

SOCIB Glider Mission Summary Report

SOCIB_ENL_CANALES_GFMRGFMRO100

Authors: P. Rivera, M. Rubio, N. Zarokanellos, A. Miralles (SOCIB glider team)

Contributors: ETD and DC team

PI: J. Tintoré

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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.

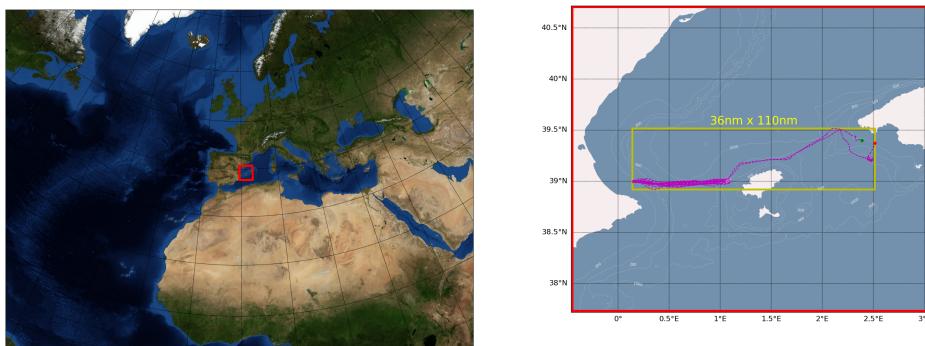


Figure 1.1: Map providing general overview of the Survey Area

1.1 Summary

Mission name	SOCIB_ENL_CANALES__GFMRGFMR0100
Platform model	G3 Electric
Platform ID / Name / WMO Code	U244/ sdeep01/ 68967
Software NAV version	Version 8.2 Under Ice, In-situ Compass Cal, JASCO Observer
Software SCI version	Version 8.2 Under Ice, In-situ Compass Cal, JASCO Observer
FWD bay sn	0076
SCI bay sn	1328
Mission duration	104.9 days
Mission start	2020-01-30 11:00:04
Mission end	2020-05-14 07:29:37
Total distance	1802.9[km] 973.49[nm]
Deployment point [dd°mm.mmmm']	N 39°24.0091' E 02°23.2935'
Recovery point [dd°mm.mmmm']	N 39°22.3696' E 02°30.9619'
Battery Consumption (Ah)	519.1(from 9.2 to 528.3)
Battery specification	20200115_SN0038/ TWR 3S lithium (702Ah)
Survey area	Canales
Objetive	SOCIB Glider Missions - Canales Endurance Line - was initiated in 2011, covering both the Mallorca and Ibiza channel in a semi-continuous operational mode and sampling physical and biogeochemical observations. The Ibiza channel is a well-established biodiversity hotspot with high mesoscale and submesoscale variability. On the canales endurance line, ocean gliders making repeated dives from the surface to seabed or up to 1000 m. The glider missions typically last about 60 to 90 days, providing 6-14 sections of the Ibiza channel and 2 sections of the Mallorca channel.
Abstract	Deployment of Slocum G2 deep glider sdeep01 in endurance line campaign Canales 2020 (SOCIB operational program), aiming the coverage of the Eivissa channel (16 transects) and Mallorca channel (2 transect) from JAN to MAY 2020, sampling physical and biogeochemical parameters (CTD and oxygen). Part of the mission took place during COVID19. Glider recovered due to oil leaking problems.

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: Plenty of anomalies on diving from surface, see figure 2.28. Thermal valve needs to refurbish. ▪ Event 3: Too symmetric deep and shallow inflections, it confirms previous event, see figure 2.29 ▪ Event 4: Inflections went faster with time, see figure 2.32 and also it was leaking (climbing and diving) more also with time, see figure 2.31
SCI events	<ul style="list-style-type: none"> ▪ Event 1: Anomalies detected on PAR sensor, too high profile values detected at depth, see figure 3.18. ▪ Event 2: A number of profiles and parts of profiles were clearly affected by bio-fueling and/or transient instrument problems. These profiles were not all in one period, in total there were 6 groups of profiles defined by dt data points as follows: 462949:463550, 1895530:1895579, 2276813:2289293, 2646262:2648338, 844787:2844890, 3071055:3092873. These data had to be removed by setting to Nan values. ▪ Event 3: Intrusions of low salinity water <37.5 that has been associated with relatively high temperature have been observed several times during the mission until the end of March that can be present as deep as 75m. From the beginning of April the upper layer of the water column warming of the upper layer (<50m) that progressively increase until the end of the mission ▪ Event 4: Hysteresis on the oxygen is present between upcast and downcast. ▪ Event 5: No data on the PAR after 16 March 2020, in order to save energy, with the exception of PAR data between 29 April and 1st of May, to perform an engineering test

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/sdeep01-scb_sldeep001/L0/2020/dep0032_sdeep01_scb-sldeep001_L0_2020-01-30_data_dt.nc
- L1: https://thredds.socib.es/thredds/fileServer/auv/glider/sdeep01-scb_sldeep001/L1/2020/dep0032_sdeep01_scb-sldeep001_L1_2020-01-30_data_dt.nc
- L2: https://thredds.socib.es/thredds/fileServer/auv/glider/sdeep01-scb_sldeep001/L2/2020/dep0032_sdeep01_scb-sldeep001_L2_2020-01-30_data_dt.nc

2 Engineering Review

2.1 Preparation

- Premission: ok
- Hardware: ok
- Batteries: ok
- Comms: ok
- Science: ok
- Ballasting: ok
- Sealing: ok
- Fileset: ok
- CEM: na
- Harbor check: ok
- Recovery: ok
- Conclusion: ok

2.2 Mission Survey

- Deployment:
 - Vessel: SOCIB I
 - Personnel: 2 GF + 1 ETD
 - Location: Palma Bay
- Navigation: The glider responded well to the commanded target waypoints.
- Underwater Maneuvering: Performed well
- Engineering sensors:

Sensor	Oddities	Warnings	Errors
GPS	5	2	0
attitude rev	0	4	0
pitch motor	81	0	0
science super	54	0	0
digifin	2184	0	0
IRIDIUM	446	0	0
DE PUMP	1043	0	0

- Communication Systems (see appendix for Iridium states):
 - Total number iridium calls [num]: 379
 - Iridium calls to secondary [num]: 3
 - ON overall iridium period [h]: 14.6
 - Iridium calls state from MODE NO CARRIER to MODE UNKNOWN [num]: 53
 - Iridium calls state from MODE CONNECT to MODE UNKNOWN [num]: 364
 - Iridium calls state from MODE NO ANSWER to MODE UNKNOWN [num]: 1

- Iridium calls state from MODE UNKNOWN to MODE AWAITING OK [num]: 419
- Iridium calls state from MODE AWAITING OK to MODE UNKNOWN [num]: 1
- Drop calls (Iridium state from 2 to 99 with c iridium on = 1) [num]: 8
- Unstable comms detected on: 2020-01-31 11:34:03
- Unstable comms detected on: 2020-05-01 10:32:26
- Total time at surface [h]: 70.96
- Total time at surface [%]: 2.82
- Hull/Hydrodynamics: No signs of problems
- Recovery:
 - Vessel: SOCIB I
 - Personnel: 1 GF + 2 ETD
 - Location: Palma Bay

