

SOCIB Glider Mission Summary Report

SOCIB-ENL-CANALES-JAN2021_U827_sdeep06_GFMR0109

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Contributors: ETD and DC team

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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.

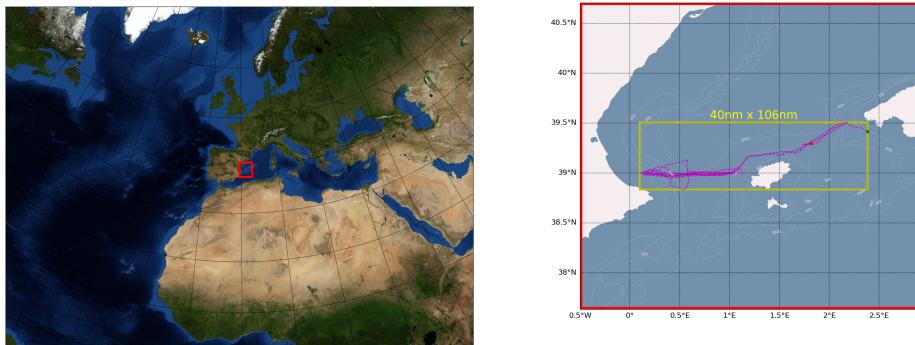


Figure 1.1: Map providing general overview of the Survey Area

1.1 Summary

Mission name	SOCIB-ENL-CANALES-JAN2021_U827_sdeep06_GFMR0109
Platform model	G3 Electric
Platform ID / Name / WMO Code	U827/ sdeep06/ 6801637
Software NAV version	Version 10.02 tags/V10.02-0-gfdea92ab (0, 1)
Software SCI version	Version 10.02 tags/V10.02-0-gfdea92ab (0, 1)
FWD bay sn	0518
SCI bay sn	1348
Mission duration	68.3 days
Mission start	2021-01-12 13:00:00
Mission end	2021-03-21 20:35:53
Total distance	1294.0[km] 698.7[nm]
Deployment point [dd°mm.mmmm']	N 39°24.9030' E 02°23.0610'
Recovery point [dd°mm.mmmm']	N 39°17.7889' E 01°49.1921'
Battery Consumption (Ah)	408.9(from 83.2 to 492.1)
Battery specification	20200716 SN0042/ TWR 4S lithium (550Ah)
Survey area	Palma Bay
Objetive	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.
Abstract	Deployment of Slocum G3 deep glider sdeep06 in endurance line campaign Canales JAN2021 (SOCIB operational program), aiming the coverage of the Eivissa channel (6 transects) and Mallorca channel (2 transect) from JAN to FEB 2021, sampling physical and biogeochemical parimeters (CTD, BSK, fluorescence and turbidity, and PAR. NO OXY data aviable).

NAV events	<ul style="list-style-type: none"> ▪ Event 1: Biofouling collected for the UIB ▪ Event 2: Unexpected abort on the previous day of the recovery, using 4S TWR batts. ▪ Event 3: Hard currents in Denia ▪ Event 4: Reduced oil leak in time, see figure 2.29 ▪ Event 5: High differences in shallow and deep inflections (72 vs 16 seconds) see figure 2.27 ▪ Event 6: Time gap, up to 10seconds at depth, see figure 3.1
SCI events	<ul style="list-style-type: none"> ▪ Event 1: There are a few CTD profiles that have issues and gave us strange ranges in temperature, salinity, and conductivity. In addition, we have 139 outlines in temperature, conductivity, salinity, and oxygen. In the upper 100m several patches of low salinity and warm waters are present. These patches have the thermohaline characteristics of the AW that lateral advected in the Balearic Sea. Furthermore, it is worth mentioning that for the first time, we are able to observe and be almost certain that we capture the different flavors of the deep water during this mission. At the beginning, we have assumed that this could be caused by sensor drifting, however, if we look more closely at the TS diagrams (time-color coded) we identify that the profiles of the mission at the beginning of the mission (in dark blue), indicate that the deep waters are less salty. Besides, after a period the deep water becomes saltier and then less salty until the deep water becomes saltier again. These changes indicate that the captured observations are valid since if these changes were due to sensor drifting there would be changed only in one direction of the salinity measurements. During that period we requested a 1-day cruise that will be focused on the better characterization of the Levantine Intermediate Water (LIW), however, our director denied the request for logistic issues. The cruise plan for cross-validating the glider ctd sensor with ctd rosette is located here https://drive.google.com/file/d/1CbbgF-p6cK44B07AKhA33XbTDs0Y8ab8/view?ts=605383da. Furthermore, mixing occurred in the upper 100m of the water column, where redistribute the chl of the DCM to the first 100m of the water column, which is also present in the backscatter data. Furthermore, at the shelf in the Ibiza Channel, we observed an increase of particles near the bottom. ▪ Event 2: In CDOM, several spikes were observed and the values of CDOM on the vertical distribution are above normal compared with measurements in the area

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	Internal
Partnership / Participation	<ul style="list-style-type: none">▪ SOCIB
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/jd07-sv9
Further Details	glider@socib.es

*Available netCDF data product:

- L0: https://thredds.socib.es/thredds/fileServer/auv/glider/sdeep06-scb_sdeep006/L0/2021/dep0002_sdeep06_scb-sdeep006_L0_2021-01-12_data_dt.nc
- L1: https://thredds.socib.es/thredds/fileServer/auv/glider/sdeep06-scb_sdeep006/L1/2021/dep0002_sdeep06_scb-sdeep006_L1_2021-01-12_data_dt.nc
- L2: https://thredds.socib.es/thredds/fileServer/auv/glider/sdeep06-scb_sdeep006/L2/2021/dep0002_sdeep06_scb-sdeep006_L2_2021-01-12_data_dt.nc

2 Engineering Review

2.1 Preparation

- Premission: ok
- Hardware: ok
- Batteries: ok, using 4S TWR
- Comms: ok
- Science: ok
- Ballasting: ok
- Sealing: ok
- Fileset: ok
- CEM: na
- Harbor check: ok
- Recovery: ok, unexpected battery capacity
- Conclusion: ok

2.2 Mission Survey

- Deployment:
 - Vessel: SOCIB I
 - Personnel: 1 ETD + 1 GF (Field team) + 1 Guest + 1 GF (piloting)
 - Location: Palma Bay
- Navigation: The glider responded well to the commanded target waypoints.
- Underwater Maneuvering: Performed well
- Engineering sensors:

Sensor	Oddities	Warnings	Errors
GPS	198	8	0
pitch motor	23	0	0
science super	1	1	0
digifin	1348	22	0
altimeter	1	0	0
IRIDIUM	151	0	0
coulomb	18	0	0
HD PUMP	26010	0	0

- Communication Systems (see appendix for Iridium states):
 - Total number iridium calls [num]: 433
 - Iridium calls to secondary [num]: 39
 - ON overall iridium period [h]: 17.5
 - Iridium calls state from MODE NO CARRIER to MODE UNKNOWN [num]: 57
 - Iridium calls state from MODE OK to MODE UNKNOWN [num]: 5

- Iridium calls state from MODE CONNECT to MODE UNKNOWN [num]: 318
- Iridium calls state from MODE ERROR to MODE UNKNOWN [num]: 18
- Iridium calls state from MODE UNKNOWN to MODE AWAITING OK [num]: 489
- Iridium calls state from MODE AWAITING OK to MODE UNKNOWN [num]: 89
- Iridium calls state from MODE AWAITING CONNECTION to MODE UNKNOWN [num]: 2
- Drop calls (Iridium state from 2 to 99 with c_iridium on = 1) [num]: 60
- Unstable comms detected on: 2021-02-07 18:29:36
- Unstable comms detected on: 2021-03-02 10:29:21
- Hull/Hydrodynamics: No signs of problems
- Recovery:
 - Vessel: SOCIB I
 - Personnel: 2 ETD + 1 GF (piloting)
 - Location: Palma Bay

