

SOCIB Glider Mission Summary Report

CNR_EXT-TNA-SMART4-FEB2020_Teresa

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Balearic Islands
Coastal Observing
and Forecasting System



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1 Introduction

The aim of this document is to summarize the most significant technical and scientific events during the glider mission. It will explain engineering events that could affect the science data and also some fact from the science point of view.

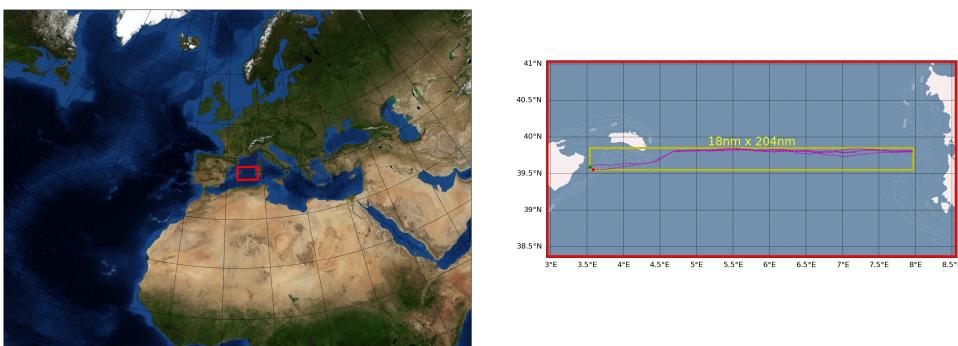


Figure 1.1: Map providing general overview of the Survey Area

1.1 Summary

Mission name	CNR_EXT-TNA-SMART4-FEB2020_Teresa
Platform model	G2 Electric glider, with Microrider
Platform ID / Name / WMO Code	U518/ Teresa/ 6801666
Software NAV version	Version 8.2 Under Ice, Insitu Compass Cal, JASCO Observer
Software SCI version	Version 8.2 Under Ice, Insitu Compass Cal, JASCO Observer
FWD bay sn	0267
SCI bay sn	1149
Mission duration	76.9 days
Mission start	2020-03-12 11:00:00
Mission end	2020-05-28 09:21:14
Total distance	1391.96[km] 751.6[nm]
Deployment point [dd°mm.mm'mm'm']	N 39°35.5734' E 03°32.4698'
Recovery point [dd°mm.mm'mm'm']	N 39°33.2944' E 03°34.9400'
Battery Consumption (Ah)	380.1(from 17.8 to 397.9)
Battery specification	CNR-ISMAR/ Teledyn 3S
Survey area	Sardinia Channel
Objetive	The Mediterranean Sea (MS) has been identified as hot sopto for climatic change, i.e., a region most impacted by ongoing warming trend and increase in extreme events. The MS provides a laboratory-type environment for documenting changes within it and for understanding the role of key processes involved making inferences on processes occurring also at the global scale.
Abstract	4th SMART mission, in the frame of the collaboration agreement between SOCIB and CNR-ISMAR. This four-leg mission begins in Mallorca (East side) and ends also there (round-trip mission). The full transect is Mallorca - Menorca - Sardinia. Working Glider is TERESA, owned by CNR-ISMAR and piloted/managed by SOCIB-GF. The mission finally ended up with 4 transects: Mallorca - Menorca - Sardinia - Menorca - Sardinia - Menorca - Mallorca » 77 mission days

NAV events	<ul style="list-style-type: none"> ▪ Event 1: Pandemic took place while the glider was on the water. On March 15th lock-down was declared. Special actions took place in order to reduce power consumption. ▪ Event 2: This is linked to GFMR0101 (it leaked). Some steps were reused. ▪ Event 3: Plenty of anomalies at surface, mostly due to RT file transmission, see figure 2.11. Needs to be reduced. ▪ Event 4: Oil leak when climbing and diving) increasing with time, see figure 2.14 ▪ Event 5: Microrider probes damaged during the mission ▪ Event 6: Wing lost on mission, probably due to wild life, notice on roll in figure 2.18, from May 2nd. See 2.1
SCI events	<ul style="list-style-type: none"> ▪ Event 1: Oxygen subduction 3.12, from 200m to 1000m (max. glider depth). ▪ Event 2: Outliers in temperature and oxygen have been recorded (284 for each sensor). Low salinity waters below 37.4 psu were observed during the observation period for the upper 50 m of the water column. ▪ Event 3: The presence of LIW has extended recorded during the mission and it takes place between 100 to up to 900m, which is exceptional in our case. Normally it takes place in the study area between 200 to 500m. This water mass has been characterized by the subsurface maximum in salinity (>38.9 psu). In addition, during the mission, we observe the transition between spring to summer period where the upper water column warms up from the middle of April until the end of May to more than 5 degrees C in the first 30 m of the water column where steady this heating expand up to 50m and the end of May. ▪ Event 4: Several eddies have been also observed during the 4 transects with the cyclonic eddy at the end of March pumping low oxygen <180ml/l up to 50 m of the water column. Also after the 10th of May the high oxygen values were observed subsurface (>235ml/l) between 30 to 70 m where normally the DCM is located showing production of oxygen due to of the biological activity.

1.2 Metadata

Principal Investigator	Prof. Joaquim Tintoré jtintore@socib.es (+34 971439821)
Institute	SOCIB
Project Affiliation (web-site)	http://www.socib.eu/
Campaign access type	Colaborative
Partnership / Participation	<ul style="list-style-type: none">▪ CNRismar
Data Retrieval	<ul style="list-style-type: none">▪ RT: sub-set via satellite link at each surface maneuver▪ DM: full/direct memory card backup after glider disassembly during Conclusion mission-phase
Data Available From*	http://thredds.socib.es/thredds/catalog/auv/glider/catalog.html
DOI (if available)	https://doi.org/10.25704/zwmh-ap87
Further Details	glider@socib.es

*Available netCDF data product:

- L0: https://thredds.socib.es/thredds/fileServer/auv/glider/teresa_cnr-teresa_L0_-L0/-03-/dep0007_teresa_cnr-teresa_L0_2020-03-12_data_dt.nc
- L1: https://thredds.socib.es/thredds/fileServer/auv/glider/teresa_cnr-teresa_L1_-L1/-03-/dep0007_teresa_cnr-teresa_L1_2020-03-12_data_dt.nc
- L2: https://thredds.socib.es/thredds/fileServer/auv/glider/teresa_cnr-teresa_L2_-L2/-03-/dep0007_teresa_cnr-teresa_L2_2020-03-12_data_dt.nc

2 Engineering Review

2.1 Preparation

- Premission: ok
- Hardware: ok, reused from GFMR0101
- Batteries: ok, reused from GFMR0101
- Comms: ok, reused from GFMR0101
- Science: ok, reused from GFMR0101
- Ballasting: ok, reused from GFMR0101
- Sealing: ok
- Fileset: ok, reused from GFMR0101
- CEM: na
- Harbor check: ok
- Recovery: ok, notice broken wing
- Conclusion: ok

2.2 Mission Survey

- Deployment:
 - Vessel: Socib Valiant
 - Personnel: 1 ETD + 2 CNR + 1 GF (field team)+ 1 GF (piloting)
 - Location: Cala Millor - Arta
- Navigation: The glider responded well to the commanded target waypoints.
- Underwater Maneuvering: Performed well
- Engineering sensors:

Sensor	Oddities	Warnings	Errors
attitude rev	0	0	3
pitch motor	41	0	0
science super	23	2	0
digifin	1601	71	0
IRIDIUM	597	2	0
DE PUMP	25	0	0

- Communication Systems (see appendix for Iridium states):
 - Total number iridium calls [num]: 407
 - Iridium calls to secondary [num]: 18
 - ON overall iridium period [h]: 7.1
 - Iridium calls state from MODE NO CARRIER to MODE UNKNOWN [num]: 101
 - Iridium calls state from MODE OK to MODE UNKNOWN [num]: 8
 - Iridium calls state from MODE CONNECT to MODE UNKNOWN [num]: 332
 - Iridium calls state from MODE NO ANSWER to MODE UNKNOWN [num]: 1

- Iridium calls state from MODE UNKNOWN to MODE AWAITING OK [num]: 451
 - Iridium calls state from MODE AWAITING OK to MODE UNKNOWN [num]: 3
 - Iridium calls state from MODE AWAITING CONNECTION to MODE UNKNOWN [num]: 6
 - Drop calls (Iridium state from 2 to 99 with c iridium on = 1) [num]: 70
 - Unstable comms detected on: 2020-03-12 11:21:09
 - Unstable comms detected on: 2020-03-17 10:25:28
 - Unstable comms detected on: 2020-04-08 10:29:55
 - Script unable to process any other log
- Hull/Hydrodynamics: No signs of problems
 - Recovery:
 - Vessel: Socib Valiant
 - Personnel: 2 ETD + 1 GF (field team)+ 1 GF (piloting)
 - Location: Cala Millor - Arta