2.3 NAV plots

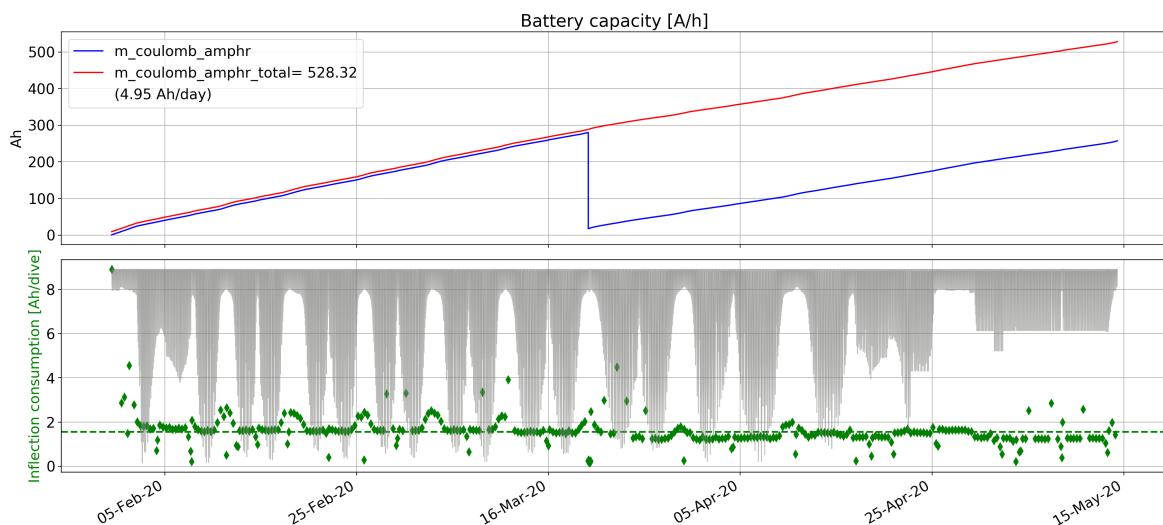


Figure 2.1: Battery capacity

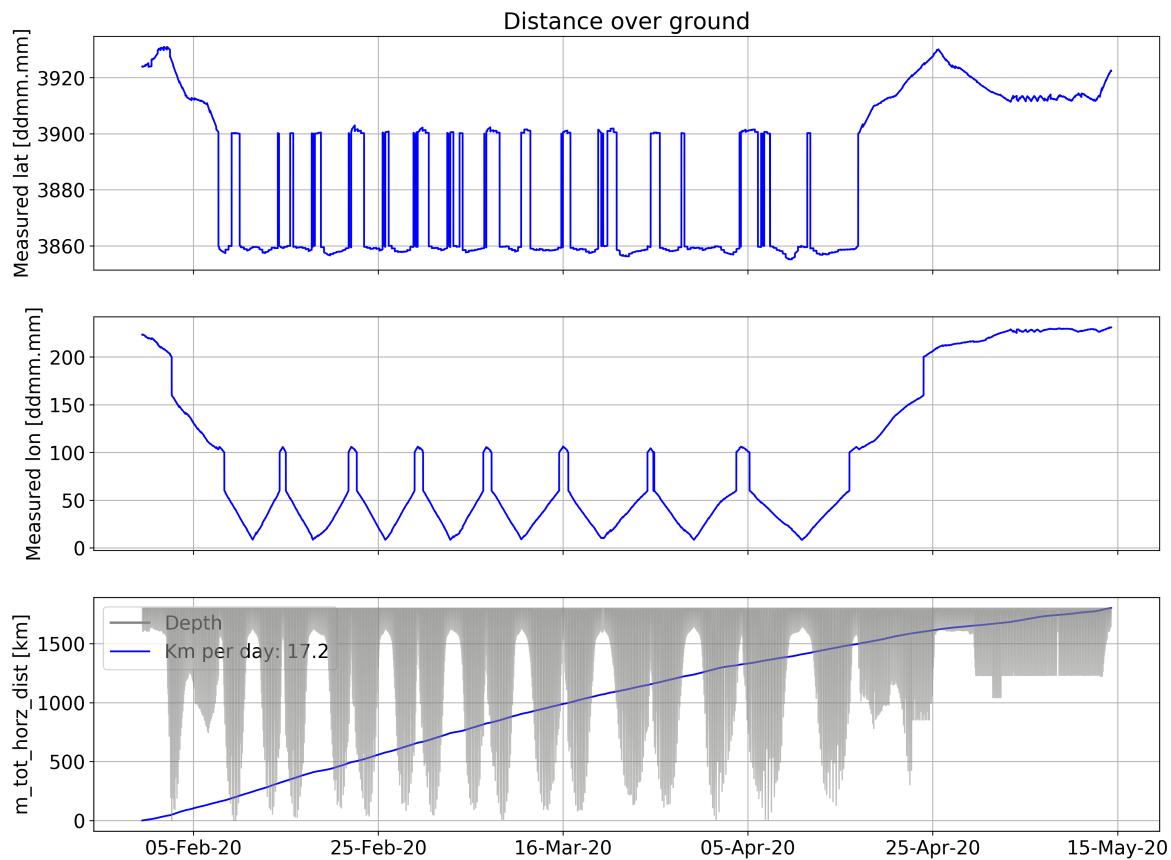


Figure 2.2: Distance over ground

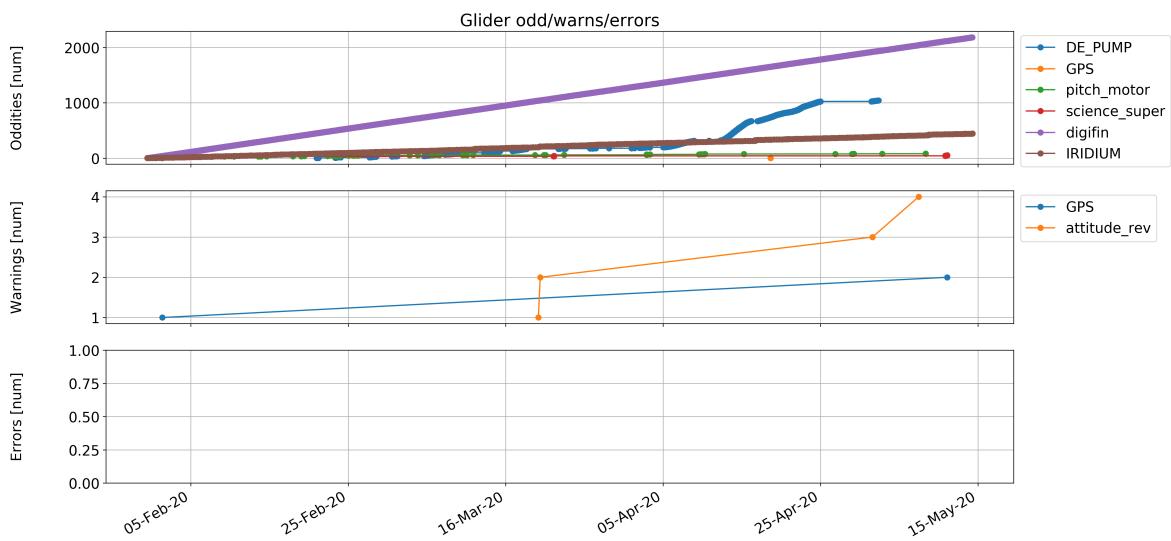


Figure 2.3: Glider Odd Warn and Err

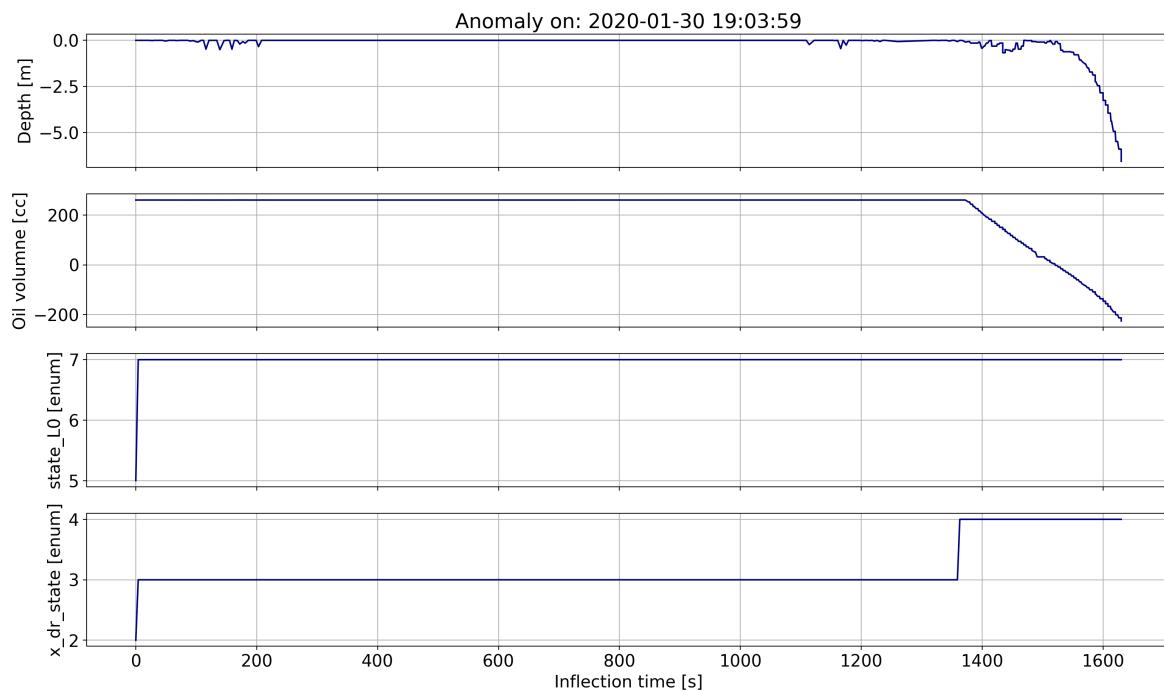


Figure 2.4: 20200130T190359 Anomaly 2

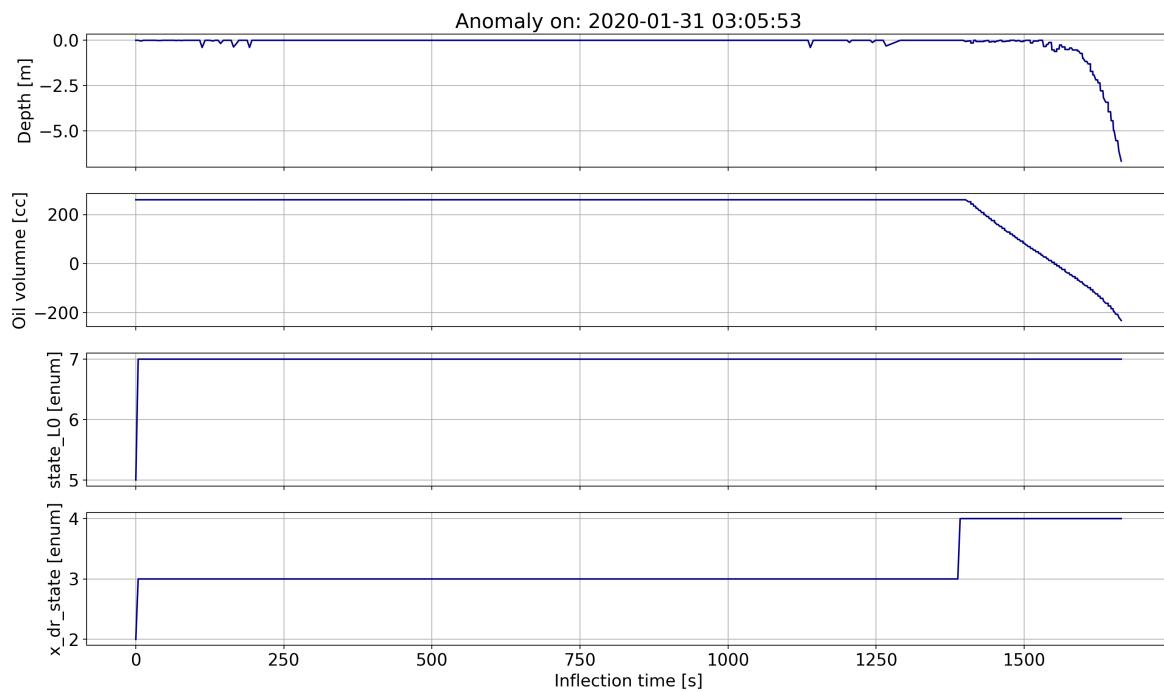


Figure 2.5: 20200131T030553 Anomaly 3

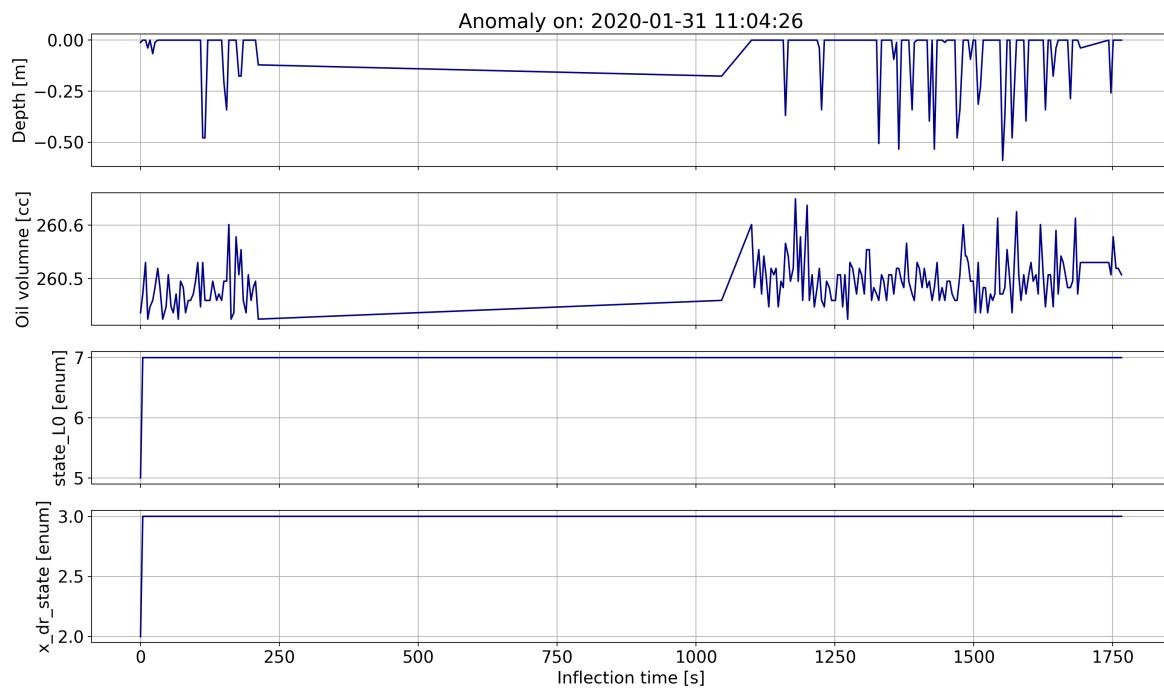


Figure 2.6: 20200131T110426 Anomaly 4

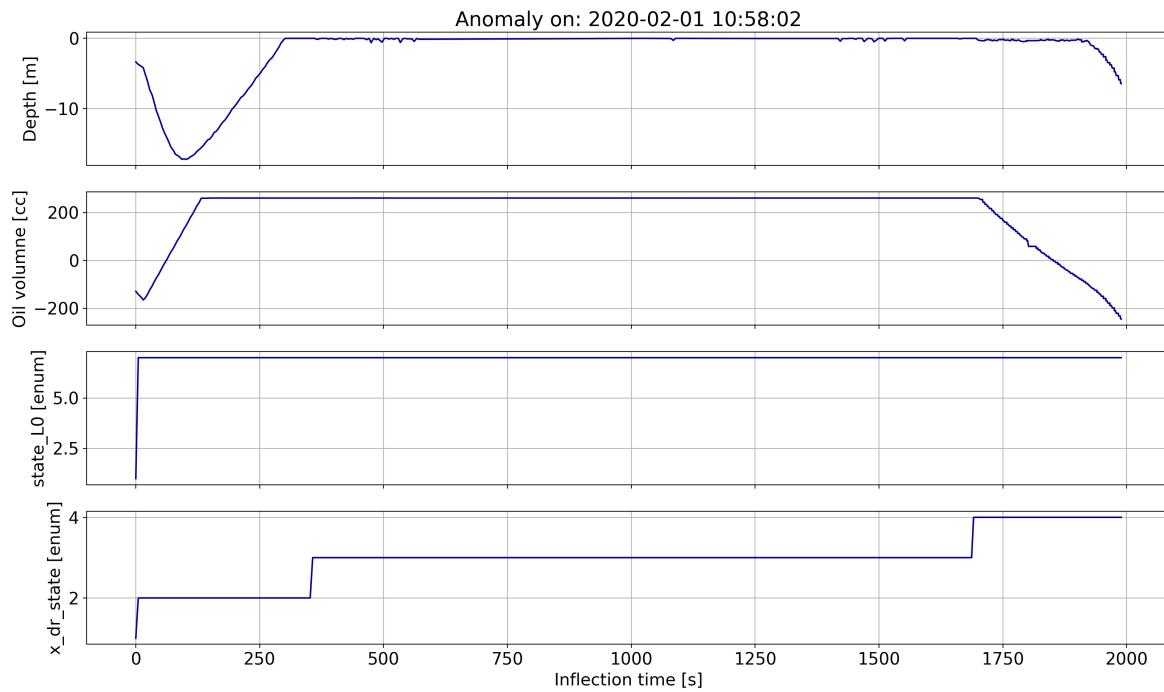


Figure 2.7: 20200201T105802 Anomaly 9

