RBR

Welcome, the RBR Webinar will begin shortly…

Welcome to the RBR technical webinar:

Assessment of RBRcoda T.ODO optode for profiling and long-term deployments

A few quick notes:

- This webinar will be recorded and posted on the RBR website
- Slides will be available on the website after the presentation
- You can use the chat section to ask questions at any time

Next week's webinar

CTD and sensor calibrations at RBR

Greg Johnson

November 25, 2020

Learn about RBR's calibration process for conductivity, temperature, pressure, and DO, and how you can maintain, and verify some sensors in the field.

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rbr-global.com

Assessment of RBRcoda T.ODO optode for profiling and long-term deployments

Greg Johnson, PhD
President, RBR

November 18, 2020

T.ODO Introduction

- **RBRcoda T.ODO introduction**
- **Sensor technology**
- **Field validations**
  - Moored
  - Profiling
- **Applications**
- **Questions**

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RBR*coda* T.ODO

Optical accuracy and stability similar to Aanderaa Optode

Standard accuracy: 8 µmol/l

High accuracy temperature measurement

Power consumption: only 36 mJ/sample

Rated to 6000m

Wiper available for |slow

Time constant options

• |fast	1s (profiling)
• Standard	8s
• |slow	30s (moored)

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RBR*coda* T.ODO

Optical accuracy and stability similar to Aanderaa Optode

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Power consumption: only 36 mJ/sample

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Interface

- RS-232 polled or autonomous streaming

Output values

- Temperature (°C)
- Dissolved O2 concentration (µmol/l)
- Dissolved O2 concentration (salinity comp (µmol/l))
- Dissolved O2 saturation (%)
- Dissolved O2 phase (°)

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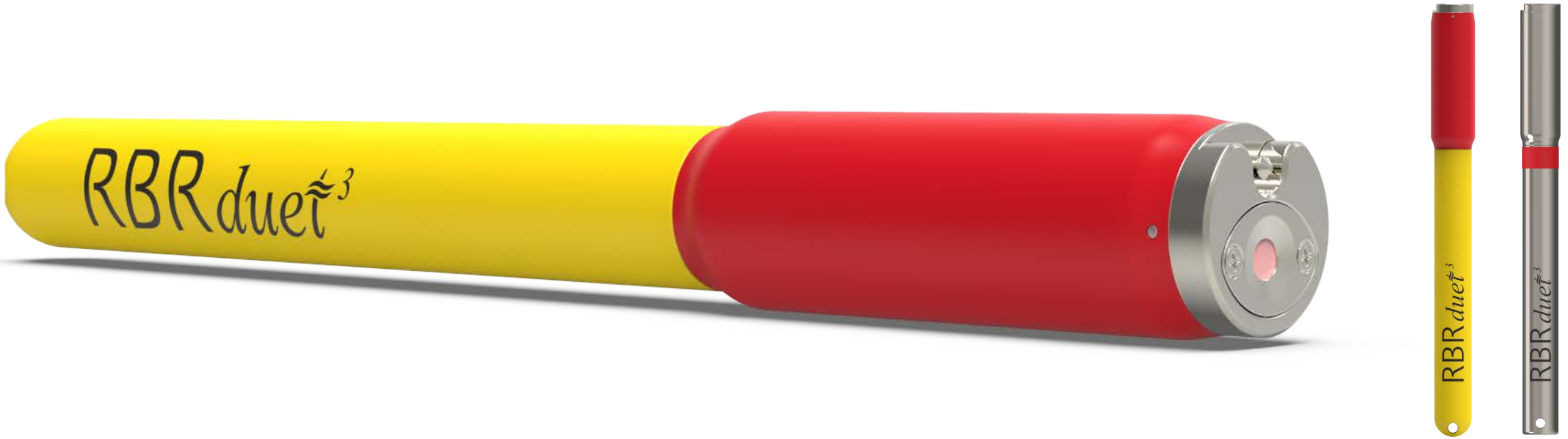

