CRUISE REPORT

SOCIB Canales AUTUMN 2020:

03rd to 8th November 2020

SOCIB_ENL_CANALES_November2020_Autumn

Document type:	Cruise report
Date:	2020/11/09

Description:	A repeat seasonal hydrographic survey of the Balearic Sea, monitoring the Ibiza and Mallorca Channels. 11 CTD stations were carried out over 2 days; the stations forming one transect across the Mallorca Channel (MC) and an intercalibration cast simultaneously with the Glider in the middle of the Ibiza Channel (IC). Furthermore to obtain a current status of the distribution of floating plastic debris, and to verify its correspondence with the forecasting models three different areas; the Mallorca Channel (MC), the east part of the Ibiza Channel (IC) and along the north-west coast of Ibiza had been performed with 15 sampling periods of 15 minutes. Additionally had been deployed in the Ibiza Channel two SVP-B surface drifters and one Argo-float. ICES-SeaDataNet Cruise Summary Report BSH-RefNo: **20203222**
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Keywords:	Mediterranean; ocean circulation; Balearic Sea; Ibiza Channel; Mallorca Channel; Northern Current;

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	09/11/2020	v1.0 of document	N.Wirth/A. Cabornero	

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Objectives

The present Canales cruises have the following objectives:

1. To make two complete SOCIB-Canales CTD sections across the Ibiza Channel (IC) and a RADMED CTD section across the Mallorca Channel (MC). The purpose of these sections are seasonal calibration points for the near continuous Glider monitoring of the IC. Measurements are made with the SeaBird SBE9 + instrument and the oceanographic Niskin bottle rosette for water samples at different depths.

2. To make continuous current profile sections of the IC and MC using the vessel mounted acoustic Doppler current profiler (VM-ADCP). These sections are for comparison with model forecasts and to support depth averaged velocity (DAV) calculations from glider data. B/O SOCIB is equipped with a RDI 150 kHz Ocean Surveyor VM-ADCP.

3. Perform a synchronized CTD cast with the current operating G2 glider in Ibiza channel as close as possible.

4. Recovery of Canales gliders as necessary.

5. A new objective from July 2020 is to conduct two transects across the Mallorca Channel (MC) and the Ibiza Channel (IC) to obtain a current status of the distribution of floating plastic debris, and to verify its correspondence with the forecasting models.

Onboard personnel

ID	Name	Role	Affiliation
1	Nikolaus Wirth	Chief Scientist and VM-ADCP (Remote support by J.Allen) / CTD / Drifter Deployment	SOCIB
2	Andrea Carbornero	Lead Biogeochemical sampling and analyses	SOCIB
3	Josep Baeza	CTD/Salinity Sampling/Plastics sampling	SOCIB
4	Luis Francisco Orejón	CTD/Plastics sampling/Biochem sampling	SOCIB

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Station plan and Timeline

11 CTD stations were carried out in the first 2 days; 1 transects in the MC and the station S2_05 in the middle of the IC. (Figure 1). 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 arrived at port.

During the second day, in the eastern part of the IC had carried out 4 Microplastic sampling stations. Furthermore, a synchronized CTD cast with the current operating G2 glider in Ibiza channel has been performed before 2 SVPb Drifters and an Argo-Float had been deployed.

Due to the weather conditions and sea state, the crew was forced to sail back to Sant Antoni and stay the next day in port.

The fourth day was splitted in the Glider Recovery and the Barnacle sampling in the morning, and Microplastic sampling in the evening. Along the north coast of Ibiza, concerning a line from more dense population on coast to less densely populated areas had been performed 3 sampling stations.

On the last day, it had taken the planned 8 Microplastic samples in the MC.

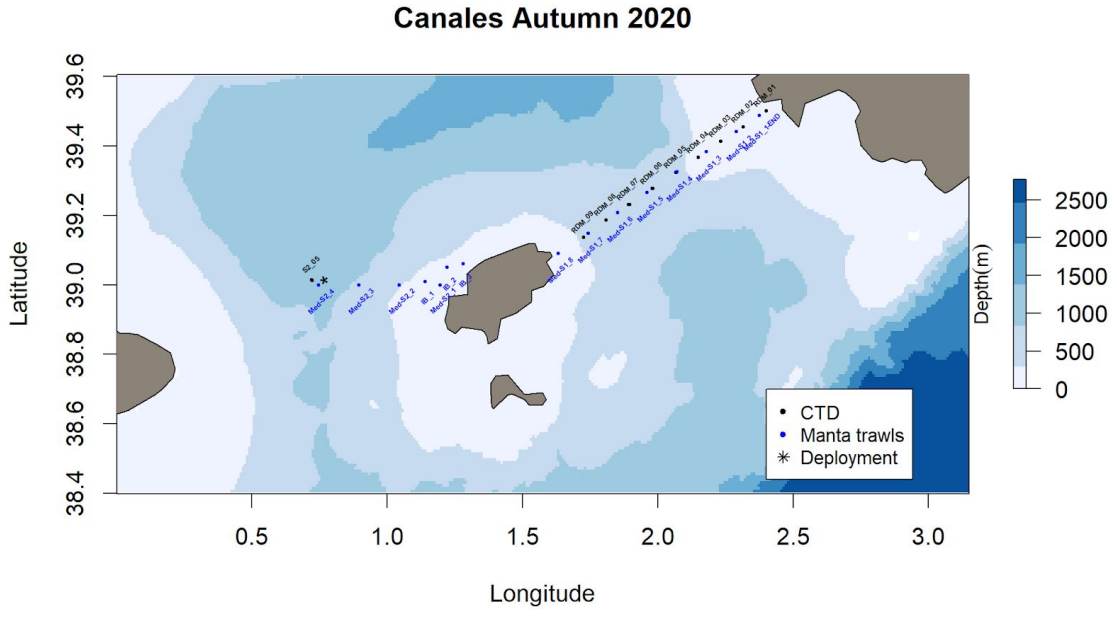


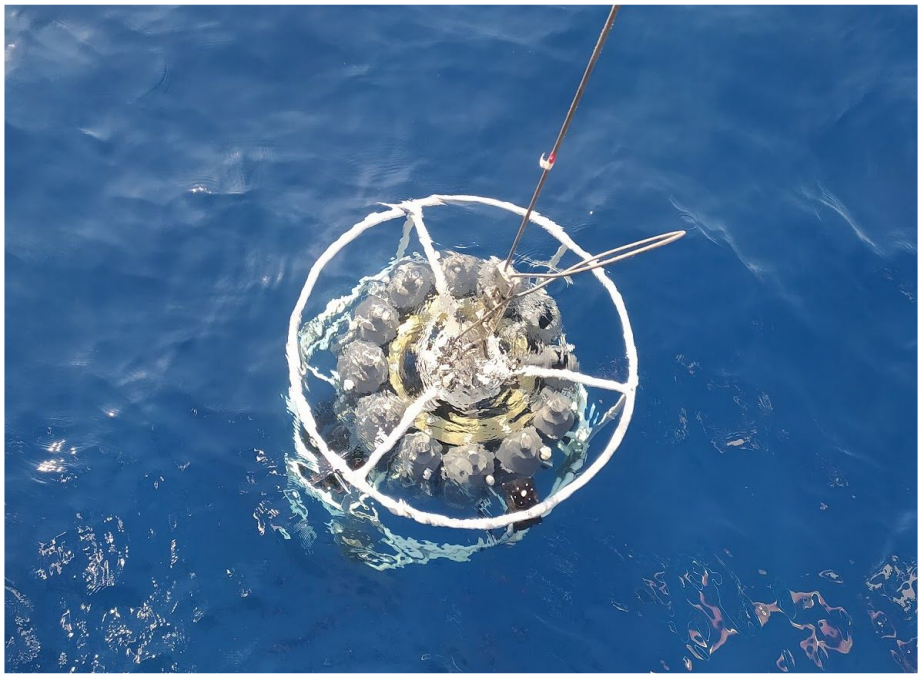
Fig. 1: Station plan

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

Cruise diary

Day 1 - 3rd November 2020

UTC	Lat	Long	Comments
6:40			Harbour of Palma, Crew on board. Begin of cruise Canales Summer 20
6:45	Harbour of Palma		leaving port (meeting regarding safety on board had been performed the day before)
6:48			ADCP ON
7:20			Termosal ON
7:25			Aviso a DataCenter,
			SEABOARD ON
7:50			calibration of BeamTransmission Sensor
			not sure if wind speed and direction are corrected in Seaboard (sailing with 12 knots, windspeed 16)
8:50	**Station RADMED_01**		CTD in the water
			water sampler software is not working , bottles will be fired manually direct from the deckunit
8:59			Start down cast Bottles are fired directly from deckunit
9:06			CTD on board, salinity and biochem sampling sailing to next station
9:32	**Station RADMED_02**		CTD in the water
9:43			CTD on board, salinity and biochem sampling sailing to next station
	Station RADMED_03		CTD in the water

10:17			CTD on board, salinity and biochem sampling sailing to next station
10:46	**Station RADMED_04**		CTD in the water The sensors of the new CTD SBE911+ seem to work fine. Difference in conductivity <0.003, dif in temp <0.0001, dif in oxigen <0.04
10:55			CTD on board, (ctd file closed 3 min later while ctd on deck) salinity and biochem sampling sailing to next station
			
11:22	**Station RADMED_05**		CTD in the water
11:34			Salinity sampling Termosal
			In the graph of the Termosal has been observed a spike during 10 sec of 36 psu …
			Internet connection established via satelite
11:46			CTD on board, sailing to next station
12:17	**Station RADMED_06**		CTD in the water

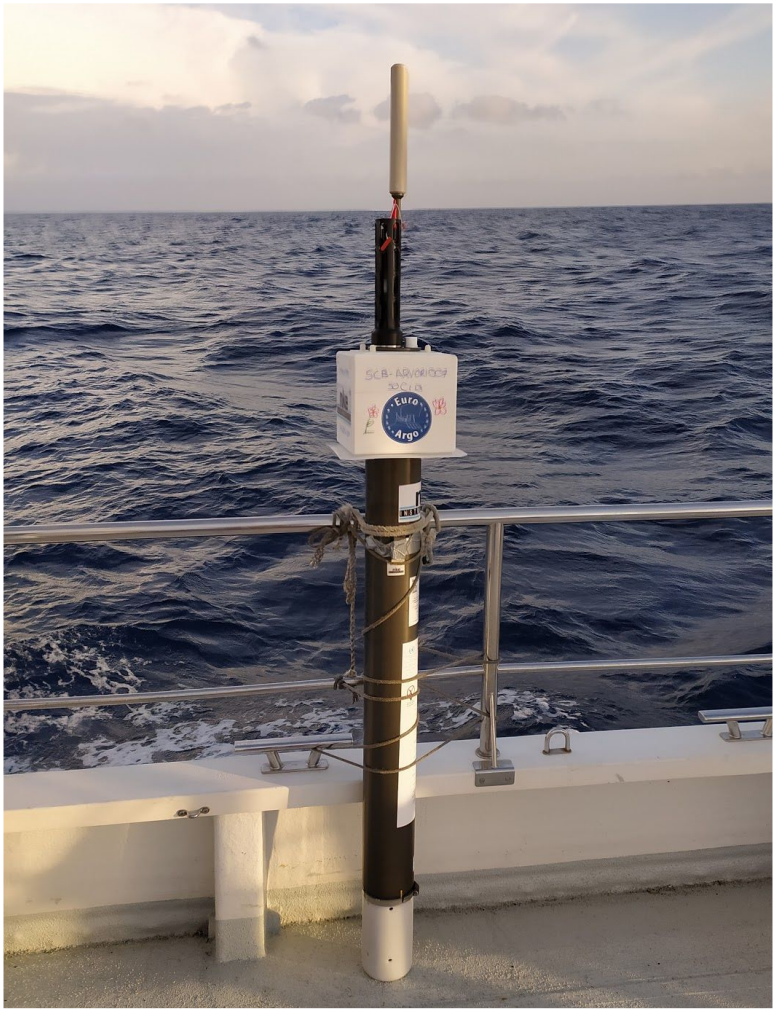
12:44			CTD on board, Bottle 10 hasn't closed salinity and biochem sampling sailing to next station
13:14	**Station RADMED_07**		CTD in the water
13:42			CTD on board, all bottles closed salinity and biochem sampling sailing to next station
14:11	**Station RADMED_08**		CTD in the water Salinity sampling Termosal In the graph of the Termosal has been observed a spike during 10 sec of 36 psu right after taking the sample!
			
