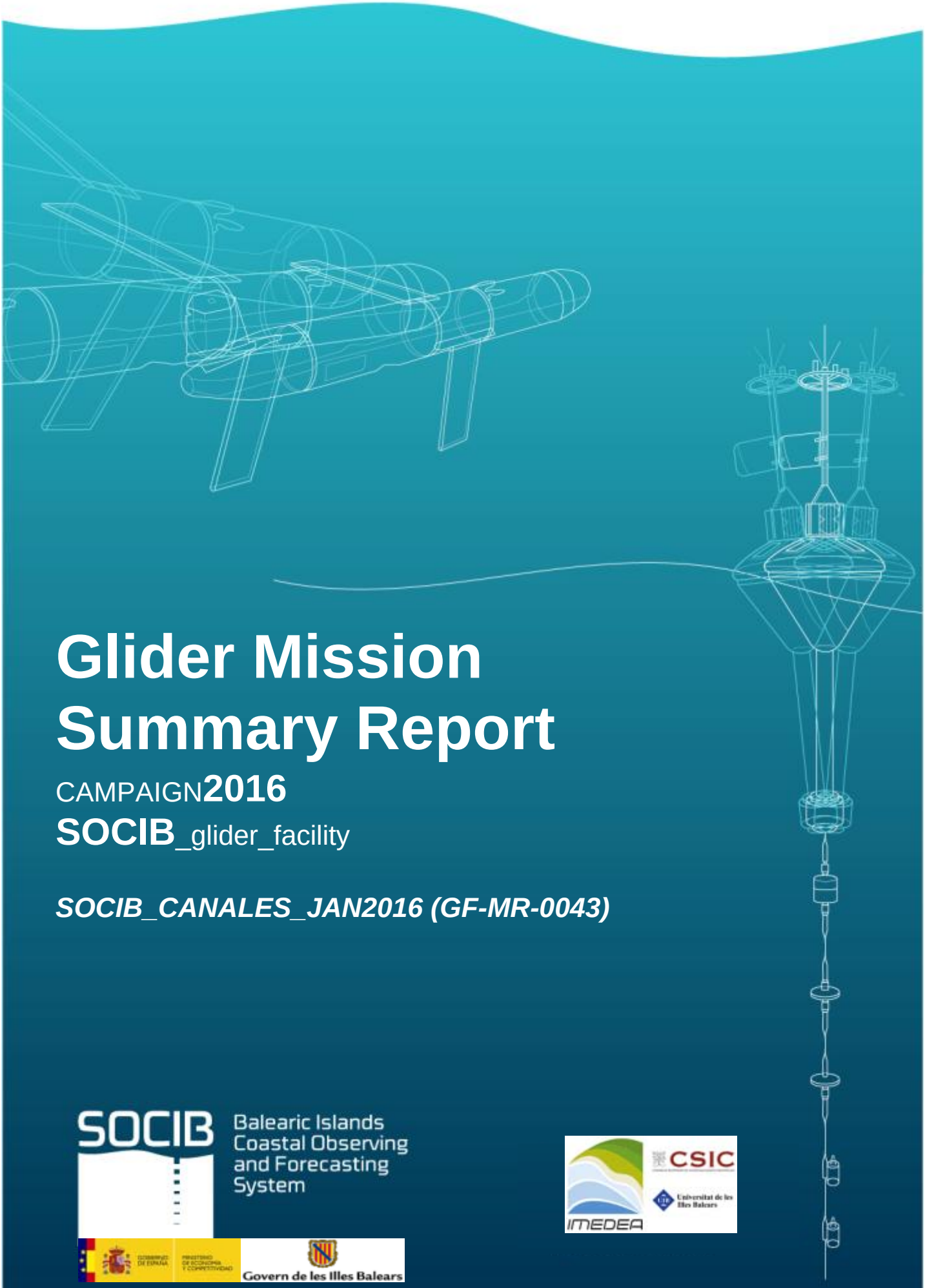

Glider Mission Summary Report

CAMPAIGN**2016**

SOCIB_glider_facility

SOCIB_CANALES_JAN2016 (GF-MR-0043)

