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Report on the Quality Control of the IMOS East Australian Current (EAC) Deep Water moorings array. Version 1.4

Deployed: April/May 2018 to September, 2019.

Rebecca Cowley

February, 2023


IMOS
Integrated Marine
Observing System

Citation

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Important disclaimer

IMOS data

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Version control information

Version	Date	Change information	Author
1.0	August, 2020	Initial version	Rebecca Cowley
1.1	April, 2021	Update moorings location table 2 to reflect reprocessing of 2012-2013 moorings. Update references.	Rebecca Cowley
1.2	March, 2022	Update details after re-processing of ADCP data through toolbox to account for bin-mapping bug fixes and to create ensemble-averaged ADCP files.	Rebecca Cowley
1.3	April, 2022	Update to QC information performed on SBE37 6266 on EAC4800 mooring.	Rebecca Cowley
1.4	February, 2023	Update to QC information and plots for EAC0500 AQD	Rebecca Cowley

Executive summary

The East Australian Current (EAC) is a complex and highly energetic western boundary system in the south-western Pacific off eastern Australia. It provides both the western boundary of the South Pacific gyre and the linking element between the Pacific and Indian Ocean gyres. The EAC deepwater moorings consisted of an array of full-depth current meter and property (CTD) moorings from the continental slope to the abyssal waters off Brisbane (27ºS).
This report details the quality control applied to the data collected from the EAC array (deployed from April/May, 2018 to September, 2019). The quality controlled datasets are publicly available via the AODN Data Portal. The data should be used in conjunction with this report.

Acknowledgments

Thanks to the CSIRO moorings team: Bernadette Sloyan, Chris Chapman, Jamie Derrick, Jim Laduke, Gary Curtis, with extra assistance on the 2019 recovery voyage from Oceane Richet, Amanda Black, Violaine Pellichero and Thomas Moore. The EAC moorings array was funded by the Integrated Marine Observing System (IMOS).

1 Introduction

The East Australian Current (EAC) is a complex and highly energetic western boundary system in the south-western Pacific off eastern Australia. It provides both the western boundary of the South Pacific gyre and the linking element between the Pacific and Indian Ocean gyres. The EAC deepwater moorings consisted of an array of full-depth current meter and property (CTD) moorings from the continental slope to the abyssal waters off Brisbane (27ºS). At this location, north of the high eddy variability, the EAC is approaching its maximum strength and its flow is relatively uniform and coherent. The aim of this observing system was to capture the mean and time-varying flow of the EAC. The array is a component of IMOS, and will provide an intensive reference set of measurements of the EAC flow over sustained period for monitoring EAC transport, improved understanding of the relationship of EAC and the South Pacific gyre and impact of the coastal marine ecosystem, and validation and interpretation of the current system in numerous climate and ocean models. This deployment continues the previous deployment of the mooring array (Cowley 2021; Lovell & Cowley, 2021a; Lovell & Cowley, 2021b), with four moorings retained in the same positions and two in new positions. The original array was planned based on the existing long-term XBT transects, satellite altimetry and glider tracks.

The EAC moorings array consisted of 6 full-depth current meter/CTD moorings extending from the continental slope to the abyssal waters off Brisbane, Australia. Deployment was during April/May, 2018 on the Investigator voyage IN2018_V03 and recovery was during September, 2019 on the Investigator voyage IN2019_V05. Additional datasets from these voyages are available from the CSIRO Marine and Atmospheric Data Centre (data interface: http://www.marine.csiro.au/marlin/). The quality control of the data from the instruments on each of the six moorings is covered in this report.

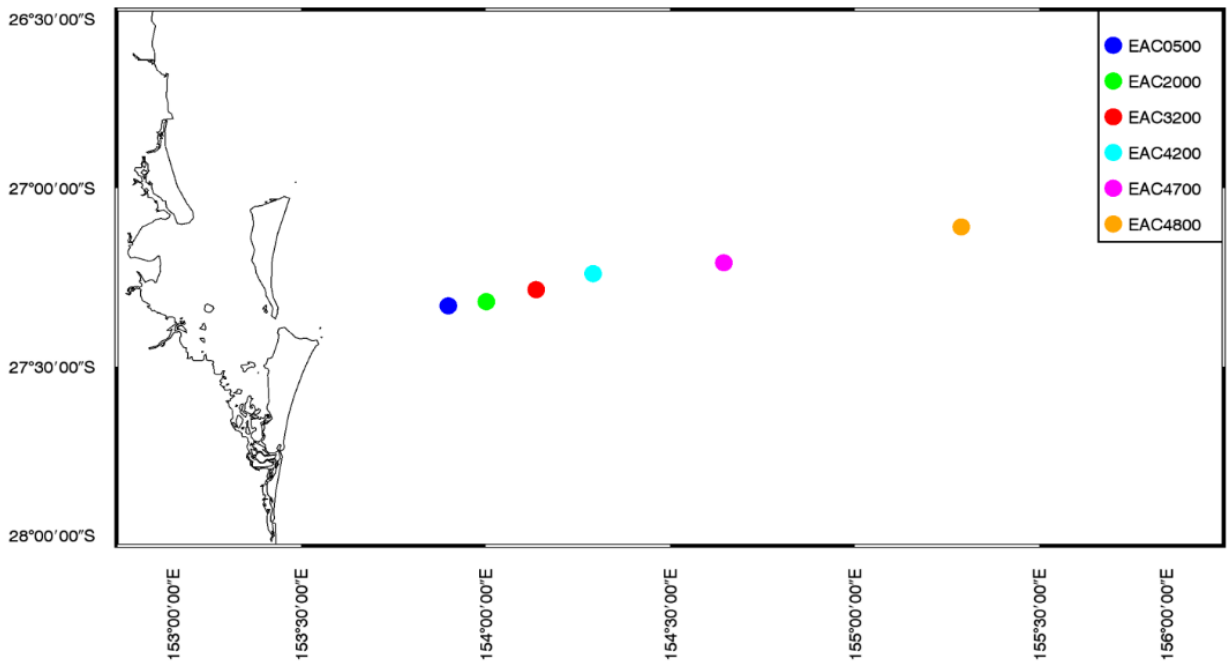
2 Moorings description

Table 1 summarises each mooring's location, depth and deployment times. Figure 1 shows the map of the mooring locations. Full information on the deployment and recovery voyages can be obtained from the CSIRO Marine and Atmospheric Data Centre (data interface: http://www.marine.csiro.au/marlin/). Voyages: IN2018_V03 and IN2019_V05.

Table 1. Summary of mooring deployment details

Mooring	Anchors Deployed (UTC)	Releases activated for retrieval (UTC)	Location		Depth (m)
			Latitude	Longitude	
EAC0500	06/05/2018 01:39	24/9/2019 02:08	-27.3260	153.8990	540
EAC2000	05/05/2018 06:28	23/09/2019 21:40	-27.3129	153.9990	1908
EAC3200	02/05/2018 03:59	20/09/2019 21:33	-27.2841	154.1301	3161
EAC4200	29/04/2018 05:14	16/09/2019 21:31	-27.2397	154.2972	4287
EAC4700	25/04/2018 06:07	13/09/2019 21:58	-27.2064	154.6486	4779
EAC4800	22/04/2018 05:50	10/09/2019 21:55	-27.1008	155.2967	4790

Figure 1. Location of the six EAC moorings.



The location of two of the EAC moorings in this deployment differs from the previous deployment (Cowley, 2021). The shallowest mooring was moved further inshore, while an additional mooring was added between the locations of EAC2000 and EAC4200. The relative locations and matchup of continuing mooring locations is summarised in **Error! Not a valid bookmark self-reference.**.

Note that while four of the mooring locations are coincident between deployments, the time series is not continuous as there was a gap of 21 months between the first and second deployments.

Table 2. Relative location of moorings between EAC 2012-13 and subsequent deployments

Nominal Depth	500 m	1500 m	2000 m	3200 m	4200 m	4700 m	4800 m
EAC 2012-13	-	EAC1520 (EACM1)	EAC2000 (EACM2)	-	EAC4200 (EACM3)	EAC4700 (EACM4)	EAC4800 (EACM5)
EAC 2015-16	EAC0500	-	EAC2000	EAC3200	EAC4200	EAC4700	EAC4800
EAC 2016-18	EAC0500	-	EAC2000	EAC3200	EAC4200	EAC4700	EAC4800
EAC 2018-19	EAC0500	-	EAC2000	EAC3200	EAC4200	EAC4700	EAC4800

2.1 Major issues with moorings

On the 21/03/2019, the top part (to 200m depth) of mooring EAC2000 broke away. Fortunately, it was recovered and the data for the first part of the deployment was included in the dataset. One instrument was lost (SBE 37 #9912 at 200m) when the mooring broke.

3 Summary of instrumentation

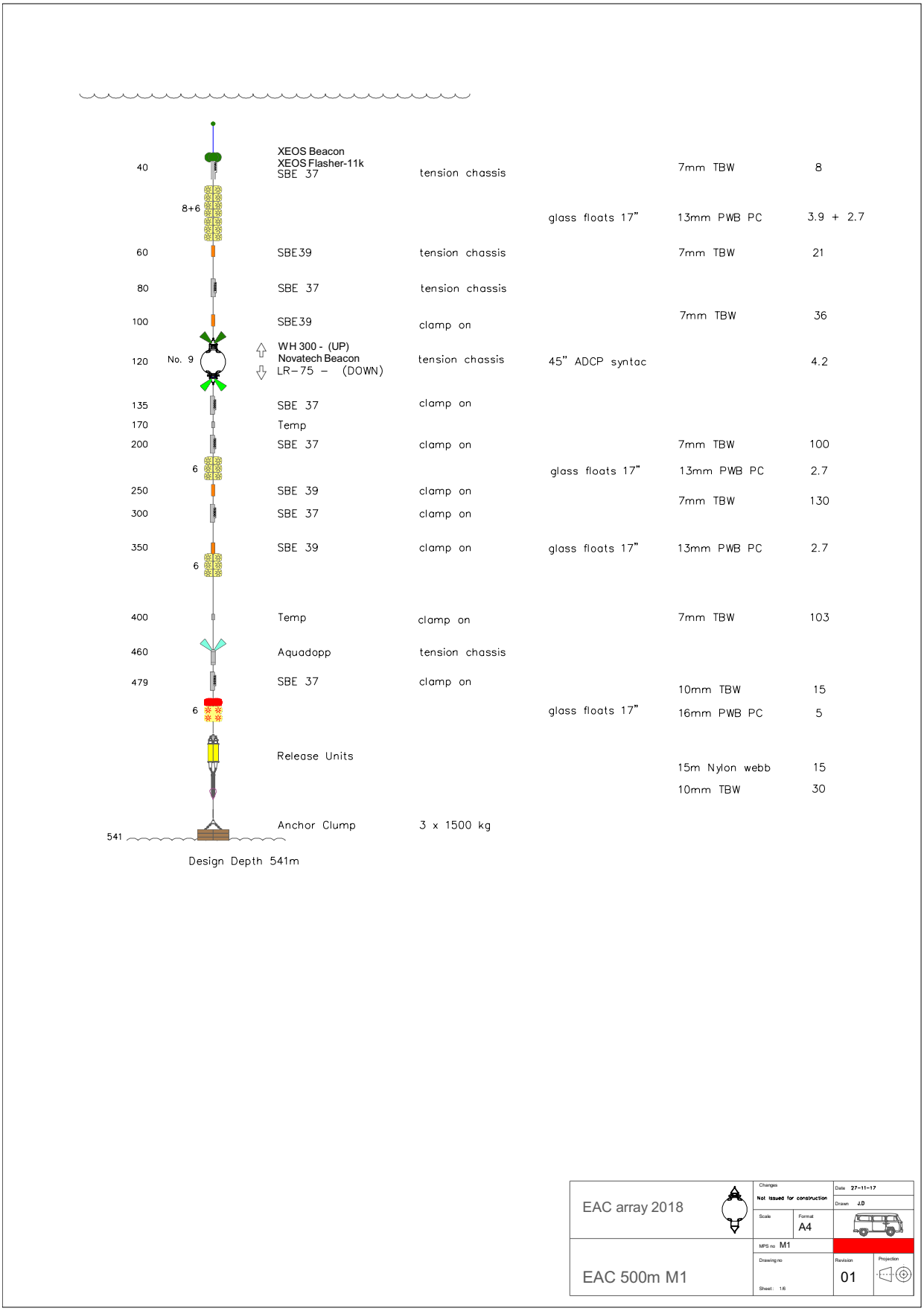
A total of 159 instruments were deployed on the six moorings.

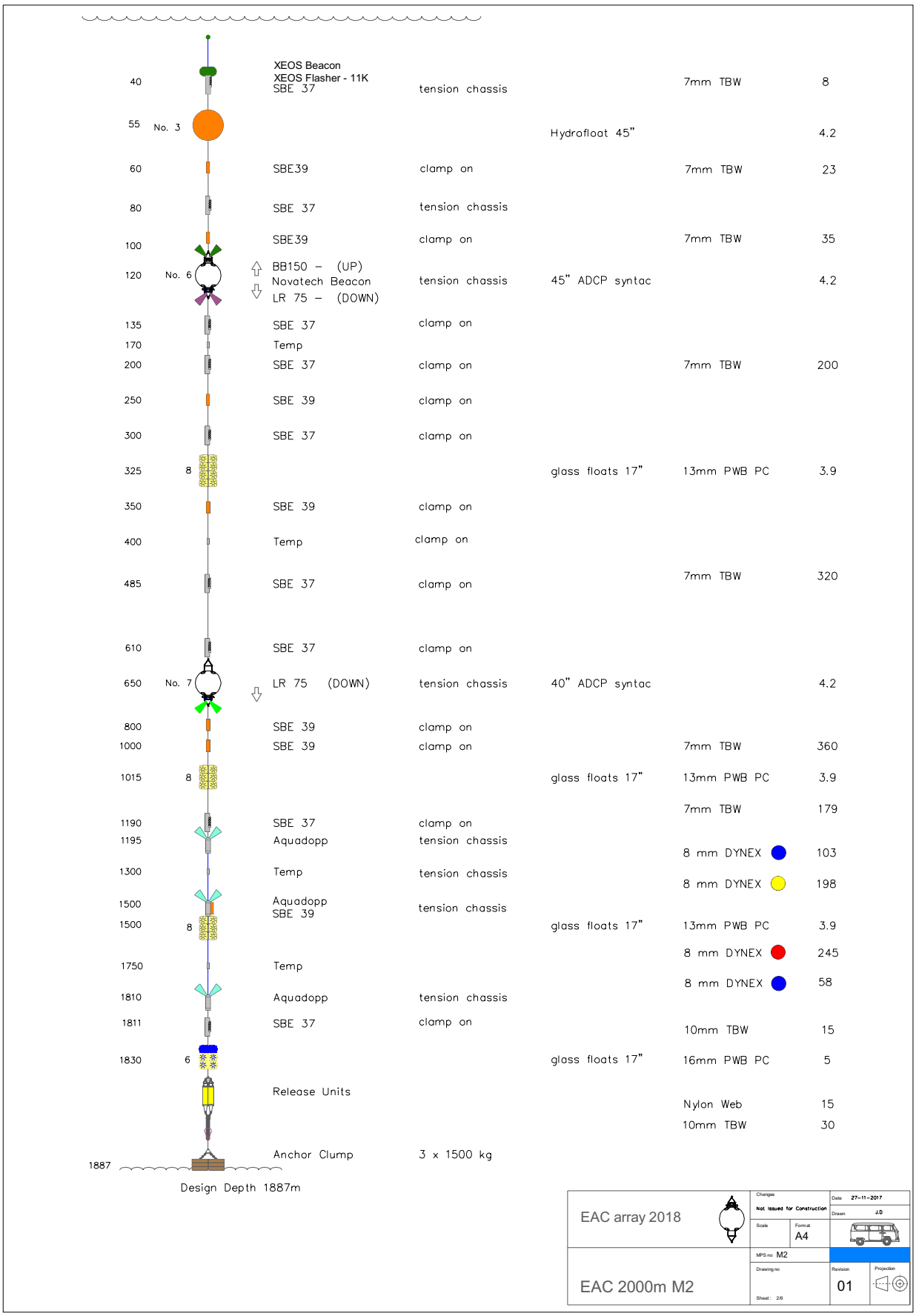
Table 3 shows the specifics of the instrument information for each mooring. The final mooring diagrams are shown in Figure 2 and Tables 4-9 summarise the instrumentation by mooring. Instruments that failed to return data are listed in Table 10.

Table 3. Summary of instrument types used.

Instrument Brand	Instrument model	Measurement types and manufacturer accuracy estimates
Seabird	SBE37 SMP (pumped unit)	Pressure (±0.1% max depth rating), temperature (±0.002°C), conductivity (±0.0003S/m)
Seabird	SBE39 Plus, measuring temperature and pressure	Pressure (±0.1% max depth rating), temperature (±0.002°C)
Seabird	SBE39, Temperature only measurements	Temperature (±0.002°C)
Star Oddi	Starmon Mini	Temperature (±0.05°C)
RDI	Longranger 75kHz	Pressure (±0.25% full scale), temperature (accuracy not stated, precision ±0.4°C), currents (stdev: 3.9cm/s @ settings used on the EAC; compass tilt max ±15°, tilt range ±50°)
RDI	Workhorse Quatermaster 150kHz	Pressure (±0.25% full scale), temperature (accuracy not stated, precision ±0.4°C), currents (stdev: 3.5cm/s @ settings used on the EAC; compass tilt max ±15°, tilt range ±50°)
RDI	Workhorse Sentinal 300kHz	Pressure (±0.25% full scale), temperature (accuracy not stated, precision ±0.4°C), currents (stdev: 3.6cm/s @ settings used on the EAC; compass tilt max ±15°, tilt range ±50°)
Nortek	Aquadopp DW	Pressure (0.25%), temperature (±0.1°C), currents (point source) (maximum tilt ±30°)

Figure 2. Mooring diagrams.