14:34			CTD on board, all bottles closed salinity and biochem sampling sailing to next station Problem of remote control for watersampler fixed (problem with cable connection)
15:03	**Station RADMED 09**		CTD in the water
15:17			CTD on board, all bottles closed salinity and biochem sampling remote control for watersampler working fine sailing to next station

15:45	**Station RADMED 10**		CTD in the water
15:52			CTD on board, all bottles closed salinity and biochem sampling
			All CTD stations completed.
16:05			sailing to Sant Antoni (harbour)
16:40			SCB-SVP010 and SCB-SVPB011 turned on
17:32	39º00,602 N	1º16,480 E	Termosal OFF
17:42	38º58,859 N	1º17,285´E	ADCP OFF (remote control by J.Allen)
18:00			moored at Sant Antoni

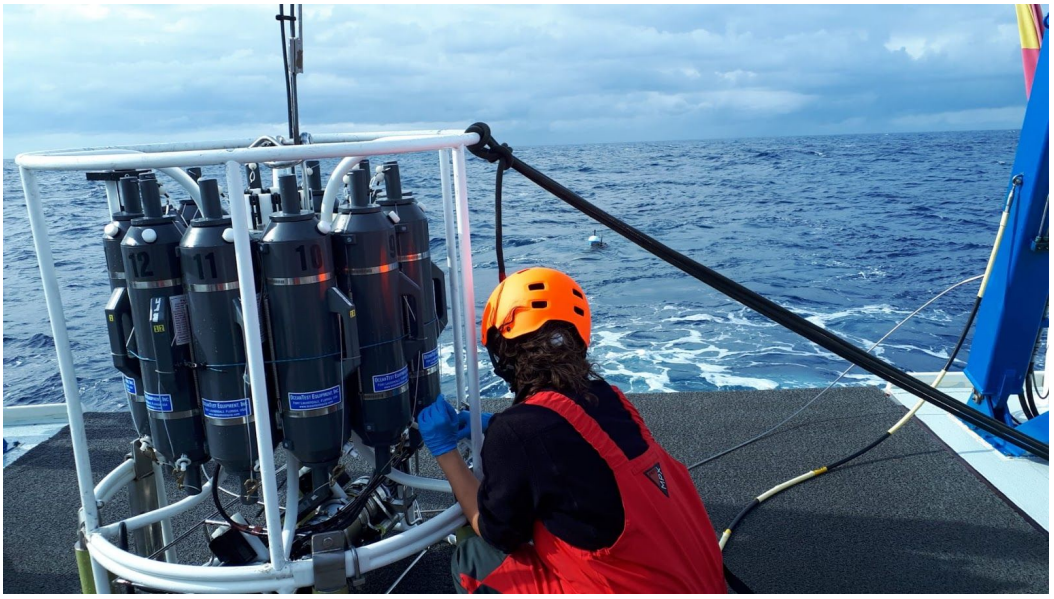
DAY 2 - 4th November 2020

UTC	Lat	Long	Comments
5:55			Leaving Sant Antoni
6:02			ADCP ON
6:25			Termosal ON
			Preparation Microplastic sampling
6:55	**Station MED-S2_01**		Start Microplasticsampling
7:15			Mantatrawl on board, sampling,
			sailing to next station
7:47	**Station MED-S2_02**		Start Microplasticsampling

8:02			Mantatrawl on board, sampling,
			sailing to next station
8:45	**Station MED-S2_03**		Start Microplasticsampling
8:51			Perfilador SCB-ARVORI007 ON
9:07			Mantatrawl on board, sampling,
9:09			confirmation Profiler is transmitting



			sailing to next station
9:59	**Station MED-S2_04**		Start Microplasticsampling
			Mantatrawl on board, sampling,
			sailing to station S2_05
			preparation CTD problems with NMEA message, restart sistem.
10:38	**Station S2_05**		CTD in the water
			due sea conditions its not possible to maintain the position,

			cast starts at 0,7 nautical miles NE of original point
10:54			Salinity Sampling Termosal
11:24			CTD on board
11:26	39º01.053'N	0º43.149'E	**Deployment SCB-AVORI007**
11:28	39º01.065'N	0º43.264'E	**Deployment SCB-SVPB010**
11:29	39º01.078'N	0º43.295'E	**Deployment SCB-SVPB011**
			
11:40			Due to the weather conditions and safety conditions, all works on deck. Furthermore to ensure the gliderrecovery on Friday we turn around and sail back to Sant Antoni port See Appendix 3
14:50			Termosal OFF
15:07			ADCP OFF
15:30			moored in port of Sant Antoni

DAY 3 - 5th November 2020

UTC	Lat	Long	Comments
6:30			meeting Captain and IP After evaluation of the sea conditions and review of the weather forecast it had been decided to stay in port for the day and do task of maintenance and reviews of the vessel.

The day in port has been used to do tasks of maintenance and revision of the vessel, it had been done a detailed inspection of the hull and reviewed of possible damages:
- in the area where the Mantatrawl are lowered has been observed damages in the painting! Protection for further work is highly recommended.
- additional camera for the bridge focusing on the bow starbordside for mooring.
- changing VHF-radios - 5 new ones

The science team has analysed the data of the CTD.
- configured the Seabird Software according to the new CTD -SBE9003 to preprocess CTD data.
- revision of data ports opened in the internal network.
- revision and cleaning of the CTD
- cleaning up of the laboratory
- restructure of cables in the Rack (Laboratory)
- Preparation of further microplastic sampling"

DAY 4 - 6th November 2020

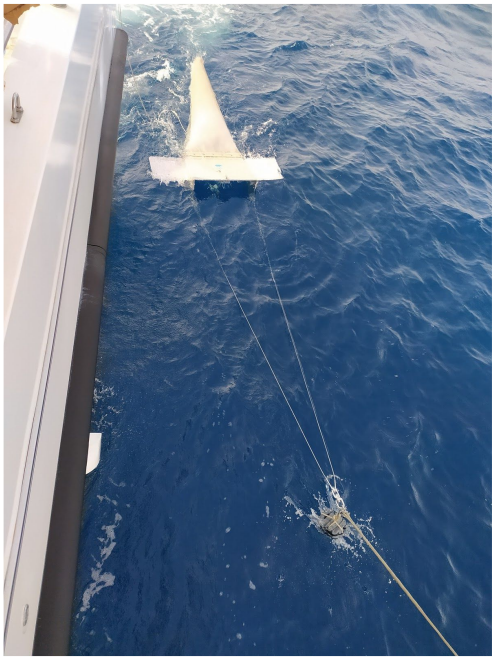
UTC	Lat	Long	Comments
5:50			Leaving port Sant Antoni
6:55			ADCP ON
7:10			Termosal ON
			way to estimated Glider waypoint
7:50			Gilder on surface, 3 miles
8:10			visual con Glider
			
8:20	N 39º02.216	E 1º 12,307	start Gliderrecovery
8:45			Glider on board
			

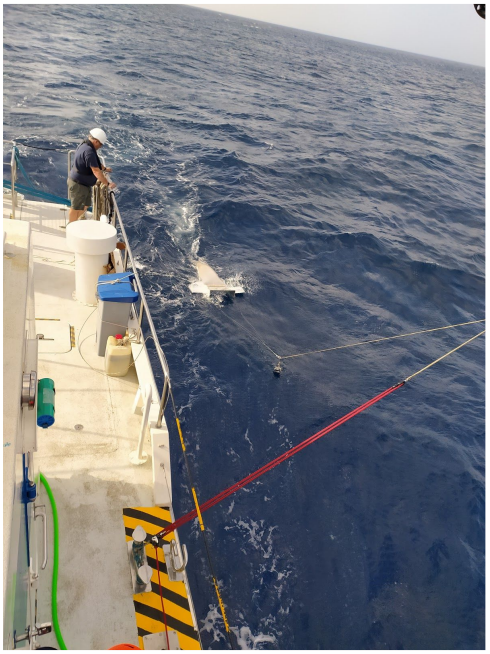
8:47			Barnacle sampling

8:57			Glider off
9:10	N 39º01,357	E 1º 14,125	Preparing Microplasticsampling
9:26	North Coast Ibiza 1		Start Microplasticsampling

9:43			Mantatrawl on board,sampling,

			saling to next station
10:05	N39º05,098	E1º22,077	Preparing Microplasticsampling
10:27	North Coast Ibiza 2		Start Microplasticsampling
10:43			Mantatrawl on board, sampling,
			saling to next station
10:58	N39º06,742	E1º28,339	Preparing Microplasticsampling
11:11	North Coast Ibiza 3		Start Microplasticsampling





11:29			Mantatrawl on board, sampling,
			Finish Microplasticsampling
11:40			sailing to Palma
12:05			Waypoint Cabo Moscarter
12:30	3 nm N of Cmoscarter		Turn 180º
			saling to Sant Antoni port
15:00			Termosal OFF

15:20			ADCP OFF
15:30			moored in port of Sant Antoni

General observations:
At the cruise briefing in morning, concerning the present sea conditions it had been taken the decision to change the Mircoplastic sampling in the Mallorca-Channel to a sampling line close to the north coast of Ibiza.

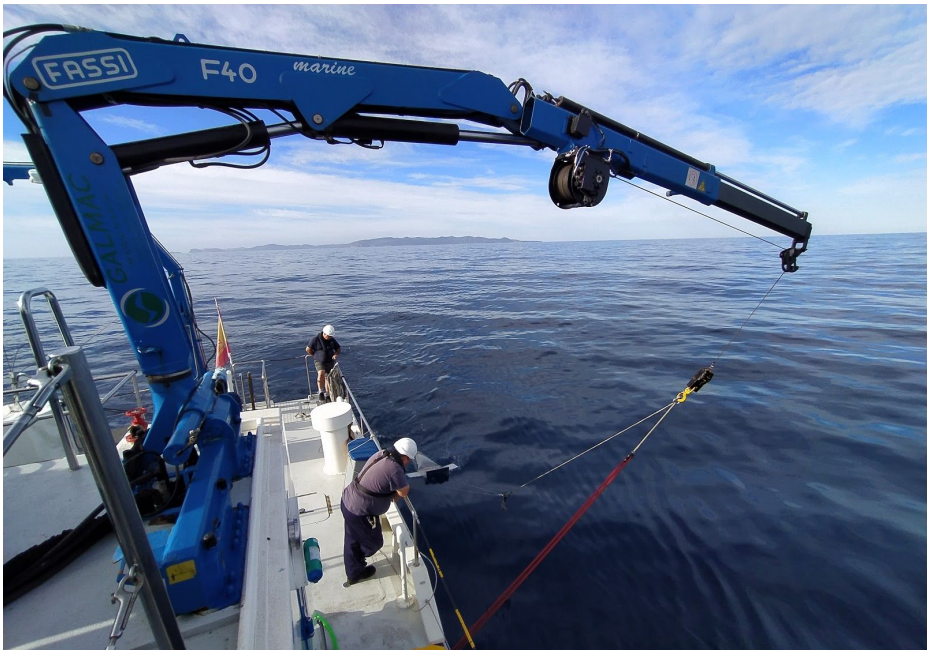
DAY 5 - 7th November 2020

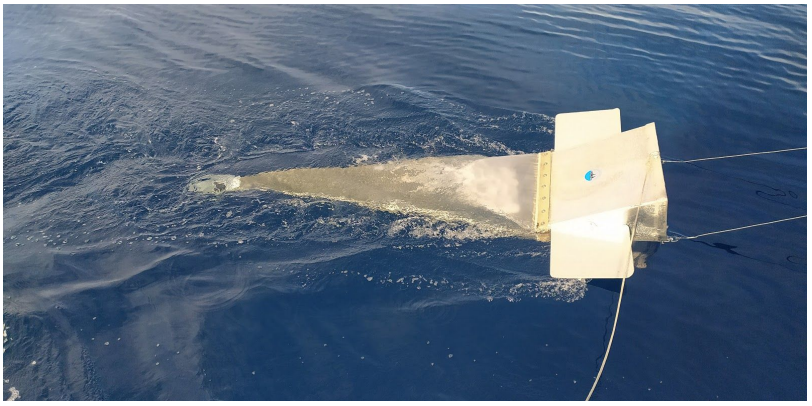
Due to the weather conditions and the forecast of the next 2 days, the decision was made to stay in port and sail back to Palma on Sunday doing the planned Microplastic sample stations.

