CRUISE REPORT

SOCIB Canales Spring 2016: 5th to 8th May 2016

SOCIB_ENL_CANALES_MAY2016_SPRING

Document type:	Cruise report
Date:	2016-05-20

Description:	A repeat seasonal hydrographic survey of the Balearic Sea, monitoring the Ibiza and Mallorca Channels. 35 CTD stations were carried out over 4 days, 25 stations formed three transects across the Ibiza Channel (IC), while the remaining 10 stations formed a Mallorca Channel (MC) transect on day 4. Two additional stops allowed for maintenance of the Ibiza Channel Buoy and the deployment of an SVP drifter.
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Keywords:	Mediterranean; ocean circulation; Balearic Sea; Ibiza Channel; Mallorca Channel; Northern Current;

DOCUMENT VERIFICATION LIST

Date:	Checked by (name)	SOCIB division	Ref.
2019-06-17	C. Muñoz	SOS	

DOCUMENT DISTRIBUTION LIST

Date:	Distribution to:
2019-06-17	public domain

CHANGE RECORD

#	Date	Description	Author	Checked by
1.0.0	2016-05-20	first version document	K. Reeve	E. Alou
1.1.0	2019-06-17	add links to data and CSR	C. Muñoz	C. Muñoz

SOCIB Balearic Islands Coastal Observing and Forecasting System

Índice de contenido

Objectives

1. Complete repeat hydrographic survey of the Ibiza Channel (IC) and Mallorca Channel (MC) through deployment of a CTD probe (SeaBird SBE911*plus*) with extra mounted sensors and rosette equipped with 12 10l Niskin-type bottles

2. Discrete water sample collection at various depths for the purpose of:
    a. Sensor comparison with the *in situ* discrete water samples for salinity, dissolved oxygen, chlorophyll a (chl *a*) concentration and
    b. Biogeochemical sampling of nutrients and phytoplankton community (through pigment signatures and microscopic post-cruise analyses).

3. Collection of VM-ADCP (vessel-mounted Acoustic Doppler Current Profiler) data throughout the cruise to gain knowledge about the current structure of the upper 200 m of the water column as well as for calibration purposes.

4. Deployment of SVP drifter.

5. On-site maintenance of the Ibiza Channel Buoy.

Onboard personnel

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B. Casas	CTD
C. Castilla	CTD
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K. Reeve	ADCP
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Contents

List of figures

List of tables

Station plan

35 CTD stations were carried out over a period of 4 days; 3 transects in the IC and one transect in the MC. The ADCP was collecting data throughout the entire duration of the cruise, from the moment the ship left the port to the moment the ship arrives at port. Figure 1 shows the station locations and the order in which stations were carried out.

A ship activity log detailing actions carried out during the cruise is provided in Appendix 1.

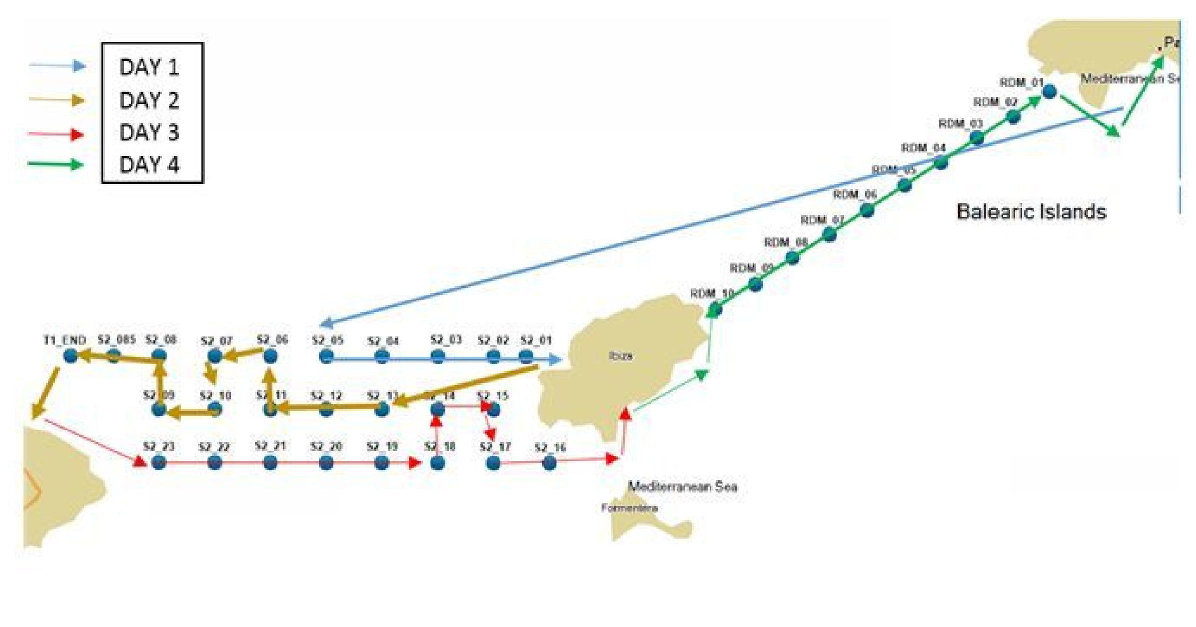


Fig. 1: Station plan

Cruise diary

Day 1 - 5th May 2016

We set off westwards from the port of Palma de Mallorca at 06:10 GMT, in clear, calm conditions. Upon exiting the port, the ADCP started running in bottom tracking mode (file 001) at 06:20 and was switched into water tracking mode upon reaching deeper water at 07:55 GMT. Typical vessel speed was 17 knots. We crossed the MC and passed north of Ibiza and westwards to the centre of the IC to reach our first station of the day, station S2_05, at 12:10 GMT. There was light cloud coverage with intermittent very light showers throughout the day, although no rain seemed to occur when collecting salinity samples. The ADCP showed predominantly north/north-easterly flow in the MC (by as much as 40 cm s^{-1}

and north of Ibiza, as well as the western shelf of Ibiza. Once off the shelf in the IC, flow was predominantly southwards (about 20-40 cm s^{-1}). Conditions remained calm throughout the day, with a typical ship speed of 10-16 knots between stations. 5 CTD stations were carried out in the Eastern side of the IC before reaching the Port of San Antonio at 17:10 GMT.

DAY 2 - 6th May 2016

We set off from the Port of San Antonio at 05:50 GMT, steaming South-West towards the first station of the day: S2_13, which was reached at 07:12. Again conditions were flat and calm, and remained relatively cloudless until about 11:00 GMT, when some light cloud coverage started to build up. There was no rain today, and absolute wind varied between 8 and 23 knots. Typical ship speed was 16 knots. At 08:00 GMT we stopped at the Ibiza buoy (38º 49.4’ N, 0º 47.42’ E); this was a stop for maintenance of the buoy with scuba divers. No CTD station was carried out here. We continued westwards onto the next station, S2_12, which was reached at 09:16 to recommence with the hydrographic survey. 10 CTD stations were carried out in the IC before reaching the Port of Denia on the Iberian Peninsula at 18:00 GMT.

DAY 3 - 7th May 2016

We left the Port of Denia at 05:50 GMT, steaming south-eastwards towards the first station of the day; station S2_23, which we reached at 06:50 GMT. Conditions were cloudier than the day before, albeit still calm. Again the ADCP was running for the entire duration of the day, switching between bottom and water tracking modes when the bottom depth deemed it necessary. The absolute wind ranged between 5 and 17 knots, mostly in the lower range. At about 12:00 GMT cloud cover decreased and the day gradually became sunnier. One station that particularly stood out was station S2_18, which will be presented in the section “Scientific Investigations”. As we steamed eastwards towards Ibiza, 10 CTD stations were carried out. The final being at the South West corner of Ibiza. We then continued steaming eastwards around a headland that marks the southernmost point of Ibiza, before steaming northwards towards the port of Ibiza Town, which was reached at 16:45 GMT.

