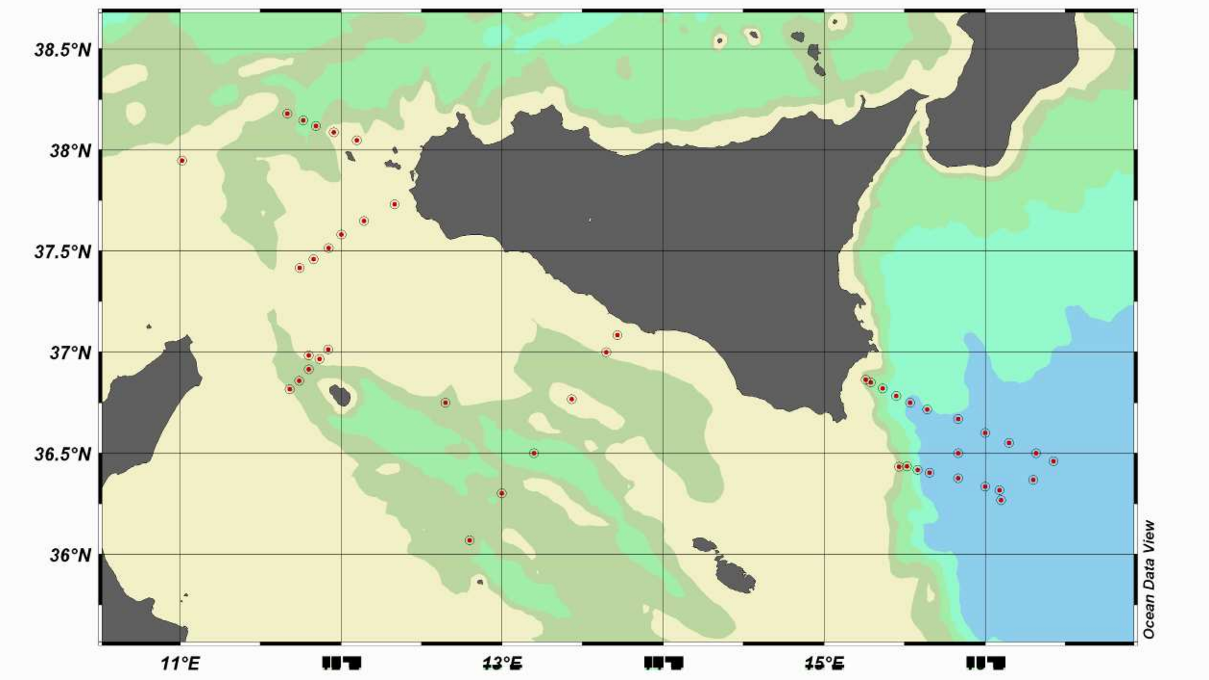
Table 2 Sampling equipment and analysis methods

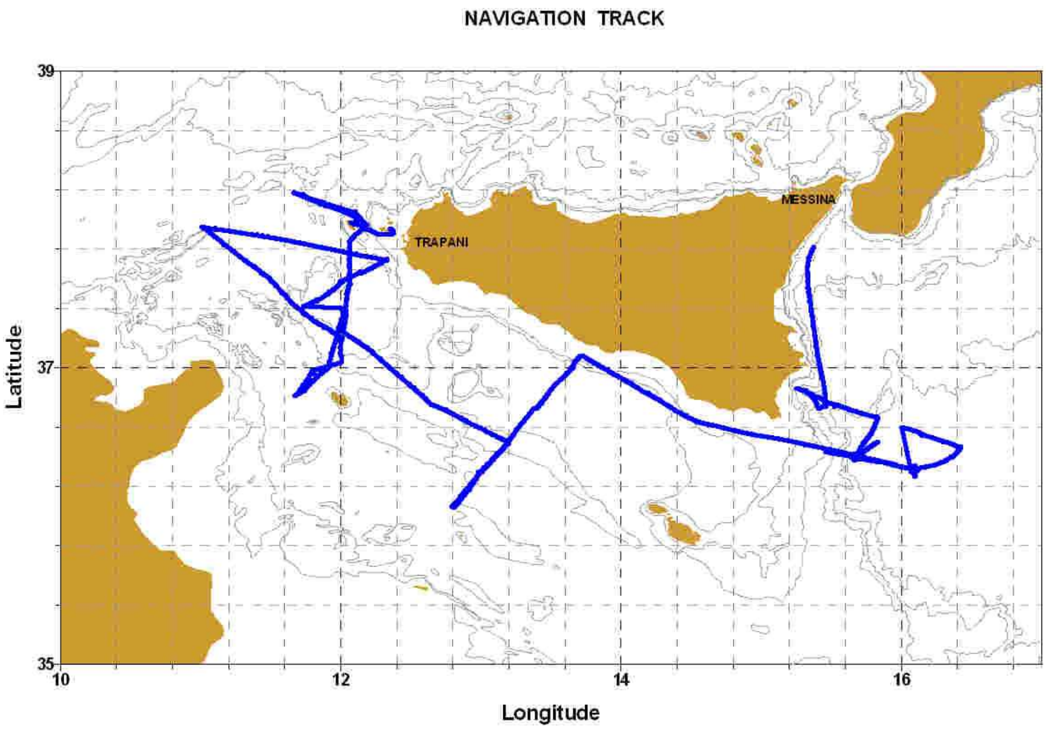
The track is shown in Figure 2. We planned to spend 15 days at sea. The geographic boundaries of the survey are 35.00 °N - 39 °N latitude and 10 °E - 17 °E longitude.

The station list is shown in table 3.

Cruise Maps

Figure 2 Station map (above) and navigation track (below)





Cruise Stations

Station	Lon (°E)	Lat (°N)	Depth (m)	ACTIVITY
406	12.003	37.581	151	Ctd – Ladcp – Oxygen - Nutrients
432	12.333	37.732	169	Ctd – Ladcp – Oxygen - Nutrients
433	11.923	37.514	107	Ctd – Ladcp – Oxygen - Nutrients
434	11.744	37.416	87	Ctd – Ladcp
438	11.830	37.460	76	Ctd – Ladcp – Oxygen - Nutrients
kc1	16.091	36.316	3391	Ctd - Ladcp
km3	15.834	36.500	3383	Ctd – Ladcp-Caesium-Nutrients-Oxygen
km4	16.101	36.266	3426	Ctd - Ladcp-Nutrients-Oxygen
nk2	16.300	36.367	3408	Ctd - Ladcp
nk4	16.001	36.333	3418	Ctd - Ladcp-Salinity-Nutrients-Oxygen
nk5	15.833	36.375	3469	Ctd - Ladcp
nk6	15.656	36.402	3347	Ctd - Ladcp -Nutrients-Oxygen
nk7	15.583	36.417	1192	Ctd - Ladcp
nk8	15.516	36.434	1192	Ctd - Ladcp-Nutrients-Oxygen
nk9	15.466	36.433	343	Ctd - Ladcp
P01	11.921	37.012	111	Ctd – Ladcp – Oxygen - Nutrients
P02	11.866	36.966	452	Ctd – Ladcp – Oxygen - Nutrients
P03	11.800	36.914	662	Ctd – Ladcp – Oxygen - Nutrients
p04	11.741	36.858	666	Ctd – Ladcp - Nutrients
p05	11.683	36.816	448	Ctd – Ladcp – Oxygen - Nutrients
nk12	16.001	36.600	3233	Ctd - Ladcp-Salinity-Nutrients-Oxygen
nk13	15.833	36.668	3275	Ctd - Ladcp
nk14	15.642	36.716	2890	Ctd - Ladcp-Salinity-Nutrients-Oxygen
nk15	15.535	36.750	2927	Ctd - Ladcp
nk16	15.449	36.783	2460	Ctd - Ladcp-Salinity-Nutrients-Oxygen
nk17	15.258	36.863	512	Ctd - Ladcp-Salinity-Nutrients-Oxygen
nk18	15.366	36.819	2306	Ctd - Ladcp-Salinity-Nutrients-Oxygen
nk40	15.290	36.850	943	Ctd - Ladcp
S-it3-001	13.716	37.083	3470	Ctd - Ladcp
S_it3-002	13.649	36.999	465	Ctd – Ladcp - Doc- Zoo-Dop-Pop – Don – Pon –Poc-Ac9 – Satlantic.
S-it3-003	13.434	36.766	326	Ctd – Ladcp - Doc- Zoo-Dop-Pop – Don – Pon –Poc-Ac9 .

S-it3-004	13.200	36.500	1733	Ctd – Ladcp - Doc- Zoo-Dop-Pop – Don – Pon –Poc-Ac9 – Satlantic – Caesium- Ossig.
S-it3-005	13.000	36.300	841	Ctd – Ladcp - Doc- Zoo-Dop-Pop – Don – Pon –Poc-Ac9 – Satlantic .
S-it3-006	12.800	36.067	866	Ctd – Ladcp - Doc- Zoo-Dop-Pop – Don – Pon –Poc-Ac9 – Satlantic – Oxygen.
S-it4-001	12.650	36.750	634	Ctd – Ladcp – Doc - Oxygen
S-it4-003	11.014	37.948	365	Ctd - Ladcp- Doc- Dop-Pop – Don –Pon – Poc- – Oxygen - Nutrients
405	12.144	37.648	97	Ctd – Ladcp – Nutrients.
nk10	16.316	36.499	3304	Ctd - Ladcp-Salinity-Nutrients-Oxygen
nk11	16.149	36.550	3314	Ctd - Ladcp
nk21	16.425	36.460	3408	Ctd - Ladcp
212	12.098	38.049	139	Ctd - Ladcp
213	11.957	38.087	410	Ctd - Ladcp
214	11.846	38.120	268	Ctd – Ladcp – Oxygen
215	11.766	38.146	1202	Ctd – Ladcp – Oxygen
217	11.667	38.181	762	Ctd - Ladcp
S-it4-002	11.800	36.983	536	Ctd - Ladcp -Doc- Dop-Pop – Don –Pon – Poc-Zoo – Ac9 – Satlantic.

Table 3 List of all CTD stations

Sampling Strategy

The stations have been selected mainly based on previous knowledge and available literature. The hydrological characteristics of the study area have been determined by CTD cast. The CTD profiles were analysed onboard to precisely define the sampling depth along the water column.

In order to achieve information about the spatial variability of nutrients, DOC and the other biogeochemical parameters a high-resolution sampling has been applied, at the standard depths (table 4).

Level	Standard depths (m)
1	0
2	25
3	50
4	75
5	100
6	200
7	300
8	400
9	500
10	750
11	1000
12	1250
13	1500
14	1750
15	2000
16	2500
17	3000

Table 4 Standard depths

Onboard Operations

CTD Casts

At all the hydrological stations, pressure (P), salinity (S), potential temperature (θ) and dissolved oxygen concentration (DO) were measured with a CTD-rosette system consisting of a CTD SBE 911 plus, and a General Oceanics rosette with 24 12-l Niskin Bottles. Temperature measurements were performed with a SBE-3/F thermometer, with a resolution of 10-3 °C, and conductivity measurements were performed with a SBE-4 sensor, with a resolution of 3 x 10-4 S/m. In addition, salinities of water samples were analysed on board using a Guildline Autosal salinometer. Dissolved oxygen was measured with a SBE-13 sensor (resolution 4.3 µM), and data were checked against Winkler titration. The vertical profiles of all parameters were obtained by sampling the signals at 24 Hz, with the CTD/rosette going down at a speed of 1 m/s. The data were processed on board, and the coarse errors were corrected.