The day in port had been spent cleaning up the laboratory, processing the data, outreach, actualization of logbooks, data visualization and preparing the cruise report.

DAY 6 - 8th November 2020

UTC	Lat	Long	Comments
5:30			engines started
6:10			Leaving port Sant Antoni
6:15			Termosal ON
6:18			ADCP ON
7:30			Preparing Microplasticsampling
8:05	Station MED-S1_08		Start Microplasticsampling
8:20			Mantatrawl on board, sampling,

			saling to next station
8:47	Station MED-S1_07		Start Microplasticsampling
			
9:02			Mantatrawl on board, sampling,
			saling to next station
9:34	Station MED-S1_06		Start Microplasticsampling
9:50			Mantatrawl on board, sampling,
			saling to next station
10:20	Station MED-S1_05		Start Microplasticsampling
10:35			Mantatrawl on board, sampling,
			saling to next station
11:04	Station MED-S1_04		Start Microplasticsampling



11:19			Mantatrawl on board, sampling,
			saling to next station
11:50	Station MED-S1_03		Start Microplasticsampling
12:05			Mantatrawl on board, sampling,
			saling to next station
12:37	Station MED-S1_02		Start Microplasticsampling
12:51			Mantatrawl on board, sampling,
			saling to next station
			Preparing Microplasticsampling
13:13	Station MED-S1_01-END		Start Microplasticsampling
13:28			Mantatrawl on board
13:45			Finished Microplasticsampling

			sailing to port of Palma
14:25			Termosal OFF
14:35			ADCP OFF
14:40			coping data of CTD, ADCP and Termosal to harddrive
			cleaning up for downloading material tomorrow
16:00			moored in port

Cruise Canales Autumn 20 finished.

Scientific Reports

Physical data report

The following contains an overview of the physical data collected from the CTD.

CTD and water bottle sampling

Data acquisition: CTD casts were carried out at 11 stations encompassing 1 transects across the MC and 1 station in the IC. At each station, water samples were collected with the rosette at various depths and from the thermosalinograph for measuring *in situ* salinity, dissolved oxygen, total Chl *a* and Phytoplankton in order to apply corrections to the conductivity sensor. Refer to the available logbook generated during the cruise for more details on sampling depths, replicates and parameters sampled at each station.

Data preprocessing and visualization: The sensor data were processed using SBE (Sea-Bird Electronics) Data Processing Version V7 23.2 (for details refer to SBE Web site). The resulting data are then processed in ODV 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 (wetlabs) 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 study phytoplankton community composition.

The sampling was carried out on 2 days from the 3th to the 4th November 2020 and followed the established R/V SOCIB protocols.

Preliminary physical results

Hydrography: Theta-S diagram

Figure 2, shows the potential temperature – salinity distribution of all stations of the entire water column, where colour indicates the longitude of the corresponding station.

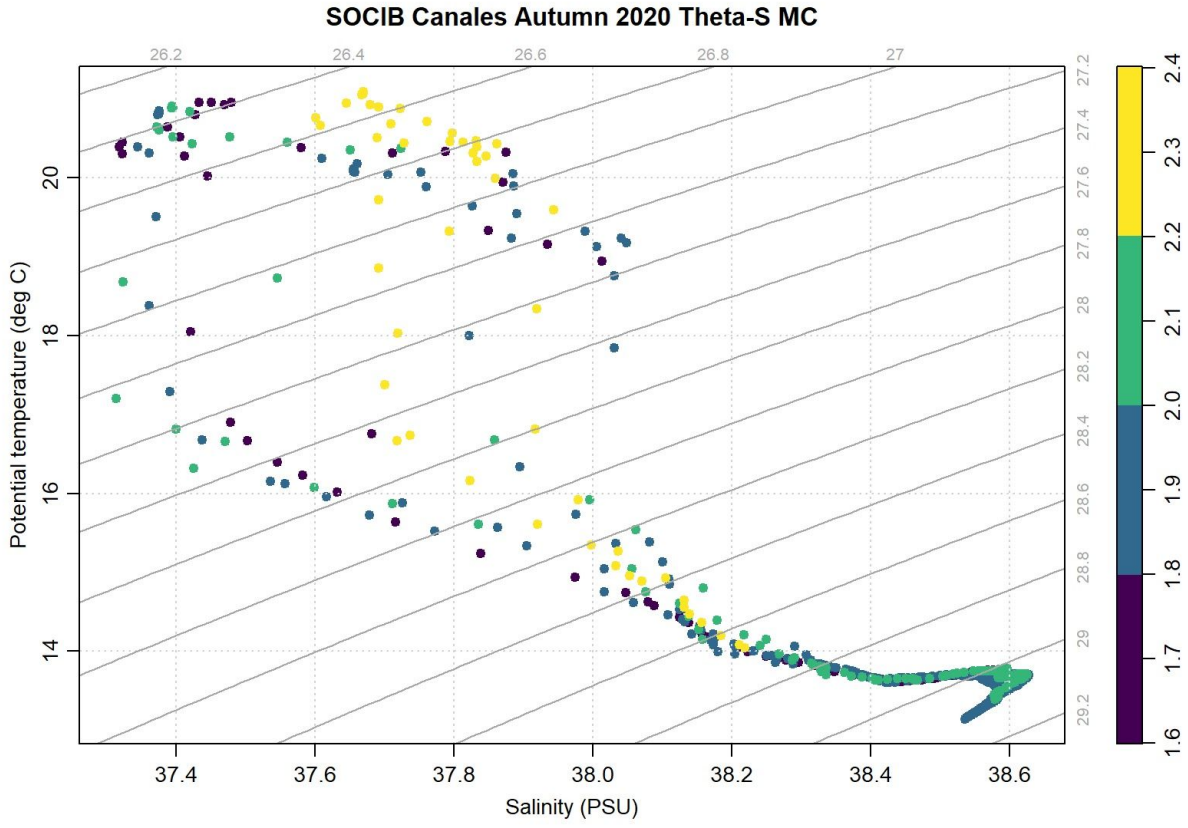


Fig 2a: T-S diagram of the stations sampled in the MC, the colour bar indicates the longitude of the station; thus the colour spectrum from yellow to blue corresponds to the MC transect, from East to West

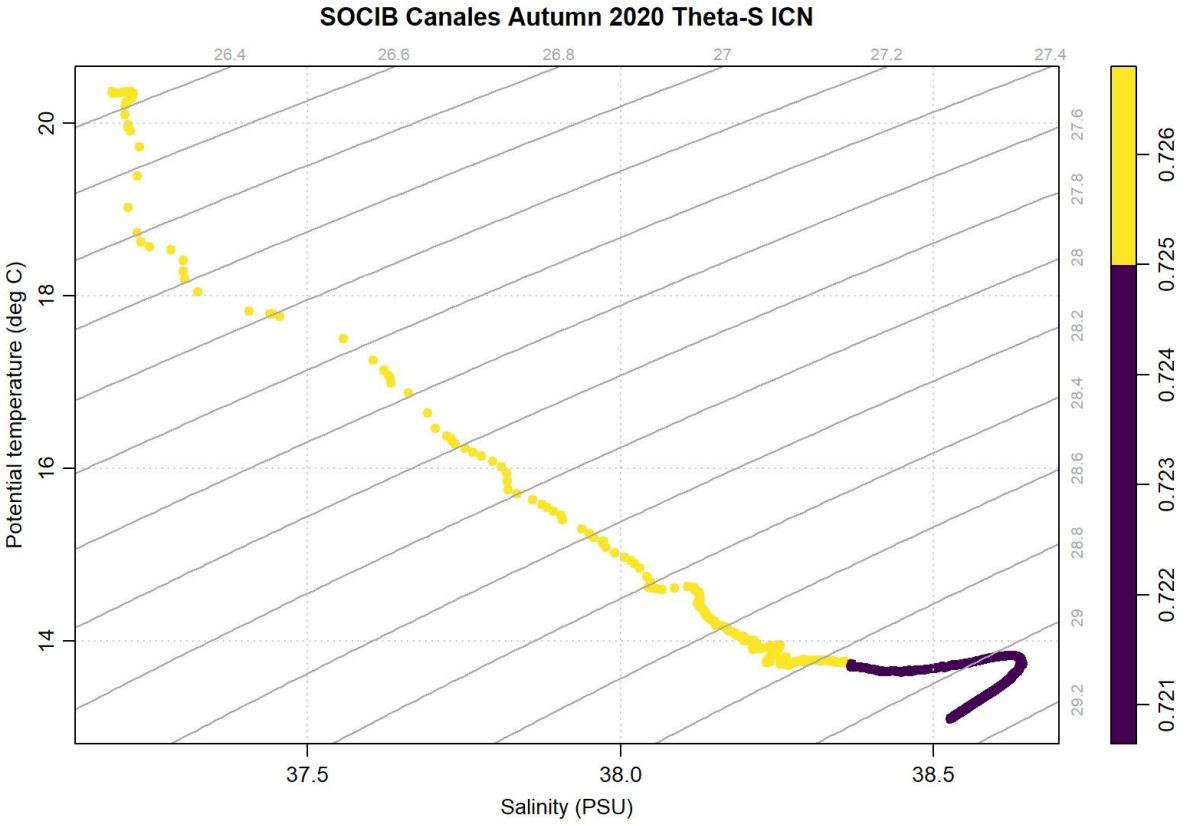


Fig 2b: T-S diagram of the station sampled in the ICN, the colour bar indicates the longitude of the station; thus the colour spectrum from yellow to blue corresponds to the MC transect, from East to West.

Mallorca Channel

The figures presented in this section are showing the transect of the MC.

Figure 3 shows the velocities u and v from the ADCP and their respective quality flags.

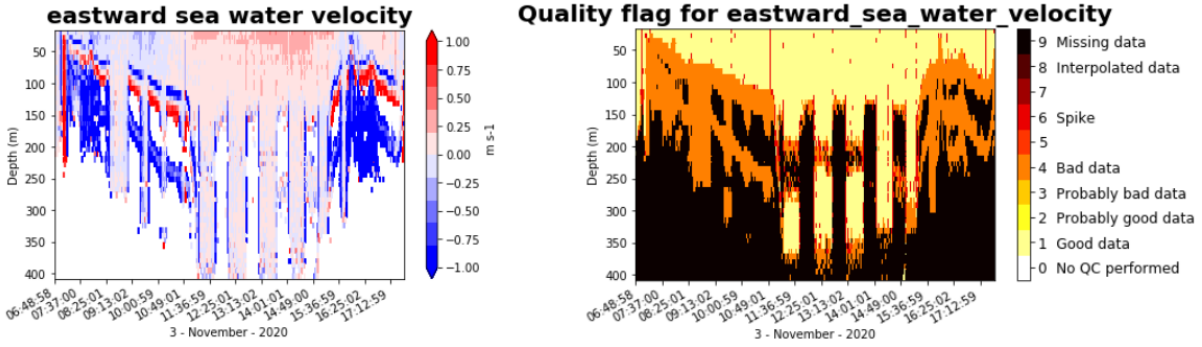


Fig 3a:East components of velocity (mm s^{-1}) and quality flag plotted over time in the northern section of the MC during day 1

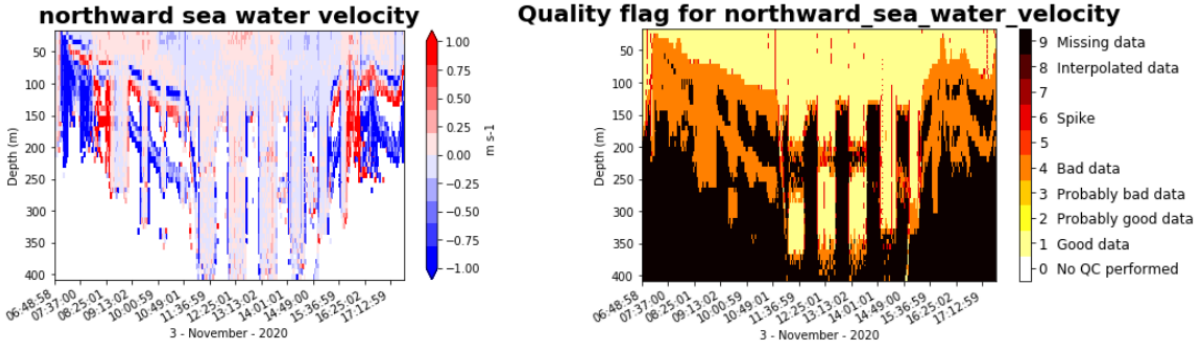


Fig. 3b. North components of velocity (mm s^{-1}) and quality flag plotted over time in the northern section of the MC during day 1