40
XEOS Beacon
XEOS Flasher - 11K
SBE 37
tension chassis
7mm TBW
8
55
No. 3
Hydrofloat 45"
4.2
60
SBE39
clamp on
7mm TBW
23
80
SBE 37
tension chassis
100
SBE39
clamp on
7mm TBW
35
120
No. 6
BB150 – (UP)
Novatech Beacon
LR 75 – (DOWN)
tension chassis
45" ADCP syntac
4.2
135
SBE 37
clamp on
170
Temp
200
SBE 37
clamp on
7mm TBW
200
250
SBE 39
clamp on
300
SBE 37
clamp on
325
8
glass floats 17"
13mm PWB PC
3.9
350
SBE 39
clamp on
400
Temp
clamp on
485
SBE 37
clamp on
7mm TBW
320
610
SBE 37
clamp on
650
No. 7
LR 75 (DOWN)
tension chassis
40" ADCP syntac
4.2
800
SBE 39
clamp on
1000
SBE 39
clamp on
7mm TBW
360
1015
8
glass floats 17"
13mm PWB PC
3.9
7mm TBW
179
1190
SBE 37
clamp on
1195
Aquadopp
tension chassis
8 mm DYNEX
103
1300
Temp
tension chassis
8 mm DYNEX
198
1500
Aquadopp
SBE 39
tension chassis
1500
8
glass floats 17"
13mm PWB PC
3.9
8 mm DYNEX
245
1750
Temp
8 mm DYNEX
58
1810
Aquadopp
tension chassis
1811
SBE 37
clamp on
10mm TBW
15
1830
6
glass floats 17"
16mm PWB PC
5
Release Units
Nylon Web
15
10mm TBW
30
1887
Anchor Clump
3 x 1500 kg
Design Depth 1887m
EAC array 2018
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Revision 01
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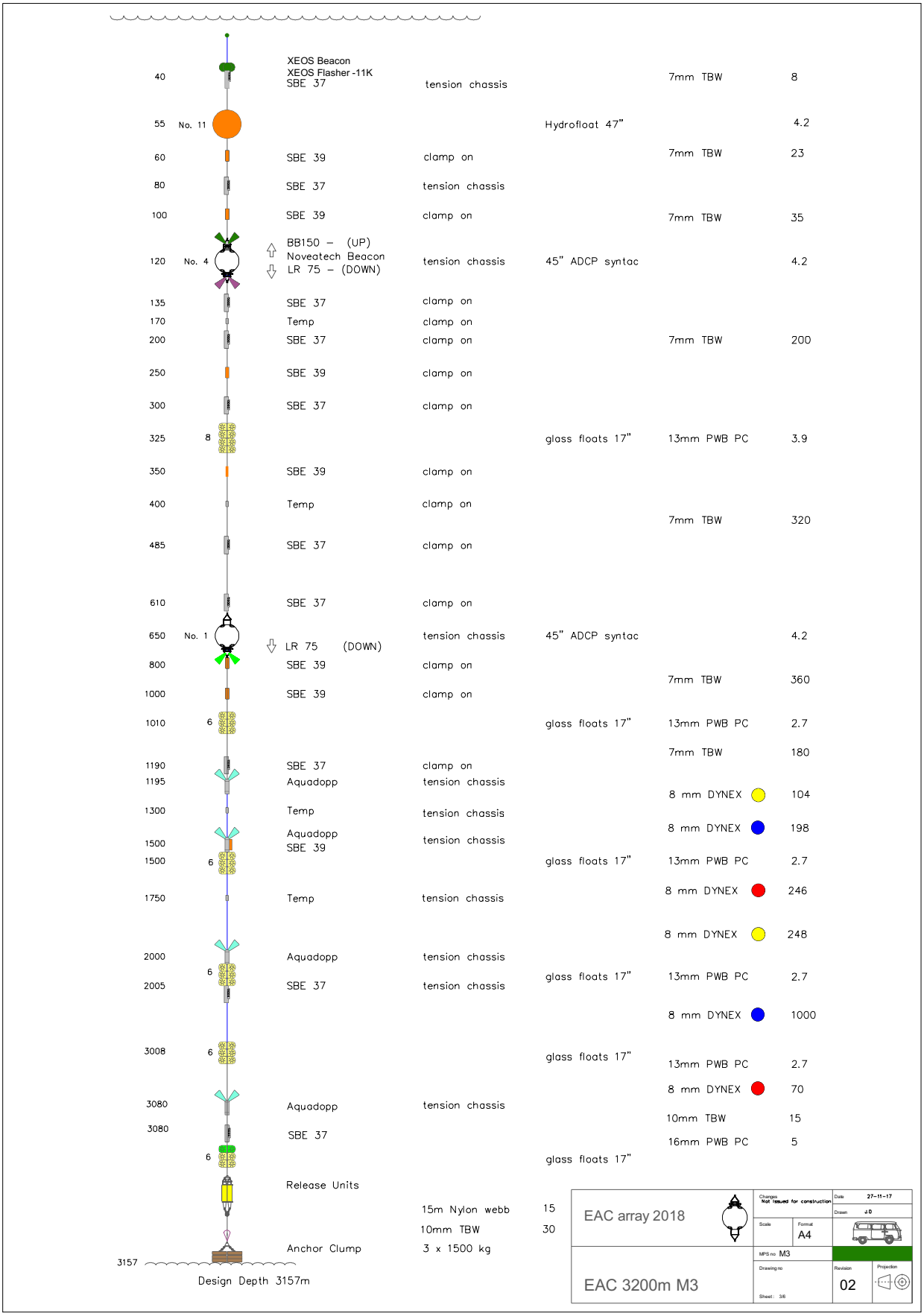
40
XEOS Beacon
XEOS Flasher -11K
SBE 37
tension chassis
7mm TBW
8
55
No. 11
Hydrofloat 47"
4.2
60
SBE 39
clamp on
7mm TBW
23
80
SBE 37
tension chassis
100
SBE 39
clamp on
7mm TBW
35
120
No. 4
BB150 – (UP)
Noveatech Beacon
LR 75 – (DOWN)
tension chassis
45" ADCP syntac
4.2
135
SBE 37
clamp on
170
Temp
clamp on
200
SBE 37
clamp on
7mm TBW
200
250
SBE 39
clamp on
300
SBE 37
clamp on
325
8
glass floats 17"
13mm PWB PC
3.9
350
SBE 39
clamp on
400
Temp
clamp on
7mm TBW
320
485
SBE 37
clamp on
610
SBE 37
clamp on
650
No. 1
LR 75 (DOWN)
tension chassis
45" ADCP syntac
4.2
800
SBE 39
clamp on
7mm TBW
360
1000
SBE 39
clamp on
1010
6
glass floats 17"
13mm PWB PC
2.7
7mm TBW
180
1190
SBE 37
clamp on
1195
Aquadopp
tension chassis
8 mm DYNEX
104
1300
Temp
tension chassis
8 mm DYNEX
198
1500
Aquadopp
SBE 39
tension chassis
1500
6
glass floats 17"
13mm PWB PC
2.7
1750
Temp
tension chassis
8 mm DYNEX
246
8 mm DYNEX
248
2000
Aquadopp
tension chassis
6
2005
SBE 37
tension chassis
glass floats 17"
13mm PWB PC
2.7
8 mm DYNEX
1000
3008
6
glass floats 17"
13mm PWB PC
2.7
8 mm DYNEX
70
3080
Aquadopp
tension chassis
10mm TBW
15
3080
SBE 37
16mm PWB PC
5
6
glass floats 17"
Release Units
15m Nylon webb
15
10mm TBW
30
Anchor Clump
3 x 1500 kg
3157
Design Depth 3157m
EAC array 2018
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Date
27-11-17
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JD
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Format
A4
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Drawing no
Sheet: 3/6
Revision
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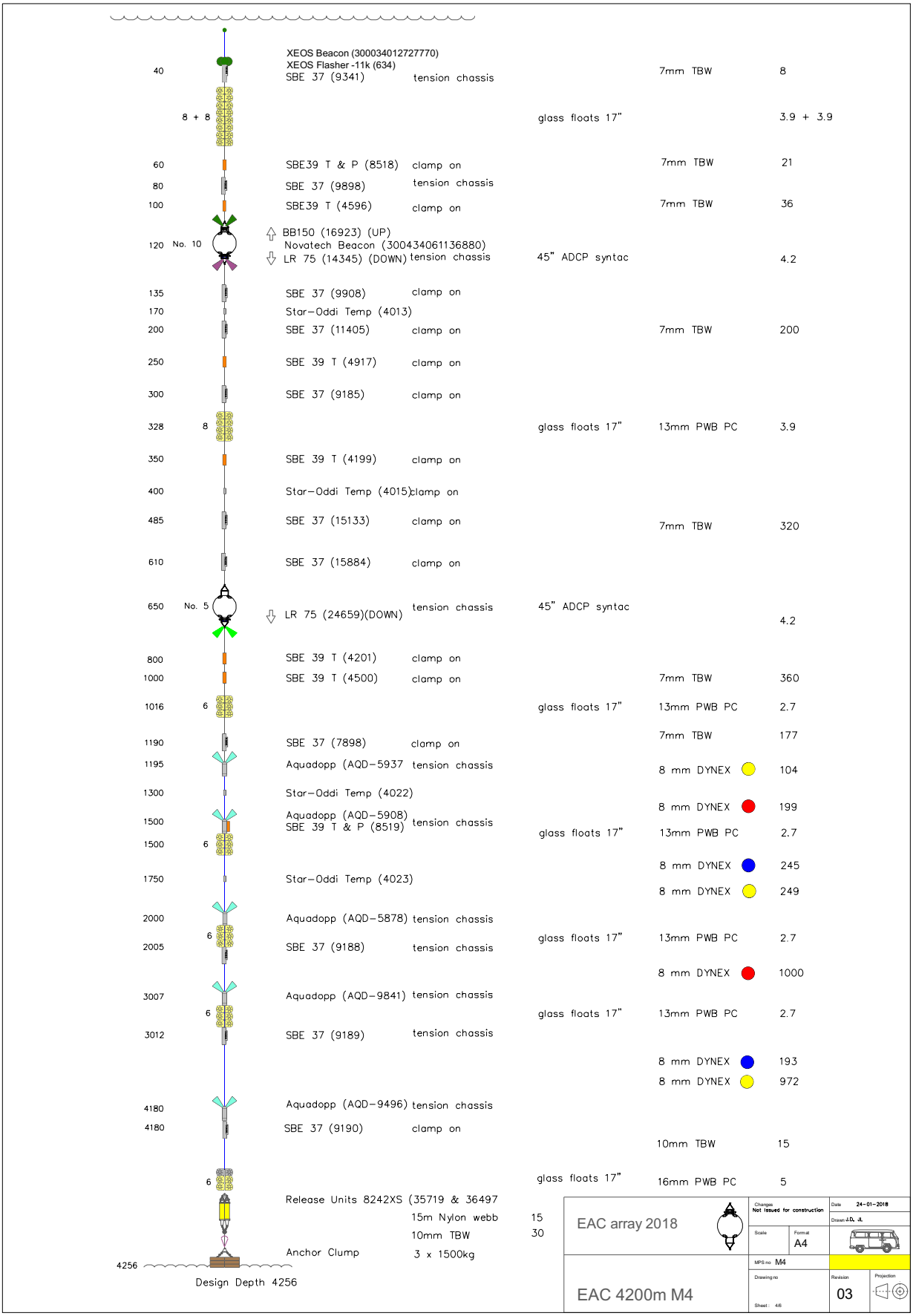
XEOS Beacon (300034012727770)
XEOS Flasher -11k (634)
40 SBE 37 (9341) tension chassis 7mm TBW 8
8 + 8 glass floats 17" 3.9 + 3.9
60 SBE39 T & P (8518) clamp on 7mm TBW 21
80 SBE 37 (9898) tension chassis
100 SBE39 T (4596) clamp on 7mm TBW 36
120 No. 10 BB150 (16923) (UP)
Novatech Beacon (300434061136880)
LR 75 (14345) (DOWN) tension chassis 45" ADCP syntac 4.2
135 SBE 37 (9908) clamp on
170 Star-Oddi Temp (4013)
200 SBE 37 (11405) clamp on 7mm TBW 200
250 SBE 39 T (4917) clamp on
300 SBE 37 (9185) clamp on
328 8 glass floats 17" 13mm PWB PC 3.9
350 SBE 39 T (4199) clamp on
400 Star-Oddi Temp (4015) clamp on
485 SBE 37 (15133) clamp on 7mm TBW 320
610 SBE 37 (15884) clamp on
650 No. 5 LR 75 (24659)(DOWN) tension chassis 45" ADCP syntac 4.2
800 SBE 39 T (4201) clamp on
1000 SBE 39 T (4500) clamp on 7mm TBW 360
1016 6 glass floats 17" 13mm PWB PC 2.7
1190 SBE 37 (7898) clamp on 7mm TBW 177
1195 Aquadopp (AQD-5937 tension chassis 8 mm DYNEX 104
1300 Star-Oddi Temp (4022) 8 mm DYNEX 199
1500 Aquadopp (AQD-5908)
SBE 39 T & P (8519) tension chassis
1500 6 glass floats 17" 13mm PWB PC 2.7
8 mm DYNEX 245
1750 Star-Oddi Temp (4023) 8 mm DYNEX 249
2000 Aquadopp (AQD-5878) tension chassis
6
2005 SBE 37 (9188) tension chassis glass floats 17" 13mm PWB PC 2.7
8 mm DYNEX 1000
3007 Aquadopp (AQD-9841) tension chassis
6 glass floats 17" 13mm PWB PC 2.7
3012 SBE 37 (9189) tension chassis
8 mm DYNEX 193
8 mm DYNEX 972
4180 Aquadopp (AQD-9496) tension chassis
4180 SBE 37 (9190) clamp on 10mm TBW 15
6 glass floats 17" 16mm PWB PC 5
Release Units 8242XS (35719 & 36497
15m Nylon webb 15
10mm TBW 30
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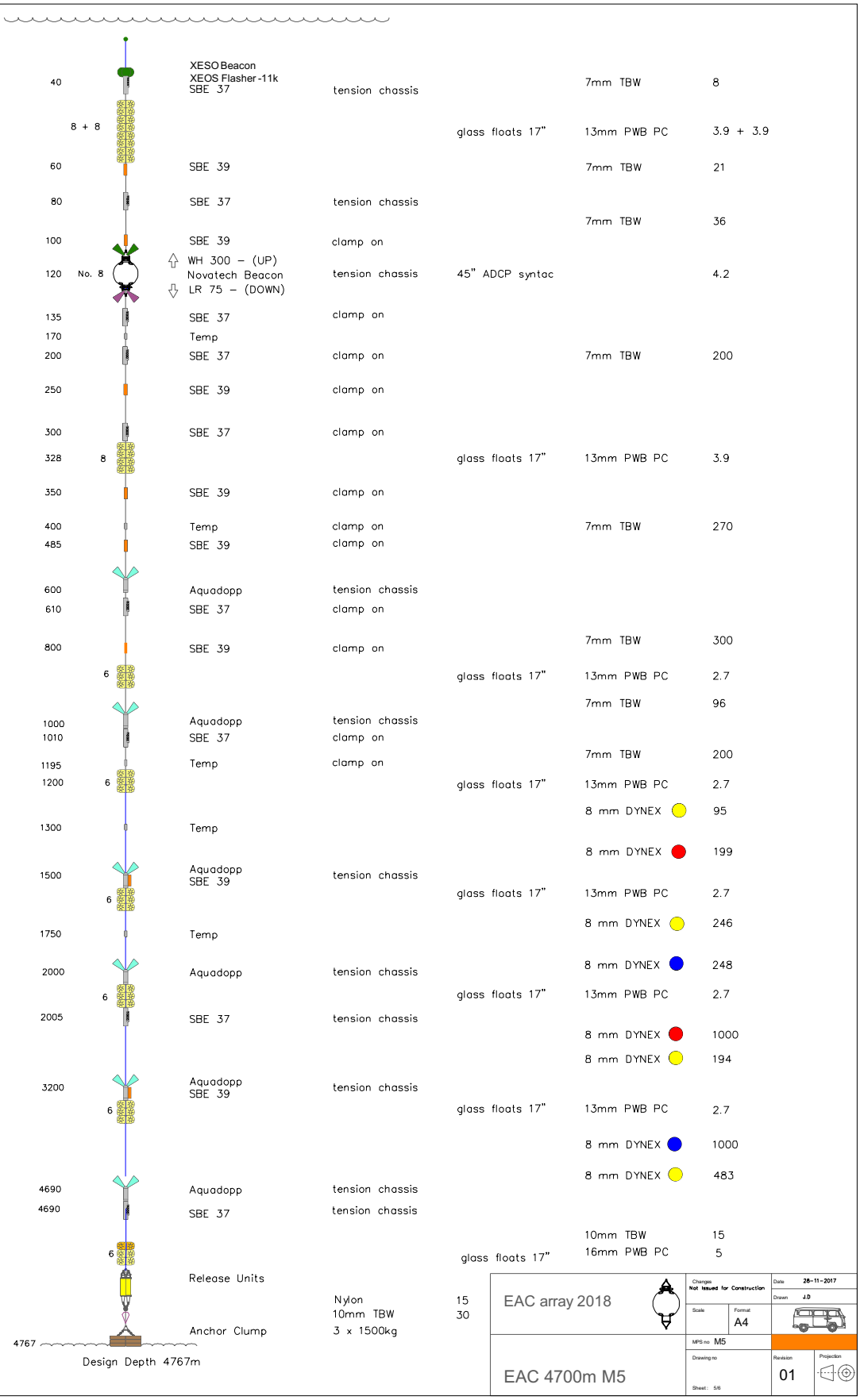
M4
EAC 4200m M4
03