2.3 NAV plots

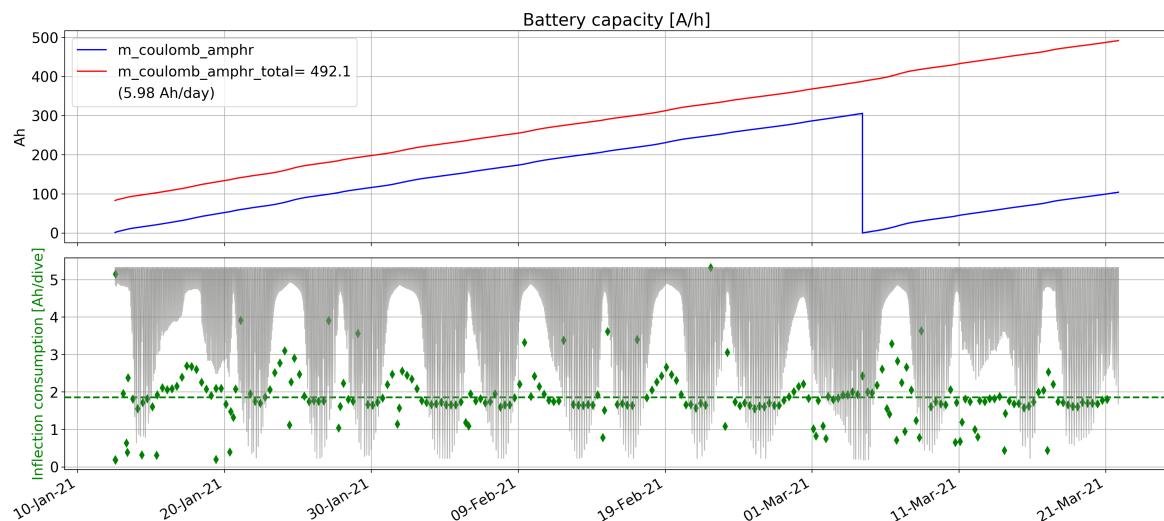


Figure 2.1: Battery capacity

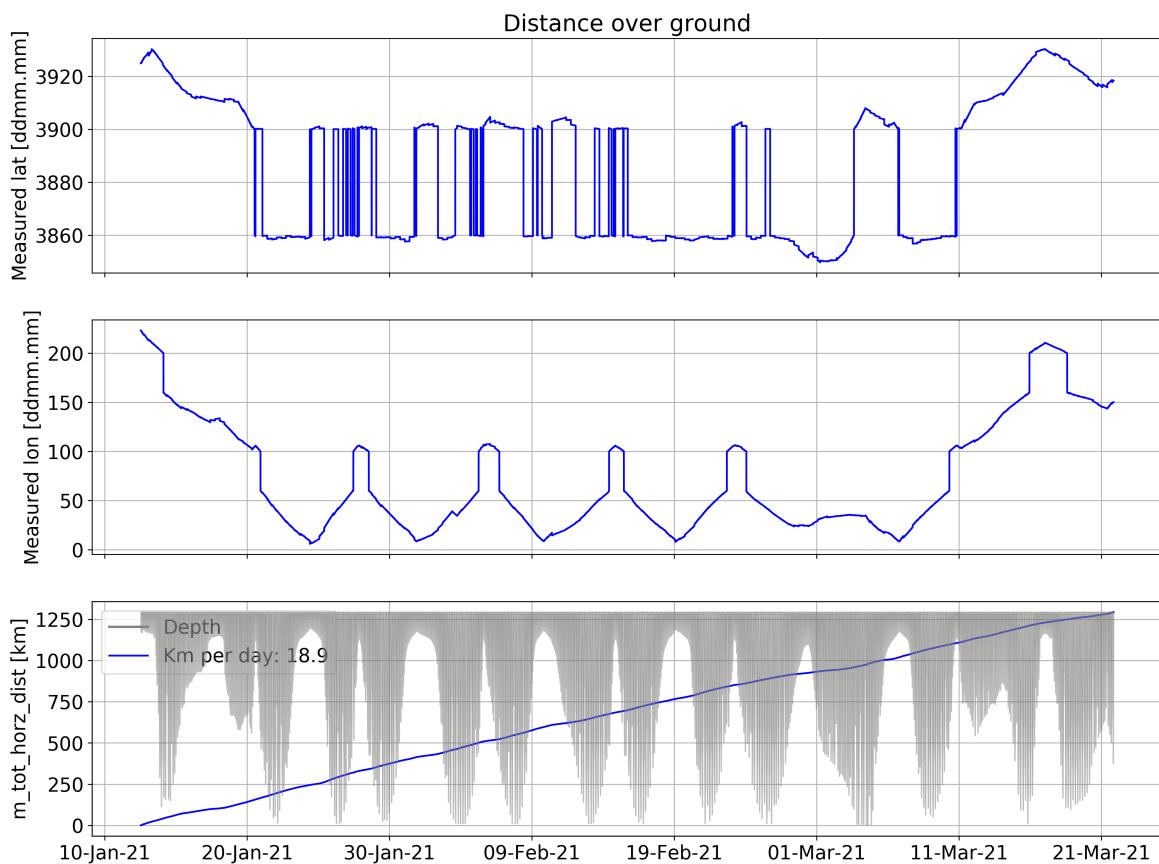


Figure 2.2: Distance over ground

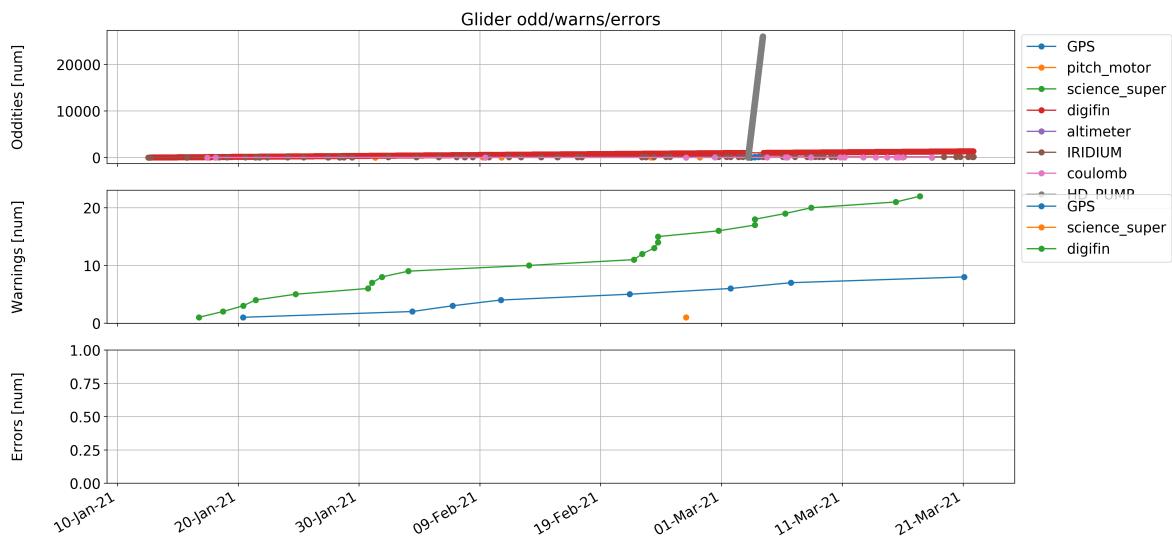


Figure 2.3: Glider Odd Warn and Err

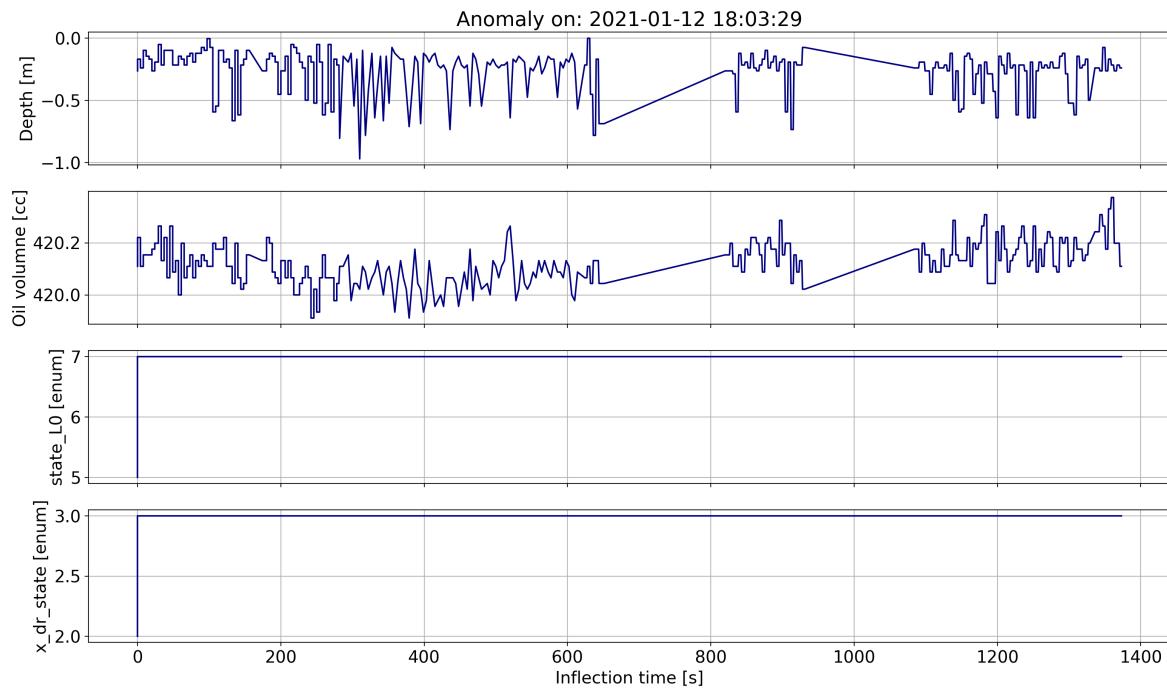


Figure 2.4: 20210112T180329 Anomaly 1

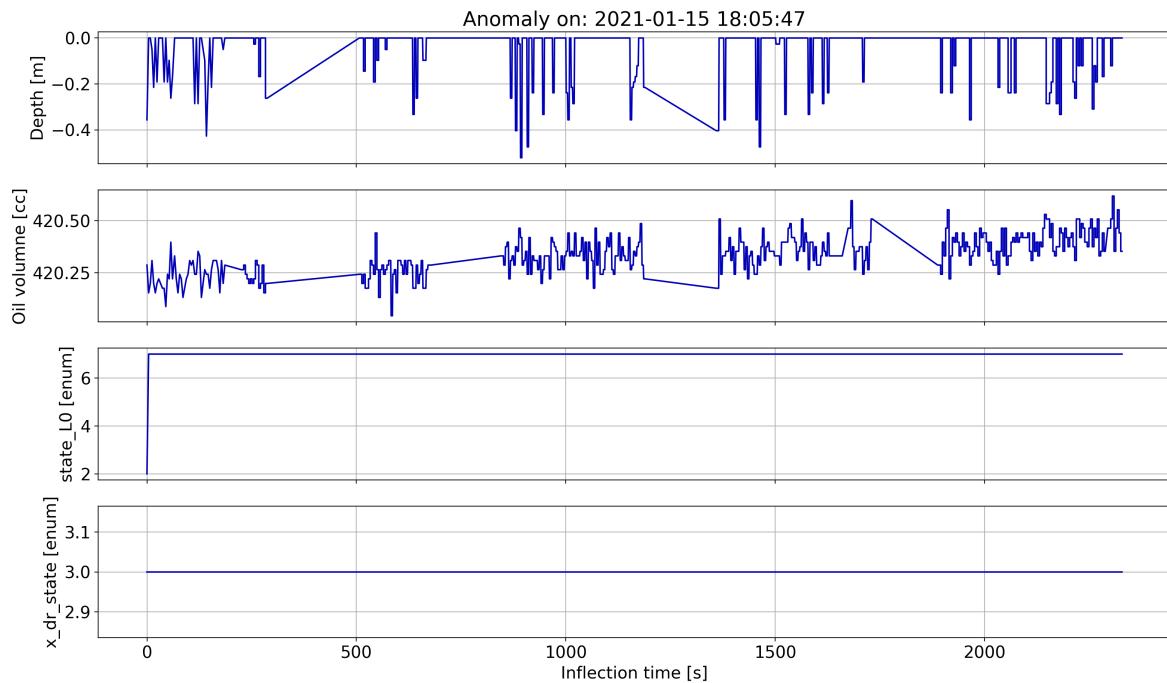


Figure 2.5: 20210115T180547 Anomaly 2

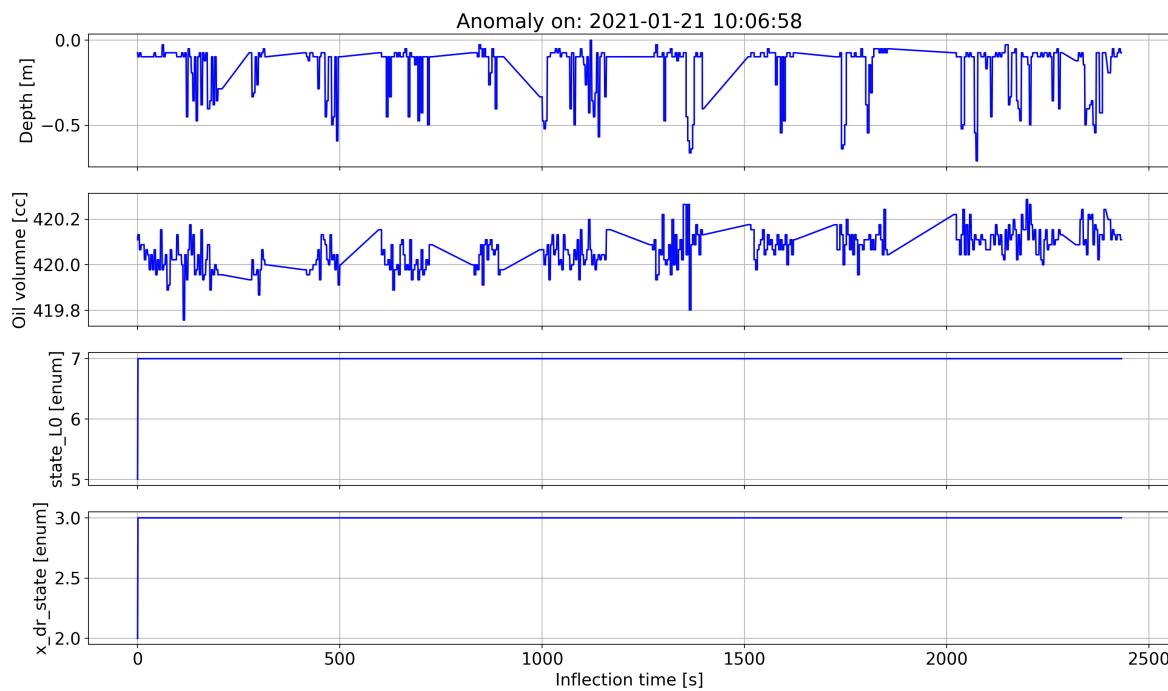


Figure 2.6: 20210121T100658 Anomaly 3

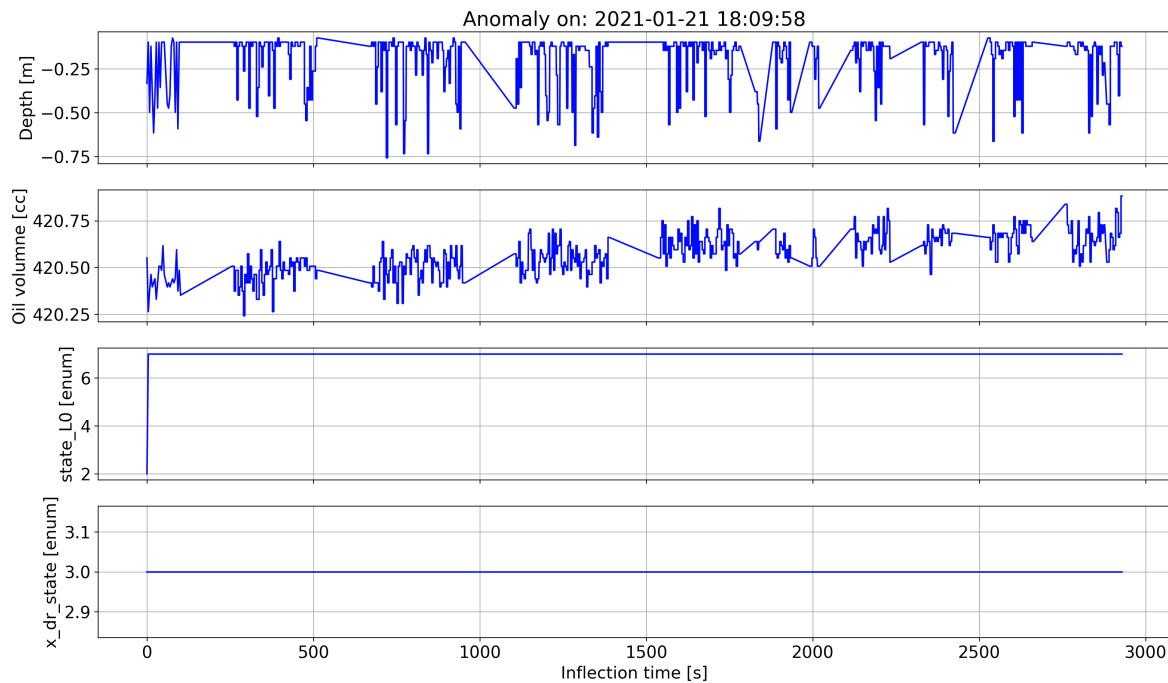


Figure 2.7: 20210121T180958 Anomaly 4



Figure 2.8: 20210127T100227 Anomaly 5

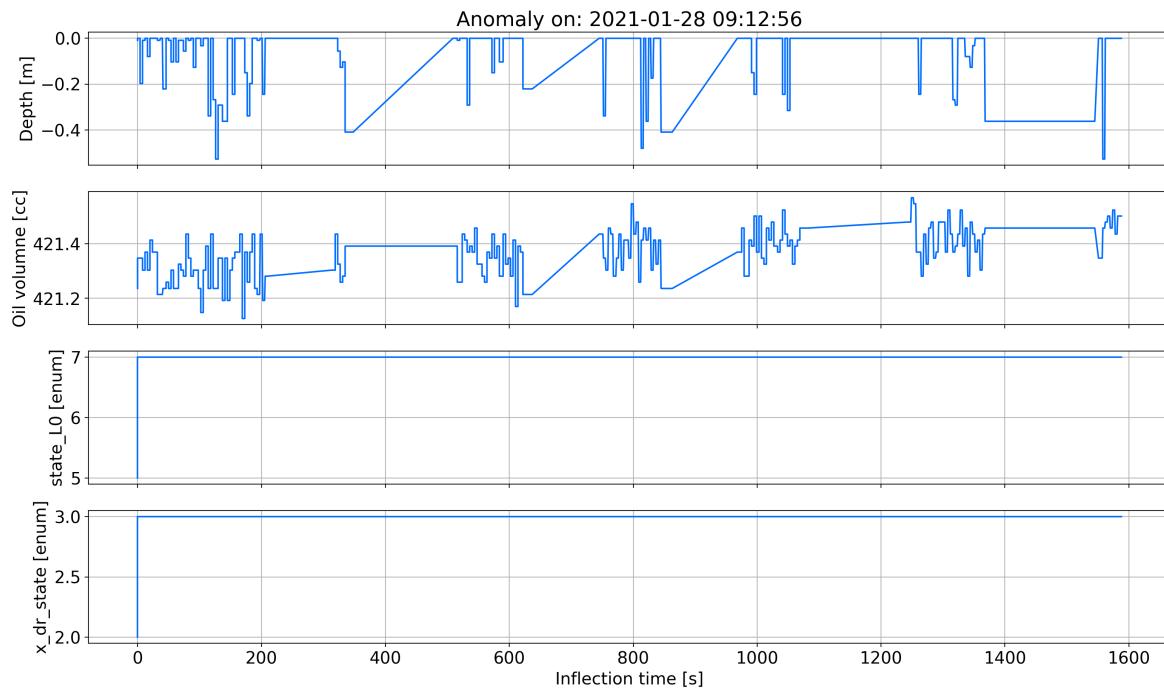


Figure 2.9: 20210128T091256 Anomaly 6