SOCIB Balearic Islands Coastal Observing and Forecasting System

Govern de les Illes Balears

IMEDEA CSIC Universitat de les Illes Balears

Mission Name	*SOCIB_CANALES_JAN2016 (GF-MR-0043)*		
Platform Model	*Slocum 1000 G1*		
Platform ID / Name / WMO Code	*U184 / IDEEP00 / 68452*		
Related Platforms / Missions	*SOCIB-R/V (this unit was on-board during Canales-Winter-2016 although finally not used for glider-rosette intercalib. trial)* *SDEEP04 (used during recovery of IDEEP00 as text messenger between field and shore teams)*		
Start Date	*2016-01-19*		
End Date	*2016-02-19*		
Total Days	*32*	**Total distance (Km / Nm)**	*654 / 354*
Survey Area (NODC or SDN region)	*Mallorca and Eïvissa Channels (Western Mediterranean Sea)*		
Objective(s)	• *Establishing the variability of the N/S exchange of water masses that occur through the Ibiza Channel(IC). Sampling standard transects across the Ibiza Channel several times using physical and biogeochemical sensors. No greater than 1 month gap in between consecutive iterations. The Mallorca Channel is also sampled when operationally practical.*		

Scientific Sensors (name & model / serial_number / calibration date)	• *CTD -SBE- / sn 0129 / 25-Jul-2014* • *FLNTU -WetLabs- / sn2128 / 01-Feb-2011* • *OPTODE -Aandera- / sn 0993 / 23-10-2009* *(calibration sheets available upon request to glidertech@socib.es)*
Number of Profiles	*1.332 (CTD), 219 (FLNTU), 219 (OXY)* *(total of 590.104 CTD samples)*
Significant Events	• *1st CANALES mission in 2016 (IMEDEA glider)* • *2nd deployment on GFMR0041 batt pack (no signs of voltage decay)* • *SCIENCE-payload turned-off twice seeking energetic saving* • *Trial of anti-fouling spray on glider's hull* • *Very good overall performance (no critical aborts nor errors)* • *Very intense currents faced when surrounding Eïvissa (Backwards Navigation)* • *Strong Wind & Waves coincident with the Glider twice during the survey* • *4 Eïvissa-Valencia transects + 1 Eïvissa-Mallorca transect* • *Difficult return to Mallorca. Recovery in the middle of Mallorca channel* • *Data backup using radio link (without hull disassembly)* • *Glider on-board SOCIB-RV for 1st intercalibration test against Rosette*
Mission Summary	*This mission stands for the 1st iteration of the Canales Mission within 2016 and also the 1st deployment of Unit 184 (IDEEP00) during the present year. Its last mission was GF-MR-0041.* *There is a Pre-mission Report, created prior to the start of the preparations, compiling the key preliminary aspects of this GF-MR-0043, derived from planning sessions.* *Preparation phases were executed between 30/Dec/2015 to 14/Jan/2016. All the checks and configurations were undertaken according to the pre-mission-report and applicable protocols. There were neither relevant issues nor problems worth to be mentioned here. Compass error was measured in a EMI-free forest location (max. error > 20 deg so the compass needs recalibration).* *Launching operation (19/Jan) was executed by 1 ETD and 1 GF facility members on board SOCIB RIB Hurricane 9m. Glider was released in N39° 30.364' E02° 10.172' at 11:34-utc. The deployment was an operative and tactical success (environmental conditions were very good). Pilot was onshore. Glider executed successful test dives prior to the first survey dive.* *The survey period was, in general terms, very successful. Main preliminary aspects were accomplished without major setbacks. No critical situations provoked the absence of emergency actions. Navigation was satisfactory but the presence of very intense N-to-S currents during the return trip (in front of St.Antoni's coast) forced the implementation of evasive maneuvers. All in all, the return trip was delayed for more than 7 days. Main achievements were: (1) Efficient flying and sampling for battery saving, (2) four Eïvissa↔Valencia transects and (3) one Eïvissa↔Mallorca transect. Multiple waypoint lists were loaded during the whole deployment and, although waypoints were accomplished satisfactorily, some of them prematurely forced (evasive maneuvers). Underwater maneuvers were executed accordingly to a configuration that changed multiple times for (1) engineering reasons such as energetics [science payload turned-off twice]; and (2) to adapt to the scientific interests (see Chart 1 for details). Data logging during sampling seems to have been successful and according to details shown in Chart 2 (common and non-critical oddities raised by Science-Payload).Surface breaks occurred every 6 hours (average), lasted 5 to 20 minutes and allowed the vehicle to send telemetry and sampled-data as well as receiving commands (to save energy, near-real-time sending was done once per day, at 10am,utc).*