XESO Beacon
XEOS Flasher -11k
40 SBE 37 tension chassis 7mm TBW 8
8 + 8 glass floats 17" 13mm PWB PC 3.9 + 3.9
60 SBE 39 7mm TBW 21
80 SBE 37 tension chassis
7mm TBW 36
100 SBE 39 clamp on
120 No. 8 WH 300 – (UP) Novatech Beacon LR 75 – (DOWN) tension chassis 45" ADCP syntac 4.2
135 SBE 37 clamp on
170 Temp
200 SBE 37 clamp on 7mm TBW 200
250 SBE 39 clamp on
300 SBE 37 clamp on
328 8 glass floats 17" 13mm PWB PC 3.9
350 SBE 39 clamp on
400 Temp clamp on 7mm TBW 270
485 SBE 39 clamp on
600 Aquadopp tension chassis
610 SBE 37 clamp on
800 SBE 39 clamp on 7mm TBW 300
6 glass floats 17" 13mm PWB PC 2.7
7mm TBW 96
1000 Aquadopp tension chassis
1010 SBE 37 clamp on
1195 Temp clamp on 7mm TBW 200
1200 6 glass floats 17" 13mm PWB PC 2.7
8 mm DYNEX 95
1300 Temp
8 mm DYNEX 199
1500 Aquadopp SBE 39 tension chassis
6 glass floats 17" 13mm PWB PC 2.7
8 mm DYNEX 246
1750 Temp
8 mm DYNEX 248
2000 Aquadopp tension chassis
6 glass floats 17" 13mm PWB PC 2.7
2005 SBE 37 tension chassis
8 mm DYNEX 1000
8 mm DYNEX 194
3200 Aquadopp SBE 39 tension chassis
6 glass floats 17" 13mm PWB PC 2.7
8 mm DYNEX 1000
8 mm DYNEX 483
4690 Aquadopp tension chassis
4690 SBE 37 tension chassis
10mm TBW 15
6 glass floats 17" 16mm PWB PC 5
Release Units
Nylon 15
10mm TBW 30
4767 Anchor Clump 3 x 1500kg
Design Depth 4767m
EAC array 2018
Changes: Not Issued for Construction
Date: 28-11-2017
Drawn: J.D
Scale
Format: A4
MPS no: M5
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Drawing no
Revision: 01
Projection
Sheet: 5/6

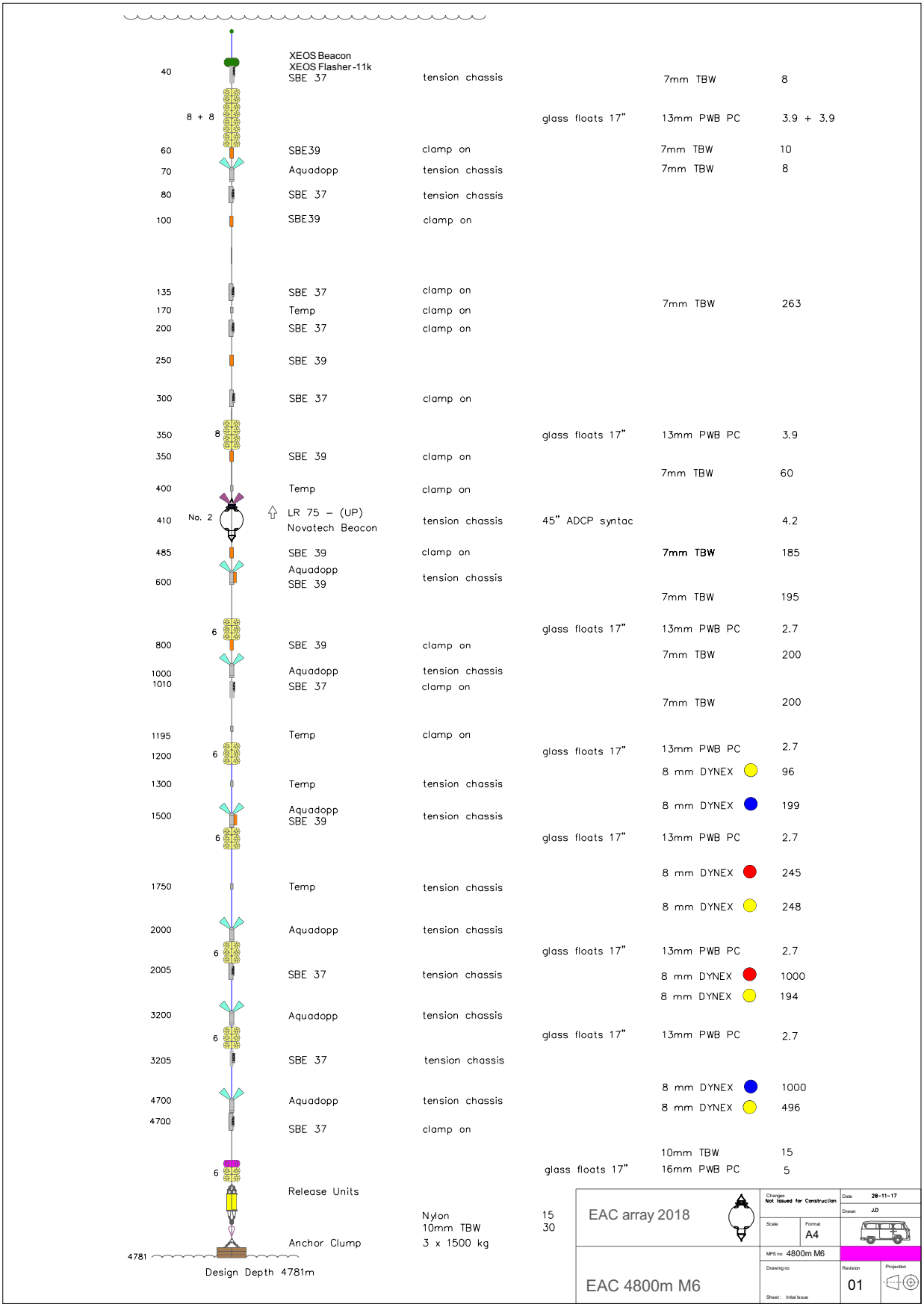

XEOS Beacon
XEOS Flasher-11k
SBE 37
tension chassis
7mm TBW
8
8 + 8
glass floats 17"
13mm PWB PC
3.9 + 3.9
60
SBE39
clamp on
7mm TBW
10
70
Aquadopp
tension chassis
7mm TBW
8
80
SBE 37
tension chassis
100
SBE39
clamp on
135
SBE 37
clamp on
170
Temp
clamp on
7mm TBW
263
200
SBE 37
clamp on
250
SBE 39
300
SBE 37
clamp on
350
8
glass floats 17"
13mm PWB PC
3.9
350
SBE 39
clamp on
7mm TBW
60
400
Temp
clamp on
410
No. 2
LR 75 – (UP)
Novatech Beacon
tension chassis
45" ADCP syntac
4.2
485
SBE 39
clamp on
7mm TBW
185
Aquadopp
600
SBE 39
tension chassis
7mm TBW
195
6
glass floats 17"
13mm PWB PC
2.7
800
SBE 39
clamp on
7mm TBW
200
1000
Aquadopp
tension chassis
1010
SBE 37
clamp on
7mm TBW
200
1195
Temp
clamp on
1200
6
glass floats 17"
13mm PWB PC
2.7
8 mm DYNEX
96
1300
Temp
tension chassis
8 mm DYNEX
199
1500
Aquadopp
SBE 39
tension chassis
6
glass floats 17"
13mm PWB PC
2.7
8 mm DYNEX
245
1750
Temp
tension chassis
8 mm DYNEX
248
2000
Aquadopp
tension chassis
6
glass floats 17"
13mm PWB PC
2.7
2005
SBE 37
tension chassis
8 mm DYNEX
1000
8 mm DYNEX
194
3200
Aquadopp
tension chassis
6
glass floats 17"
13mm PWB PC
2.7
3205
SBE 37
tension chassis
8 mm DYNEX
1000
4700
Aquadopp
tension chassis
8 mm DYNEX
496
4700
SBE 37
clamp on
10mm TBW
15
6
glass floats 17"
16mm PWB PC
5
Release Units
Nylon
15
10mm TBW
30
4781
Anchor Clamp
3 x 1500 kg
Design Depth 4781m
EAC array 2018
Changes
Not issued for Construction
Date
28-11-17
Drawn
JD
Scale
Format
A4
MPS no
4800m M6
Drawing no
EAC 4800m M6
Revision
01
Projection
Sheet: Initial Issue

Table 4. Instrumentation summary for EAC0500 mooring.

Instrument	Serial Number	Planned depth (m)	Sample Period (s)	End of deployment time offset (s) (instrument - UTC)
Sea-Bird Electronics SBE37SMP	9335	40	600	33
Sea-Bird Electronics SBE39	4777	60	300	78
Sea-Bird Electronics SBE37SMP	9895	80	600	23
Sea-Bird Electronics SBE39	4780	100	300	89
WH300	14254	120	72	126
LR75	9788	120	225	108
Sea-Bird Electronics SBE37SMP	9905	135	600	5
Star Oddi Starmon mini	T-3998	170	300	-600
Sea-Bird Electronics SBE37SMP	9911	200	600	19
Sea-Bird Electronics SBE39	4782	250	300	82
Sea-Bird Electronics SBE37SMP	9171	300	600	51
Sea-Bird Electronics SBE39	1332	350	300	92
Star Oddi Starmon mini	T-3999	400	300	-600
Nortek Aquadopp DW	A3L-5175 (AQD 9964)	460	1800	-57.6
Sea-Bird Electronics SBE37SMP	15121	463	600	-1

Table 5. Instrumentation summary for EAC2000 mooring.

Instrument	Serial Number	Planned depth (m)	Sample Period (s)	End of deployment time offset (s) (instrument - UTC)
Sea-Bird Electronics SBE37SMP	9336	46	600	0
Sea-Bird Electronics SBE39plus	39p-8086	66	300	0
Sea-Bird Electronics SBE37SMP	9896	86	600	7
Sea-Bird Electronics SBE39plus	39p-8087	106	300	-3
BB150	17958	126	72	0
LR75	16072	126	225	40
Sea-Bird Electronics SBE37SMP	9906	141	600	-15
Star Oddi Starmon mini	T-4000	176	300	0
Sea-Bird Electronics SBE37SMP	9912	206	600	0
Sea-Bird Electronics SBE39	4887	256	300	93
Sea-Bird Electronics SBE37SMP	9183	306	600	53
Sea-Bird Electronics SBE39	4888	356	300	84
Star Oddi Starmon mini	T-4001	406	300	0
Sea-Bird Electronics SBE37SMP	15131	491	600	1
Sea-Bird Electronics SBE37SMP	15134	616	600	2
LR75	24473	656	225	257
Sea-Bird Electronics SBE39plus	39p-8107	806	300	-5
Sea-Bird Electronics SBE39plus	39p-8108	1006	300	-7
Sea-Bird Electronics SBE37SMP	13081	1196	600	-23
Nortek Aquadopp DW 2Mhz	A6L-3637 (AQD 5943)	1201	1800	0
Star Oddi Starmon mini	T-4005	1306	300	0
Nortek Aquadopp DW 2Mhz	A6L-3638 (AQD 5971)	1506	1800	-85.1
Sea-Bird Electronics SBE39plus	39p-8435	1506	300	-2
Star Oddi Starmon mini	T-4007	1756	300	0
Nortek Aquadopp DW 2Mhz	A6L-3639 (AQD 5975)	1816	1800	-60.5
Sea-Bird Electronics SBE37SMP	7895	1817	1200	-103

Table 6. Instrumentation summary for EAC3200 mooring.

Instrument	Serial Number	Planned depth (m)	Sample Period (s)	End of deployment time offset (s) (instrument - UTC)
Sea-Bird Electronics SBE37SMP	9340	28	600	18
Sea-Bird Electronics SBE39plus	39p-8436	48	300	-8
Sea-Bird Electronics SBE37SMP	9897	68	600	20
Sea-Bird Electronics SBE39	3916	88	300	71
BB150	17959	108	72	5
LR75	14292	108	225	466
Sea-Bird Electronics SBE37SMP	9907	123	600	1
Star Oddi Starmon mini	T-4008	158	300	300
Sea-Bird Electronics SBE37SMP	11401	188	600	27
Sea-Bird Electronics SBE39	4169	238	300	0
Sea-Bird Electronics SBE37SMP	9184	288	600	47
Sea-Bird Electronics SBE39	4326	338	300	0
Star Oddi Starmon mini	T-4010	388	300	-300
Sea-Bird Electronics SBE37SMP	15132	473	600	-7
Sea-Bird Electronics SBE37SMP	15883	598	600	-21
LR75	24475	638	225	229
Sea-Bird Electronics SBE39plus	39p-8516	788	300	5
Sea-Bird Electronics SBE39	4171	988	300	90
Sea-Bird Electronics SBE37SMP	9187	1178	600	16
Nortek Aquadopp DW 2Mhz	A6L-3641 (AQD 5938)	1183	1800	-37.6
Star Oddi Starmon mini	T-4011	1288	300	-600
Nortek Aquadopp DW 2Mhz	A6L-3653 (AQD 5976)	1488	1800	-70.3
Sea-Bird Electronics SBE39plus	39p-8517	1488	300	204
Star Oddi Starmon mini	T-4012	1738	300	-900
Nortek Aquadopp DW 2Mhz	A6L-3654 (AQD 5928)	1993	1800	-17.6
Sea-Bird Electronics SBE37SMP	13082	1998	600	-7
Nortek Aquadopp DW 2Mhz	A6L-3655 (AQD 5961)	3068	1800	0
Sea-Bird Electronics SBE37SMP	7897	3071	1200	56

Table 7. Instrumentation summary for EAC4200 mooring.

Instrument	Serial Number	Planned depth (m)	Sample Period (s)	End of deployment time offset (s) (instrument - UTC)
Sea-Bird Electronics SBE37SMP	9341	40	600	45
Sea-Bird Electronics SBE39plus	39p-8518	60	300	3
Sea-Bird Electronics SBE37SMP	9898	80	600	10
Sea-Bird Electronics SBE39	4596	100	300	71
BB150	22801	120	72	791
LR75	14345	120	225	776
Sea-Bird Electronics SBE37SMP	9908	135	600	-12
Star Oddi Starmon mini	T-4013	170	300	0
Sea-Bird Electronics SBE37SMP	11405	200	600	11
Sea-Bird Electronics SBE39	4197	250	300	74
Sea-Bird Electronics SBE37SMP	9185	300	600	57
Sea-Bird Electronics SBE39	4199	350	300	-65
Star Oddi Starmon mini	T-4015	400	300	-300
Sea-Bird Electronics SBE37SMP	15133	485	600	14
Sea-Bird Electronics SBE37SMP	15884	610	600	-9
LR75	24659	650	225	-93
Sea-Bird Electronics SBE39	4201	800	300	0
Sea-Bird Electronics SBE39	4500	1000	300	0
Sea-Bird Electronics SBE37SMP	9189	1190	600	84
Nortek Aquadopp DW 2Mhz	A6L-3656 (AQD 5937)	1195	1800	-65
Star Oddi Starmon mini	T-3995	1300	300	-600
Nortek Aquadopp DW 2Mhz	A6L-3661 (AQD 5908)	1500	1800	-62
Sea-Bird Electronics SBE39plus	39p-8519	1500	300	-7
Star Oddi Starmon mini	T-4023	1750	300	-1200
Nortek Aquadopp DW 2Mhz	A6L-4864 (AQD 9840)	2000	1800	-85.3
Sea-Bird Electronics SBE37SMP	9188	2005	600	43
Nortek Aquadopp DW 2Mhz	A6L-4865 (AQD 9841)	3000	1800	-70
Sea-Bird Electronics SBE37SMP	7898	3005	1200	25
Nortek Aquadopp DW 2Mhz	A6L-4869 (AQD 9496)	4180	1800	-70
Sea-Bird Electronics SBE37SMP	9190	4180	600	22

Table 8. Instrumentation summary for EAC4700 mooring.