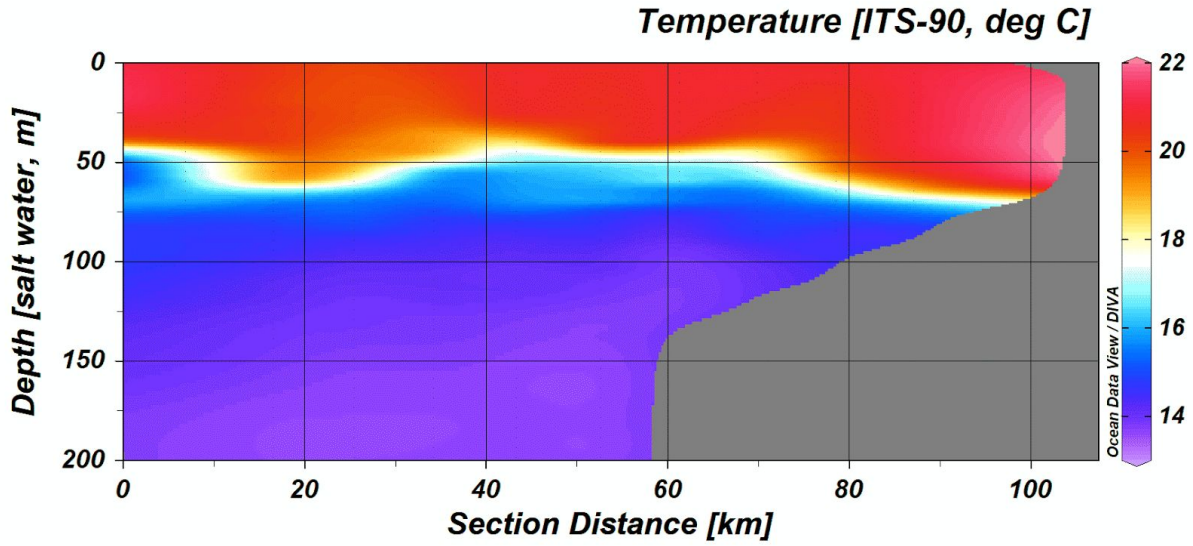


Fig. 4a: Temperature (ºC) of the MC cross-section (upper 200 m section).

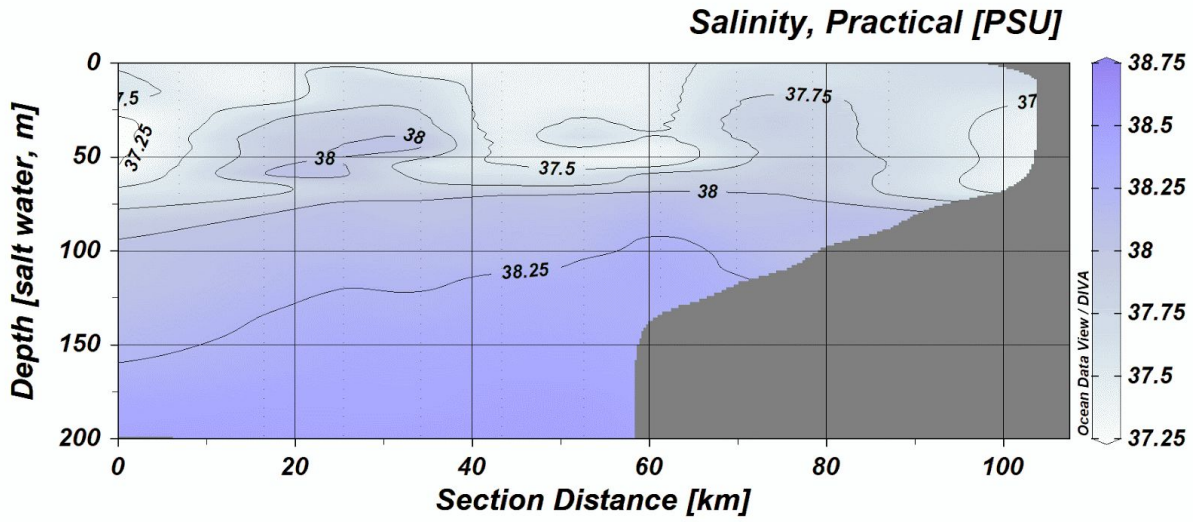


Fig. 4b: Salinity of the MC cross-section (upper 200 m section).

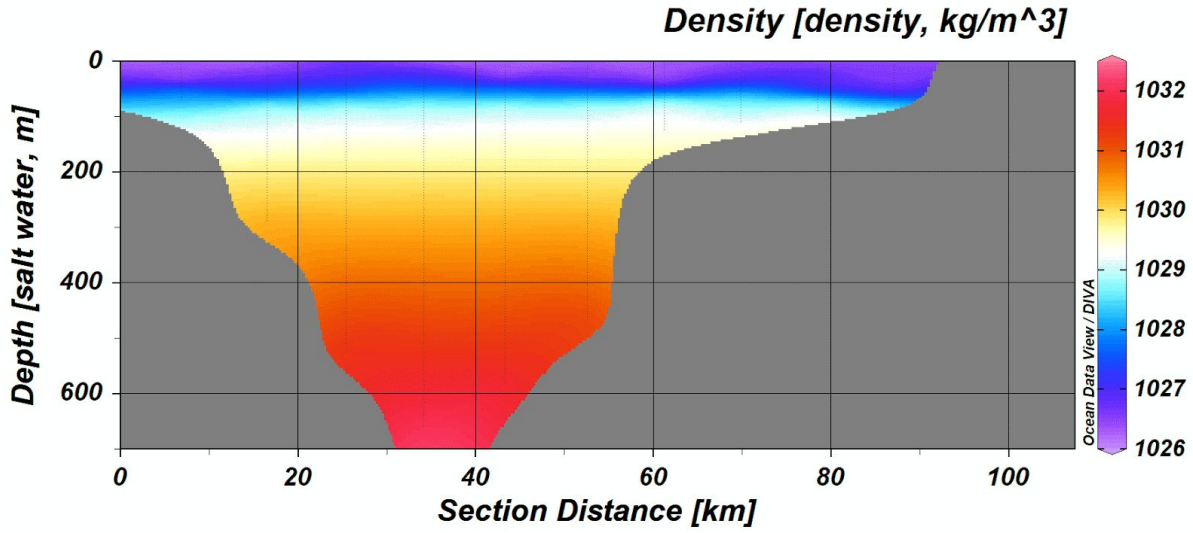


Fig. 4c: Density (kg m^{-3}) of the MC cross-section.

Ibiza Channel

The figures presented in this section are showing the first 5stations of the ICN transect. Figure 5 shows the velocities u and v from the ADCP and their respective quality flags.

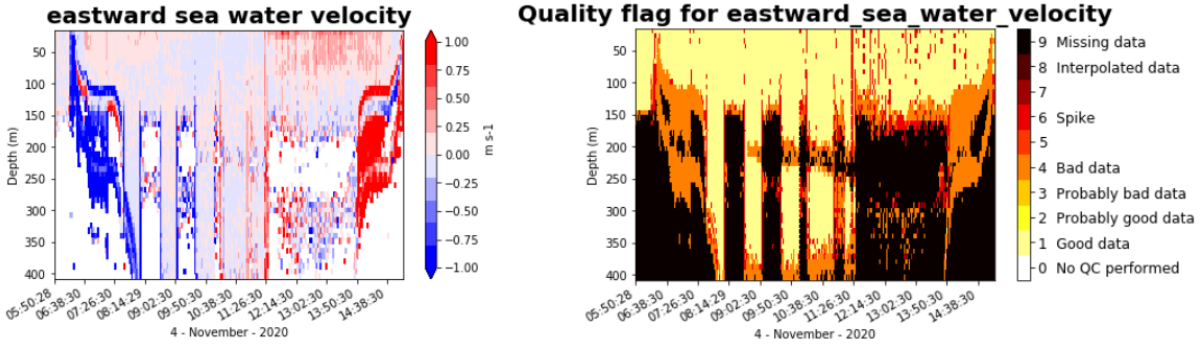


Fig. 5a. East components of velocity (mm s^{-1}) and quality flag plotted over time in the ICN section of the during day 2.

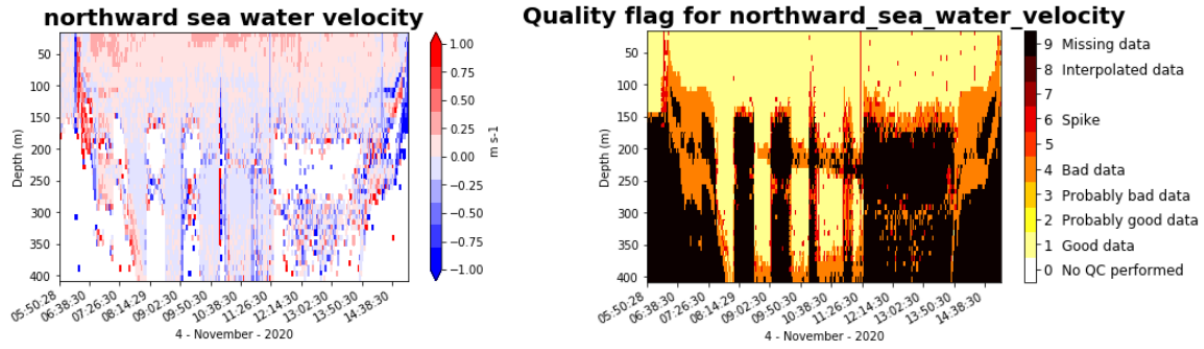


Fig. 5b. North components of velocity (mm s^{-1}) and quality flag plotted over time in the ICN section of the IC during day 2.

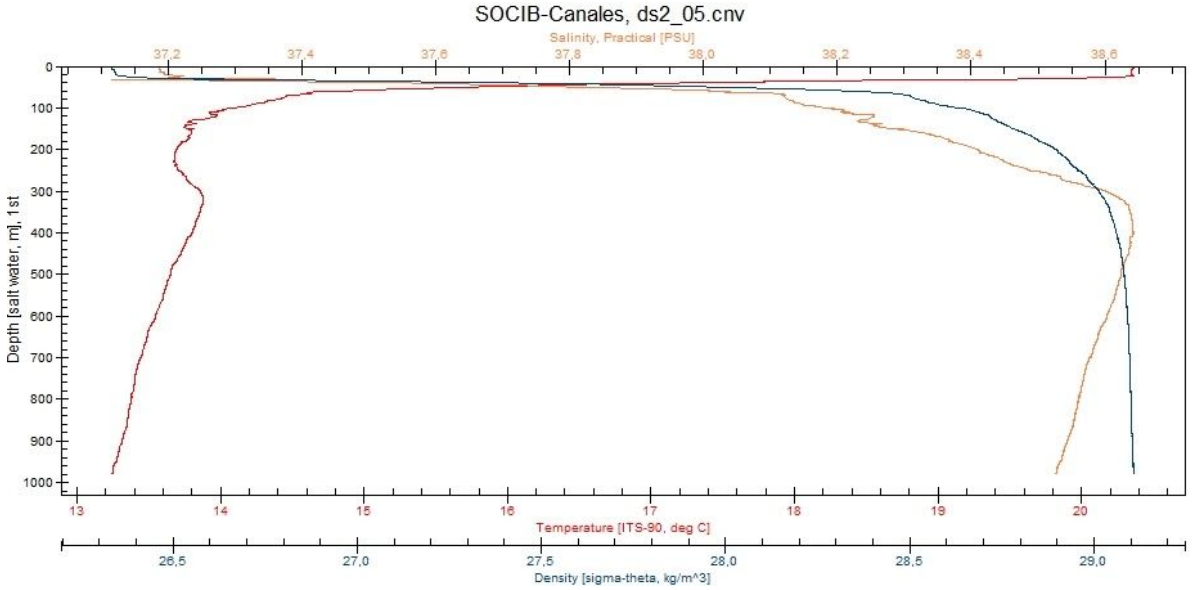


Fig. 6: Temperature (ºC), salinity (PSU) and density (kg m^{-3}) of the IC station (down cast)

Preliminary biogeochemical results

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

Mallorca Channel

Below we present some preliminary results obtained with the CTD sensors for dissolved oxygen (Fig. 7a) and *in vivo* fluorescence (Fig. 7b).