DAY 4 - 8th May 2016

We left the port of Ibiza Town at 05:40 GMT, steaming north eastwards around the coast of Ibiza in order to reach the first station, RDM_10, in the MC. Today started as very cloudy, which decreased slightly and then remained relatively constant throughout the day. Very light rain occurred on station RDM_06. Again, conditions were calm. We reached the first station at 06:40 GMT, and continued eastwards across the Mallorca Channel, carrying out 10 stations, only three of which were in regions where the bottom depth exceeded 500 m. This allowed for relatively longer ADCP transects in bottom tracking mode for calibration purposes. We arrived at the final station, RDM_01 at 13:19, after which we continued on to the Port of Palma de Mallorca, where the cruise terminated at 14:40 GMT.

Instrumentation description and configuration

In this section are described the instrumentation and the configuration used during the cruise

CTD-Probe

Manufacturer:	SeaBird
Model:	SBE9+
S/N:	1031
SOCIB Inventory:	SCB-SBE9002
Deck Unit:	SBE11
SOCIB Inventory:	SCB-SBE11+001

Sensor	Model	S/N	Calibration date
Temperature	SBE 3P	03P5427	2013/12/19
Temperature 2	SBE 3P	03P5449	2013/12/19
Conductivity	SBE 4C	043872	2014/01/14
Conductivity 2	SBE 4C	043877	2014/01/14
Pressure		119076	2014/02/03
Oxygen	SBE 43	432117	2014/01/18
Transmissometer	WET Labs C-Star 25-650	CST-1413DR	2014/03/05
Turbidity	STM Sea Point	12181	2014/01/23
Fluorometer	Seapoint 6000m	3258	2014/01/23

Irradiance	PAR Biospherical QCP-2300L-HP	70363	2011/03/25
Surface Irradiance	SPAR Superficie Biospherical QCR2200	20395	2011/03/28
Altimeter	Datasonics PSA-916D	52712	

Configuration

For controlling the CTD it was used the XXX.xmlcom file (where XXX corresponds to the current station name, for details refer to Appendix 2).

Acoustic doppler profiler

Manufacturer:	RDI
Model:	Ocean Surveyor 150 kHz
S/N:	1878
SOCIB Inventory:	

Configuration

Thermo-salinometer

Manufacturer:	SeaBird	
Model:	SBE21	
S/N:	3370	
SOCIB Inventory:	SCB-TSL001	
Calibration date:	2011/12/21	

Configuration

The data are collected using the UTM - Termosal.exe software. The data are stored directly in the main desktop and are processed through the SOCIB-DC system.

Fluorometer

Data with this instrument were not collected during this cruise (see biogeochemical data report section for further details).

Manufacturer:	Turner
Model:	10 - AU
S/N:	1100195
SOCIB Inventory:	
Calibration date:	2015/09/17

Weather Station

Manufacturer:	Geonica
Model:	Meteodata 2000
S/N:	
SOCIB Inventory:	SCB-MET009
Calibration date:	2011

Configuration

The data are collected using the UTM - SADO System. The data are stored directly in the main desktop and are processed through the SOCIB-DC system.

Scientific Reports

Physical data report

The following contains an overview of the physical data collected from the CTD and the VM-ADCP on board the R/V SOCIB catamaran from the 5th to the 8nd May 2016. The first section is a technical description of the VM-ADCP data processing and visualization, and a calibration report, while the second section briefly outlines the steps followed in order to process the CTD data. Lastly, some results are presented from both the VM-ADCP and CTD, drawing attention to any particularly interesting features.

VM-ADCP

Throughout the entire cruise (i.e. both during sections and during transits), a VM-ADCP was recording data about the movement of the upper 200 m of the water column. The R/V SOCIB is equipped with a 150 kHz, RDI Ocean Surveyor, VM-ADCP (vessel-mounted Acoustic Doppler Current Profiler) transducer located in the port hull just forward of the accommodation bulkhead in front of the fuel tanks. Data is recorded and displayed real-time using the RDI developed software VmDas (RDI's data acquisition and playback software) and WinADCP (RDI's visualisation software).

Data acquisition and processing: The basic data processing was carried out to SOCIB's VM-ADCP standard operating procedures (SOPs) within VM-DAS and WinADCP (refer to these documents for further details).

The initiation files for both bottom-tracking and water-tracking mode included the following settings:

- Transducer depth = 2 m
- Blank distance = 8 m
- Number of Bins = 50
- Bin thickness = 8 m
- Max range for bottom tracking = 400 m
- STA files (short term averaging) = 120 s
- LTA files (long term averaging) = 600 s

Calibration: The EA Heading alignment was set to -45.5o while the velocity scale factor for profile velocities was initially set to 1.0080, in accordance with previous cruises. These values correct for misalignment between the VM-ADCP instrument and the ship. Throughout the cruise, a total of 8 transects were carried out in bottom-tracking mode for the purpose of misalignment calibration checks (as described in the SOPs). The bottom track STA files were read into excel and sections of data were then copied into a VM-ADCP calibration spreadsheet. These data sections were subjectively chosen on the basis of relatively constant ship velocity, heading and bottom depth. The calibration spreadsheet follows the standard theory for VM-ADCP installation calibration from bottom track information as described in Joyce (1989) and Pollard and Reed (1989). The resulting calibrations of the five bottom-track sections are provided in table 1. The mean misalignment angle varies from about -0.014o to about 0.201o, with no statistical significance (on average standard deviation: SD ± 0.26).

For the first three ADCP bottom tracking mode files, the velocity scale factor was set as 1.008. However, calibrations resulted in a mean amplitude factor that varied between 1.0016 and 1.0038 ± 0.003 (SD). This leads to the suggestion that calibrations could be improved if the velocity scale factor were to be increased to 1.001 (range 1.0096 to 1.012). While these results are not statistically significant, it reflects the same findings as in previous cruises that the velocity scale factor could be increased to 1.01. This setting was applied in bottom tracking mode to file 006; on day 2 (2016/05/06), upon entering the eastern shelf of the Iberian Peninsula during transit to the Port of Denia. For the remainder of the cruise, the velocity scale factor remained as 1.01. The calibration results suggested that an increase of this magnitude had small yet positive influence; the resulting mean amplitude factors range from 0.9999 to 1.004, with a SD of typically 0.004. This leads to new velocity scale factors from 1.0099 to 1.0144; with a mean over 5 calibrations of 1.012; however, only one calibration is statistically significant, possibly due to paucity of adequate quality data for the calibration. Thus, with a velocity scale factor of 1.01, the greatest accuracy we have been able to achieve is a SD of the amplitude factor of about 0.004.

Date	File	Nº bins	Bin size (m)	Max range (m)	Align. offset	Velocity scale factor	Nº data points	Mean Phi	Std mean Phi	Mean Amplitude Factor	Std Amplitude Factor	New velocity scale factor	Min new velocity scale factor	Max new velocity scale factor
5/5	16001	50	8	400	-45.5	1.008	24	0.058	0.196	-1.00376	0.00142	1.01179	1.01035	1.01322
5/5	16003	50	8	400	-45.5	1.008	18	0.088	0.363	-1.00263	0.00400	1.01065	1.00661	1.01468
5/6	16004	50	8	400	-45.5	1.008	12	0.008	0.198	-1.00163	0.00398	1.00965	1.00563	1.01366
5/6	16006	50	8	400	-45.5	1.010	35	-0.014	0.307	-1.00314	0.00447	1.01317	1.00866	1.01768
5/7	16007	50	8	400	-45.5	1.010	15	-0.028	0.245	-0.99991	0.00612	1.00991	1.00373	1.01609
5/7	16009	50	8	400	-45.5	1.010	36	0.014	0.260	-1.00246	0.00322	1.01248	1.00922	1.01574
5/8	16010	50	8	400	-45.5	1.010	10	0.202	0.322	-1.00039	0.00434	1.01039	1.00601	1.01478
5/8	16012	50	8	400	-45.5	1.010	18	-0.004	0.205	-1.00435	0.00261	1.01439	1.01175	1.01704

Table 1. Calibration results of the bottom tracking VM-ADCP files Date format: m/d year 2016

CTD and water bottle sampling

Data acquisition: CTD casts were carried out at 35 stations encompassing 3 transects across the IC and 1 across the MC. At each station, water samples were collected with the rosette at various depths for measuring *in situ* salinity, dissolved oxygen and fluorescence in order to apply corrections to the conductivity, oxygen and fluorescence sensors. Bottles were fired on the upcast "on the fly" at a nominal ascent rate of approx. 1 m s^{-1}. See cruise logbook for detailed sampled depths and fired bottles information.