Instrument	Serial Number	Planned depth (m)	Sample Period (s)	End of deployment time offset (s) (instrument - UTC)
Sea-Bird Electronics SBE37SMP	9882	33	600	-4
Sea-Bird Electronics SBE39plus	39p-8520	53	300	-10
Sea-Bird Electronics SBE37SMP	9899	73	600	12
Sea-Bird Electronics SBE39	4613	93	300	71
WH300	17055	113	72	267
LR75	14434	123	225	-39
Sea-Bird Electronics SBE37SMP	9909	128	600	10
Star Oddi Starmon mini	T-4024	163	300	-900
Sea-Bird Electronics SBE37SMP	9166	193	600	62
Sea-Bird Electronics SBE39	4591	243	300	65
Sea-Bird Electronics SBE37SMP	9186	293	600	55
Sea-Bird Electronics SBE39	4592	343	300	72
Star Oddi Starmon mini	T-4025	393	300	-600
Sea-Bird Electronics SBE39	4168	478	300	89
Nortek Aquadopp DW 2Mhz	A6L-4881 (AQD 9893)	593	1800	113
Sea-Bird Electronics SBE37SMP	9193	603	600	-4
Sea-Bird Electronics SBE39	4593	793	300	0
Nortek Aquadopp DW 2Mhz	A6L-4885 (AQD 9470)	993	1800	68.5
Sea-Bird Electronics SBE37SMP	9191	1003	600	50
Star Oddi Starmon mini	T-4026	1188	300	-300
Star Oddi Starmon mini	T-4029	1293	300	-1200
Nortek Aquadopp DW 2Mhz	A6L-4888 (AQD 9842)	1493	1800	91.9
Sea-Bird Electronics SBE39plus	39p-8521	1493	300	0
Star Oddi Starmon mini	T-4030	1743	300	-900
Nortek Aquadopp DW 2Mhz	A6L-5063 (AQD 9827)	1993	1800	0
Sea-Bird Electronics SBE37SMP	7899	1998	1200	30
Nortek Aquadopp DW 2Mhz	A6L-5066 (AQD 9820)	3198	1800	60
Sea-Bird Electronics SBE39	6272	3198	300	83
Nortek Aquadopp DW 2Mhz	A6L-5475 (AQD 8391)	4693	1800	69
Sea-Bird Electronics SBE37SMP	9194	4698	600	55

Table 9. Instrumentation summary for EAC4800 mooring.

Instrument	Serial Number	Planned depth (m)	Sample Period (s)	End of deployment time offset (s) (instrument - UTC)
Sea-Bird Electronics SBE37SMP	9889	40	600	4
Sea-Bird Electronics SBE39plus	39p-8522	60	300	8
Nortek Aquadopp DW	A3L-5199 (AQD 9848)	70	1800	53.8
Sea-Bird Electronics SBE37SMP	9900	80	600	23
Sea-Bird Electronics SBE39	4675	100	300	0
Sea-Bird Electronics SBE37SMP	9910	135	600	0
Star Oddi Starmon mini	T-4031	170	300	-600
Sea-Bird Electronics SBE37SMP	13078	200	600	-20
Sea-Bird Electronics SBE39	4676	250	300	79
Sea-Bird Electronics SBE37SMP	15105	300	600	-5
Sea-Bird Electronics SBE39	4779	350	300	77
Star Oddi Starmon mini	T-3997	400	300	-900
LR75	14890	410	225	-620
Sea-Bird Electronics SBE39	1003	485	300	0
Nortek Aquadopp DW 2Mhz	A6L-5477 (AQD 8461)	600	1800	38.46
Sea-Bird Electronics SBE39	4889	600	300	77
Sea-Bird Electronics SBE39	4594	800	300	69
Nortek Aquadopp DW 2Mhz	A6L-5478 (AQD 8448)	1000	1800	68.5
Sea-Bird Electronics SBE37SMP	13077	1010	600	-10
Star Oddi Starmon mini	T-4033	1195	300	-1200
Star Oddi Starmon mini	T-4034	1300	300	-900
Nortek Aquadopp DW 2Mhz	A6L-5480 (AQD 8377)	1500	1800	0
Sea-Bird Electronics SBE39	4890	1500	300	99
Star Oddi Starmon mini	T-3996	1750	300	-900
Nortek Aquadopp DW 2Mhz	A6L-4218 (AQD 6718)	2000	1800	45.7
Sea-Bird Electronics SBE37SMP	4300	2005	1200	-2
Nortek Aquadopp DW 2Mhz	A6L-3640 (AQD 5977)	3200	1800	59.3
Sea-Bird Electronics SBE37SMP	6265	3205	1200	31
Nortek Aquadopp DW 2Mhz	A6L-3657 (AQD 5950)	4700	1800	83.8
Sea-Bird Electronics SBE37SMP	6266	4705	1200	29

Table 10. Instruments deployed that returned no data

Instrument	Mooring	Serial Number	Planned depth (m)	Comment
LR75	EAC500	9788	120	No data, instrument failed due to a card writing error. Instrument was pinging when put in water.
SBE37SMP	EAC2000	9912	200	Instrument lost when mooring broke
Starmon Mini	EAC2000	4001	400	No data - fault in star oddi.
SBE39T	EAC3200	4326	338	No data, no response.
Aquadop DW	EAC3200	5878	3068	No data collected - instrument not set to collect data??
SBE39T	EAC4700	4593	793	Leaked, no data.
SBE39TP	EAC4700	8521	1493	Leaked, no data.
Aquadop DW	EAC4700	9827	1993	Not responding when data download tried, retried in Hobart and no data.
SBE37SMP	EAC4800	9910	135	Instrument leaked and was pressurised on recovery.
SBE39T	EAC4800	1003	485	No data - did not record, battery disconnected and time reset.

4 Instrument handling and data processing summary

Instrument setups were completed at CSIRO before shipping to be loaded on the *RV Investigator*. Before deployment, all instruments were re-checked to ensure they were operating prior to deployment. Setup of Seabird and RDI instruments was completed using automated scripts and the outputs from each instrument recorded. Nortek and Star Oddi instruments were set up manually. All setup procedures have extensive documentation and sign-off sheets requiring two persons to check and confirm no errors. Appendix A contains samples of the setups for each instrument type.

The majority of Seabird CTDs were calibrated at the CSIRO Marine and Atmospheric Research Calibration Facility (or in the case of new instruments and those previously identified as having issues, by the manufacturer) prior to deployment. Temperature calibration was performed at the CSIRO calibration facility on all Star Oddi instruments prior to deployment. Compass calibration was performed during the initial setup and configuration of the RDI ADCP instruments at CSIRO, Hobart.

Post-deployment, the Star Oddi and Seabird instruments were placed in a calibration bath on board the ship. After several hours, the bath temperature was changed by adding cooler seawater. The same, recently calibrated Seabird SBE37 was used in each bath to compare to the instruments retrieved from the mooring. In addition, the Seabird instruments were all attached to the CTD rosette on the ship and a calibration 'dip' was performed. The Seabird 911 rosette instrument was used to assess the salinity and temperature accuracy of these instruments at the end of the deployment (see section 5.4).

Processing and quality control of the data was completed using the IMOS toolbox version 2.6.5. For the RDI ADCP instruments, the toolbox is currently unable to handle the large datasets nor do the correct conversions from beam coordinates to magnetic coordinates. As a result, the QC of these data were completed partly outside the toolbox and with some edits to the toolbox workhorse parser to allow conversion of the data. The final single-ping QC'd files were produced by the toolbox. Hourly, bin averaged netcdf files cannot be produced with the current toolbox version, but once the tool is available, they will be produced and included in the AODN datasets.

5 QC specifics

5.1 In/Out of water information for each mooring

The in water and out of water times are used to flag data outside these times automatically with a '4', indicating that the data is considered to be 'bad' since the mooring is out of the water. The in/out of water times were selected based on the mooring deployment time (the time the anchor is dropped from the back of the ship) and the mooring release time (the time the acoustic releases are activated to release the mooring to the surface), and are adjusted after reviewing the temperature and depth data for each instrument. These times are consistent for each instrument on each mooring (Table 11), with the exception of the EAC2000 mooring, where the top part of the mooring broke part way through deployment. Anchor deploy and release times are given in Table 1.

Table 11. Mooring in/out of water times.

Mooring	In water time (UTC)	Out water time (UTC)
EAC0500	2018-05-06 01:59:00	2019-09-24 02:08:00
EAC2000	2018-05-05 07:08:00	2019-09-23 21:20:00
EAC2000 (Broken section)	2018-05-05 07:08:00	2019-03-21 17:36:00
EAC3200	2018-05-02 04:52:00	2019-09-20 21:33:00
EAC4200	2018-04-29 06:30:00	2019-09-16 21:31:00
EAC4700	2018-04-25 07:30:00	2019-09-13 21:58:00
EAC4800	2018-04-22 08:44:00	2019-09-10 21:55:00

5.2 Timing adjustments

The instrument clocks were checked for offsets at the start and end of the voyage. All instrument clocks were synchronised to UTC before deployment. Even with careful synchronisation, instrument clocks can drift and sometimes errors with local/UTC time can occur. Visual checks of times in and out of water will also show clearly time offsets.
Tables 4 to 9 include the applied time adjustments determined from time checks at the end of the deployment. The time record of each instrument was adjusted linearly to account for the clock drift.

5.3 Quality issues for each instrument

Specific quality issues were found for some instruments. Timing errors, spiking data, power downs, pressure sensor drifts, missing time steps and flooded units were some of the problems encountered. Table 12 contains a summary of these issues and the QC action for affected instruments.
A number of SBE37 instruments returned to Seabird for calibration following the recovery were found to have cracked conductivity cells. In some cases this was evident in the data, but in others it was not. In the latter case it is not possible to identify when the cell became cracked and if the data during this deployment is affected.
The pressure performance of Nortek DW Aquadopp instruments has previously been investigated (Cowley, 2021). Many of these instruments record pressure that has a consistent offset. In all cases for Aquadopp DW instruments, the pressure was flagged with 4 and the depth has been calculated

from adjacent instruments. When depth is inferred, the pressure (PRES_REL) does not appear in the netcdf files.

Table 12. Quality Issues specified by instrument.

Instrument	Mooring	Serial Number	Planned depth (m)	Issue	QC action
Aquadop DW	EAC0500	9964	460	UCUR and VCUR inconsistent with adjacent current meters. Inaccurate pressure	Flag 3 applied to UCUR and VCUR. Infer DEPTH from adjacent instruments.
Aquadop DW	EAC2000	5943	1195	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC2000	5971	1500	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC2000	5975	1810	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC3200	5938	1183	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC3200	5976	1488	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC3200	5928	1993	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC3200	5878	3068	No data collected - instrument not set to collect data??	
Aquadop DW	EAC4200	5937	1216	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4200	5908	1521	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4200	9840	2026	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4200	9841	3026	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.

Instrument	Mooring	Serial Number	Planned depth (m)	Issue	QC action
Aquadop DW	EAC4200	9496	4201	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4700	9893	593	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC4700	9470	993	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC4700	9842	1493	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC4700	9827	1993	Not responding when data download tried, retried in Hobart and no data.	
Aquadop DW	EAC4700	9820	3198	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4700	8391	4693	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4800	9848	70	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC4800	8461	600	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC4800	8448	1000	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4800	8377	1500	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
Aquadop DW	EAC4800	6718	2000	Inaccurate pressure	Infer DEPTH from adjacent instruments
Aquadop DW	EAC4800	5977	3200	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.

Instrument	Mooring	Serial Number	Planned depth (m)	Issue	QC action
Aquadop DW	EAC4800	5950	4700	Inaccurate temperature and pressure	TEMP flagged with 3 due to cold offset compared to adjacent SBE. PRES_REL flagged with 4 and depth interpolated from adjacent instruments.
BB150	EAC2000	17958	120	Mooring broke. Last good data at 21-3-2019 17:36:00.	
LR75	EAC0500	9788	120	No data, instrument failed due to a card error.	
LR75	EAC3200	14292	108	Pressure is bad at start of deployment.	Infer depth from adjacent SBE instruments and flag bad portion of PRES_REL with QC4.
LR75	EAC2000	16072	120	Mooring broke. Last good data at 21-3-2019 17:36:00.	
WH300	EAC4700	17055	113	Record short. Finishes 20 November, 2018. Due to memory card not being the right size (needed upgrade).	
SBE37SMP	EAC0500	9335	40	PSAL offset near end of deployment. Corresponding offset in TEMP.	Flag offsets in PSAL and TEMP with flags 4 and 3.
SBE37SMP	EAC0500	9905	135	Cell replaced.	Rosette calibration data looks no worse than other instruments on the mooring. PSAL data QC 1.
SBE37SMP	EAC0500	9911	200	Cell replaced.	Rosette calibration data looks no worse than other instruments on the mooring. PSAL data QC 1.
SBE37SMP	EAC3200	9184	288	Conductivity sensor failure from 09/05/2018.	Flag CNDC and PSAL as QC4 from this date.
SBE37SMP	EAC3200	11401	188	Covered in long line. Long line antenna also snared in mooring. Salinity is very bad soon after deployment.	QC4 for most of the PSAL data.
SBE37SMP	EAC0500	15121	463	Either drift or offset in PSAL data.	Have flagged most of last part of record as QC4 for PSAL.
SBE37SMP	EAC4800	9910	135	Instrument leaked and was pressurised, no data.	

Instrument	Mooring	Serial Number	Planned depth (m)	Issue	QC action
SBE37SMP	EAC2000	9912	200	Instrument lost when mooring broke	
SBE37SMP	EAC2000	13081	1190	Large PSAL offset at start and part way through deployment (>7) from 27-2-2019. Considerable spiking before this.	All PSAL and COND flagged QC4.
SBE37SMP	EAC2000	15131	485	Large PSAL offset part way through deployment (>7psu) from 7-4-2019. Also spiking and drifting from around mid-July 2018.	Affected PSAL and COND flagged QC4.
SBE37SMP	EAC2000	9336	40	Mooring broke. Last good data at 21-3-2019 17:36:00	
SBE37SMP	EAC2000	9896	80	Mooring broke. Last good data at 21-3-2019 17:36:00	
SBE37SMP	EAC2000	9906	135	Mooring broke. Last good data at 21-3-2019 17:36:00	
SBE37SMP	EAC4700	9166	193	Possibly very small PRES_REL drift (<1.0dbar).	PRES-REL kept as QC1.
SBE37SMP	EAC4800	6266	4700	PRES_REL drift (<15.0dbar). PSAL drift. Might be due to PRES_REL drift.	PRES-REL flagged with QC2. Not used for depth interpolation for other instruments. Flag PSAL as QC2.
SBE37SMP	EAC0500	9171	300	Pressure sensor drift. Starts at ~7m shallow, finishes at ~27m shallow. Also has a jump in pressure during September, 2018.	Infer depth from SBE4782 and 1332.
SBE37SMP	EAC4200	15133	506	PSAL drift from 18/02/2019.	Flag PSAL with QC4
SBE37SMP	EAC3200	15883	598	PSAL drift from early April, 2019.	Flagged PSAL as QC4 from here to end.
SBE37SMP	EAC4800	15105	300	PSAL drift or offset – offset at end of deployment with calibration dip.	Flag end of PSAL data with QC3.
SBE37SMP	EAC4700	9882	33	PSAL drift towards end of the deployment.	Flag with QC4 for drifting part.

Instrument	Mooring	Serial Number	Planned depth (m)	Issue	QC action
SBE37SMP	EAC4200	9188	2031	PSAL entire record offset. Calibration at end of record shows PSAL offset of 0.582.	Flag all PSAL as QC4.
SBE37SMP	EAC3200	7897	3071	PSAL offset low for entire period. TEMP offset, therefore PSAL is offset.	Flag PSAL and TEMP with QC3.
SBE37SMP	EAC4200	9190	4201	PSAL offset low.	Flag PSAL with QC3.
SBE37SMP	EAC0500	9335	40	PSAL offset near end of deployment. Corresponding offset in TEMP	Flag offset PSAL and TEMP with flags 4 and 3.
SBE37SMP	EAC3200	9187	1178	PSAL some small spikes.	Flag spikes as QC4
SBE37SMP	EAC4200	7898	3031	PSAL very constant across deployment. Looks offset when plotted with other moorings and CTD data.	Flag all PSAL with QC3
SBE37SMP	EAC4800	6265	3205	Small PRES_REL drift (<5.0dbar). Lots of small spikes in PSAL.	PRES-REL flagged with QC1. PSAL spikes flagged QC4.
SBE37SMP	EAC2000	7895	1811	Small PSAL offset around the 6-4-19, but returns to good after this.	Flag PSAL offset with QC4.
SBE37SMP	EAC3200	9340	28	Some small PSAL offsets and spikes flagged as QC4	Flag PSAL offset and spikes with QC4.
SBE37SMP	EAC4700	9194	4698	Some small PSAL offsets and spikes.	
SBE39T	EAC4700	4593	793	Leaked, no data.	
SBE39T	EAC4800	1003	485	No data – did not record, battery disconnected and time reset.	
SBE39T	EAC3200	4326	338	No data, no response.	
SBE39T	EAC2000	4887	250	Pressure after mooring break is deeper than instrument below @306m.	Keep all data as flag 1, good.
SBE39TP	EAC4800	4779	350	Didn't respond – disconnected battery, but has data and data downloaded.	
SBE39TP	EAC4700	8520	53	fishing lines/hooks – missing guard	

Instrument	Mooring	Serial Number	Planned depth (m)	Issue	QC action
SBE39TP	EAC4700	8521	1493	Leaked, no data	
SBE39TP	EAC2000	8086	60	Mooring broke. Last good data at 21-3-2019 17:36:00	
SBE39TP	EAC2000	8087	100	Mooring broke. Last good data at 21-3-2019 17:36:00	
SBE39TP	EAC4800	4889	600	Some pressure drift during start of deployment, <1dbar	PRES_REL left as QC1
SBE39TP	EAC2000	8107	800	TEMP fails early, at 29/5/2019	
Starmon Mini	EAC0500	3998	170	Data very spiky throughout deployment	Flag TEMP spikes QC4
Starmon Mini	EAC0500	3999	400	Data very spiky throughout deployment	Flag TEMP spikes QC4
Starmon Mini	EAC4700	4026	1188	Many TEMP spikes.	Flag TEMP spikes QC4
Starmon Mini	EAC2000	4000	170	Mooring broke. Last good data at 21-3-2019 17:36:00. Instrument failed before deployment. Some data up till 2 days before deployed.	
Starmon Mini	EAC2000	4001	400	No data – fault in star oddi.	
Starmon Mini	EAC4800	4031	170	Temperature data is spiking for most of deployment and worse in second half.	Flag TEMP spikes QC4

5.4 ADCP Quality control

The ADCP data from the RDI instruments was collected in single-ping mode, and in BEAM coordinates for this deployment. As a result, some effort was required to import and quality control these extremely large datasets. Import required some modification to the IMOS toolbox parser so that the conversion of Beam to ENU coordinates was completed. QC was performed on the single-ping data and subsequent checking of the data was completed on hourly averaged data. The averaging routine is not yet built into the IMOS toolbox, so the data at the AODN are only available in single-ping format as of end of 2020. In future, the hourly-averaged data will be available as the default option and single-ping datasets available for specialised uses.