Figure 2.1: Damaged wing

2.3 NAV plots

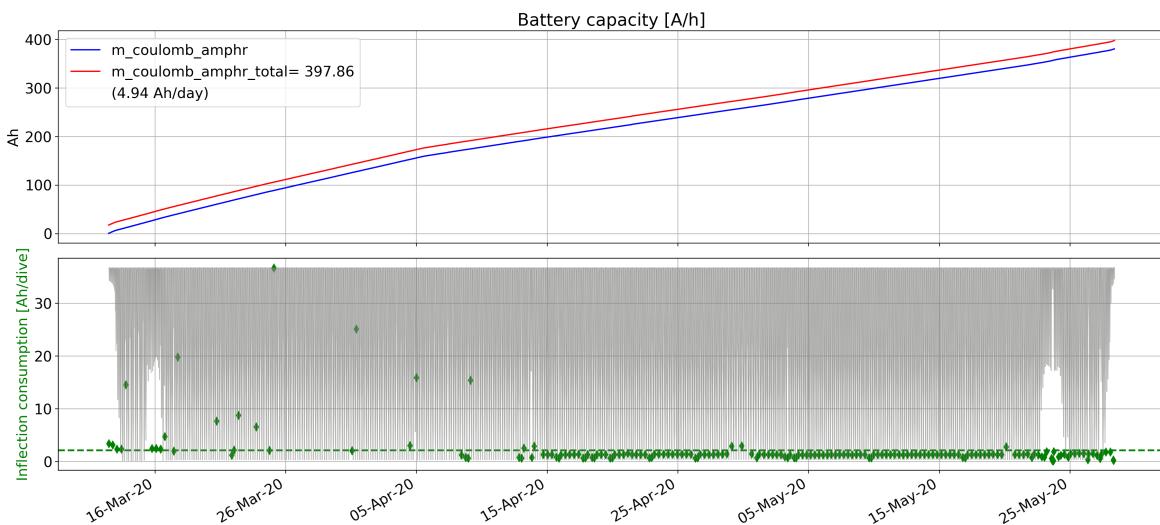


Figure 2.2: Battery capacity

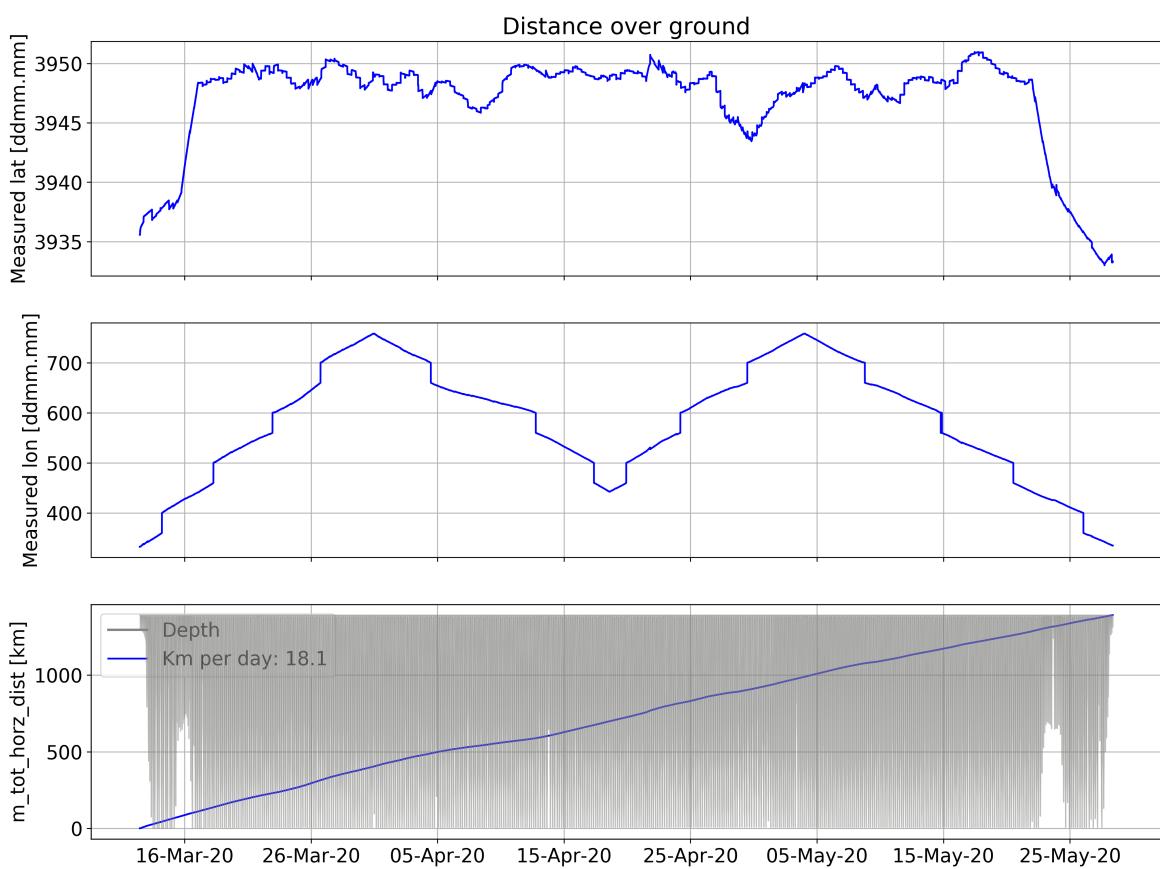


Figure 2.3: Distance over ground

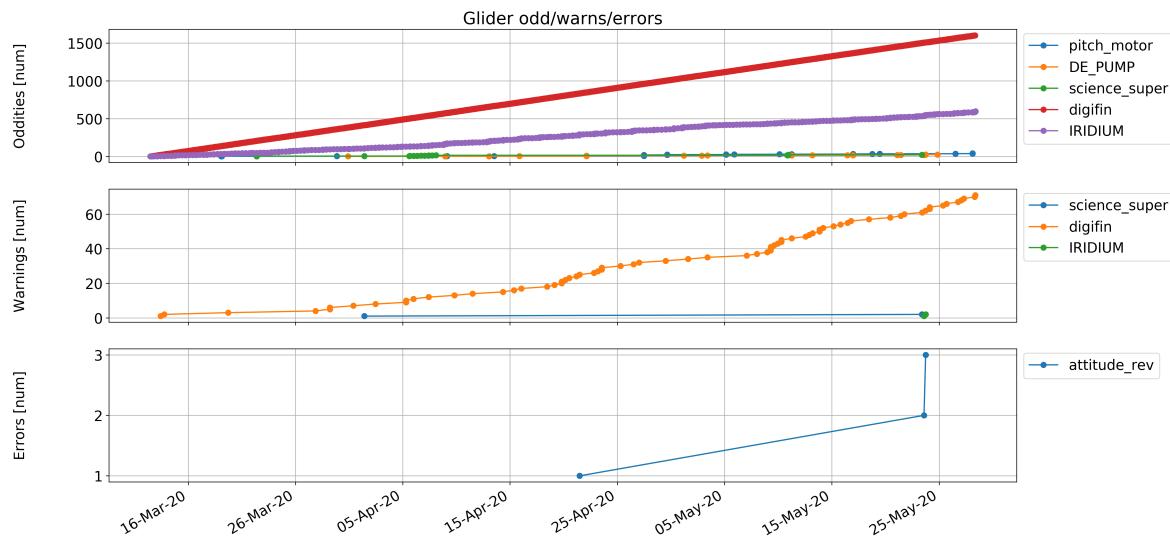


Figure 2.4: Glider Odd Warn and Err

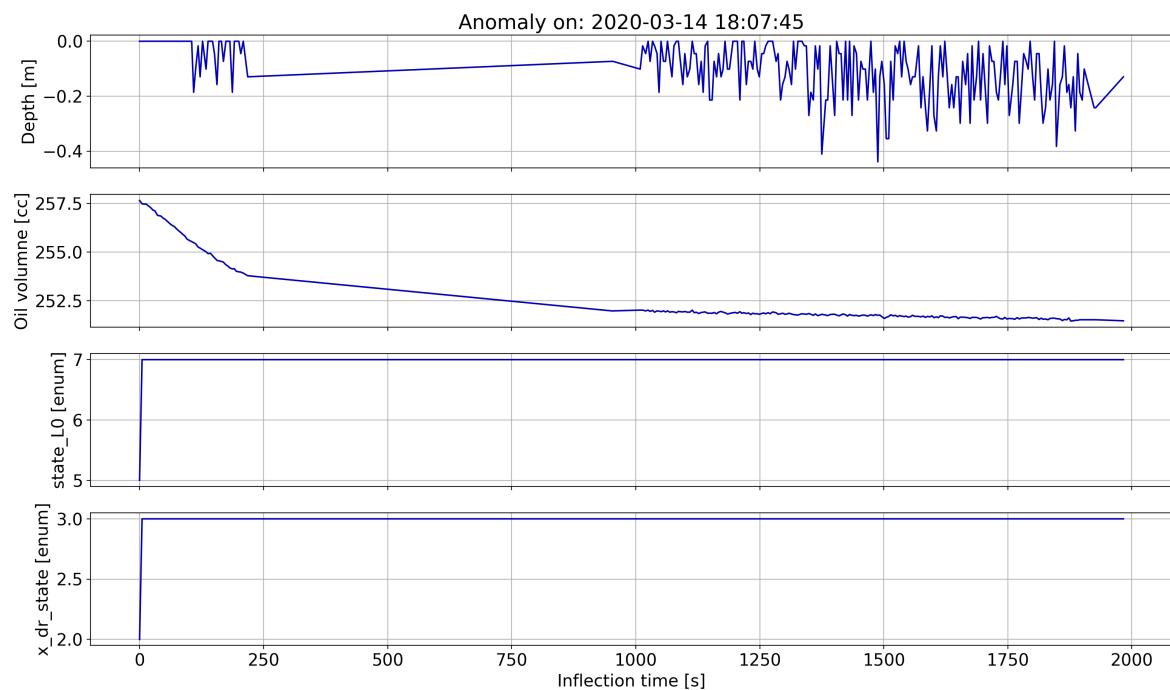


Figure 2.5: 20200314T180745 Anomaly 3

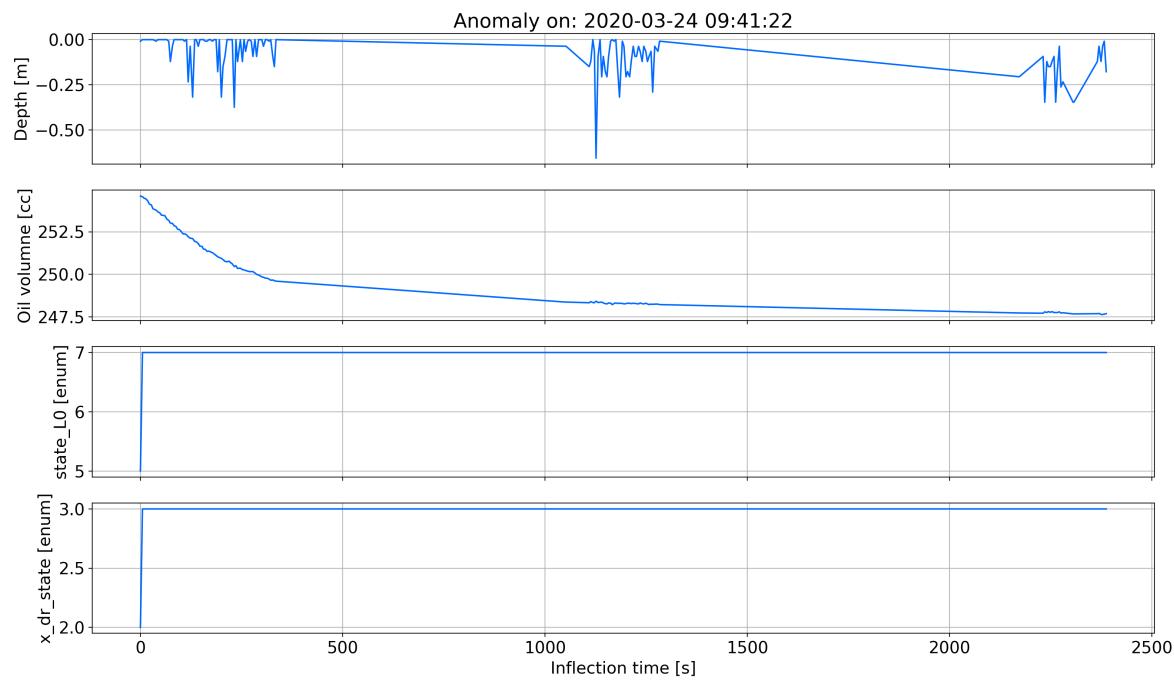


Figure 2.6: 20200324T094122 Anomaly 24