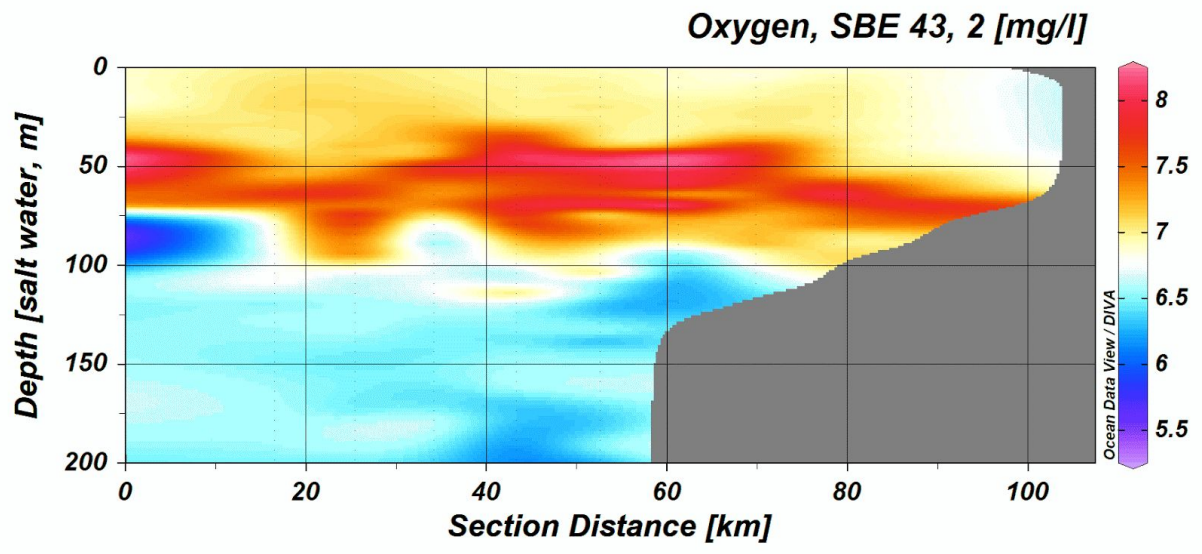


Fig. 7a: Initial figure for dissolved oxygen concentration distribution obtained on the Mallorca Channel cross-section (upper 200m).

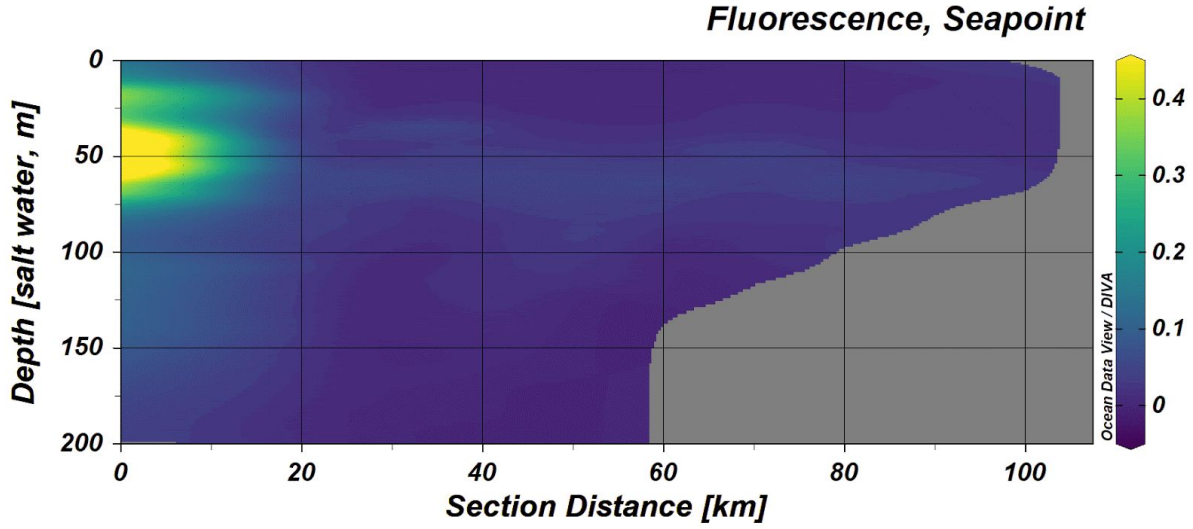


Fig. 7b: Initial figure for fluorescence distribution obtained on the the Mallorca Channel cross-section (upper 200m)

Ibiza Channel

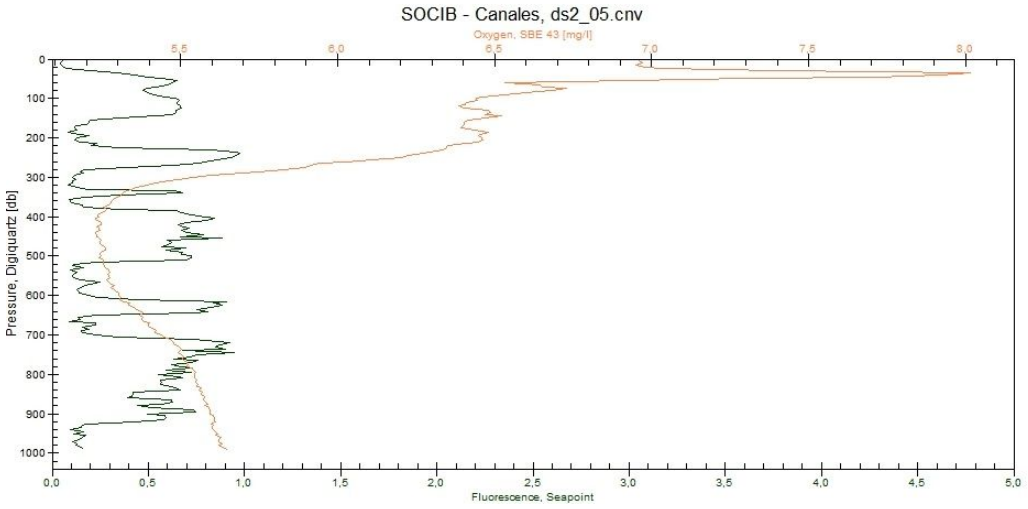


Fig. 8: Initial figure for dissolved oxygen (2 sensors) and fluorescence distribution obtained on the the Ibiza Channel station (down cast)

Preliminary results from the Lagrangian platforms

During the Canales Autumn 2020, 2 SVP-B (surface drifters SVP with a barometer sensor) have been launched (04/11/2020) as part of the Global Drifter Program (NOAA, USA).

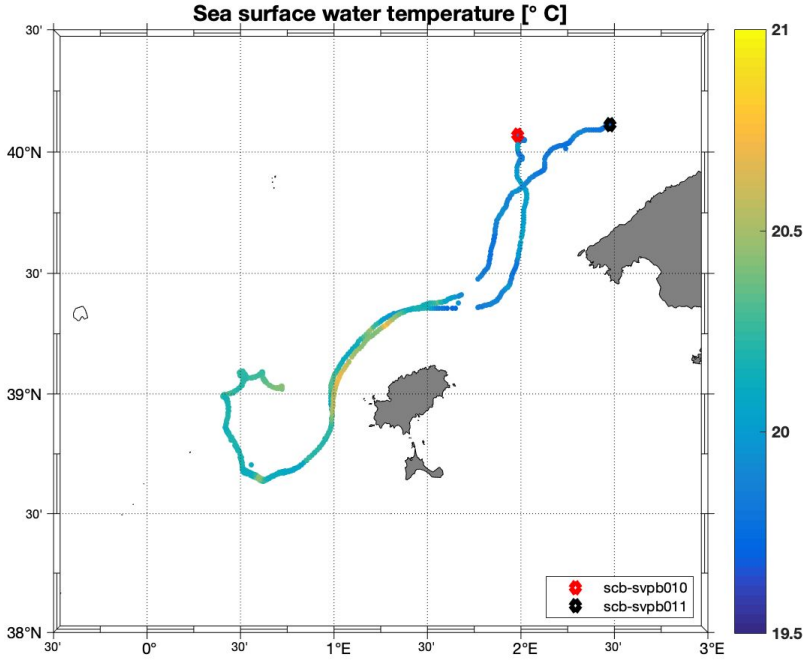


Fig. 9: Sea surface water temperature measured by the SVP-B's (with barometer sensor). Period represented: 04/11/2020-18/11/2020

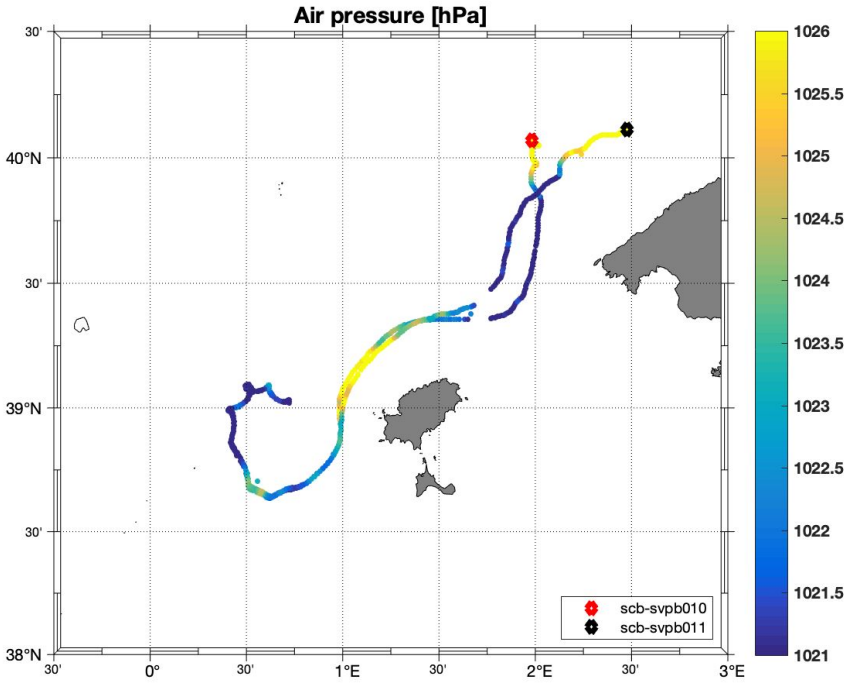


Fig. 10: Air pressure measured by SVP-B's (with barometer sensor). Period represented: 04/11/2020-18/11/2020

One ARVOR-I have been launched in the Ibiza Channel

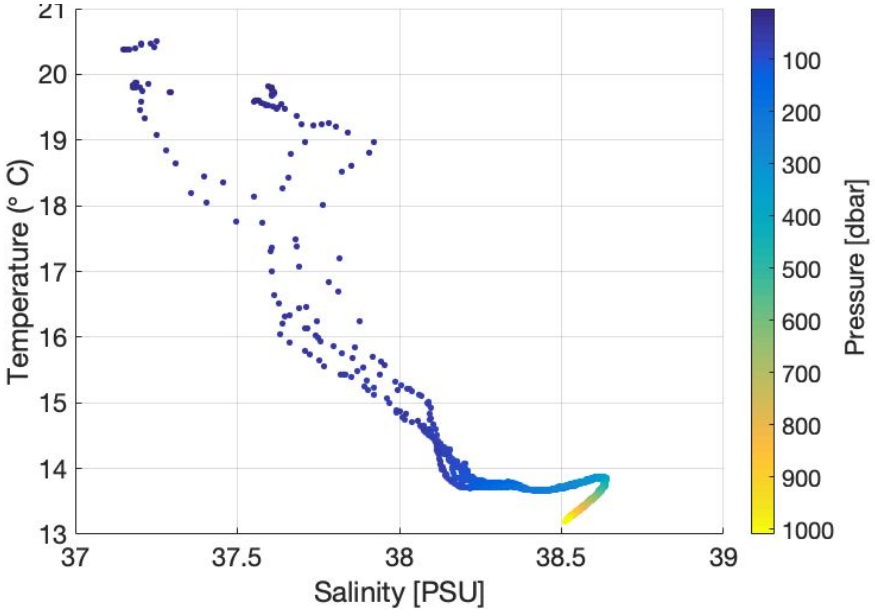


Fig. 11: TS diagram for the ARVORI 007, period represented 04/11/2020-18/11/2020.