Quality control of the RDI ADCP instruments utilises the quality control data and current data output from the RDI ADCP instruments (echo amplitude, correlation magnitude, percent good, error velocity and velocities). Thresholds for each test are selected individually for each instrument, the goal being to flag as 'bad' (flag 4) current data that is above the surface, within the side-lobe reflection region and any that has a large error associated with it.

During re-processing, the surface detection test used was the imosEchoIntensitySetQC test, with the echo intensity threshold shown in table 12 and a selection of propagate = 1, bound_by_depth=50m. Matlab plotting routines were used to assess the data from each instrument and to inform the QC operator about what thresholds to choose. Several iterations may be required to select appropriate thresholds. Table 13 summarises the thresholds selected for the EAC mooring RDI instruments. Once thresholds were determined, they were applied in the IMOS toolbox and the data exported to netcdf format.
Nortek Aquadopp instruments measure currents at a single point near the instrument head. The tests run on these instruments were minimal, with horizontal and vertical velocity tests applied with large windows. Some data points were flagged manually, but the velocity values are good.
Figure 3 shows the u and v velocities with depth for each mooring, after QC.

Table 13. ADCP QC thresholds.

Serial No.	kHz	Mooring	Fish detection (Echo range)	Surface Detection (Echo Amplitude)	Surface Detection (Side Lobe)	Correlation Magnitude	Error Velocity	Horizontal Velocity	Vertical Velocity	Tilt (flag 2)	Tilt (flag 4)	Ringing Bin
17958	150	EAC2000	50	30	0.5	100	0.08	2	0.5	40	60	NA
17959	150	EAC3200	50	30	0.5	100	0.08	3	1.2	40	60	3, 4
22801	150	EAC4200	50	30	0.5	100	0.1	3	1	40	60	NA
14434	75	EAC4700	50	NA	NA	110	0.06	1	0.1	40	60	NA
16072	75	EAC2000	50	NA	NA	100	0.07	2	0.5	40	60	NA
9788	75	EAC0500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14292	75	EAC3200	50	NA	NA	110	0.05	2	0.1	40	60	NA
24473	75	EAC2000	50	NA	NA	100	0.05	0.7	0.025	40	60	NA
24475	75	EAC3200	50	NA	NA	110	0.05	0.6	0.05	40	60	NA
14345	75	EAC4200	50	NA	NA	110	0.06	1	0.08	40	60	NA
24659	75	EAC4200	50	NA	NA	100	0.05	0.45	0.04	40	60	NA
14890	75	EAC4800	50	NA	NA	100	0.08	1.5	0.1	40	60	NA
14254	300	EAC0500	60	20	0.5	80	0.5	3.5	1.2	40	60	NA
17055	300	EAC4700	50	30	0.5	64	0.1	2	0.1	40	60	NA

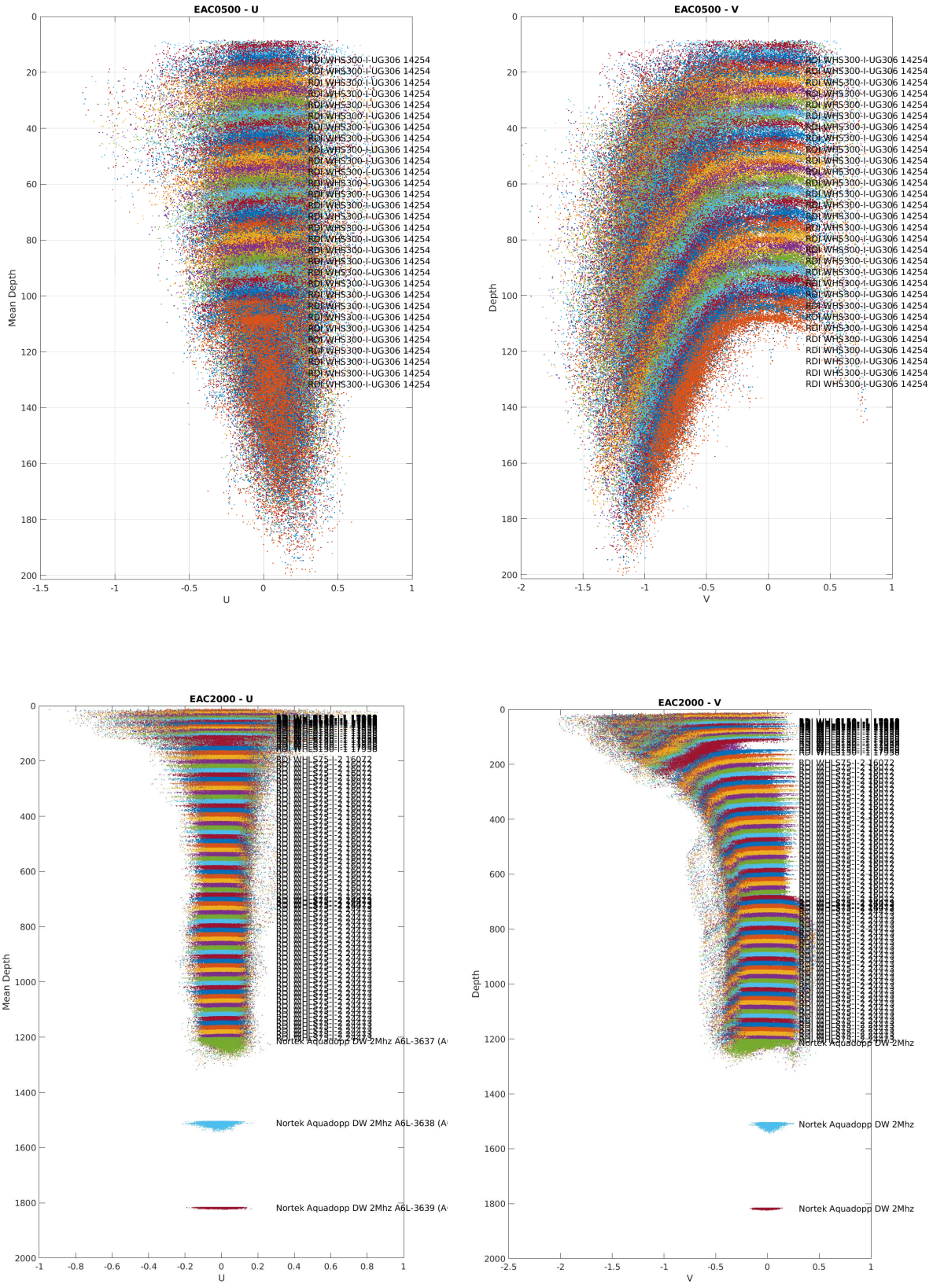
5.5 Instruments requiring inferred depths

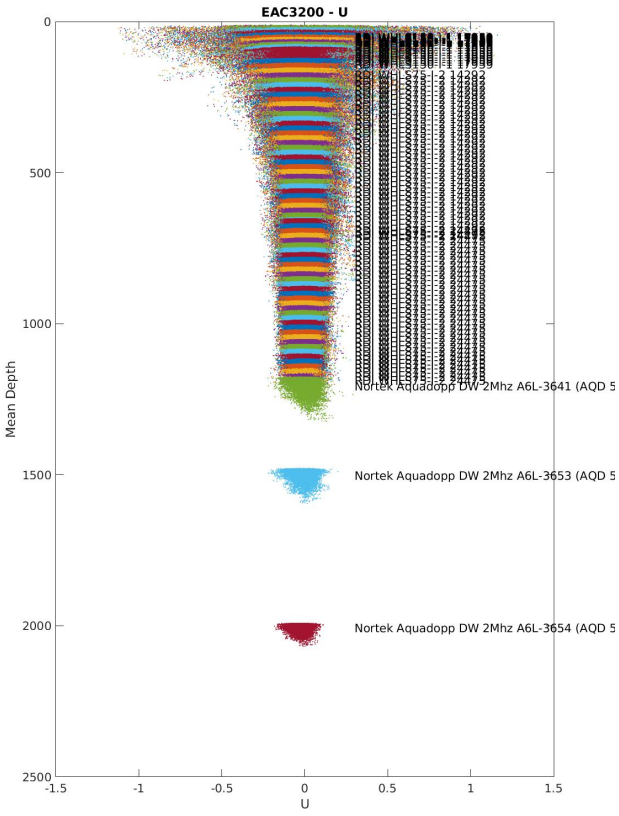
All Star Oddi instruments record temperature only, so require a depth to be inferred from adjacent instruments. In addition, some instruments were assessed to have inaccurate and/or drifting pressure and required depth to be inferred (Table 14).

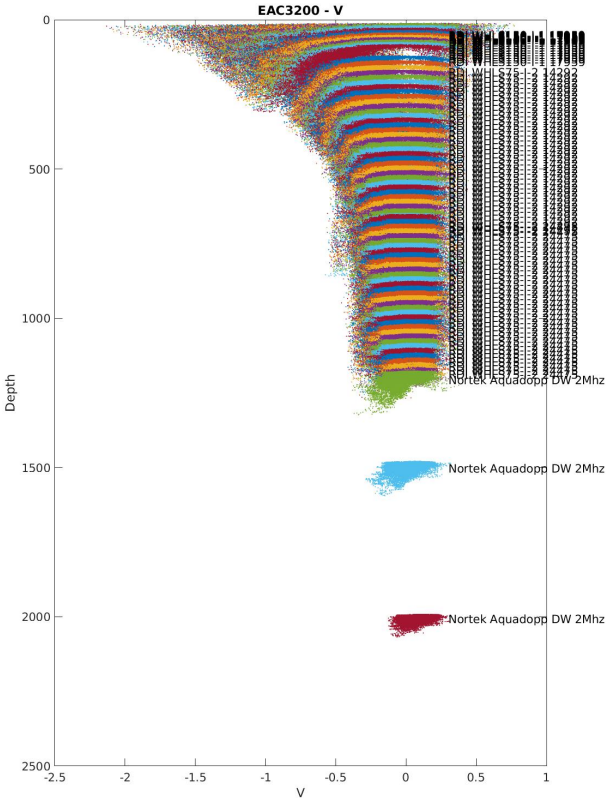
Table 14. Instruments with inferred depths.

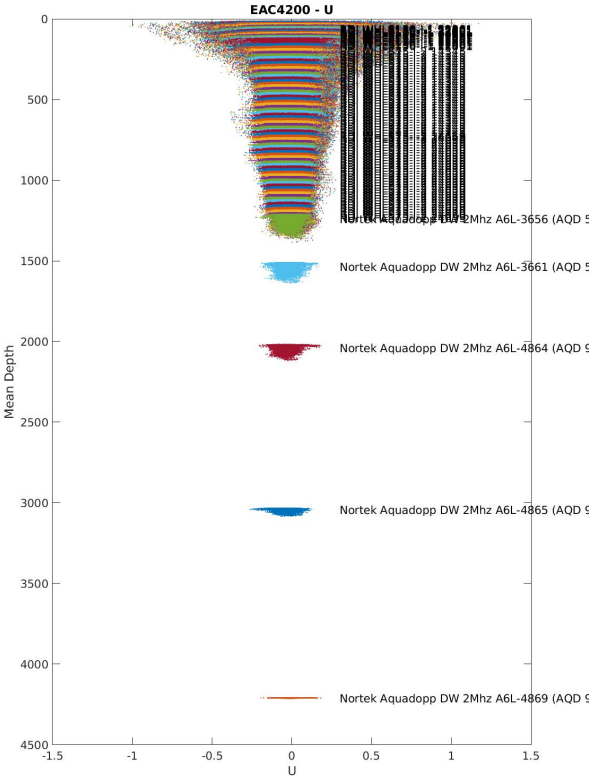
Mooring	Planned Depth (m)	Instrument type	Serial number
All	All	Starmon Mini	All
All	All	Aquadopp DW	All
All	All	SBE39T	All
EAC4800	4700	SBE37SMP	6266
EAC0500	300	SBE37SMP	9171
EAC3200	108	LR75	14292

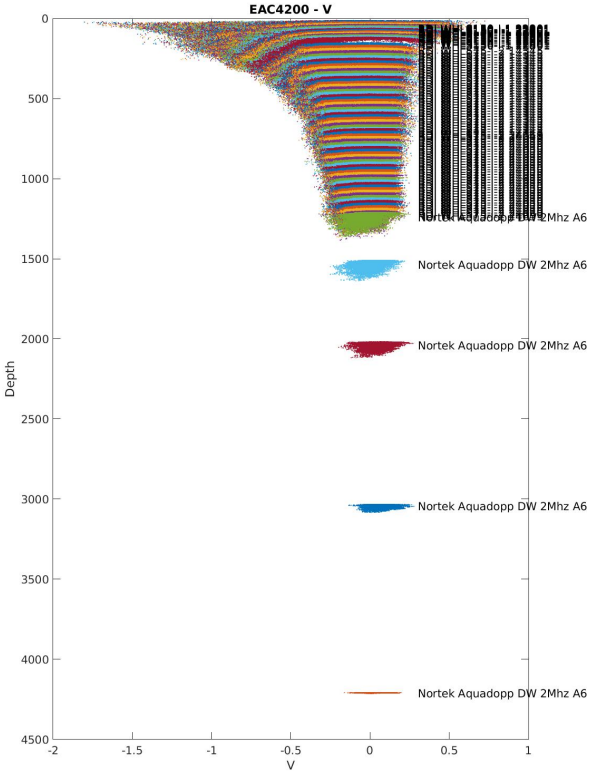
Figure 3. Hourly U and V velocities for each mooring after QC.

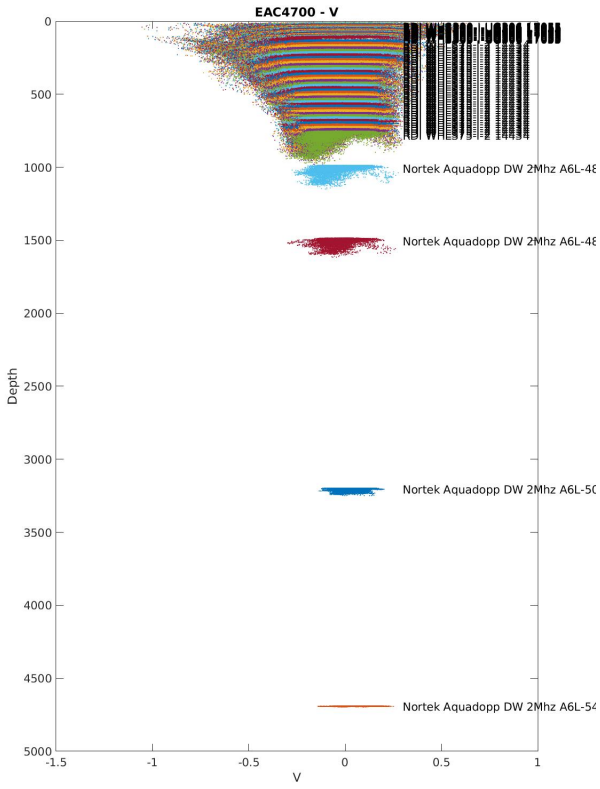


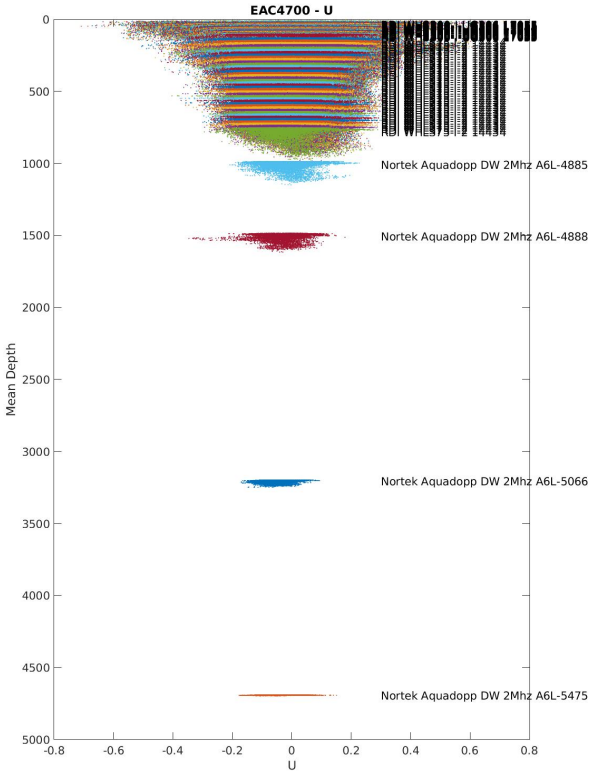

EAC3200 - U
Mean Depth
U
Nortek Aquadopp DW 2Mhz A6L-3641 (AQD 5
Nortek Aquadopp DW 2Mhz A6L-3653 (AQD 5
Nortek Aquadopp DW 2Mhz A6L-3654 (AQD 5