Data preprocessing and visualization: The CTD sensor data were processed using SBE (SeaBird Electronics) Data Processing Version V7 23.2 (for details refer to SBE Web site). The resulting data are then processed in Matlab in order to provide the figures in the following section. Post cruise processing will involve the correction of the salinity data based on calibration with *in situ* water samples analysed in the lab with a Guildline Portasal model 8410A salinometer. The biogeochemical sampling will be discussed in the next section: the biogeochemical report.

Biogeochemical data report

As mentioned in the general objectives, the primary objective of the biogeochemical data collection during this cruise is to compare the CTD oxygen (SBE-43) and fluorescence (Seapoint) sensors against the *in situ* discrete water samples of these parameters.

Secondary field objectives are:

1. To estimate chl *a* concentration and distribution (as a proxy for phytoplankton biomass).
2. To assess nutrient concentration distribution: Nitrate (NO_3^-), nitrite (NO_2^-), silicate (SiO_4^{2-}) and phosphate (PO_4^{3-}).
3. To study phytoplankton community composition.

The sampling was carried out on 4 days from the 5th to the 8th May 2016 and followed the established R/V SOCIB protocols.

Dissolved oxygen

Discrete water samples (Winkler's method, Langdom 2010, see protocols) for comparison were taken at each station along each transect at a maximum of 3 depths. We chose depths of varying oxygen concentrations (in order to sample the full spectrum of oxygen concentrations). Refer to the available logbook generated during the cruise for more details on sampling depths, replicates and parameters sampled at each station.

Samples were analyzed on board after an 8-12 h period in darkness with a titration procedure with potentiometric endpoint detection (Metrohm 888 Titrator).

The final dissolved oxygen dataset will be produced post-cruise following the analysis of the data.

Chl *a* concentration

Samples for chl *a* concentration were taken at all stations at 4 depths (see logbook for details). Post-cruise chl a determination will be carried out at the IMEDEA by fluorometry (Turner Trilogy fluorometer, see available protocol).

During the cruise we made an effort to check the quality of the *in vivo* chl a fluorescence measured by the fluorometer Turner-10 AU (Turner designs) carried on board (alongside the thermosalinometer). The instrument was operated continuously for the length of the cruise, measuring the *in vivo* chl *a* fluorescence from the continuous flow (surface water). We sampled from the continuous flow at certain stations for validation (see logbook) in order to make a comparison between the *in vivo* chl *a* fluorescence and the chl *a* analyses with extraction. To our knowledge, such a quality check has not been carried out in previous cruises. A decision was made at the end of the cruise to transport the instrument to the laboratory and do the work that is needed. This will involve adjusting the sensitivity level of the instrument to the expected low chl *a* concentration values that are usually encountered on the surface waters of the study area.

Nutrients

Samples for inorganic nutrient concentrations were taken at all stations at a maximum of 9 depths (see logbook and protocols available). Samples will be kept frozen at -20ºC at the IMEDEA until analysis.

Phytoplankton community composition

Samples were taken on each station at the deep chlorophyll maximum (DCM) for general cell identification (cells fixed in Lugol's solution, Utermöhl 1958). Samples for microscopy will be analyzed post-cruise at the IMEDEA. Additionally surface samples were taken at a few selected stations (see logbook).

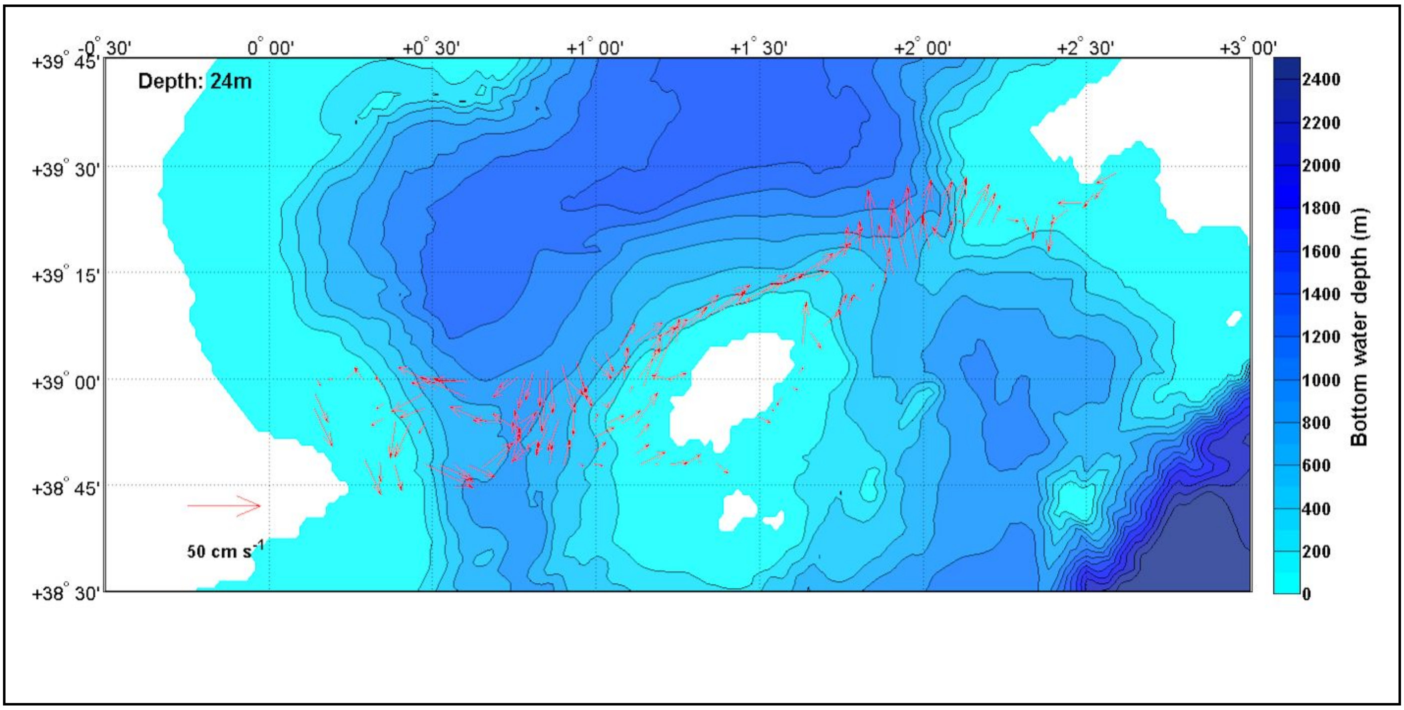
Samples for High Performance Liquid Chromatography (HPLC) analyses were taken on each station at 2 depths (surface and DCM). The total fraction was collected and a volume of 2 L filtered through a GF/F filter (retaining microorganisms larger than the nominal pore size of 0.7 µm). Samples are stored at the IMEDEA (-80ºC) until analysis.

Preliminary results

Physical

1. Velocity Vector Maps: 24 and 96 m

Figure 2 shows 4 km averaged VM-ADCP velocity at 24 (a) and 96 m (b); these depths were chosen to represent the current structure above and below the thermocline. There is particularly strong northern flow (20-30 cm s^{-1}) in the MC at 24 m, which occurs in both the outgoing and return transits. Another striking feature is the southern flow to the East of the deepest section of the IC and on the Iberian Peninsula Shelf, with an apparent cyclonic eddy type structure between the shelf edge and the deepest section at about 0.75^o E. The difference in the velocity magnitude between 24 and 96 m is distinct in the MC, whereas the flow magnitude is more consistent above and below the thermocline in the IC.