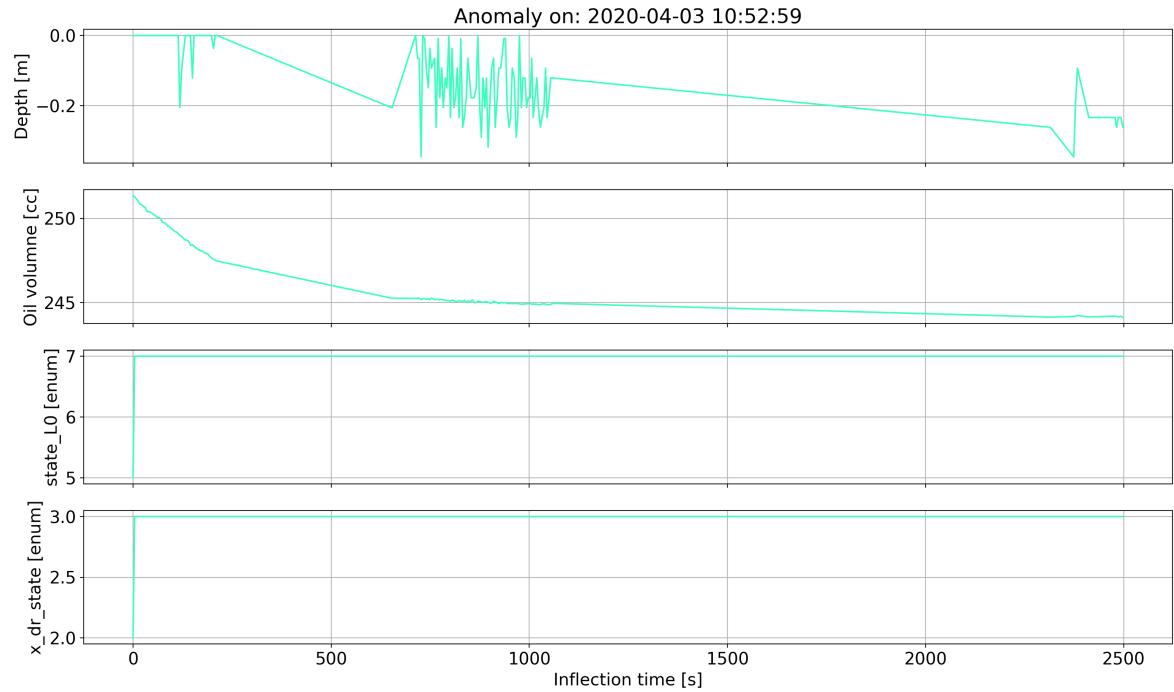


Figure 2.7: 20200403T105259 Anomaly 50

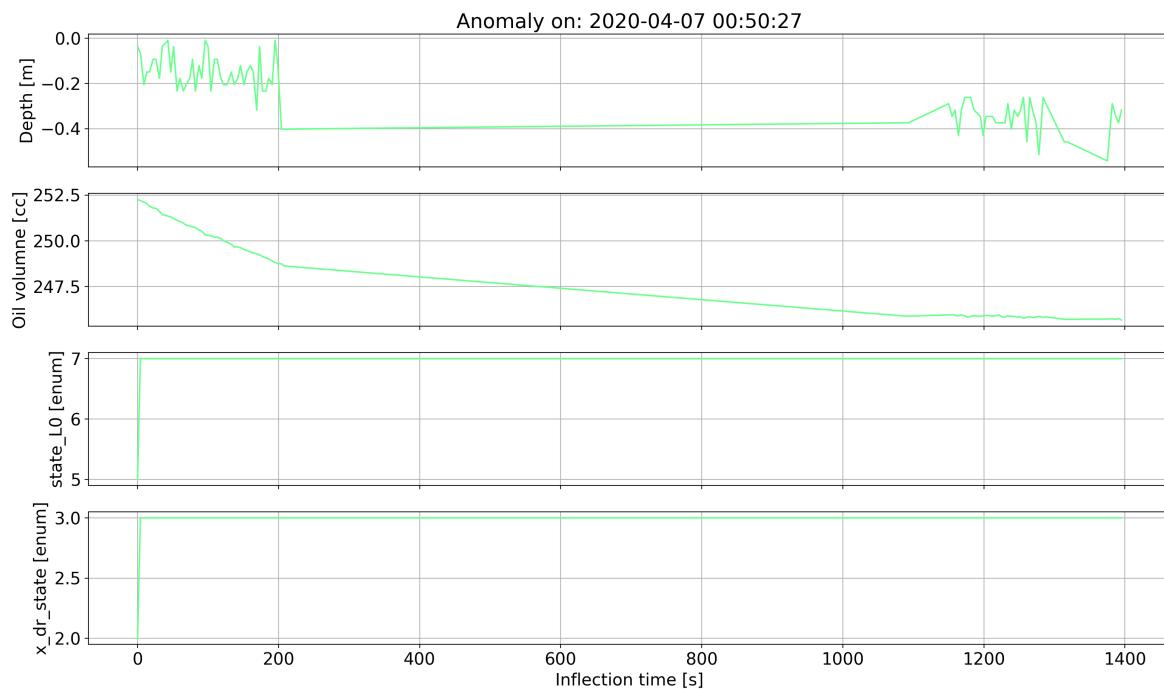


Figure 2.8: 20200407T005027 Anomaly 59

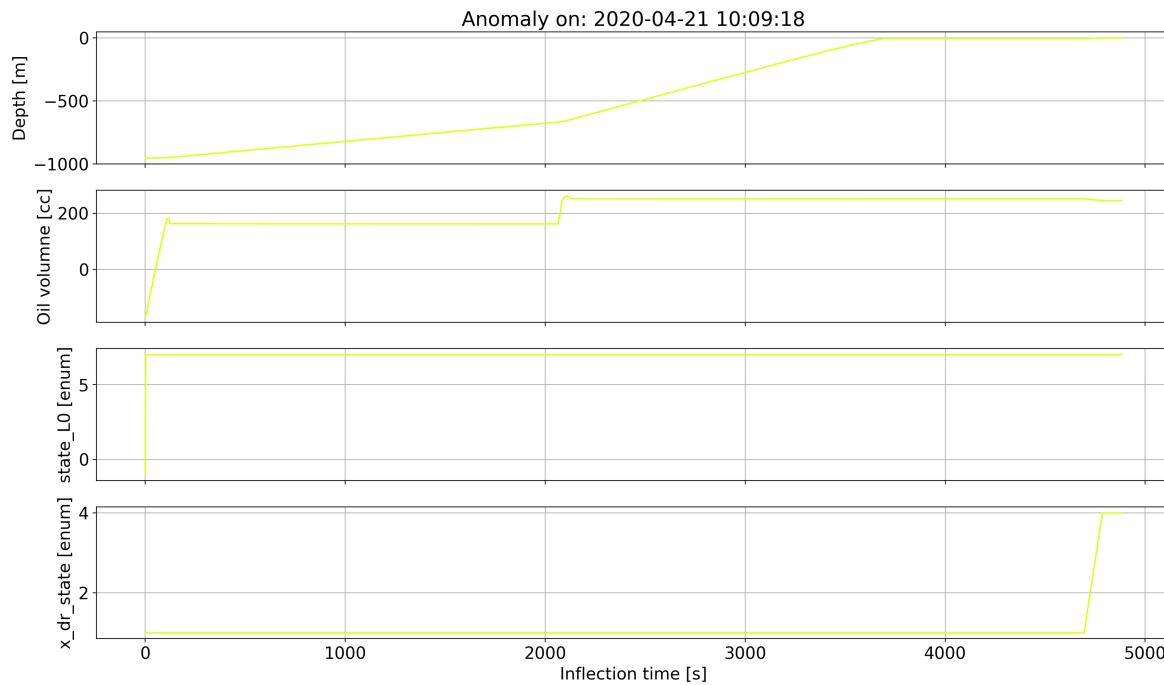


Figure 2.9: 20200421T100918 Anomaly 77

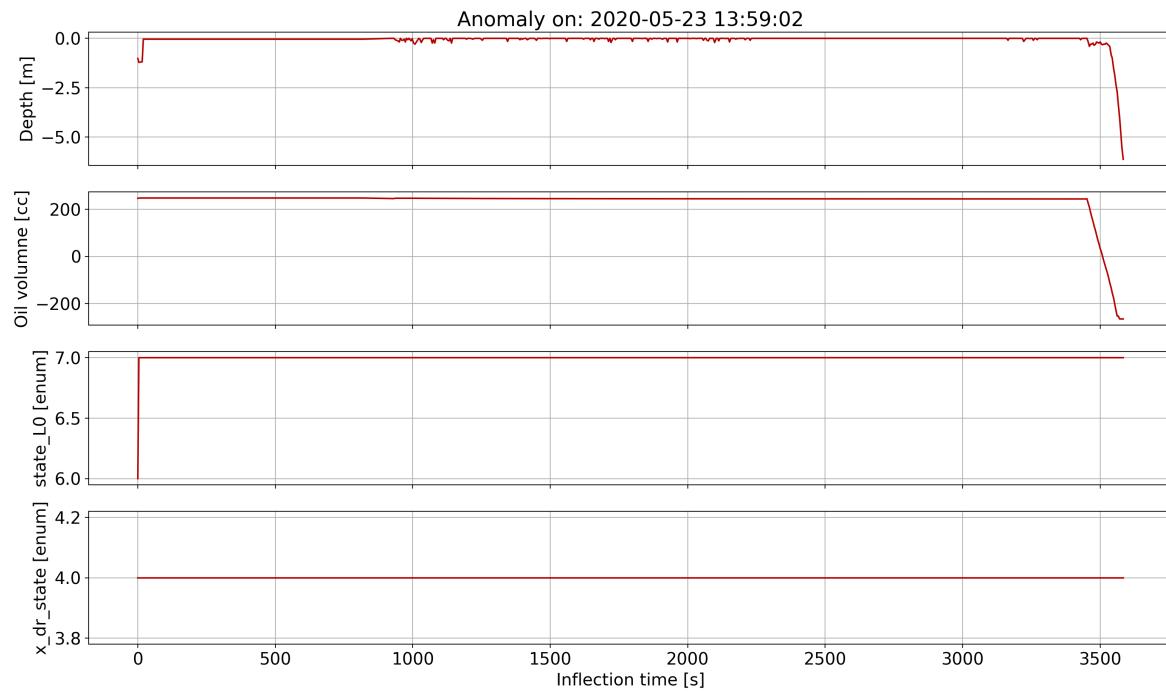


Figure 2.10: 20200523T135902 Anomaly 84

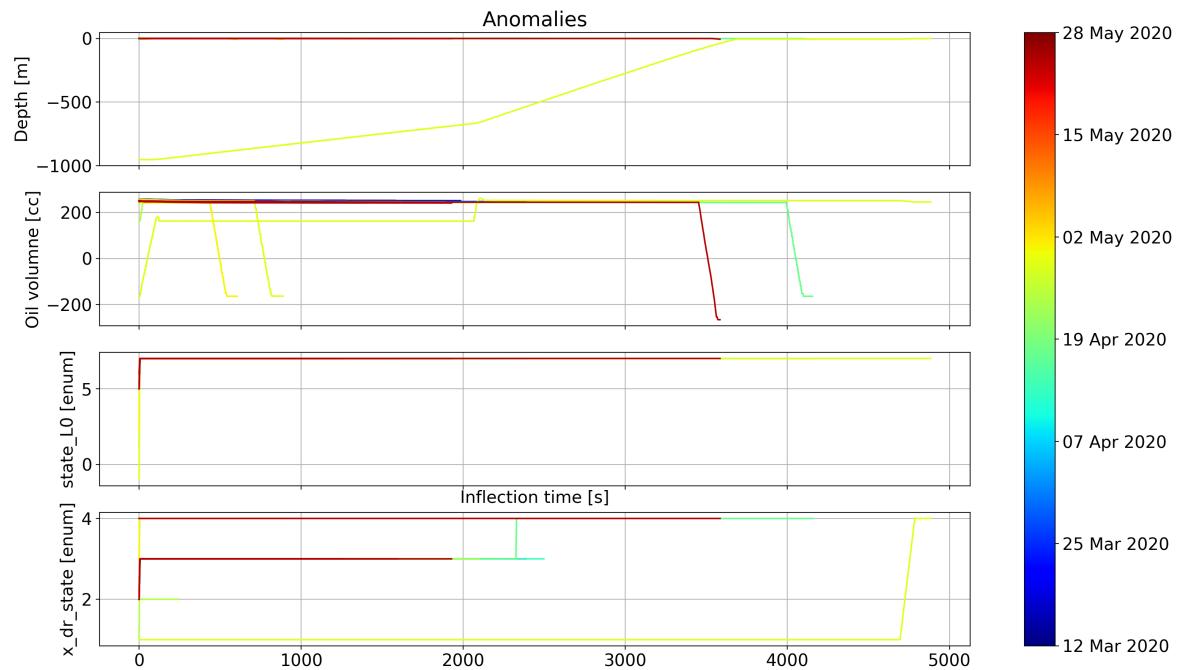


Figure 2.11: Anomalies (time)