Seadatanet Cruise Summary Report Link

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

CSR Source	URL
BSH Ref-No.: **20203222**	http://seadata.bsh.de/Cgi-csr/retrieve_sdn2/csrreport.pl?project=SDN&session=70168&v1=10&v2=1&pcode=

Processed Data Repository

Data Source	Thredds URL
Position	http://thredds.socib.es/thredds/catalog/research_vessel/gps/socib_rv-scb_pos001/L1/2020/11/catalog.html?dataset=research_vessel/gps/socib_rv-scb_pos001/L1/2020/11/dep0067_socib-rv_scb-pos001_L1_2020-11-03.nc
Thermosal	http://thredds.socib.es/thredds/catalog/research_vessel/thermosalinometer/socib_rv-scb_tsl001/L1/2020/11/catalog.html?dataset=research_vessel/thermosalinometer/socib_rv-scb_tsl001/L1/2020/11/dep0063_socib-rv_scb-tsl001_L1_2020-11-03.nc
Weather Station	http://thredds.socib.es/thredds/catalog/research_vessel/weather_station/socib_rv-scb_met009/L1/2020/11/catalog.html?dataset=research_vessel/weather_station/socib_rv-scb_met009/L1/2020/11/dep0064_socib-rv_scb-met009_L1_2020-11-03.nc
CTD	http://thredds.socib.es/thredds/catalog/research_vessel/ctd/socib_rv-scb_sbe9003/L1/2020/catalog.html?dataset=research_vessel/ctd/socib_rv-scb_sbe9003/L1/2020/dep0001_socib-rv_scb-sbe9003_L1_2020-11-03_data_dt.nc
VM-ADCP	http://thredds.socib.es/thredds/catalog/research_vessel/current_profiler/socib_rv-scb_rdi001/L1/2020/catalog.html?dataset=research_vessel/current_profiler/socib_rv-scb_rdi001/L1/2020/dep0032_socib-rv_scb-rdi001_L1_2020-11_data_dt.nc
SCB-SVPB010	https://thredds.socib.es/thredds/catalog/drifter/surface_drifter/drifter_svpb010-scb_svpb010/L1/2020/catalog.html?dataset=drifter/surface_drifter/drifter_svpb010-scb_svpb010/L1/2020/dep0001_drifter-svpb010_scb-svpb010_L1_2020-11-04.nc
SCB-SVPB011	https://thredds.socib.es/thredds/catalog/drifter/surface_drifter/drifter_svpb011-scb_svpb011/L1/2020/catalog.html?dataset=drifter/surface_drifter/drifter_svpb011-scb_svpb011/L1/2020/dep0001_drifter-svpb011_scb-svpb011_L1_2020-11-04.nc
	https://thredds.socib.es/thredds/catalog/drifter/profiler_drifter/profiler_dri

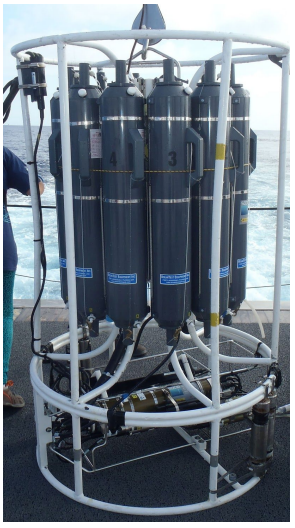
SCB-ARVORI007	fter_arvori007-scb_arvori007/L1/2020/catalog.html?dataset=drifter/profiler_drifter/profiler_drifter_arvori007-scb_arvori007/L1/2020/dep0001_profiler-drifter-arvori007_scb-arvori007_L1_2020-11-04.nc

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:	1414
SOCIB Inventory:	SCB-SBE9003
Deck Unit:	SBE11+
SOCIB Inventory:	SCB-SBE11002



Sensor	Manufacturer - Model	S/N	Inventory ID	Calibration date
Temperature	SeaBird - SBE 3P	03-6451	WTEM-SCB-SBE9003	28/01/2020
Temperature 2	SeaBird - SBE 3P	03-6465	WTEM-SCB-SBE9003.2	28/01/2020

Conductivity	SeaBird - SBE4C	04-4933	COND-SCB-SBE9003	28/01/2020
Conductivity 2	SeaBird - SBE4C	04-4935	COND-SCB-SBE9003.2	28/01/2020
Pressure	-	1414	-	07/02/2020
Oxygen	SeaBird - SBE 43	43-3917	OXI-SCB-SBE9003	17/01/2020
Oxygen	SeaBird - SBE 43	43-3918	OXI-SCB-SBE9003.2	17/01/2020
Transmissometer	WET Labs C-Star	CST-2010DR	TRANS-SCB-SBE9003	10/02/2020 25/10/2019
Turbidity	STM Sea Point	3432	TURB-SCB-SBE9003	16/01/2020
Fluorometer	Seapoint 6000m	3920	FLUO-SCB-SBE9003	16/01/2020
Irradiance	PAR Biospherical QCP-2350	70754	PAR-SCB-SBE9003	04/11/2019
Surface Irradiance	SPAR Superficie Biospherical QSR2200	20519	SPAR-SBE9001	11/04/2016
Altimeter	Datasonics PSA-916D	7692	ALTIM-SCB-SBE9003	13/01/2020

Configuration

For controlling the CTD the following file was used: 2020-10-29_1414_SOCIB.xmlcom. The information contained in that file is located in CTD Configuration File

Acoustic doppler profiler

Manufacturer:	RDI
Model:	Ocean Surveyor 150 kHz
S/N:	1878
SOCIB Inventory:	SCB-RDi001

Configuration

The VM-ADCP initialisation files were copied from Canales February 2020, for both bottom track and water track modes. These had a misalignment angle, φ of 44.1 degrees and an amplitude correction factor, A, of 1.0045.

A VM-ADCP calibration check was made in bottom track mode on the first day's transect from Palma to San Antonio. These gave

mis-alignment angle, φ = -0.1247 ± 0.3641 and

amplitude factor A = 0.9995 ± 0.0039.

These clearly indicated that the calibration was still very good, and therefore remained unchanged.

Thermo-salinometer

Manufacturer:	SeaBird
Model:	SBE21
S/N:	3370
SOCIB Inventory:	SCB-TSL001
Calibration date:	2018/07/03

Configuration

The data were collected using the NEREIDAS system and acquisition backup was performed using seasave software. The data were stored directly in the vessel server and processed through the SOCIB-DC system.

Weather Station

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

Configuration

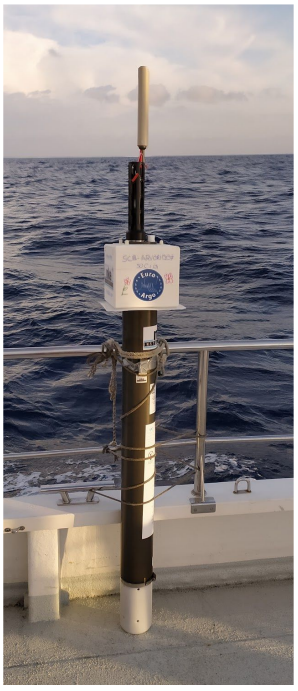
The data were collected using the NEREIDAS System. The data were stored directly in the vessel server and processed through the SOCIB-DC system.

SVP-B Surface Drifters

Manufacturer:	Data Buoy Instrumentation, LLC (DBi)
Model:	SVP-B
IMEI / WMO:	300234067549120/6202694 300234067549320/6202695
SOCIB Inventory:	SCB-SVPB010 SCB-SVPB011
Calibration date:	Testing SCB-SVPB010 Testing SCB-SVPB011

Argo Profiler / NKE

Manufacturer:	NKE
Model:	NKE
IMEI / WMO:	300234068701180 / 6901281
SOCIB Inventory:	SCB-ARVORI007
Argo profiler S/N:	AI2600-19EU023
Calibration date:	Testing SCB-ARVORI007



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.

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

APPENDIX 1: Activities through Canales Autumn2020

For a table of all ship activities logged during the campaign, refer to the excel file, SHIP_LOGBOOK.