Laboratory: ISMAR-CNR

LADCP

Two Lowered Acustic Doppler Current Profilers (LADCP) were used to measure velocity profiles. We used two RDI Workhorse 300 kHz ADCP. For data post-processing we used the LDEO LADCP (versione 8.1) software.

Laboratory: CNR-ISMAR

Inorganic Nutrients

Seawater samples for nutrient measurements were collected at different depths, when the system CTD /rosette was going up, according to the vertical profiles of salinity, potential temperature and dissolved oxygen, recorded in real time. Samples of 100 ml of seawater were collected at different depths and immediately filtered through a polycarbonate filters (0.47 µm Ø and pore size 0.4 µm) under slight vacuum. The filtered samples were transferred in 20 ml polyethylene vials and frozen at -20°C. The analysis of inorganic nutrients will be performed in the laboratory on land by the AutoAnalyser AAIII Bran+Luebbe (Grasshoff,1999).

Laboratory: ENEA

DOC-CDOM

Seawater samples for DOC measurements were collected at different depths, during the CTD/rosette up cast, according to the vertical profiles of salinity, potential temperature and dissolved oxygen, recorded in real time. They were immediately filtered on board, through sterile 0.2 µm membrane filters (Sartorius, Minisart, SM16534 K) under low N2 pressure and stored in amber glass bottles at 4 °C in the dark until the analysis. The conditioning of the filters was performed by rinsing with a 200 ml aliquot of the seawater to be collected. DOC measurements will be carried out, in the laboratory ashore, with a Shimadzu 5000 TOC Analyser, equipped with quartz combustion column with 1.2% Pt on silica pillows of approximately 2 mm diameter (Santinelli et al., 2002).

Seawater samples for CDOM measurements were collected at different depths (surface to bottom). CDOM measurements will be carried out, in the laboratory ashore, with a Perkin Elmer Lambda 25 Spectrophotometer, equipped with 100 mm quartz cells, in 260-700 nm wavelength range.

Laboratory: CNR-IBF

Chlorophyll and pigments

A HPLC analysis of particulate matter was programmed to investigate pigment composition of the phytoplanktonic community. Water was collected with 12 L Niskin bottles from 10 depths in the euphotic layer at each station. 2.5 L of water were then filtered on GF/F filters 25 mm in diameter by means of a filtration apparatus connected to a pressure pump. Filters were put in liquid nitrogen to store them on board. HPLC analysis will be performed in the Laboratoire d'Océanographie de Villefranche/Mer (LOV – CNRS).

Laboratory: Stazione Zoologica Anton Dohrn

POC

Samples of 1-5 litres of seawater were collected at different depths above and below the Deep Chlorophyll Maximum (DCM) and immediately filtered through pre-ignited (450 °C) 0.7 µm glass fiber filters (25 mm Ø) under slight vacuum. Then the filter was frozen at –20 °C. Analysis will be performed in the laboratory on land with a CHN Analyzer (Grasshoff et al., 1983).

Laboratory: ENEA

POP

Samples of 4 liters of seawater were collected at different depths above and below the Deep Chlorophyll Maximum (DCM) and immediately filtered through pre-ignited (450° C) 0.7 µm glass fiber filters (25 mm Ø) under slight vacuum. The filter was frozen at -20°C. Analysis of particulate organic phosphorus will be performed in the laboratory on land, after digestion of the filter, by the AutoAnalyser AAIII Bran+Luebbe (Grasshoff,1999).

Laboratory: ENEA

DOP and DON

Samples of 100 ml of seawater were collected at different depths and immediately filtered through a polycarbonate filters (0.47 µm Ø and pore size 0.4 µm) under slight vacuum. The filtered samples were transferred in 20 ml polyethylene vials and frozen at -20°C. The analysis of dissolved organic phosphorus and nitrogen will be performed in the laboratory on land by the AutoAnalyser AAIII Bran+Luebbe (mineralization on line).

Laboratory: ENEA

Mesozooplankton

Meso-zooplankton samples for taxonomic identification and counts of animals (species abundance), and total biomass (as dry weight) were collected during the cruise. Samples were collected by vertical tows with a closing WP2 net (56 cm diameter, 200 µm mesh aperture) in the following depth layers: 200-100 m, 100-50 m, 50-0 m. Sampling was always performed in light hours (8:20-17:30 local time). Each complete sampling series lasted for about 1 hour. The volume of filtered sea water was calculated from a flowmeter applied to the mouth of the net.

After collection, each sample was split in two halves (1/2) after careful mixing with graduated beakers. One half was immediately fixed and preserved in a formaldehyde-seawater solution (4% final concentration) to be successively analyzed at the dissecting microscope in the laboratory on land for species composition and abundance. The other half was kept fresh and sieved in succession on nitex of 1000 µm, 500 µm e 200 µm mesh, in order to obtain the following size fractions: >1000 µm, 500-1000 µm , 200-500 µm. Each size fraction was then filtered on GF/C (pre combusted and weighed) for biomass measurements as dry weight and carbon content (at CHN). Each filter with zooplankton material was placed in a small plastic petri dish, dried in the oven at 60°C for a few hours and then frozen at -20 °C until further processing in the lab.

Further meso-zooplankton samples were collected for DNA analyses of species to be successively selected and sorted. At three stations a sample was collected in the layer 200-0 m with a vertical tow performed with the same WP2 net (200 µm). The samples were successively concentrated on 1000 µm (to separate jellies) and 200 µm nitex and the two size fractions (> 1000 µm and 200-1000 µm) were separately preserved in ethyl alcohol (96%). After 24 and 48 hours, alcohol was drained off and replaced with fresh alcohol. All samples were kept in the dark.

Laboratory: Stazione Zoologica Anton Dohrn

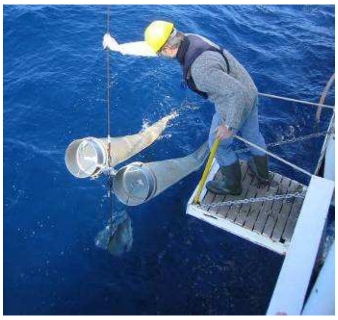
Optical profiles

AC-9 was used to measure absorbance and total attenuation along vertical profiles in the water column on 9 wavelengths between 410 and 680 nm. The instrument permits to obtain very useful data connected with both biological parameters (phytoplanktonic biomass, dissolved organic material) and hydrological ones (water masses). At each station 2 casts of the instrument were performed till an approximate depth of 85 meters with a velocity of 0.4 m/s. Considering that the instruments acquires both in the downcast and in the upcast, it was possible to obtain 4 profiles for each station.

A Satlantic spectroradiometer is used for spectral measurements of downwelling irradiance and upwelling radiance, covering wavelengths from infrared to ultraviolet. It is a passive instruments (in the sense that it doesn't emit light) so it was necessary to acquire data in the central hours of the day, when sunlight was at its maximum intensity. The instrument was cast manually from stern taking care that ship shadow did not intercept the path. Data acquisition was limited to the downcast when instrument tilt and velocity were more controlled. Generally two casts were made at each station to a depth of about 100 meters or greater.

Laboratory: Stazione Zoologica Anton Dohrn

Ichthyoplankton



The Bongo40 is a sampler consisting of two coupled nets, with a mouth of 40 cm of diameter, which are fixed together by a steel structure. The cast of the Bongo40 was carried out between 100 and 0 m, towing it obliquely (about 45°) at a constant velocity of 2 knots. Two GO fluxmeters have permitted to control the filtered volume and the efficiency of the filtration. The Bongo40 net has a mesh of 200 μm, and allows to sample the ichthyoplankton.

Laboratory: CNR-IAMC

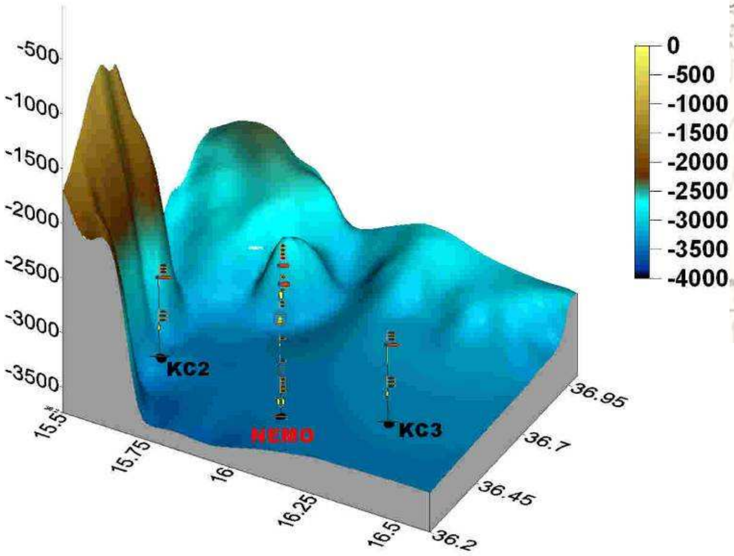
Caesium-137

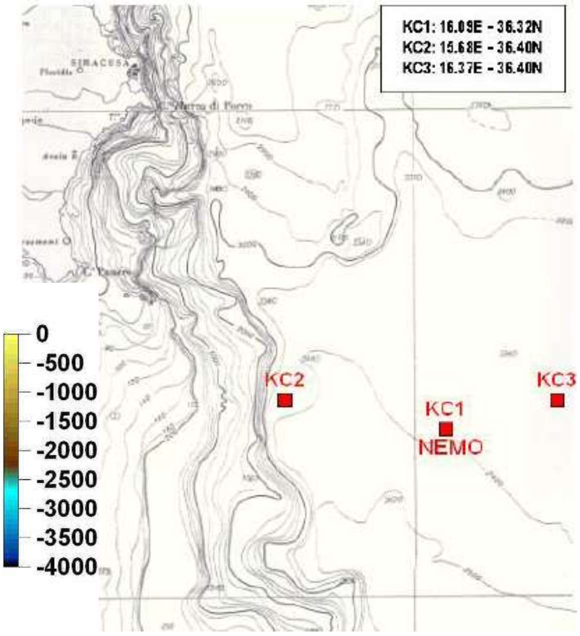
20 l seawater samples were collected at discrete depths along the water column in different water masses with reference to the hydrological structure. Samples were transferred to open plastic container and acidified by hydrochloric acid until pH = 1.5. A known amount of 134Cs was added as yield determinant. The samples were stirred for about 15 min, then 6 g of AMP were added. Stirring was continued for 3 hours. The supernatant was removed and the AMP was collected in 250 ml PVC bottles. On land the sample is transferred to calibrated containers for gamma spectrometry and dried in oven at 50°C.

Laboratory: ENEA

Recovering and deployment of moorings

Three moorings were deployed in May 2007, one in the NEMO position (KC1), the others, KC2 and KC3, about 20 nm northwestward and northeastward, respectively . During the cruise the KC1, KC2 and KC3 moorings were recovered and only KC1 and KC2 were redeployed.





Laboratory: CNR-ISMAR

Vessel-mounted ADCPs

The hydrographic data set has been integrated with direct current measurements, carried out with a two vessel-mounted ADCP. During the whole campaign two VM-ADCP (RDI Ocean Surveyor, 75 KHz, and RDI Workhorse, 300 KHz) were used for direct measurements of the currents along the whole ship track. The depth range of the two current profilers is about 700 m (OS75) and 150 m (WH300). Data acquisition is carried out using the RDI VMDAS software vers. 1.44. The ADCP data will be submitted to a post-processing with the CODAS3 Software System, which allows to extract, assign coordinates, edit and correct velocity data. Data will be corrected for errors in the value of sound velocity in water, and misalignment of the instrument with respect to the axis of the ship.