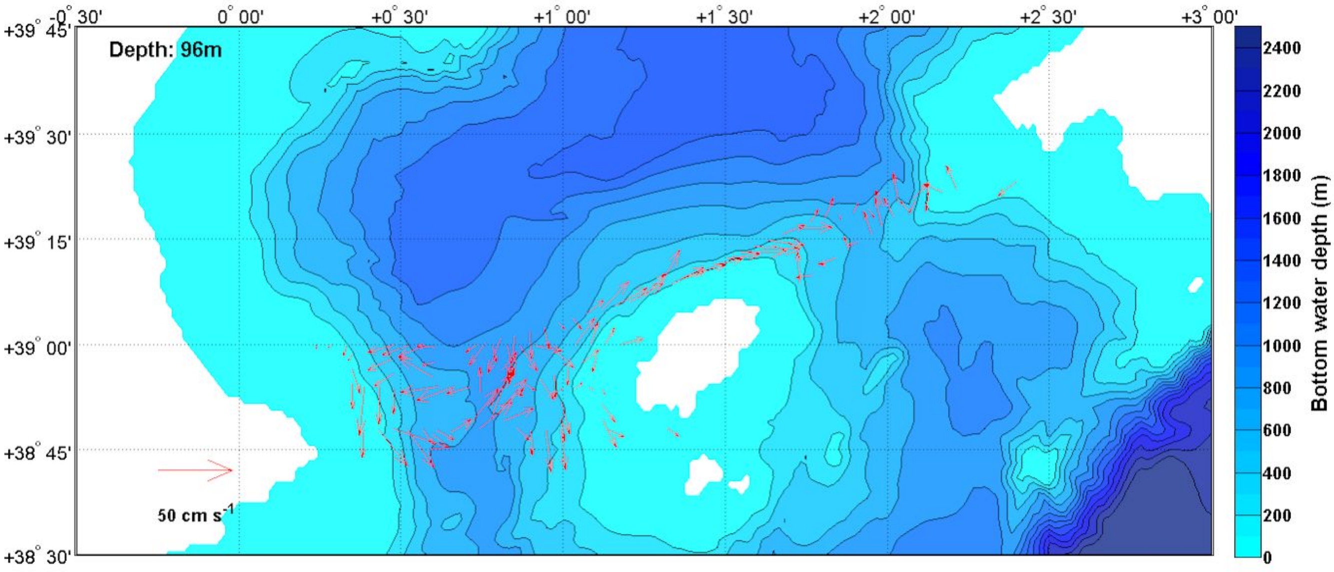


Fig. 2: 4 km averaged velocity at (a) 24 and (b) 96 m from VM-ADCP data. These depth bins were used to represent above and below the thermocline respectively

2. Hydrography: T-S diagram

Figure 3 shows the potential temperature – salinity distribution of all stations of the entire water column, where colour indicates the longitude of the corresponding station; thus in the MC waters (i.e. where the colour of the data points are towards the red end of the colour bar) are higher in salinity and have slightly different characteristics from the waters of the IC; here the water is fresher, coming from the North (Fig. 2); the water in the Mallorca Current appears to come largely from the South (with a component of flow from the West, flowing along the north coast of Ibiza from the northern shelf edge flow of the IC.

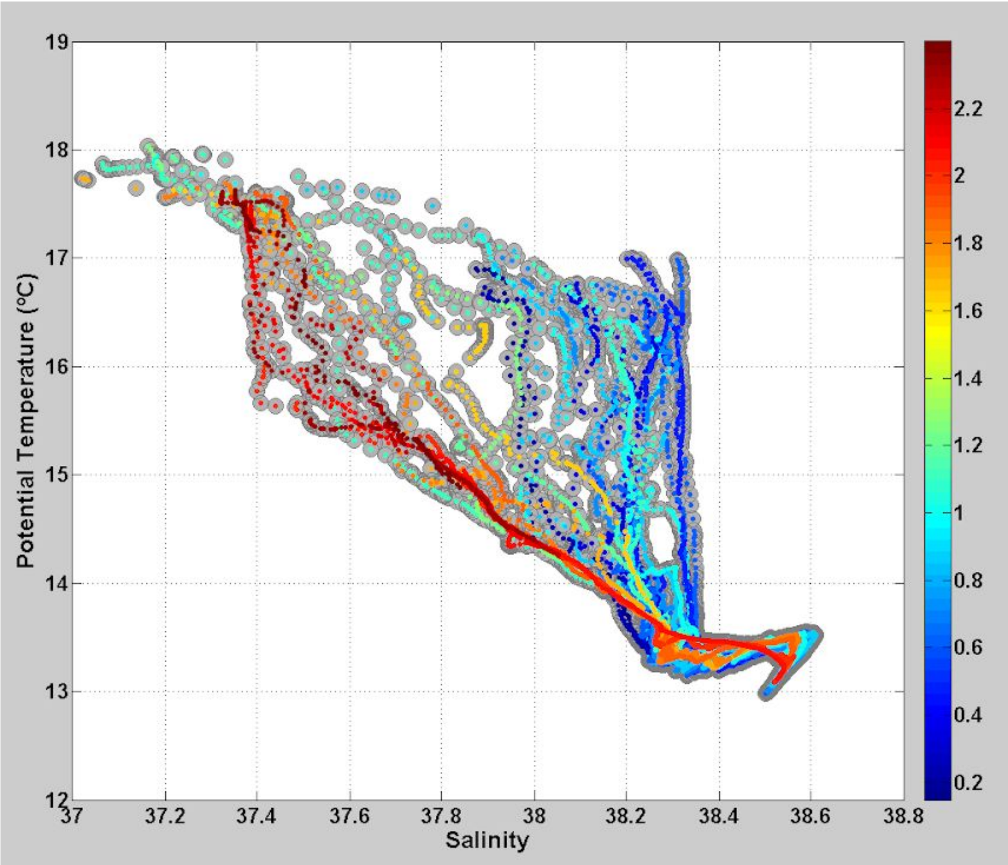


Fig. 3: T-S diagram of all stations; the colour bar indicates the longitude of the station; Thus the red end of the spectrum data points originate from the MC whereas the remainder are from the IC, from East to West approaching the blue end of the spectrum.

3. Ibiza Channel

The figures presented in this section are showing the third, most southerly transect of the IC. Figure 4 shows the velocities u and v from the ADCP, of the off-shelf region of the IC during that transect (note the ship departed from the latitude of the third transect twice: first, after steaming eastwards for 24 km the ship steamed north-eastwards for 6 km in order to check the Ibiza buoy and returned to the transect further east at 36 km in Fig. 4. The second departure was after 48 km of steaming; the last 12 km takes place at about 1° E, steaming directly northwards). The subplot c shows a plot of the distance covered by the ship against the distance between each ensemble ping; where the distance between each ensemble ping reduces to almost 0 we can identify periods where the ship is on station. By plotting against distance covered instead of ensemble number, the pixels where the ship is stationary have been compressed, providing a more uniform picture of the spatial structure of the Ibiza Channel. Flow is predominantly eastward throughout. Both subplots as well as the velocity vector maps in Fig. 2 show a strong south-easterly flow towards both shelf edges east and west of the Channel, and a strong north-easterly flow in the centre at about 0.65° to 0.85° E (at ~18-30 km in Fig. 4.). The flow is generally uniform throughout the upper 200 m of the water column, with the exception of the region beginning at the Ibiza shelf edge and extending onto the shelf just south of the Ibiza coast; here the flow is north-easterly in the top 50 m and predominantly southern below that depth, which incidentally coincides with the base of the thermocline (Fig. 5a). There is a distinct horizontal gradient in potential density in this region East of 0.9° E (Fig. 5c), with some suggestion of vertical instabilities in salinity and to a lesser extent potential temperature (Figs. 5b and 5a respectively). Another distinct horizontal gradient occurs at mid-depth of the deepest section of the IC: in salinity (Fig. 5b) and potential density (Fig. 5c) from ~230 m at 0.6o E to ~400 m at ~0.87° E.