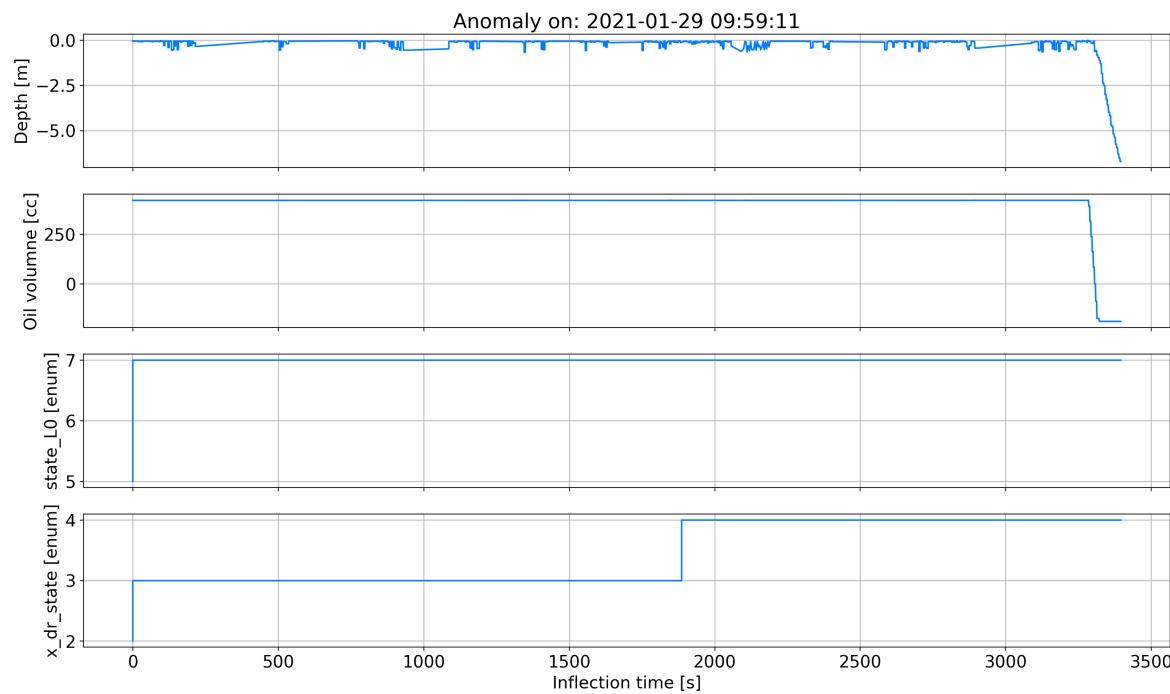


Figure 2.10: 20210129T095911 Anomaly 7

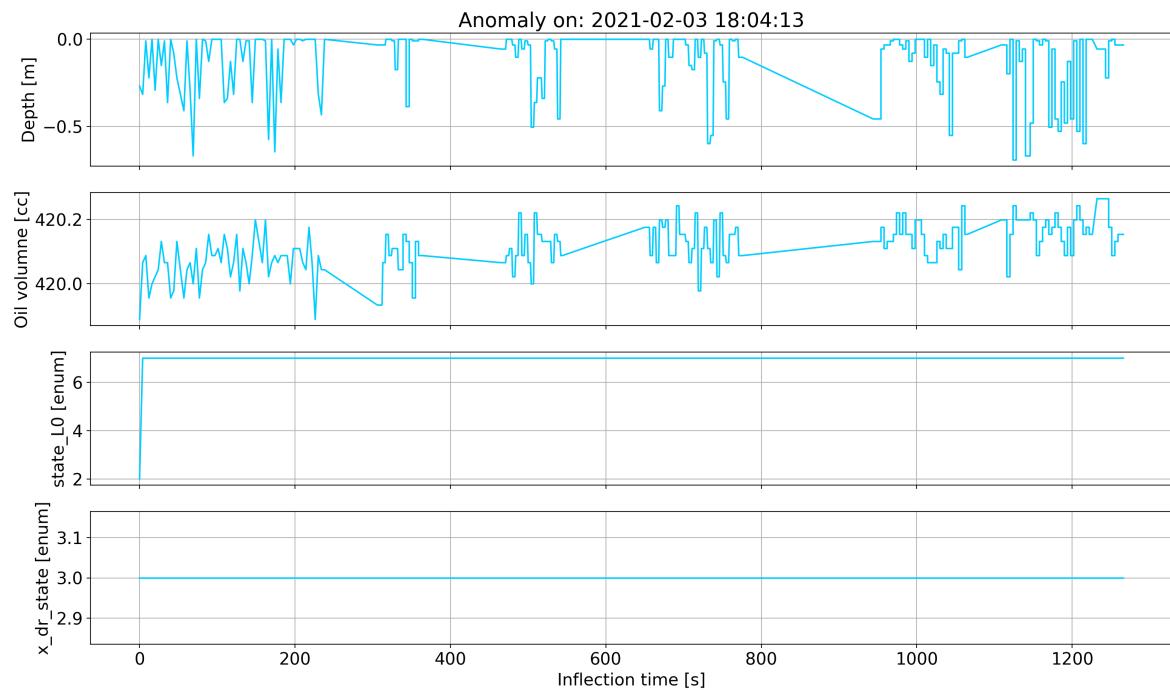


Figure 2.11: 20210203T180413 Anomaly 8

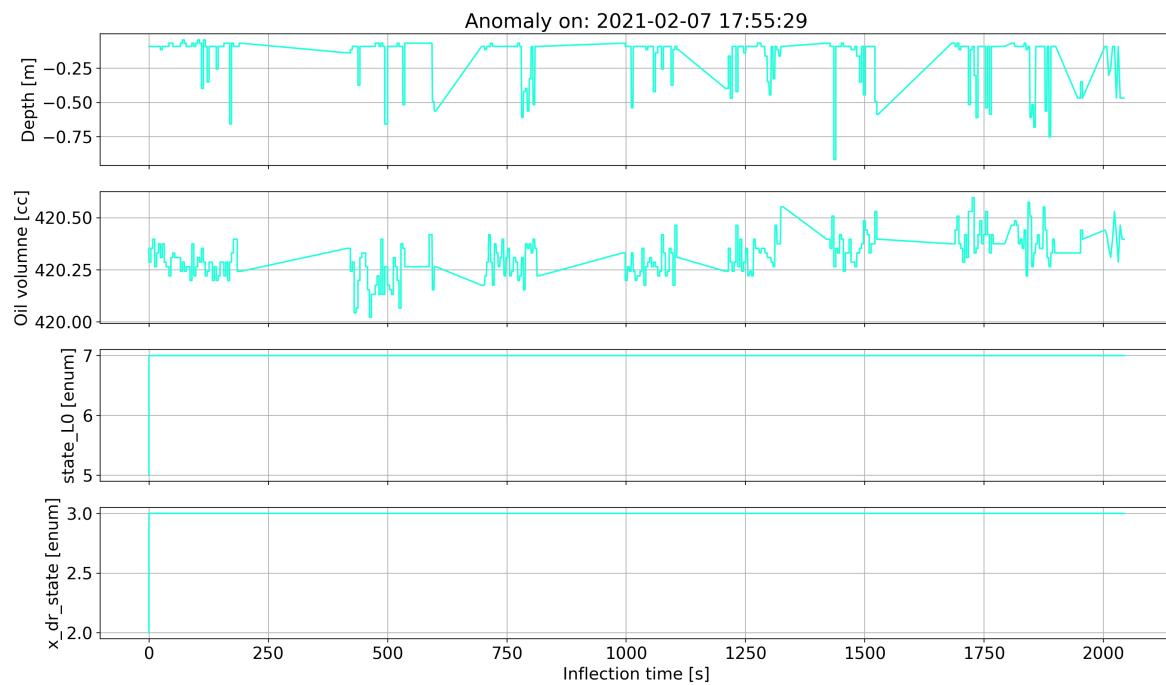


Figure 2.12: 20210207T175529 Anomaly 9

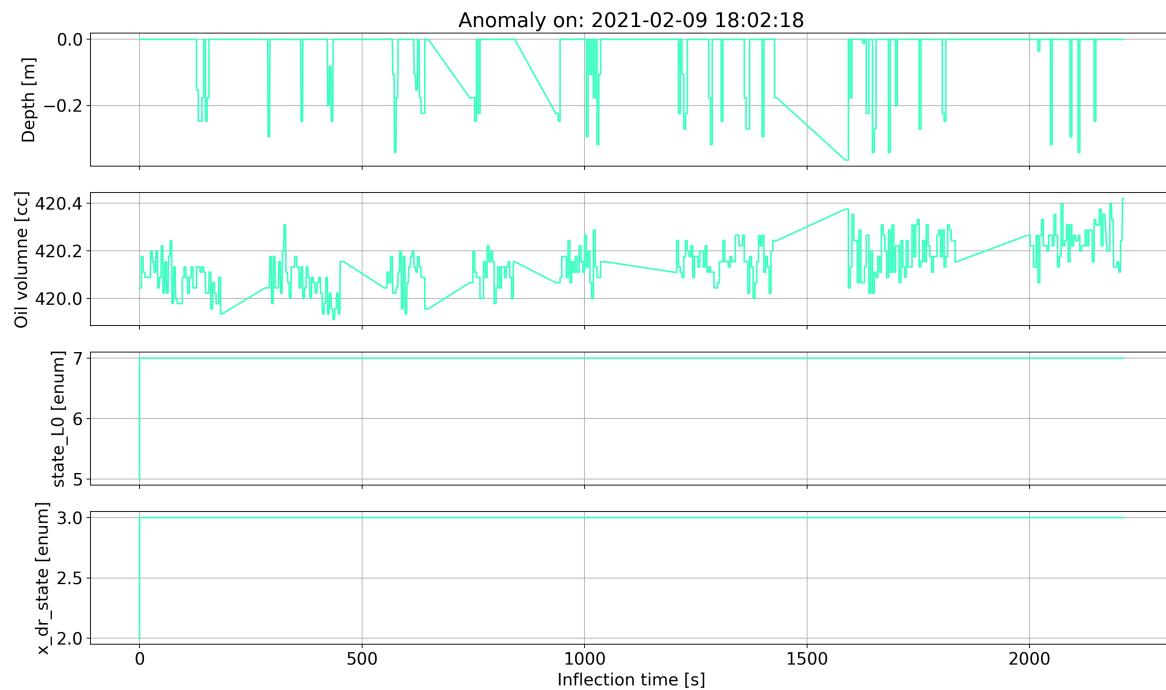


Figure 2.13: 20210209T180218 Anomaly 10

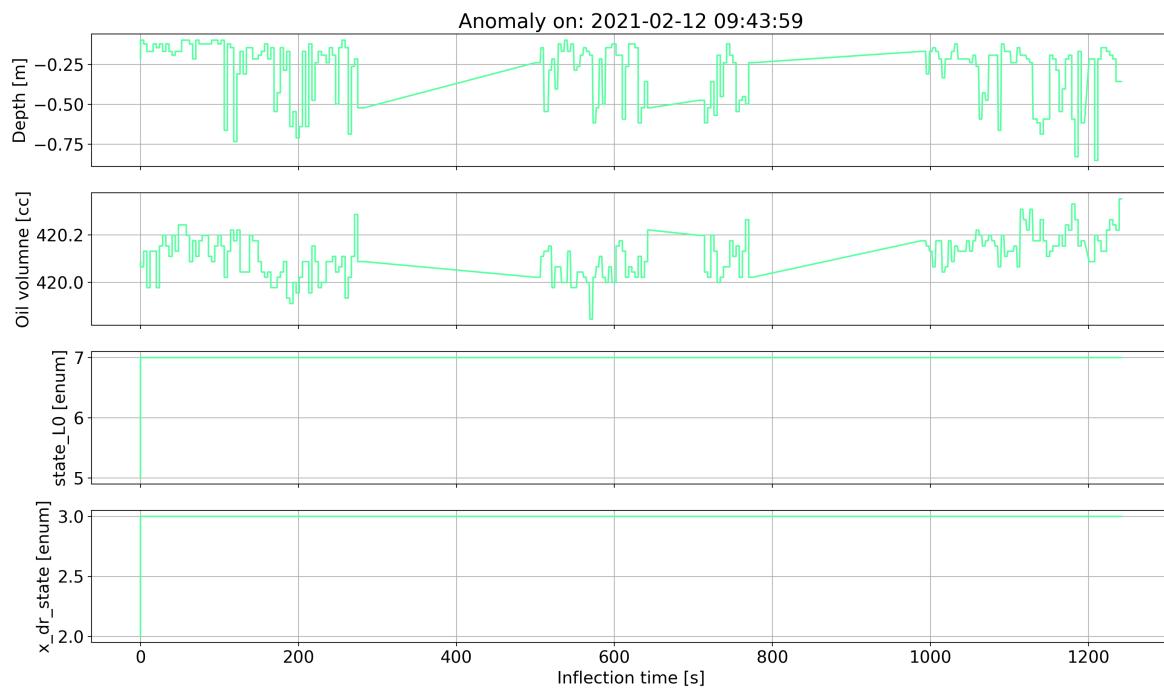


Figure 2.14: 20210212T094359 Anomaly 11

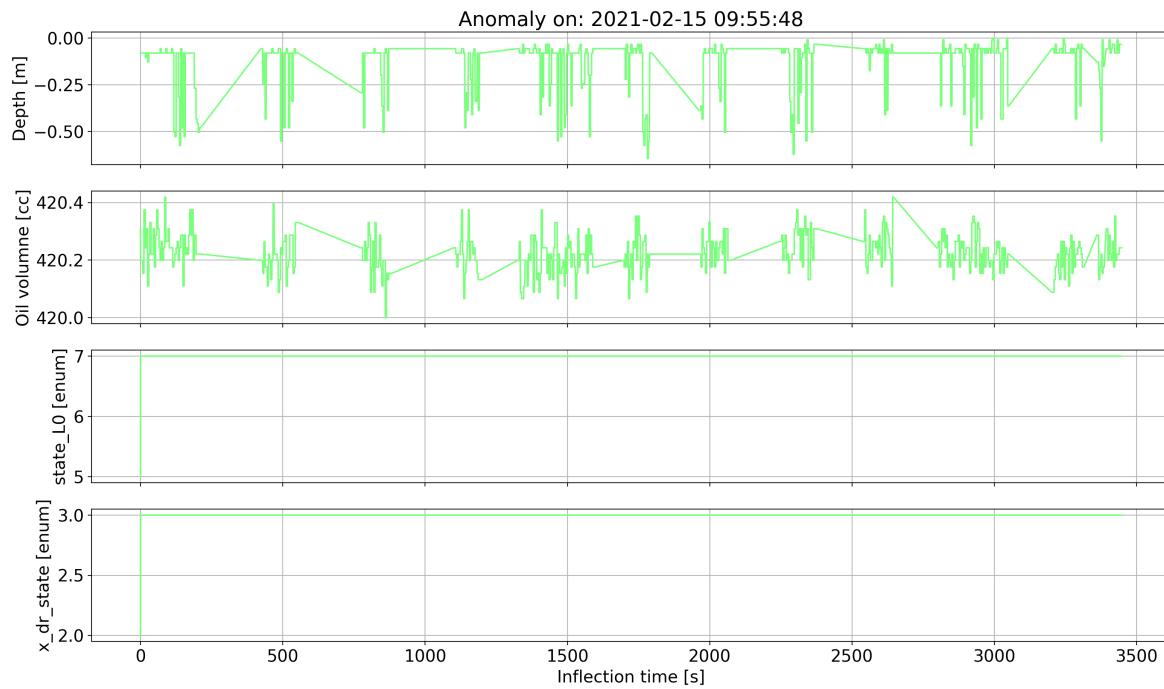


Figure 2.15: 20210215T095548 Anomaly 12

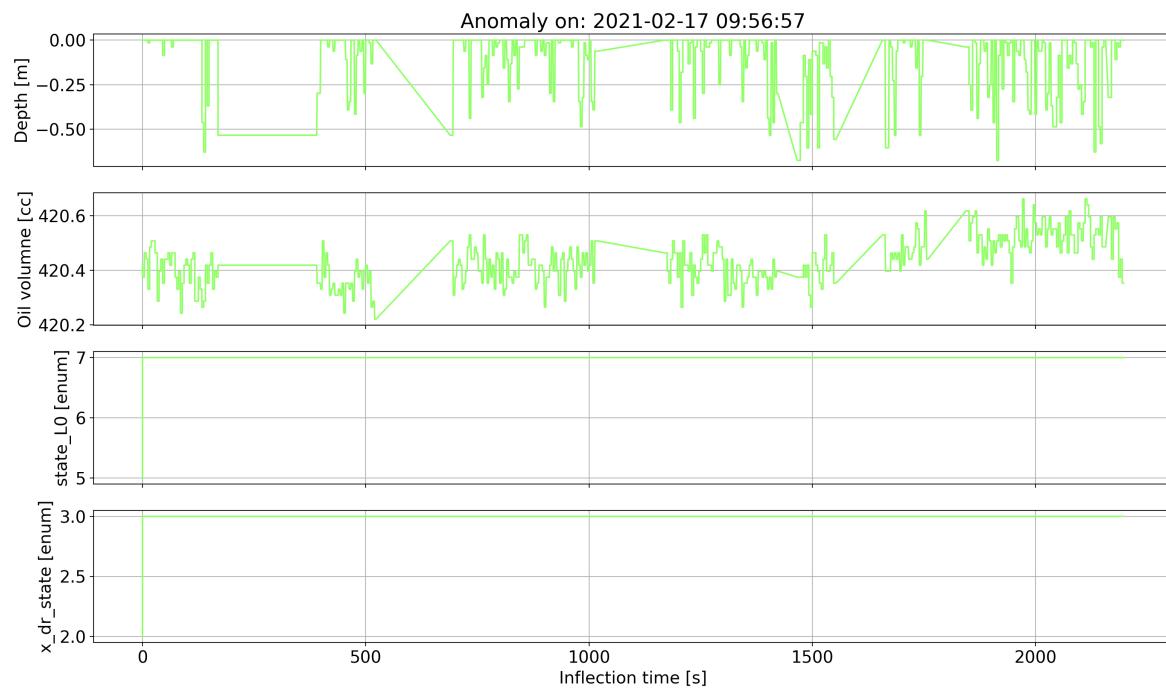


Figure 2.16: 20210217T095657 Anomaly 13

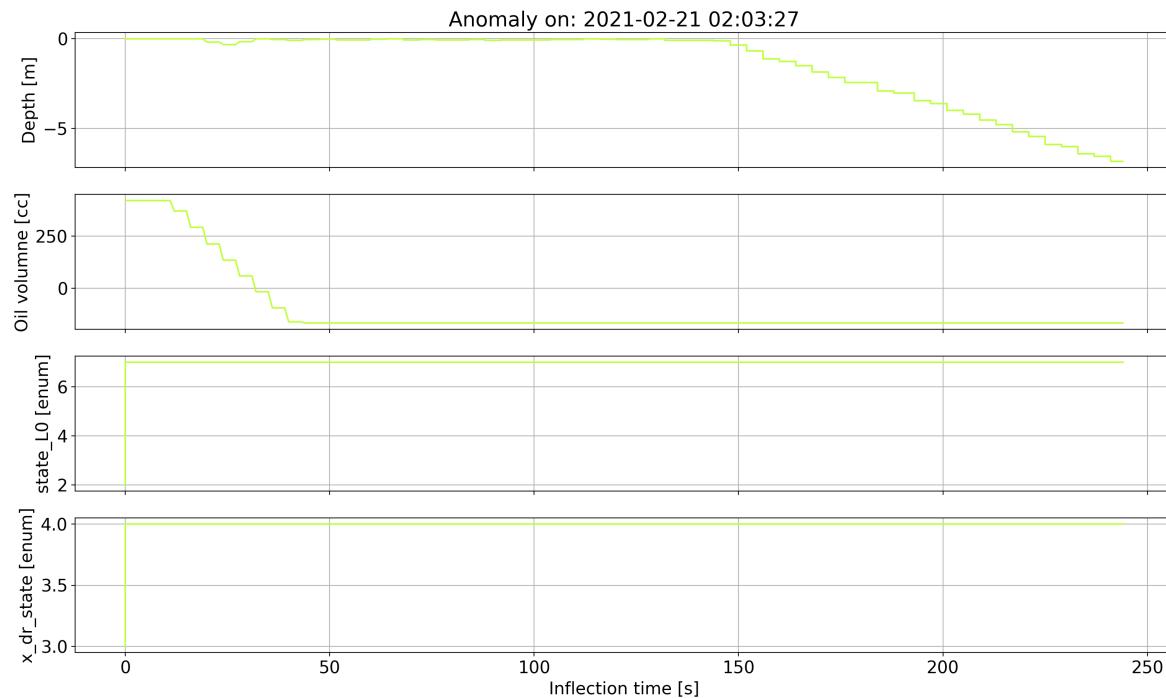


Figure 2.17: 20210221T020327 Anomaly 14

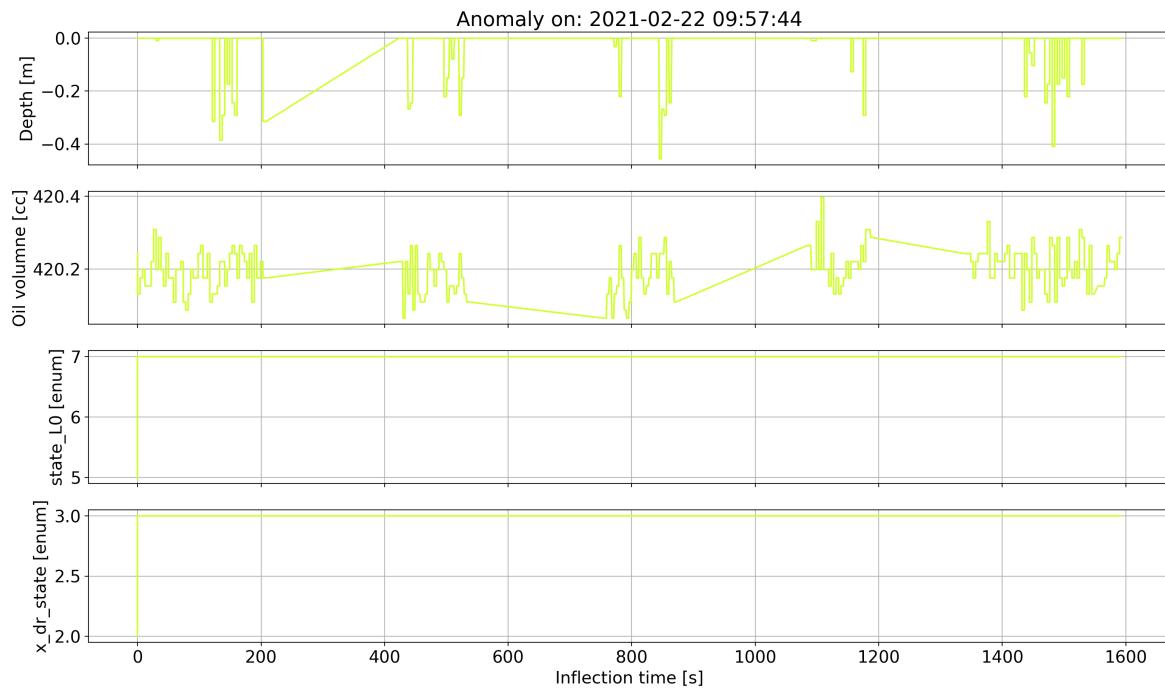