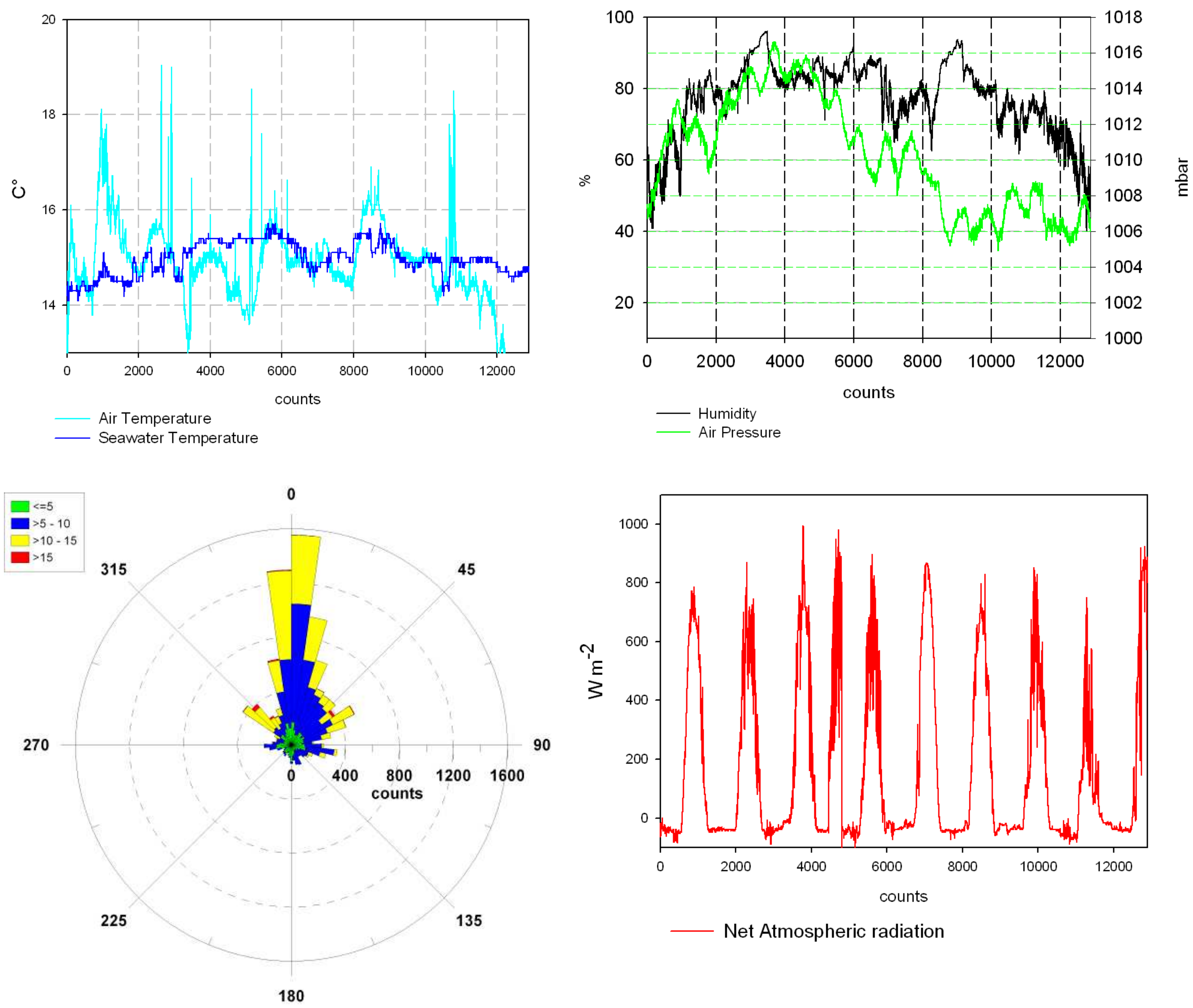
Laboratory: CNR-ISMAR

Preliminary Results

Weather conditions

The diagrams in figure 3 show the sea and weather conditions during the cruise.

Figure 3 Evolution of the weather conditions between 11th and 21th March 2008 (air temperature, sea temperature, relative humidity, air pressure, wind rose, irradiance)



Hydrology

The Sicily Strait

In the following some preliminary hydrological data and current measurements (LADCP data) of the Sicily Strait are presented.

Hydrographic sections

Figure 4 Distribution of potential temperature, salinity, potential density and oxygen along the transect 217-212 (above) and transect 434-432 (below)

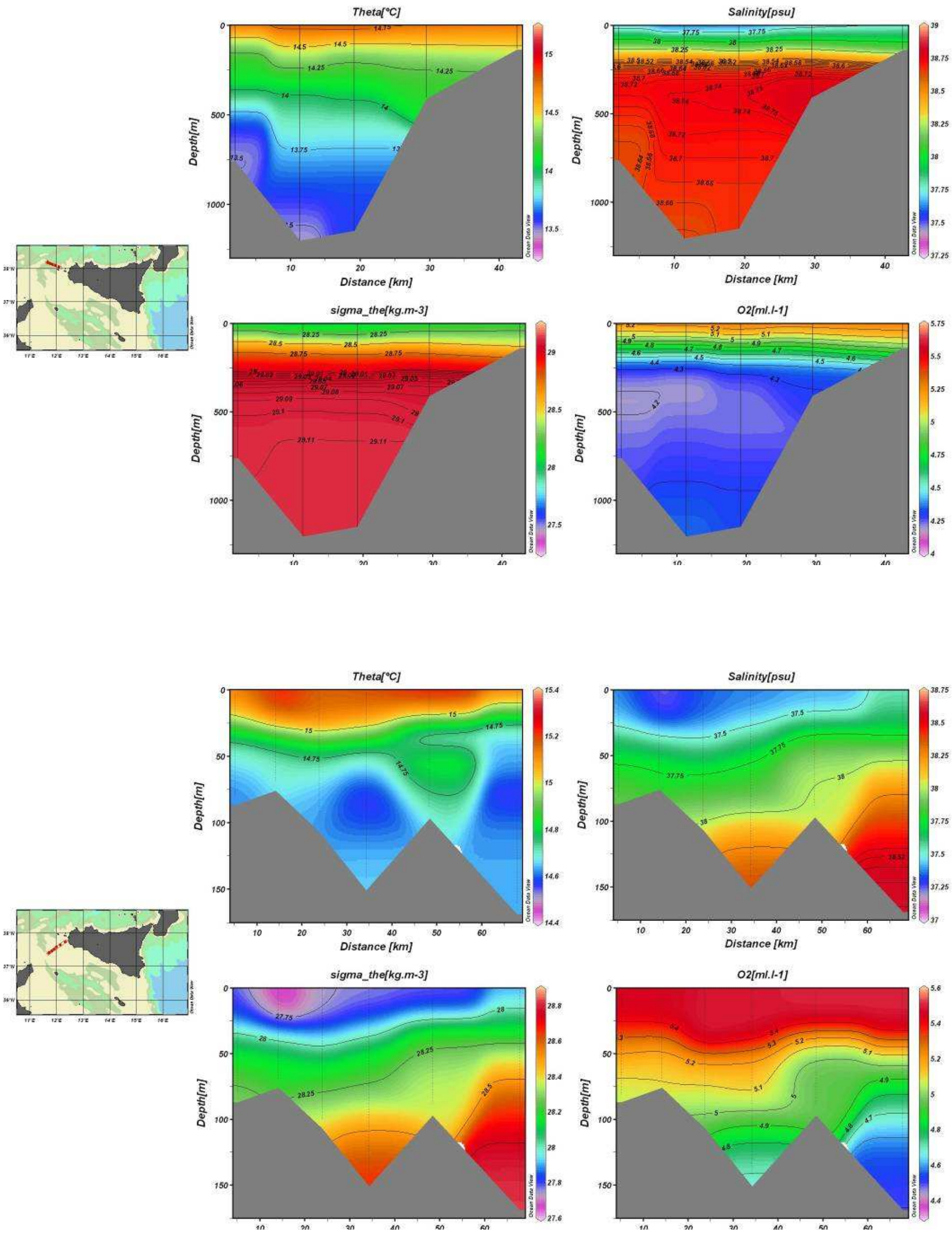
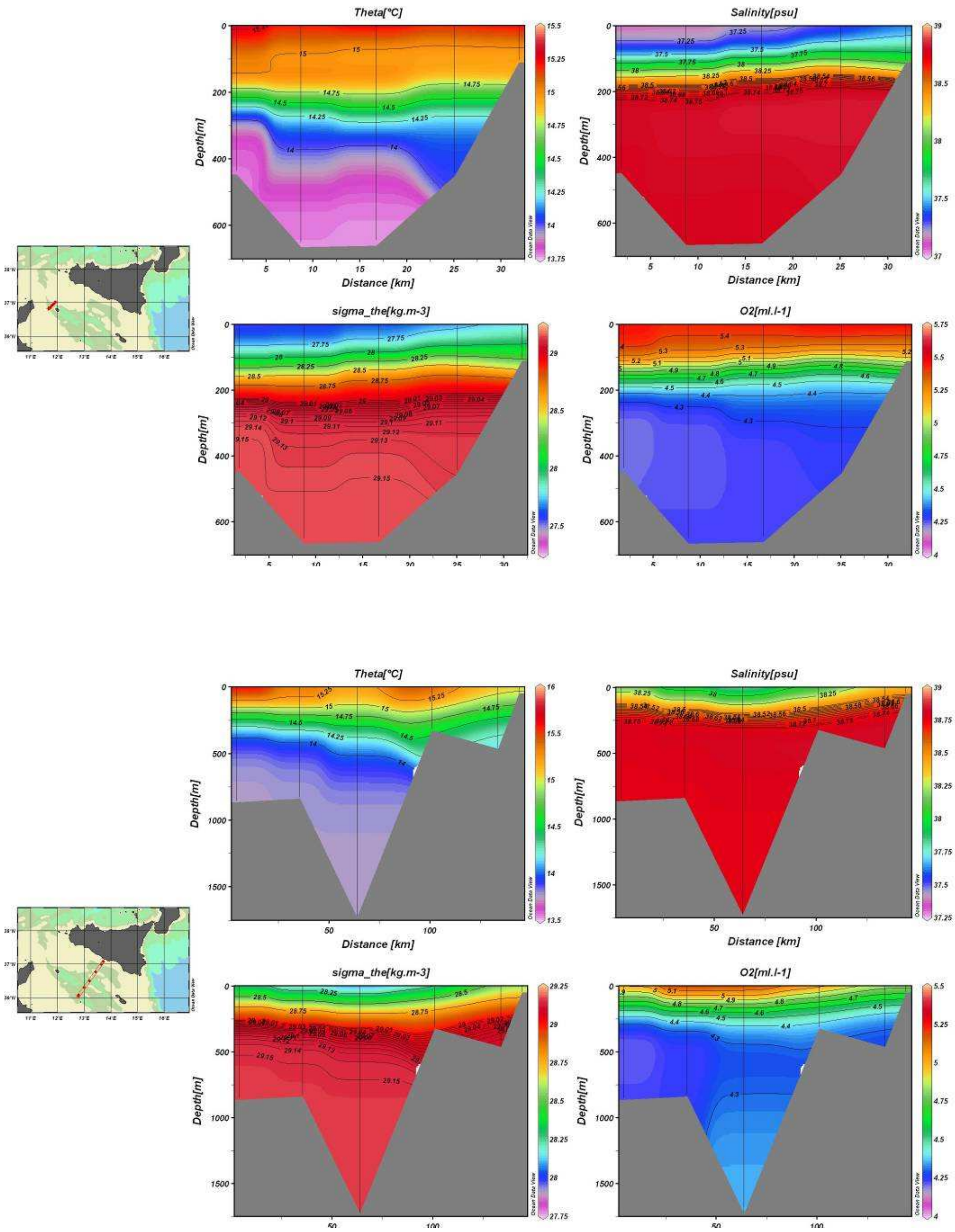
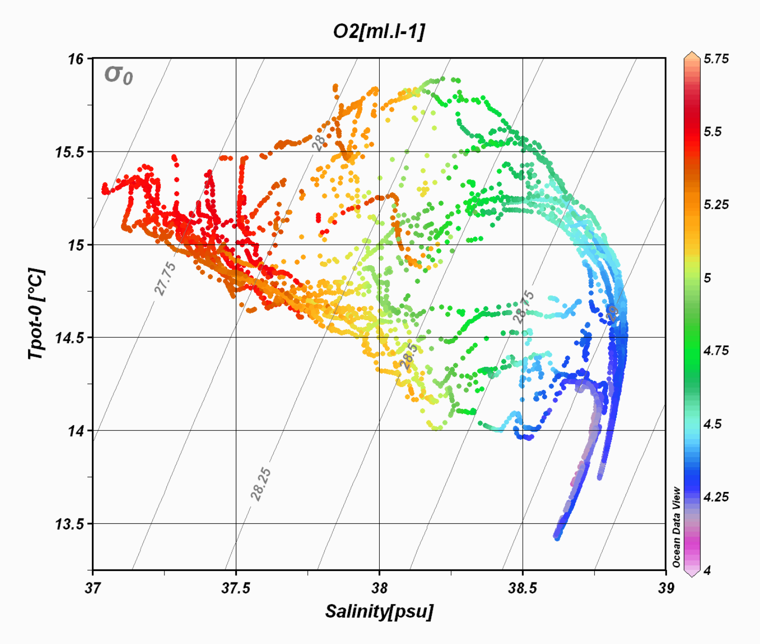