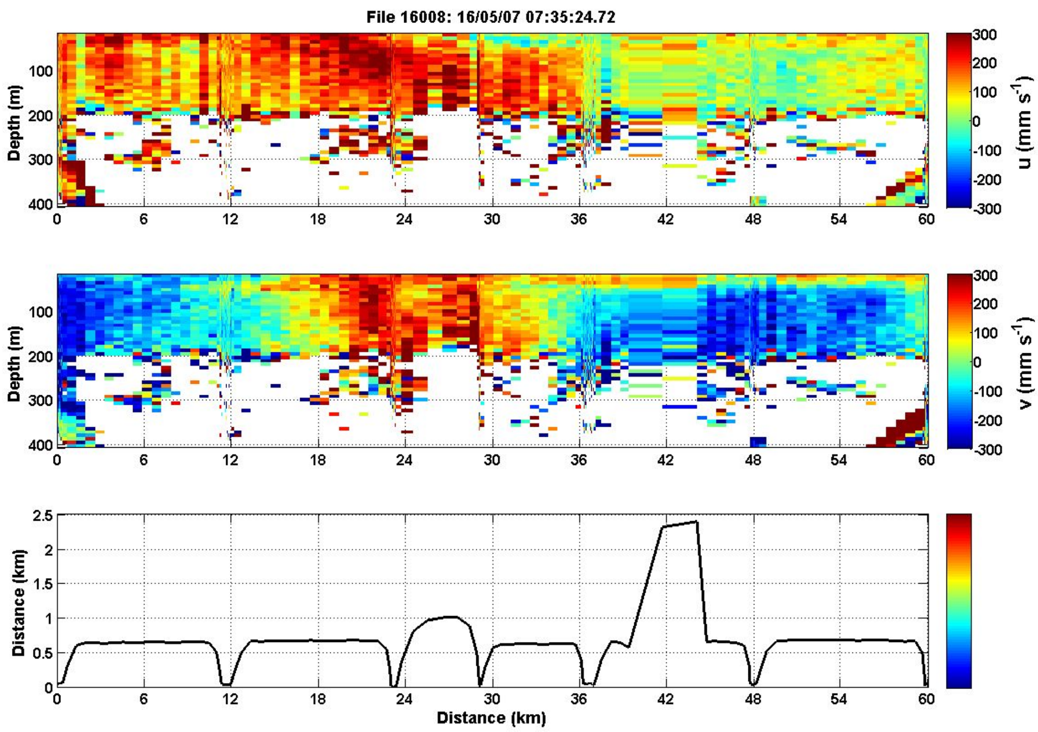


Fig. 4: u (a) and v (b) components of velocity (mm s^{-1}) plotted over distance covered by the ship in the IC on 2016/05/07. The last plot (c) shows the distance between neighboring ensemble pings plotted over ship distance in order to compress pixels where the ship is on station (these regions have close to 0 km between ensemble pings, whereas the distance between pings is

larger than 0 km when the ship is in transit.

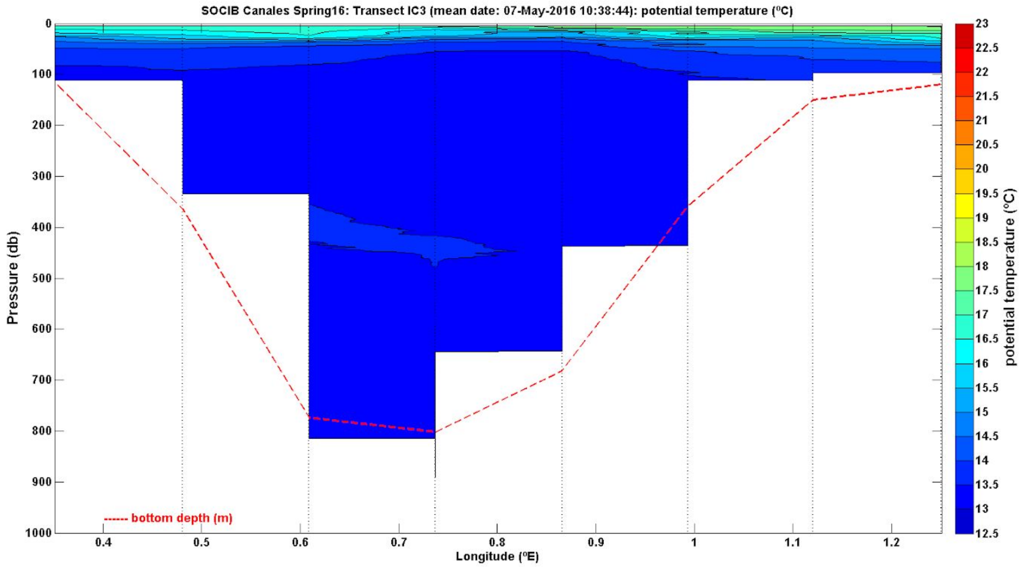


Fig. 5a: Potential temperature (ºC) of the third (most southerly) transect of the IC.

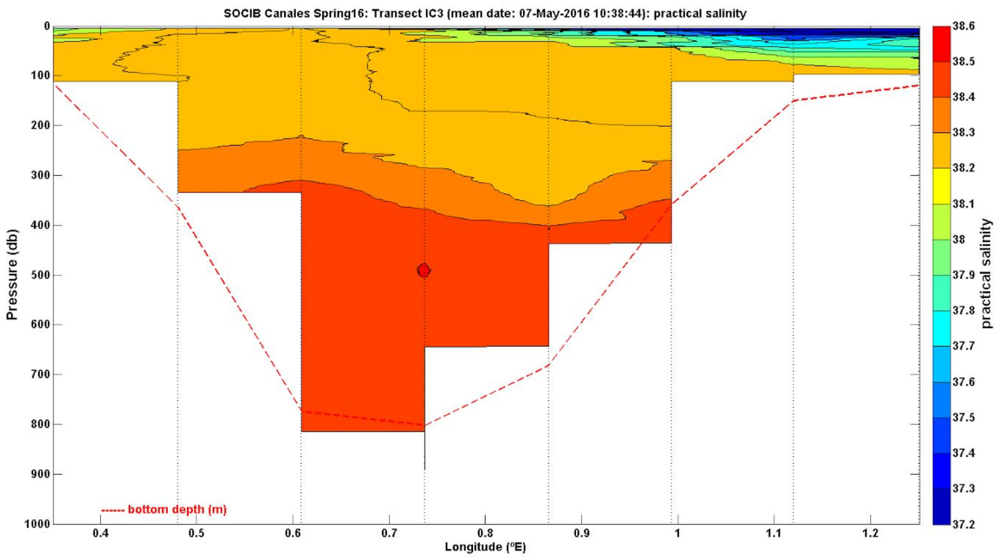


Fig. 5b. Salinity of the third (most southerly) transect of the IC.

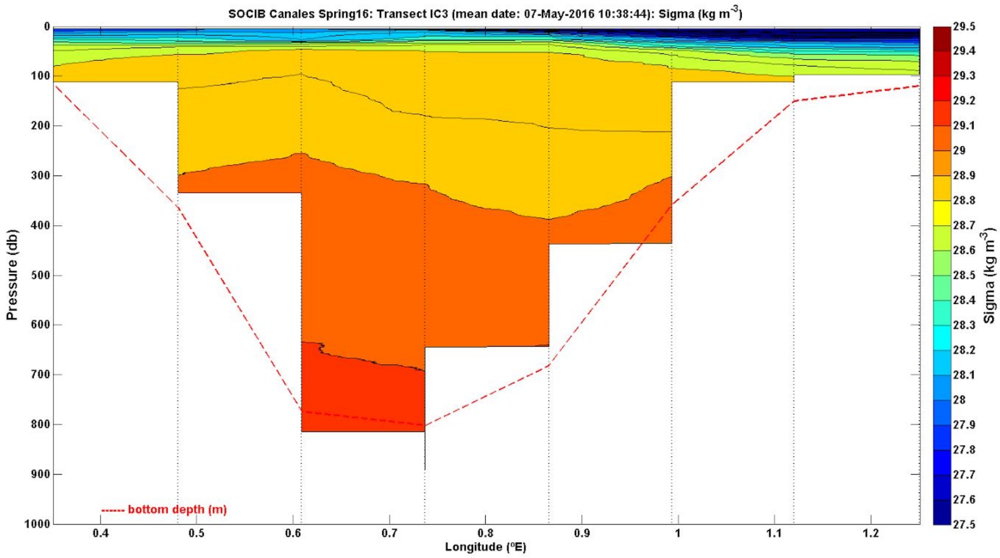


Fig. 5c. Potential density (kg m^{-3}) of the third (most southerly) transect of the IC.

4. Mallorca Channel

Figure 6 Shows the u and v components of velocity across the MC (start point at 0 km is the western shelf edge of Ibiza while the end point is just on the Mallorca shelf at 2.13º E). Of particular interest is the north flowing current structure 16 to 34 km into the transect which ranges between 10 to 30 cm s^{-1}. The flow is not uniform with depth, and there appears to be a horizontal gradient in the magnitude of the v-component of flow, where the change from 20 to 10 cm s^{-1} occurs just below the surface at 16 km (~1.9º E), and deepens to ~150 m 30 km into the transect (at about 2º E). This region corresponds to a marked horizontal gradient in potential temperature, salinity and potential density (Figs. 7a-c respectively).