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Energetically, the power source (Primary Lithium Batteries), already used during GF-MR-0041, behaved perfectly although under special observation due to its depletion-knee being unknown. At the end, it was stable and fully capable of fulfilling the requirements of all the on-board systems. Electro-Mechanical actuators and sensors exhibited a more than acceptable performance (but Oddities raised by buoyancy-pump and digifin); Pitch control was manual (to save energy) since 20/Jan. Communication systems were reliable and fluent although (1)there were 3 missing calls; and (2) 1 GPS pre-fixes were also not completed correctly. Electronic modules (processors, memory cards, control boards,...) revealed no evidences of problems at all. Moreover, there were no signs of problems derived from the Hull sections nor the hydrodynamic elements attached to those. Finally, the statistics of device performance concluded that occurred 0 Errors; 3 Warnings (2 gps, 1 attitude_rev) and 1731 Oddities (710 ocean_pressure, 19 pitch-motor, 10 science-super, 648 digifin, 257 Iridium, 38 coulomb and 49 de-pump). Out of these oddities, only the ones from de-pump and coulomb are relevant and call for a more detailed analysis. Mission Runs were 3 in total (0335xxxx to 0337xxxx log file identifier-names to be considered).

The recovery operation associated to this mission was farther than usual due to the delay accumulated due to St.Antoni's currents. Due to that distance (no GSM coverage), SDEEP04 was taken on-board to be used as communication platform between field and shore teams. It all occurred on 19/Feb, in N39° 15.462' E02° 22.908', at 09:13am,utc. The last 7 days of mission were dedicated to exclusively navigate from Eïvissa island to target recovery waypoint (1st mission Rerun). During this period all scientific sensors remained turned-off. (2nd mission Rerun to extend Overtime counter). Special YO file was loaded the same morning to make the glider surface after completing 2 consecutive 200m-dives so to not having to wait excessively in case field team arrived to the recovery area whilst the glider was underwater avoiding ship collisions. The night before, the mission end was configured to occur on 19/Feb at 11am,utc. Finally, the mission concluded with a "same-depth" abort since the field team put the glider on-board before shore-pilot could end the mission remotely. This mistake was revised and corrective measures taken not to repeat that again.

The conclusion phase associated to this mission started once IDEEP00 was recovered and transported (19/Feb) to SOCIB's Glider-Lab (IMEDEA building). Radio EBD,DBD downloading was done during the weekend and the glider prepared to be a part of the SOCIB-RV Canales-Winter-2016 campaign: to be tested during the first trial of intercalibration glider-vs-rosette. Unfortunately, the breaking of the supporting structure aborted this trial and IDEEP00 was not even used. Upon return to IMEDEA (26/Feb) the conclusion proceeded following the applicable protocol. During the following two weeks the glider underwent the conclusion procedure mainly focused on (1) general checkout of all devices, assemblies and components (complete disassembly); (2) external-surfaces and sensor cleaning/refurbishment (which was intensive due to the solidification of the anti-fouling product applied at Preparation. This product was concluded to not being useful on Gliders) ; (3) gathered-data backup (direct duplication of memory flash-cards in this case) and uploading to SOCIB's data-center for post-processing; and, finally, (4) preparation for storage and battery removal (this pack is considered exhausted and will be disposed). After that, the storage status of the vehicle was "Standing-by & Ready for a new preparation".

(Note that although multiple administrative and notification procedures took place during the different stages described above, these have not been reported because are considered out of the scope of this report. Same applies for multimedia and public-diffusion; and also for accounting).

With respect to the human resources: coordination amongst multiple participants (glider-techs, field-techs, scientists & open-access-users) was fluent and efficient in spite of the field failure during recovery. There were no personal damages and the availability of each member, for all the tasks assigned at each moment, was correct (including on-alert shifts for field intervention and 24/7 glider monitoring during survey).

Detail Charts:

Date (utc)	D_{UTI}	D_{UBI}	T_{UND}	d_{BOT}	N_{DIV}	N_{COM}	t_{UTC}	H_{WPT}
19/Jan@M.S.	20	950	21600	40	∞	12	4,11,16,20	1000
13/Feb@16:00	20	500	21600	40	∞	12	4,11,16,20	1000
19/Feb@04:00	20	200	3000	40	2	12	4,10(to end the mission), 16,20	1000

(M.S.): Mission Start
D_{UTI}: Underwater Top Inflection Depth (m)
D_{UBI}: Underwater Bottom Inflection Depth (m)
T_{UND}: Average Period of Underwater Navigation (secs)
d_{BOT}: Minimum Distance to Sea-floor to be kept (m)
N_{DIV}: Surface upon completion of this # of dives
N_{COM}: Surface if this amount of hours without stable communications (hrs)
t_{UTC}: Surface at this particular UTC times
H_{WPT}: Surface if a waypoint is hit within that distance (m)

Chart 1 Summary of Underwater Strategies (Navigation)