Figure 5 Distribution of potential temperature, salinity, potential density and oxygen along the transect P5-P1 (above) and transect S-IT3-006 – S-IT3-001 (below)



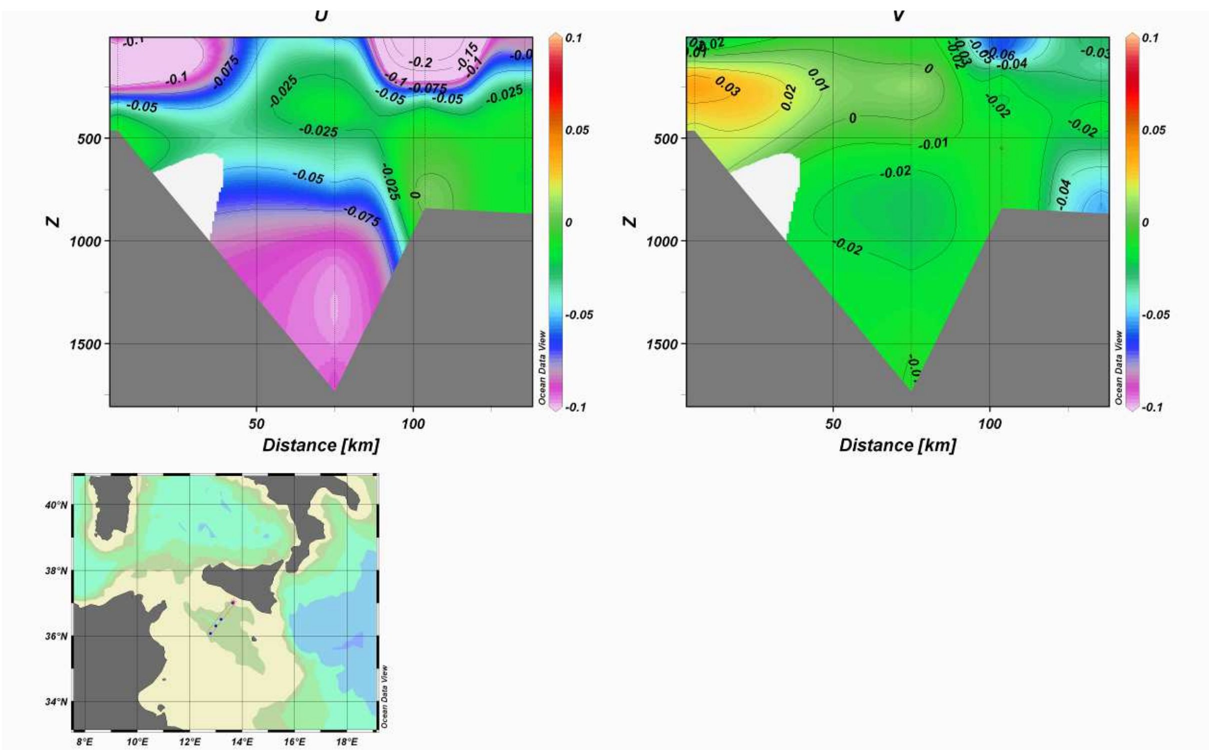
Potential Temperature vs Salinity Diagrams

Figure 6 Theta-S diagram of all station in the whole water column. Colours indicate oxygen concentrations



Currents (U and V components)

Figure 7 Distribution of the measured velocity components U and V in m/s along transect S-IT3-006 – S-IT3-001

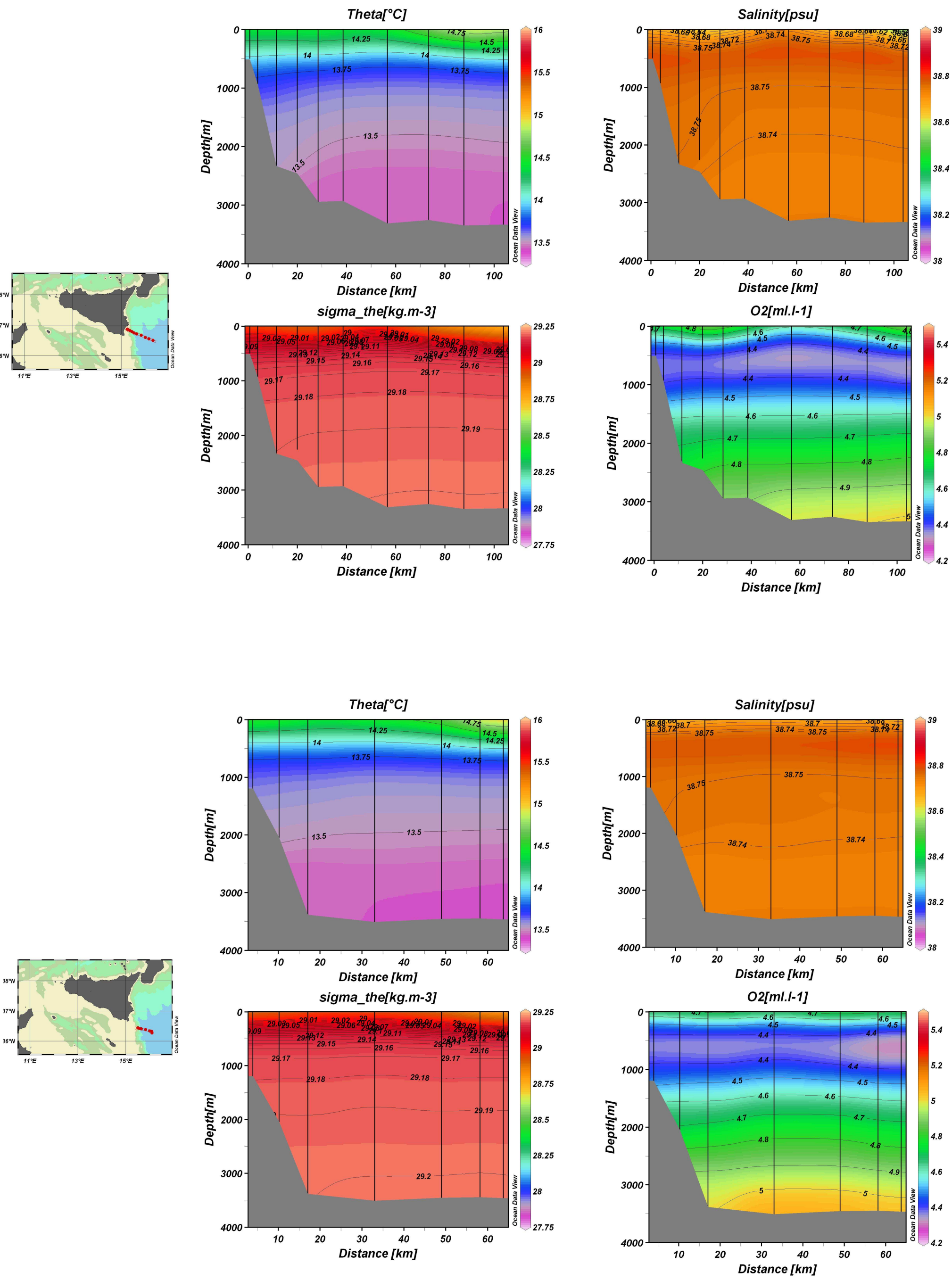


The Ionian Sea

In the following some preliminary hydrological data and current measurements (LADCP data) of the western Ionian Sea are presented.

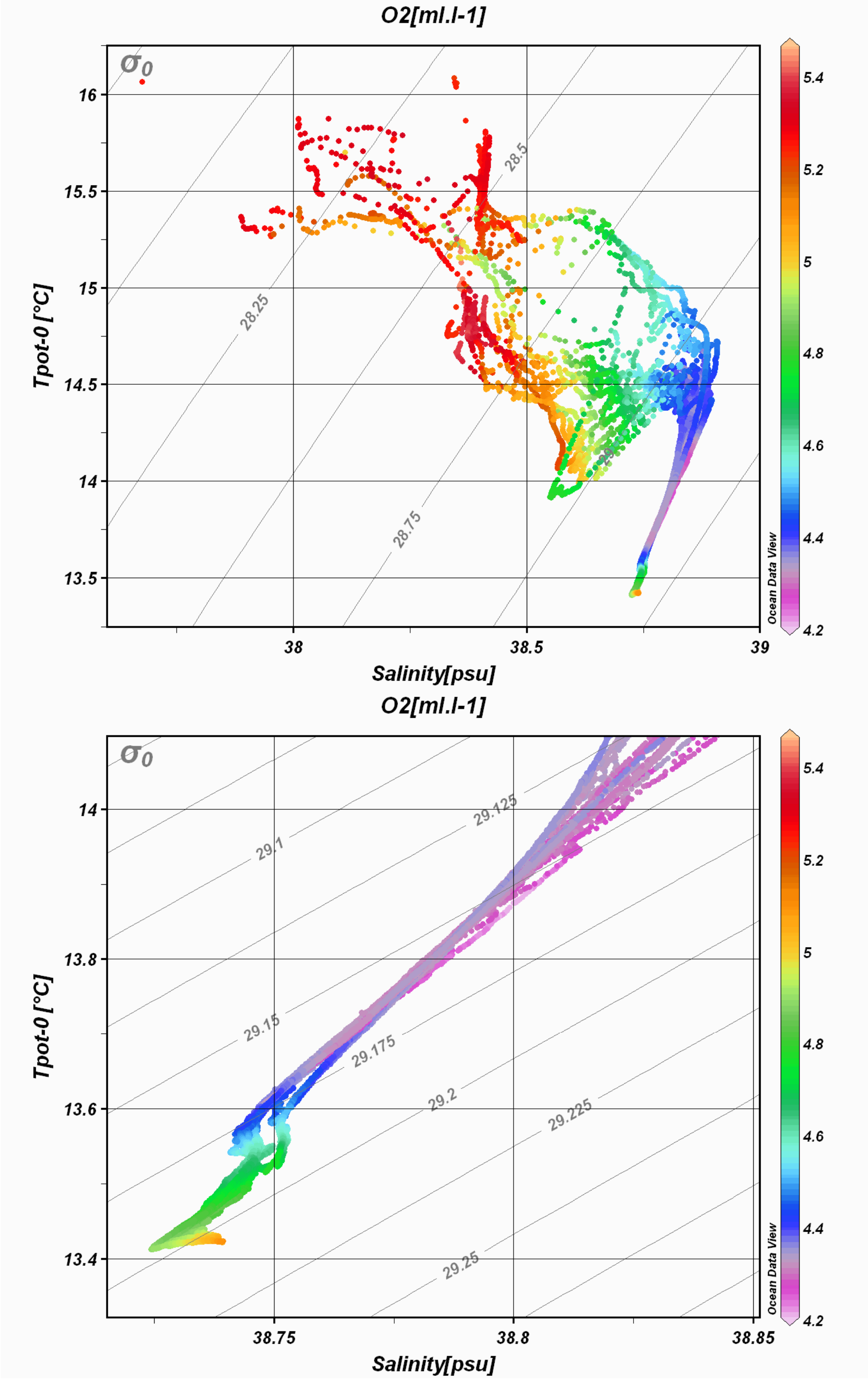
Hydrographic sections

Figure 8 Distribution of potential temperature, salinity, potential density and oxygen along the transect NK17-NK21 (above) and transect NK9-KM4 (below)