RBR*duet*³ T.ODO

20M measurements
Any AA battery
USB-C download

Optical accuracy and stability similar to Aanderaa Optode

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• |fast	1s (profiling)
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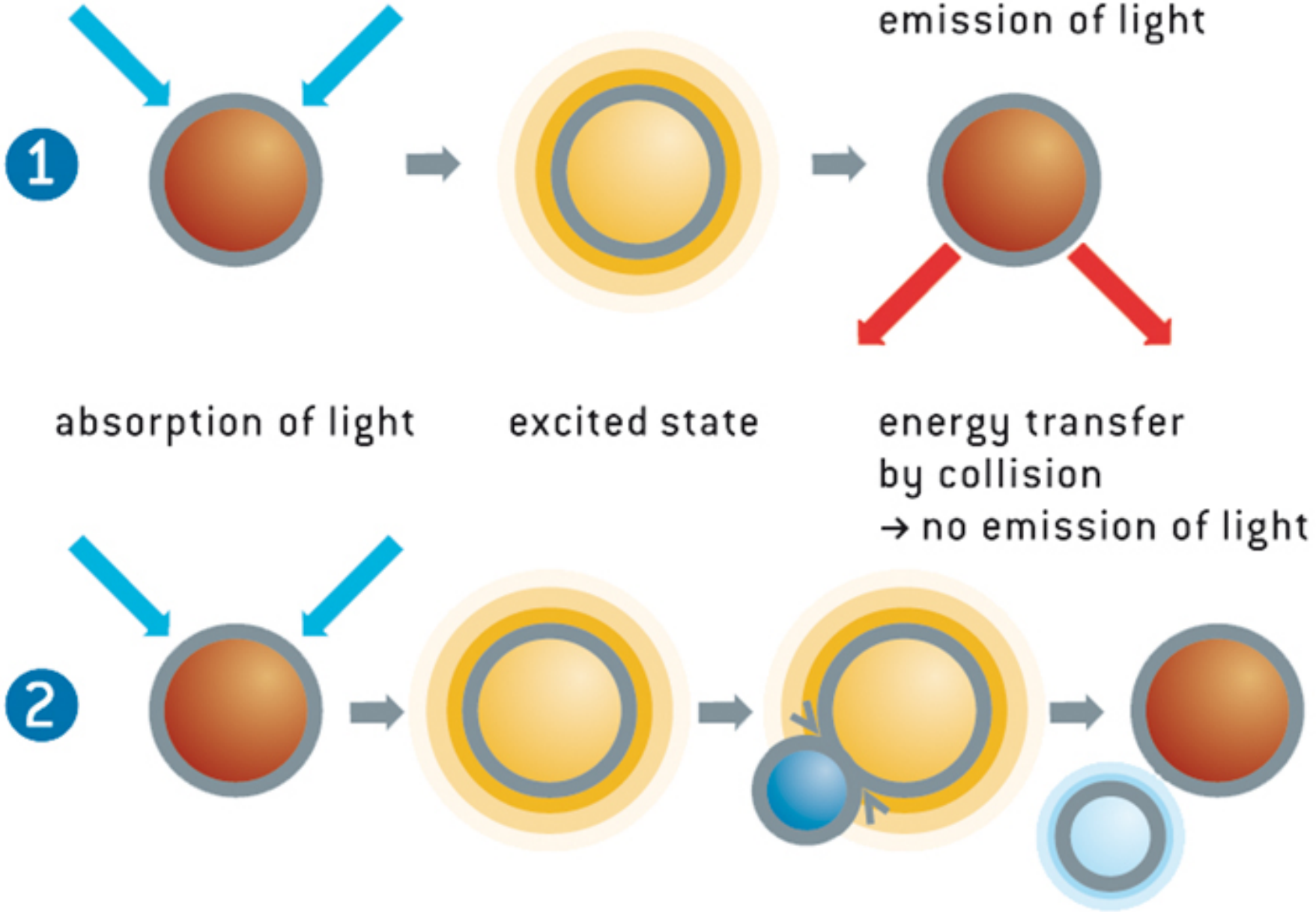
Sensor Technology