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Date (utc)	S_{EN}	f_{SMP}	D_{RNG}	M_{DIV}	M_{CLI}
19/Jan@M.S.	CTD	0,5000	[-5, 2000]	yes	yes
"	OXY	0,2500	[-5, 2000]	yes	no
"	FLNTU	0,1250	[-5, 150]	yes	no
"	FLNTU	0,0625	[150, 300]	yes	no
21/Jan@16:00	CTD	off	-	-	-
"	OXY	off	-	-	-
"	FLNTU	off	-	-	-
"	FLNTU	off	-	-	-
24/Jan@16:00	CTD	0,5000	[-5, 2000]	yes	yes
"	OXY	0,2500	[-5, 2000]	yes	no
"	FLNTU	0,1250	[-5, 150]	yes	no
"	FLNTU	0,0625	[150, 300]	yes	no
29/Jan@10:30	CTD	[-5, 2000]	yes	yes	0,5000
"	OXY	off	-	-	-
"	FLNTU	off	-	-	-
"	FLNTU	off	-	-	-
12/Feb@20:00	CTD	off	-	-	-
"	OXY	off	-	-	-
"	FLNTU	off	-	-	-
"	FLNTU	off	-	-	-

S_{EN}: Sensor type
f_{SMP}: Frequency of sampling (Hz)
D_{RNG}: Depth range this configuration applies (m)
M_{DIV}: Sampling during Diving maneuver
M_{CLI}: Sampling during Climbing maneuver

Chart 2 Summary of Underwater Strategies (Sampling)

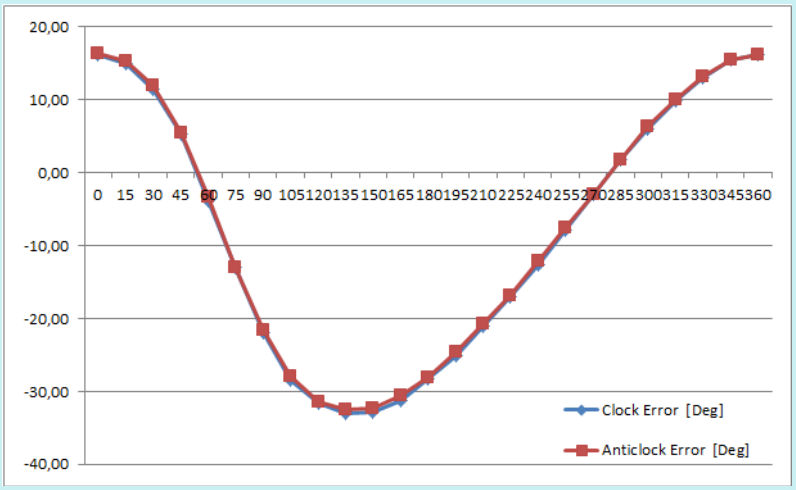

Fig 3.1- Error measured during Compass Error Check procedure in an electromagnetic-field-free environment located in a forest close to IMEDEA (in Esporles)

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Principal Investigator (e-mail or contact phone/address)	• *Prof. Joaquim Tintoré jtintore@socib.es (+34 971439821)*
Institute	*SOCIB in collaboration with IMEDEA*
Project Affiliation (web-site)	*http://www.socib.eu*
Partnership / Participation	• *SOCIB* • *IMEDEA (in-kind contribution of glider and infrastructures)*
Glider Software Version	*Nav : v7.13 Acomms, Payload: 3.17*
Data Retrieval (real-time [RT] / delayed-mode [DM])	• *RT: sub-set via satellite link every 24 hours every day during 12am,lt control-call* • *DM: direct download of full gathered data sets (flash-cards backup)*
Compass Calibration (specify procedure)	*Compass error was measured. Observed error suggests re-calibration is needed. Deviation in Navigation is considered a consequence of strong currents though (See Figure 3.1)*
Battery Type	*2nd-ever SAFT Custom Lithium Pack (430Ah-nominal capacity) (With in-house-designed ballasting chassis)*
Battery Consumption (Ah)	*125.455Ah (reading from 220.384 to 345.839Ah)*
Data Available From	*http://thredds.socib.es/thredds/dodsC/auv/glider/ideep00-ime_sldeep000/L1/2016/dep0016_ideep00_ime-sldeep000_L1_2016-01-18_data_dt.nc.html*
Further Details	*glidertech@socib.es*