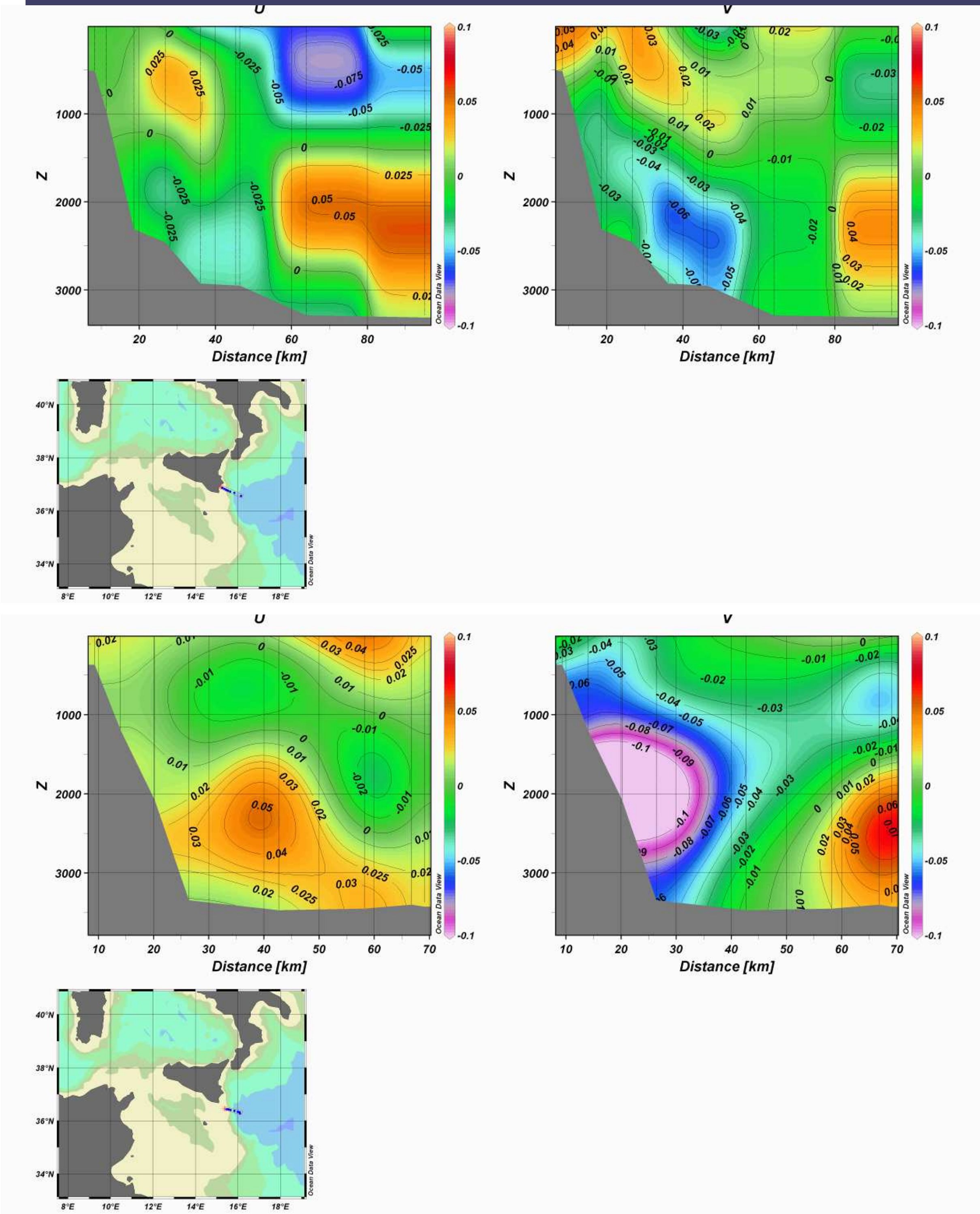
Potential Temperature vs Salinity Diagrams

Figure 9 Theta-S diagram of all station in the whole water column (above) and in the deep layer (below). Colours indicate oxygen concentrations



Currents (U and V components)

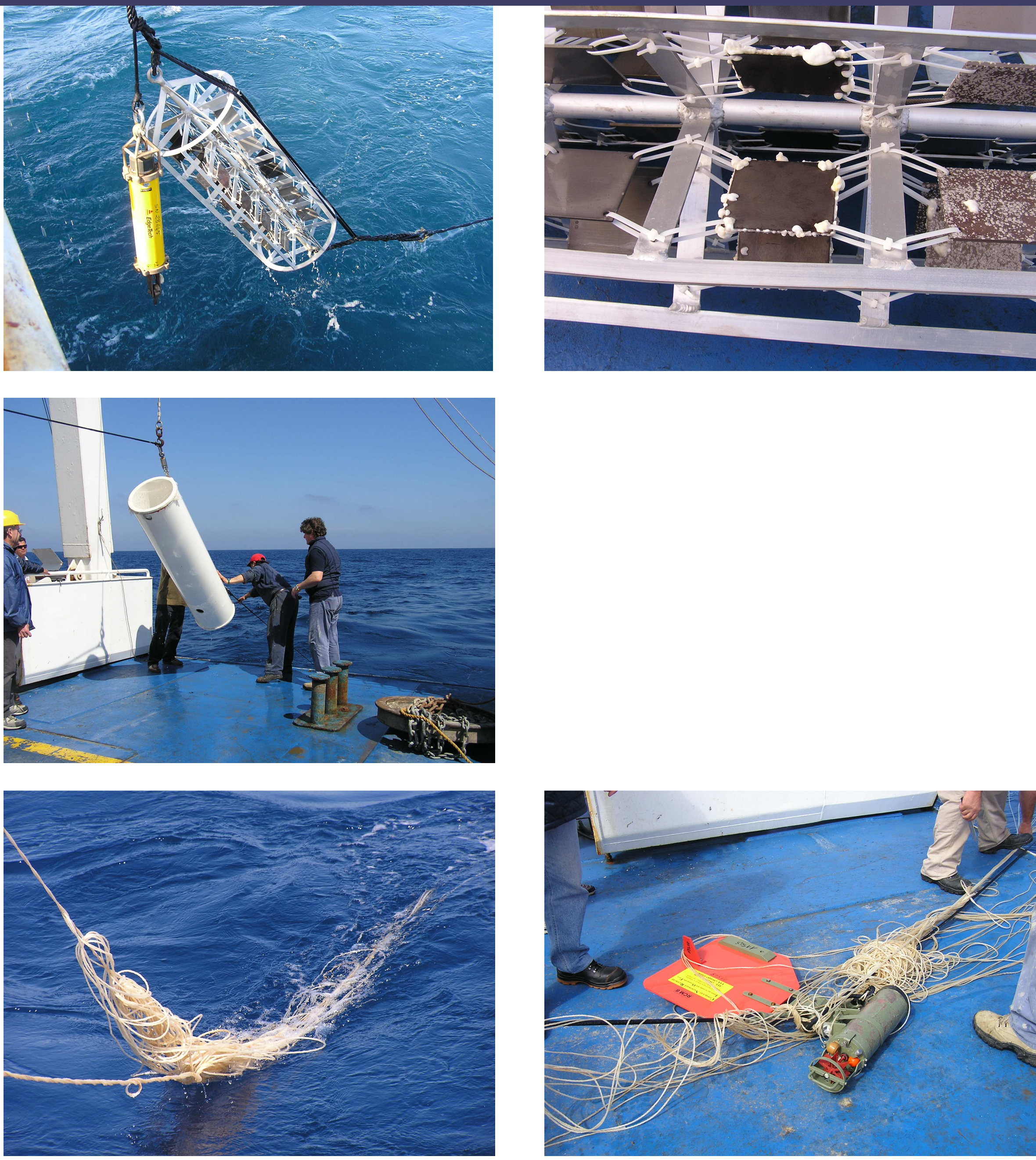
Figure 10 Distribution of the measured velocity components U and V in m/s along transect NK17-NK21 (above) and transect NK9-KM4 (below)



Eulerian measurements

Three moorings were deployed in May 2007, one in the NEMO position (KC1), the others, KC2 and KC3, about 20 nm northwestward and northeastward, respectively . During the cruise the KC1, KC2 and KC3 moorings were recovered and only KC1 and KC2 were redeployed. Figure 11 shows some moments of the recovering, while figures 12-14 represent the schemes of the three moorings.

Figure 11 (a) recovering of the corrosion-test cage, (b) detail of the corrosion effects on different metals, (c) recovering of the sediment trap, (d) huge presence of the "cannizzi", which made the recovering of KC1 very difficult, (e) the "cannizzi" wrapping an Aanderaa currentmeter



a) **b)**

c)