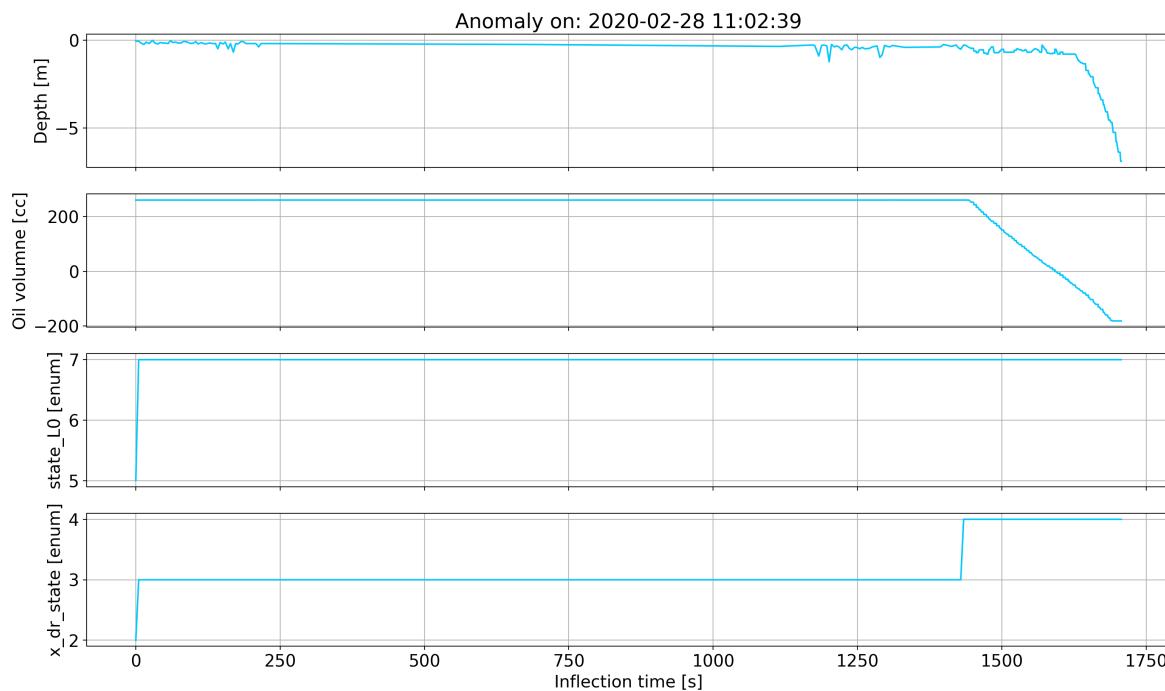


Figure 2.8: 20200228T110239 Anomaly 99

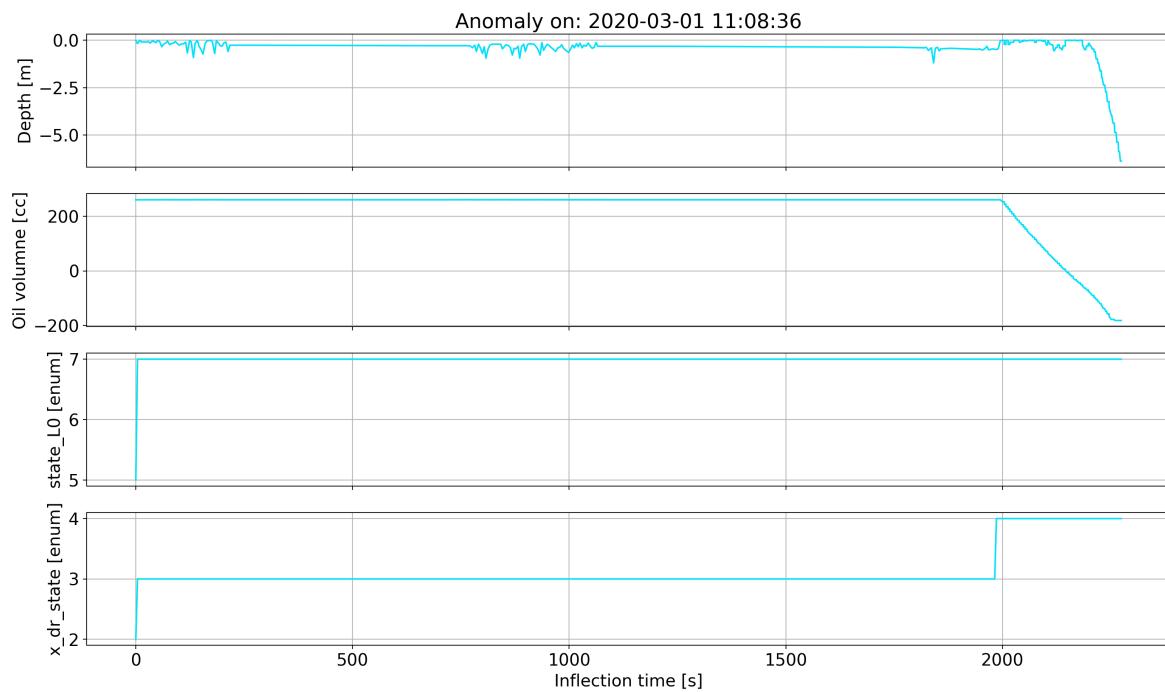


Figure 2.9: 20200301T110836 Anomaly 106

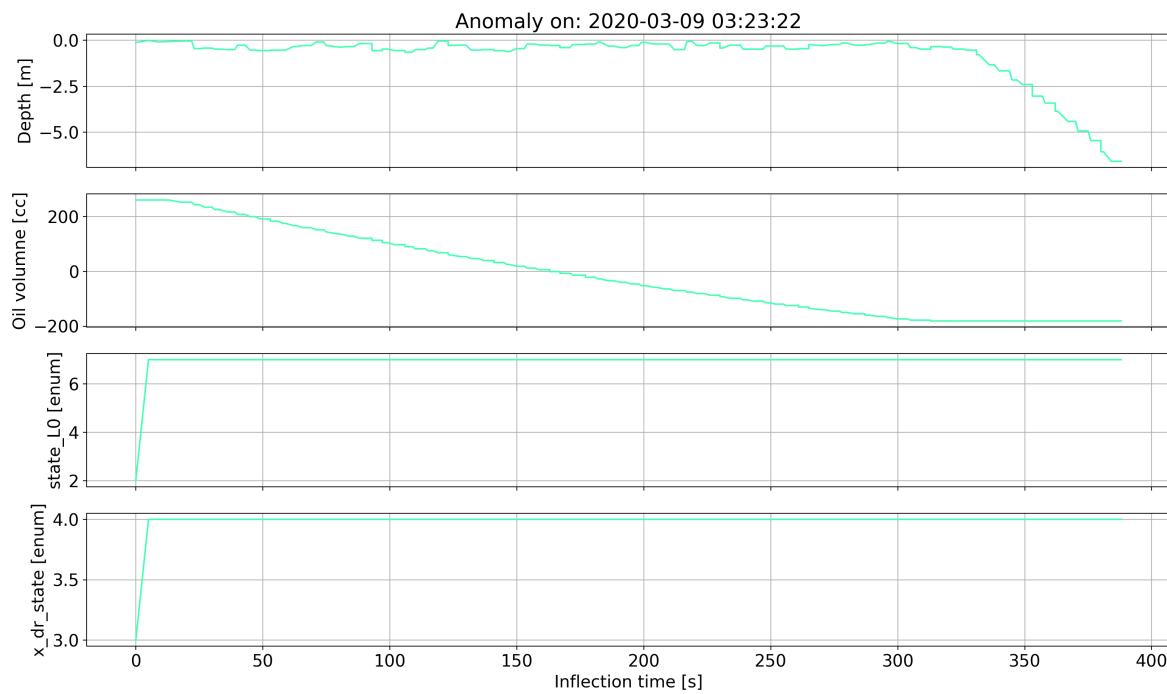


Figure 2.10: 20200309T032322 Anomaly 130

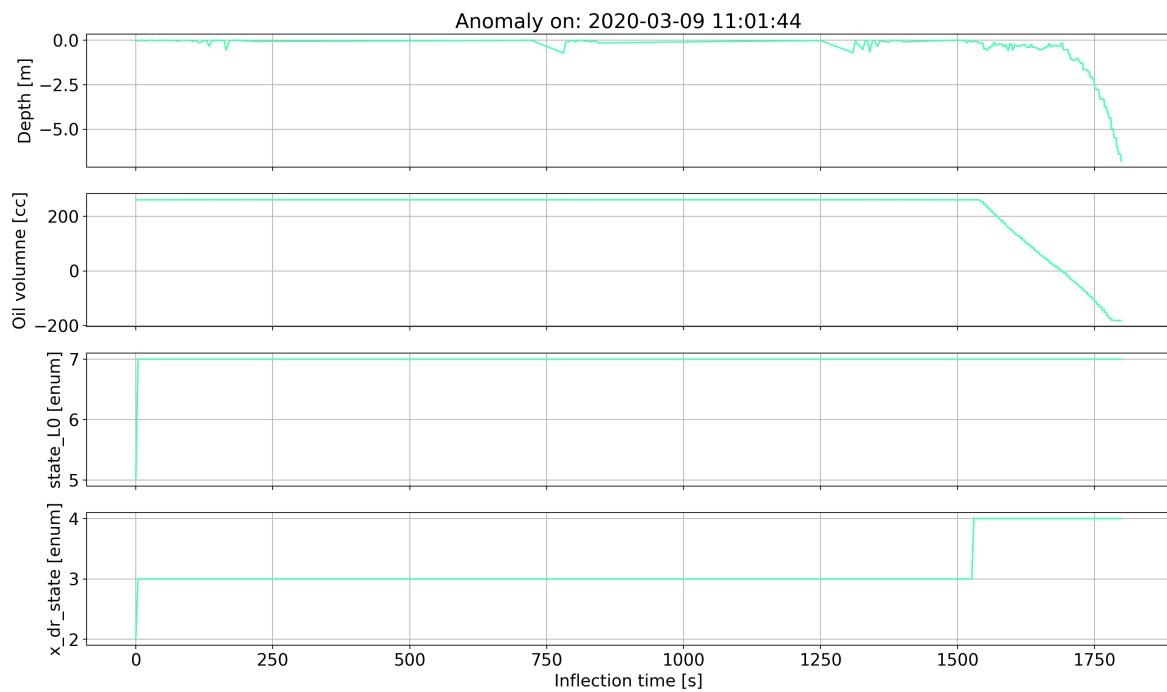


Figure 2.11: 20200309T110144 Anomaly 131

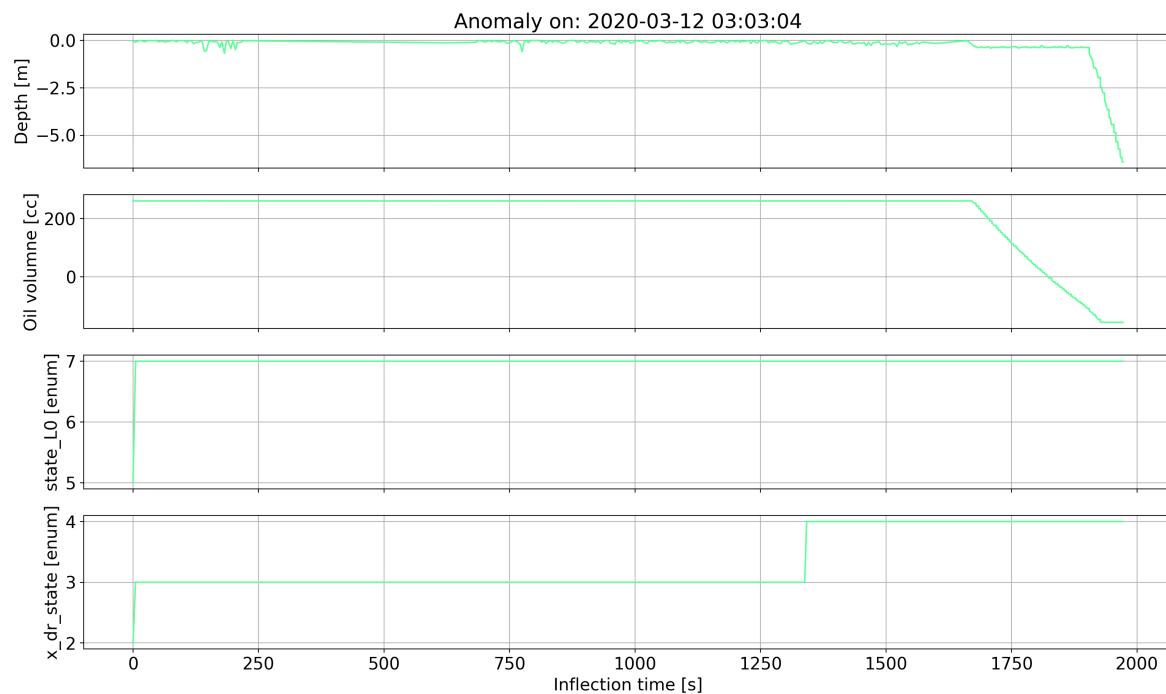


Figure 2.12: 20200312T030304 Anomaly 139

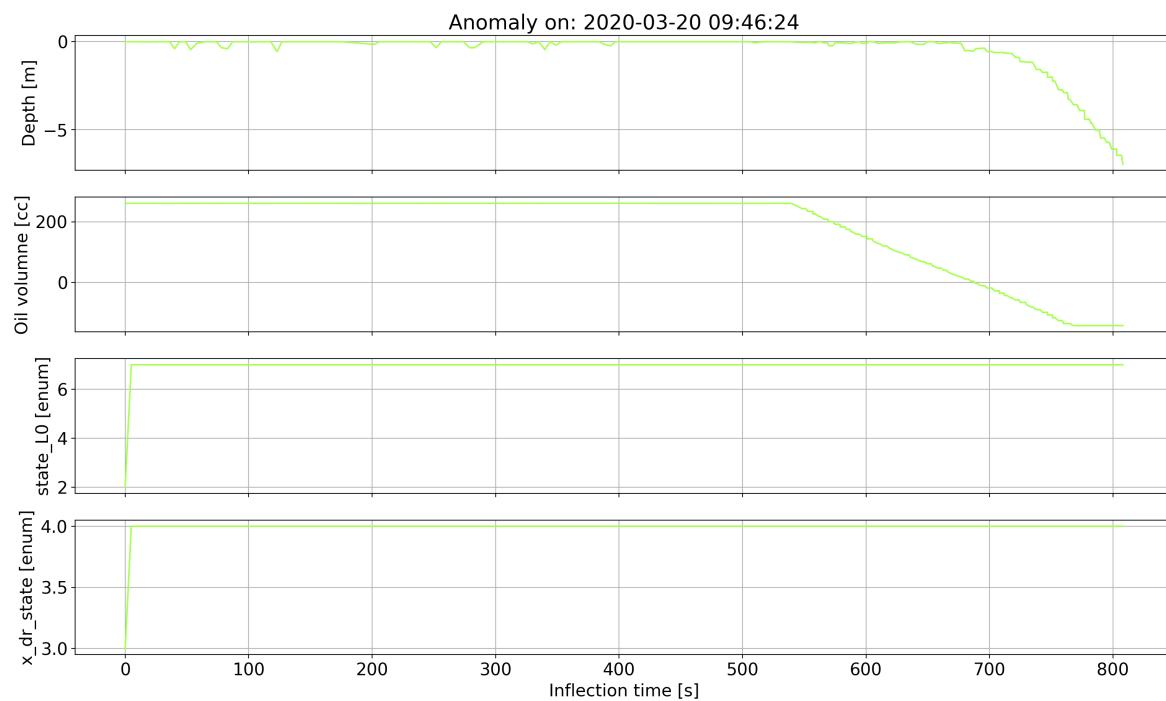


Figure 2.13: 20200320T094624 Anomaly 175

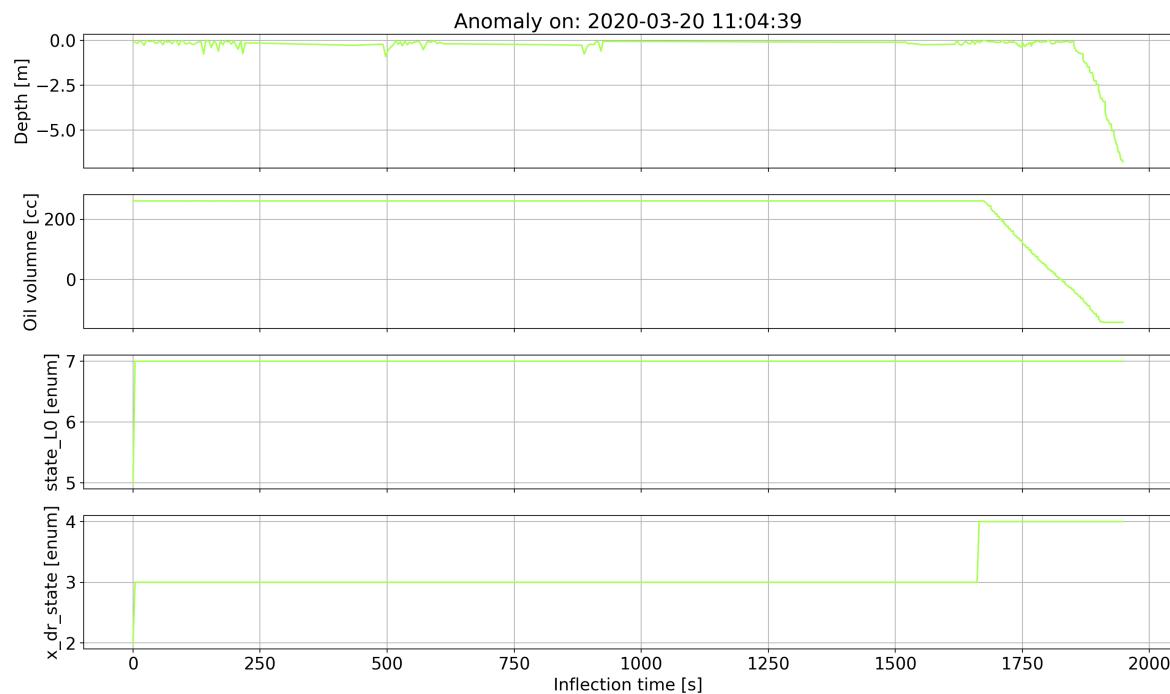


Figure 2.14: 20200320T110439 Anomaly 176