Figure 1

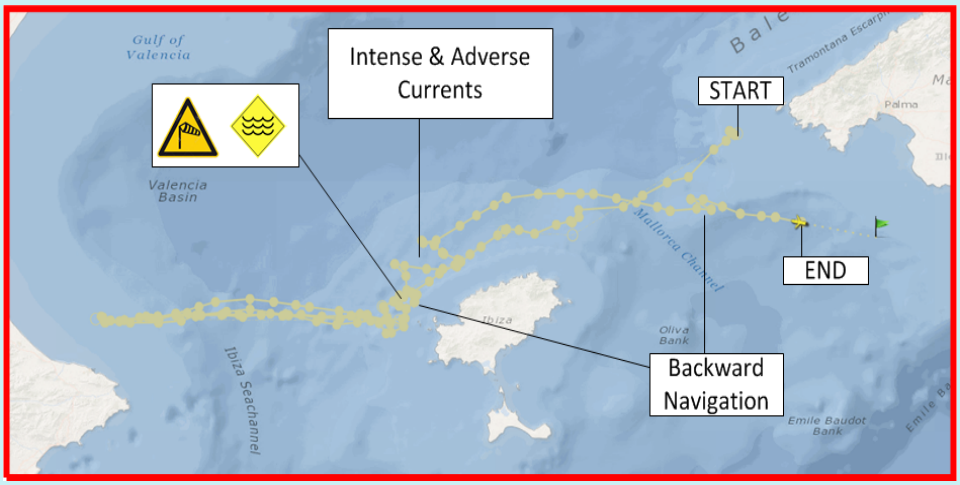
(Map providing general overview of Survey Area)

On-line Track

http://apps.socib.es/dapp/?deployments=566-33-100-CCCC99&layers=ocean_basemap&units=scientific

Figure 2

(Map providing detailed overview of Survey Area and traced Flight Path with surface points if possible)



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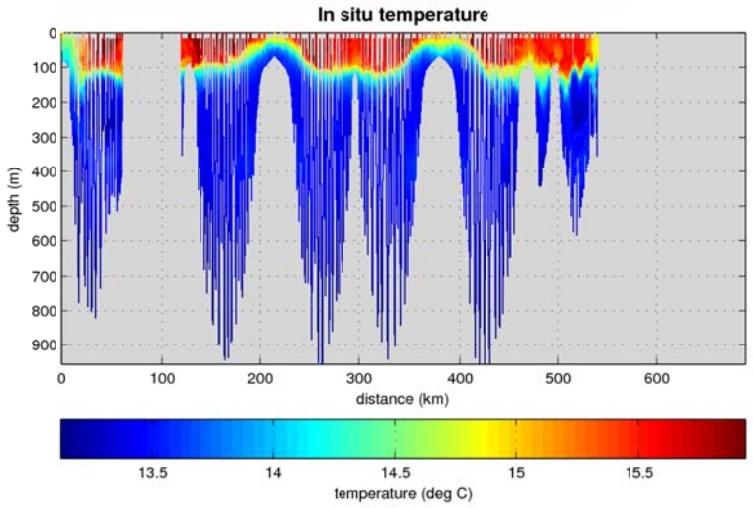
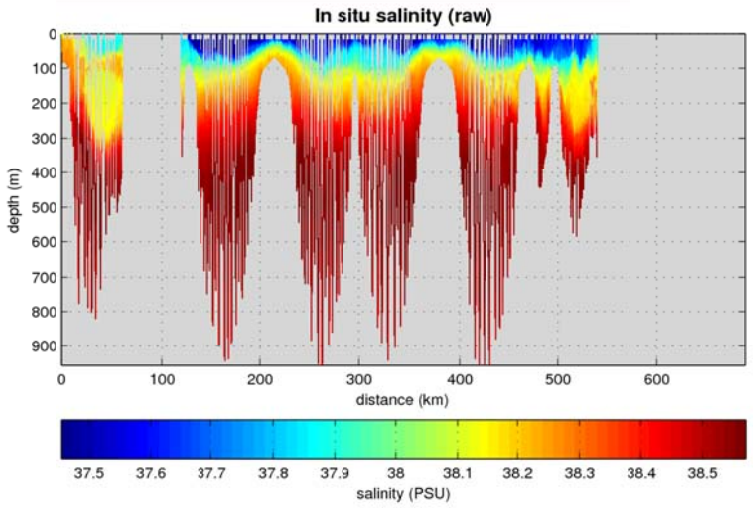
Scientific Preliminary Review

(Compilation of preliminary post-processing plots provided by SOCIB's data-center glider-toolbox and processing services. Contact data.center@socib.es for further info. Plots available through DAPP - See Figure 1 -. Comments provided by SOCIB's scientific staff)