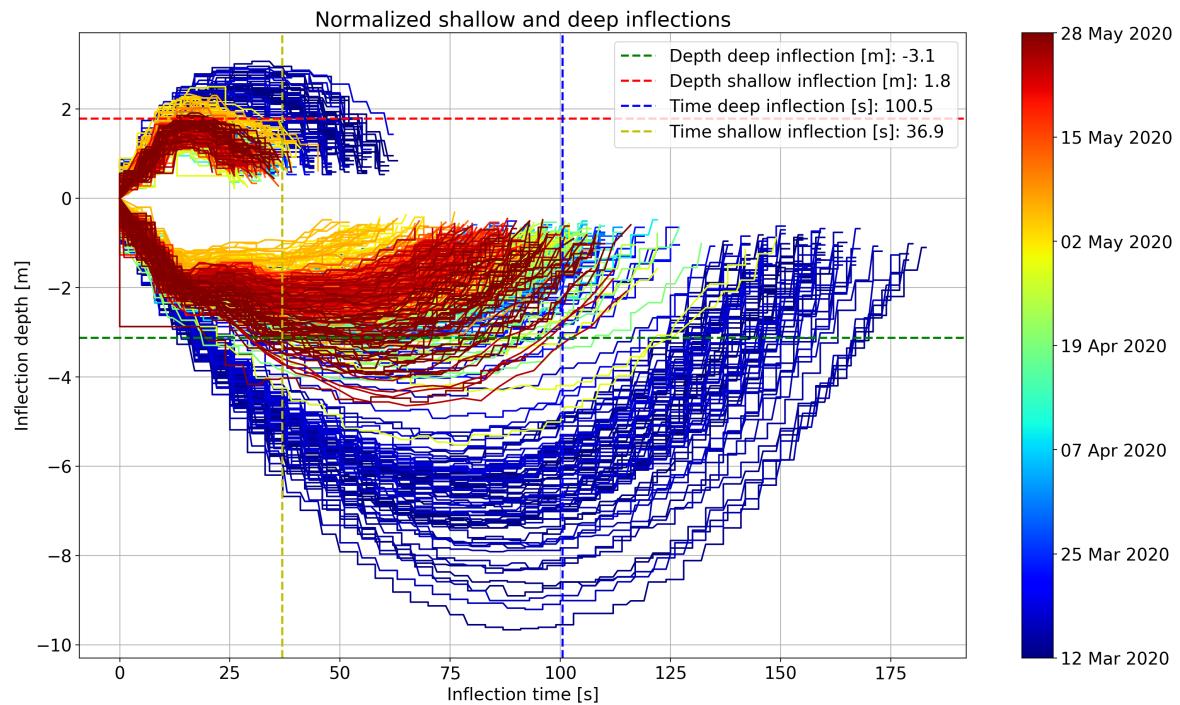


Figure 2.12: Depth inflections

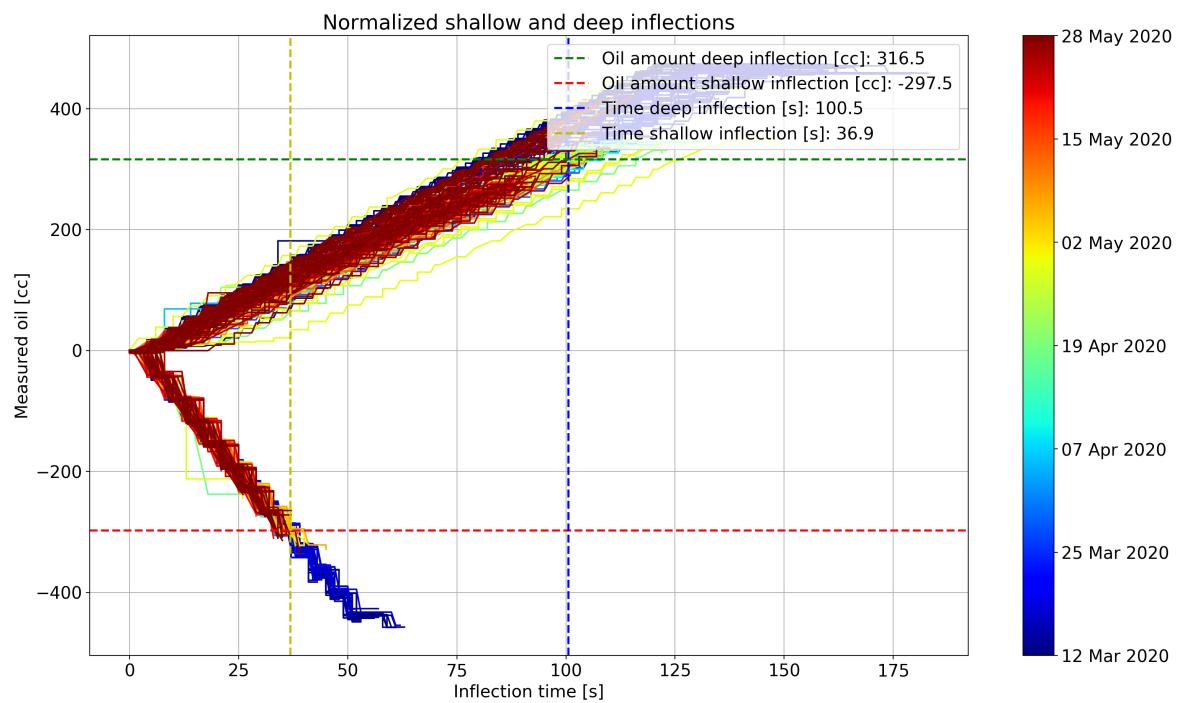


Figure 2.13: Oil inflections

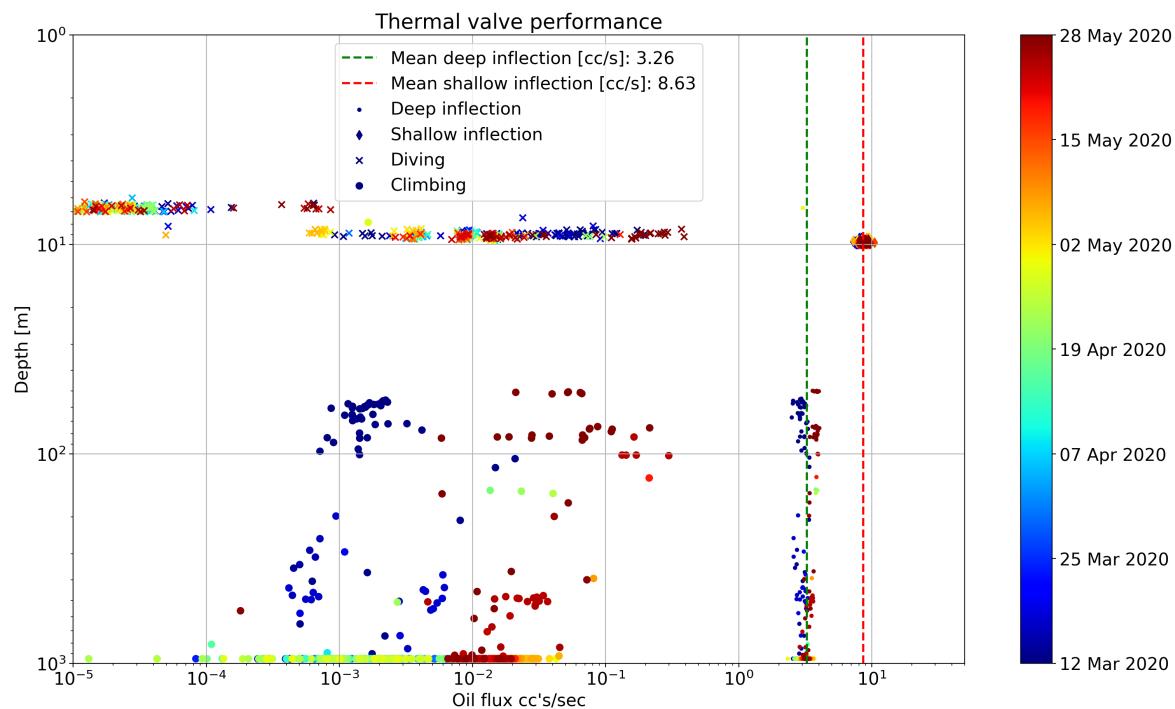


Figure 2.14: Oil flux

Normalized shallow and deep inflections

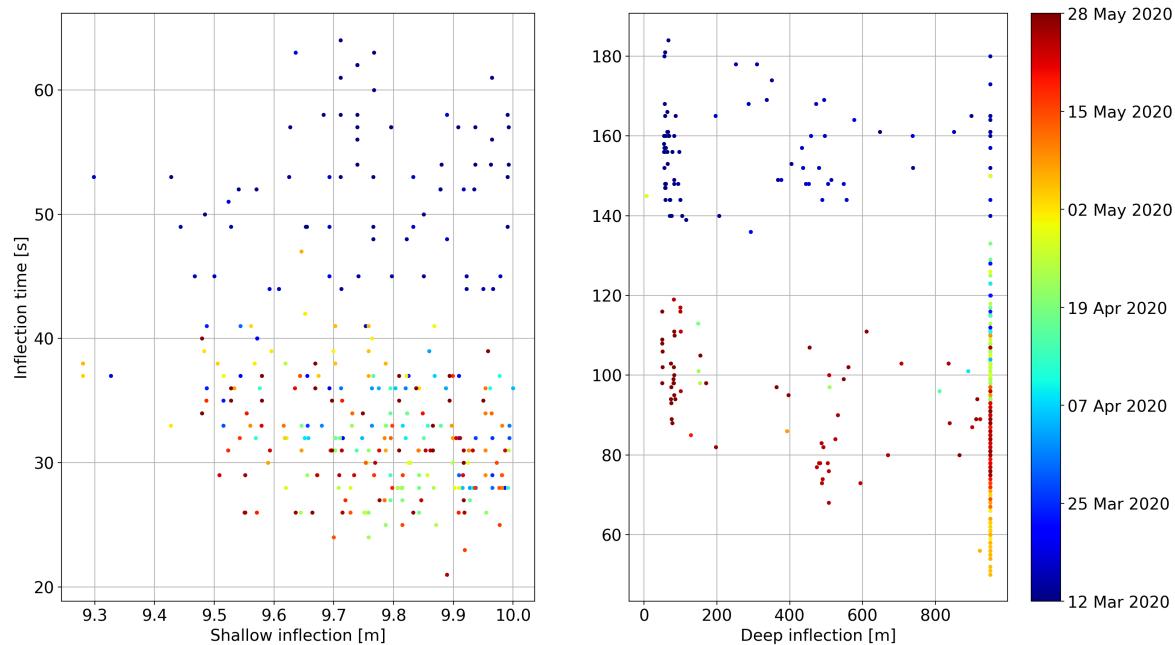


Figure 2.15: Duration inflections

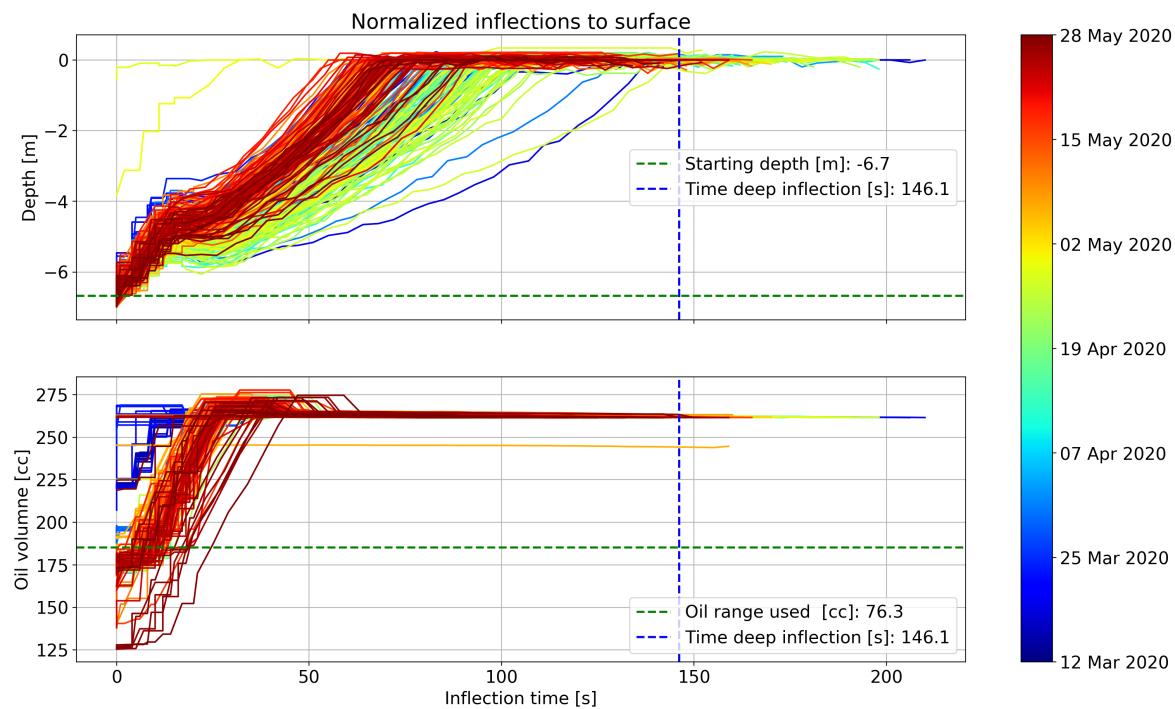


Figure 2.16: Surface Oil inflections

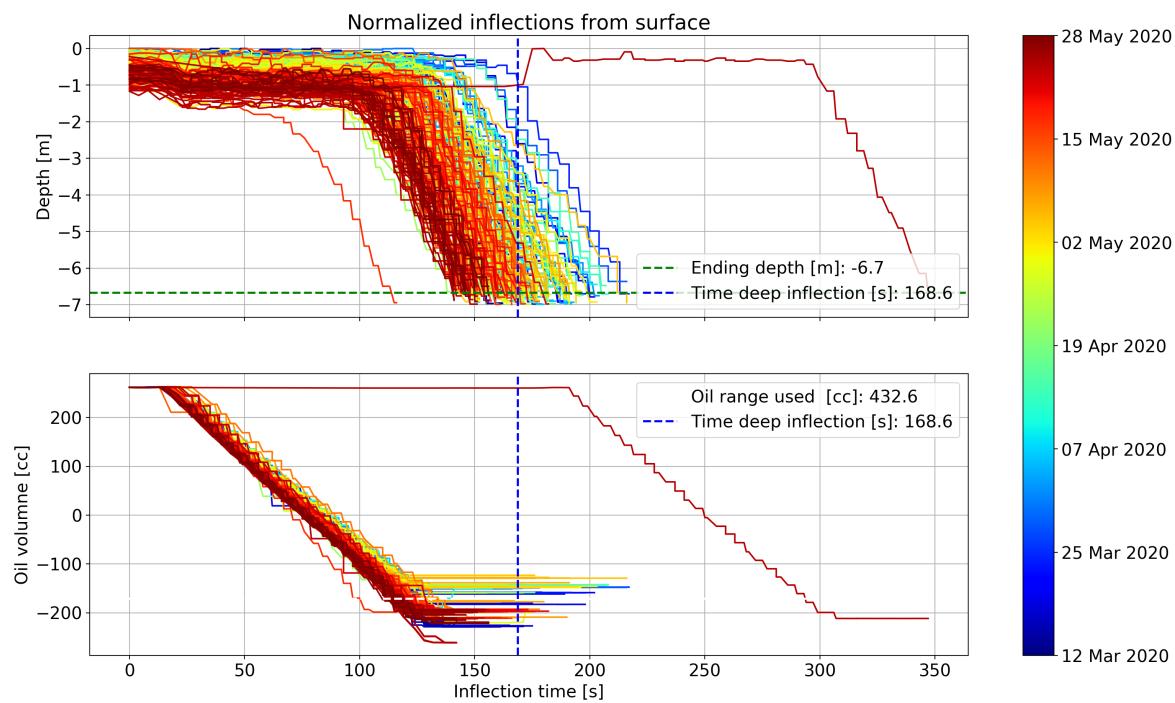


Figure 2.17: Surface Duration inflections

Flying pitch and roll

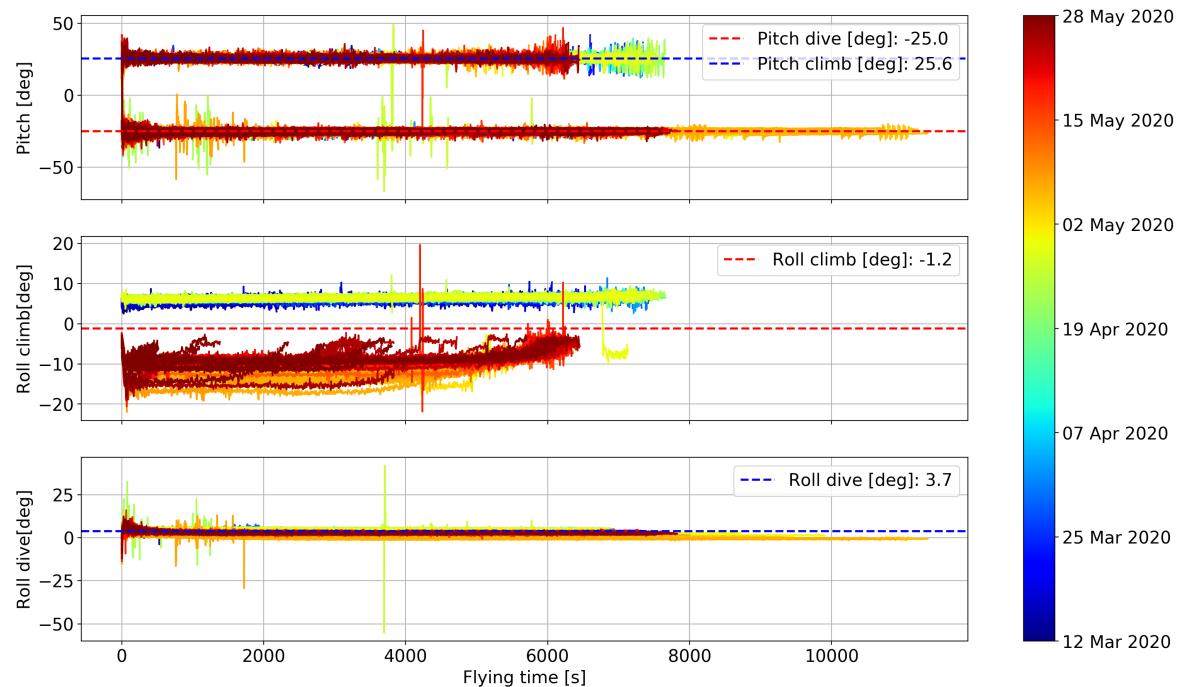


Figure 2.18: Pitch and roll, when climbing and diving

3 Scientific Preliminary Review

3.1 SCI Profiles

Calibration sheets available upon request to glider@socib.es

Sensor	Serial number	Calibration date	Casts	Half YOs	Samples	Intersample time [s]*	Sampled distance [km]
CTD	9239	20191024	1106	1116	2097128	3.012	872.9
FLNTU- FLBBCDSLC	na	na	na	na	na	na	na
OXY 3-4	0360	20200106	1101	1116	660431	9.513	868.4
PAR	na	na	na	na	na	na	na
Hydrophone	na	na	na	na	na	na	na
Microrider	0125	na	na	na	na	na	na

* See appendix for sampling strategy details and changes during the mission

Sensor parameters set:

CTD	CC's per second	na
FLx	Chlorophyll dark count	na
FLx	Turbidity dark count	na
FLx	CDOM dark count	na
FLx	BB700 dark count	na