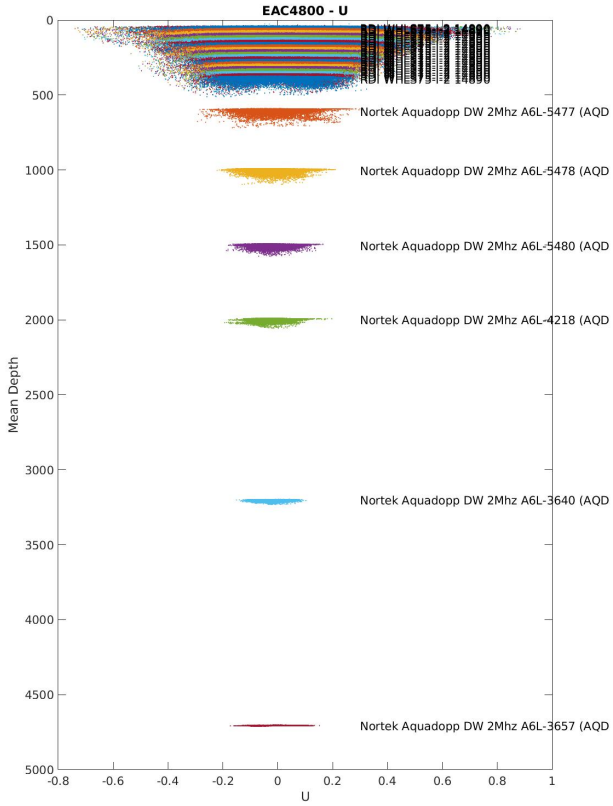

EAC3200 - V
Depth
V
Nortek Aquadopp DW 2Mhz
Nortek Aquadopp DW 2Mhz
Nortek Aquadopp DW 2Mhz

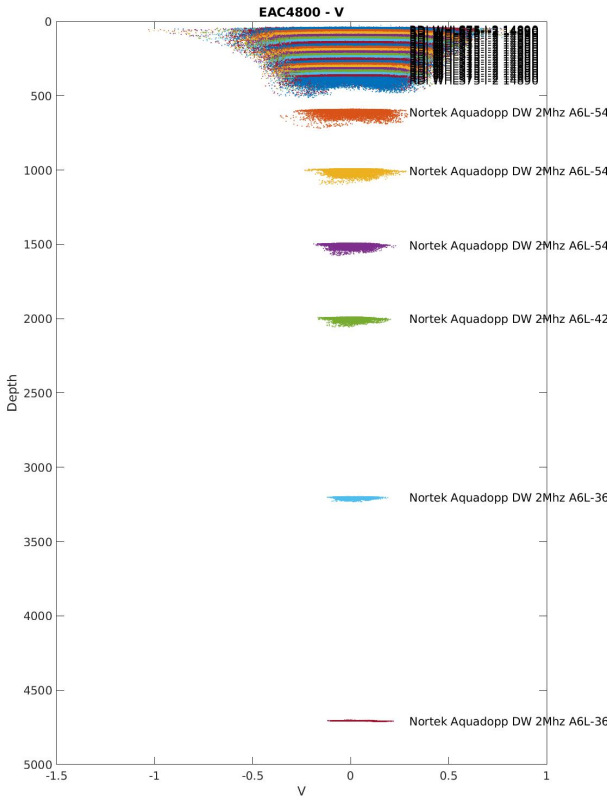

EAC4200 - U
Mean Depth
U
Nortek Aquadopp DW 2Mhz A6L-3656 (AQD 5
Nortek Aquadopp DW 2Mhz A6L-3661 (AQD 5
Nortek Aquadopp DW 2Mhz A6L-4864 (AQD 5
Nortek Aquadopp DW 2Mhz A6L-4865 (AQD 5
Nortek Aquadopp DW 2Mhz A6L-4869 (AQD 5


EAC4200 - V
Depth
V
Nortek Aquadopp DW 2Mhz A6
Nortek Aquadopp DW 2Mhz A6
Nortek Aquadopp DW 2Mhz A6
Nortek Aquadopp DW 2Mhz A6
Nortek Aquadopp DW 2Mhz A6


EAC4700 - V
Depth
V
Nortek Aquadopp DW 2Mhz A6L-48
Nortek Aquadopp DW 2Mhz A6L-48
Nortek Aquadopp DW 2Mhz A6L-5(
Nortek Aquadopp DW 2Mhz A6L-5


EAC4700 - U
Mean Depth
U
Nortek Aquadopp DW 2Mhz A6L-4885
Nortek Aquadopp DW 2Mhz A6L-4888
Nortek Aquadopp DW 2Mhz A6L-5066
Nortek Aquadopp DW 2Mhz A6L-5475


EAC4800 - U
Mean Depth
U
Nortek Aquadopp DW 2Mhz A6L-5477 (AQD
Nortek Aquadopp DW 2Mhz A6L-5478 (AQD
Nortek Aquadopp DW 2Mhz A6L-5480 (AQD
Nortek Aquadopp DW 2Mhz A6L-4218 (AQD
Nortek Aquadopp DW 2Mhz A6L-3640 (AQD
Nortek Aquadopp DW 2Mhz A6L-3657 (AQD

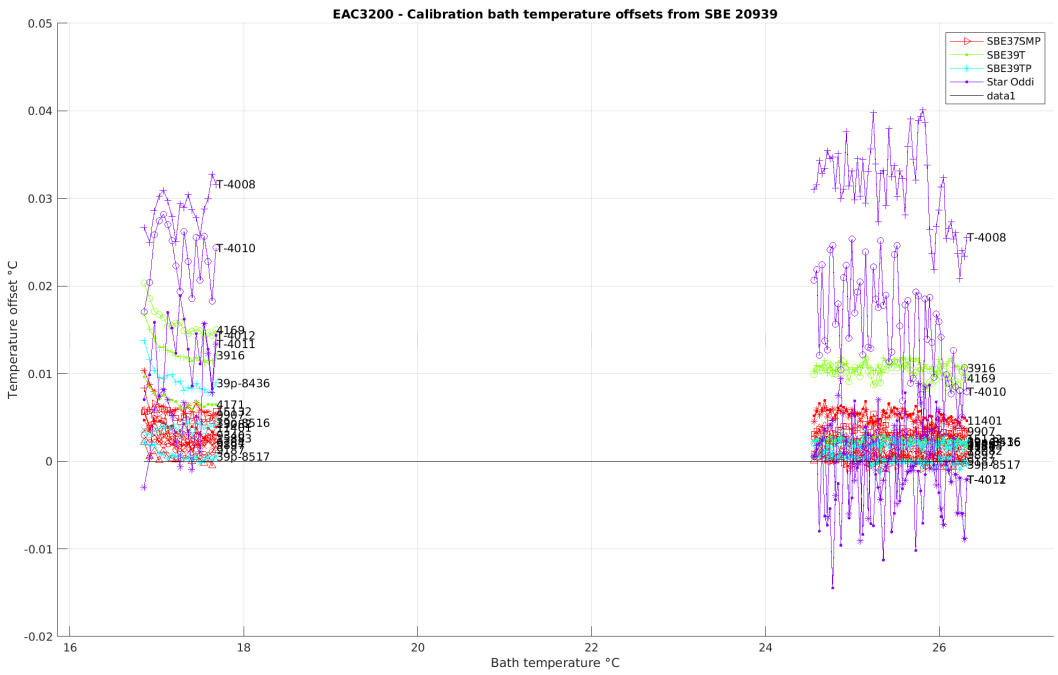

EAC4800 - V
Depth
V
Nortek Aquadopp DW 2Mhz A6L-54
Nortek Aquadopp DW 2Mhz A6L-54
Nortek Aquadopp DW 2Mhz A6L-54
Nortek Aquadopp DW 2Mhz A6L-42
Nortek Aquadopp DW 2Mhz A6L-36
Nortek Aquadopp DW 2Mhz A6L-36

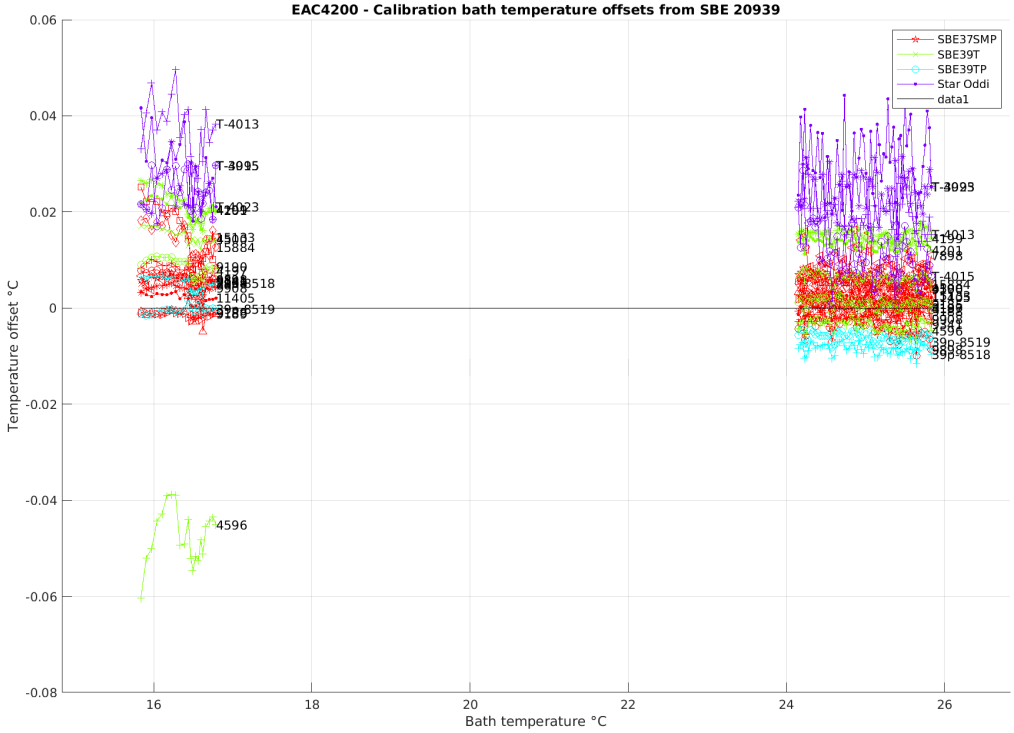
5.6 Salinity and temperature calibration bath and rosette calibrations

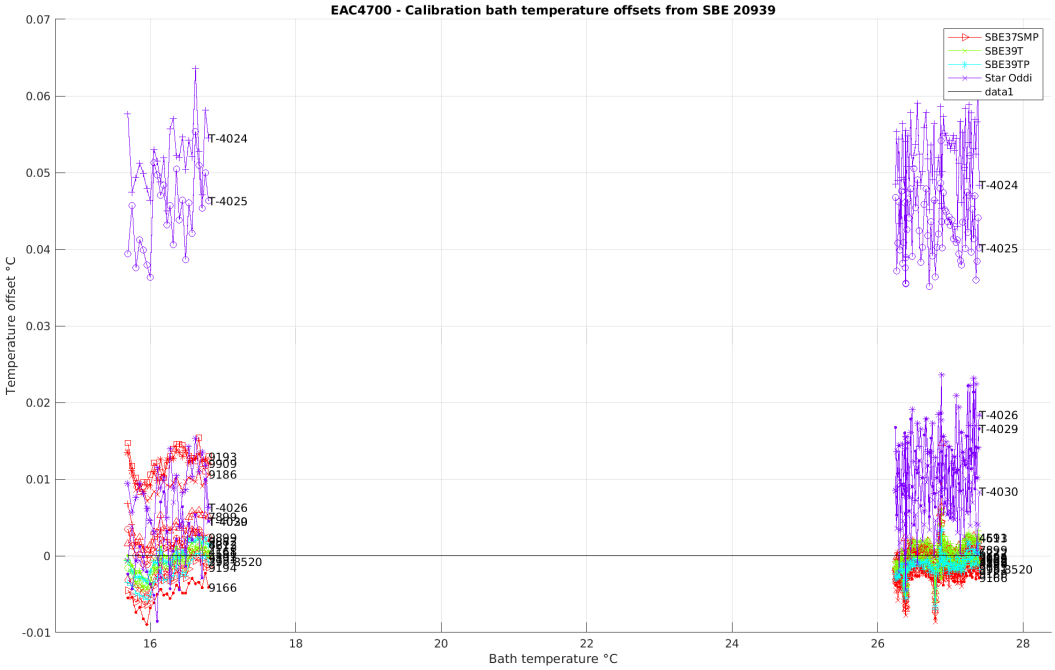
5.6.1 CALIBRATION BATH FOR TEMPERATURE

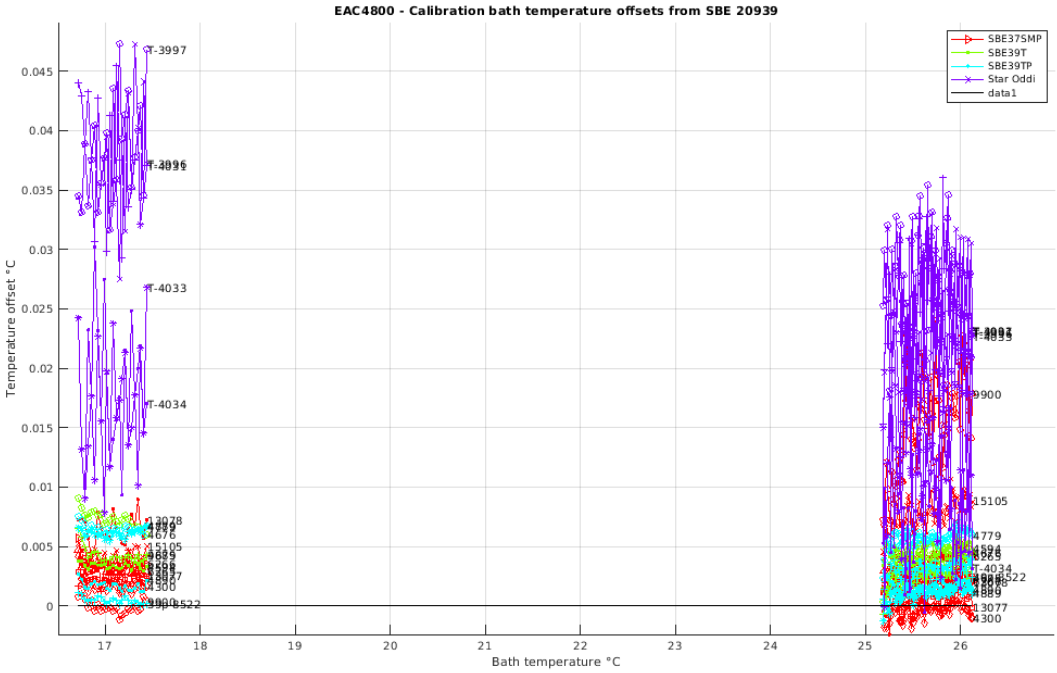
Immediately after retrieval of each mooring, Seabird and Star Oddi instruments were given a cursory clean, then placed in a well-mixed calibration bath on board the ship. The calibration bath is not designed to give an accurate temperature offset for each instrument, but rather indicate any large offset problems due to the long period on the mooring and fouling. The usual procedure is for instruments to be left for a few hours and then to add cooled seawater to reduce the temperature of the bath. This procedure gives an estimate of temperature offsets over two different temperature ranges.
A calibrated Seabird CTD (serial number 20939) was placed in the bath to compare the instruments to. The same CTD was used in the calibration bath for each mooring retrieval.
The temperatures in the calibration baths do not indicate any large offsets to be concerned about. Calibration baths were not completed correctly for EAC0500 and EAC2000 moorings as the calibration SBE was not put into the bath.

Figure 4. Calibration Bath plots.




EAC4200 - Calibration bath temperature offsets from SBE 20939
SBE37SMP
SBE39T
SBE39TP
Star Oddi
data1
Temperature offset °C
Bath temperature °C
T-4013
4596


EAC4700 - Calibration bath temperature offsets from SBE 20939
SBE37SMP
SBE39T
SBE39TP
Star Oddi
data1
Temperature offset °C
Bath temperature °C
T-4024
T-4025
T-4026
T-4029
T-4030



5.6.2 ROSETTE CALIBRATION FOR SALINITY

After retrieval and data download, the Seabird 37 and 39 instruments were set to collect data every 30 seconds, attached to the CTD rosette and a calibration dip was conducted. At selected depths, the rosette was held at the location for 10 minutes to allow all the instruments to collect data at the same temperature and salinity and enable comparison of the data to the rosette Seabird 911 instrument.

To assess the data, data from the time period of each 10 minute stop was collected together, placed onto the same time base and an average of the differences (instrument – SBE 911) at each stop calculated. The results are presented in Table 15. Instruments with large offsets are highlighted in red. All instruments in red were identified in the QC process as having bad salinities and these data are flagged appropriately.