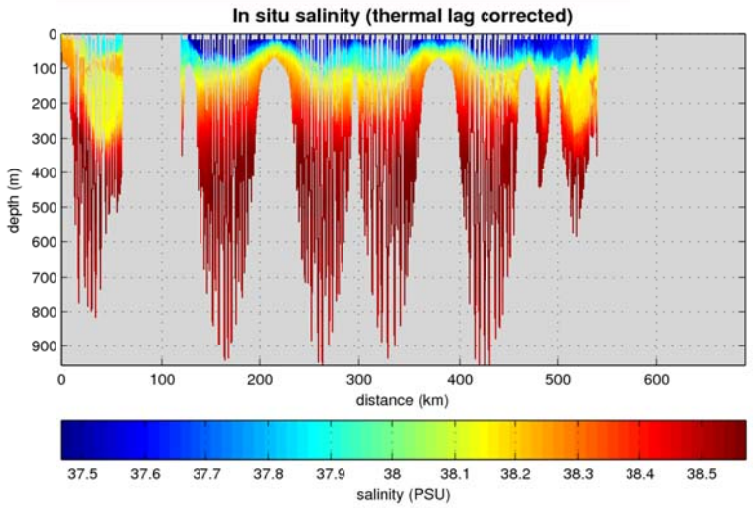
CTD



Plot 1 – In situ temperature



Plot 2– In situ salinity (un-corrected)



Plot 3 – In situ salinity (with thermal lag correction)

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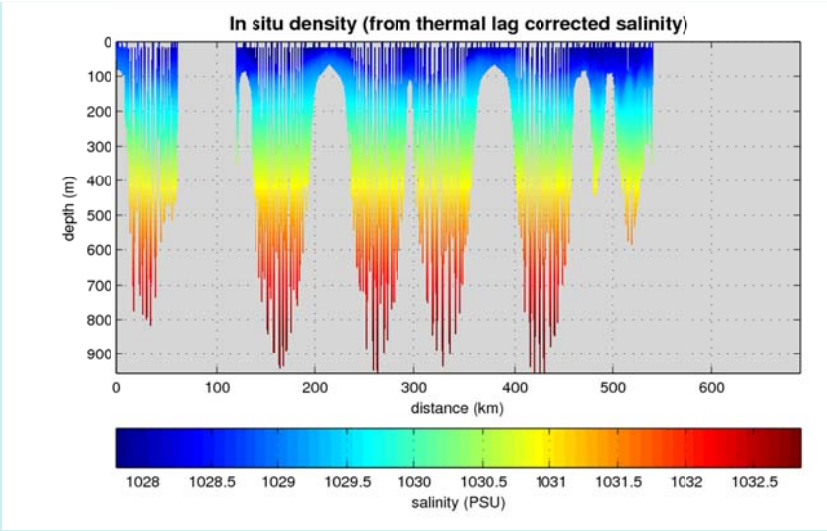
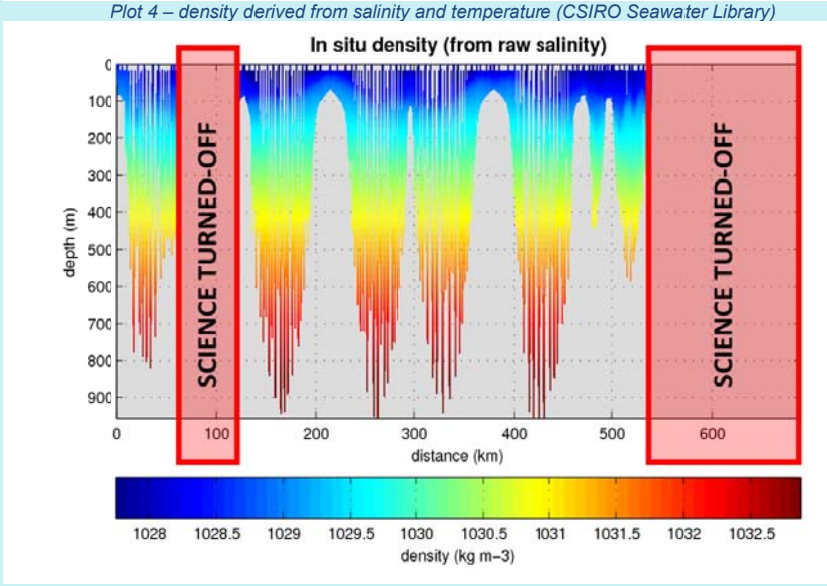
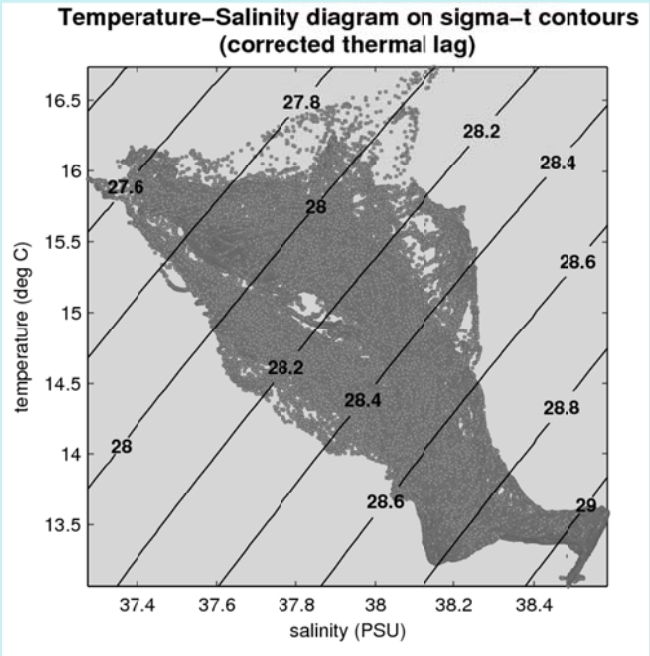