3.2 SCI plots

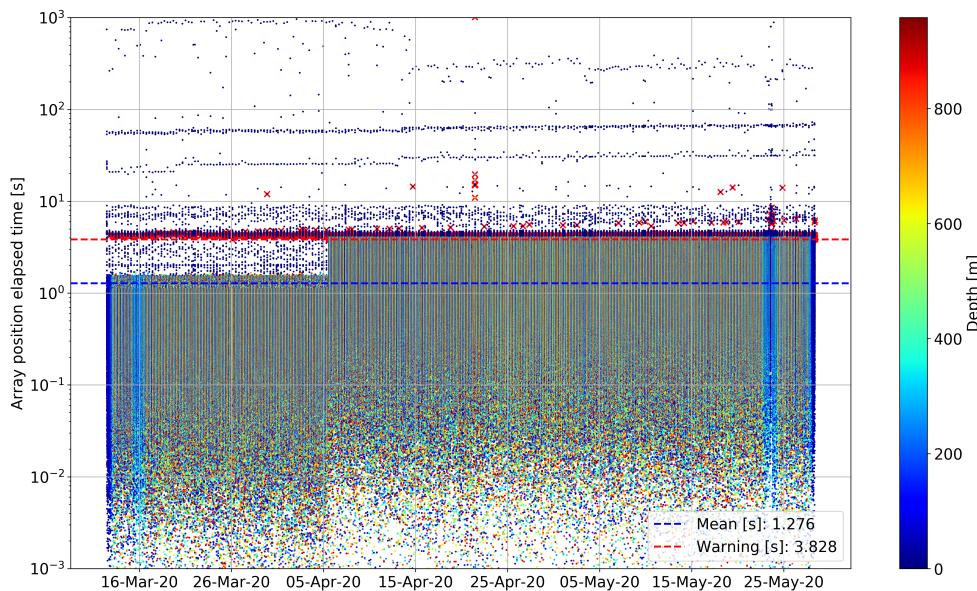


Figure 3.1: Array time

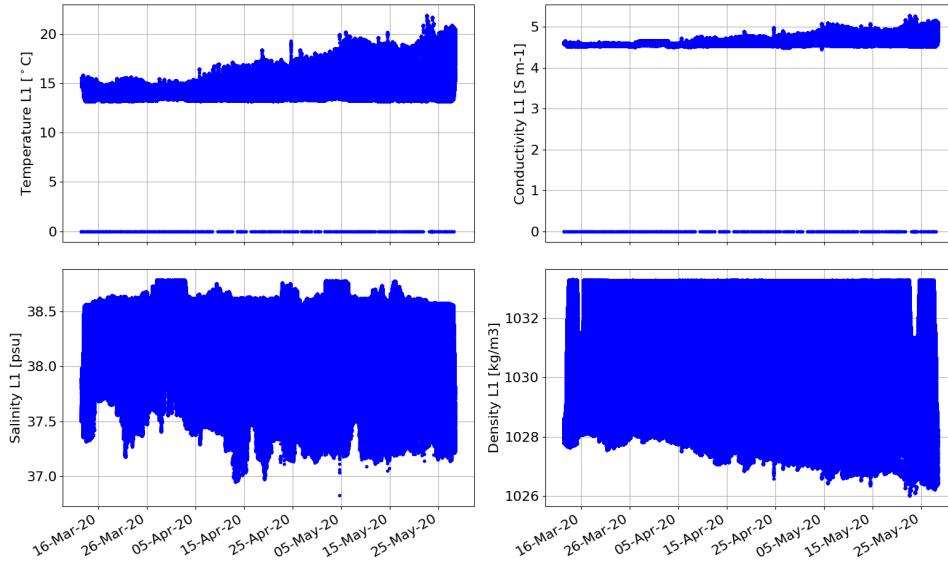


Figure 3.2: Raw CTD L1

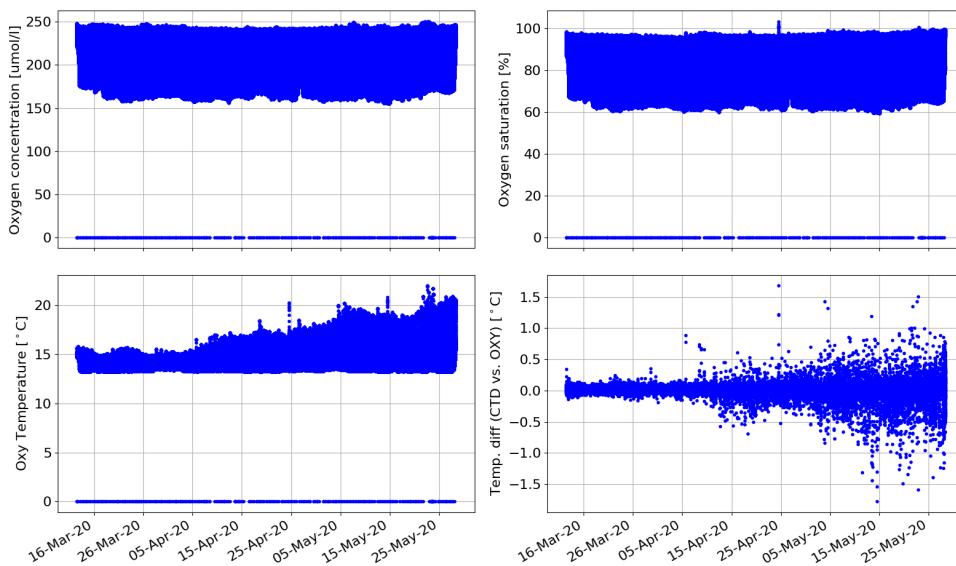


Figure 3.3: Raw OXY L1

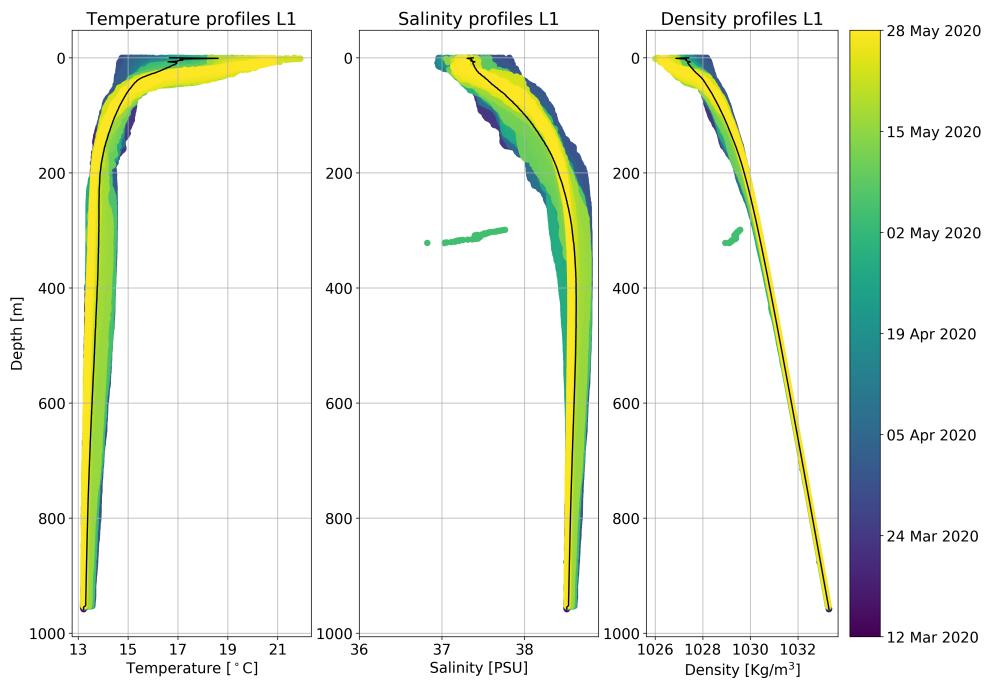


Figure 3.4: CTD profiles

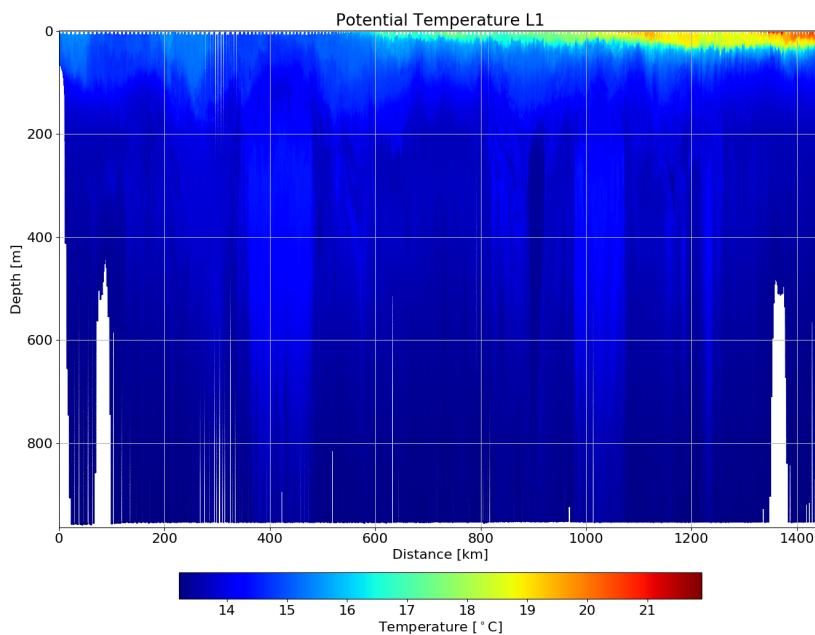


Figure 3.5: CTD temperature

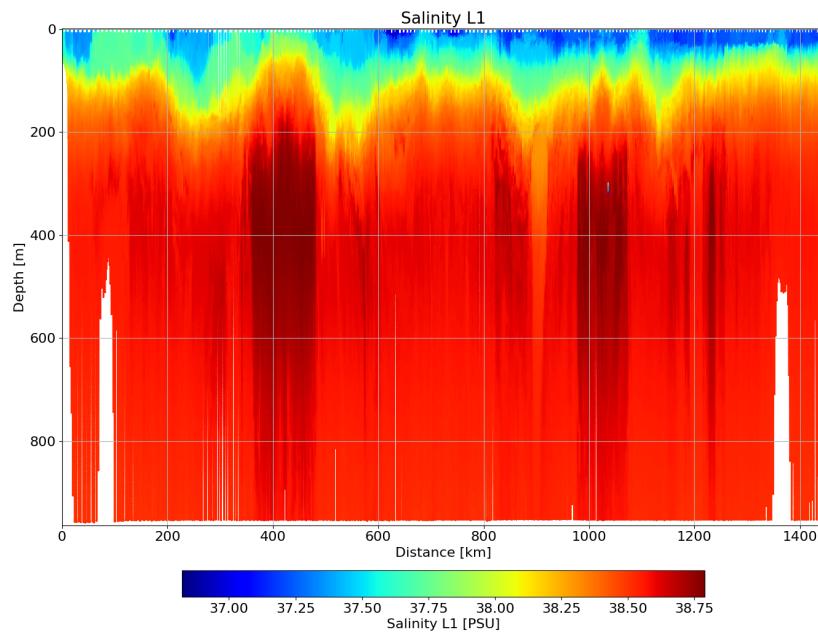


Figure 3.6: CTD Salinity

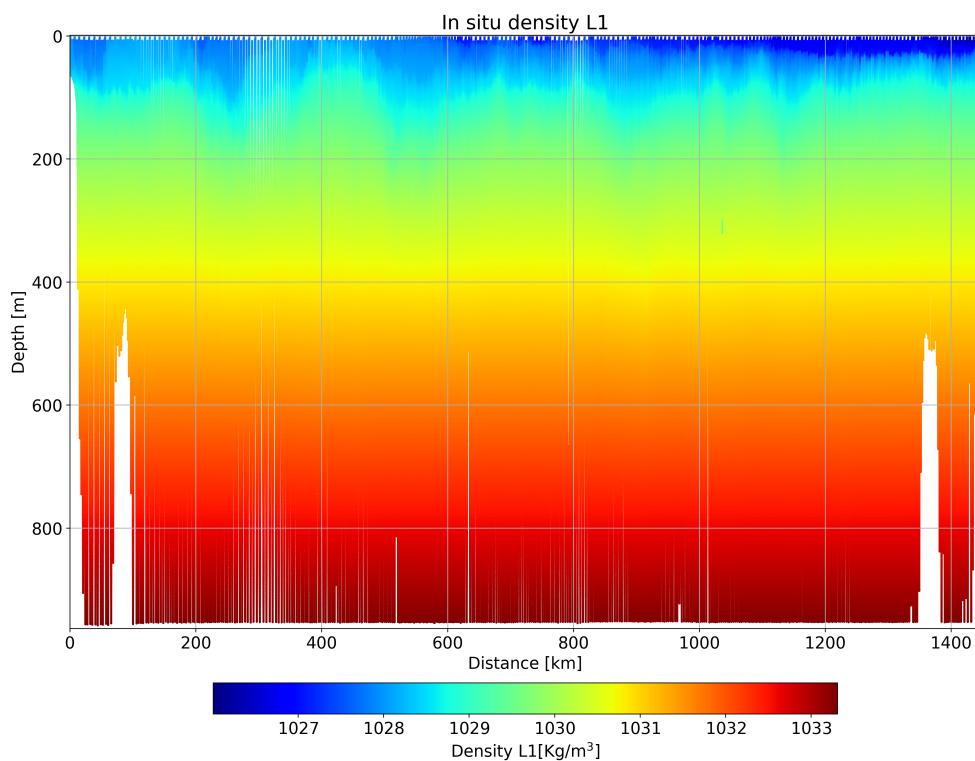


Figure 3.7: CTD Density

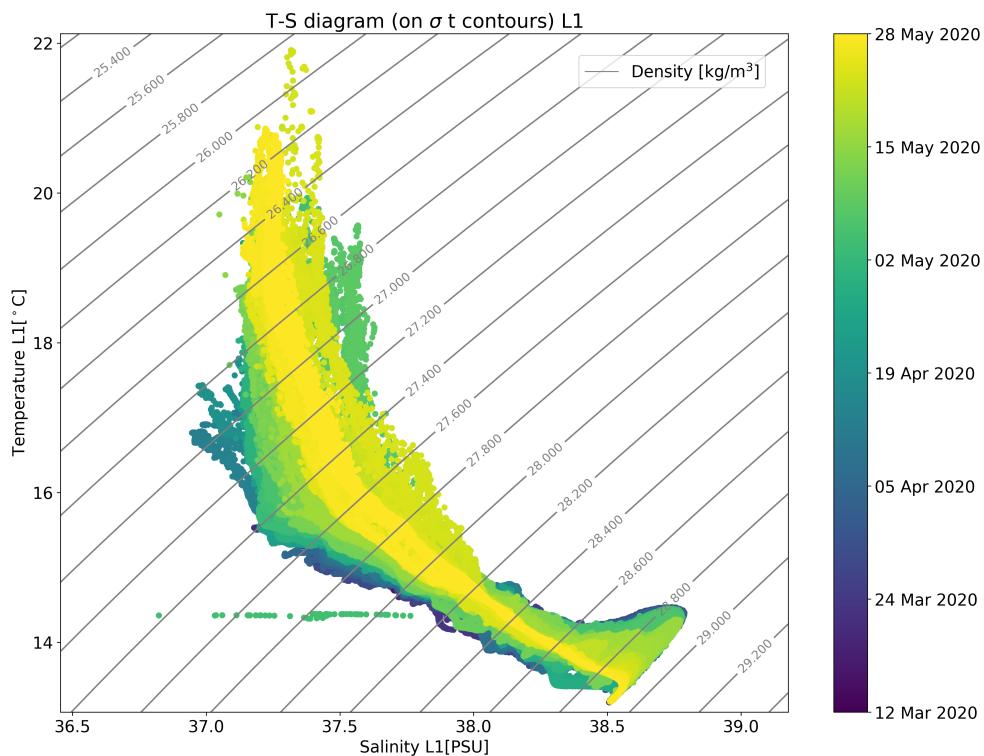


Figure 3.8: TS diagram (CTD)