d) **e)**

Figure 12 Scheme of the KC1 mooring, located at 36°18.97' N and 16°05.48' E

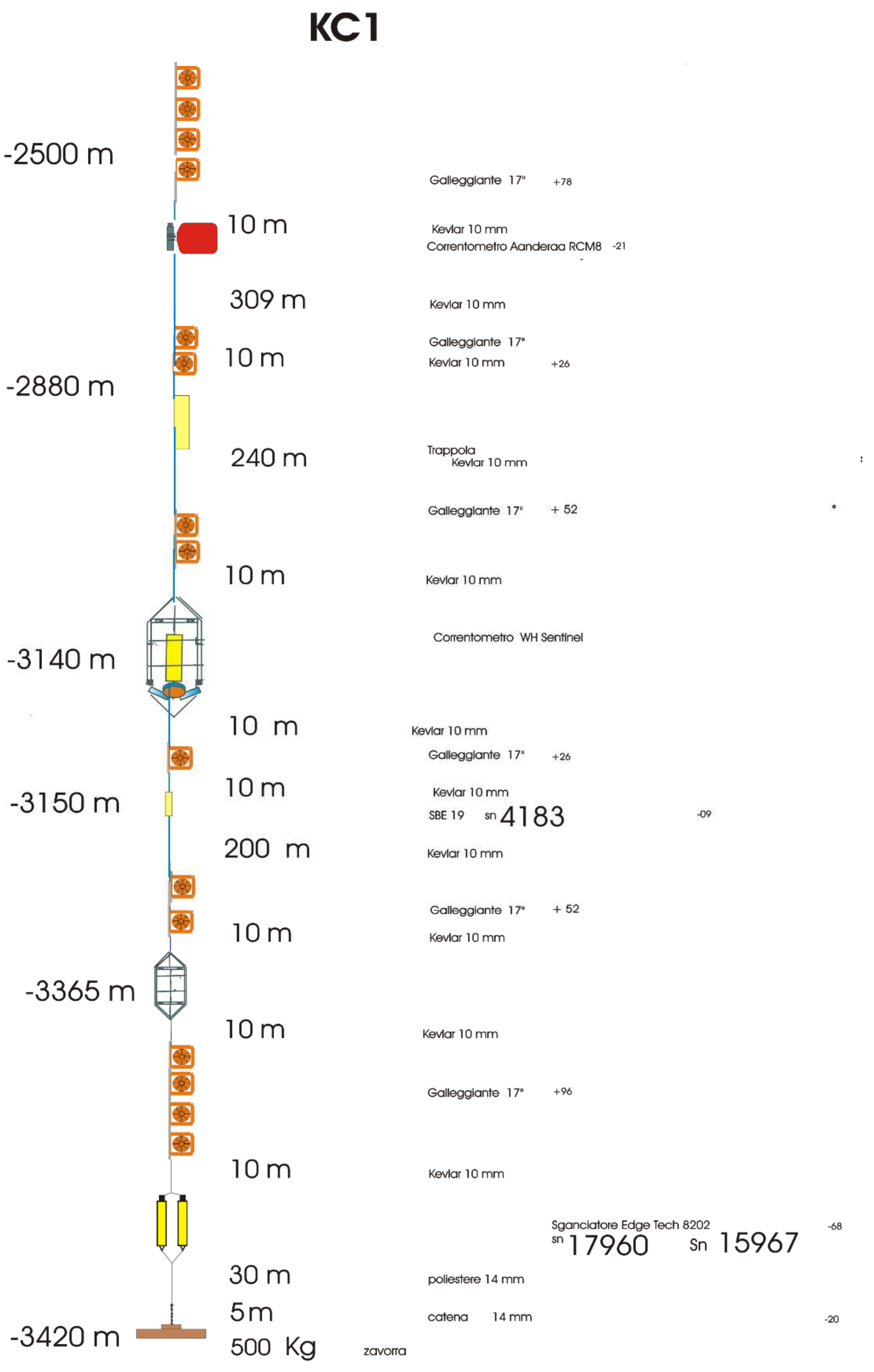


Figure 13 Scheme of the KC2 mooring, located at 36°24.03' N and 15°40.93' E

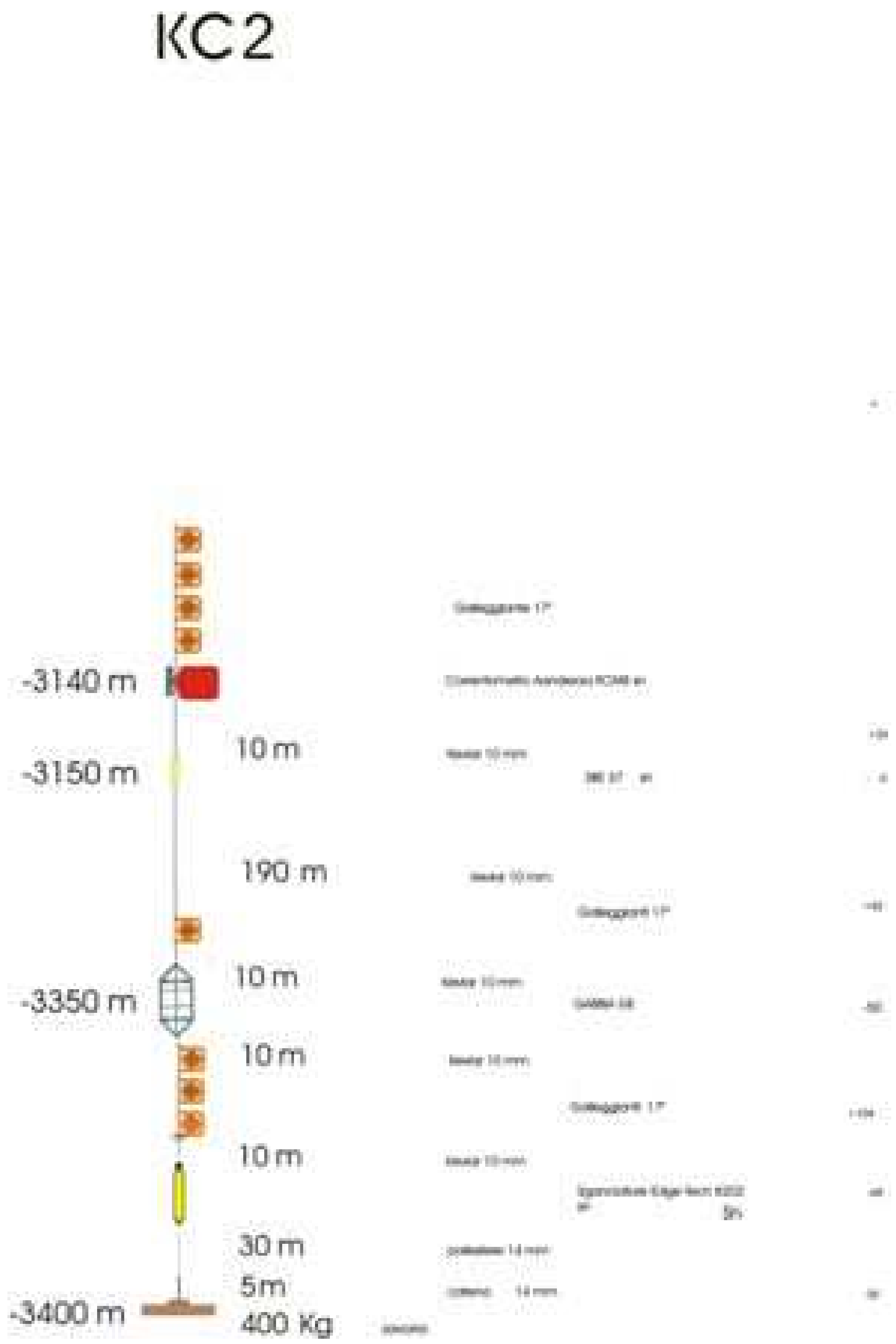
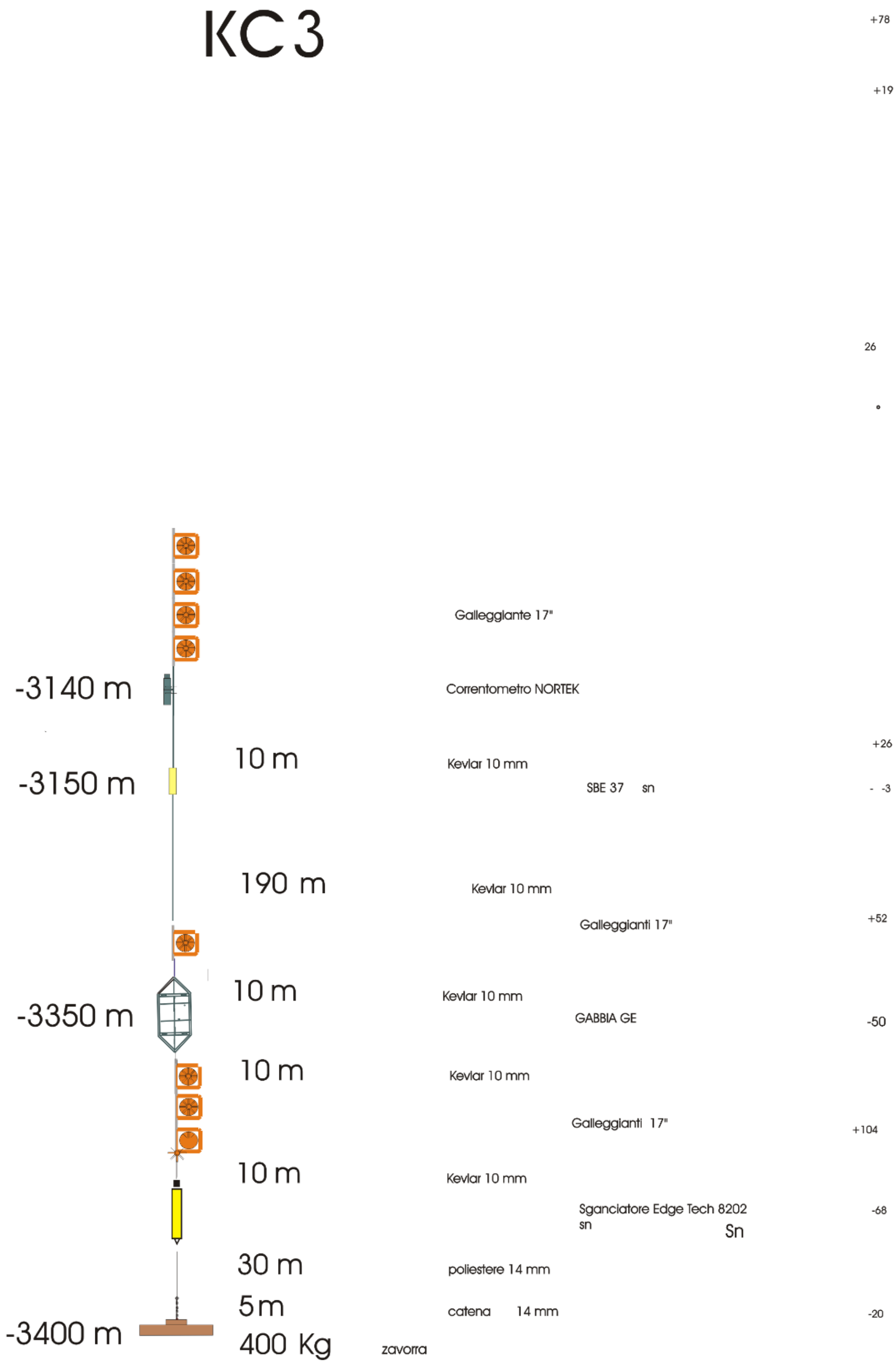


Figure 14 Scheme of the KC3 mooring, located at 36°23.94' N and 16°21.98' E



The recovering of the instruments was aimed to maintenance and to download the different data time-series from the internal memories. In the following graphs we show some preliminary data elaborations.