On return to Hobart, all Seabird instruments were returned to the manufacturer for calibration and (if required) repair.

Table 15. Salinity and temperature offsets for Seabird 37 instruments on the rosette calibration

Instrument	Mooring	Serial No	Depth	Salinity offset, PSU (instrument - SBE 911)	Temperature offset, °C (instrument – SBE911)
SBE37SMP	EAC0500	9335	40	0.067	-0.001
SBE37SMP	EAC0500	9895	80	0.045	0.001
SBE37SMP	EAC0500	9905	135	0.047	-0.0003
SBE37SMP	EAC0500	9911	200	0.045	0.006
SBE37SMP	EAC0500	9171	300	0.094	0.003

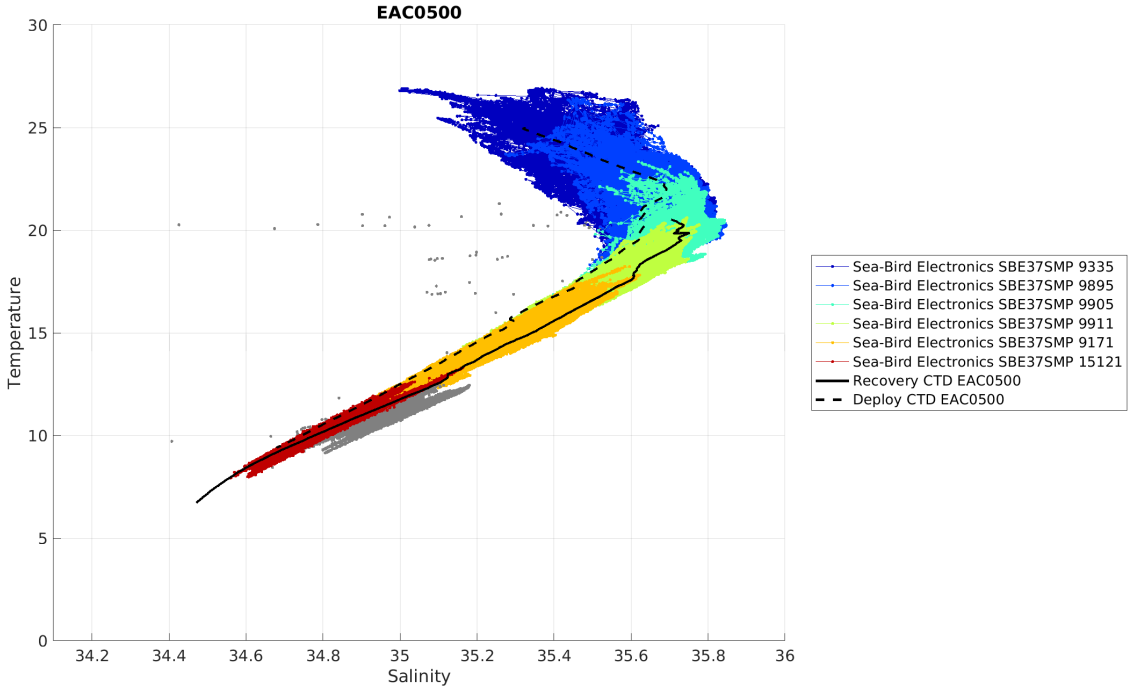
Instrument	Mooring	Serial No	Depth	Salinity offset, PSU (instrument - SBE 911)	Temperature offset, °C (instrument – SBE911)
SBE37SMP	EAC0500	15121	463	0.11	0.001
SBE37SMP	EAC2000	9183	300	0.032	0.002
SBE37SMP	EAC2000	15131	485	-7	0.001
SBE37SMP	EAC2000	15134	610	0.008	0.001
SBE37SMP	EAC2000	13081	1190	-7	0.0005
SBE37SMP	EAC2000	7895	1811	-0.0004	0.007
SBE37SMP	EAC3200	9340	28	0.012	-0.003
SBE37SMP	EAC3200	9897	68	0.07	0.006
SBE37SMP	EAC3200	9907	123	0.065	0.007
SBE37SMP	EAC3200	11401	188	-35	0.005
SBE37SMP	EAC3200	9184	288	0.045	0.005
SBE37SMP	EAC3200	15132	473	0.033	0.006
SBE37SMP	EAC3200	15883	598	-7	0.006
SBE37SMP	EAC3200	9187	1178	-0.001	0.006
SBE37SMP	EAC3200	13082	1998	-0.007	0.002
SBE37SMP	EAC3200	7897	3071	-3.3	-0.277
SBE37SMP	EAC4200	9341	61	0.079	-0.005
SBE37SMP	EAC4200	9898	101	0.046	0.001
SBE37SMP	EAC4200	9908	156	0.052	0.001
SBE37SMP	EAC4200	11405	221	0.026	0.0009
SBE37SMP	EAC4200	9185	321	0.032	0.002
SBE37SMP	EAC4200	15133	506	0.196	0.001
SBE37SMP	EAC4200	15884	631	0.008	0.0009
SBE37SMP	EAC4200	9189	1211	0.001	0.002
SBE37SMP	EAC4200	9188	2031	0.582	0.003
SBE37SMP	EAC4200	7898	3031	0.006	0.0001
SBE37SMP	EAC4200	9190	4201	-0.008	0.001
SBE37SMP	EAC4700	9882	33	0.133	0.003
SBE37SMP	EAC4700	9899	73	0.053	0.002
SBE37SMP	EAC4700	9909	128	0.072	0.003

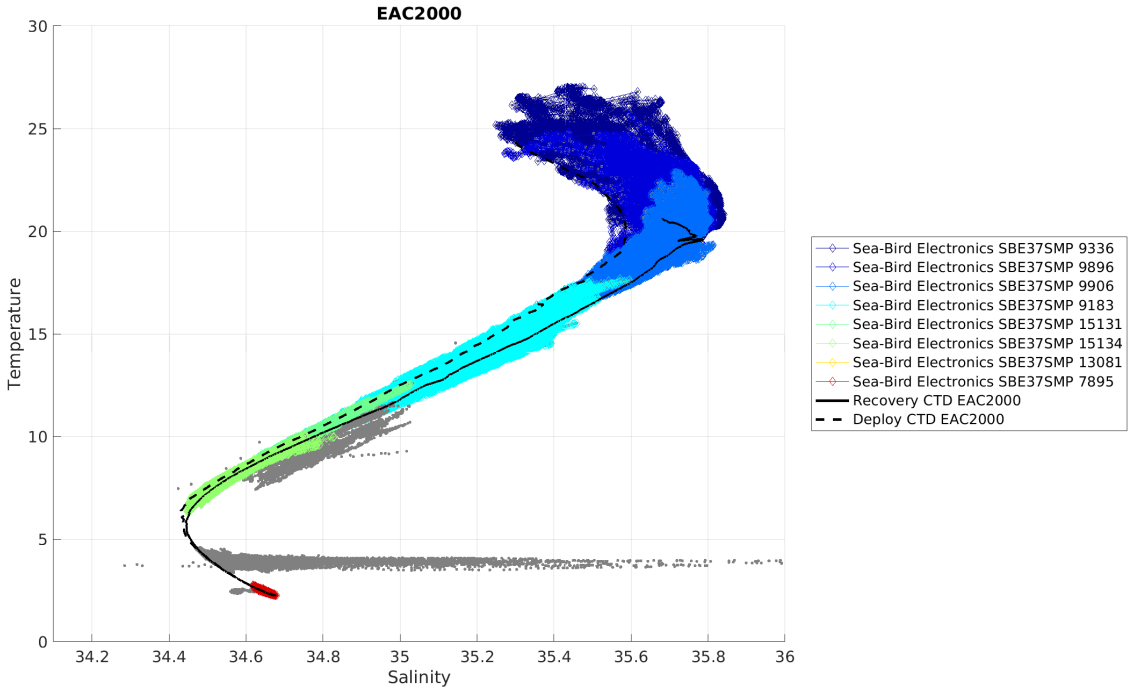
Instrument	Mooring	Serial No	Depth	Salinity offset, PSU (instrument - SBE 911)	Temperature offset, °C (instrument – SBE911)
SBE37SMP	EAC4700	9166	193	0.029	0.004
SBE37SMP	EAC4700	9186	293	0.041	0.003
SBE37SMP	EAC4700	9193	603	0.008	0.002
SBE37SMP	EAC4700	9191	1003	0.019	0.003
SBE37SMP	EAC4700	7899	1998	0.004	0.002
SBE37SMP	EAC4700	9194	4698	0.003	0.004
SBE37SMP	EAC4800	9889	40	0.077	0.001
SBE37SMP	EAC4800	9900	80	0.086	0.001
SBE37SMP	EAC4800	13078	200	0.049	-0.0003
SBE37SMP	EAC4800	15105	300	0.108	-0.0002
SBE37SMP	EAC4800	13077	1010	0.004	0.0006
SBE37SMP	EAC4800	4300	2005	0.004	-0.001
SBE37SMP	EAC4800	6265	3205	0.0008	0.0002
SBE37SMP	EAC4800	6266	4700	0.007	-0.0006

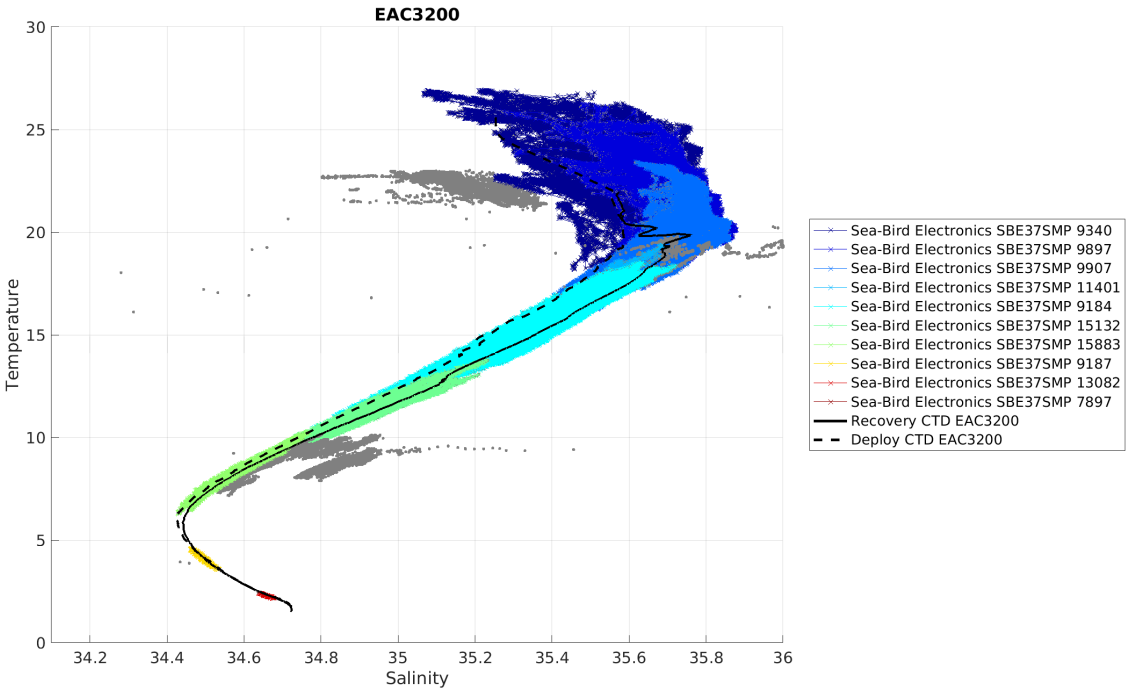
5.6.3 COMPARISON WITH DEPLOYMENT AND RECOVERY CTDS

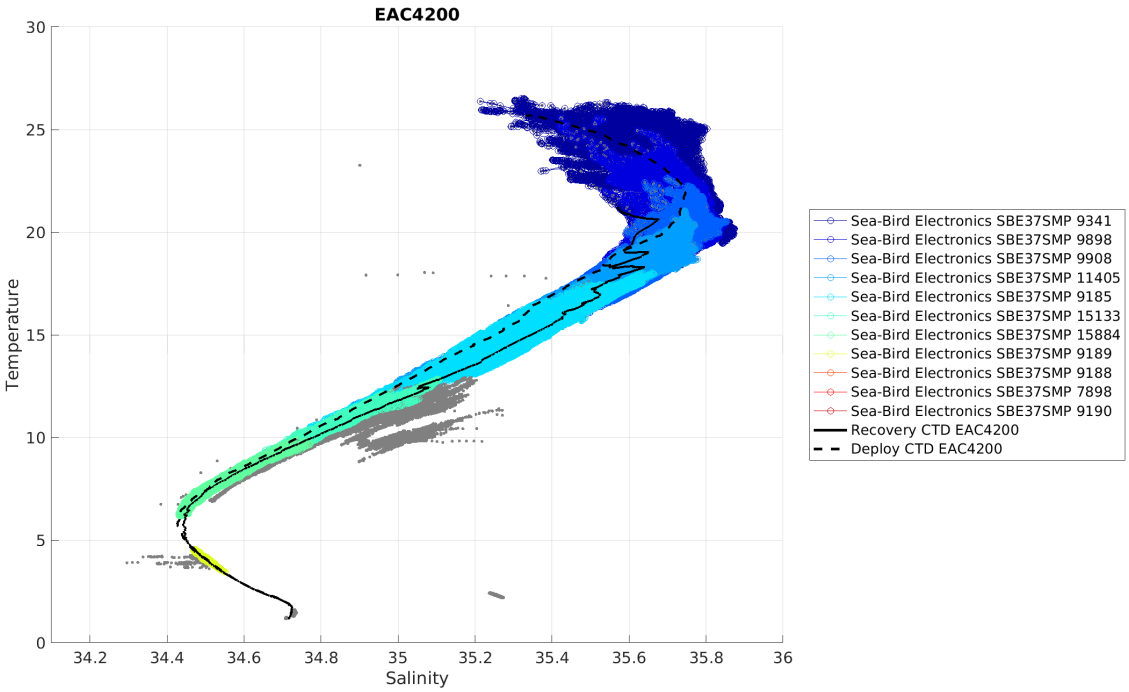
Figure 5 shows a TS plot for each mooring. The deployment and recovery CTDs are shown on the plots for comparison. Data flagged with flag 3 or 4 are shown in grey. After quality control, the TS plots compare well with the CTDs. It might be possible to retrieve some of the PSAL data where simple offsets in salinity were observed. However, the decision was made to flag all data (offset or drifting) with a flag 3 or 4.

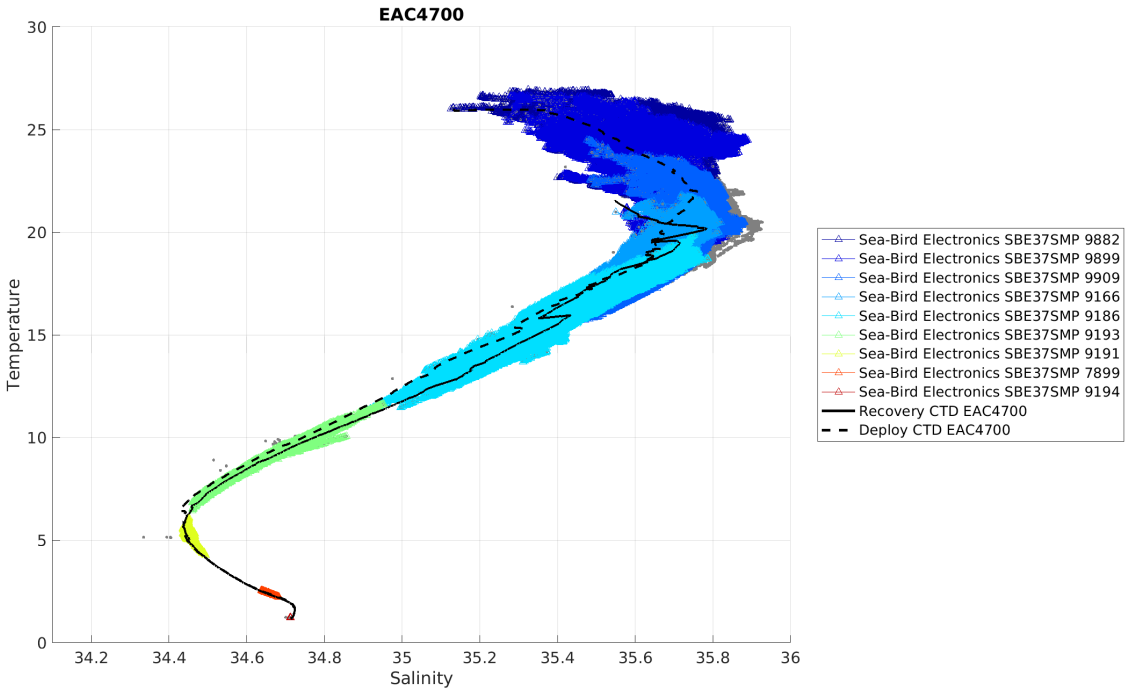
Figure 5. TS plots for each mooring with coloured datapoints indicating good data and grey indicating bad data.