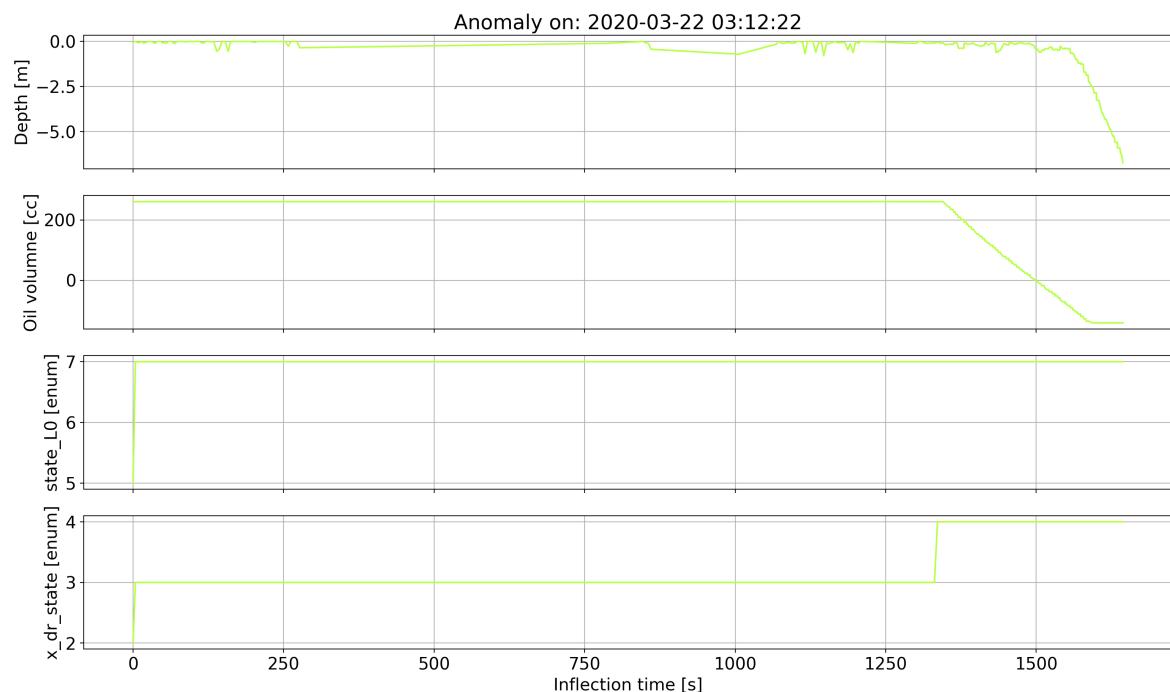


Figure 2.15: 20200322T031222 Anomaly 181

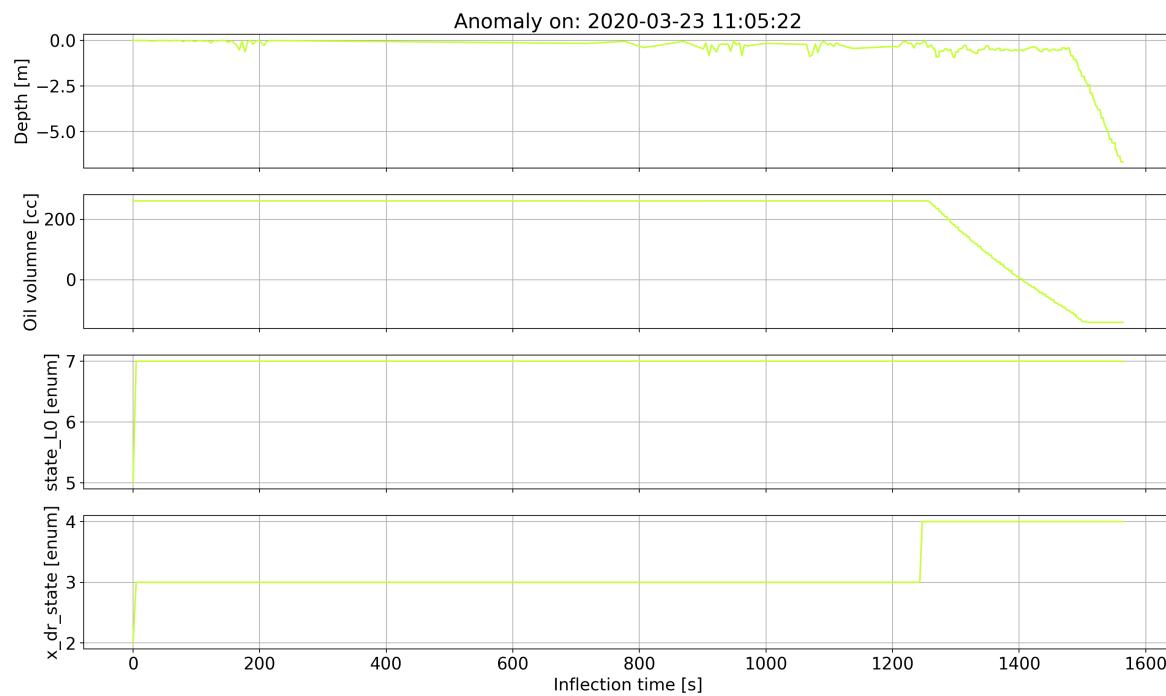


Figure 2.16: 20200323T110522 Anomaly 185

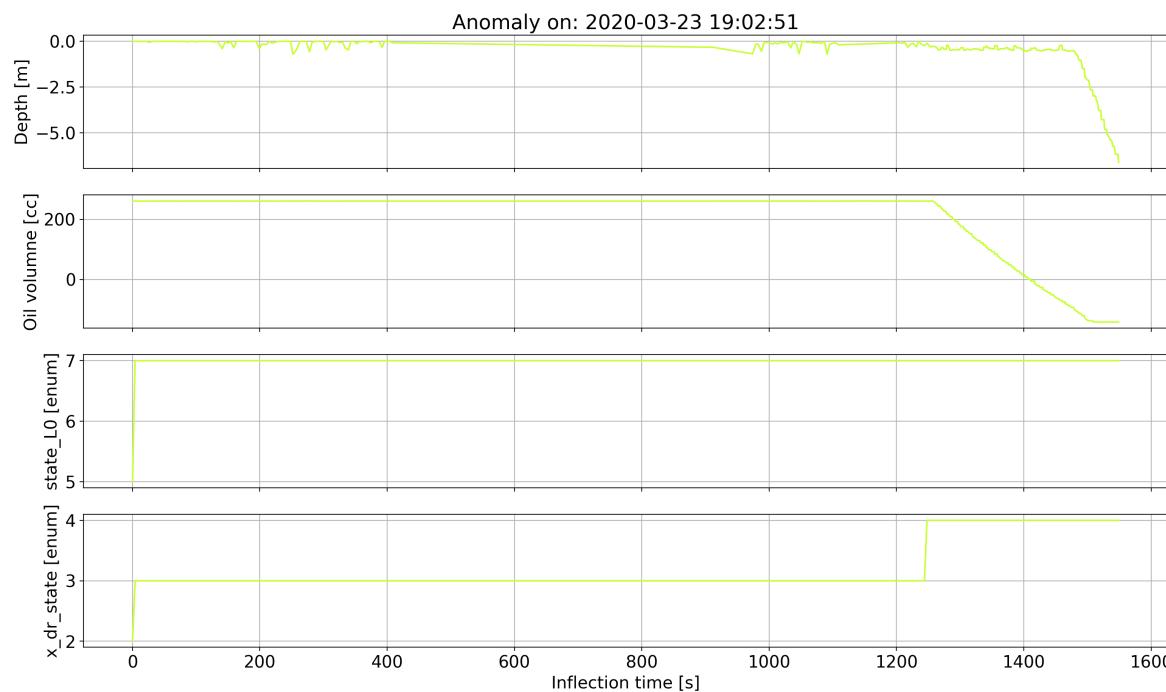


Figure 2.17: 20200323T190251 Anomaly 186

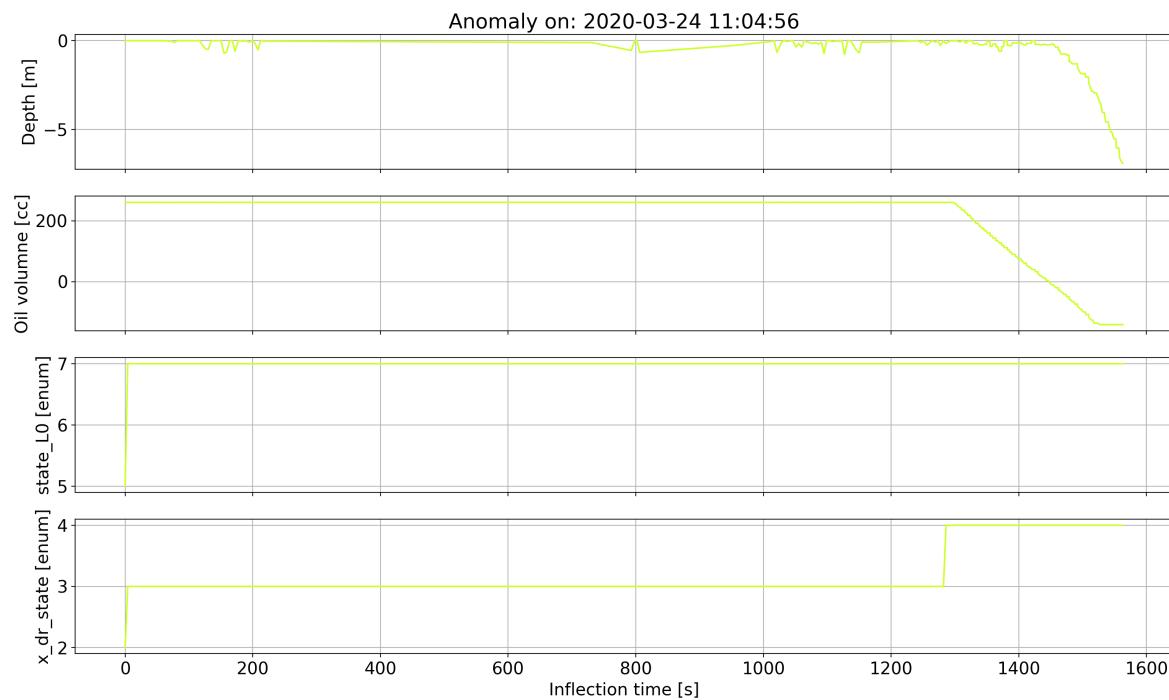


Figure 2.18: 20200324T110456 Anomaly 188

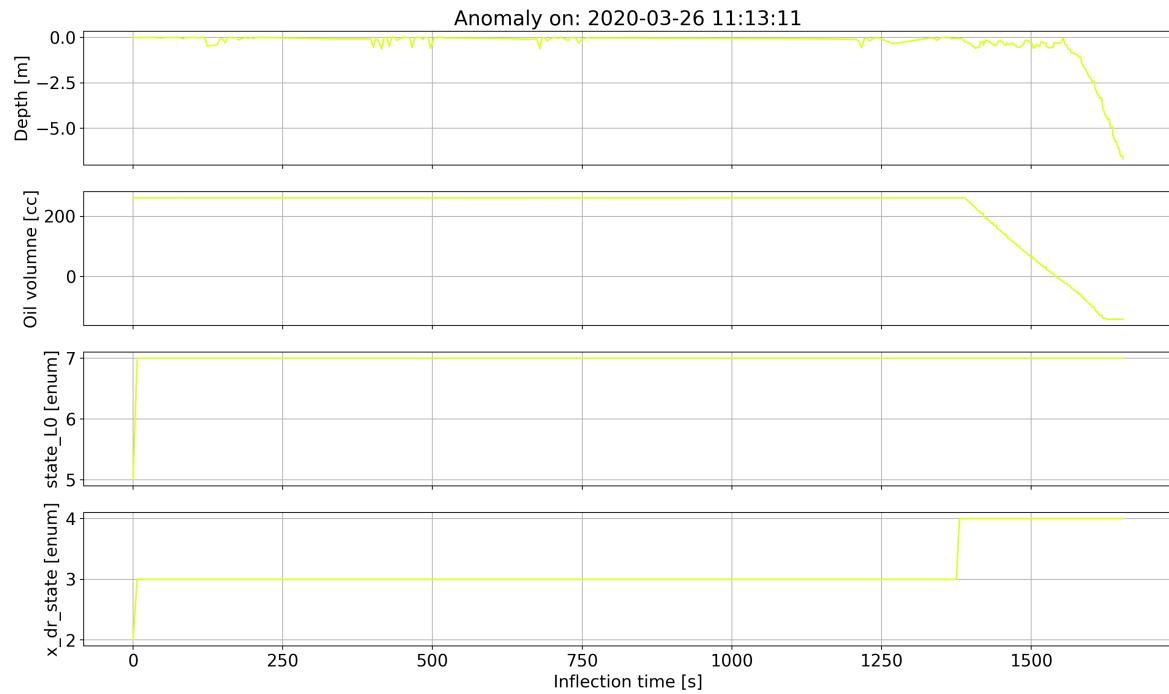


Figure 2.19: 20200326T111311 Anomaly 194

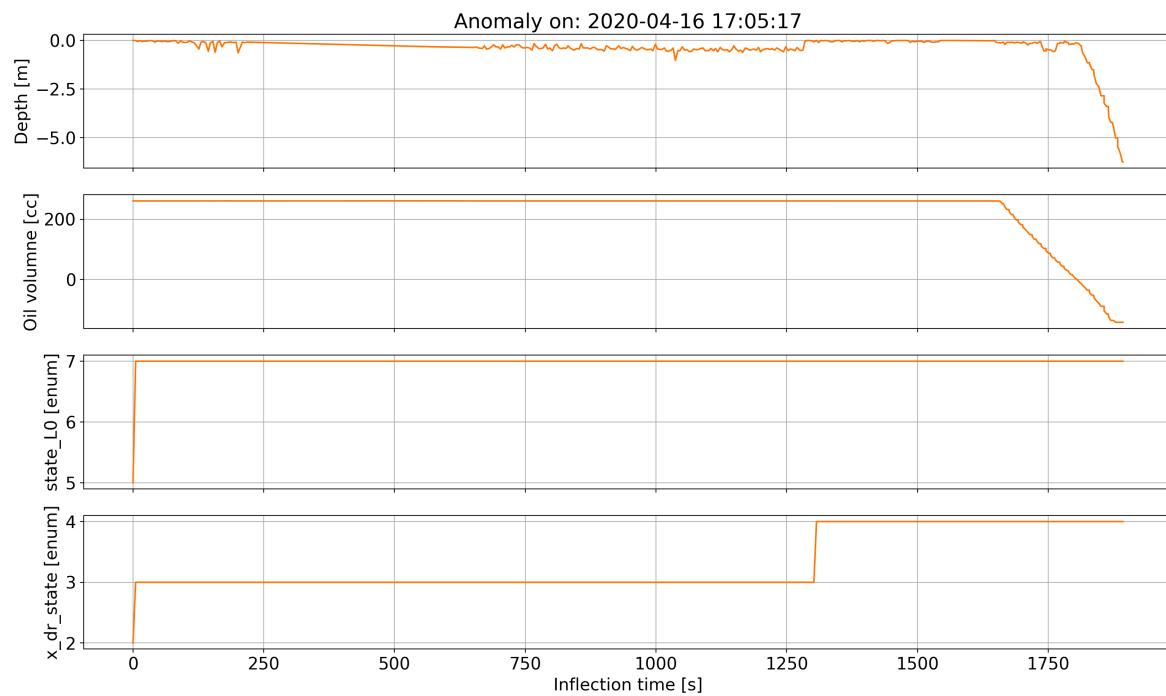


Figure 2.20: 20200416T170517 Anomaly 261

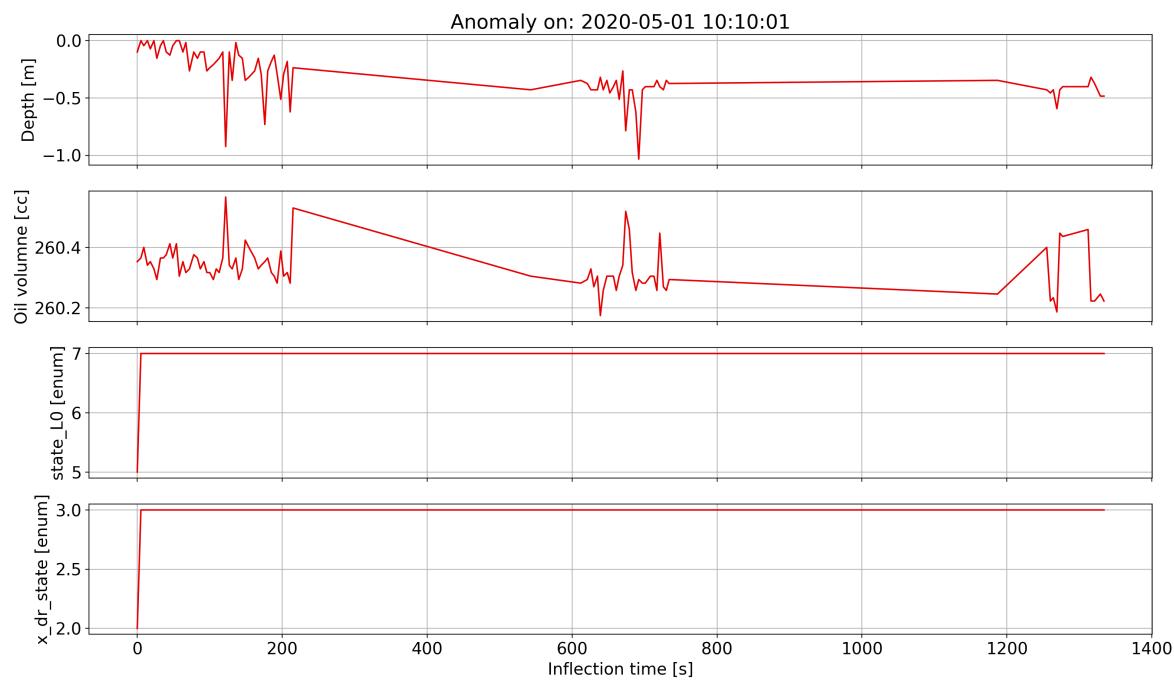


Figure 2.21: 20200501T101001 Anomaly 309