Figure 15 Stick plot of the velocities measured by a down looking RDI WH 300 kHz, positioned at a depth of 3140 m in the KC1 mooring

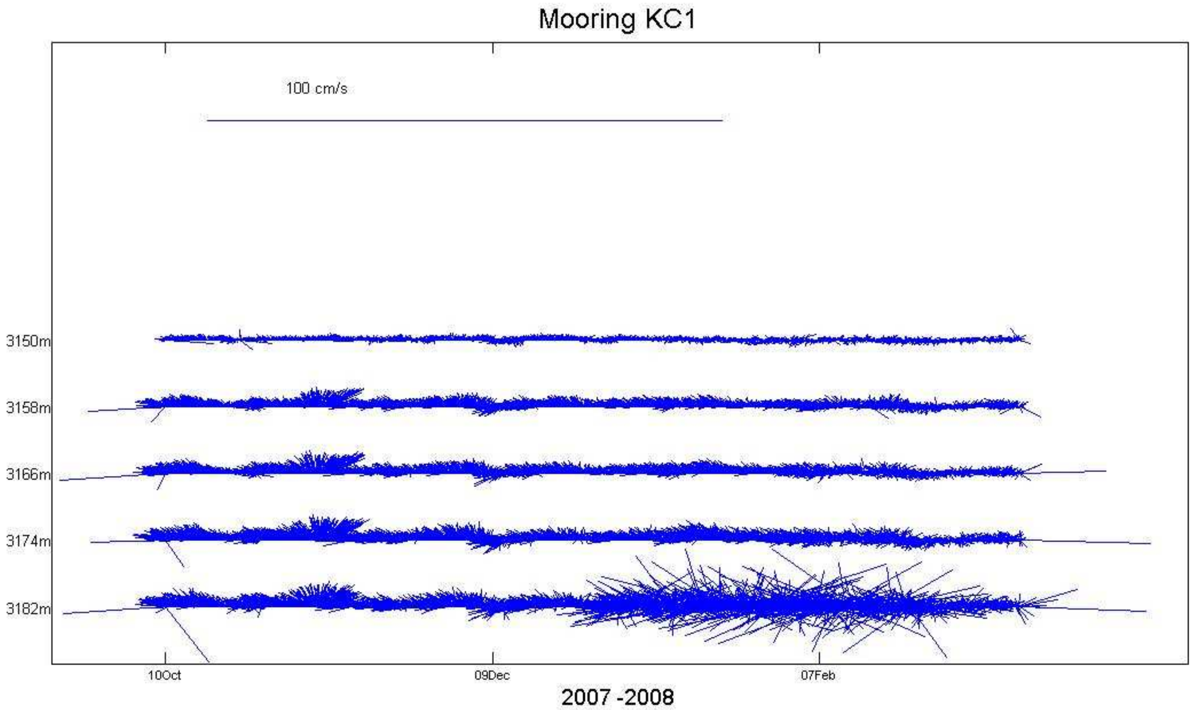


Figure 16 Currentmeter AANDERAA RCM8 at 2500 m depth in the KC1 mooring: velocity (m/s), stick plot and progressive vector diagram

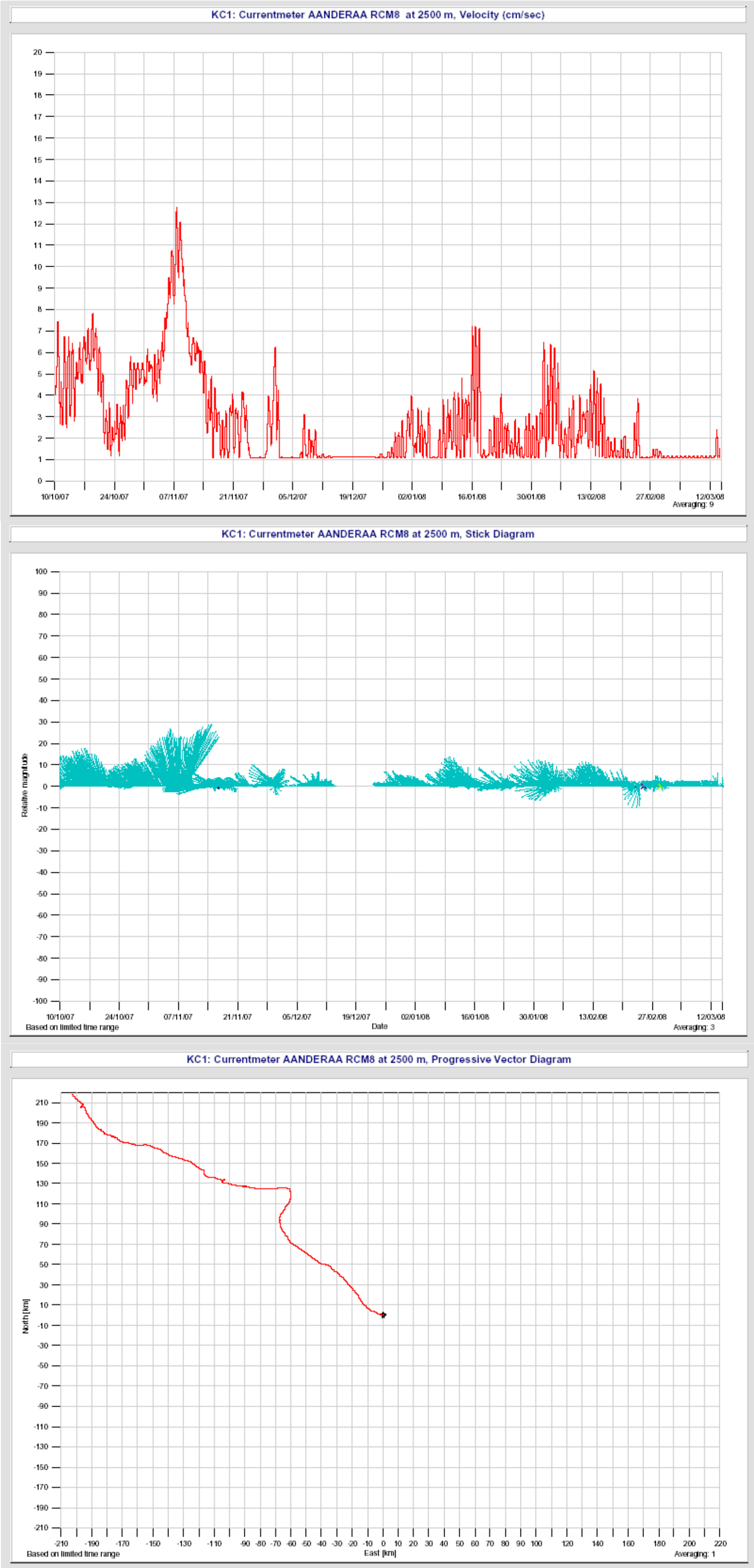
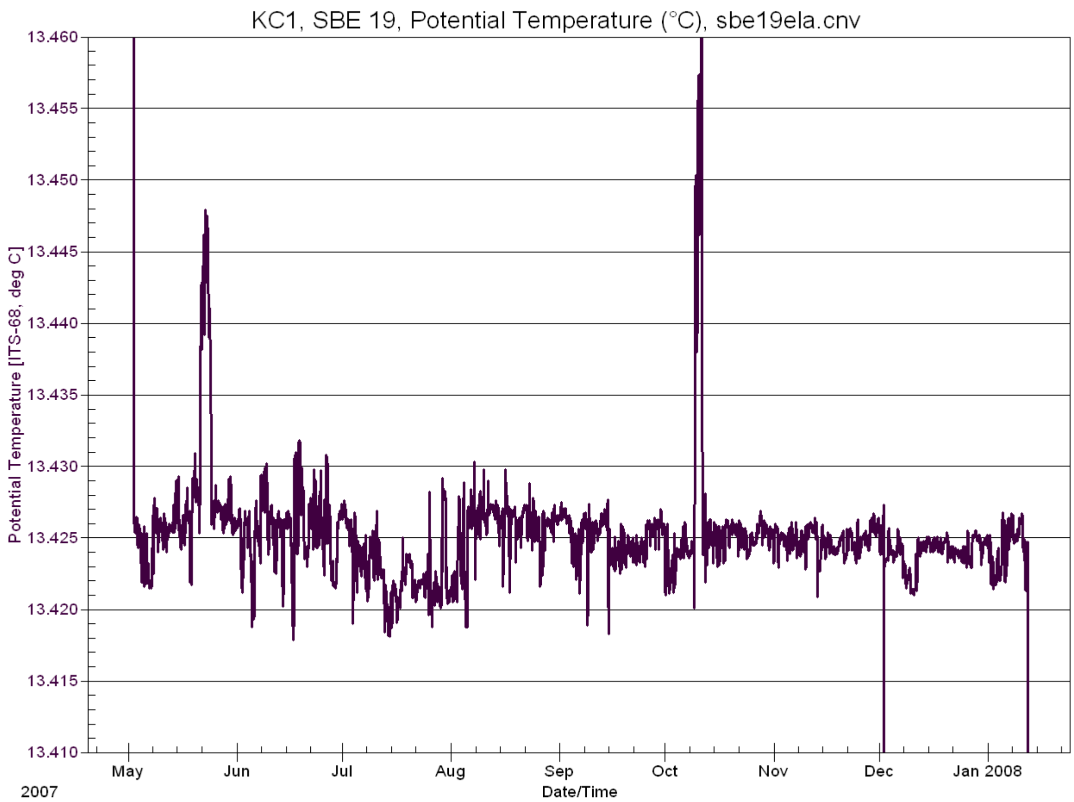


Figure 17 Temporal evolution of potential temperature and salinity measured by an SBE19 at 3150 m depth in the KC1 mooring



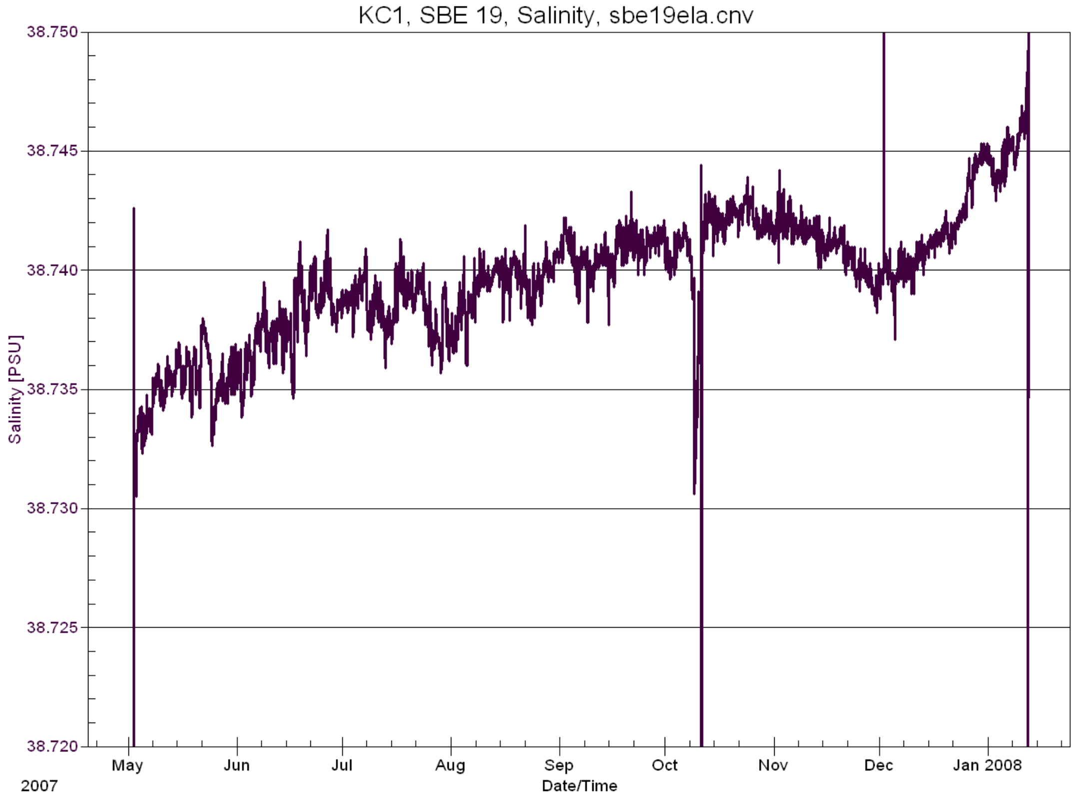


Figure 18 Currentmeter AANDERAA RCM8 at 3150 m depth in the KC2 mooring: velocity (m/s), stick plot and progressive vector diagram