Luminescence quenching by molecular oxygen



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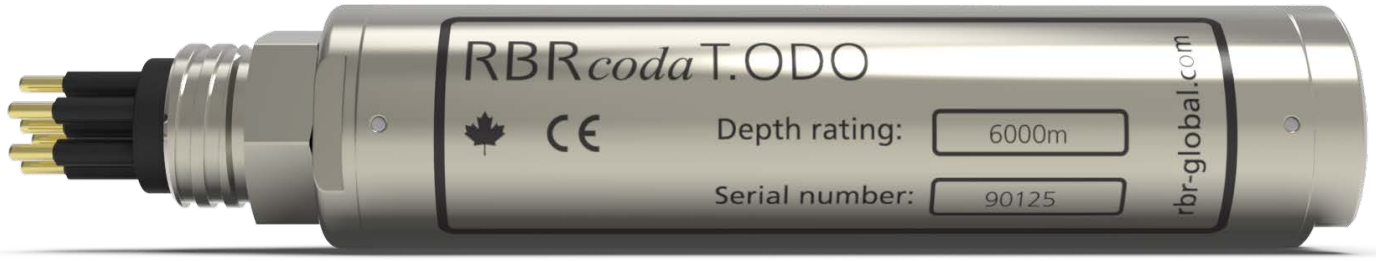
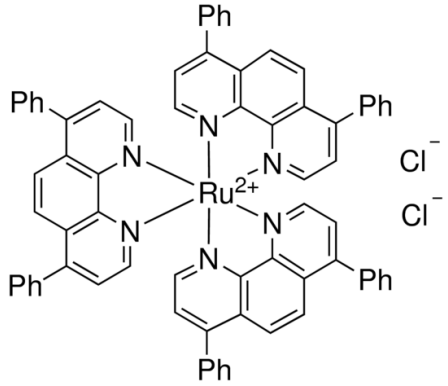
RBR*coda* T.ODO

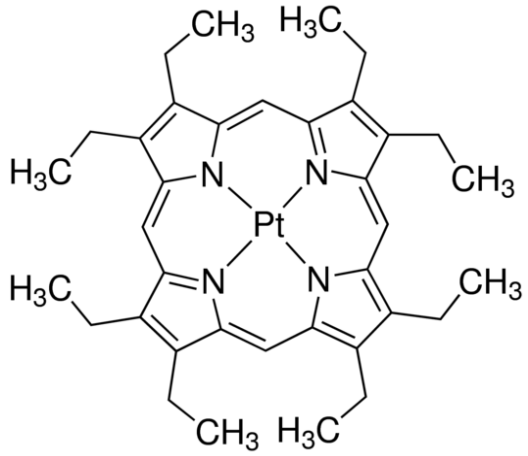




Ruthenium(II) complex

|fast

- Tau ~1sec (Temperature dependent)
- Drift <0.6 µmol/l per month (2.5 million samples)