APPENDIX 2: CTD configuration files in Canales Autumn2020

2020-10-29 SCB-SBE9003 (_1414).XMLCON

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<SBE_InstrumentConfiguration SB_ConfigCTD_FileVersion="7.26.4.0" >
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    <FrequencyChannelsSuppressed>0</FrequencyChannelsSuppressed>
    <VoltageWordsSuppressed>0</VoltageWordsSuppressed>
    <ComputerInterface>0</ComputerInterface>
    <!-- 0 == SBE11plus Firmware Version >= 5.0 -->
    <!-- 1 == SBE11plus Firmware Version < 5.0 -->
```

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    <!-- 2 == SBE 17plus SEARAM -->
    <!-- 3 == None -->
    <DeckUnitVersion>0</DeckUnitVersion>
    <ScansToAverage>1</ScansToAverage>
    <SurfaceParVoltageAdded>1</SurfaceParVoltageAdded>
    <ScanTimeAdded>0</ScanTimeAdded>
    <NmeaPositionDataAdded>1</NmeaPositionDataAdded>
    <NmeaDepthDataAdded>0</NmeaDepthDataAdded>
    <NmeaTimeAdded>1</NmeaTimeAdded>
    <NmeaDeviceConnectedToPC>1</NmeaDeviceConnectedToPC>
    <SensorArray Size="15" >
      <Sensor index="0" SensorID="55" >
        <TemperatureSensor SensorID="55" >
          <SerialNumber>6451</SerialNumber>
          <CalibrationDate>28-Jan-20</CalibrationDate>
          <UseG_J>1</UseG_J>
          <A>0.00000000e+000</A>
          <B>0.00000000e+000</B>
          <C>0.00000000e+000</C>
          <D>0.00000000e+000</D>
          <F0_Old>0.000</F0_Old>
          <G>4.37851279e-003</G>
          <H>6.40804481e-004</H>
          <I>2.29979583e-005</I>
          <J>2.16160286e-006</J>
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          <Slope>1.00000000</Slope>
          <Offset>0.0000</Offset>
        </TemperatureSensor>
      </Sensor>
      <Sensor index="1" SensorID="3" >
        <ConductivitySensor SensorID="3" >
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          <CalibrationDate>28-Jan-20</CalibrationDate>
          <UseG_J>1</UseG_J>
          <!-- Cell const and series R are applicable only for wide
range sensors. -->
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          <CellConst>2000.0000</CellConst>
          <ConductivityType>0</ConductivityType>
          <Coefficients equation="0" >
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            <C>0.00000000e+000</C>
            <D>0.00000000e+000</D>
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```
            <CPcor>-9.57000000e-008</CPcor>
          </Coefficients>
          <Coefficients equation="1" >
            <G>-1.00933881e+001</G>
            <H>1.45853995e+000</H>
            <I>-9.14173035e-004</I>
            <J>1.46287053e-004</J>
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          <Offset>0.00000</Offset>
        </ConductivitySensor>
      </Sensor>
      <Sensor index="2" SensorID="45" >
        <PressureSensor SensorID="45" >
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          <CalibrationDate>05-FEB-2020</CalibrationDate>
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          <C2>1.021526e+000</C2>
          <C3>1.640390e-002</C3>
          <D1>3.968600e-002</D1>
          <D2>0.000000e+000</D2>
          <T1>3.006224e+001</T1>
          <T2>7.580840e-005</T2>
          <T3>4.157030e-006</T3>
          <T4>1.442530e-009</T4>
          <Slope>1.00000000</Slope>
          <Offset>0.00000</Offset>
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          <AD590B>-9.177960e+000</AD590B>
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          <C>0.00000000e+000</C>
          <D>0.00000000e+000</D>
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          <J>2.11567301e-006</J>
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          <Offset>0.0000</Offset>
        </TemperatureSensor>
      </Sensor>
      <Sensor index="4" SensorID="3" >
        <ConductivitySensor SensorID="3" >
          <SerialNumber>4935</SerialNumber>
          <CalibrationDate>28-Jan-20</CalibrationDate>
          <UseG_J>1</UseG_J>
          <!-- Cell const and series R are applicable only for wide
range sensors. -->
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            <C>0.00000000e+000</C>
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            <CPcor>-9.57000000e-008</CPcor>
            <CTcor>3.2500e-006</CTcor>
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-->
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          <CalibrationDate>17-Jan-20</CalibrationDate>
          <Use2007Equation>1</Use2007Equation>
          <CalibrationCoefficients equation="0" >
            <!-- Coefficients for Owens-Millard equation. -->
            <Boc>0.0000</Boc>
            <Soc>0.0000e+000</Soc>
            <offset>0.0000</offset>
            <Pcor>0.00e+000</Pcor>
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            <Tau>0.0</Tau>
          </CalibrationCoefficients>
          <CalibrationCoefficients equation="1" >
            <!-- Coefficients for Sea-Bird equation - SBE calibration
in 2007 and later. -->
            <Soc>5.1266e-001</Soc>
            <offset>-0.4972</offset>
            <A>-4.2444e-003</A>
            <B> 1.7236e-004</B>
            <C>-2.6264e-006</C>
            <D0> 2.5826e+000</D0>
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            <H2> 5.0000e+003</H2>
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          </CalibrationCoefficients>
        </OxygenSensor>
      </Sensor>
      <Sensor index="6" SensorID="38" >
        <OxygenSensor SensorID="38" >
          <SerialNumber>3918</SerialNumber>
          <CalibrationDate>18-Jan-20</CalibrationDate>
          <Use2007Equation>1</Use2007Equation>
          <CalibrationCoefficients equation="0" >
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            <Pcor>0.00e+000</Pcor>
            <Tcor>0.0000</Tcor>
            <Tau>0.0</Tau>
          </CalibrationCoefficients>
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            <!-- Coefficients for Sea-Bird equation - SBE calibration
```

```
in 2007 and later. -->
            <Soc>4.1213e-001</Soc>
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            <A>-3.8925e-003</A>
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        </OxygenSensor>
      </Sensor>