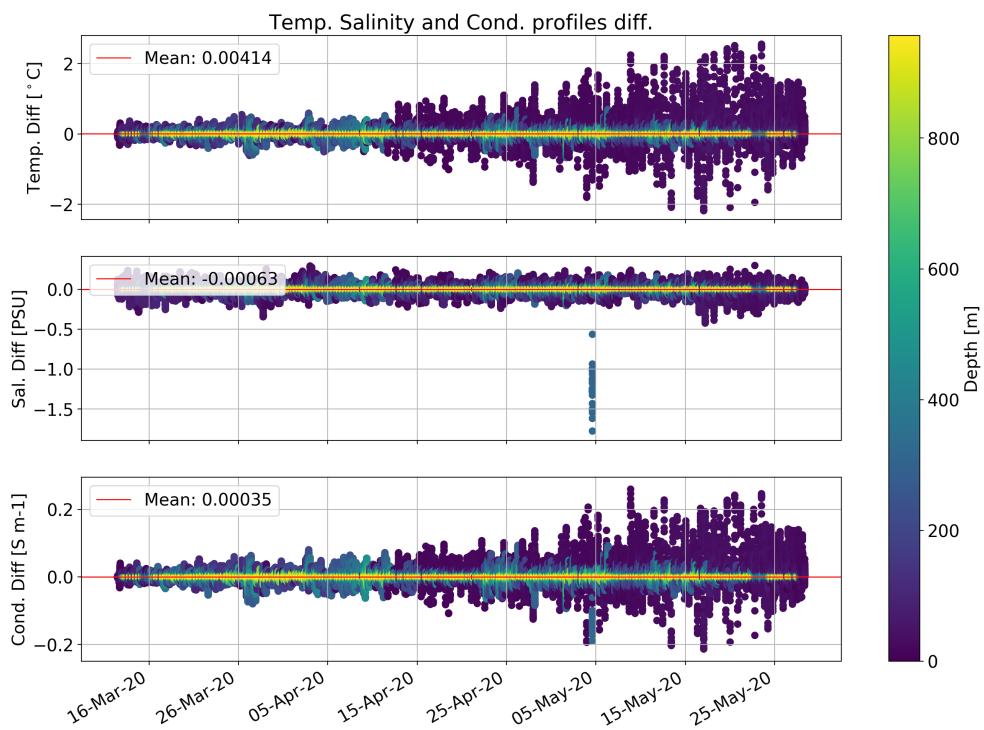


Figure 3.9: Profile consistency (CTD)