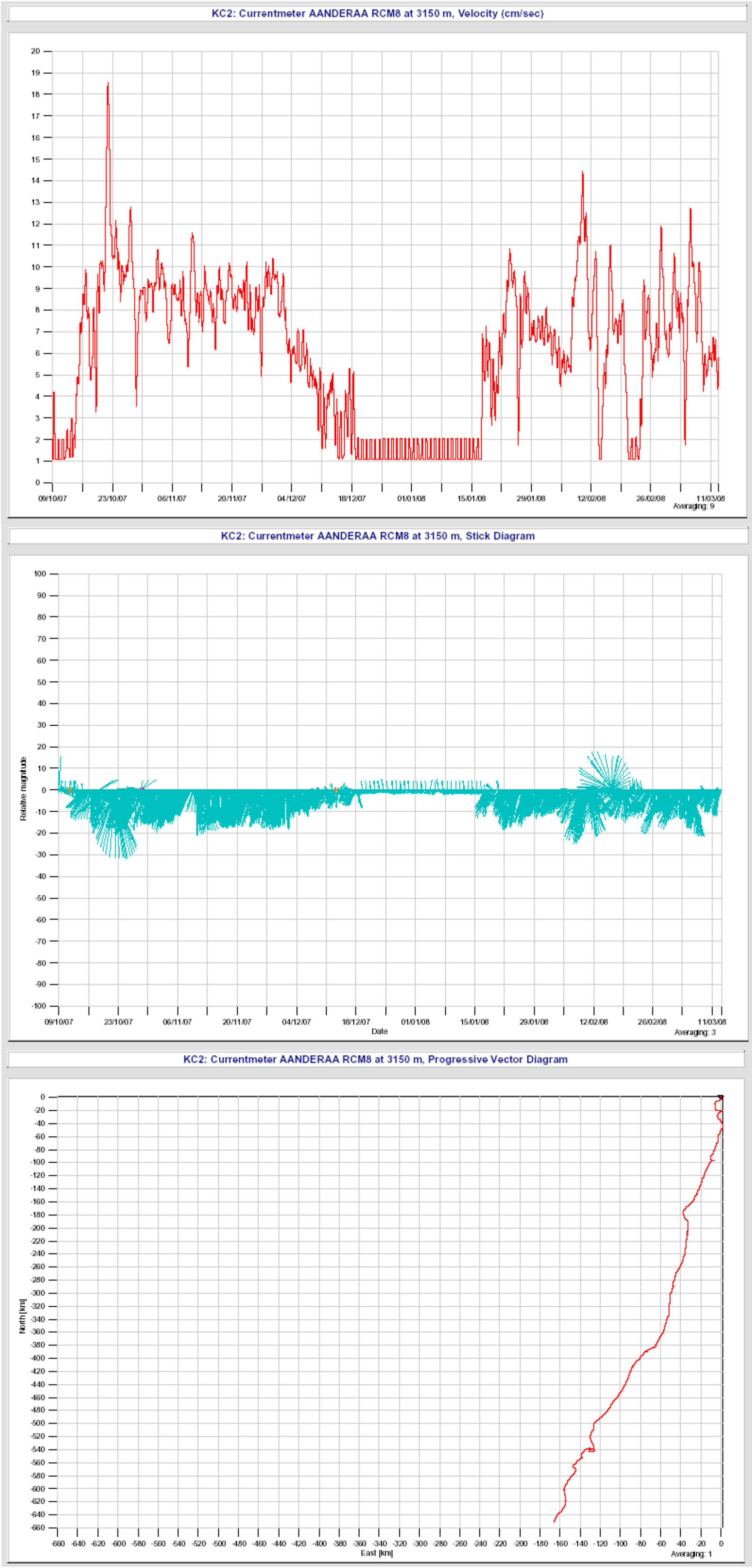


Figure 19 Temporal evolution of potential temperature and conductivity measured by an SBE37 at 3150 m depth in the KC2 mooring

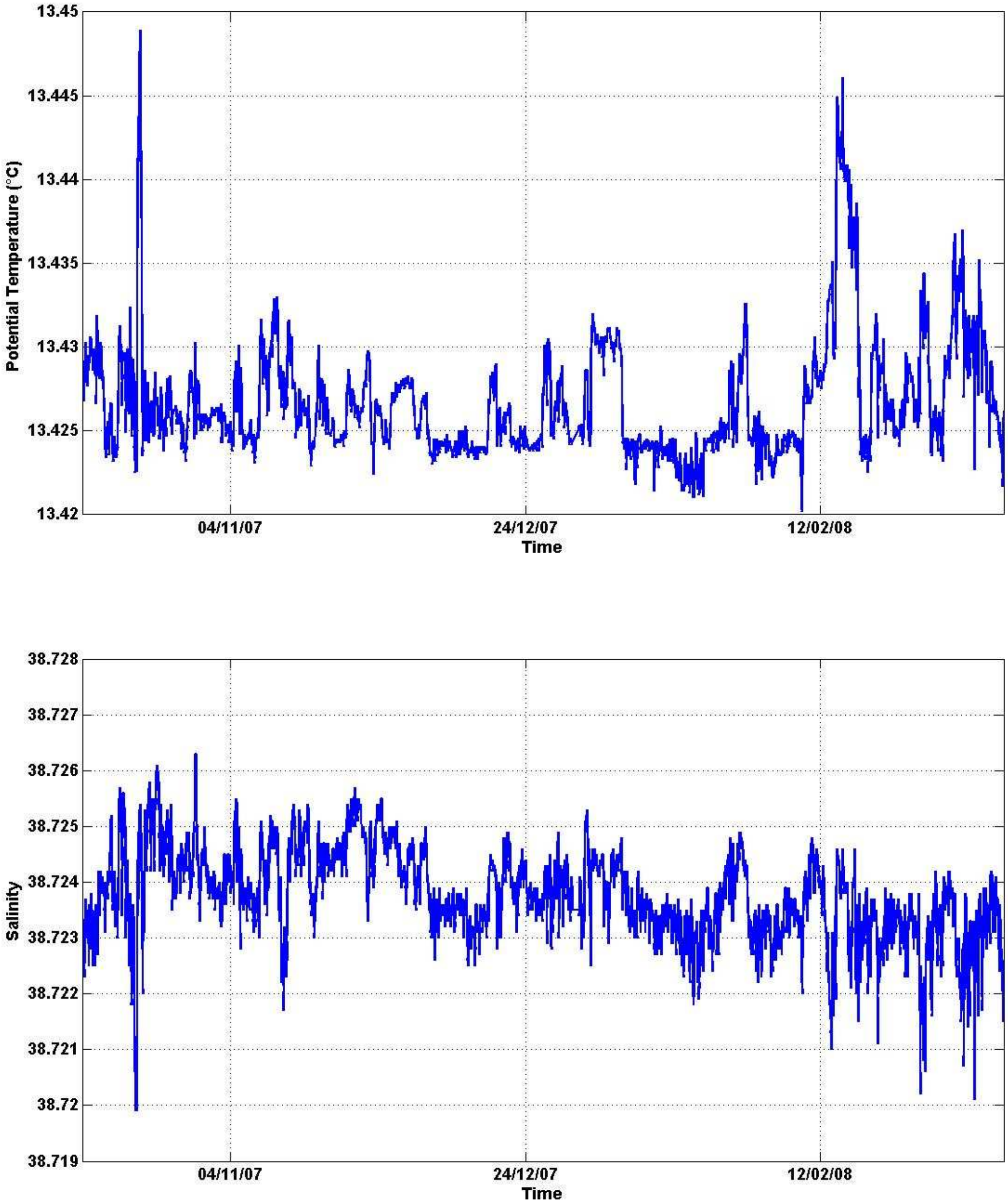


Figure 20 Currentmeter AQUADOPP at 3400 m depth in the KC3 mooring: velocity and angle histogram

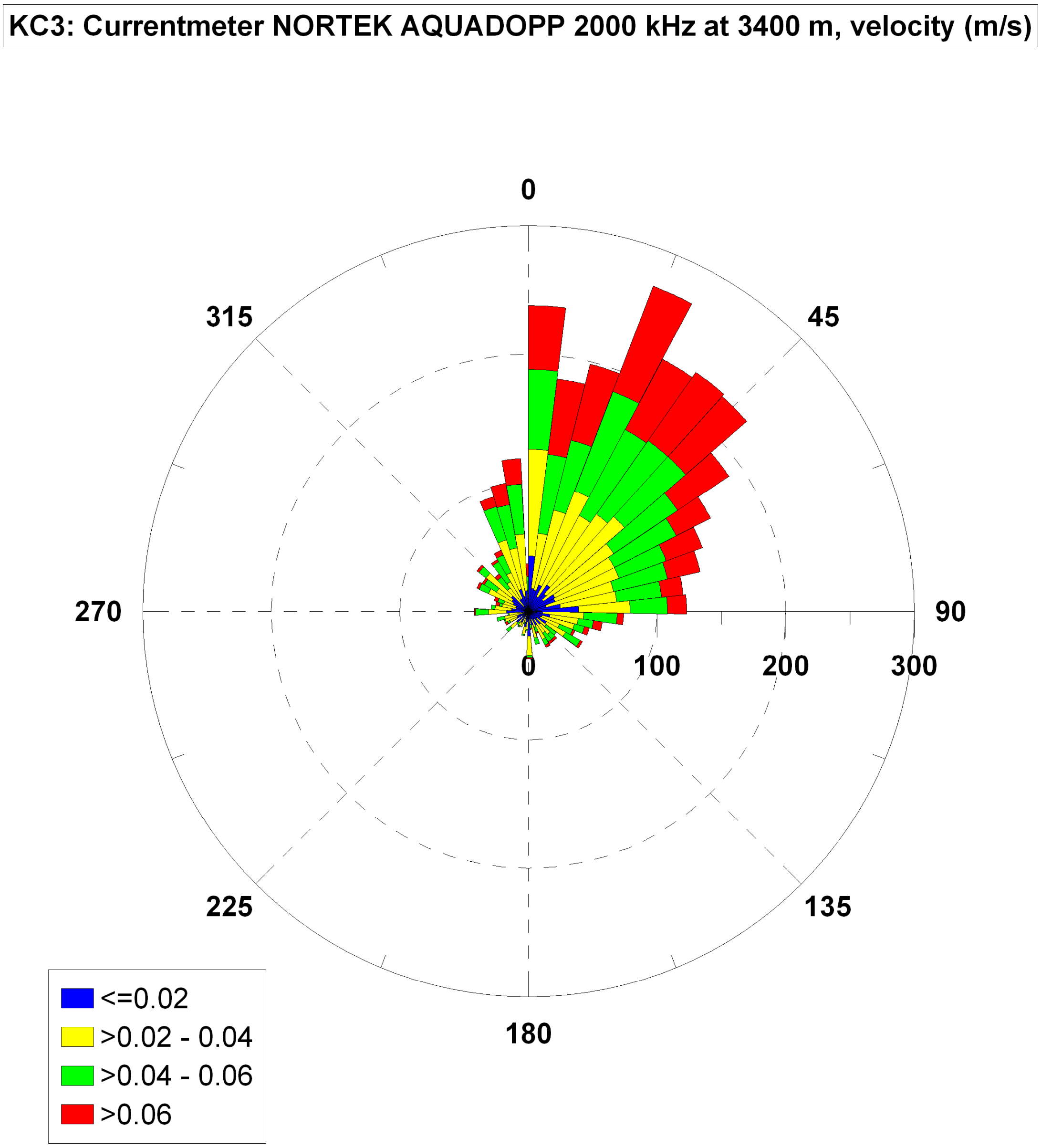


Figure 21 Temporal evolution of potential temperature and conductivity measured by an SBE37 at 3150 m depth in the KC3 mooring