Figure 2.18: 20210222T095744 Anomaly 15

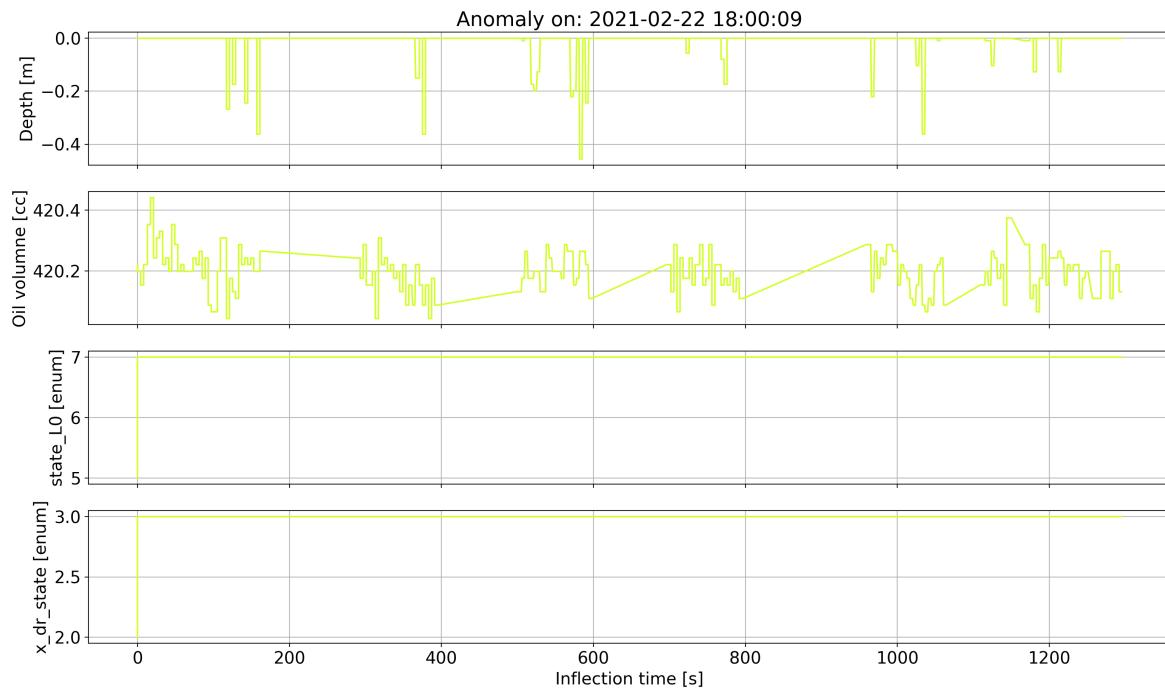


Figure 2.19: 20210222T180009 Anomaly 16

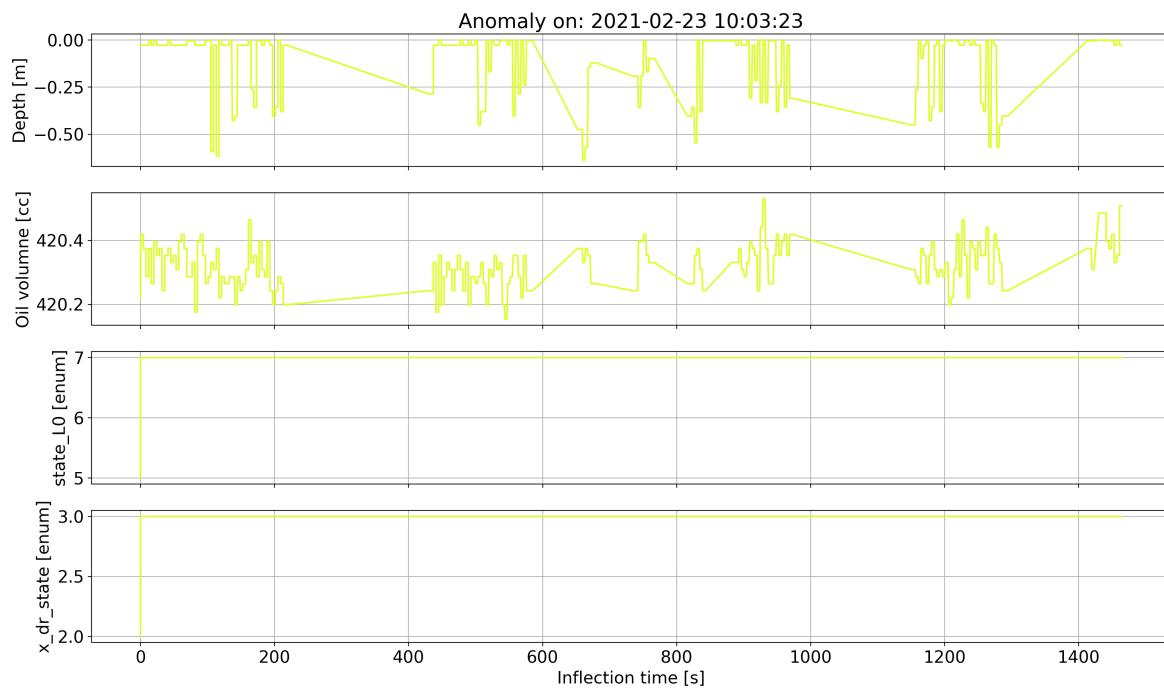


Figure 2.20: 20210223T100323 Anomaly 17

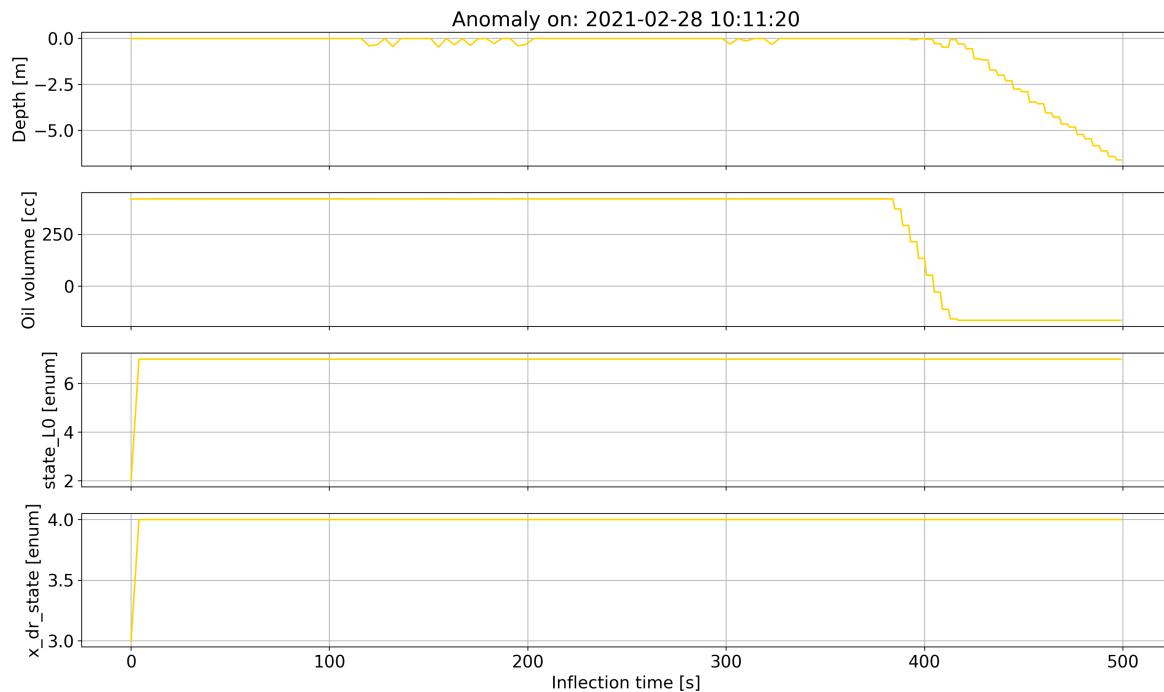


Figure 2.21: 20210228T101120 Anomaly 18

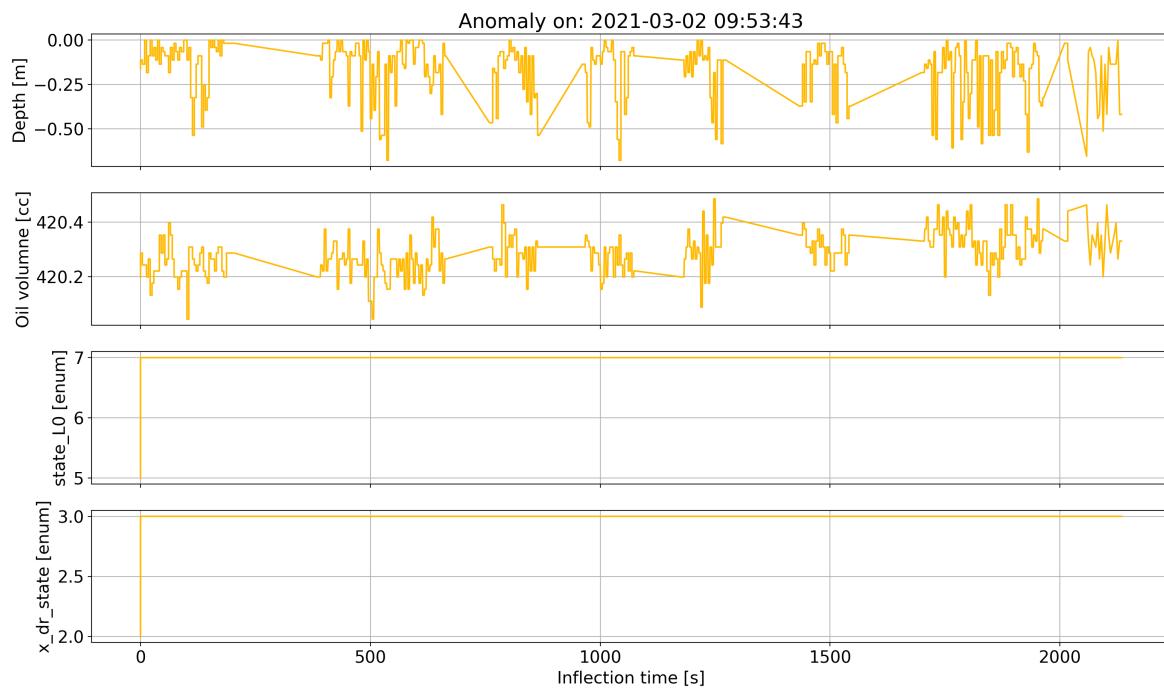


Figure 2.22: 20210302T095343 Anomaly 19

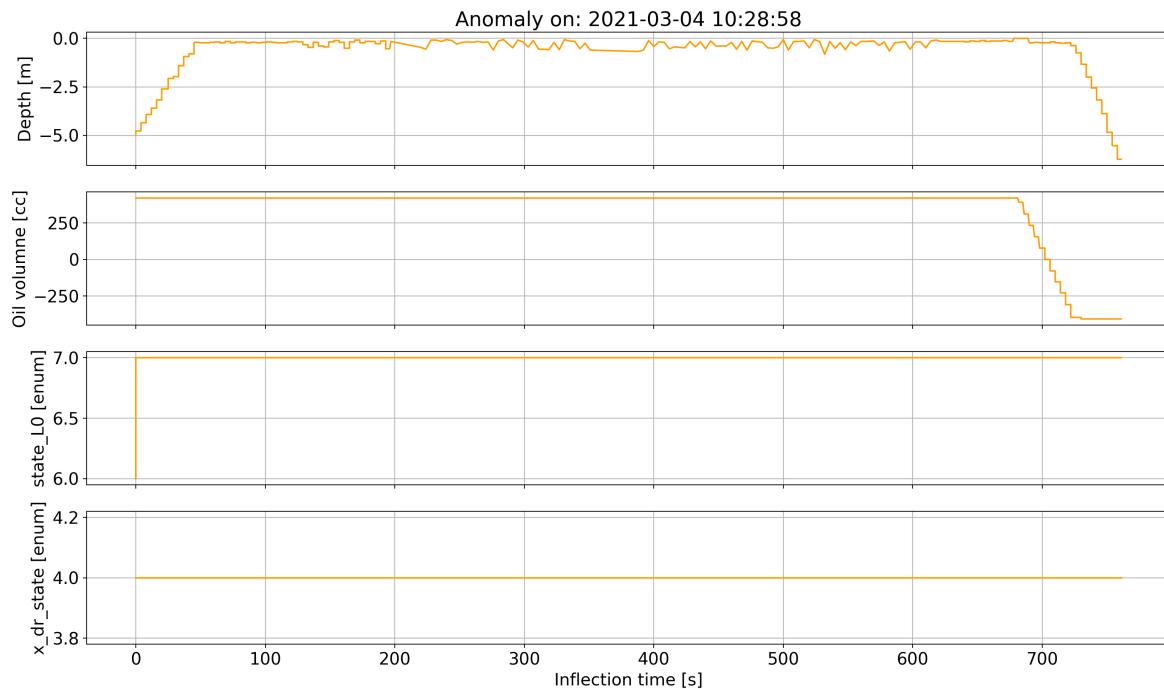


Figure 2.23: 20210304T102858 Anomaly 20

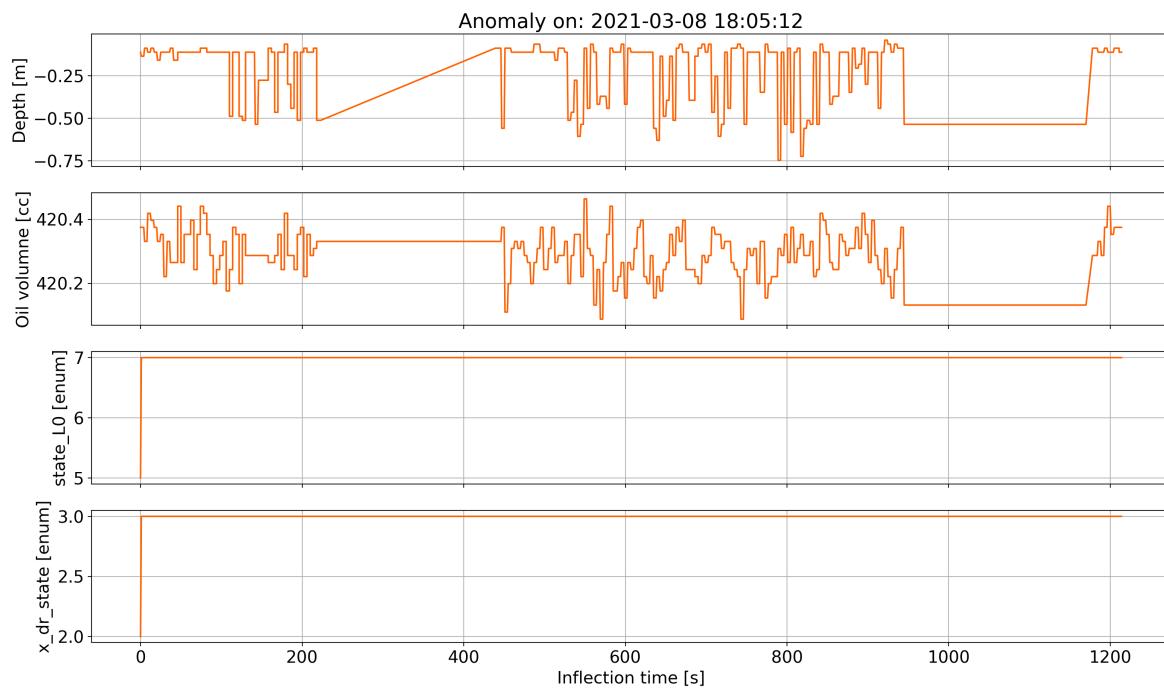


Figure 2.24: 20210308T180512 Anomaly 21

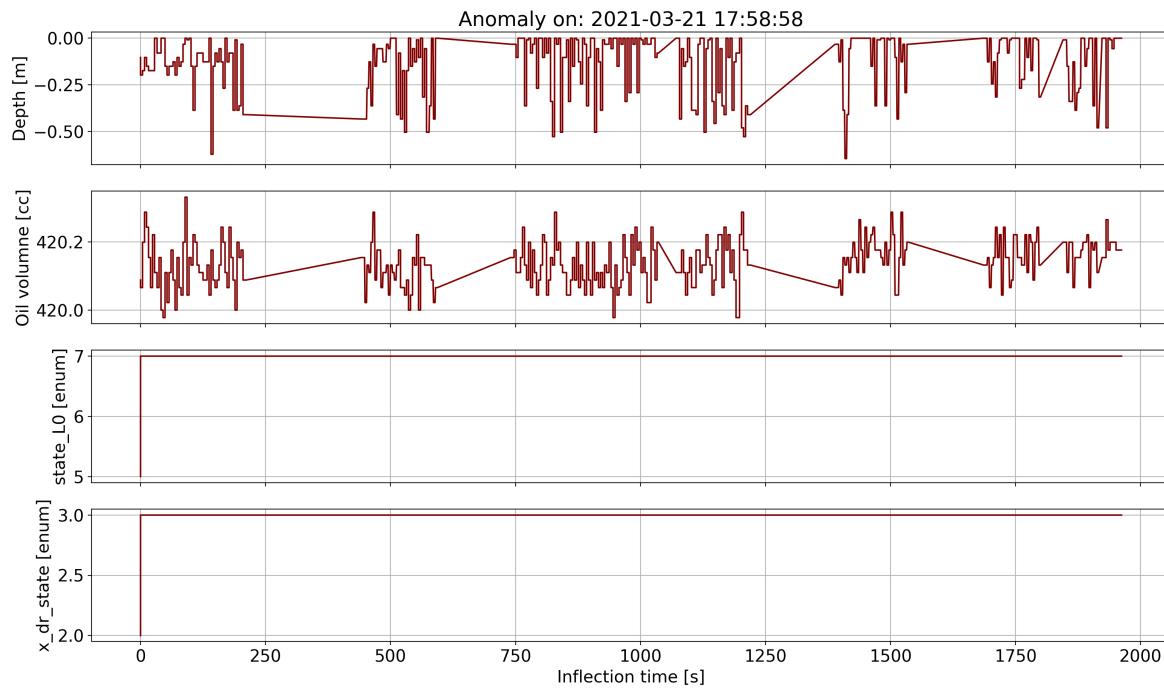


Figure 2.25: 20210321T175858 Anomaly 22

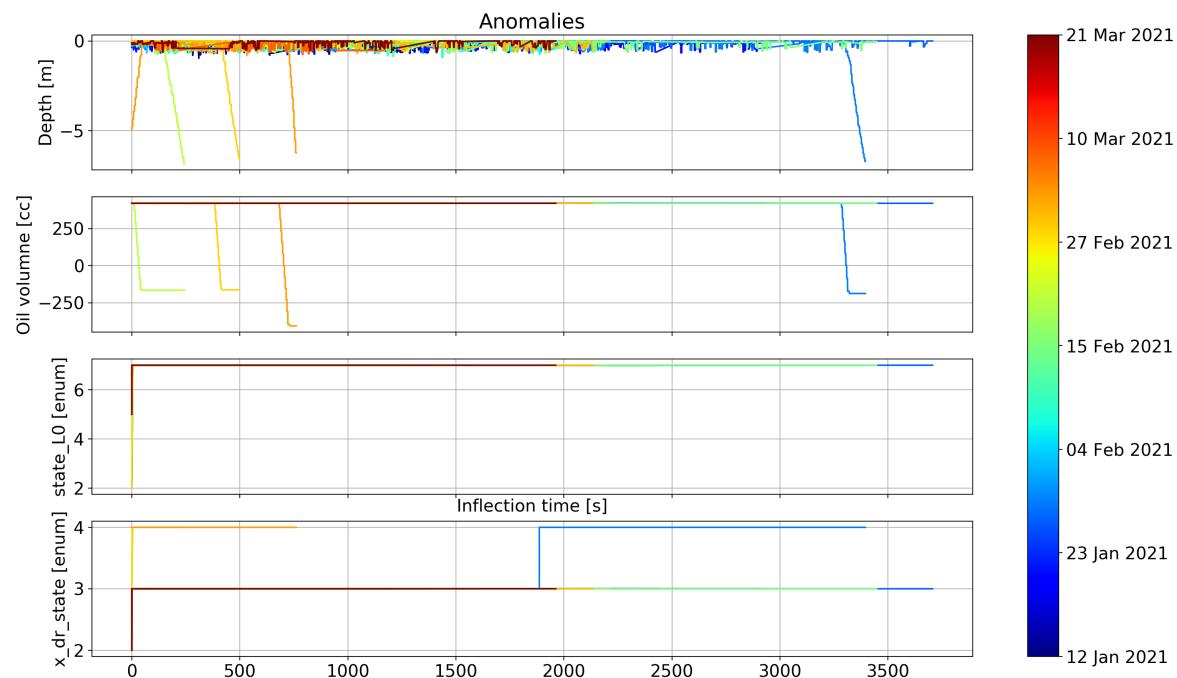


Figure 2.26: Anomalies (time)