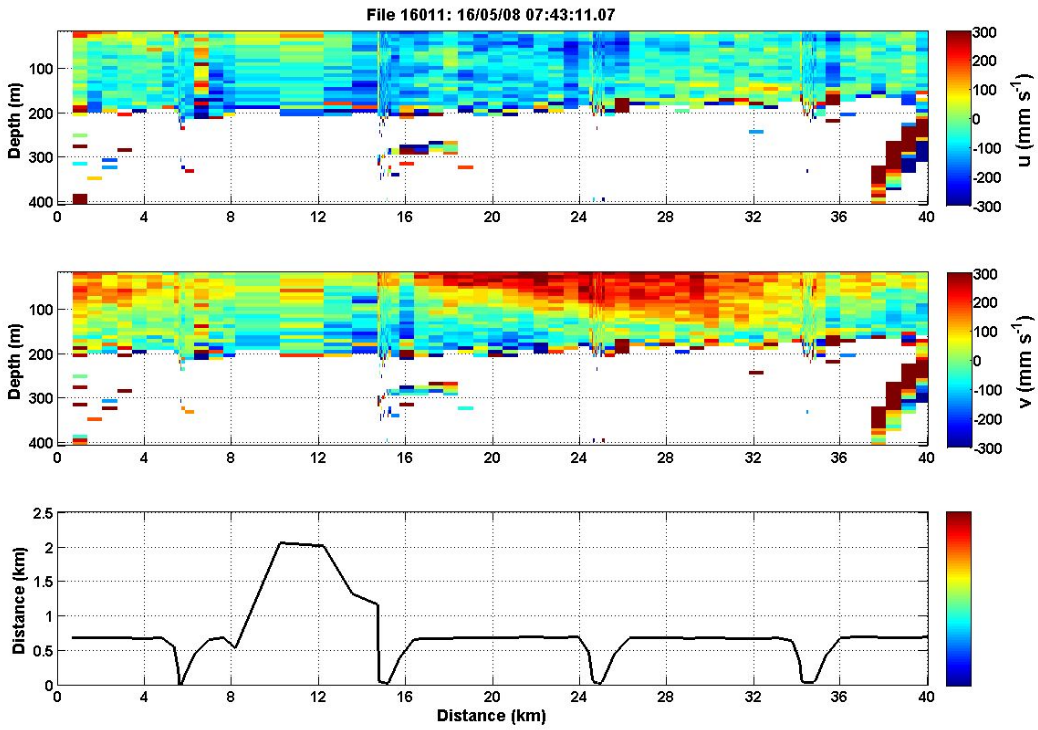


Fig. 6. u (a) and v (b) components of velocity (mm s^{-1}) plotted over distance covered by the ship in the MC on 05/07/2016. The last plot (c) shows the distance between neighboring ensemble pings plotted over ship distance in order to compress pixels where the ship is on station (these regions have close to 0 km between ensemble pings, whereas the distance between pings is larger than 0 km when the ship is in transit.

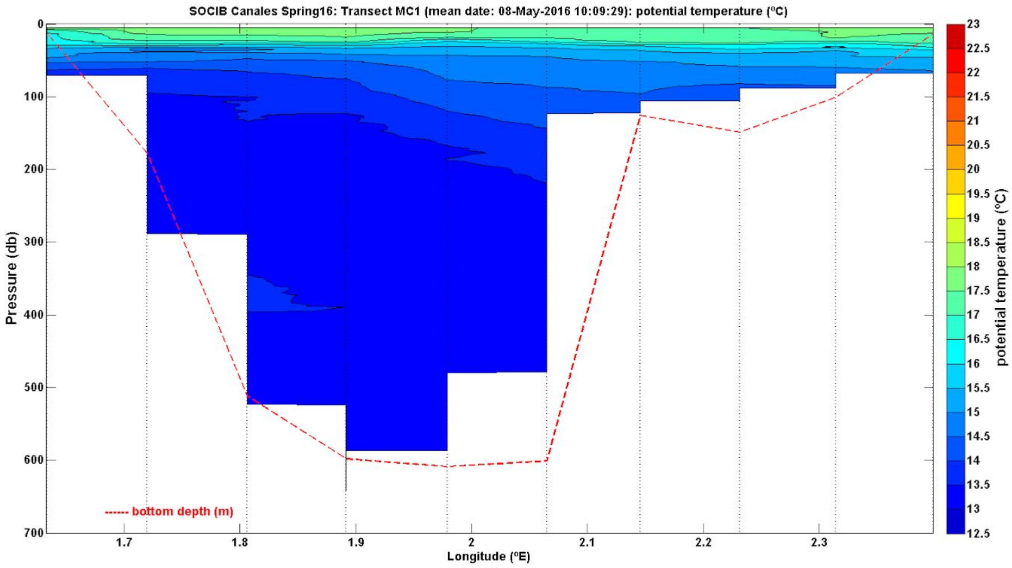


Fig. 7a. Potential temperature (ºC) of the MC.

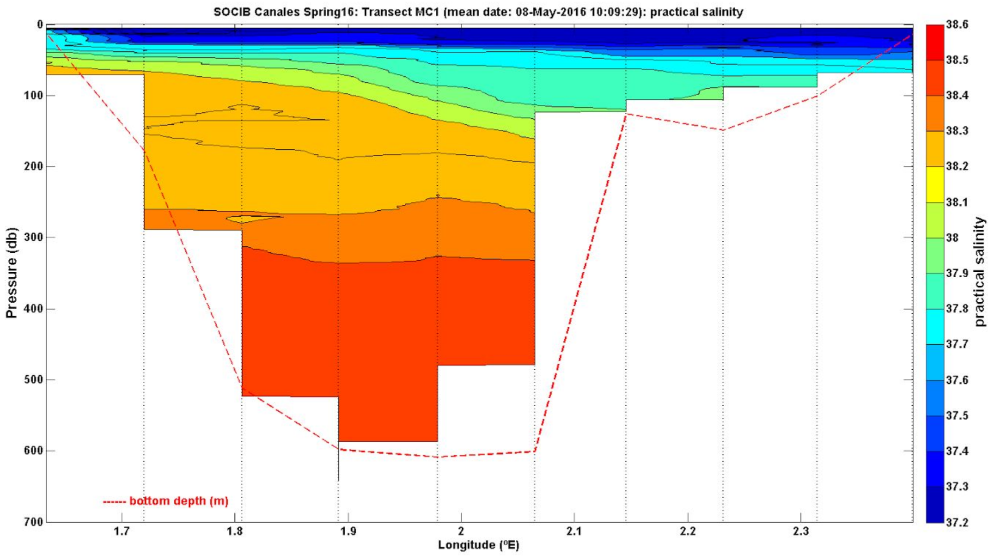


Fig. 7b. Salinity of the MC.

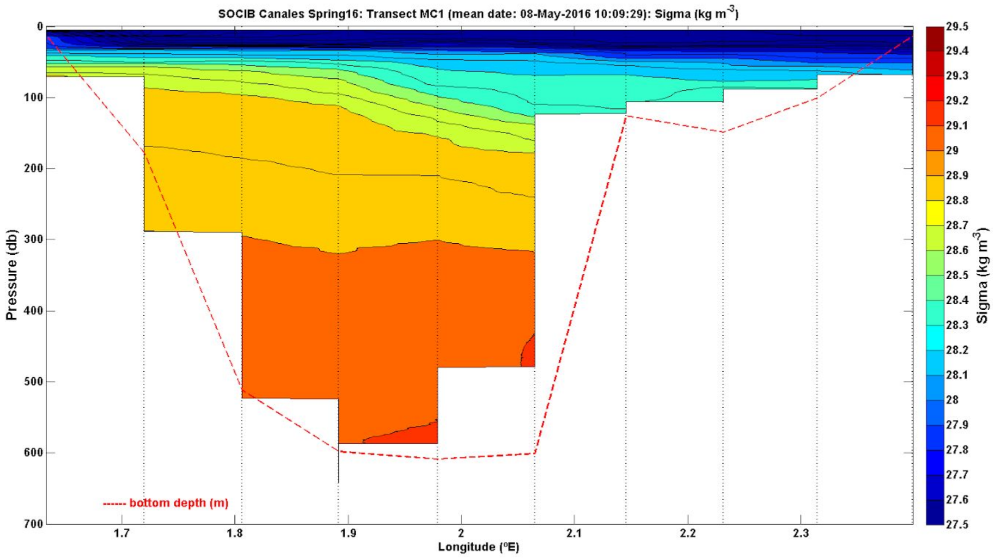


Fig. 7c. Potential density (kg m^{-3}) of the MC.