Platinum octaethylporphyrin

regular & |slow

- Tau ~8, 30 sec (Temperature dependent)
- Drift - negligible

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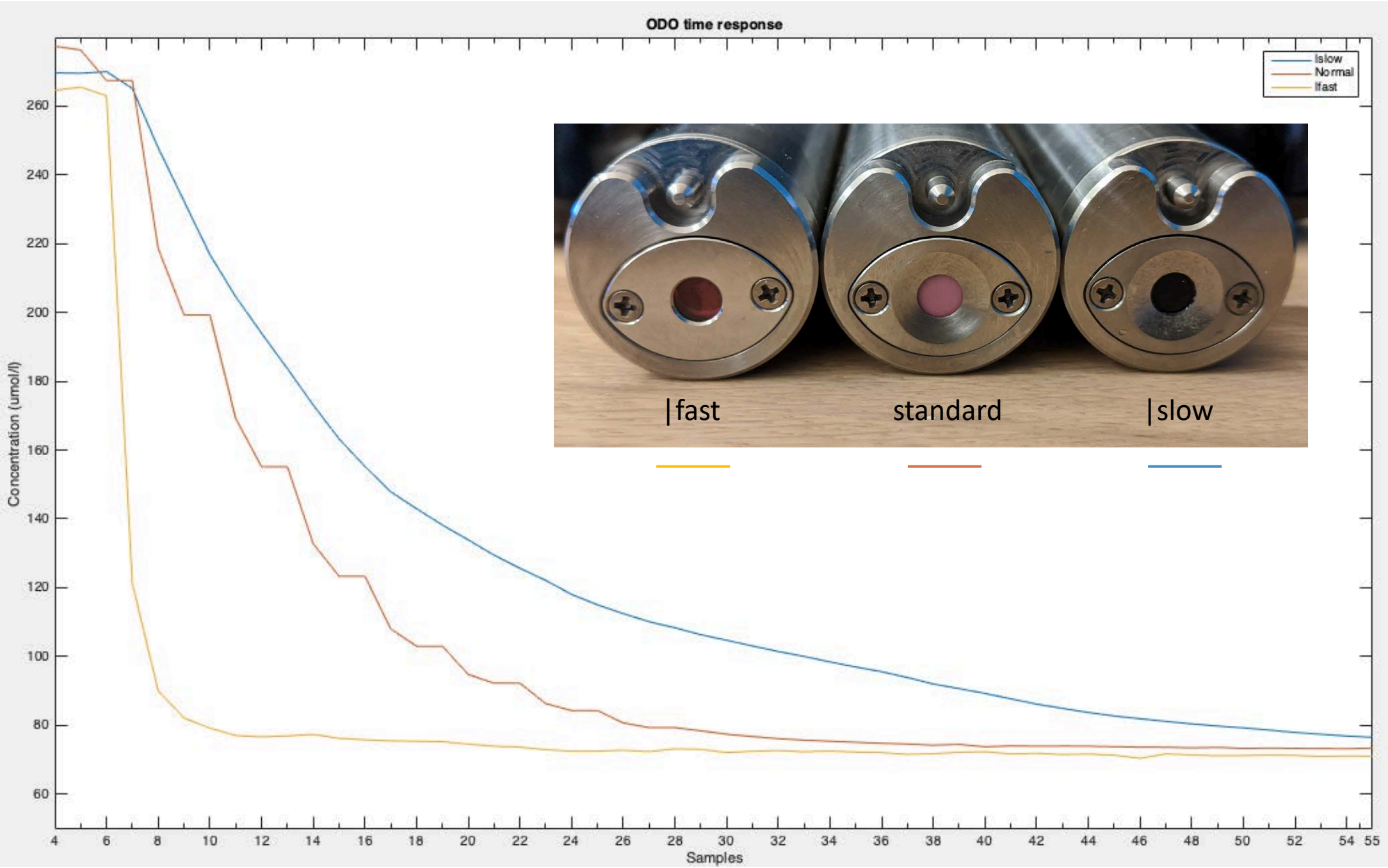
ODO time response
Islow
Normal
Ifast
Concentration (umol/l)
Samples
260
240
220
200
180
160
140
120
100
80
60
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
55