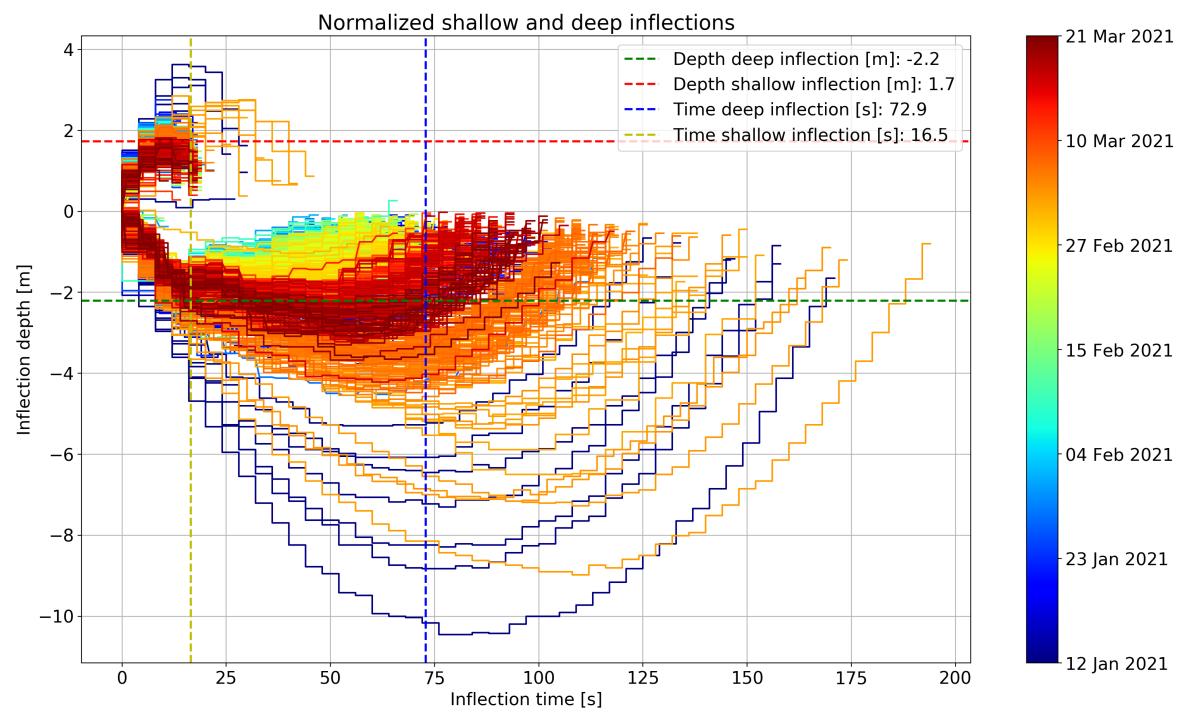


Figure 2.27: Depth inflections

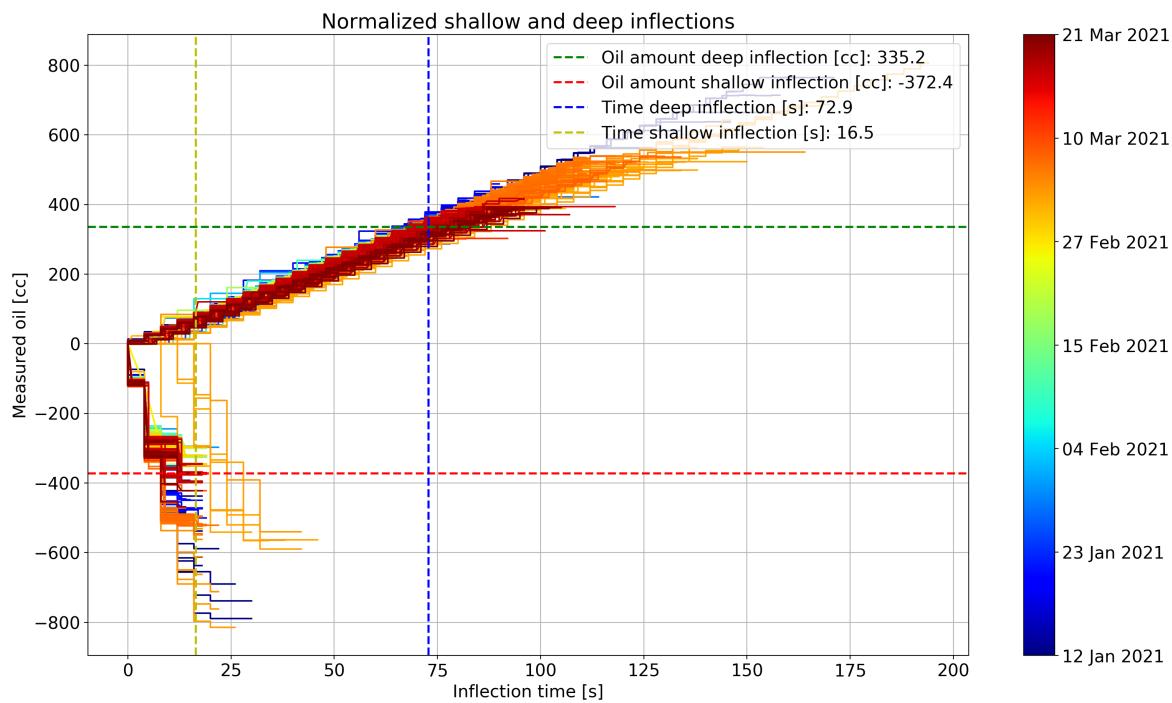


Figure 2.28: Oil inflections

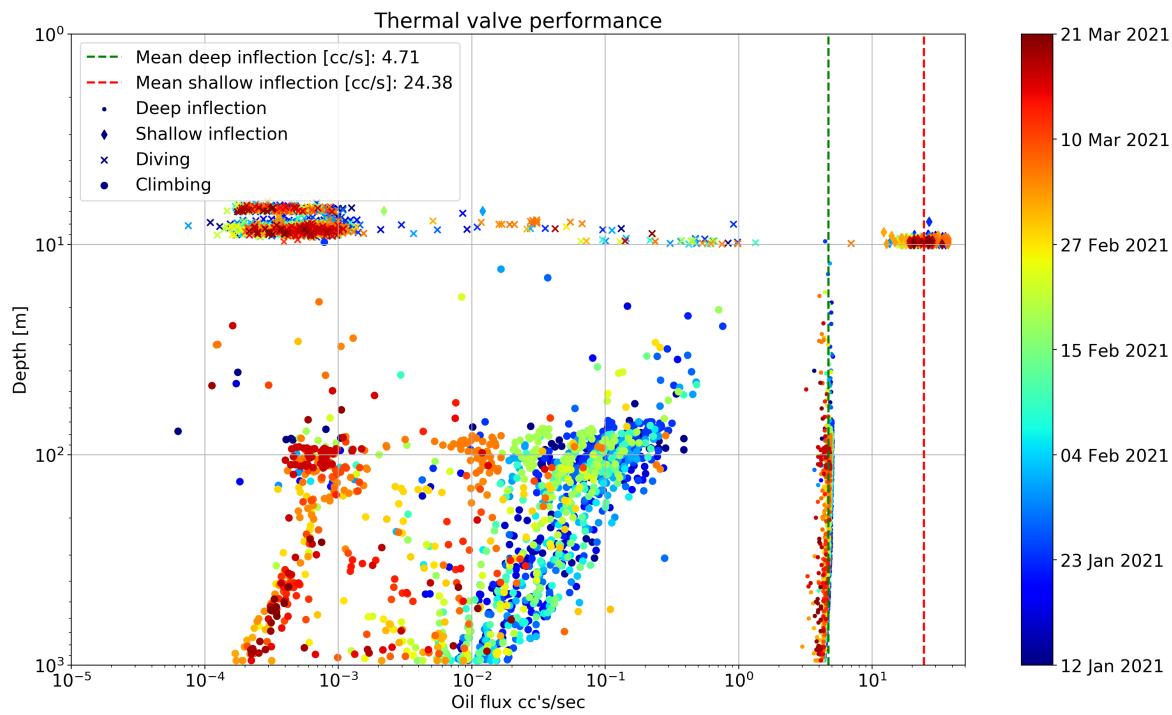


Figure 2.29: Oil flux

Normalized shallow and deep inflections

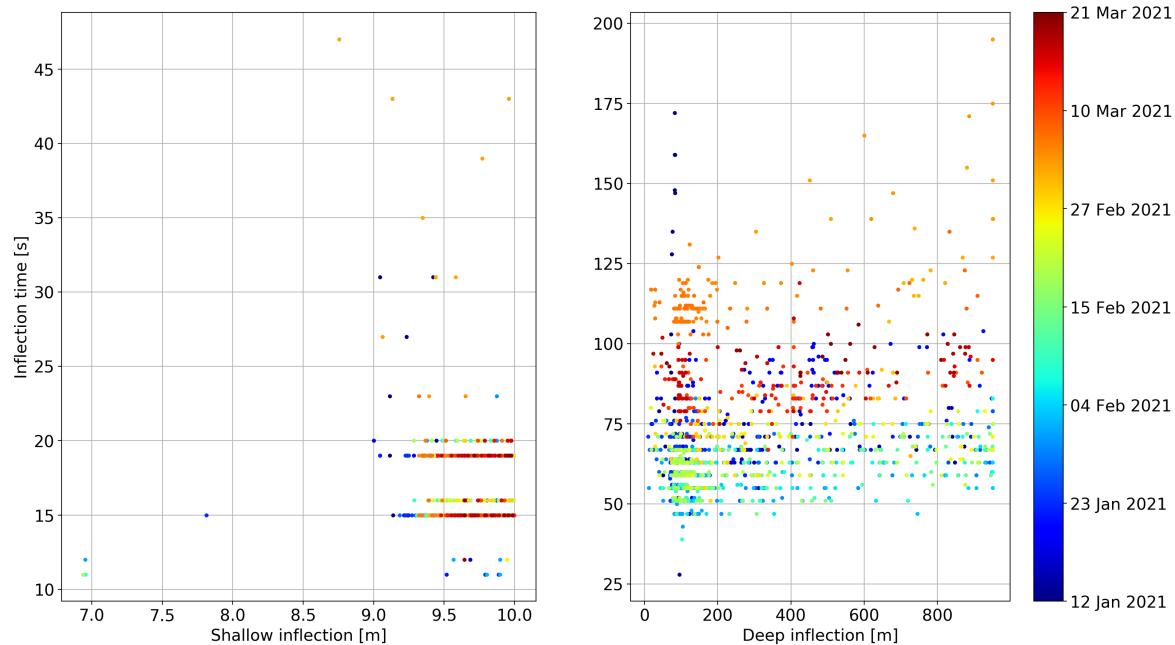


Figure 2.30: Duration inflections

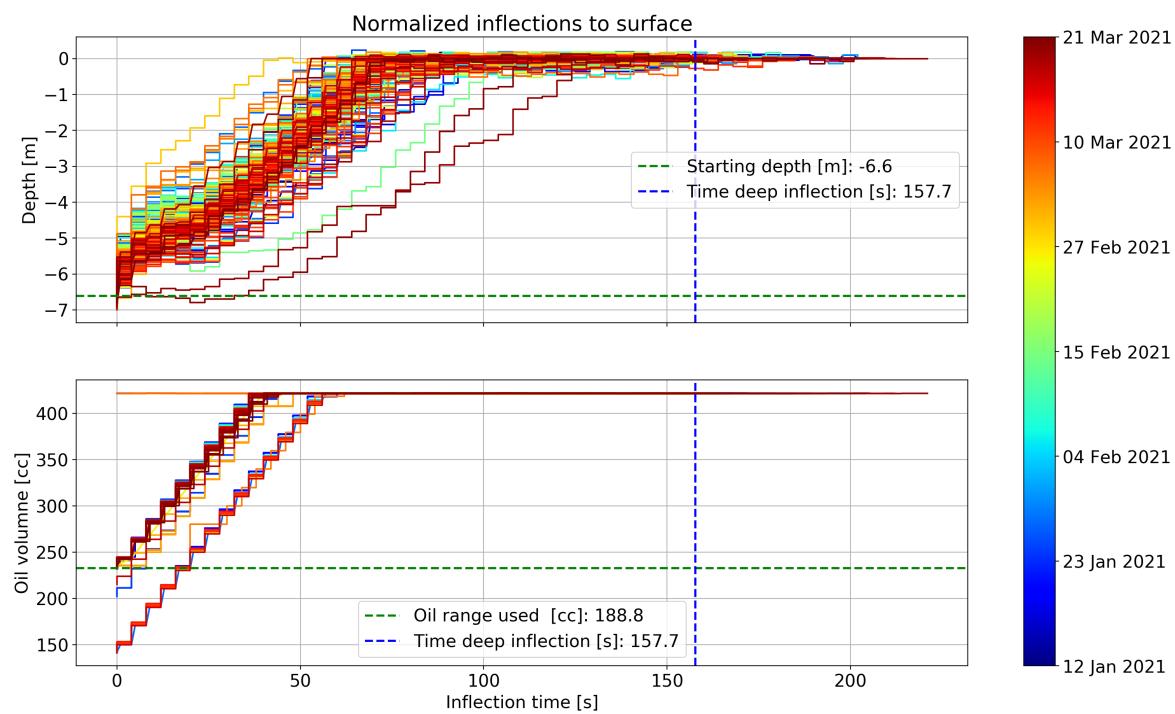


Figure 2.31: Surface Oil inflections

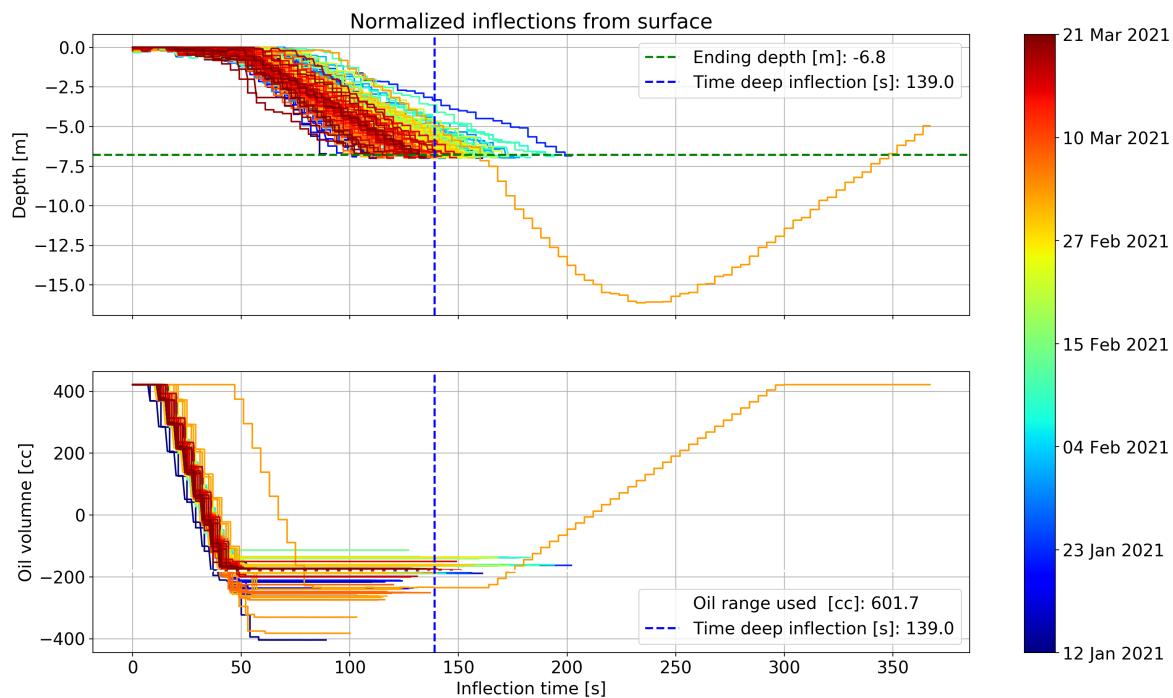


Figure 2.32: Surface Duration inflections

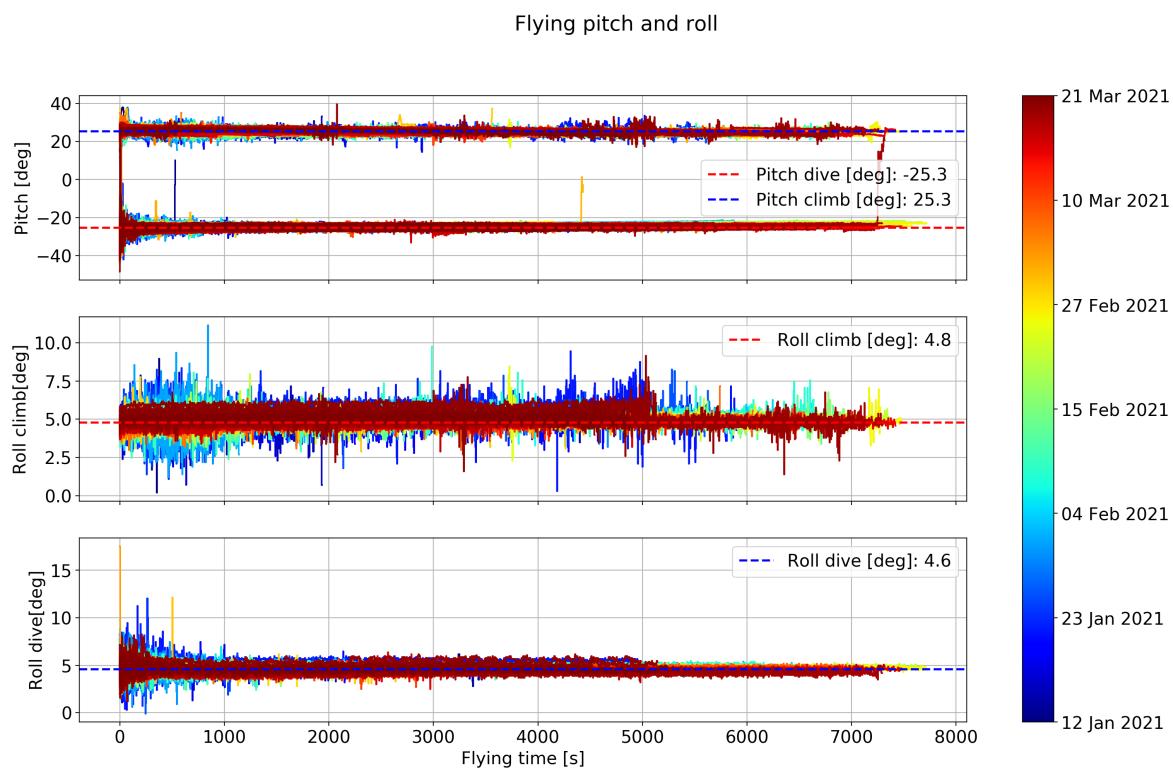


Figure 2.33: Pitch and roll, when climbing and diving

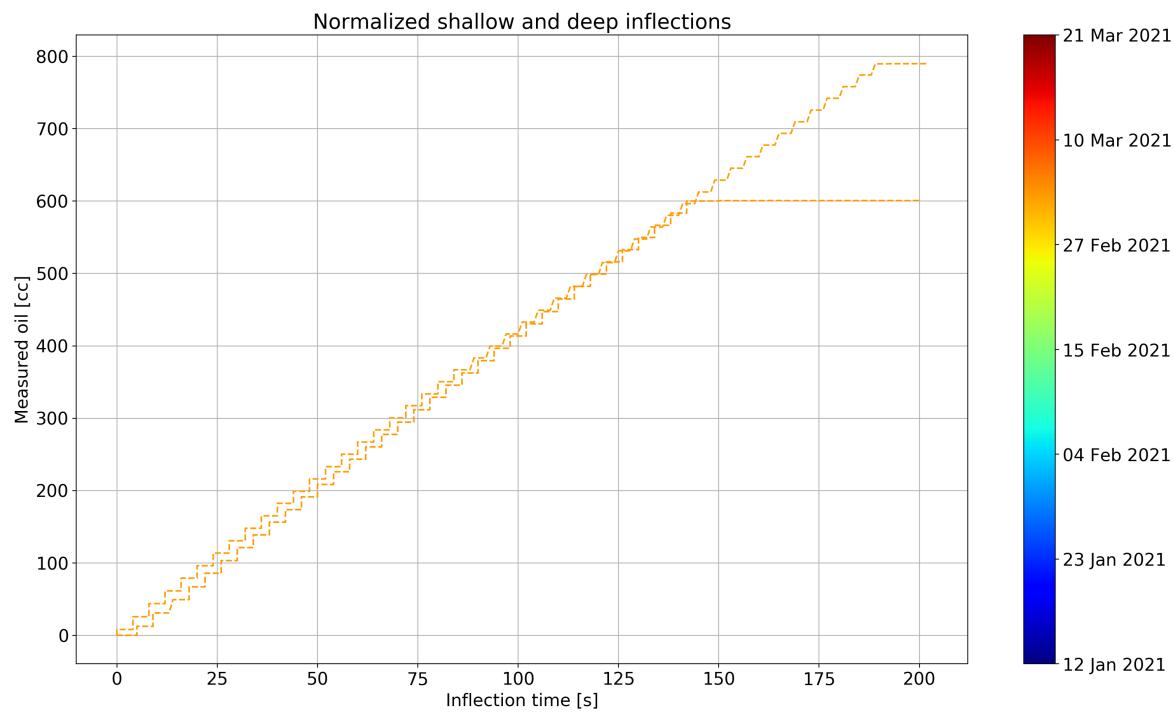


Figure 2.34: Oil inflections long

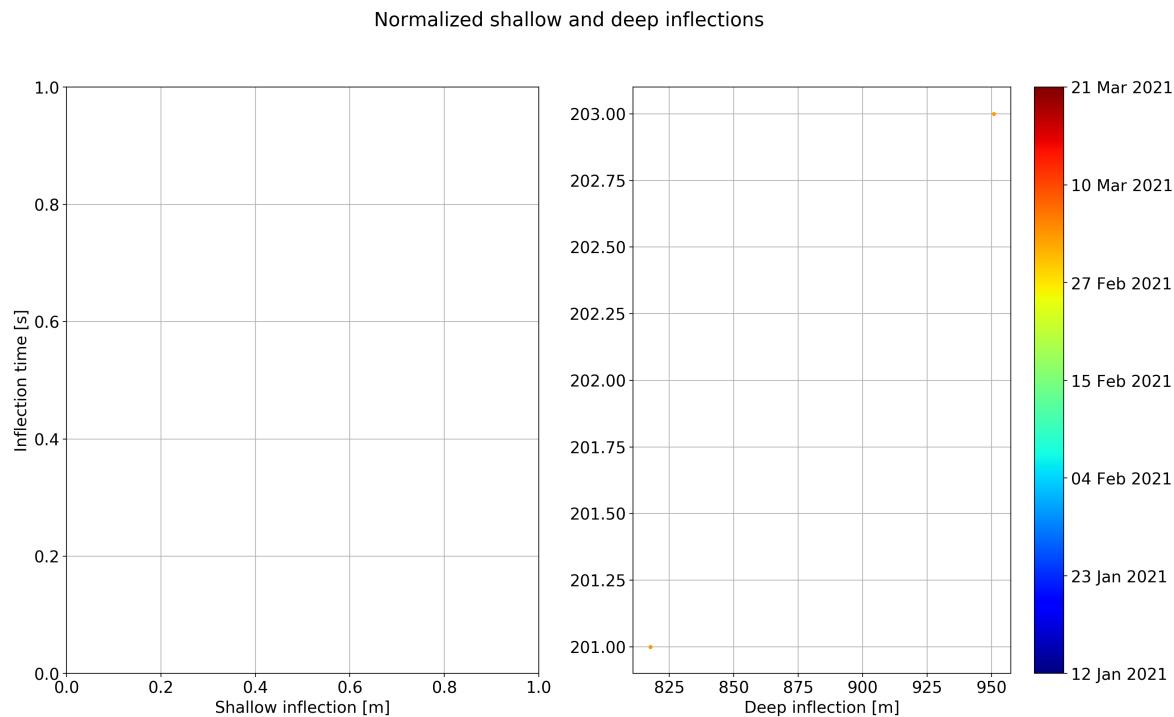


Figure 2.35: Duration inflections long

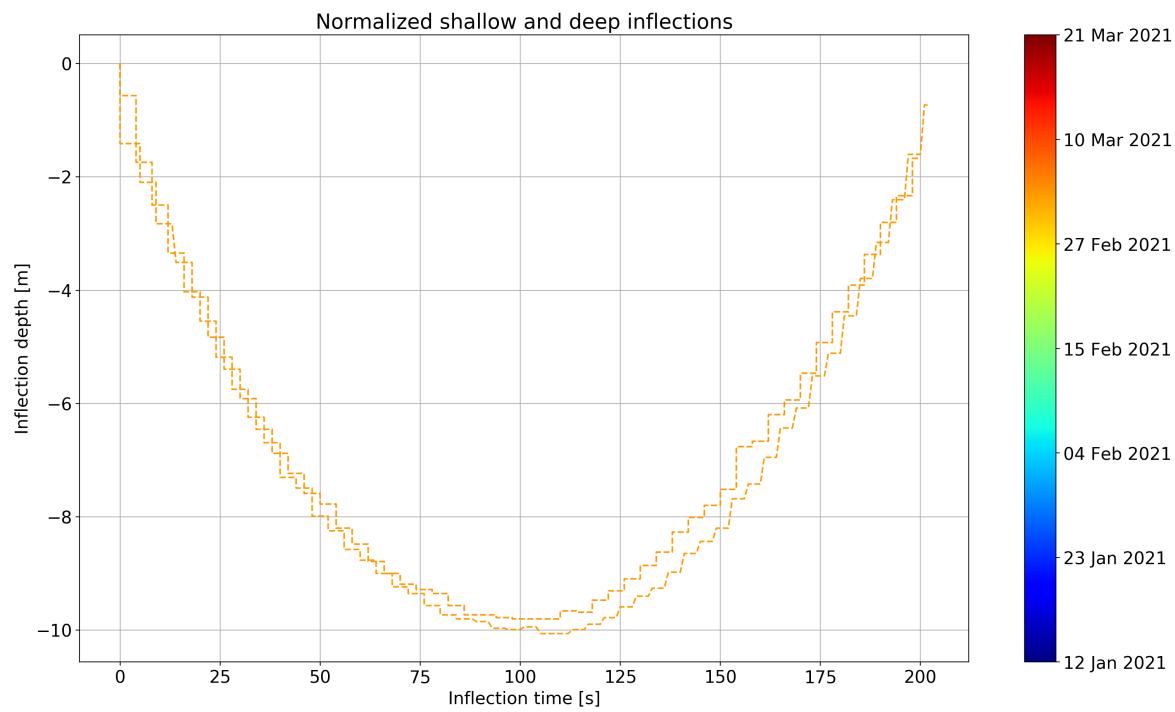


Figure 2.36: Depth inflections long

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	9597	20190612	3123	3134	952101	6.0	803.1
FLNTU-FLBBCDSLC	6041	20191230	1562	3134	na	na	264.0
OXY 3-4	0842	20190919	3123	3134	952073	5.999	803.1
PAR	50318	20200316	1562	3134	na	na	264.7
Hydrophone	na	na	na	na	na	na	na
Microrider	na	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	47
FLx	Turbidity dark count	na
FLx	CDOM dark count	50
FLx	BB700 dark count	45