Biogeochemical

The final biogeochemical dataset will be produced in due course following post-cruise analysis of the data.

Below we present some preliminary results obtained with the CTD sensors for dissolved oxygen (Fig. 8a, 9a) and *in vivo* fluorescence (Fig. 8b, 9b) of the third transect of the IC and the MC respectively. The maximum values for fluorescence were obtained on the third transect of the IC (see Fig 8b).

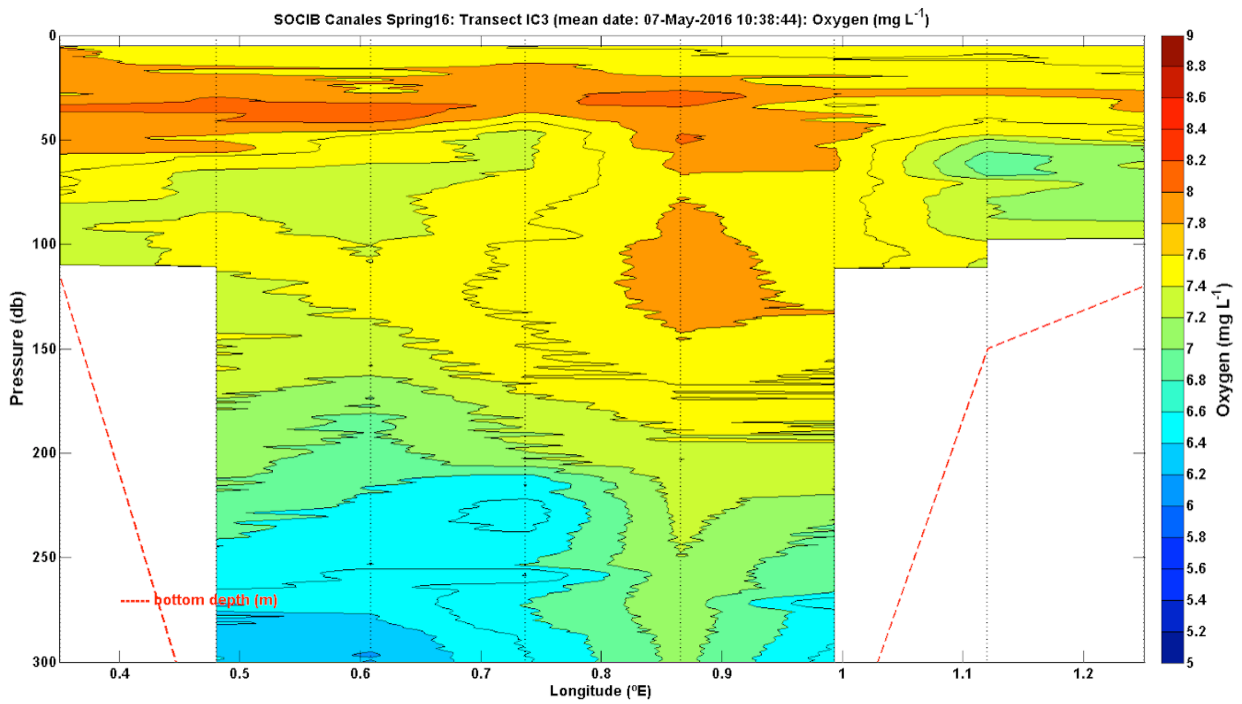


Fig. 8a: Initial figure for dissolved oxygen distribution obtained during the third transect of the IC

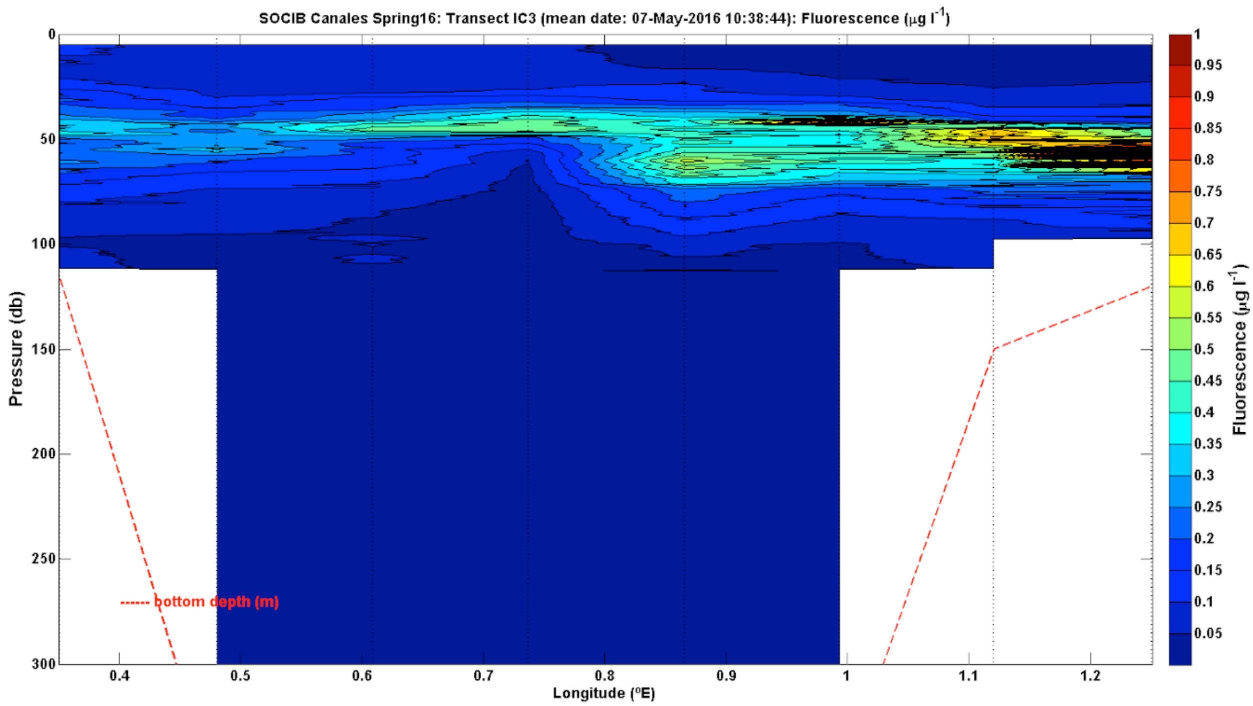


Fig. 8b: Initial figure for fluorescence distribution obtained during the third transect of the IC