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          <CalibrationDate>02/12/2020</CalibrationDate>
          <M>23.7510</M>
          <B>-0.0140</B>
          <PathLength>0.250</PathLength>
        </WET_LabsCStar>
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          <Free>1</Free>
        </NotInUse>
      </Sensor>
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        <OBS_SeapointTurbiditySensor SensorID="33" >
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          <CalibrationDate>16/01/2020</CalibrationDate>
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setting. -->
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setting. -->
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          <B>0.00000000</B>

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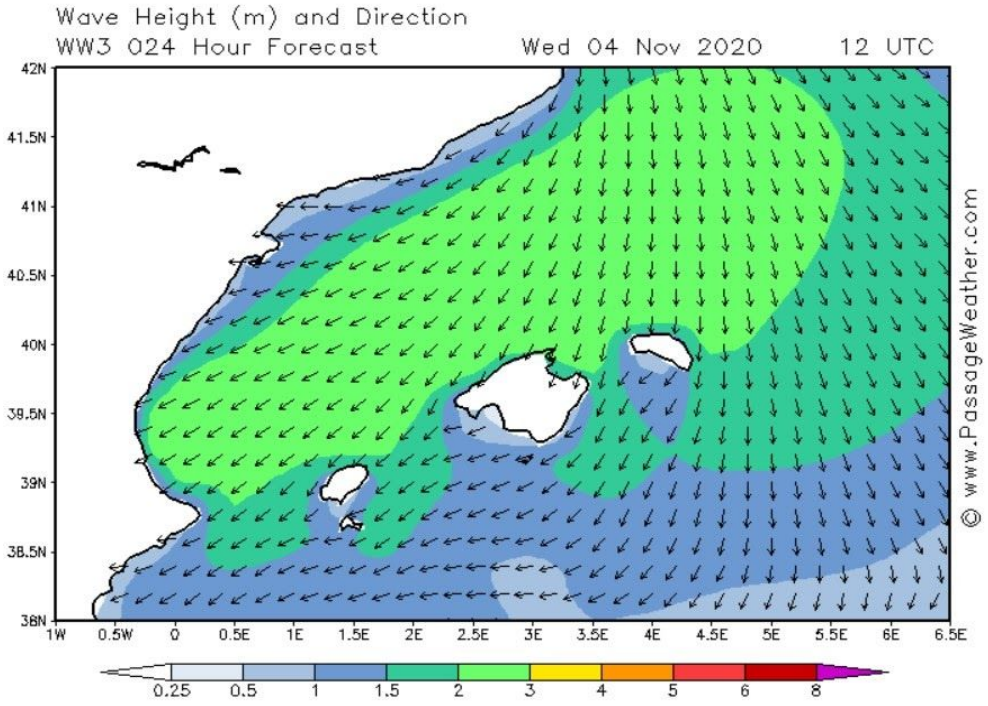
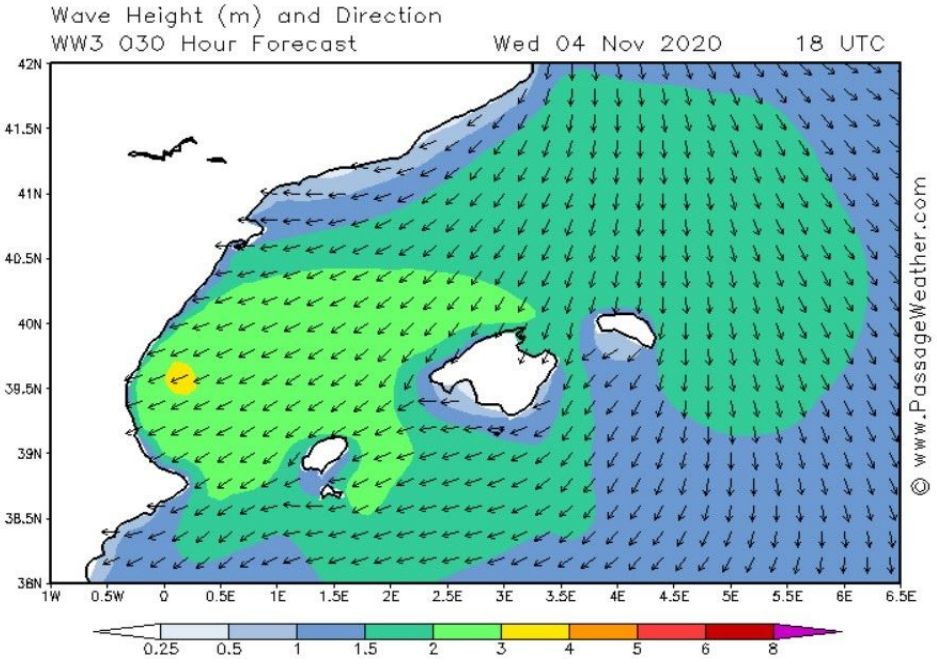
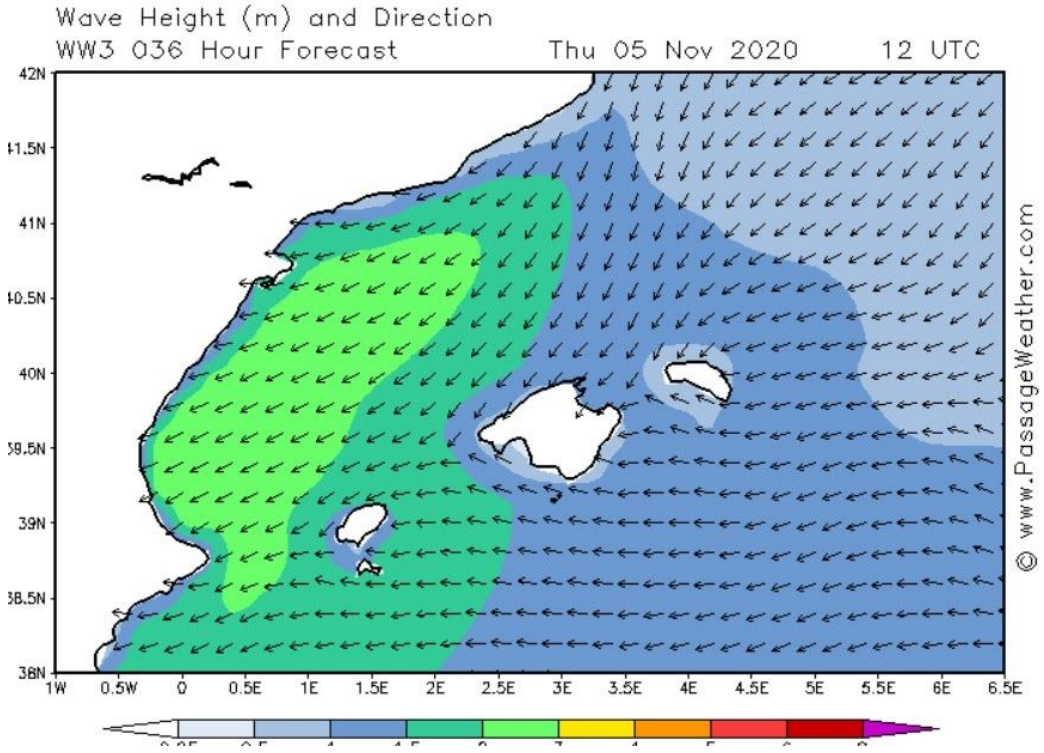
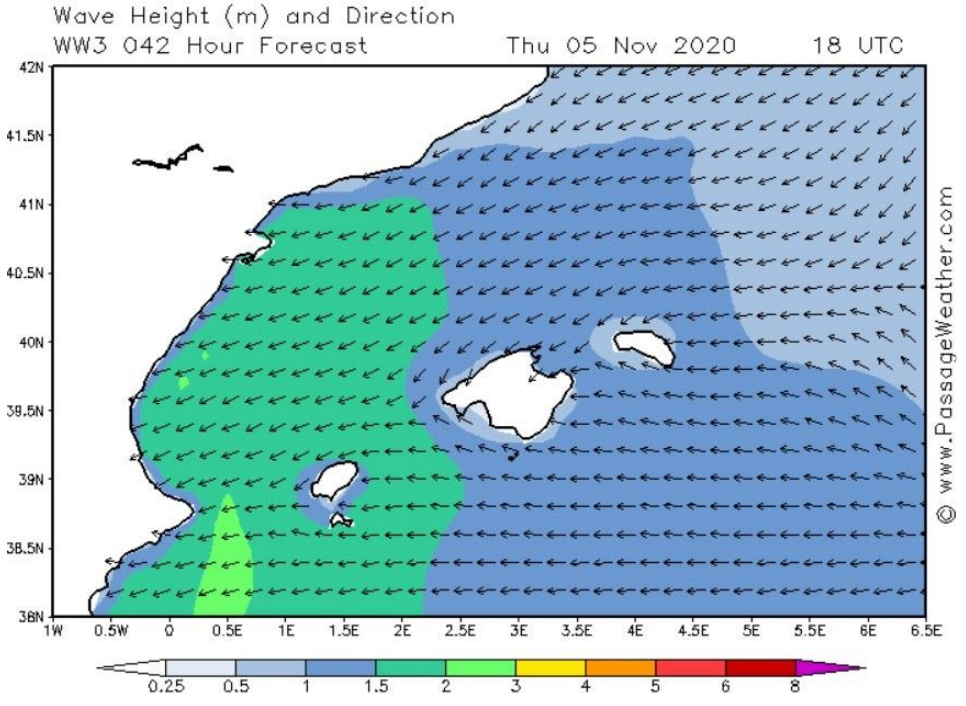
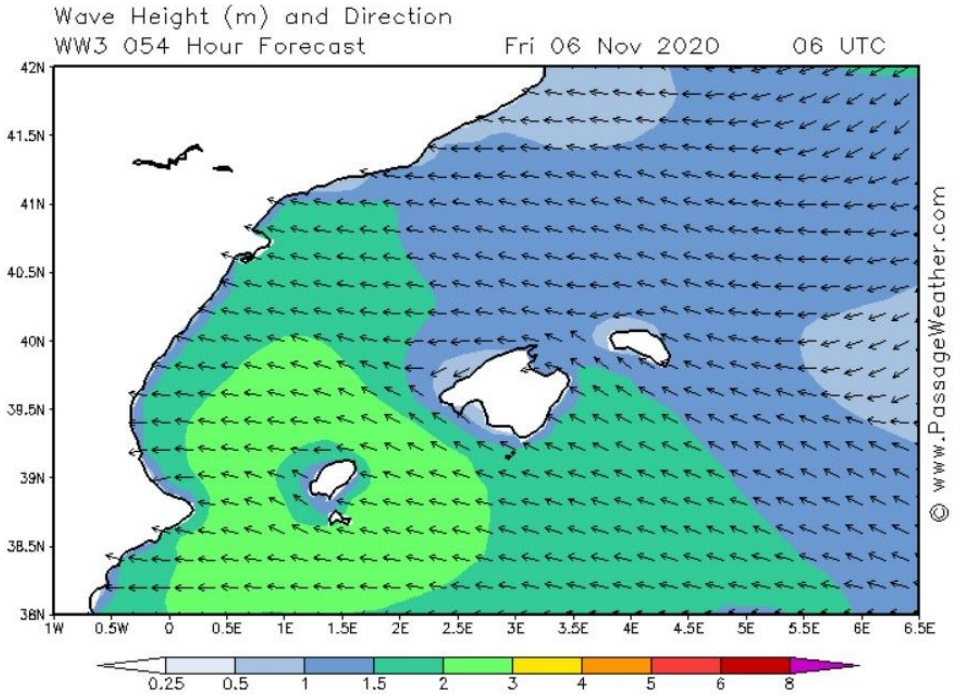
APPENDIX 3: Weather Forecast and Sea Conditions






Wave Height (m) and Direction
WW3 036 Hour Forecast
Thu 05 Nov 2020 12 UTC
42N
41.5N
41N
40.5N
40N
39.5N
39N
38.5N
38N
1W 0.5W 0 0.5E 1E 1.5E 2E 2.5E 3E 3.5E 4E 4.5E 5E 5.5E 6E 6.5E
© www.PassageWeather.com


Wave Height (m) and Direction
WW3 042 Hour Forecast
Thu 05 Nov 2020 18 UTC
42N
41.5N
41N
40.5N
40N
39.5N
39N
38.5N
38N
1W 0.5W 0 0.5E 1E 1.5E 2E 2.5E 3E 3.5E 4E 4.5E 5E 5.5E 6E 6.5E
0.25 0.5 1 1.5 2 3 4 5 6 8
© www.PassageWeather.com


Wave Height (m) and Direction
WW3 054 Hour Forecast
Fri 06 Nov 2020
06 UTC
42N
41.5N
41N
40.5N
40N
39.5N
39N
38.5N
38N
1W
0.5W
0
0.5E
1E
1.5E
2E
2.5E
3E
3.5E
4E
4.5E
5E
5.5E
6E
6.5E
0.25
0.5
1
1.5
2
3
4
5
6
8
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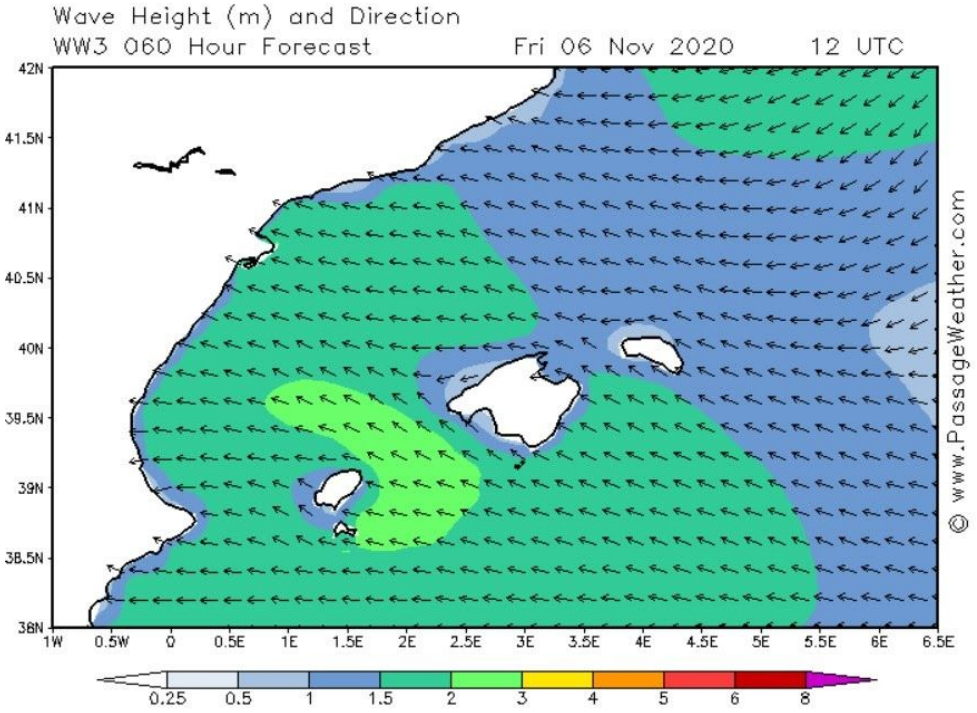
Wave Height (m) and Direction
WW3 060 Hour Forecast
Fri 06 Nov 2020
12 UTC
42N
41.5N
41N
40.5N
40N
39.5N
39N
38.5N
38N
1W
0.5W
0
0.5E
1E
1.5E
2E
2.5E
3E
3.5E
4E
4.5E
5E
5.5E
6E
6.5E
0.25
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AEMet Puertos del Estado

Informe de Predicción Océano-Meteorológica

MEDITERR7

Predicción de Oleaje, Viento y Corrientes:

Punto de predicción:
- 38.92ºN 1.67ºE

Fecha de predicción:
- miércoles 04 nov, 2020 00.h

Predicción de nivel del mar:

Punto de predicción:
- 38.73ºN 1.42ºE

Fecha de predicción:
- miércoles 04 nov, 2020 00.h

	Hora		Viento		Mar Total				Mar de Viento		Mar de Fondo 1			Corrientes		Nivel del Mar			Hidrografía	
Fecha	GMT	Local	Vv	Dir	Hs	Dir	Tp	Tz	Hs	Dir	Hs	Dir	Tz	Vc	Dir	Nivel	Marea	Res.	Temp.	Sal.
04-11-20	01	02	7.3		0.99		4.7	3.7			0.56		4.4	0.19		-0.09	-0.05	-0.04	21.2	37.4
04-11-20	03	04	8.1		1.18		5.7	3.9			0.69		4.9	0.19		-0.06	-0.04	-0.03	21.2	37.4
04-11-20	05	06	8.5		1.39		6.8	4.3			0.97		6.2	0.18		-0.02	-0.00	-0.02	21.2	37.4
04-11-20	06	07	9.1		1.49		7.5	4.4			1.11		6.4	0.17		0.01	0.02	-0.01	21.2	37.4
04-11-20	07	08	9.5		1.60		7.5	4.5			1.23		6.6	0.17		0.02	0.03	-0.01	21.1	37.4
04-11-20	08	09	9.4		1.73		9.1	4.6			1.33		6.8	0.18		0.03	0.04	-0.01	21.1	37.4
04-11-20	09	10	11.0		1.88		8.3	4.7			1.36		7.0	0.19		0.04	0.04	-0.00	21.1	37.4
04-11-20	10	11	8.6		1.85		8.3	4.9			1.39		6.5	0.21		0.05	0.04	0.00	21.1	37.4
04-11-20	11	12	5.2		1.71		8.3	5.2			1.36		6.7	0.22		0.05	0.04	0.01	21.1	37.4
04-11-20	12	13	2.9		1.63		8.3	5.4			1.33		6.5	0.22		0.05	0.04	0.01	21.1	37.4
04-11-20	13	14	2.6		1.62		8.3	5.5			1.31		6.5	0.22		0.05	0.03	0.02	21.0	37.4
04-11-20	14	15	2.2		1.65		8.3	5.5			1.02		8.0	0.21		0.05	0.03	0.02	21.0	37.4
04-11-20	15	16	6.1		1.71		8.3	5.5			1.36		6.9	0.20		0.04	0.02	0.02	21.0	37.4
04-11-20	16	17	8.2		1.83		8.3	5.3			1.39		7.3	0.20		0.04	0.02	0.03	21.0	37.4
04-11-20	17	18	9.2		1.91		8.3	5.2			1.41		7.6	0.19		0.04	0.01	0.03	20.9	37.4
04-11-20	18	19	8.4		1.92		8.3	5.2			1.42		7.8	0.16		0.04	0.01	0.03	20.9	37.4
04-11-20	19	20	10.4		2.03		8.3	5.1			1.37		7.8	0.14		0.03	0.00	0.03	20.9	37.4
04-11-20	20	21	12.8		2.27		8.3	5.0			1.03		8.1	0.11		0.02	-0.01	0.03	20.9	37.4
04-11-20	21	22	12.6		2.43		7.5	5.2			0.64		9.4	0.08		0.01	-0.02	0.03	20.9	37.4
04-11-20	22	23	12.9		2.64		7.5	5.4			0.74		8.8	0.06		-0.00	-0.03	0.03	20.9	37.4
04-11-20	23	00	13.3		2.85		7.5	5.6			0.69		6.2	0.05		-0.02	-0.04	0.02	20.9	37.4
jueves nov 05, 2020																				
05-11-20	00	01	13.7		2.96		7.5	5.6			0.88		7.2	0.06		-0.03	-0.05	0.02	20.9	37.3
05-11-20	03	04	14.6		3.14		7.5	5.7			1.02		7.5	0.13		-0.03	-0.05	0.02	20.8	37.3
05-11-20	06	07	13.5		2.92		7.5	5.6			1.00		7.4	0.19		0.02	0.00	0.02	20.6	37.3
05-11-20	09	10	11.7		2.64		7.5	5.6			1.09		7.2	0.21		0.06	0.04	0.02	20.3	37.3
05-11-20	12	13	9.7		2.44		7.5	5.7			1.52		6.8	0.17		0.07	0.05	0.02	20.2	37.3
05-11-20	15	16	10.3		2.25		7.5	5.4			1.35		6.8	0.14		0.05	0.03	0.02	20.3	37.3
05-11-20	18	19	10.1		2.09		7.5	5.2			1.16		6.7	0.10		0.03	0.01	0.02	20.3	37.3
05-11-20	21	22	9.5		1.64		6.8	5.0			1.03		5.8	0.08		0.00	-0.02	0.02	20.3	37.3
viernes nov 06, 2020																				
06-11-20	00	01	9.5		1.72		6.8	4.6			0.92		5.6	-	-	-0.04	-0.05	0.02	-	-
06-11-20	03	04	8.6		1.66		6.8	4.7			0.81		5.4	-	-	-0.03	-0.06	0.02	-	-
06-11-20	06	07	8.6		1.48		6.2	4.4			0.50		7.2	-	-	0.01	-0.02	0.03	-	-
06-11-20	09	10	6.7		1.25		6.2	4.3			0.60		5.3	-	-	0.06	0.04	0.02	-	-
06-11-20	12	13	5.9		1.14		6.2	4.2			0.57		5.3	-	-	0.09	0.05	0.04	-	-
06-11-20	15	16	6.2		1.09		6.2	4.1			0.53		5.2	-	-	0.08	0.04	0.04	-	-
06-11-20	18	19	6.7		1.03		5.7	3.9			0.56		4.6	-	-	0.07	0.02	0.05	-	-
06-11-20	21	22	5.4		1.03		5.1	3.9			0.36		5.3	-	-	0.06	-0.01	0.08	-	-

El mar de viento es el oleaje que está siendo generado por el viento, el mar de fondo es el oleaje procedente de otro lugar donde fue generado por el viento. El mar total es la superposición del mar de viento y del mar de fondo.

- Hs [m]: Altura significante. Representa la altura media del tercio de ondas más altas.
- Tz [s]: Periodo medio del oleaje.
- Tp [s]: Periodo pico del oleaje.
- Vv [m/s]: Velocidad media del viento a 10 metros sobre la superficie.
- Vc [m/s]: Velocidad media de la corriente superficial.
- Nivel [m]: Nivel del mar corregido con el efecto del viento y de la presión atmosféricos. Referencia: Nivel medio
- Marea [m]: Marea astronómica. Referencia: Nivel medio
- Res. [m]: Residuo meteorológico (Nivel-Marea).
- Temp. [ºC]: Temperatura superficial del agua.
- Sal [psu]: Salinidad.