|fast
standard
|slow

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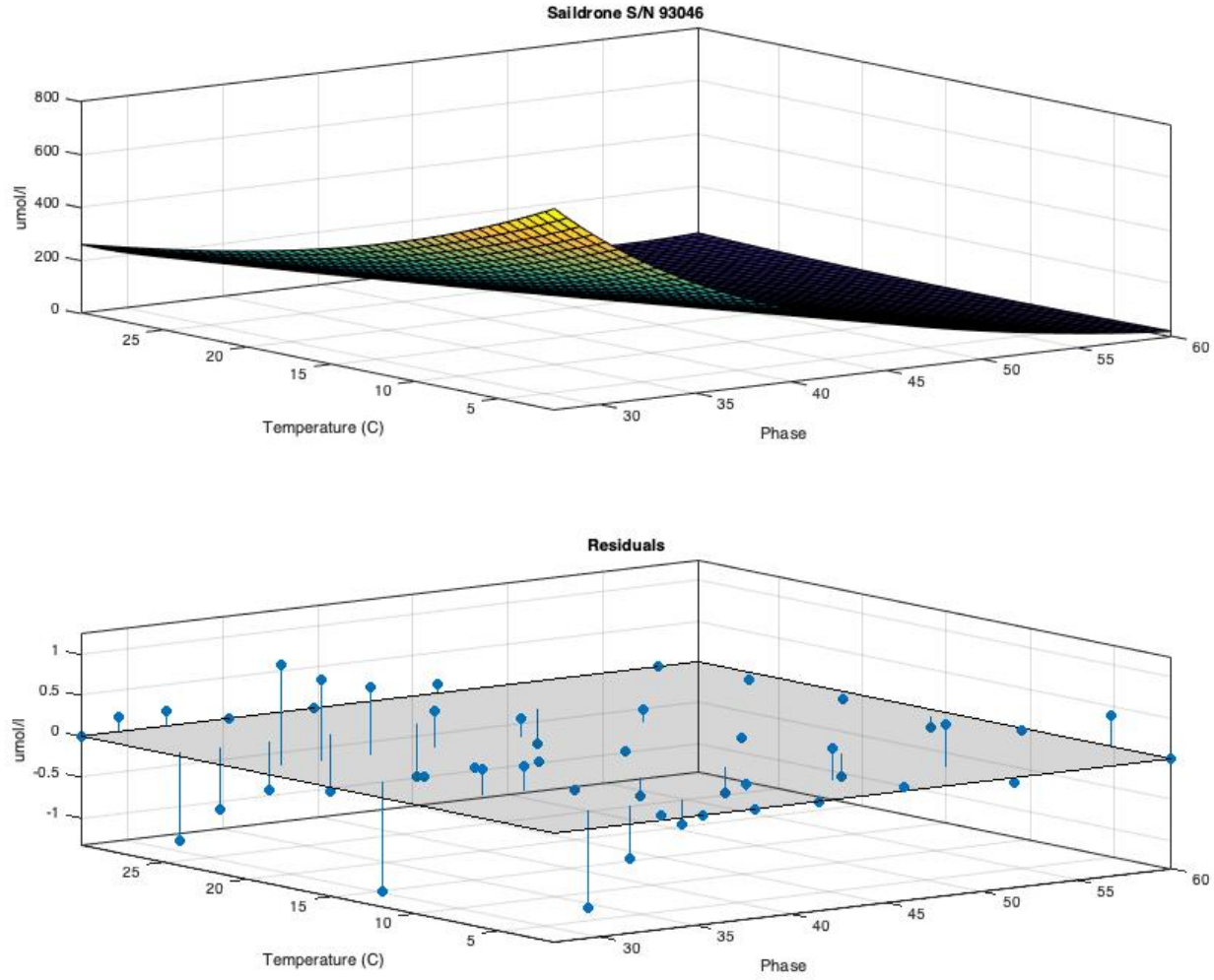
RBR*coda* T.ODO - Calibration



Dissolved Oxygen calibration

- 49 plateaus
- Temperature range: 1.5 – 30 ℃
- Saturation: 0 – 120%
- Residuals: < 4 µmol/l