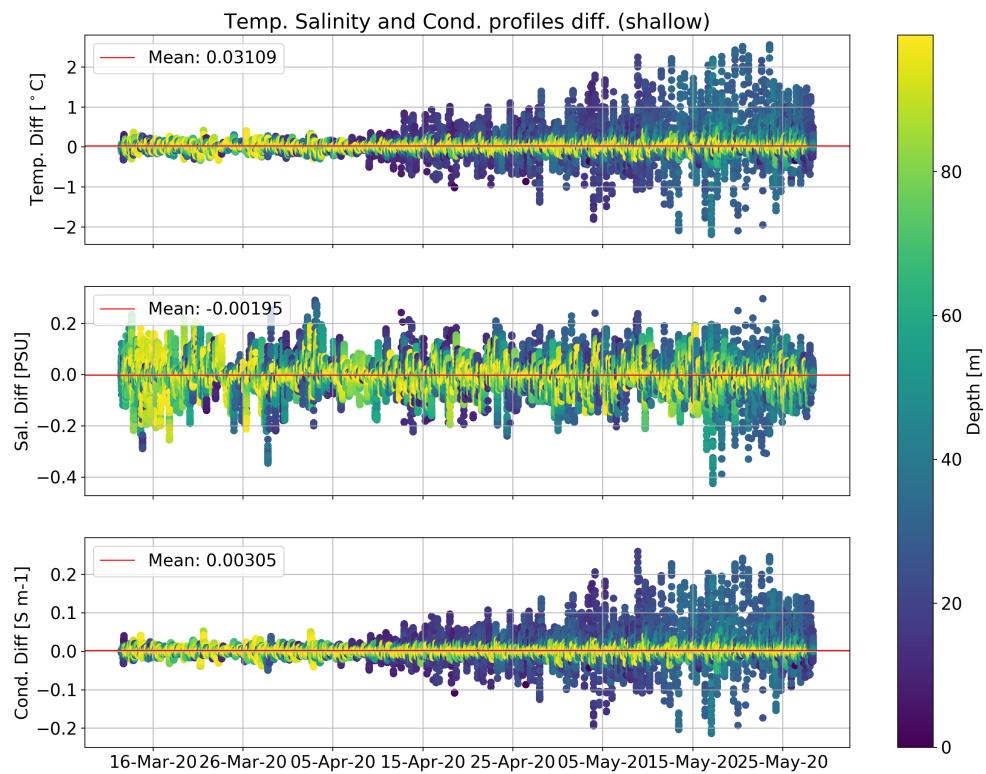


Figure 3.10: Profile consistency (CTD) zoom

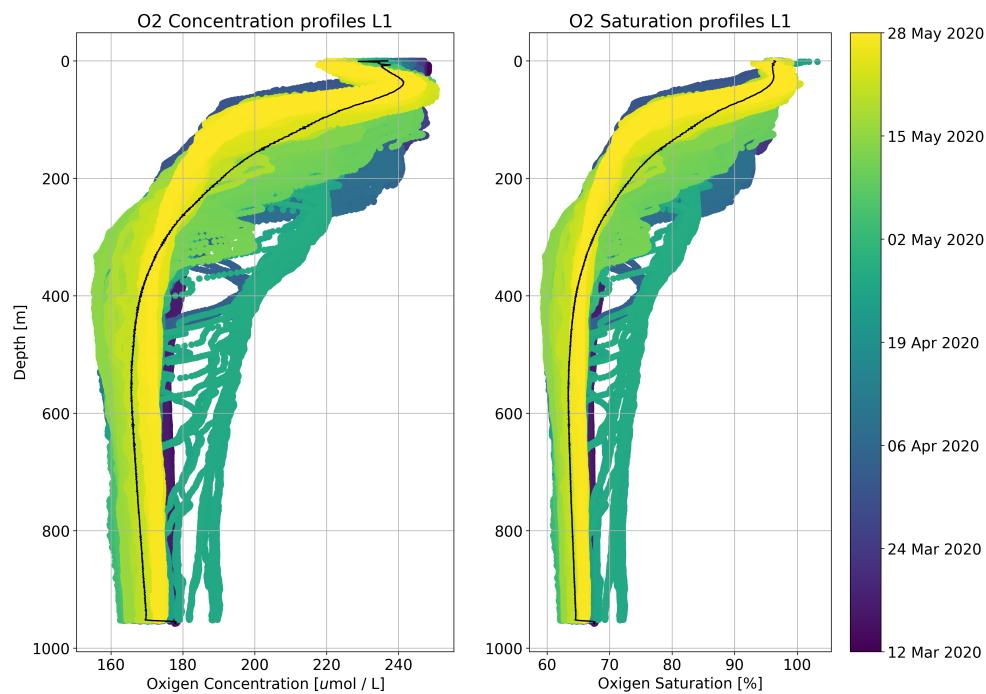


Figure 3.11: Oxygen profiles

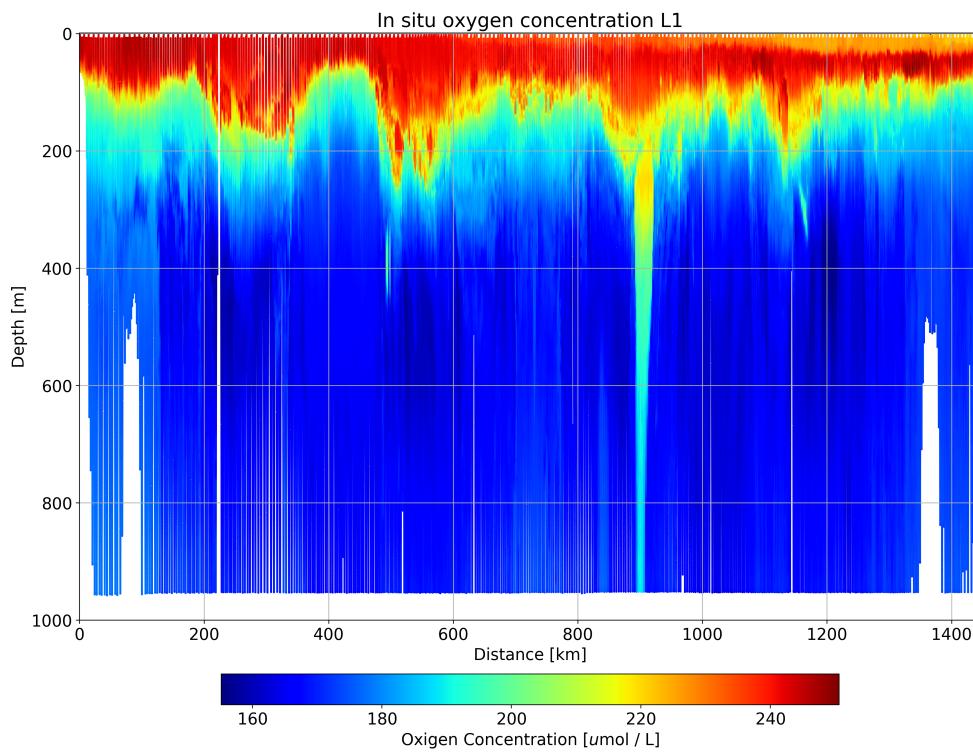


Figure 3.12: Oxygen Concentration

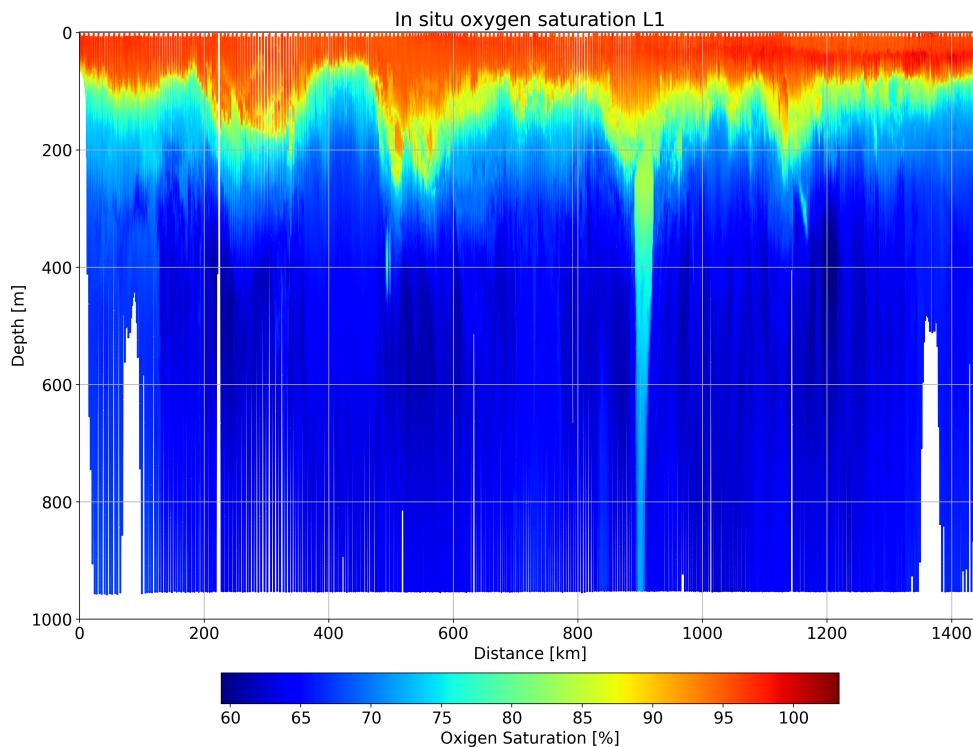


Figure 3.13: Oxygen Saturation

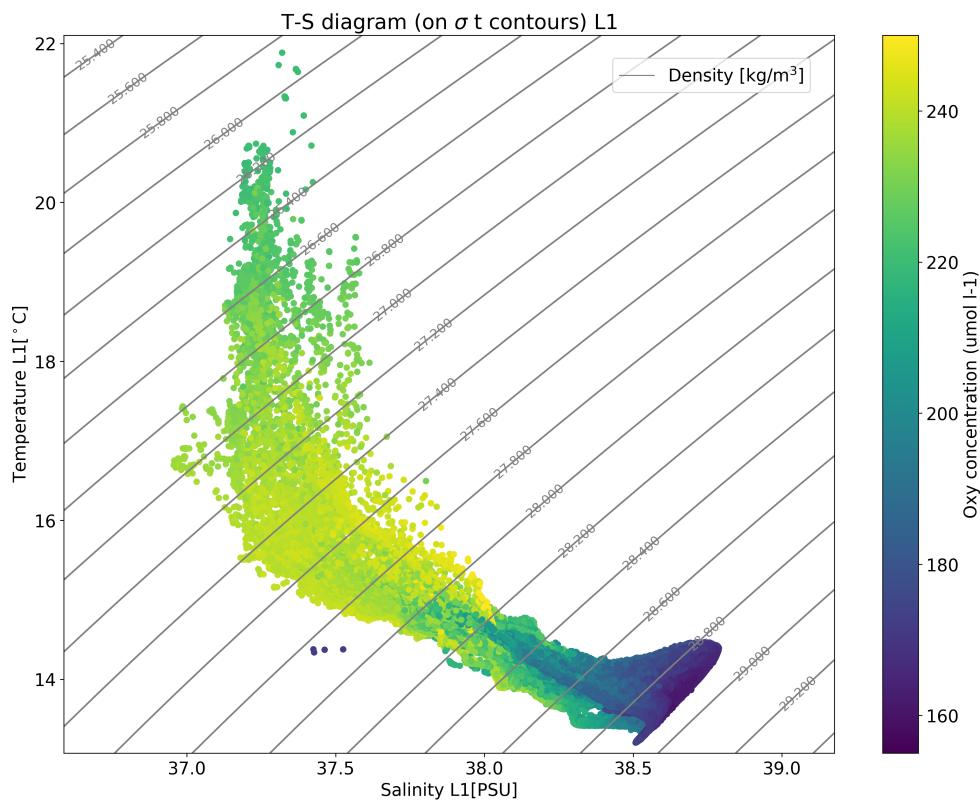


Figure 3.14: TS diagram (OXY)

4 Appendix

4.1 Glider behaviour

Showing changes on Sampling :

- 12 Mar 2020 10:45:23 @ Sampling of: sample13.ma
- 12 Mar 2020 10:45:24 @ Sampling state to sample set to: Diving, climbing and hovering
- 12 Mar 2020 10:45:24 @ Sampling argument: intersample time set to: 0.0 s
- 12 Mar 2020 10:45:24 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Mar 2020 10:45:25 @ Sampling argument: min depth set to: -5.0 m
- 12 Mar 2020 10:45:25 @ Sampling argument: max depth set to: 2000.0 m
- 15 Mar 2020 03:30:22 @ Sampling argument: intersample time set to: -1.0 s

Showing changes on Sampling :

- 12 Mar 2020 10:45:25 @ Sampling of: sample12.ma
- 12 Mar 2020 10:45:25 @ Sampling state to sample set to: Diving and climbing
- 12 Mar 2020 10:45:25 @ Sampling argument: intersample time set to: 8.0 s
- 12 Mar 2020 10:45:26 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Mar 2020 10:45:26 @ Sampling argument: min depth set to: -5.0 m
- 12 Mar 2020 10:45:26 @ Sampling argument: max depth set to: 2000.0 m

Showing changes on Sampling :

- 12 Mar 2020 10:45:26 @ Sampling of: sample11.ma
- 12 Mar 2020 10:45:26 @ Sampling state to sample set to: Diving and climbing
- 12 Mar 2020 10:45:26 @ Sampling argument: intersample time set to: 2.0 s
- 12 Mar 2020 10:45:26 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Mar 2020 10:45:27 @ Sampling argument: min depth set to: -5.0 m
- 12 Mar 2020 10:45:27 @ Sampling argument: max depth set to: 2000.0 m

Showing changes on Yoing :

- 12 Mar 2020 10:45:27 @ Yoing num half cycles to do(nodim) set to: 2.0
- 12 Mar 2020 10:45:27 @ Yoing d target depth(m) set to: 950.0
- 12 Mar 2020 10:45:27 @ Yoing d bpump value(X) set to: -233.0
- 12 Mar 2020 10:45:27 @ Yoing d target altitude(m) set to: 40.0
- 12 Mar 2020 10:45:27 @ Yoing d use pitch(enum) set to: 3.0
- 12 Mar 2020 10:45:27 @ Yoing d pitch value(X) set to: -0.453700
- 12 Mar 2020 10:45:27 @ Yoing c use pitch(enum) set to: 3.0
- 12 Mar 2020 10:45:27 @ Yoing c pitch value(X) set to: 0.453700
- 12 Mar 2020 11:21:12 @ Yoing num half cycles to do(nodim) set to: -1.0
- 12 Mar 2020 11:21:12 @ Yoing d target altitude(m) set to: 20.0
- 16 Mar 2020 18:29:33 @ Yoing d bpump value(X) set to: -190.0
- 17 Mar 2020 10:25:27 @ Yoing num half cycles to do(nodim) set to: 4.0
- 17 Mar 2020 10:25:27 @ Yoing d bpump value(X) set to: -170.0
- 20 Mar 2020 16:45:37 @ Yoing d bpump value(X) set to: -160.0
- 21 Apr 2020 11:29:13 @ Yoing num half cycles to do(nodim) set to: 2.0
- 21 Apr 2020 11:29:13 @ Yoing d target depth(m) set to: 5.0
- 21 Apr 2020 11:29:13 @ Yoing d bpump value(X) set to: -233.0
- 21 Apr 2020 11:29:13 @ Yoing d target altitude(m) set to: 40.0
- 21 Apr 2020 11:29:13 @ Yoing d pitch value(X) set to: -0.453800
- 21 Apr 2020 11:29:14 @ Yoing c pitch value(X) set to: 0.453800
- 21 Apr 2020 11:45:00 @ Yoing num half cycles to do(nodim) set to: 4.0
- 21 Apr 2020 11:45:00 @ Yoing d target depth(m) set to: 950.0
- 21 Apr 2020 11:45:00 @ Yoing d bpump value(X) set to: -160.0
- 21 Apr 2020 11:45:00 @ Yoing d target altitude(m) set to: 20.0
- 21 Apr 2020 11:45:00 @ Yoing d pitch value(X) set to: -0.453700

- 21 Apr 2020 11:45:01 @ Yoing c pitch value(X) set to: 0.453700
- 28 Apr 2020 17:59:43 @ Yoing d bpump value(X) set to: -140.0
- 01 May 2020 14:12:10 @ Yoing d bpump value(X) set to: -190.0
- 02 May 2020 13:23:17 @ Yoing d bpump value(X) set to: -210.0
- 26 May 2020 09:02:03 @ Yoing num half cycles to do(nodim) set to: -1.0
- 27 May 2020 17:42:26 @ Yoing d bpump value(X) set to: -230.0
- 28 May 2020 07:35:07 @ Yoing num half cycles to do(nodim) set to: 4.0
- 28 May 2020 07:35:07 @ Yoing d target depth(m) set to: 50.0

Showing changes on Altimeter set to :

- 12 Mar 2020 11:01:57 @ Altimeter set to u alt min depth set to: 2
- 24 Mar 2020 09:43:20 @ Altimeter set to u alt min depth set to: 900
- 01 Apr 2020 09:39:27 @ Altimeter set to u alt min depth set to: 1000
- 21 May 2020 18:10:06 @ Altimeter set to u alt min depth set to: 2

4.2 Installed devices (from autoexec.mi)

- Forward section assy _SN: 0267
- Payload bay assy _SN: 1149
- Aft section assy _SN: 0860
- Aft electronic assy _SN: 0858
- Aft end cap assy _SN: 0861
- Diginfin _SN: 1557
- Strobe assy _SN: 1234
- Pressure transducer _SN: 96654
- Aft hull _SN: 0944
- Fwd hull _SN: 0935
- Freewave master _SN: 862-6459
- Iridium sim card _SN: 8988169214001025941
- Argos ID _SN: 146191-dec/D96C8F2-hex
- Altimeter _SN: 3070140
- Pitch motor _SN: 1279
- 1000- Motor _SN: controller0397
- 1000- Front air pump _SN: 0380
- 1000- Pump assy _SN: 0371
- 1000- Valve assy _SN: 0379
- Science persistor _SN: 1068
- science motherboard _SN: jj02834
- Science flashcard _SN: 0585
- seabird CTD _SN: 9239
- Microrider _SN: 0125
- Aanderaa Optode _SN: 0360
- Main board _SN: jj02686
- Communication board _SN: jj02265
- Iridium phone _SN: 0985
- Main flashcard _SN: 0510
- Main persistor _SN: 1051
- Attitude sensor _SN: 36133
- Air pump _SN: 1388
- Communications Assy _SN: 0789
- Freewave Slave _SN: 864-0702
- GPS _SN: 1131
- Argos X-cat _SN: 0862
- Air bladder _SN: 1362

4.3 Possible Iridium states

- MODEM NO CARRIER = 0
- MODEM OK = 1
- MODEM CONNECT = 2
- MODEM ERROR = 3
- MODEM NO ANSWER = 4
- MODEM BUSY = 5
- MODEM NO DIALTONE = 6
- LOGGING IN = 7
- LOGGED ON = 8
- MODEM AWAITING OK = 10
- MODEM AWAITING CONNECTION = 11
- MODEM TIMEOUT = 12
- MODEM UNKNOWN = 99
- NO CHARS TIMEOUT = 100

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