Plot 4 – density derived from salinity and temperature (CSIRO Seawater Library)



Plot 5 – density derived from corrected salinity (thermal lag correction) and temperature (CSIRO Seawater Library)



Plot 6 – Temperature/corrected salinity diagram

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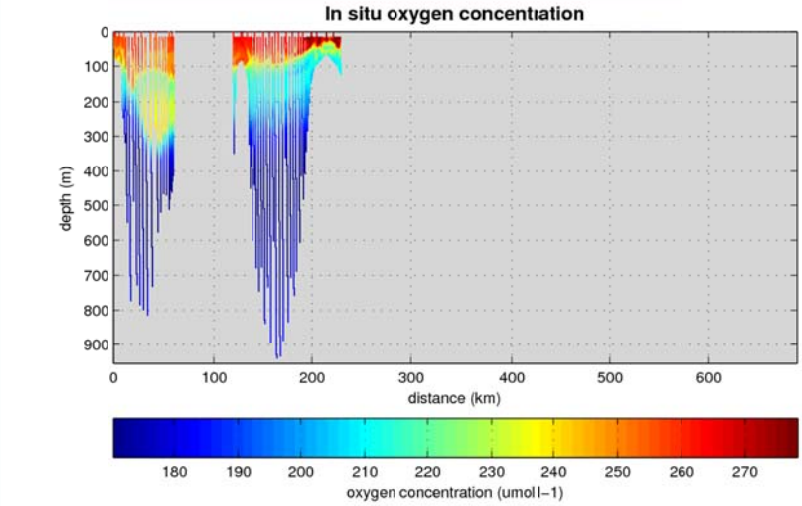
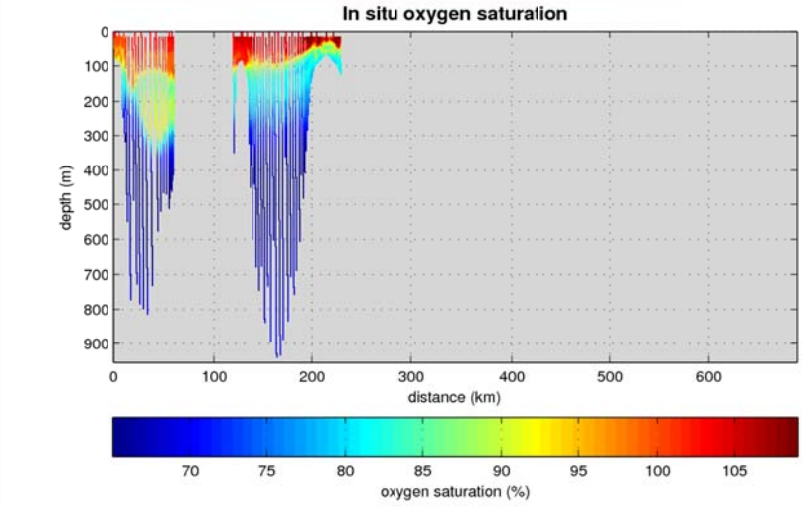
Across most of this mission, excepting the initial transect of the Mallorca Channel, relatively fresh salinities, in the range 37.5 – 37.7, are visible in the surface 0 - 70 m, see Plot 3 and T/S diagram Plot 6. This surface fresher salinity is likely Atlantic Water of more recent Atlantic origin (AWr), which periodically inflows from the Algerian Basin to the south of the Ibiza Channel. This fresher water mass has been previously defined as having salinities < 37.5, however the ongoing glider observations suggest that < 37.7 could be a more useful 'cut-off', fresher than typical 38.0 salinity of the resident Modified Atlantic Waters (MAW). The appearance of this fresher AW has previously been associated with strong inflows in the east of the Ibiza Cannel, and indeed the glider experienced strong northward (and southward) flowing currents in the east of the channel during this mission. The difference being that in this mission the fresher water mass is present across the width of the Ibiza Channel, rather than being concentrated in the east associated with a vigorous north flowing current. Further analysis will provide greater insight into the dynamics associated with this AWr.