Temperature

- Accuracy: 0.002 °C
- Range: -5 to 35°C

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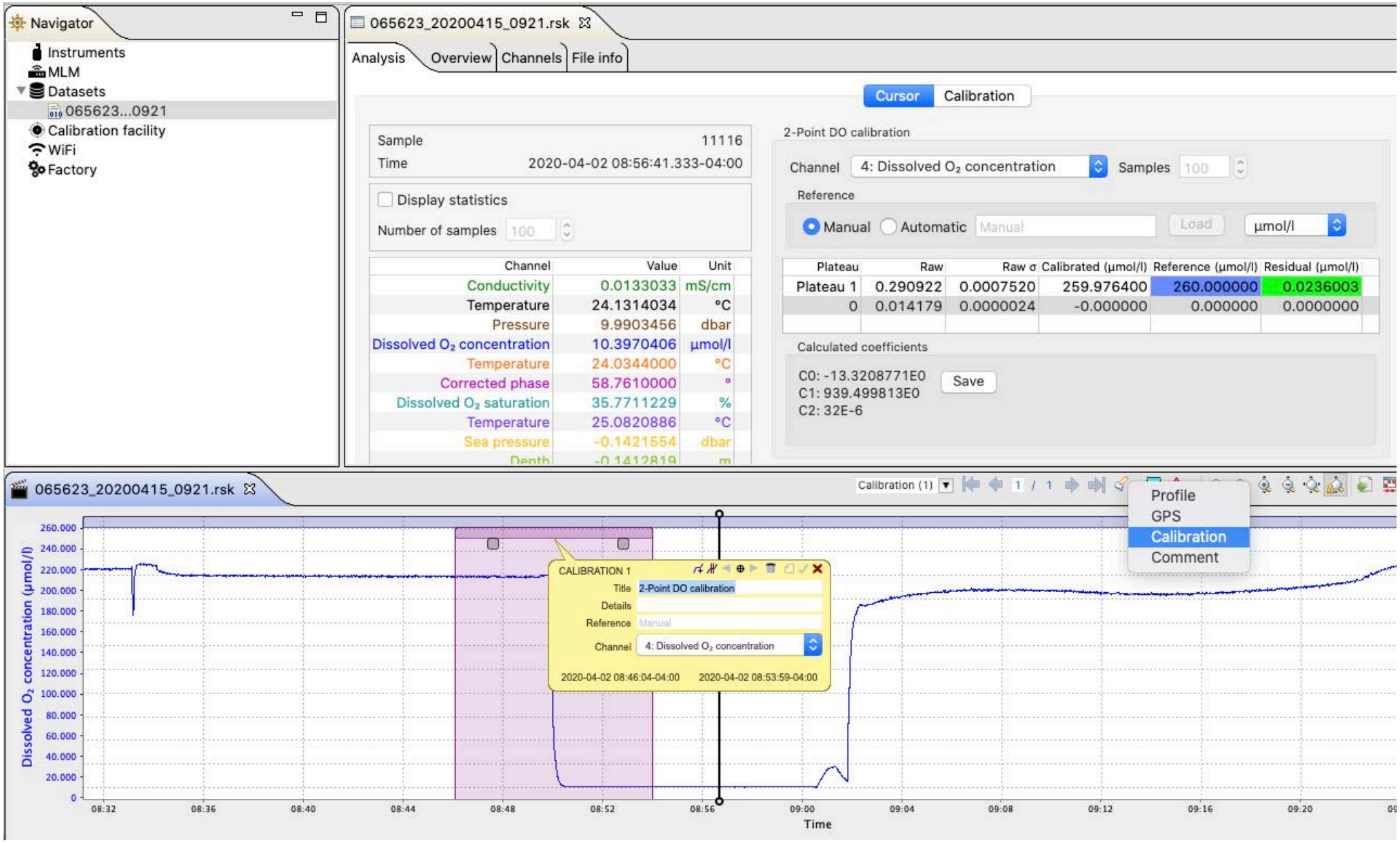
RBR*coda* T.ODO - Customer calibration