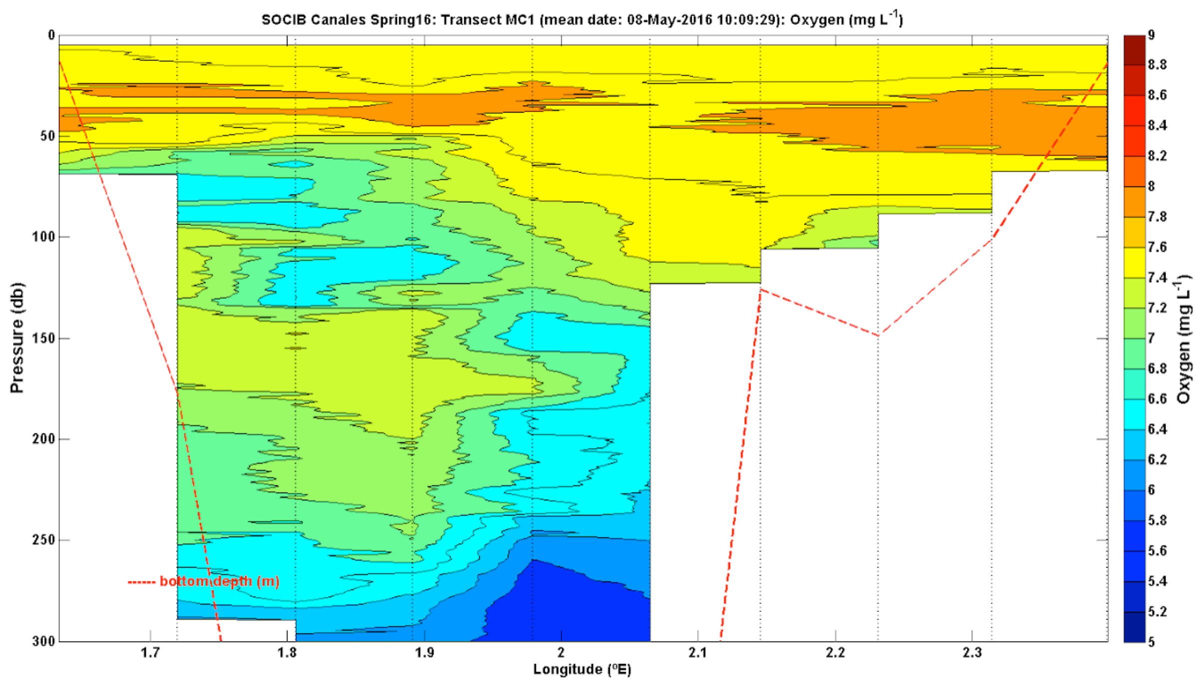


Fig. 9a: Initial figure for dissolved oxygen concentration distribution obtained on the MC transect

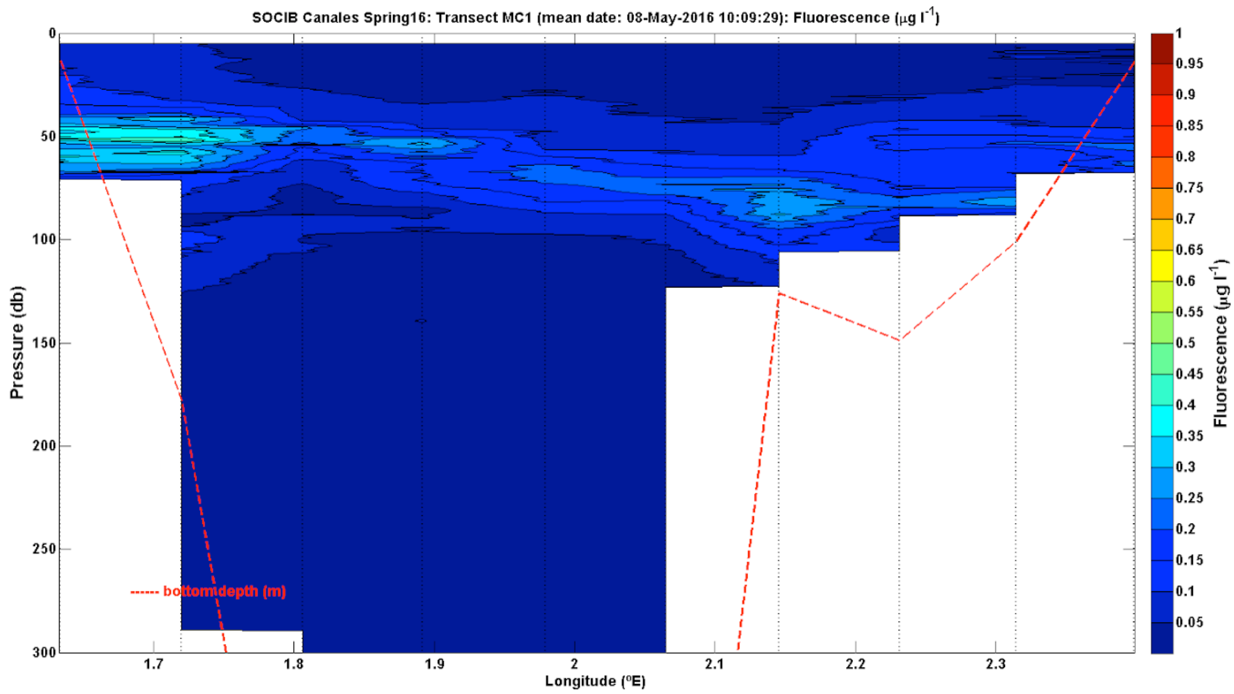


Fig. 9b: Initial figure for fluorescence distribution obtained on the MC transect

Problems encountered

The Turbidity sensor seems to generate bad profiles; looks like a recurrent problem.

There was a mismatch between the down and up cast on the oxygen sensor at a few stations (see logbook). There was also a spike on the dissolved oxygen values on the IC -transect 1 (station S2_05, values ≥ 9 mg l^{-1}). The *in situ* water sample results (Winkler) will help to clarify this.

Seadatanet Cruise Summary Report Link

The SDN-ICES Cruise Summary Report that references to this cruise is available through the following link:

http://seadata.bsh.de/Cgi-csr/retrieve_sdn2/csrreport.pl?project=SDN&session=26406&v1=10&v2=17&pcode=

Processed Data Repository

Data Source	Thredds URL
Position	http://thredds.socib.es/thredds/catalog/research_vessel/gps/socib_rv-scb_pos001/L1/2016/05/catalog.html?dataset=research_vessel/gps/socib_rv-scb_pos001/L1/2016/05/dep0030_socib-rv_scb-pos001_L1_2016-05-05.nc
Thermosal	http://thredds.socib.es/thredds/catalog/research_vessel/thermosalinometer/socib_rv-scb_tsl001/L1/2016/05/catalog.html?dataset=research_vessel/thermosalinometer/socib_rv-scb_tsl001/L1/2016/05/dep0028_socib-rv_scb-tsl001_L1_2016-05-05.nc
Weather Station	http://thredds.socib.es/thredds/catalog/research_vessel/weather_station/socib_rv-scb_met009/L1/2016/05/catalog.html?dataset=research_vessel/weather_station/socib_rv-scb_met009/L1/2016/05/dep0030_socib-rv_scb-met009_L1_2016-05-05.nc
CTD	http://thredds.socib.es/thredds/catalog/research_vessel/ctd/socib_rv-scb_sbe9002/L1/2016/catalog.html?dataset=research_vessel/ctd/socib_rv-scb_sbe9002/L1/2016/dep0030_socib-rv_scb-sbe9002_L1_2016-05-05.nc

VM-ADCP	http://thredds.socib.es/thredds/catalog/research_vessel/current_profiler/socib_rv-scb_rdi001/L1/2016/catalog.html?dataset=research_vessel/current_profiler/socib_rv-scb_rdi001/L1/2016/dep0003_socib-rv_scb-rdi001_L1_2016-05.nc

References

Joyce T.M. (1989). On in situ "calibration" of shipboard ADCPs. Journal of Atmospheric and Oceanic Technology 6:169–172.

Langdon C. (2010). Determination of dissolved oxygen in seawater by Winkler titration using the amperometric technique. In: Sloyan B.M., Sabine C. (Eds). GO–SHIP repeat hydrography manual: A Collection of Expert Reports and guidelines. IOC/IOCCP. Paris.

Pollard R., Read J. (1989). A method for calibrating shipmounted acoustic Doppler profilers and the limitations of gyro compasses. Journal of Atmospheric and Oceanic Technology 6:859–865.

Utermöhl H. (1958). Zur Vervollkomnung der quantitativen Phytoplankton-Methodik. Mitteilungen der internationale Vereinigung für theorische und angewandte Limnologie 9:1–38.

APPENDIX 1: Ship activity summary.

For a table of all ship activities logged during the Spring 2016 campaign, refer to the excel file, SHIP_LOG_OF_ACTIVITIES. The excel file contains various spreadsheets of ship log activities, in order of most recent campaign. The spreadsheet detailing the activity log of this specific cruise is labelled "**CANALES_Spring2016**".

APPENDIX 2: CTD configuration file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       <VoltageWordsSuppressed>0</VoltageWordsSuppressed>
       <ComputerInterface>0</ComputerInterface>
       <!-- 0 == SBE11plus Firmware Version >= 5.0 -->
       <!-- 1 == SBE11plus Firmware Version < 5.0 -->
       <!-- 2 == SBE 17plus SEARAM -->
       <!-- 3 == None -->
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                <!-- Coefficients for Sea-Bird equation - SBE calibration in 2007 and
later. -->
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Balearic Islands Coastal Observing and Forecasting System


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