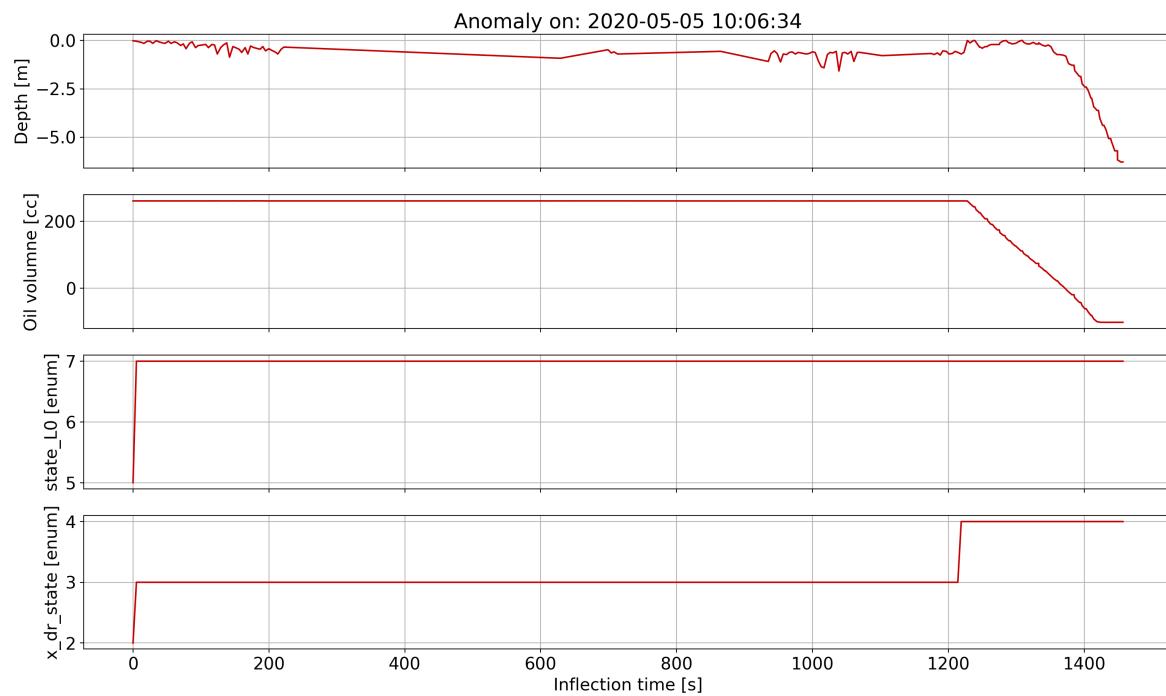


Figure 2.22: 20200505T100634 Anomaly 325

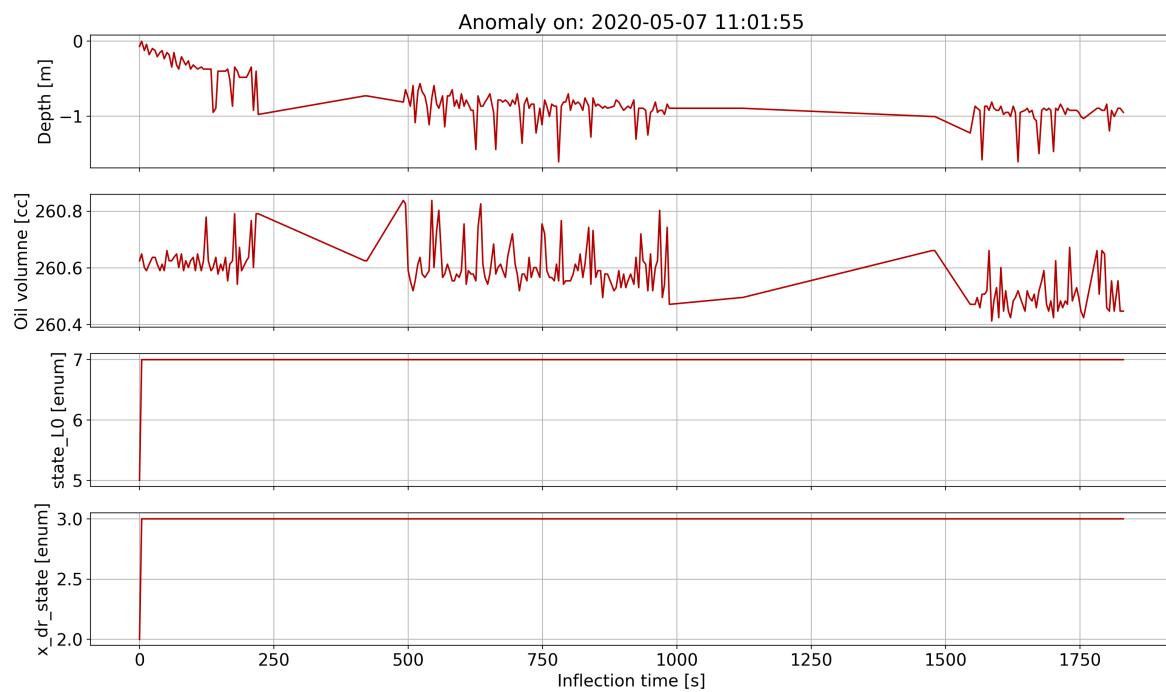


Figure 2.23: 20200507T110155 Anomaly 332

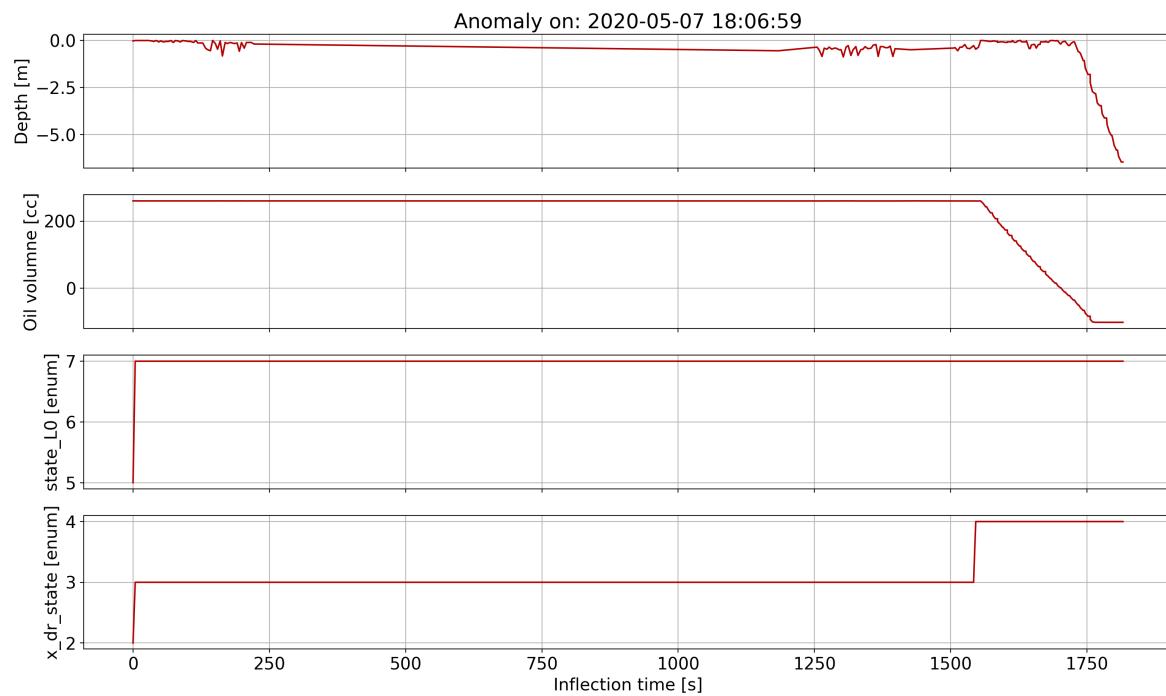


Figure 2.24: 20200507T180659 Anomaly 334

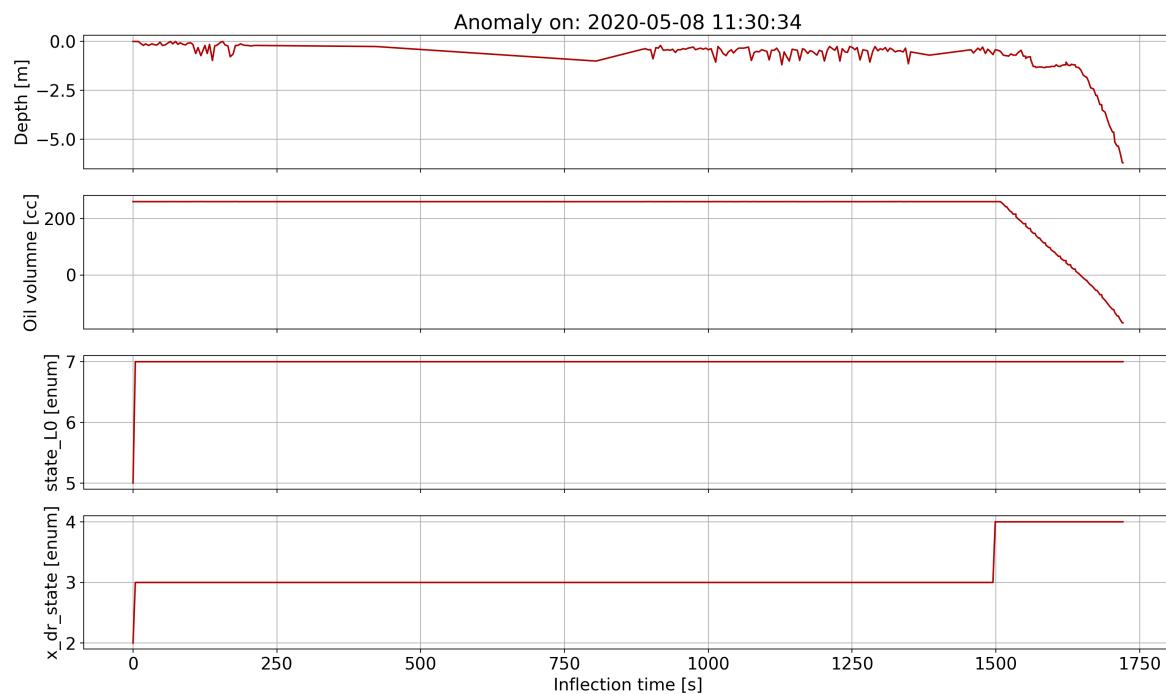


Figure 2.25: 20200508T113034 Anomaly 336

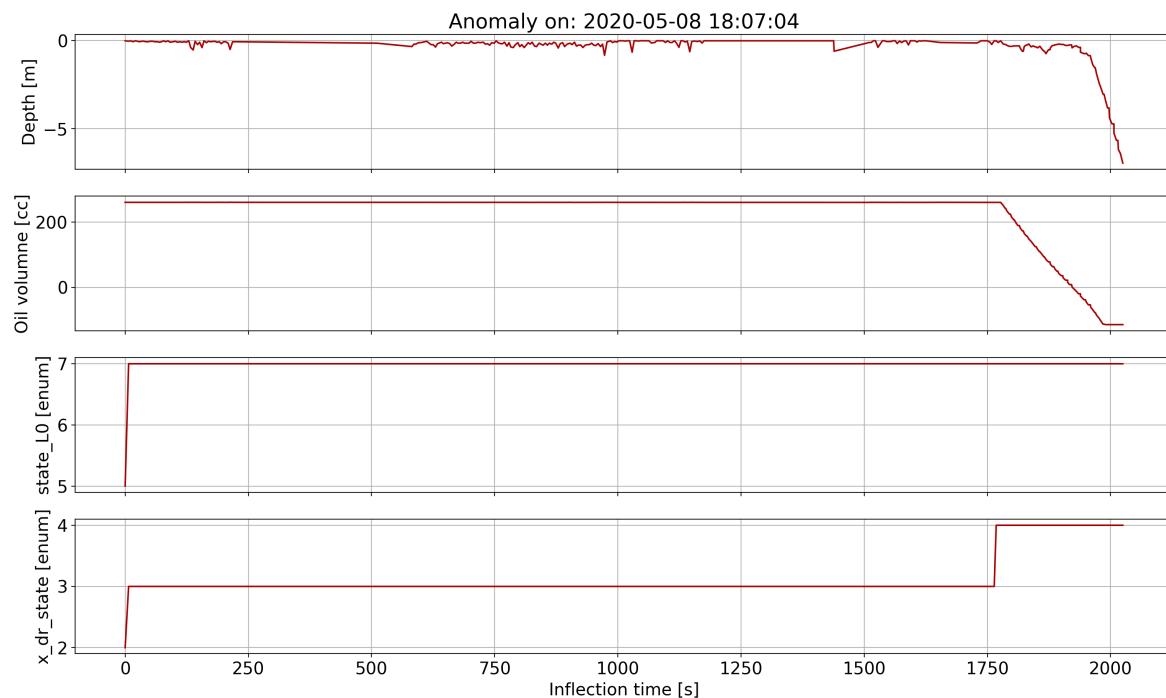


Figure 2.26: 20200508T180704 Anomaly 339

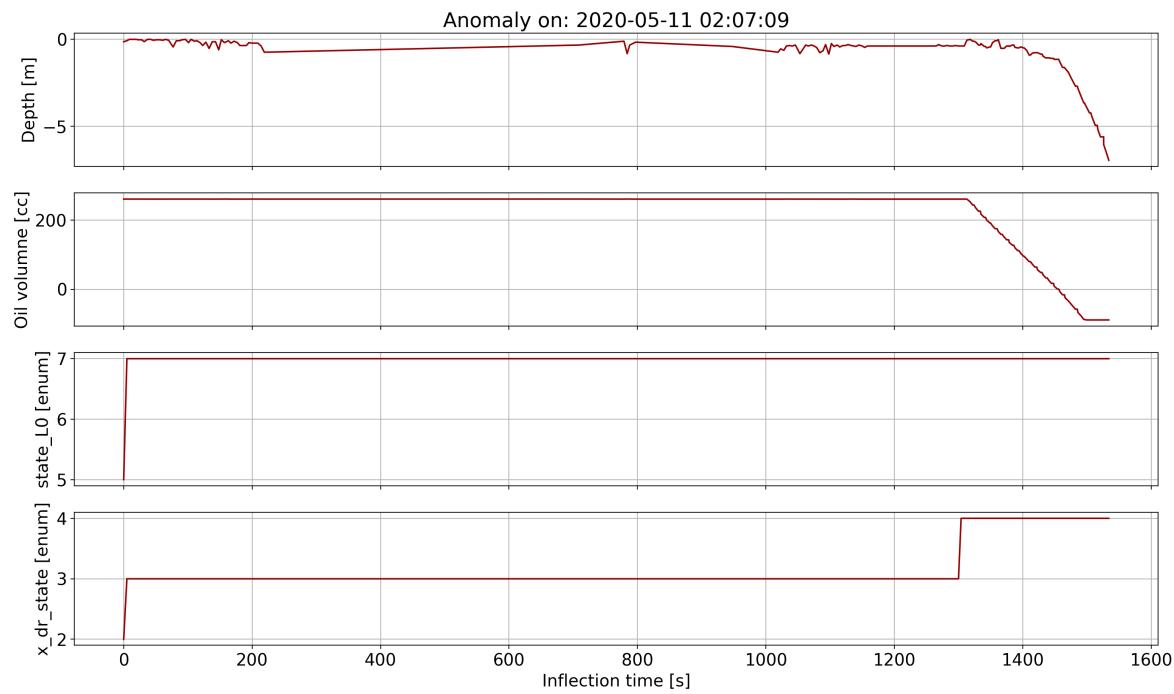


Figure 2.27: 20200511T020709 Anomaly 345

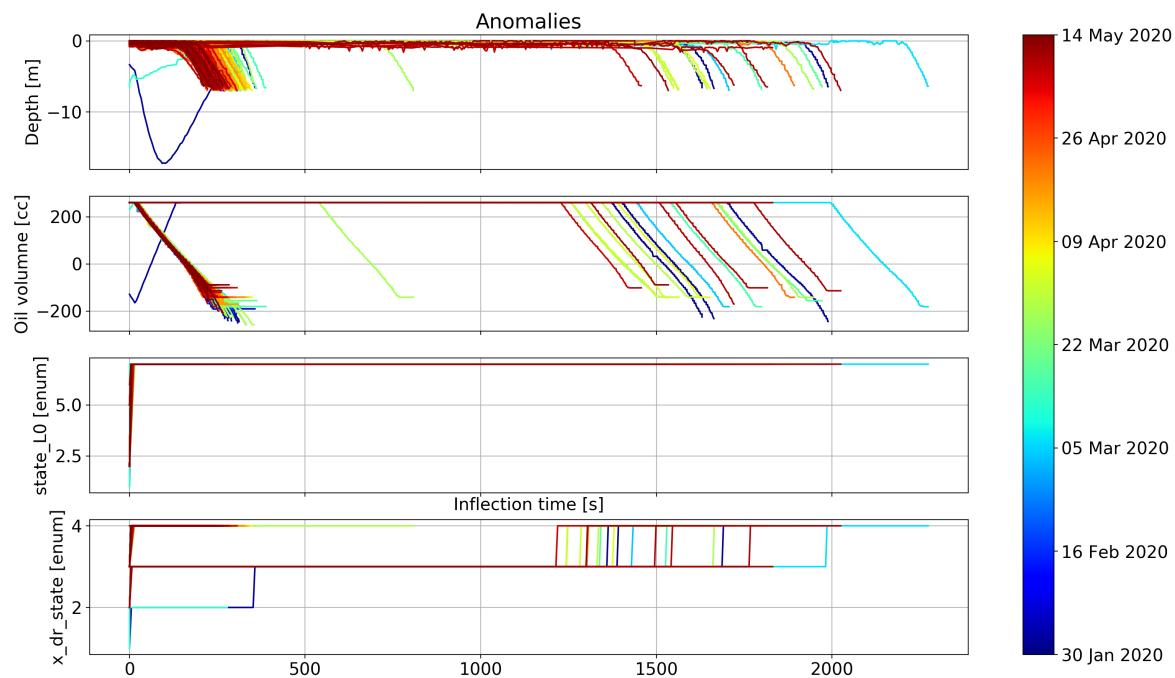


Figure 2.28: Anomalies (time)