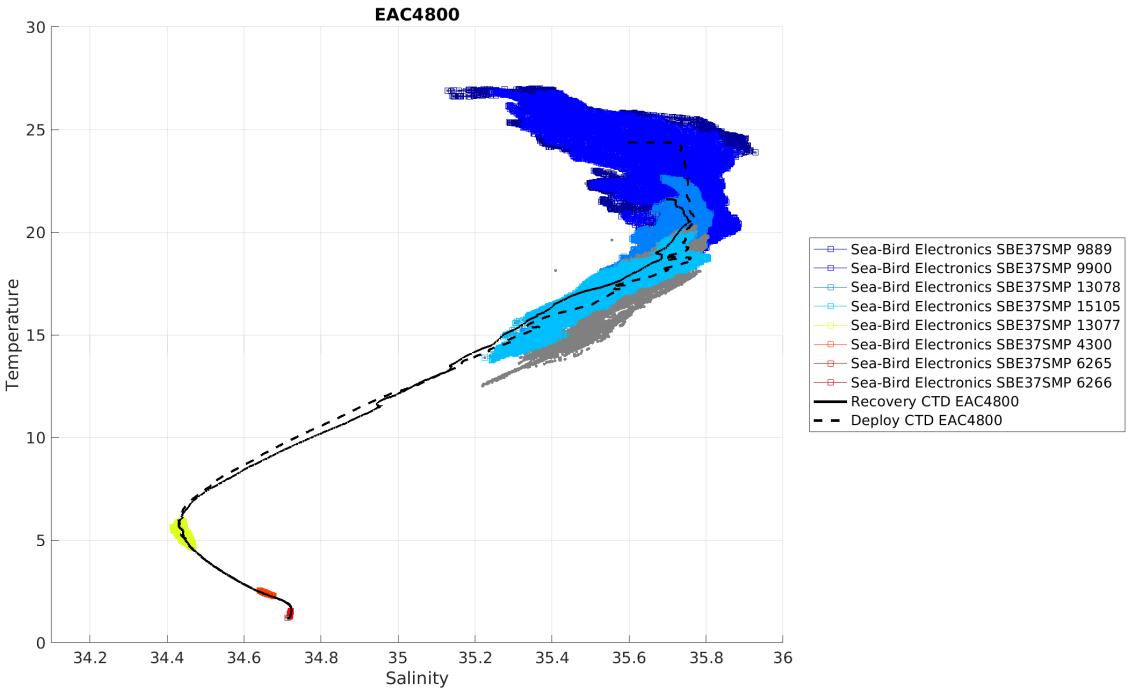





EAC3200
Temperature
Salinity
30
25
20
15
10
5
0
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8
36
Sea-Bird Electronics SBE37SMP 9340
Sea-Bird Electronics SBE37SMP 9897
Sea-Bird Electronics SBE37SMP 9907
Sea-Bird Electronics SBE37SMP 11401
Sea-Bird Electronics SBE37SMP 9184
Sea-Bird Electronics SBE37SMP 15132
Sea-Bird Electronics SBE37SMP 15883
Sea-Bird Electronics SBE37SMP 9187
Sea-Bird Electronics SBE37SMP 13082
Sea-Bird Electronics SBE37SMP 7897
Recovery CTD EAC3200
Deploy CTD EAC3200


EAC4200
Temperature
Salinity
30
25
20
15
10
5
0
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8
36
Sea-Bird Electronics SBE37SMP 9341
Sea-Bird Electronics SBE37SMP 9898
Sea-Bird Electronics SBE37SMP 9908
Sea-Bird Electronics SBE37SMP 11405
Sea-Bird Electronics SBE37SMP 9185
Sea-Bird Electronics SBE37SMP 15133
Sea-Bird Electronics SBE37SMP 15884
Sea-Bird Electronics SBE37SMP 9189
Sea-Bird Electronics SBE37SMP 9188
Sea-Bird Electronics SBE37SMP 7898
Sea-Bird Electronics SBE37SMP 9190
Recovery CTD EAC4200
Deploy CTD EAC4200


EAC4700
Temperature
Salinity
30
25
20
15
10
5
0
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8
36
Sea-Bird Electronics SBE37SMP 9882
Sea-Bird Electronics SBE37SMP 9899
Sea-Bird Electronics SBE37SMP 9909
Sea-Bird Electronics SBE37SMP 9166
Sea-Bird Electronics SBE37SMP 9186
Sea-Bird Electronics SBE37SMP 9193
Sea-Bird Electronics SBE37SMP 9191
Sea-Bird Electronics SBE37SMP 7899
Sea-Bird Electronics SBE37SMP 9194
Recovery CTD EAC4700
Deploy CTD EAC4700


EAC4800
Temperature
Salinity
30
25
20
15
10
5
0
34.2
34.4
34.6
34.8
35
35.2
35.4
35.6
35.8
36
Sea-Bird Electronics SBE37SMP 9889
Sea-Bird Electronics SBE37SMP 9900
Sea-Bird Electronics SBE37SMP 13078
Sea-Bird Electronics SBE37SMP 15105
Sea-Bird Electronics SBE37SMP 13077
Sea-Bird Electronics SBE37SMP 4300
Sea-Bird Electronics SBE37SMP 6265
Sea-Bird Electronics SBE37SMP 6266
Recovery CTD EAC4800
Deploy CTD EAC4800

6 Accessing the data

The final datasets are available via the AODN portal: https://portal.aodn.org.au/. The datasets are labelled as the IMOS Deep Water Moorings, Deepwater Arrays (DA), the IMOS facility was formerly known as "Australian Bluewater Observing System." The data are also available from the THREDDS catalog at http://thredds.aodn.org.au/thredds/catalog/IMOS/DWM/DA/catalog.html.

7 References

Cowley, R. (2021) Report on the Quality Control of the IMOS East Australian Current (EAC) Deep Water moorings array. Deployed: April 2012 to August, 2013. Version 3.0. CSIRO Oceans and Atmosphere, Australia. DOI: 10.26198/N3XJ-SY16 (https://doi.org/10.26198/N3XJ-SY16)

Lovell, J & Cowley, R. (2021a). Report on the Quality Control of the IMOS East Australian Current (EAC) Deep Water moorings array. Deployed: May 2015 to November 2016. Version 3.1. CSIRO, Australia. DOI:10.26198/5d3fb95821dda (https://doi.org/10.26198/5d3fb95821dda)

Lovell, J. and Cowley, R. (2021b). Report on the Quality Control of the IMOS East Australian Current (EAC) Deep Water moorings array. Version 1.2. Deployed: November 2016 to May, 2018. CSIRO Oceans and Atmosphere, Australia. DOI: 10.26198/5ec1df4b25cca (https://doi.org/10.26198/5ec1df4b25cca)

Appendix A. Setup information for each instrument type

Nortek DW

```
============================================================
Deployment   : 5938
Current time : 20/02/2018 00:54:31
Start at     : 15/04/2018
Comment:
EAC4-3200 @ 1195 metres
------------------------------------------------------------
Measurement interval  (s) : 1800
Average interval      (s) : 60
Blanking distance     (m) : 0.50
Measurement load      (%) : 4
Power level               : HIGH
Diagnostics interval(min) : 720:00
Diagnostics samples       : 20
Compass upd. rate     (s) : 600
Coordinate System         : ENU
Speed of sound      (m/s) : MEASURED
Salinity            (ppt) : 35
Analog input 1            : NONE
Analog input 2            : NONE
Analog input power out    : DISABLED
Raw magnetometer out      : OFF
File wrapping             : OFF
TellTale                  : OFF
AcousticModem             : OFF
Serial output             : OFF
Baud rate                 : 9600
------------------------------------------------------------
Assumed duration   (days) : 540.0
Battery utilization   (%) : 78.0
Battery level         (V) : 14.1
Recorder size        (MB) : 9
Recorder free space  (MB) : 8.973
Memory required      (MB) : 1.9
Vertical vel. prec (cm/s) : 1.4
Horizon. vel. prec (cm/s) : 0.9
------------------------------------------------------------
Instrument ID             : AQD 5938
Head ID                   : A6L 3641
Firmware version          : 3.33
------------------------------------------------------------
Aquadopp Deep Water Version 1.40.16
Copyright (C) Nortek AS
============================================================
```

RDI 75kHz

CQ = 255 ---------- Xmt Power (0=Low, 255=High)>
CF = 11101 ---------- Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)>
EA = +00000 ---------- Heading Alignment (1/100 deg)>
EB = +00000 ---------- Heading Bias (1/100 deg)>
ES = 35 ---------- Salinity (0-40 pp thousand)>
EX = 00111 ---------- Coord Transform (Xform:Type; Tilts; 3Bm; Map)>
EZ = 1111101 ---------- Sensor Source (C;D;H;P;R;S;T)>
WA 255,255 ---------- False Target Threshold (Max)(0-255),[Start Bin]>
WB 1 ---------- Bandwidth Control (0=Wid,1=Nar)>
WC 000 ---------- Correlation Threshold>
WD 111100000 ---------- Data Out (Vel;Cor;Amp PG;St;P0 P1;P2;P3)>
WE 0000 ---------- Error Velocity Threshold (0-5000 mm/s)>
WF 0704 ---------- Blank After Transmit (cm)>
WN 040 ---------- Number of depth cells (1-255)>
WP 00001 ---------- Pings per Ensemble (0-16384)>
WS 1600 ---------- Depth Cell Size (cm)>
WV 175 ---------- Mode 1 Ambiguity Vel (cm/s radial)>
TE 00:03:45.00 --------- Time per Ensemble (hrs:min:sec.sec/100)>
TP 03:45.00 ---------- Time per Ping (min:sec.sec/100)>
TG 2018/04/15,00:00:00 - Time of First Ping (CCYY/MM/DD,hh:mm:ss)

RDI 150kHz

CQ = 255 ---------- Xmt Power (0=Low, 255=High)>
CF = 11101 ---------- Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)>
EA = +00000 ---------- Heading Alignment (1/100 deg)>
EB = +00000 ---------- Heading Bias (1/100 deg)>
ES = 35 ---------- Salinity (0-40 pp thousand)>
EX = 00111 ---------- Coord Transform (Xform:Type; Tilts; 3Bm; Map)>
EZ = 1111101 ---------- Sensor Source (C;D;H;P;R;S;T)>
WA 255,255 ---------- False Target Threshold (Max)(0-255),[Start Bin]>
WB 1 ---------- Bandwidth Control (0=Wid,1=Nar)>
WC 000 ---------- Correlation Threshold>
WD 111100000 ---------- Data Out (Vel;Cor;Amp PG;St;P0 P1;P2;P3)>
WE 0000 ---------- Error Velocity Threshold (0-5000 mm/s)>
WF 0352 ---------- Blank After Transmit (cm)>
WN 028 ---------- Number of depth cells (1-255)>
WP 00001 ---------- Pings per Ensemble (0-16384)>
WS 0800 ---------- Depth Cell Size (cm)>
WV 175 ---------- Mode 1 Ambiguity Vel (cm/s radial)>
TE 00:01:12.00 --------- Time per Ensemble (hrs:min:sec.sec/100)>
TP 01:12.00 ---------- Time per Ping (min:sec.sec/100)>
TG 2018/04/15,00:00:00 - Time of First Ping (CCYY/MM/DD,hh:mm:ss)>

RDI 300kHz

CQ = 255 ---------- Xmt Power (0=Low, 255=High)>
CF = 11101 ---------- Flow Ctrl (EnsCyc;PngCyc;Binry;Ser;Rec)>
EA = +00000 ---------- Heading Alignment (1/100 deg)>
EB = +00000 ---------- Heading Bias (1/100 deg)>

ES = 35 ---------- Salinity (0-40 pp thousand)>
EX = 00111 ---------- Coord Transform (Xform:Type; Tilts; 3Bm; Map)>
EZ = 1111101 ---------- Sensor Source (C;D;H;P;R;S;T)>
WA 255,255 ---------- False Target Threshold (Max)(0-255),[Start Bin]>
WB 1 ---------- Bandwidth Control (0=Wid,1=Nar)>
WC 000 ---------- Correlation Threshold>
WD 111100000 ---------- Data Out (Vel;Cor;Amp PG;St;P0 P1;P2;P3)>
WE 0000 ---------- Error Velocity Threshold (0-5000 mm/s)>
WF 0176 ---------- Blank After Transmit (cm)>
WN 035 ---------- Number of depth cells (1-255)>
WP 00001 ---------- Pings per Ensemble (0-16384)>
WS 0400 ---------- Depth Cell Size (cm)>
WV 175 ---------- Mode 1 Ambiguity Vel (cm/s radial)>
TE 00:01:12.00 --------- Time per Ensemble (hrs:min:sec.sec/100)>
TP 01:12.00 ---------- Time per Ping (min:sec.sec/100)>
TG 2018/04/15,00:00:00 - Time of First Ping (CCYY/MM/DD,hh:mm:ss)>

Star Oddi

Filename: C:\SeaStar\Starmon mini\T3997\T3997.RDT
SeaStar 7.58

Recorder type : Starmon mini
Recorder number : T3997
Recorder version : 17 CRC8/19200
Recorder measures : Temperature
Recorder memory(byte/meas.) : 524063 / 349375
Measurement sequence number : 2
Recorder started from PC : 8/03/2018 04:26:45

Measurement interval def. : Single interval = 00:05:00
Measurement start time : 15/04/2018 00:00:00

Measurement settings: [dd:hh:mm:ss] x number

Start delay : 37:19:33:15
1. interval period : 00:05:00 x 25700
2. interval period : 00:05:00 x 25700

Estimated time duration and battery usage for NMS

Battery energy at start (%): 93,5

Seabird 37

SBE37SM-RS232 v4.1 SERIAL NO. 9193 23 Mar 2018 01:51:27
vMain = 13.16, vLith = 3.11
samplenumber = 0, free = 559240
not logging, waiting to start at 15 Apr 2018 00:00:00

sample interval = 600 seconds
data format = raw Decimal
transmit real-time = no
sync mode = no
pump installed = yes, minimum conductivity frequency = 3088.7

Seabird 39

SBE 39 V 3.1b SERIAL NO. 4676 26 Feb 2018 21:07:58
battery voltage = 8.9
not logging: waiting to start at 15 Apr 2018 00:00:00
sample interval = 300 seconds
samplenumber = 0, free = 4699867
serial sync mode disabled
real-time output disabled
SBE 39 configuration = temperature only
Rx, binary upload does not include time
Rx, temperature = 17.91 deg C

Seabird 39 Plus

SBE39plus v4.3.0 SERIAL NO. 03908516 02 Mar 2018 00:16:04
battery voltage = 6.49, back-up voltage = 3.20
not logging: waiting to start at 15 Apr 2018 00:00:00
sample interval = 300 seconds
samplenumber = 0, free = 5592405
serial sync mode disabled
real-time output disabled
configuration = temperature and pressure
data format = converted engineering
output temperature, Celsius
output pressure, Decibar
output sample number
temperature = 20.78 deg C

Appendix B. Description of RDI ADCP (Teledyne) threshold tests.

The RDI ADCP threshold quality control tests are based on methods developed by Janet Sprintall and Rebecca Cowley, following information from a RDI technical note by Darryl Symonds (2006). The procedure uses the technical data collected by the ADCP: echo intensity, correlation magnitude, error velocity, as well as the vertical and horizontal velocities. Percent good tests do not apply to single ping data and are not included for this deployment. The tests described below are also employed in the IMOS toolbox. The descriptions below give an overview of the tests.

1. **Tier 1 Failure tests:**
   a. **Error Velocity test:** Error velocity is a measure of the disagreement in velocity measurements in opposite beams. Error velocity is derived from two independent beams and is therefore two independent measurements of vertical velocity. If error velocity is greater than the threshold, the test is failed.

   Fail if abs(error velocity) > threshold

   If one beam fails for some reason, and a 3-beam solution is calculated, no error velocity value is calculated. Therefore, data points where error velocity values are missing and a 3-beam solution was calculated are not failed, but given flag 2 (probably good). Typical thresholds for error velocity are around 0.15 to 0.2 cm/s.

   b. **Correlation Magnitude test:** The correlation magnitude is a measure of the pulse-to-pulse correlation in a ping for each cell. Low correlation magnitude values are an indicator of low data accuracy.

   Step 1: Fail if correlation magnitude <= threshold

   Step 2: Fail if 3 or more beams fail step 1

   For Longranger 75kHz, the typical threshold is 64, Sentinal 300kHz and 150kHz, 110.

   c. Vertical Velocity test: A global range test to look for large outliers in velocities. Usually the threshold for this test is set to larger than the maximum during deployment.

   Fail if abs(vertical velocity) >= threshold

   d. Horizontal Velocity test: A global range test to look for large outliers in velocities. Usually the threshold for this test is set to larger than the maximum during deployment.

   Fail if abs(horizontal velocity) >= threshold

   e. Surface detection test: A mix of Echo Amplitude and sidelobe tests, described below.
      a. Echo amplitude test: The echo amplitude values can be used to detect the surface or bottom. Values in bins beyond the failure point are also failed. The test is based on the differences in echo amplitude between consecutive bins, and is usually only applied to the centre bin to the furthest bin from the ADCP head. In some cases, where the instrument is set closer to the surface/bottom, the starting bin requires adjustment.

      Fail all bins > bin_n if (bin_{n+1} – bin_n) >= threshold

      The threshold for this test can vary between 10 to 30 counts. The echo amplitude test may be irrelevant since the side-lobe test also removes data from above the surface and bottom.

      b. **Side lobe test:** Tests for bins affected by reflections from the surface or the bottom (or any solid object). It is recommended in the Symonds technical note that 2 bins below the failure point be failed due to contamination in these bins. For the EAC, no extra bins were failed, only the failure point and beyond were failed.

      Surface = depth – (depth * cos(beam_angle*pi/180) – binsize)

      Fail all bins >= surface

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