3.2 SCI plots

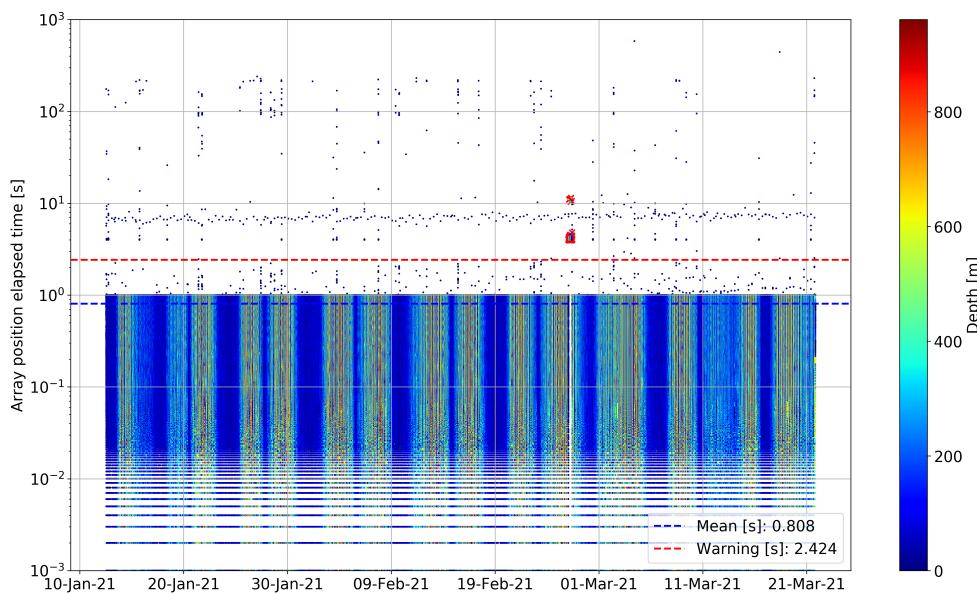


Figure 3.1: Array time

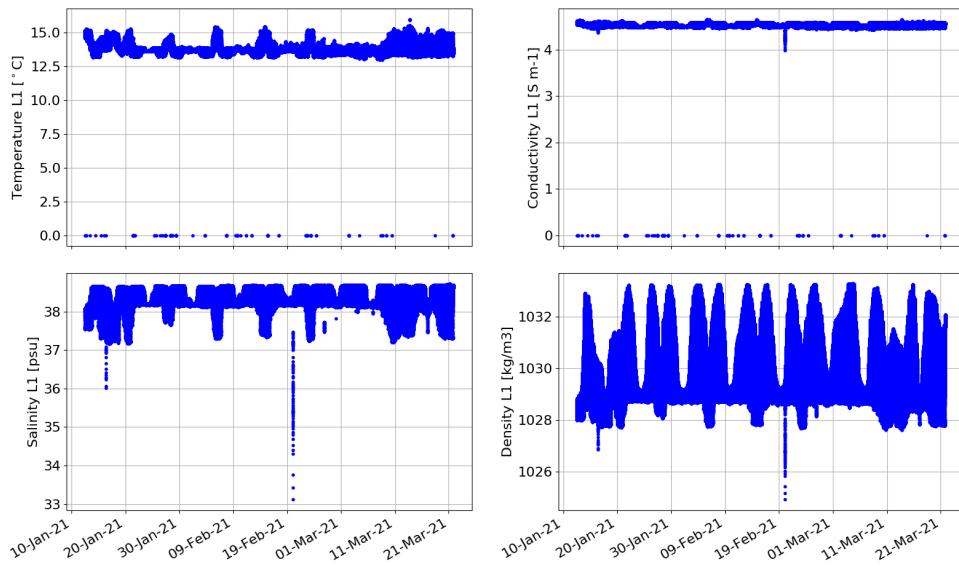


Figure 3.2: Raw CTD L1

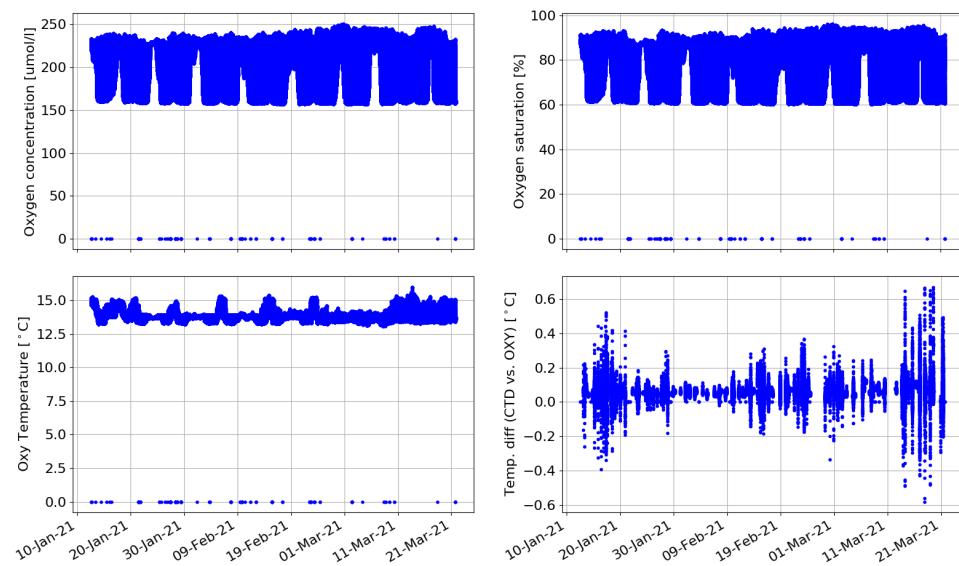


Figure 3.3: Raw OXY L1

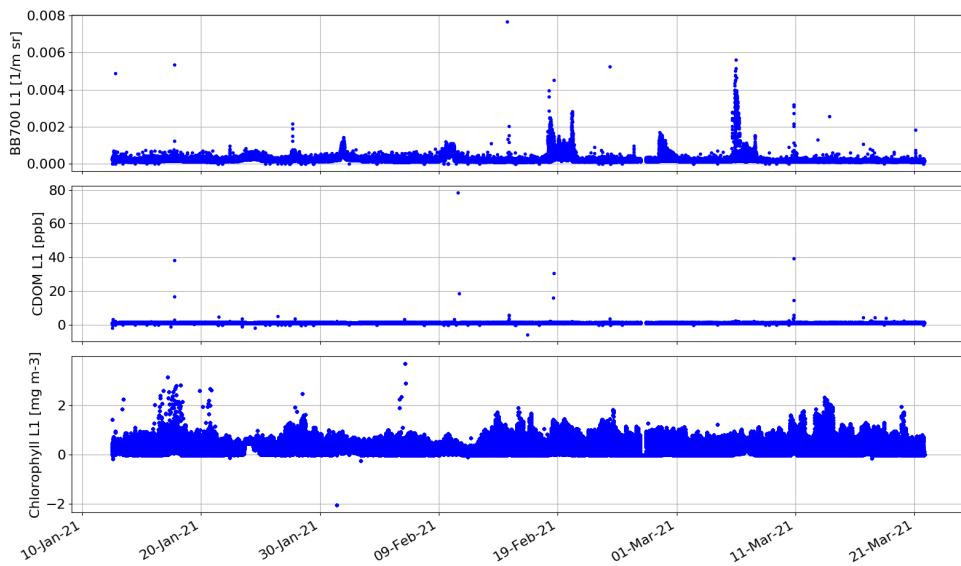


Figure 3.4: Raw FLBBCDSLC L1

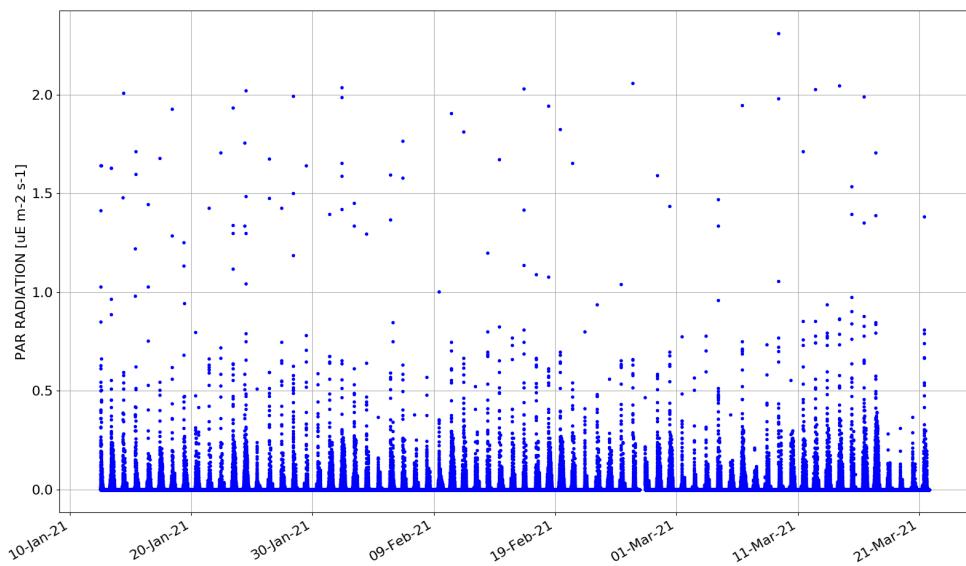


Figure 3.5: Raw PAR L1

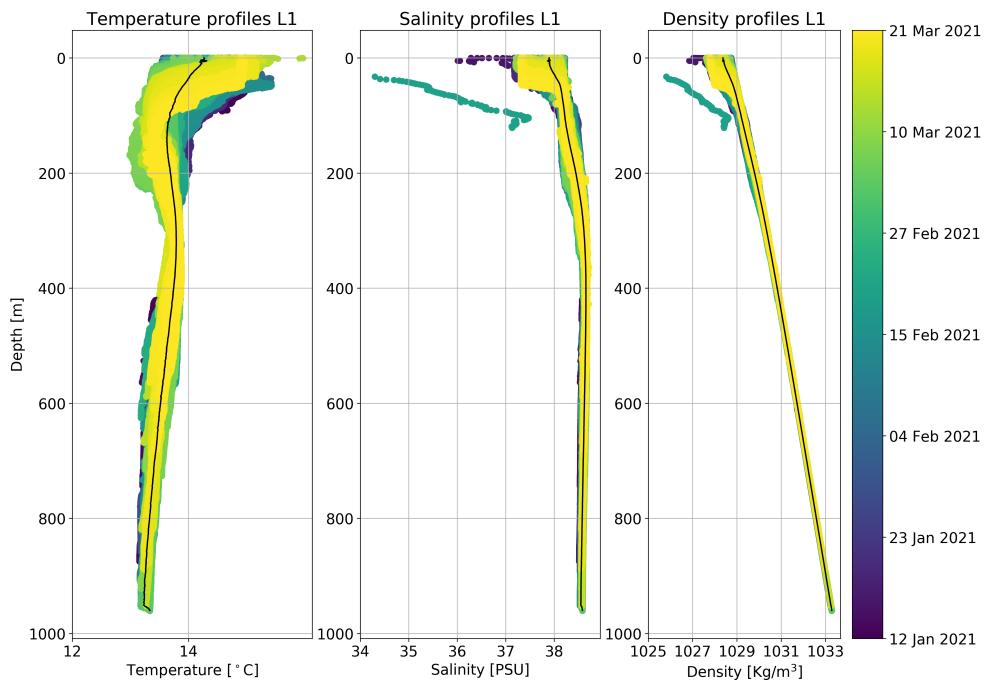


Figure 3.6: CTD profiles

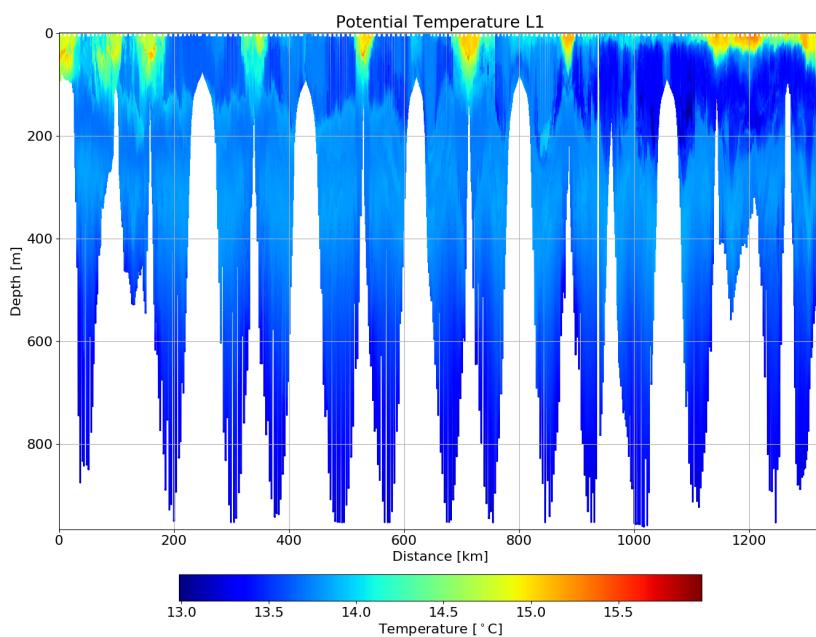


Figure 3.7: CTD temperature

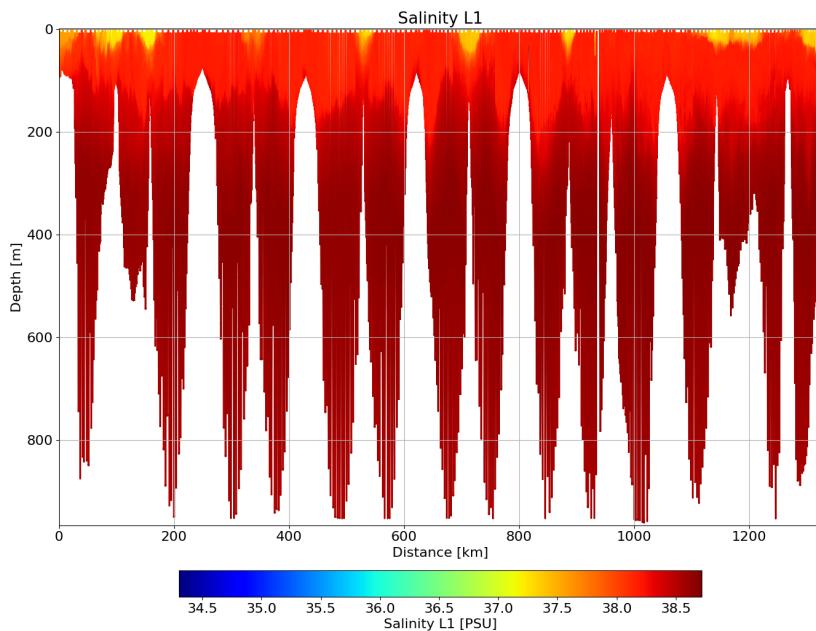


Figure 3.8: CTD Salinity

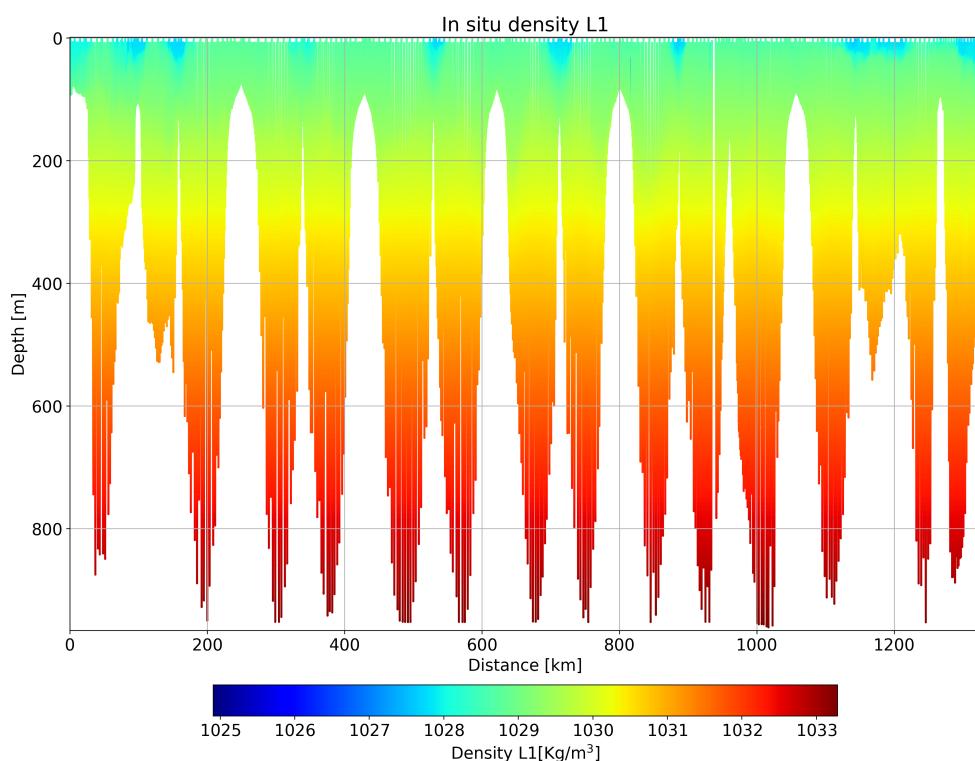


Figure 3.9: CTD Density

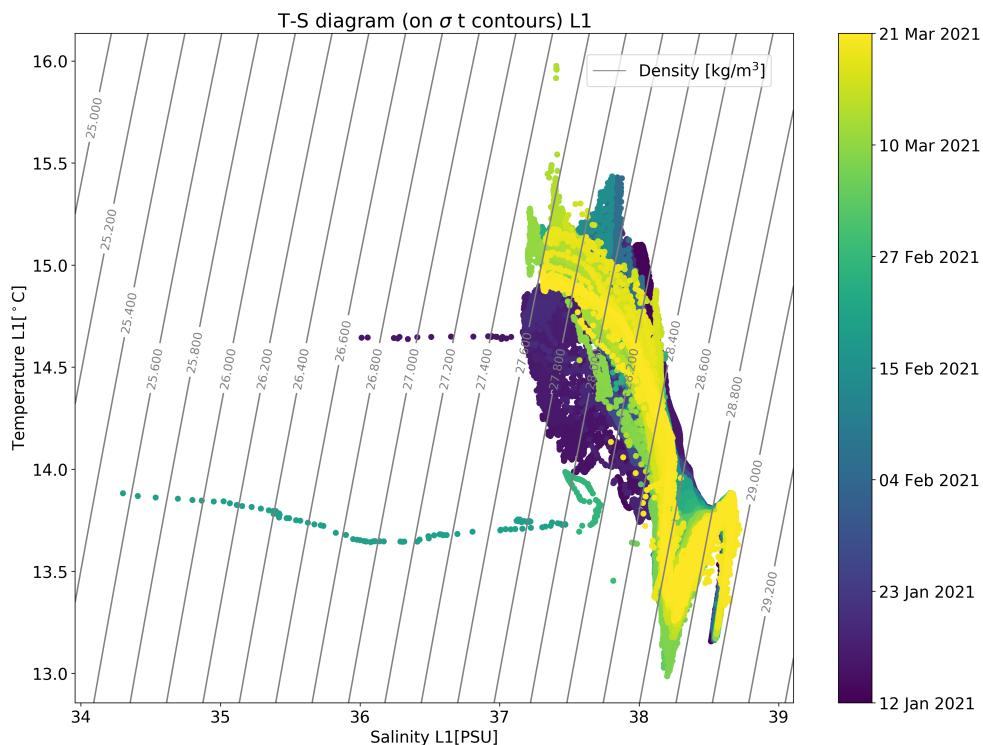


Figure 3.10: TS diagram (CTD)