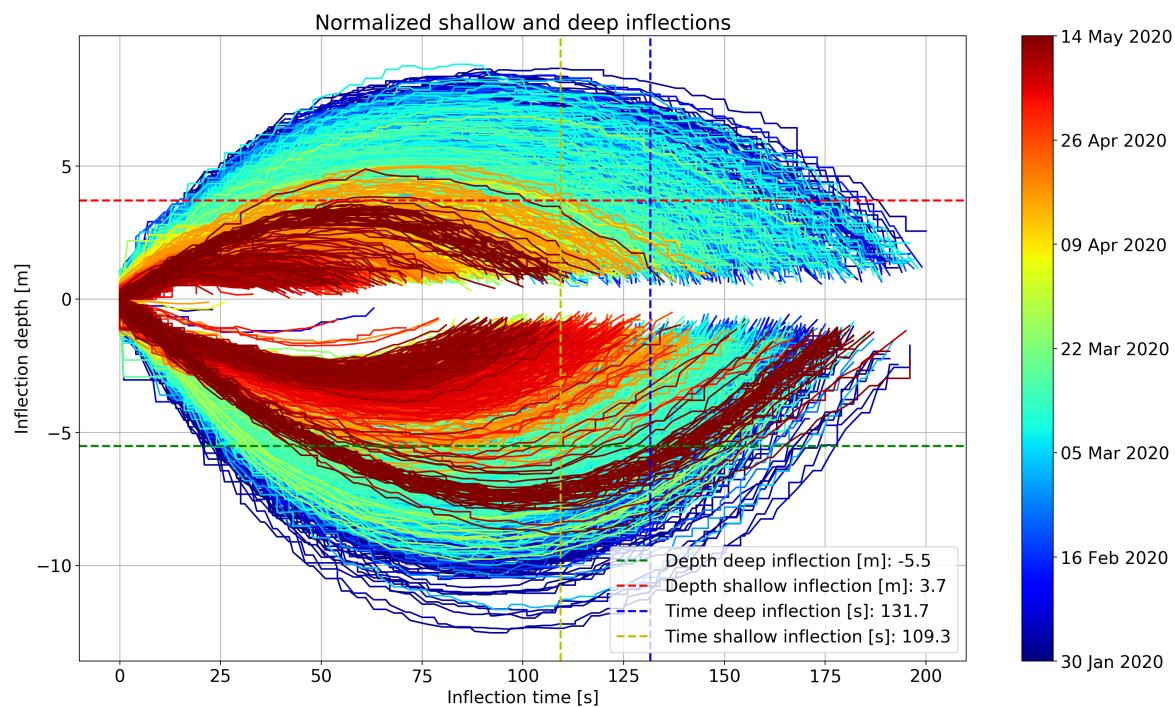


Figure 2.29: Depth inflections

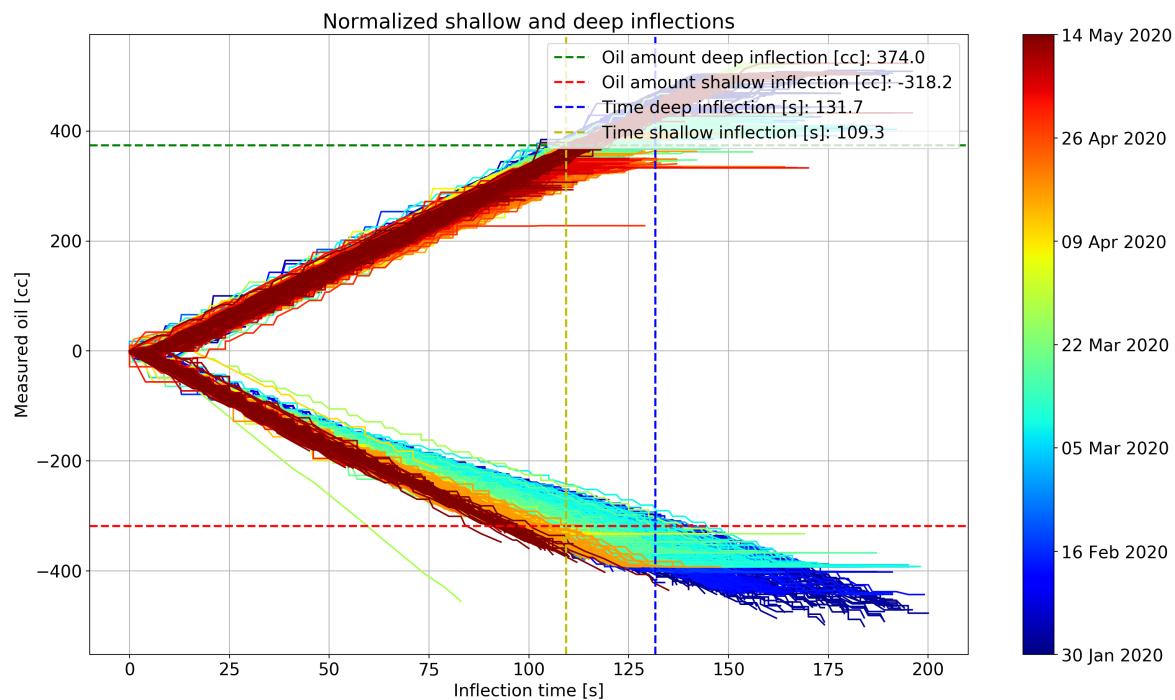


Figure 2.30: Oil inflections

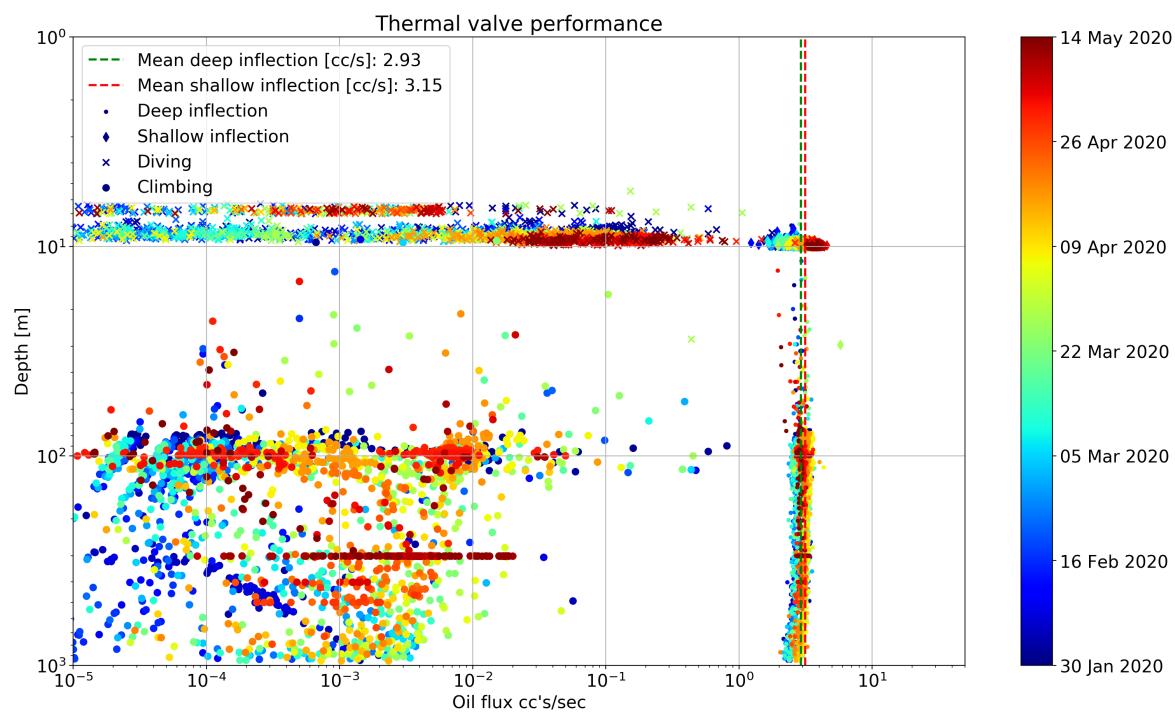


Figure 2.31: Oil flux

Normalized shallow and deep inflections

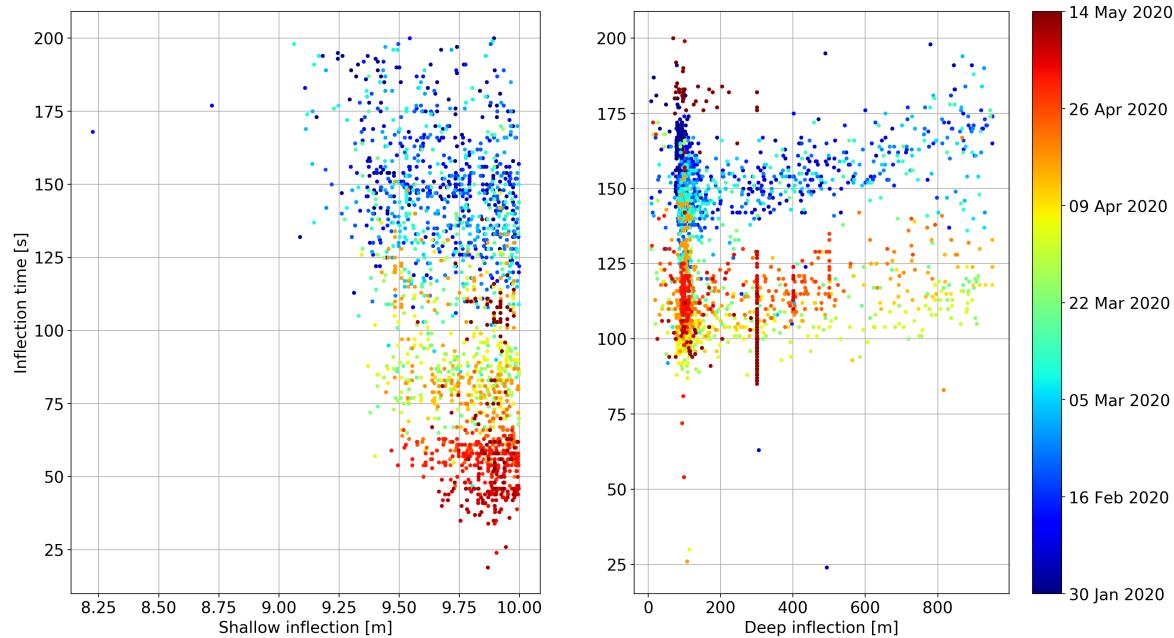


Figure 2.32: Duration inflections

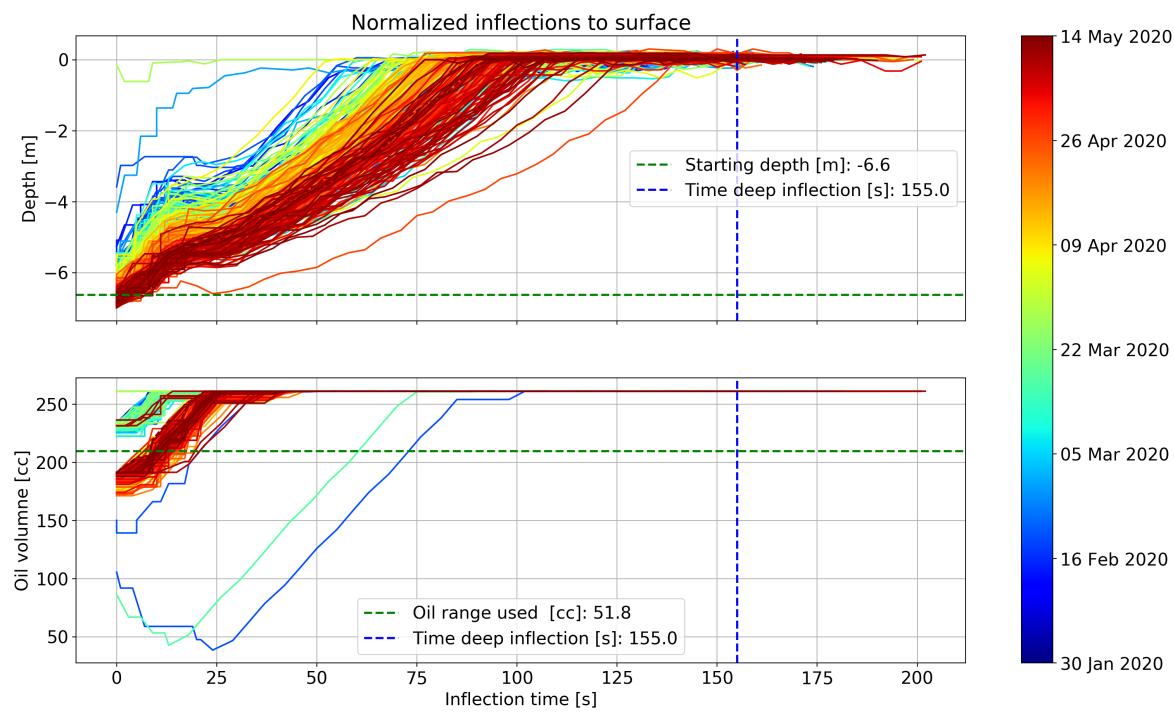


Figure 2.33: Surface Oil inflections

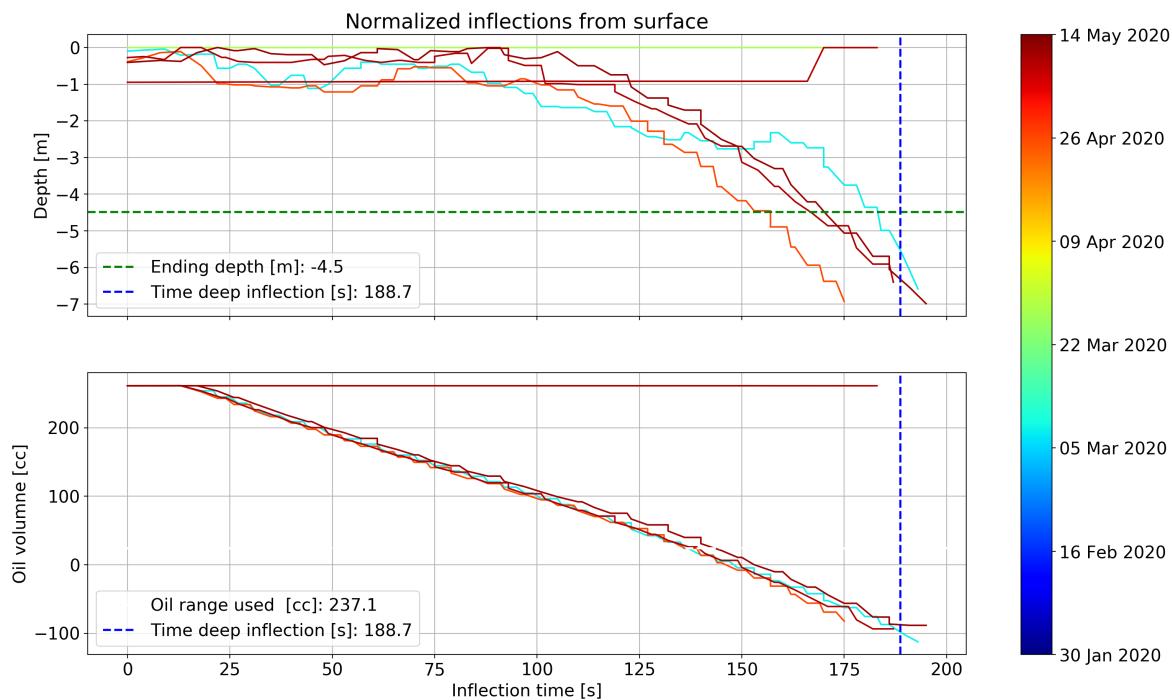


Figure 2.34: Surface Duration inflections

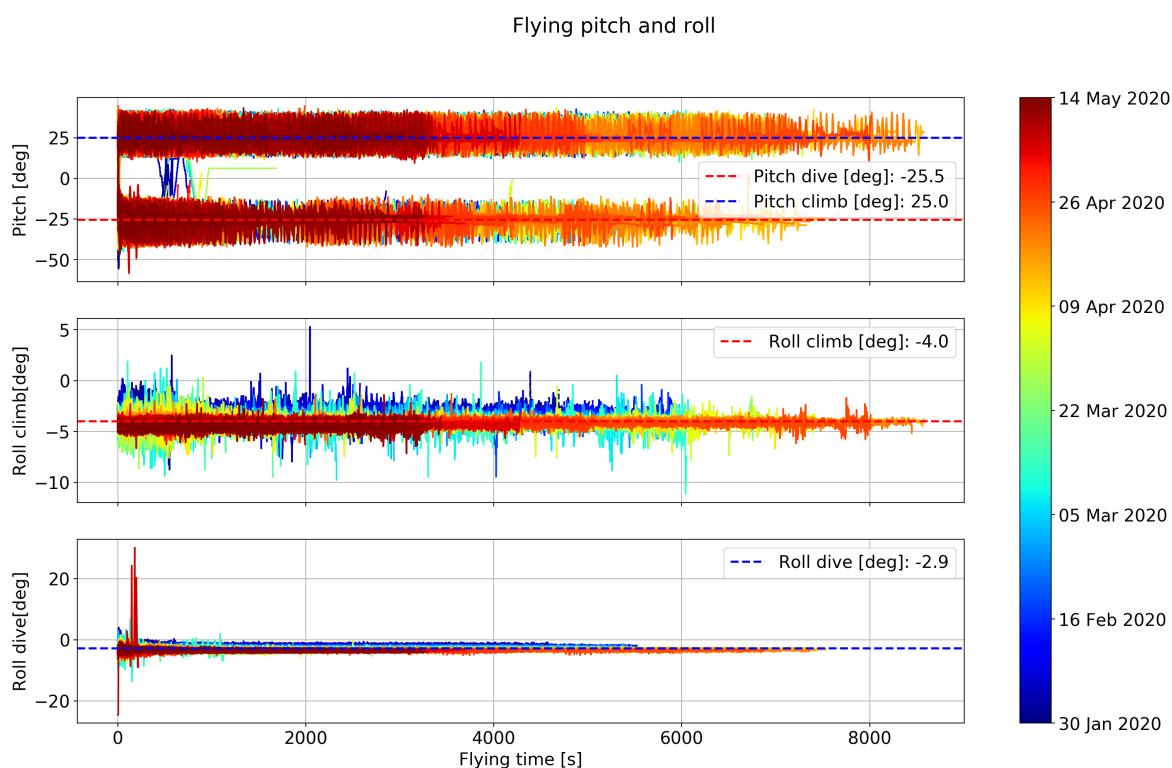


Figure 2.35: Pitch and roll, when climbing and diving

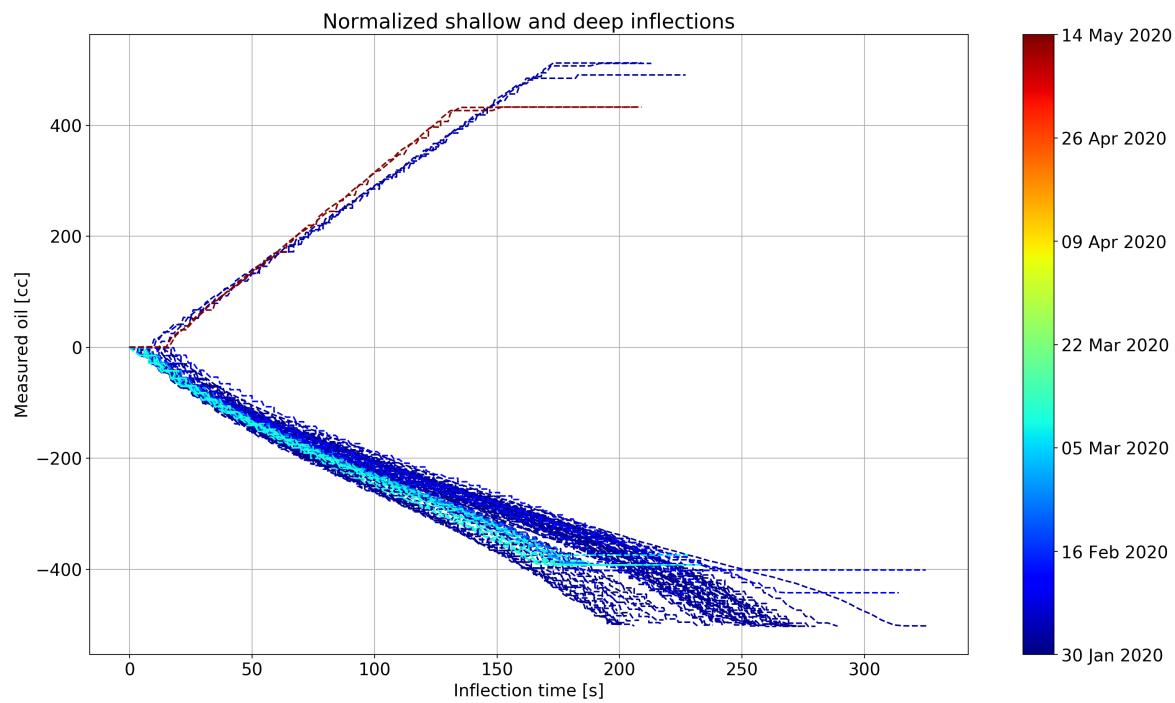


Figure 2.36: Oil inflections long

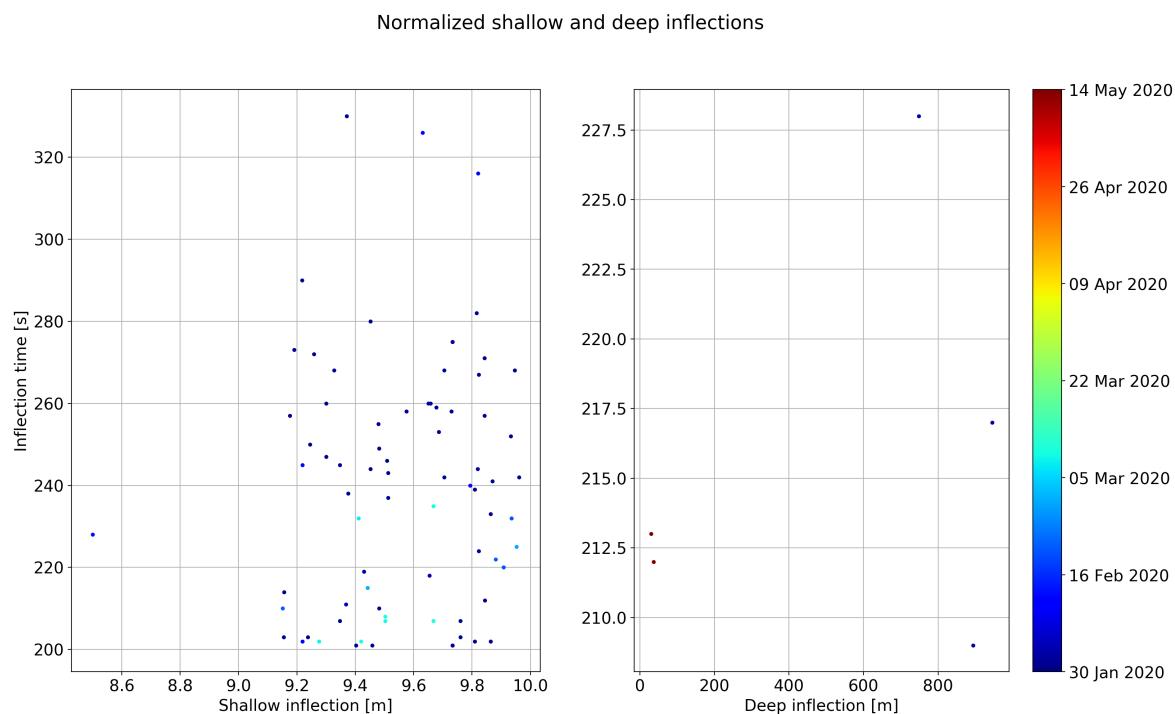


Figure 2.37: Duration inflections long

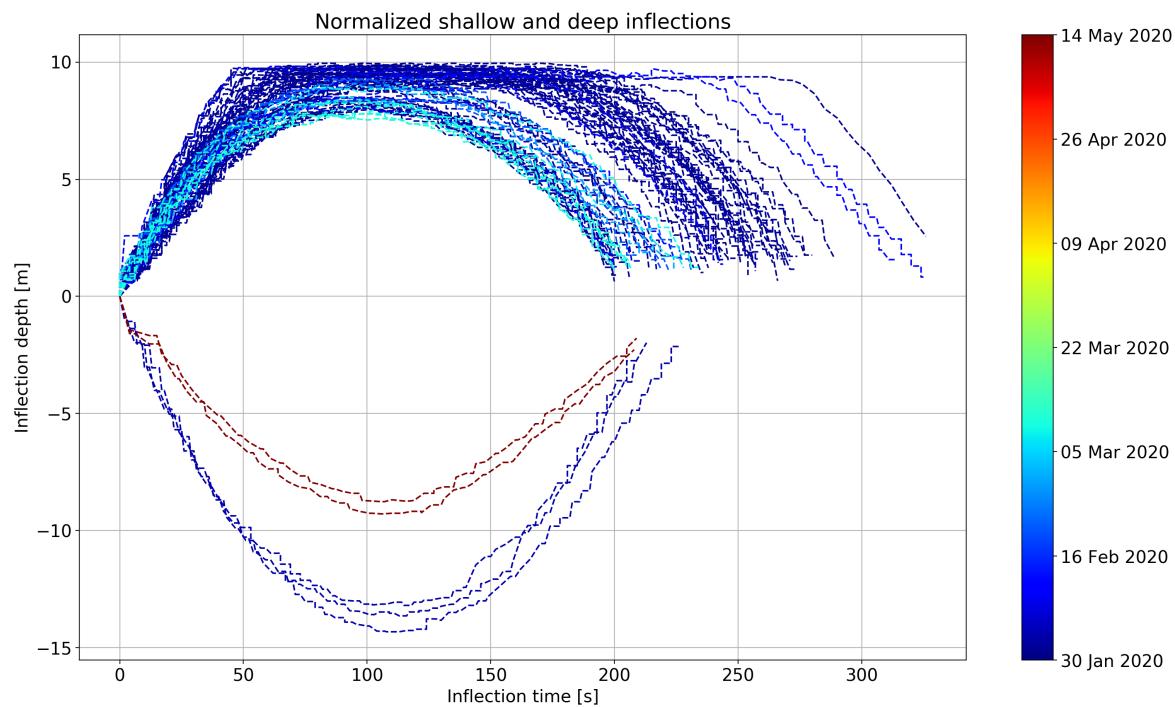


Figure 2.38: Depth inflections long

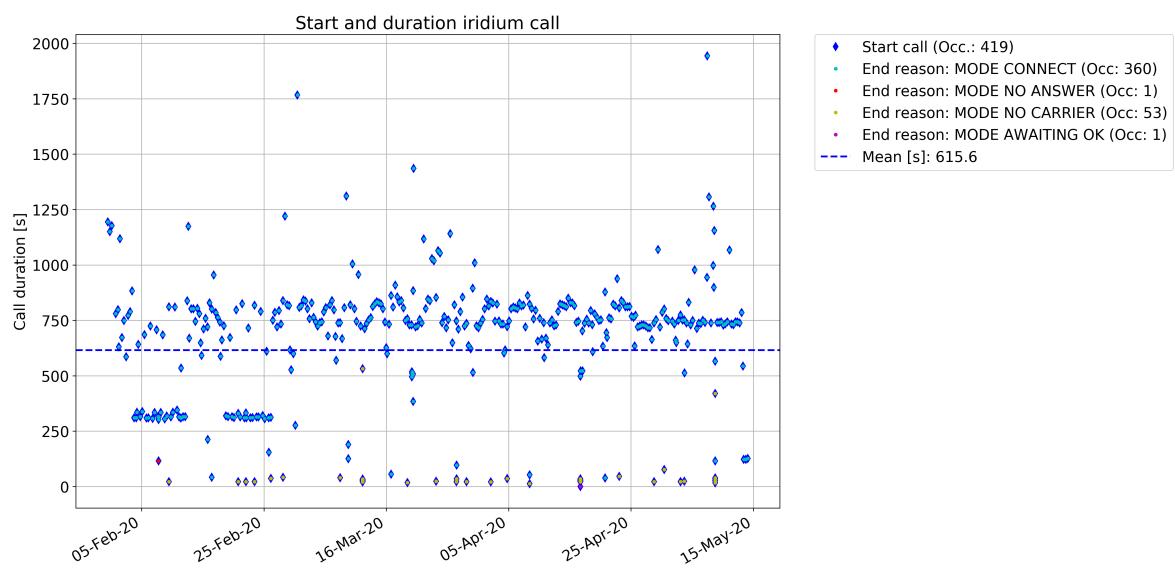


Figure 2.39: Iridium Status

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	9599	20190524	4532	4578	1433560	5.995	1125.9
FLNTU-FLBBCDSLC	na	na	na	na	na	na	na
OXY 3-4	0825	20190815	2769	4578	824759	5.904	725.9
PAR	50310	20190823	1200	4578	na	na	203.7
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	44
FLx	Turbidity dark count	49
FLx	CDOM dark count	na
FLx	BB700 dark count	na