In addition low sub surface temperature and salinities (< 3.4 deg., 38.15) in the Mallorca Channel, depths of 100 – 300 m, indicate the presence of a lens of WIW, perhaps associated with an anti-cyclonic eddy, see Plots 1 and 3. The high levels of oxygen concentration (Plot 7) for this lens support the presence of recently formed WIW, which is seen in the T/S diagram (Plot 6) as a T min at around salinities of 38.1.

OXYGEN



Plot 7 – in situ oxygen concentration



Plot 8 – in situ oxygen saturation

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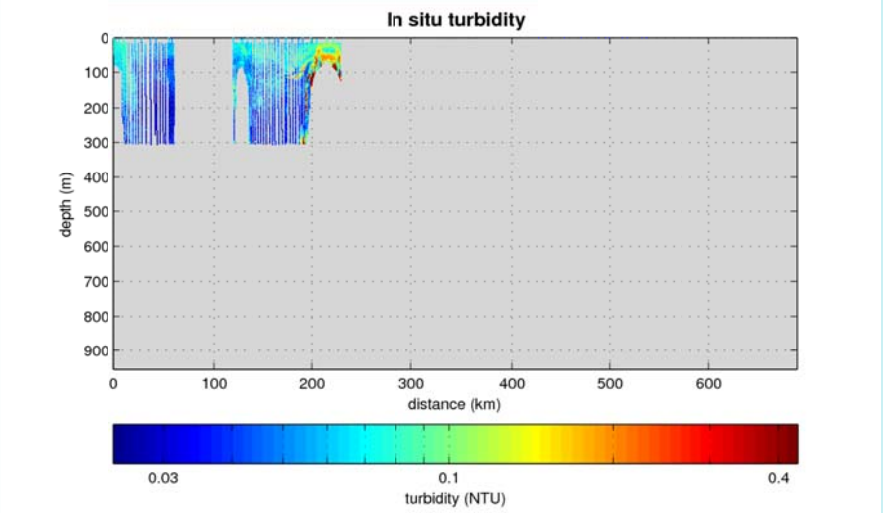
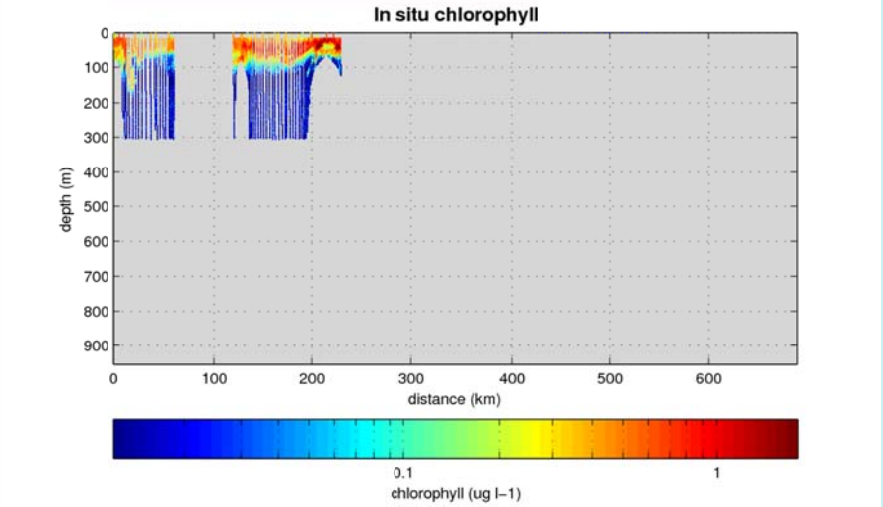
TURBIDITY & CHLOROPHYLL



Plot 9 – in situ turbidity



Plot 10 – in situ fluorescence

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