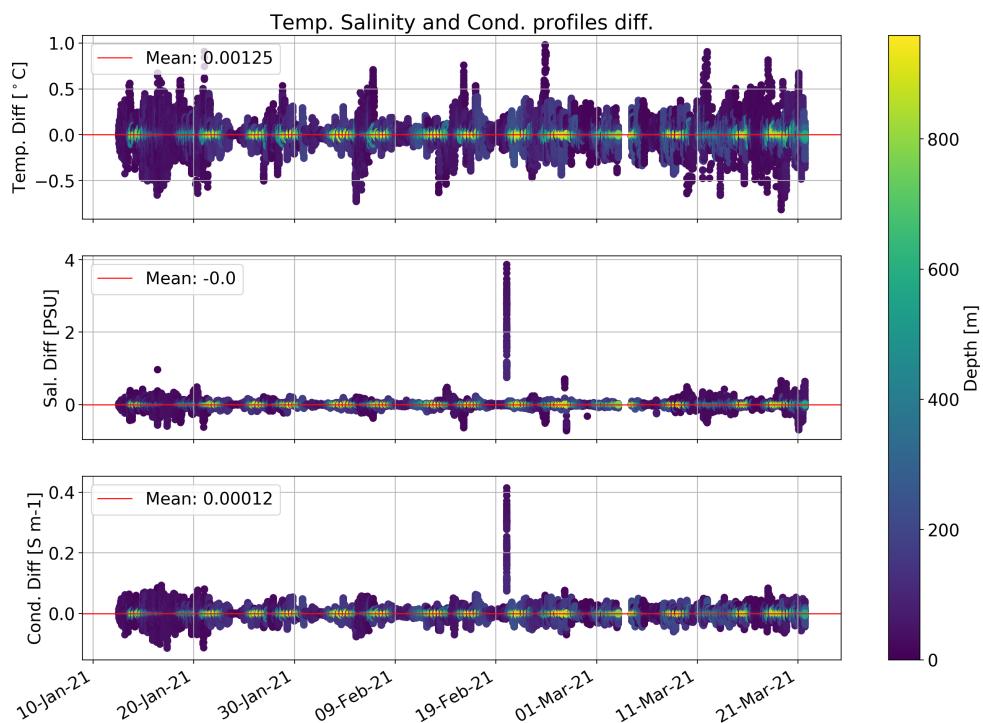


Figure 3.11: Profile consistency (CTD)

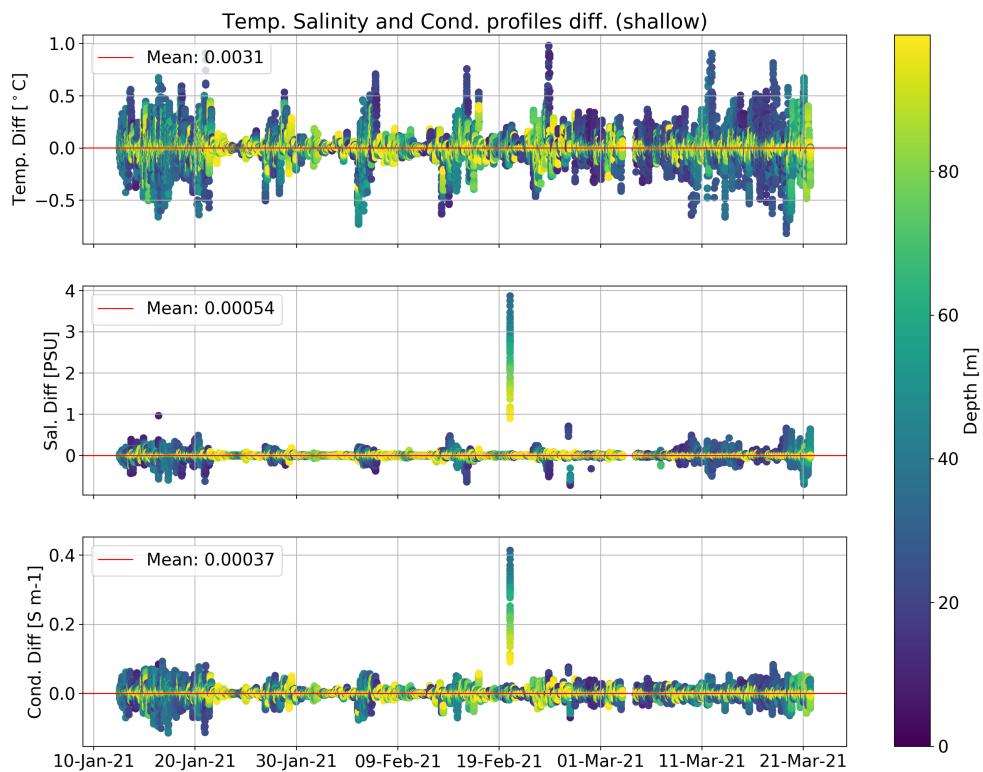


Figure 3.12: Profile consistency (CTD) zoom

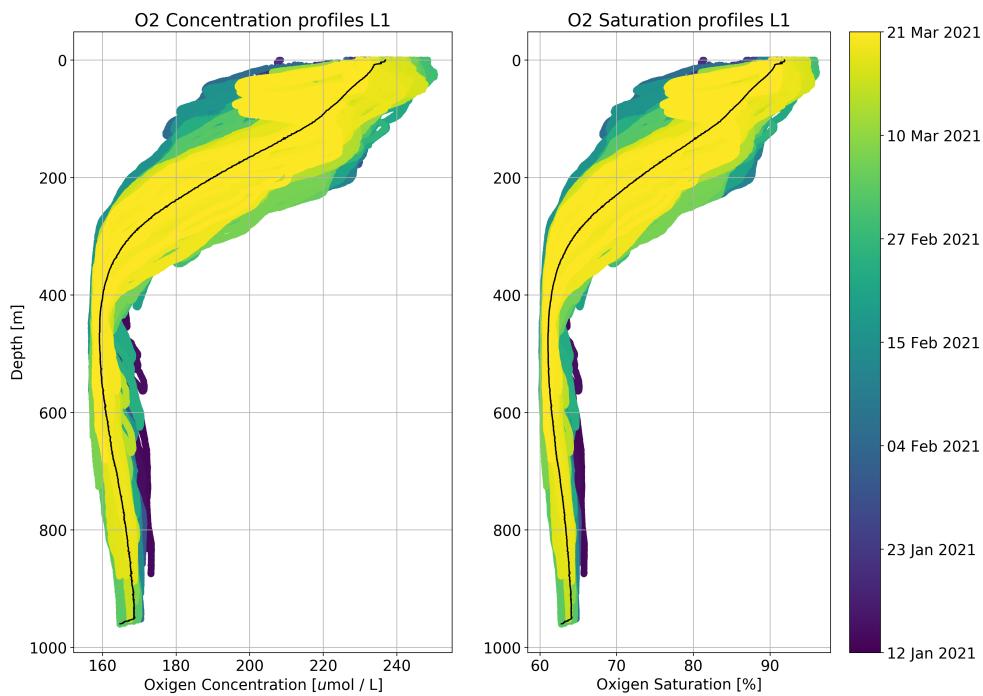


Figure 3.13: Oxygen profiles

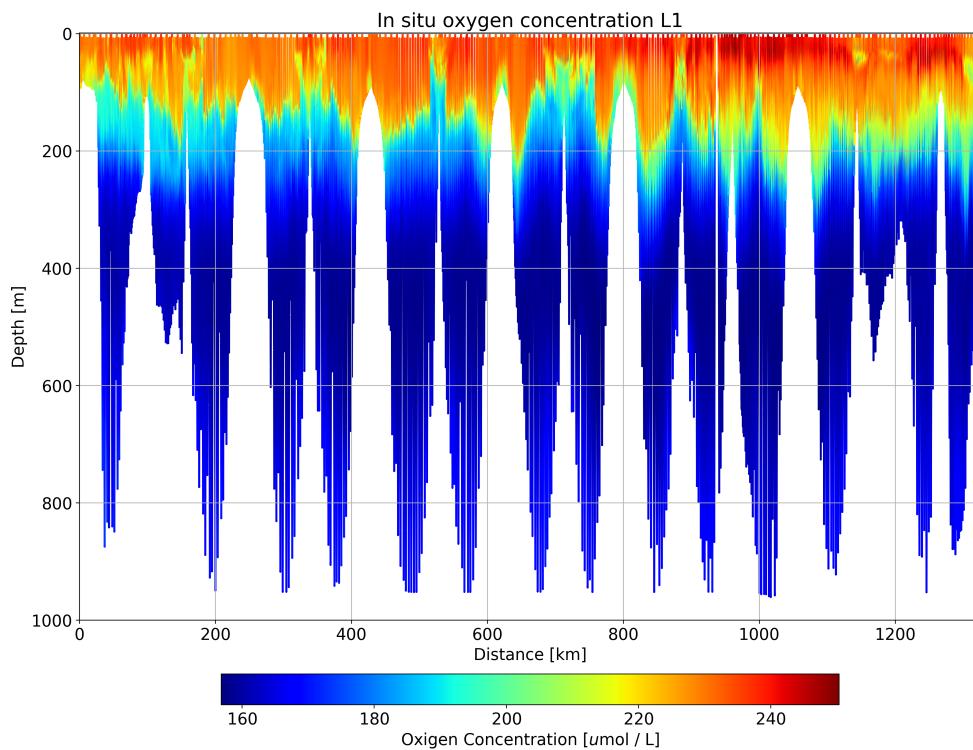


Figure 3.14: Oxygen Concentration

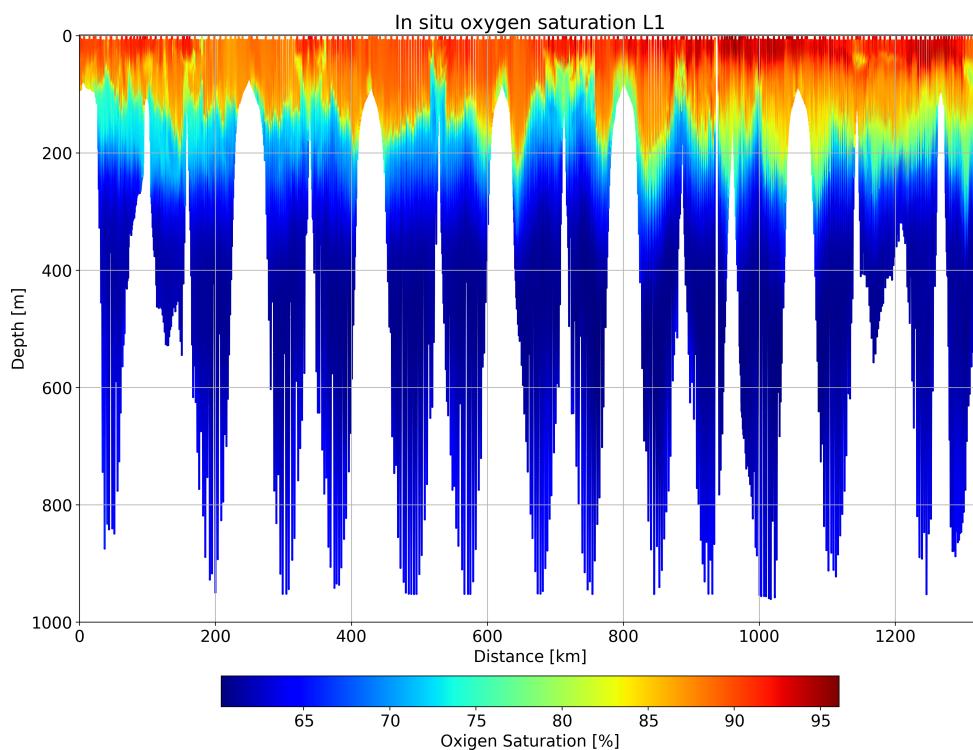


Figure 3.15: Oxygen Saturation

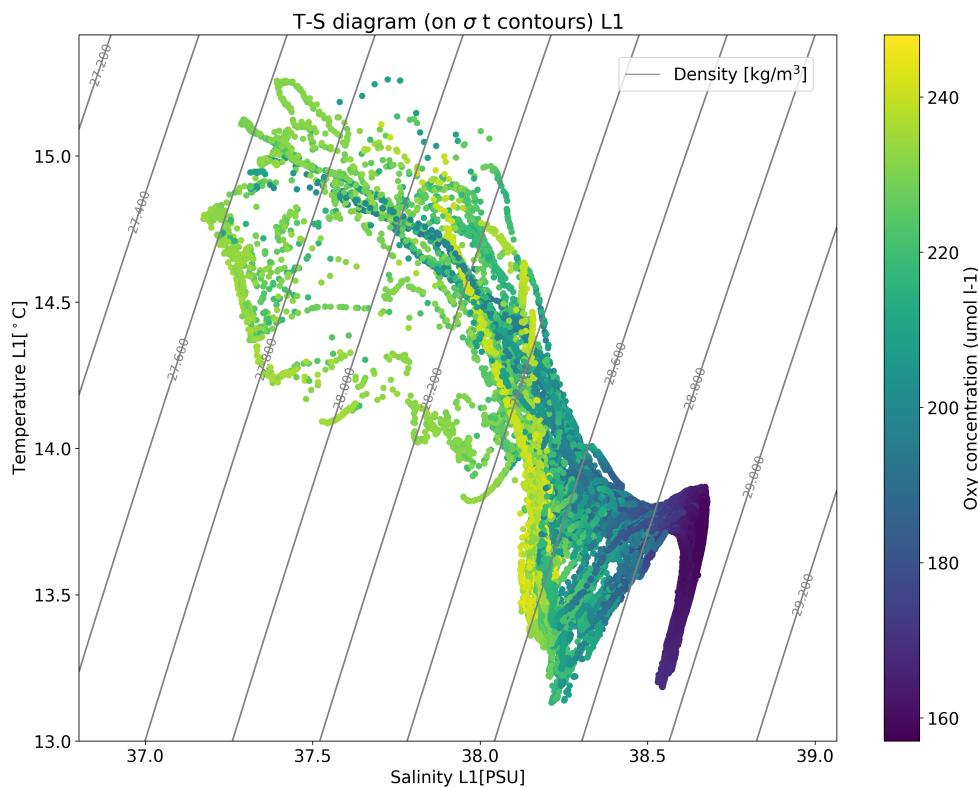


Figure 3.16: TS diagram (OXY)