3.2 SCI plots

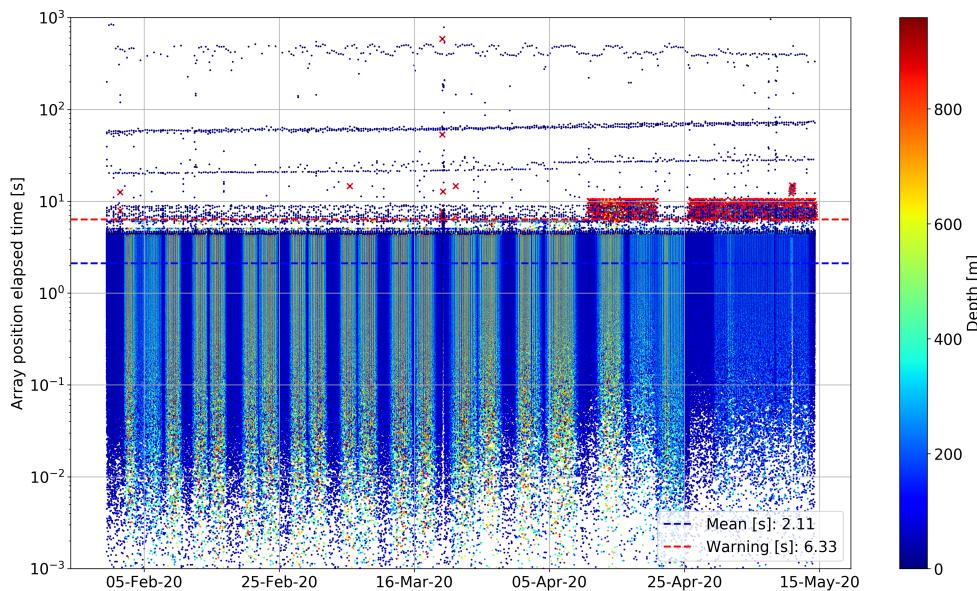


Figure 3.1: Array time

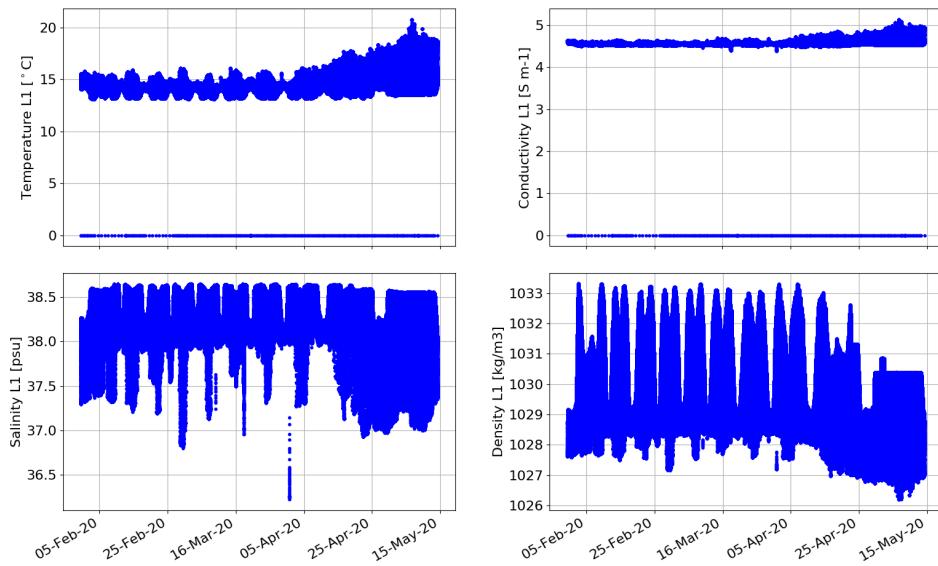


Figure 3.2: Raw CTD L1

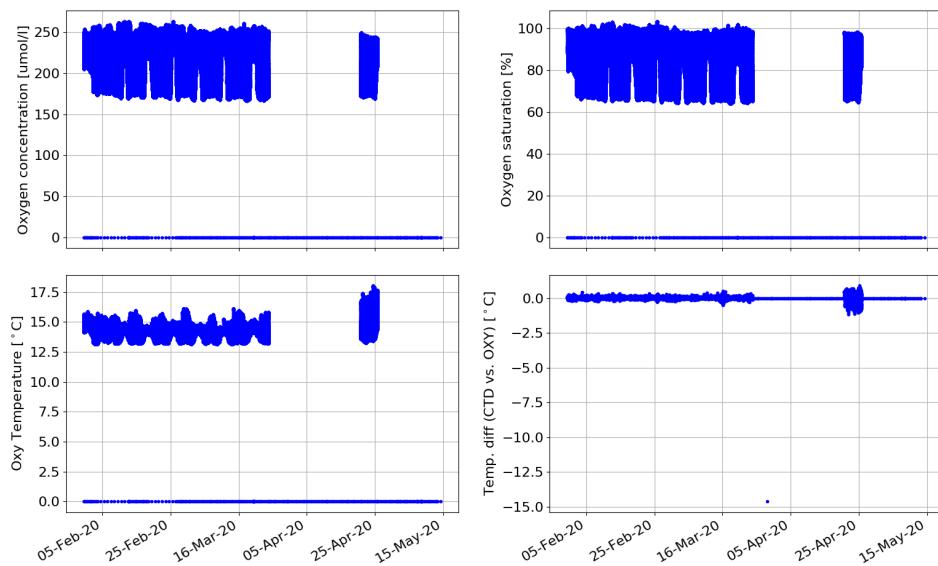


Figure 3.3: Raw OXY L1

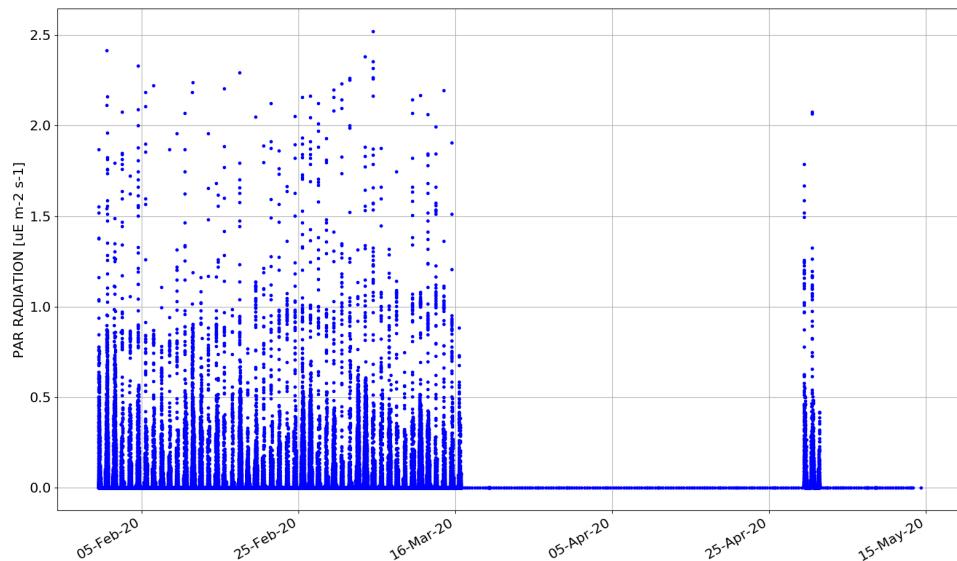


Figure 3.4: Raw PAR L1

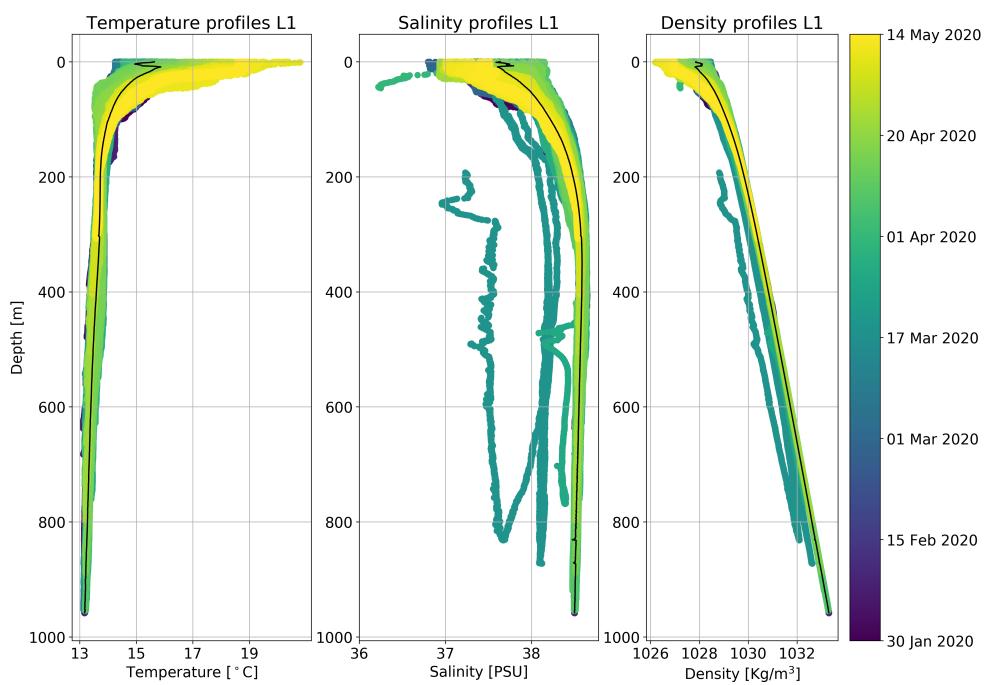


Figure 3.5: CTD profiles

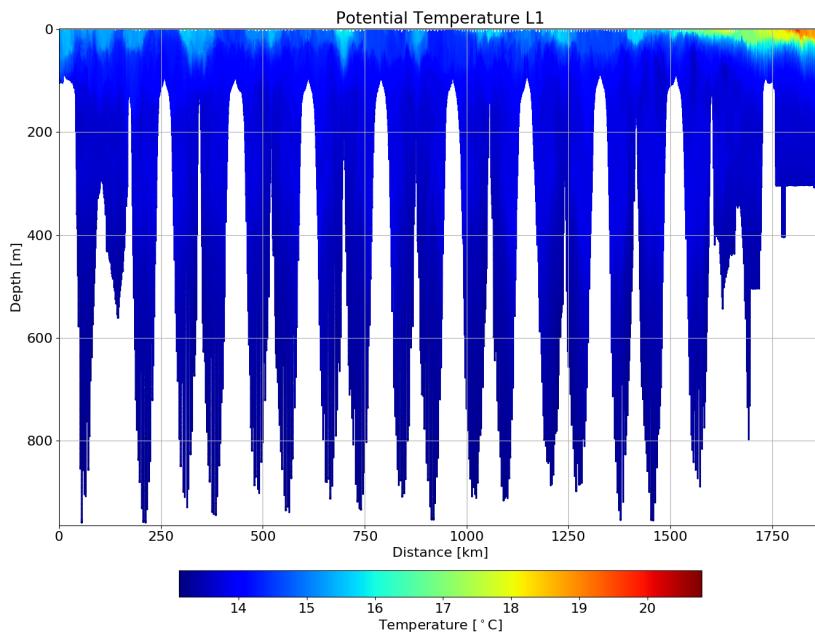


Figure 3.6: CTD temperature

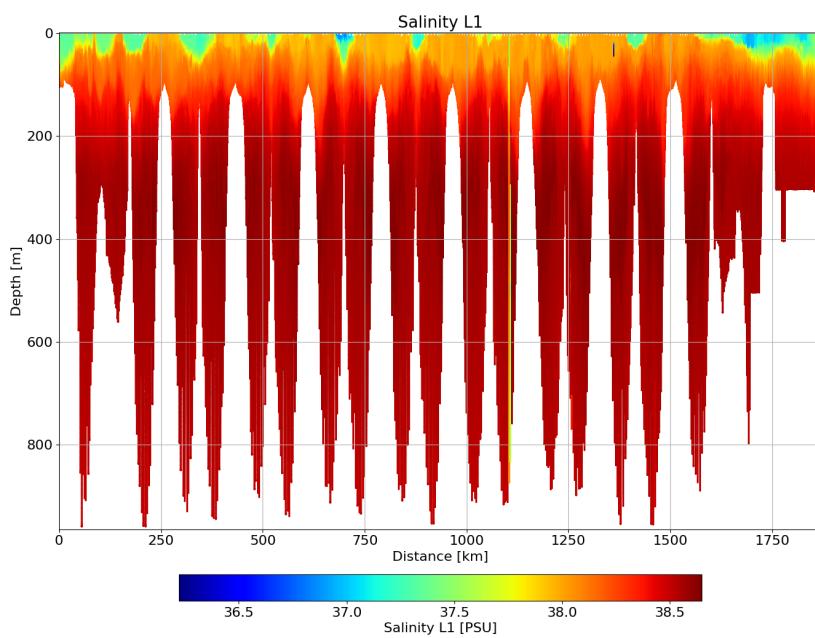


Figure 3.7: CTD Salinity

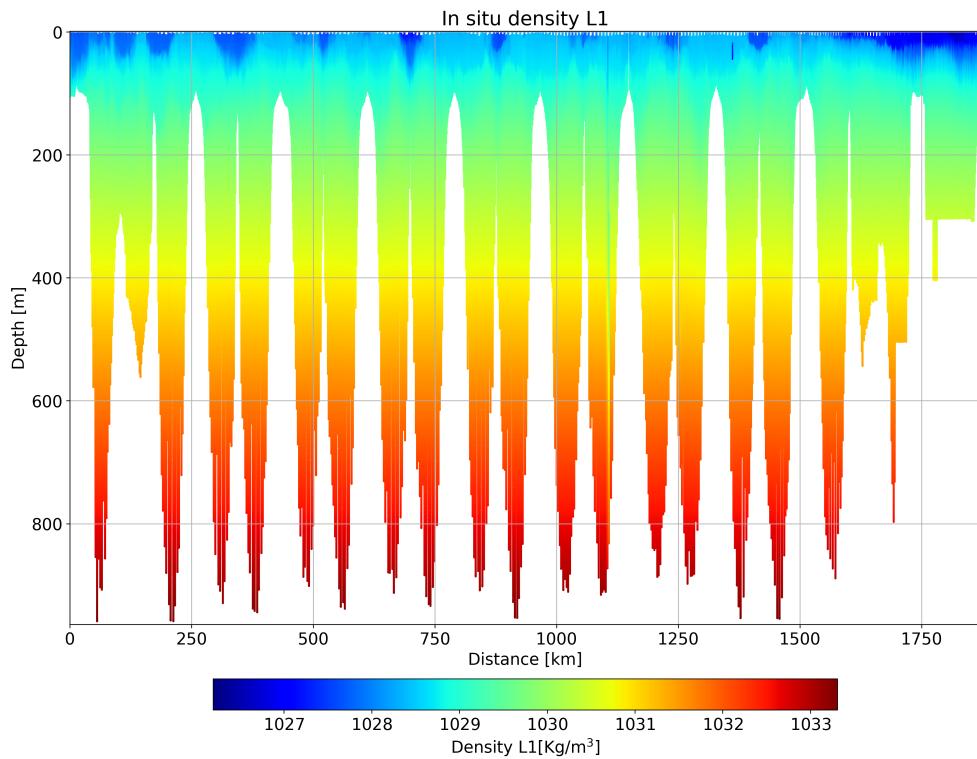


Figure 3.8: CTD Density

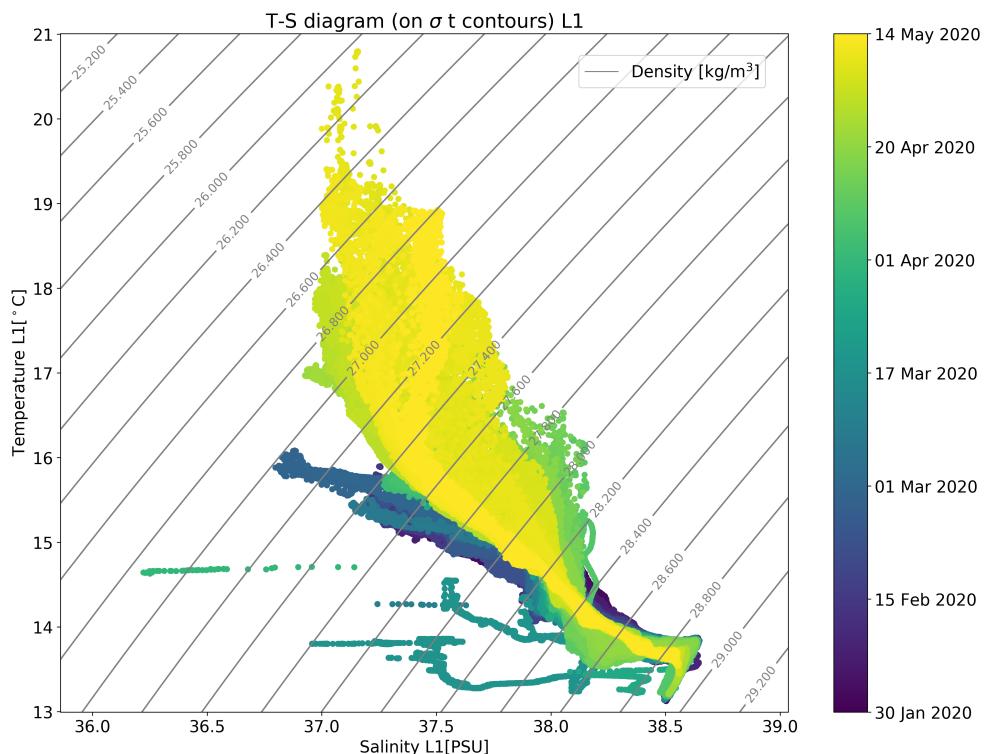


Figure 3.9: TS diagram (CTD)

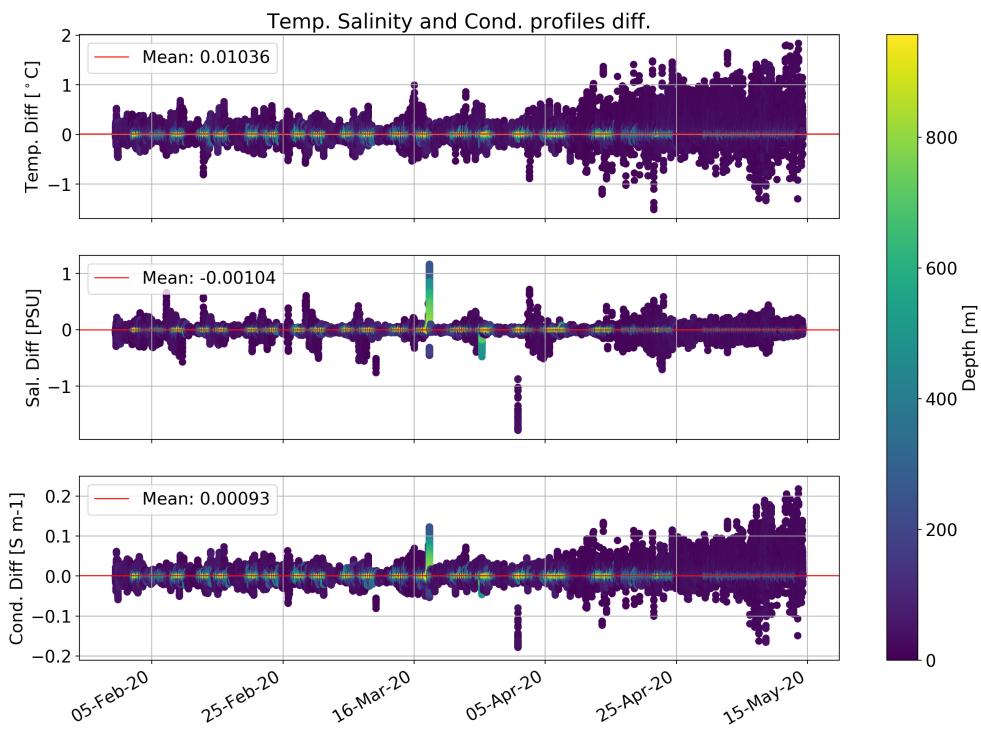


Figure 3.10: Profile consistency (CTD)

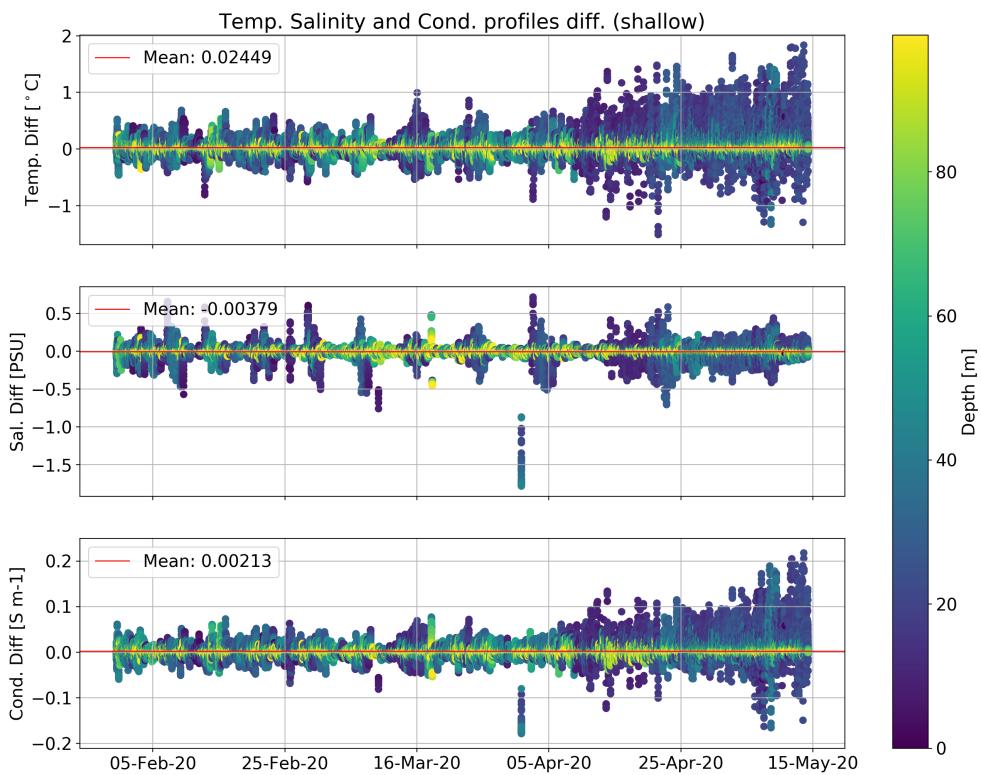


Figure 3.11: Profile consistency (CTD) zoom

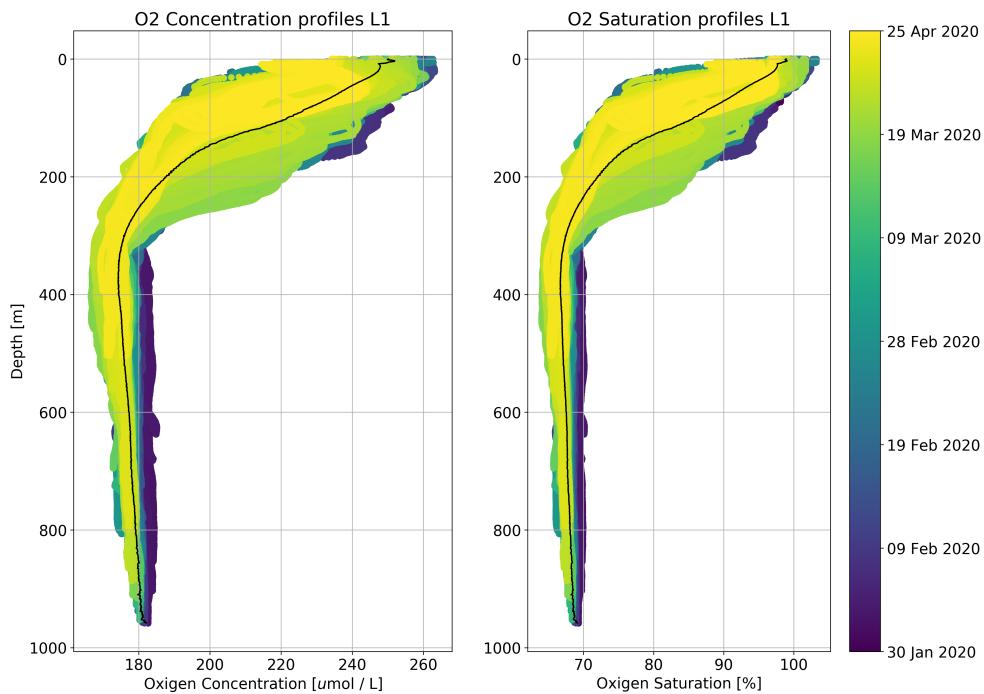


Figure 3.12: Oxygen profiles

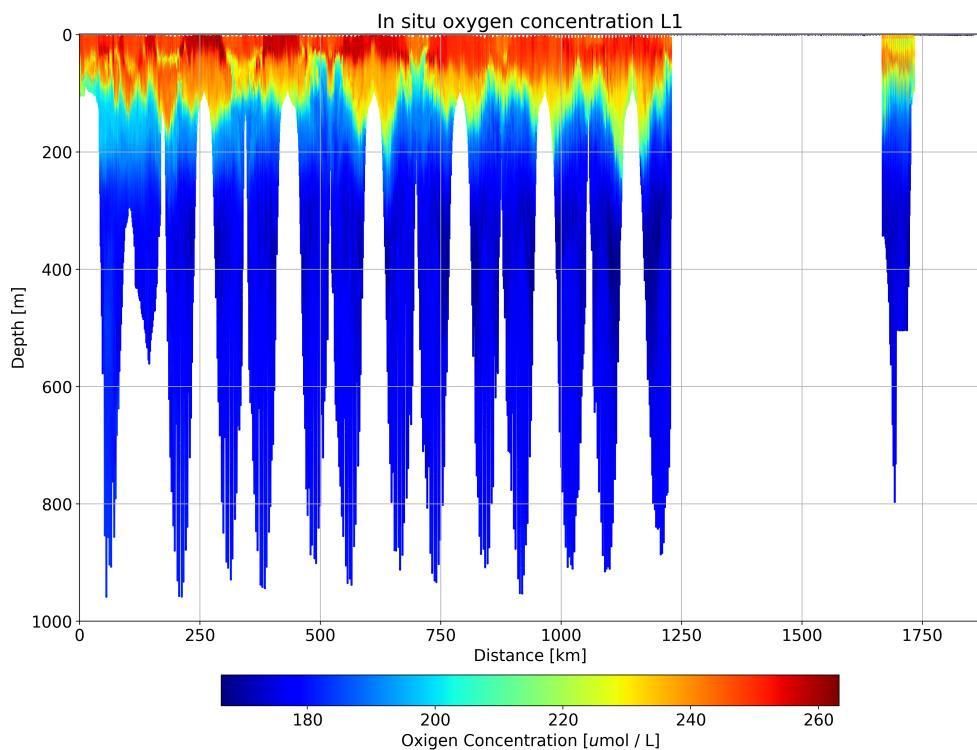


Figure 3.13: Oxygen Concentration

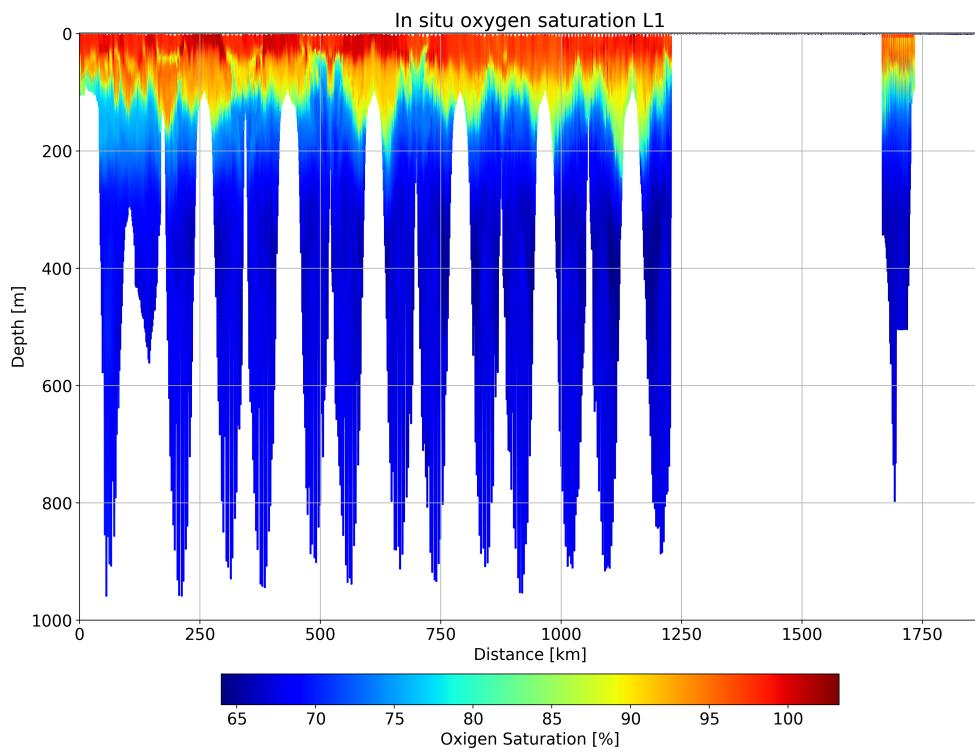
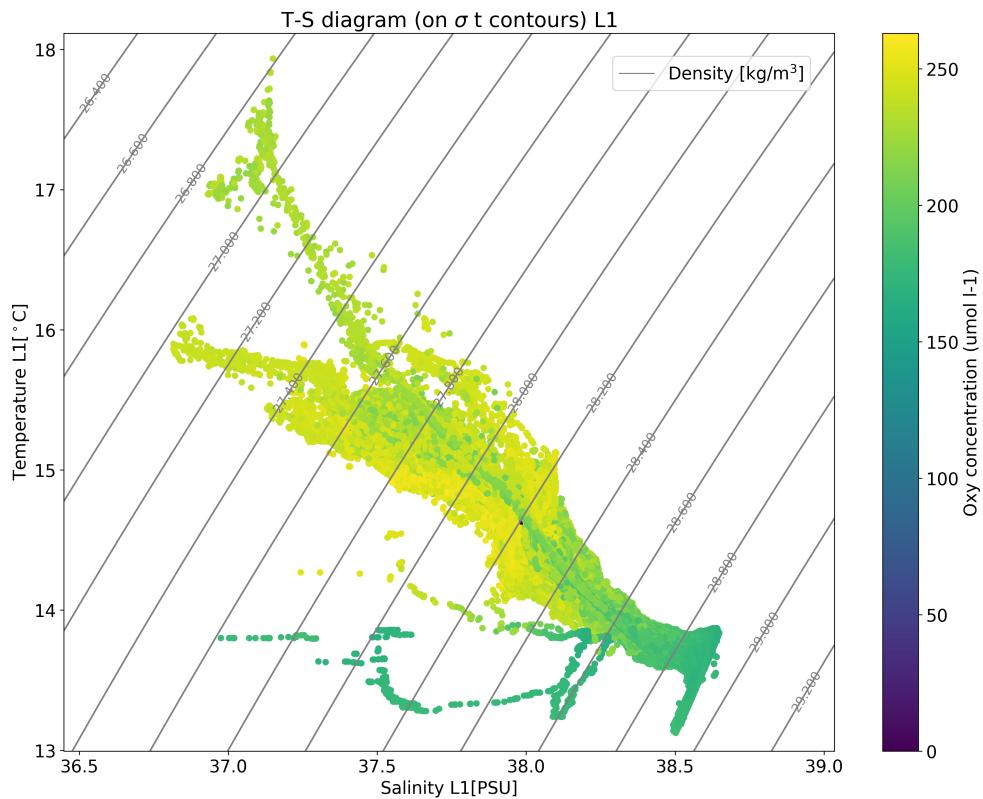