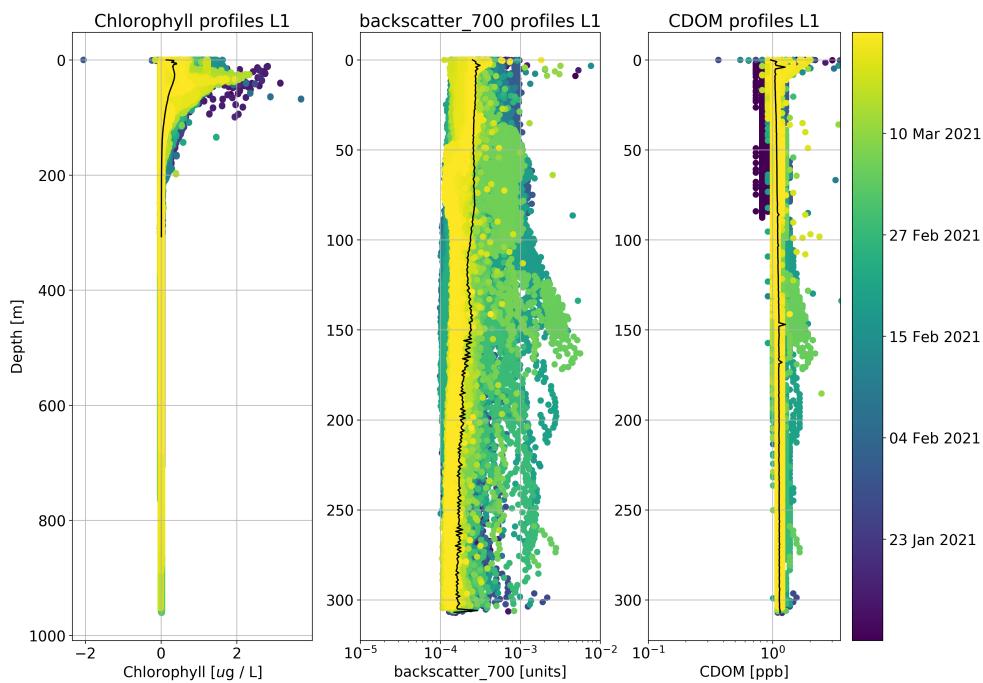


Figure 3.17: Chlorophyll-a, CDOM and BB700 profiles

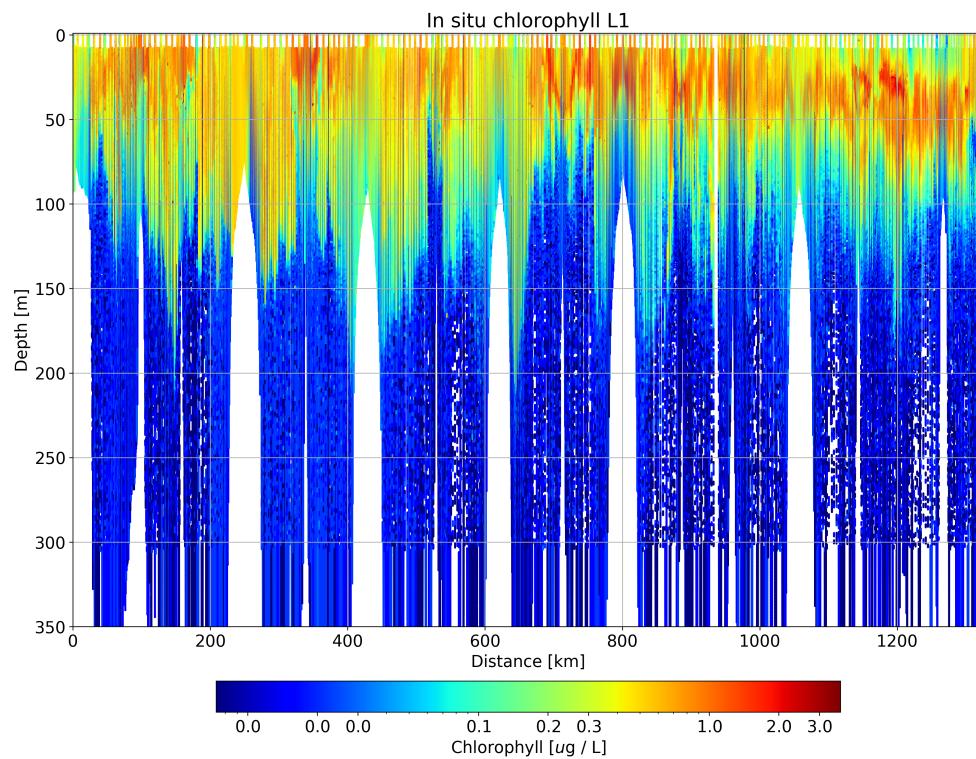


Figure 3.18: Chlorophyll-a

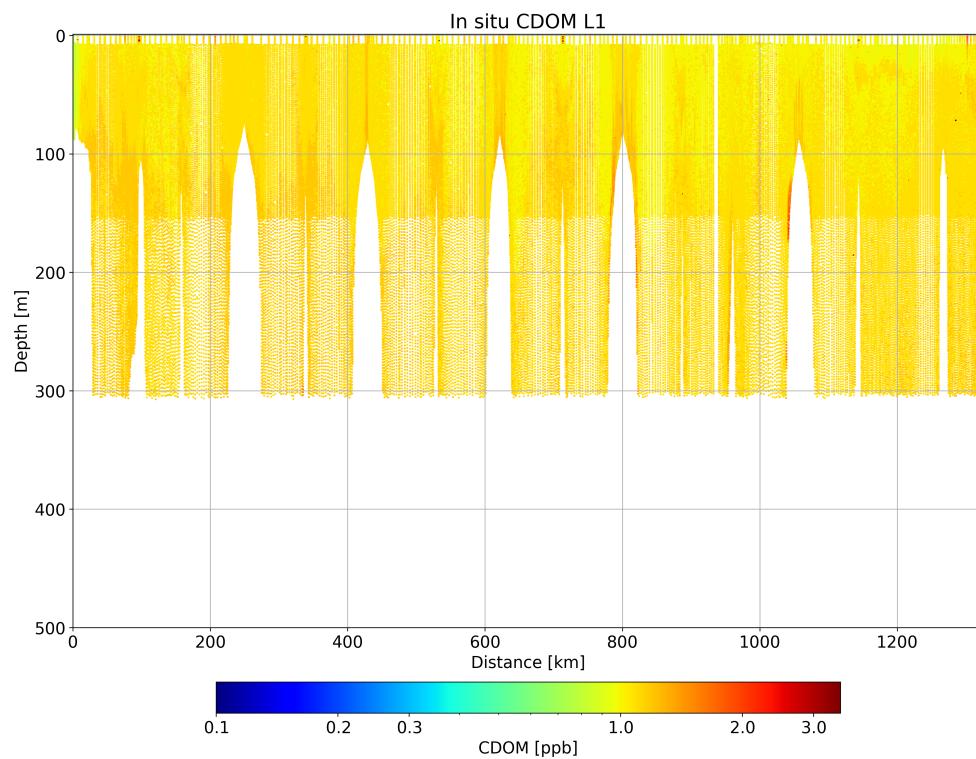


Figure 3.19: CDOM

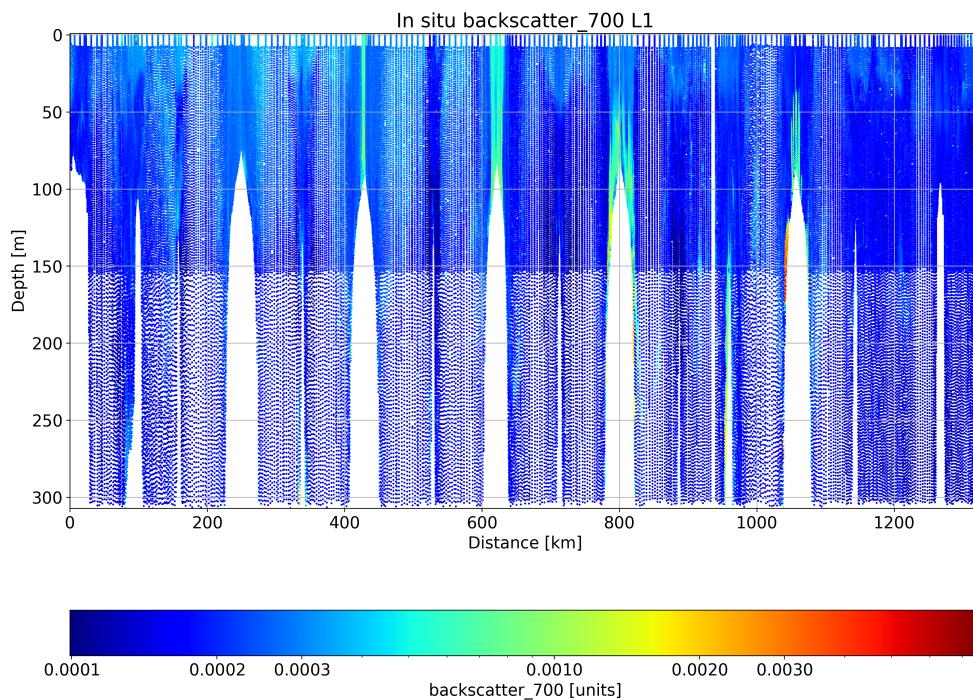


Figure 3.20: Backscatter 700

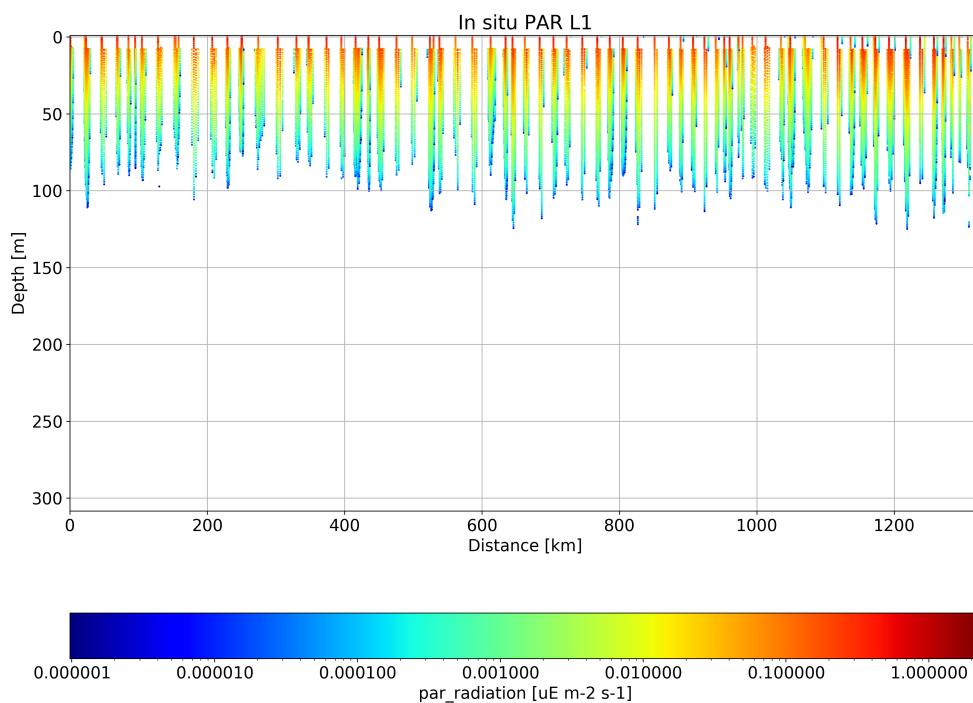


Figure 3.21: PAR radiation

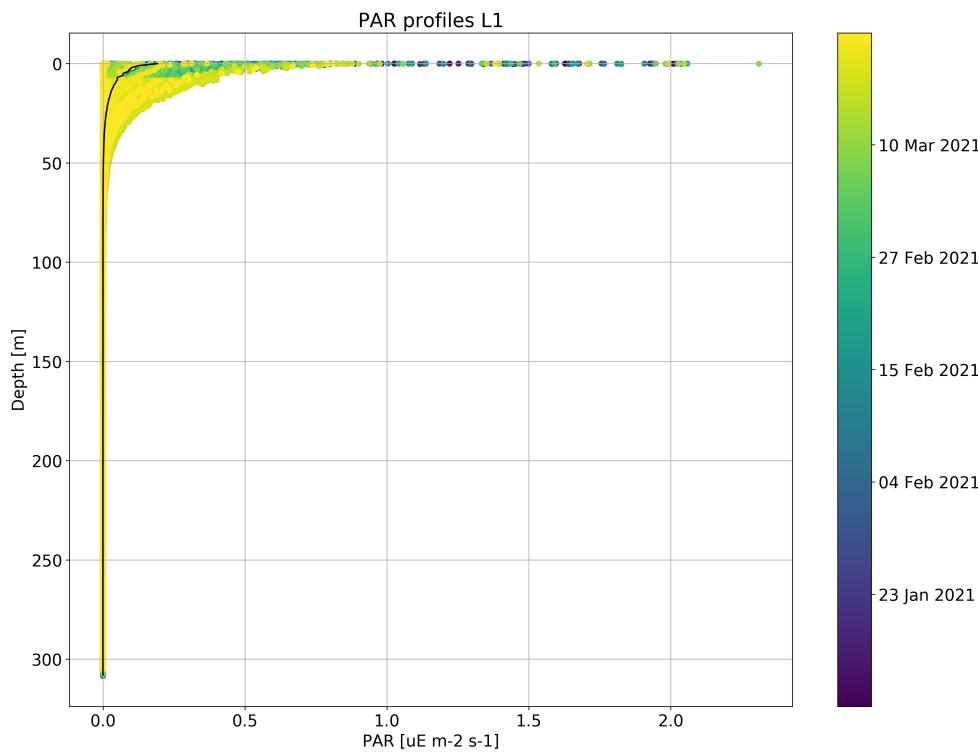


Figure 3.22: PAR profiles

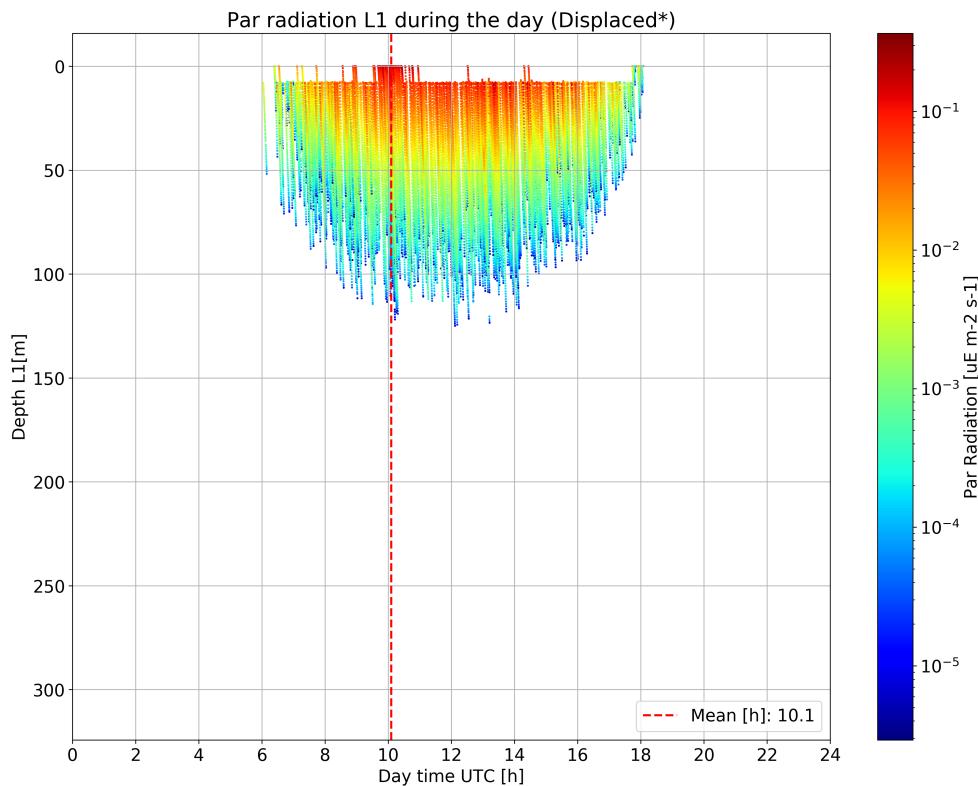


Figure 3.23: Daily par

4 Appendix

4.1 Glider behaviour

Showing changes on Sampling (behaviour 16):

- 12 Jan 2021 11:17:09 @ Sampling of: SAMPLE15.MA PAR(0m to -300m) sn 50318
- 12 Jan 2021 11:17:09 @ Sampling state to sample set to: Diving
- 12 Jan 2021 11:17:09 @ Sampling argument: intersample time set to: 8.0 s
- 12 Jan 2021 11:17:09 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Jan 2021 11:17:09 @ Sampling argument: min depth set to: 0.0 m
- 12 Jan 2021 11:17:09 @ Sampling argument: max depth set to: 300.0 m
- 21 Mar 2021 21:15:28 @ Sampling argument: intersample time set to: -1.0 s

Showing changes on Sampling (behaviour 15):

- 12 Jan 2021 11:17:09 @ Sampling of: SAMPLE13.MA OXY48311W sn 0842
- 12 Jan 2021 11:17:09 @ Sampling state to sample set to: Diving and climbing
- 12 Jan 2021 11:17:09 @ Sampling argument: intersample time set to: 4.0 s
- 12 Jan 2021 11:17:09 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Jan 2021 11:17:09 @ Sampling argument: min depth set to: -5.0 m
- 12 Jan 2021 11:17:09 @ Sampling argument: max depth set to: 2000.0 m
- 21 Mar 2021 21:15:28 @ Sampling argument: intersample time set to: -1.0 s

Showing changes on Sampling (behaviour 14):

- 12 Jan 2021 11:17:09 @ Sampling of: SAMPLE14.MA FLNTU(-150m to -300m) sn 6041
- 12 Jan 2021 11:17:09 @ Sampling state to sample set to: Diving
- 12 Jan 2021 11:17:09 @ Sampling argument: intersample time set to: 16.0 s
- 12 Jan 2021 11:17:09 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Jan 2021 11:17:09 @ Sampling argument: min depth set to: 150.0 m
- 12 Jan 2021 11:17:09 @ Sampling argument: max depth set to: 300.0 m
- 21 Mar 2021 21:15:28 @ Sampling argument: intersample time set to: -1.0 s

Showing changes on Sampling (behaviour 13):

- 12 Jan 2021 11:17:09 @ Sampling of: SAMPLE12.MA FLNTU(surface to -150m) sn 6041
- 12 Jan 2021 11:17:09 @ Sampling state to sample set to: Diving
- 12 Jan 2021 11:17:09 @ Sampling argument: intersample time set to: 8.0 s
- 12 Jan 2021 11:17:09 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Jan 2021 11:17:09 @ Sampling argument: min depth set to: -5.0 m
- 12 Jan 2021 11:17:09 @ Sampling argument: max depth set to: 150.0 m
- 21 Mar 2021 21:15:28 @ Sampling argument: intersample time set to: -1.0 s

Showing changes on Sampling (behaviour 12):

- 12 Jan 2021 11:17:09 @ Sampling of: SAMPLE11.MA CTD(Profile) sn 9597
- 12 Jan 2021 11:17:09 @ Sampling state to sample set to: Diving, climbing and hovering
- 12 Jan 2021 11:17:09 @ Sampling argument: intersample time set to: 4.0 s
- 12 Jan 2021 11:17:09 @ Sampling nth yo to sample set to: 1.0 nodim
- 12 Jan 2021 11:17:09 @ Sampling argument: min depth set to: -5.0 m
- 12 Jan 2021 11:17:09 @ Sampling argument: max depth set to: 2000.0 m
- 21 Mar 2021 21:15:28 @ Sampling argument: intersample time set to: -1.0 s

Showing changes on Yoing (behavior yo 11):

- 12 Jan 2021 11:17:09 @ Yoing num half cycles to do(nodim) set to: 2.0
- 12 Jan 2021 11:17:09 @ Yoing d target depth(m) set to: 5.0
- 12 Jan 2021 11:17:09 @ Yoing d bpump value(X) set to: -230.0
- 12 Jan 2021 11:17:09 @ Yoing d target altitude(m) set to: 20.0
- 12 Jan 2021 11:17:09 @ Yoing d use pitch(enum) set to: 3.0
- 12 Jan 2021 11:17:09 @ Yoing d pitch value(X) set to: -0.453800
- 12 Jan 2021 11:17:09 @ Yoing c use pitch(enum) set to: 3.0

- 12 Jan 2021 11:17:09 @ Yoing c pitch value(X) set to: 0.453800
 - 12 Jan 2021 12:13:17 @ Yoing d target depth(m) set to: 950.0
 - 12 Jan 2021 13:55:55 @ Yoing num half cycles to do(nodim) set to: -1.0
 - 12 Jan 2021 13:55:55 @ Yoing d bpump value(X) set to: 400.0
 - 18 Jan 2021 10:03:40 @ Yoing d bpump value(X) set to: 500.0
 - 21 Jan 2021 18:02:14 @ Yoing d bpump value(X) set to: 400.0
 - 29 Jan 2021 10:20:14 @ Yoing d bpump value(X) set to: 350.0
 - 06 Feb 2021 09:38:24 @ Yoing d bpump value(X) set to: 400.0
 - 07 Feb 2021 18:07:42 @ Yoing d bpump value(X) set to: 350.0
 - 28 Feb 2021 09:25:59 @ Yoing d bpump value(X) set to: 400.0
 - 02 Mar 2021 09:48:37 @ Yoing d bpump value(X) set to: 550.0
 - 04 Mar 2021 10:22:50 @ Yoing num half cycles to do(nodim) set to: 2.0
 - 04 Mar 2021 10:22:50 @ Yoing d target depth(m) set to: 5.0
 - 04 Mar 2021 10:22:50 @ Yoing d bpump value(X) set to: -230.0
 - 04 Mar 2021 10:36:31 @ Yoing num half cycles to do(nodim) set to: -1.0
 - 04 Mar 2021 10:36:31 @ Yoing d target depth(m) set to: 950.0
 - 04 Mar 2021 10:36:31 @ Yoing d bpump value(X) set to: 550.0
 - 08 Mar 2021 10:37:54 @ Yoing d bpump value(X) set to: 400.0
 - 21 Mar 2021 21:15:28 @ Yoing num half cycles to do(nodim) set to: 2.0
 - 21 Mar 2021 21:15:28 @ Yoing d target depth(m) set to: 5.0
 - 21 Mar 2021 21:15:28 @ Yoing d bpump value(X) set to: -230.0
 - 21 Mar 2021 21:31:43 @ Yoing num half cycles to do(nodim) set to: -1.0
 - 21 Mar 2021 21:31:43 @ Yoing d target depth(m) set to: 300.0
 - 21 Mar 2021 21:31:43 @ Yoing d bpump value(X) set to: 400.0
- Showing changes on Altimeter set to (behaviour u alt min depth):
- 12 Jan 2021 11:24:05 @ Altimeter set to u alt min depth set to: 2

4.2 Installed devices (from autoexec.mi)

- Forward section assy _SN: 518
- Payload bay assy _SN: 1348
- Aft section assy _SN: 1001
- Aft electronic assy _SN: 0002
- Aft end cap assy _SN: 153
- Radomefin _SN: 1237
- Pressure transducer _SN: 123648
- Aft hull _SN: 2430
- Fwd hull _SN: 2420
- Freewave master _SN: 970-3925
- Iridium sim card _SN: 8988169234003166048
- Argos ID _SN: Dec 198867/Hex 0C16335
- Altimeter _SN: 60201896
- Pitch motor _SN: 250
- 1000- Motor _SN: controller117
- 1000- Pump assy _SN: 03L20
- 1000- Valve assy _SN: 636
- Science persistor _SN: 00029
- science motherboard _SN: 00014
- seabird CTD _SN: 9597
- Main board _SN: 159
- Communication board _SN: 2
- Iridium phone _SN: 200
- Main persistor _SN: 22

- Attitude sensor _SN: 42805
- Air pump _SN: 1288
- Communications Assy _SN: 0002
- Freewave Slave _SN: 968-0550
- GPS _SN: 1470
- Argos X-cat _SN: 1202
- Air bladder _SN: 39630664.21

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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2.11 20210203T180413 Anomaly 8	11
2.12 20210207T175529 Anomaly 9	12
2.13 20210209T180218 Anomaly 10	12
2.14 20210212T094359 Anomaly 11	13
2.15 20210215T095548 Anomaly 12	13
2.16 20210217T095657 Anomaly 13	14
2.17 20210221T020327 Anomaly 14	14
2.18 20210222T095744 Anomaly 15	15
2.19 20210222T180009 Anomaly 16	15
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2.21 20210228T101120 Anomaly 18	16
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