Figure 3.14: Oxygen Saturation



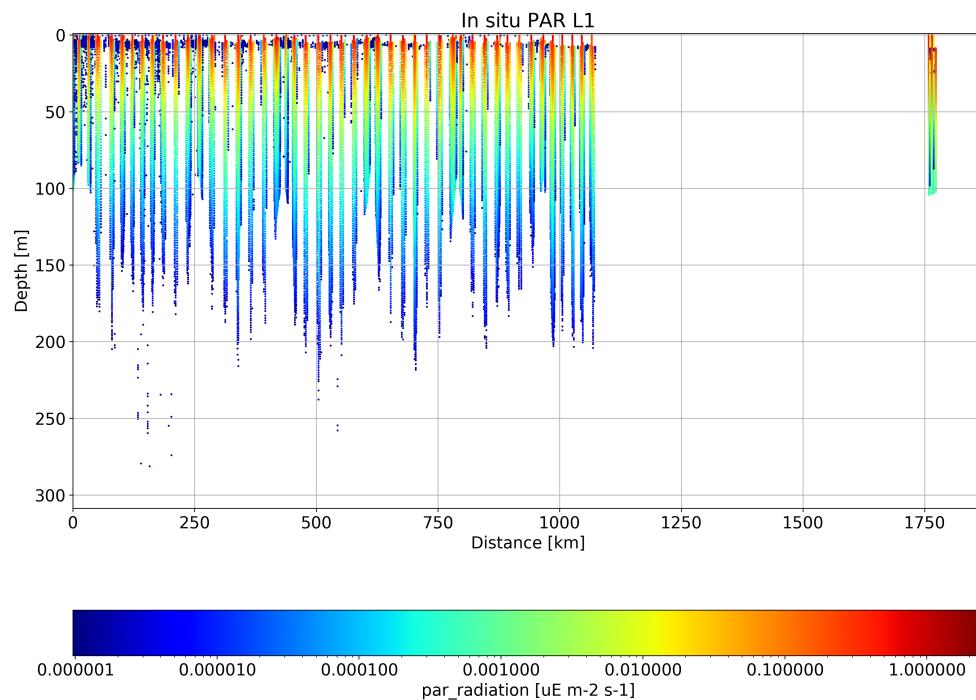


Figure 3.16: PAR radiation

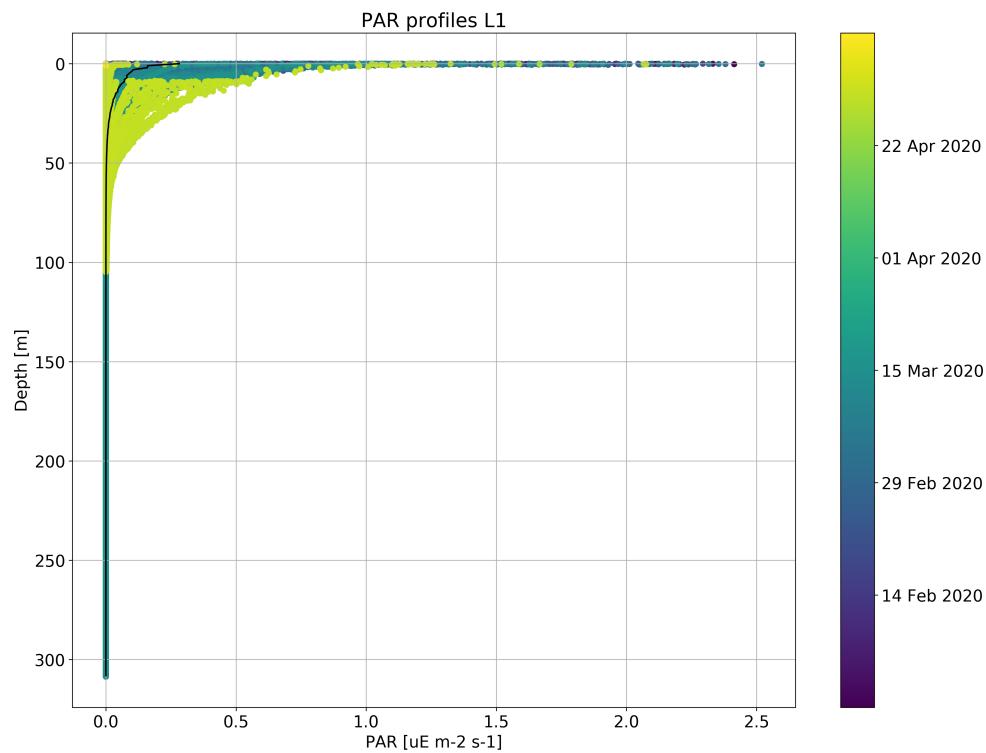


Figure 3.17: PAR profiles

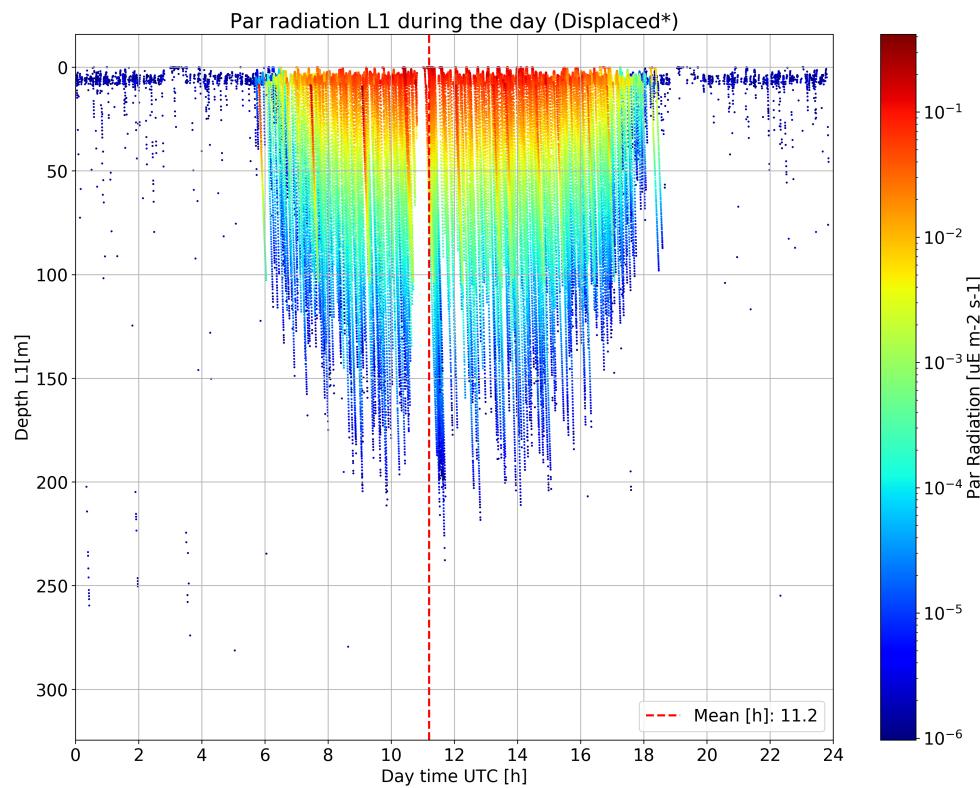


Figure 3.18: Daily par

4 Appendix

4.1 Glider behaviour

Showing changes on Sampling (behaviour 14):

- 30 Jan 2020 10:30:40 @ Sampling of: 22/01/2020mrubio@socib.es initial version (FILESET step) (GF-MR-0100) PAR sn50310 SCI-BAY sn1328
- 30 Jan 2020 10:30:41 @ Sampling state to sample set to: Diving
- 30 Jan 2020 10:30:41 @ Sampling argument: intersample time set to: 8.0 s
- 30 Jan 2020 10:30:41 @ Sampling nth yo to sample set to: 1.0 nodim
- 30 Jan 2020 10:30:41 @ Sampling argument: min depth set to: 0.0 m
- 30 Jan 2020 10:30:41 @ Sampling argument: max depth set to: 300.0 m
- 16 Mar 2020 19:18:52 @ Sampling argument: intersample time set to: -1.0 s
- 29 Apr 2020 10:28:07 @ Sampling argument: intersample time set to: 8.0 s
- 29 Apr 2020 10:28:07 @ Sampling argument: max depth set to: 100.0 m
- 01 May 2020 10:32:27 @ Sampling argument: intersample time set to: -1.0 s
- 01 May 2020 10:32:27 @ Sampling argument: max depth set to: 300.0 m

Showing changes on Sampling (behaviour 13):

- 30 Jan 2020 10:30:41 @ Sampling of: 22/01/2020mrubio@socib.es initial version (FILESET step) (GF-MR-0100) OXY4-4831 sn0825 SCI-BAY sn1328
- 30 Jan 2020 10:30:42 @ Sampling state to sample set to: Diving and climbing
- 30 Jan 2020 10:30:42 @ Sampling argument: intersample time set to: 4.0 s
- 30 Jan 2020 10:30:42 @ Sampling nth yo to sample set to: 1.0 nodim
- 30 Jan 2020 10:30:42 @ Sampling argument: min depth set to: -5.0 m
- 30 Jan 2020 10:30:42 @ Sampling argument: max depth set to: 2000.0 m
- 24 Mar 2020 19:26:09 @ Sampling argument: intersample time set to: -1.0 s
- 20 Apr 2020 18:22:47 @ Sampling argument: intersample time set to: 4.0 s
- 25 Apr 2020 18:21:09 @ Sampling argument: intersample time set to: -1.0 s

Showing changes on Sampling (behaviour 12):

- 30 Jan 2020 10:30:42 @ Sampling of: CTD(Profile) based on configuration for CALYPSO2019(GF-MR-0087)
- 30 Jan 2020 10:30:43 @ Sampling state to sample set to: Diving and climbing
- 30 Jan 2020 10:30:43 @ Sampling argument: intersample time set to: 4.0 s
- 30 Jan 2020 10:30:43 @ Sampling nth yo to sample set to: 1.0 nodim
- 30 Jan 2020 10:30:43 @ Sampling argument: min depth set to: -5.0 m
- 30 Jan 2020 10:30:43 @ Sampling argument: max depth set to: 2000.0 m
- 10 Apr 2020 20:06:51 @ Sampling argument: intersample time set to: 8.0 s
- 20 Apr 2020 18:22:48 @ Sampling argument: intersample time set to: 4.0 s
- 25 Apr 2020 18:21:10 @ Sampling argument: intersample time set to: 8.0 s

Showing changes on Yoing (behavior behavior yo 11):

- 30 Jan 2020 10:30:43 @ Yoing num half cycles to do(nodim) set to: 2.0
- 30 Jan 2020 10:30:43 @ Yoing d target depth(m) set to: 5.0
- 30 Jan 2020 10:30:43 @ Yoing d bpump value(X) set to: -233.0
- 30 Jan 2020 10:30:44 @ Yoing d target altitude(m) set to: 40.0
- 30 Jan 2020 10:30:44 @ Yoing d use pitch(enum) set to: 3.0
- 30 Jan 2020 10:30:44 @ Yoing d pitch value(X) set to: -0.453800
- 30 Jan 2020 10:30:44 @ Yoing c use pitch(enum) set to: 3.0
- 30 Jan 2020 10:30:44 @ Yoing c pitch value(X) set to: 0.453800
- 30 Jan 2020 10:48:20 @ Yoing d target depth(m) set to: 950.0
- 30 Jan 2020 11:29:28 @ Yoing num half cycles to do(nodim) set to: -1.0
- 30 Jan 2020 11:29:28 @ Yoing d target altitude(m) set to: 20.0
- 31 Jan 2020 11:34:06 @ Yoing d bpump value(X) set to: -250.0
- 03 Feb 2020 11:17:51 @ Yoing d bpump value(X) set to: -190.0

- 10 Feb 2020 19:08:36 @ Yoing d bpump value(X) set to: -210.0
 - 12 Feb 2020 11:16:32 @ Yoing num half cycles to do(nodim) set to: 4.0
 - 12 Feb 2020 15:30:31 @ Yoing num half cycles to do(nodim) set to: -1.0
 - 12 Feb 2020 15:30:31 @ Yoing d bpump value(X) set to: -190.0
 - 16 Feb 2020 19:24:05 @ Yoing d bpump value(X) set to: -180.0
 - 10 Mar 2020 11:21:03 @ Yoing d bpump value(X) set to: -165.0
 - 11 Mar 2020 11:18:16 @ Yoing d bpump value(X) set to: -155.0
 - 16 Mar 2020 19:18:55 @ Yoing d bpump value(X) set to: -140.0
 - 20 Mar 2020 09:31:09 @ Yoing num half cycles to do(nodim) set to: 2.0
 - 20 Mar 2020 09:31:09 @ Yoing d target depth(m) set to: 25.0
 - 20 Mar 2020 09:31:09 @ Yoing d bpump value(X) set to: -233.0
 - 20 Mar 2020 09:51:17 @ Yoing num half cycles to do(nodim) set to: -1.0
 - 20 Mar 2020 09:51:17 @ Yoing d target depth(m) set to: 950.0
 - 20 Mar 2020 09:51:17 @ Yoing d bpump value(X) set to: -140.0
 - 09 Apr 2020 10:18:31 @ Yoing d bpump value(X) set to: -170.0
 - 10 Apr 2020 20:06:51 @ Yoing d bpump value(X) set to: -140.0
 - 22 Apr 2020 18:39:00 @ Yoing d target depth(m) set to: 500.0
 - 25 Apr 2020 18:21:10 @ Yoing d target depth(m) set to: 300.0
 - 01 May 2020 10:32:29 @ Yoing d target depth(m) set to: 400.0
 - 02 May 2020 10:16:16 @ Yoing d target depth(m) set to: 300.0
 - 02 May 2020 10:16:16 @ Yoing d bpump value(X) set to: -120.0
 - 03 May 2020 10:22:06 @ Yoing d bpump value(X) set to: -100.0
 - 07 May 2020 10:21:31 @ Yoing num half cycles to do(nodim) set to: 2.0
 - 07 May 2020 10:21:31 @ Yoing d target depth(m) set to: 100.0
 - 07 May 2020 10:21:31 @ Yoing d bpump value(X) set to: 300.0
 - 07 May 2020 11:32:29 @ Yoing num half cycles to do(nodim) set to: -1.0
 - 07 May 2020 11:32:29 @ Yoing d target depth(m) set to: 300.0
 - 07 May 2020 11:32:29 @ Yoing d bpump value(X) set to: -100.0
 - 08 May 2020 10:22:09 @ Yoing num half cycles to do(nodim) set to: 4.0
 - 08 May 2020 10:22:09 @ Yoing d target depth(m) set to: 100.0
 - 08 May 2020 10:22:09 @ Yoing d bpump value(X) set to: 300.0
 - 08 May 2020 14:47:01 @ Yoing num half cycles to do(nodim) set to: -1.0
 - 08 May 2020 14:47:01 @ Yoing d target depth(m) set to: 300.0
 - 13 May 2020 02:21:03 @ Yoing d bpump value(X) set to: 500.0
- Showing changes on Altimeter set to (behaviour u alt min depth):
- 30 Jan 2020 10:43:20 @ Altimeter set to u alt min depth set to: 2
 - 23 Mar 2020 19:04:52 @ Altimeter set to u alt min depth set to: 50

4.2 Installed devices (from autoexec.mi)

- Forward section assy _SN: 0076
- Payload bay assy _SN: 1328
- Aft electronic assy _SN: 0363
- Aft end cap assy _SN: 0148
- Diginfin _SN: 0966
- Strobe assy _SN: 1139
- Pressure transducer _SN: 86513
- Fwd hull _SN: 0078
- Aft hull _SN: 0075
- Freewave master _SN: 9517289
- Iridium sim card _SN: 8988169312003176066
- Argos ID _SN: 111291-Dec/6FE29BE-Hex
- Altimeter _SN: 3326125

- Pitch motor _SN: 0979
- 1000- Motor _SN: controller0199
- 1000- Front air pump _SN: 0197
- 1000- Pump assy _SN: 0181
- 1000- Valve assy _SN: 0181
- Science persistor _SN: 0452
- science motherboard _SN: jj00556
- Science flashcard _SN: 25221
- seabird CTD _SN: 9599
- Main board _SN: jj00328
- Communication board _SN: 0281
- Iridium phone _SN: 0716
- Main flashcard _SN: 25206
- Main persistor _SN: 0449
- Attitude sensor _SN: 34333
- Air pump _SN: 1092
- Communications Assy _SN: 0281
- Freewave Slave _SN: 8797296
- GPS _SN: 0806
- Argos X-cat _SN: 0536
- Air bladder _SN: 1058
- sensor specific for OXY4-4831 _SN: SN0825

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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2.7 20200201T105802 Anomaly 9	9
2.8 20200228T110239 Anomaly 99	10
2.9 20200301T110836 Anomaly 106	10
2.10 20200309T032322 Anomaly 130	11
2.11 20200309T110144 Anomaly 131	11
2.12 20200312T030304 Anomaly 139	12
2.13 20200320T094624 Anomaly 175	12
2.14 20200320T110439 Anomaly 176	13
2.15 20200322T031222 Anomaly 181	13
2.16 20200323T110522 Anomaly 185	14
2.17 20200323T190251 Anomaly 186	14
2.18 20200324T110456 Anomaly 188	15
2.19 20200326T111311 Anomaly 194	15
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