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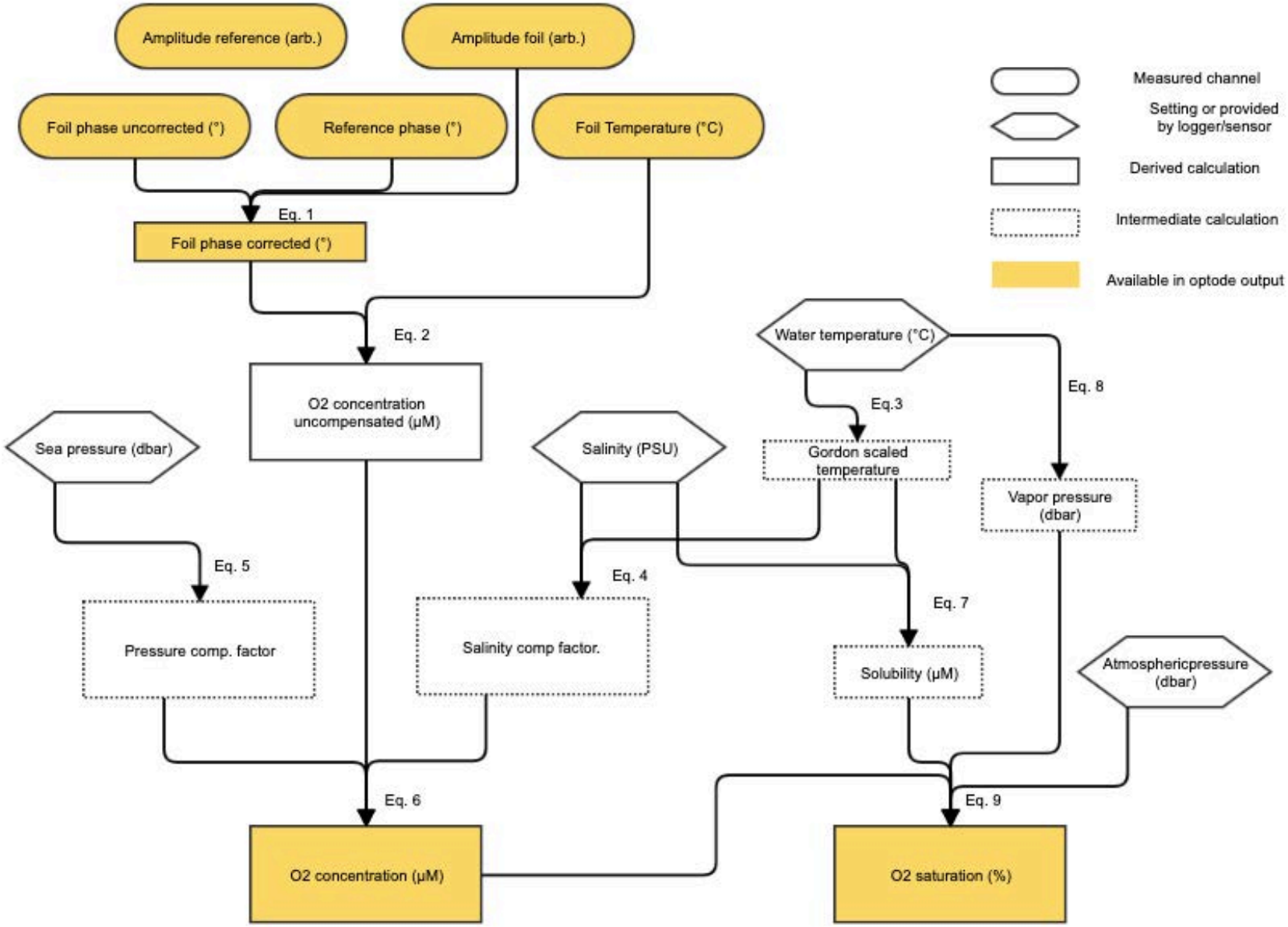
Equations used by the RBR DO Sensor



Eq. 2

$$C(t,\phi) = \begin{bmatrix}\phi^0 & \phi^1 & \phi^2 & \phi^3 & \phi^4\end{bmatrix} \begin{bmatrix} c_{00} & c_{01} & c_{02} & c_{03} \\ c_{10} & c_{11} & c_{12} & c_{13} \\ c_{20} & c_{21} & c_{22} & c_{23} \\ c_{30} & c_{31} & c_{32} & c_{33} \\ c_{40} & c_{41} & c_{42} & c_{43} \end{bmatrix} \begin{bmatrix} t^0 \\ t^1 \\ t^2 \\ t^3 \end{bmatrix}$$

Eq. 4

$$F_{cs} = e^{\left(S\left(\sum_{i=0}^{3} G_{bi} t_s^i\right) + G_{c0} S^2\right)}$$

Eq. 5

$$F_{cp} = 1 + P \times C_p$$

Eq. 6

$$C_c = C_u \times F_{cp} \times F_{cs}$$

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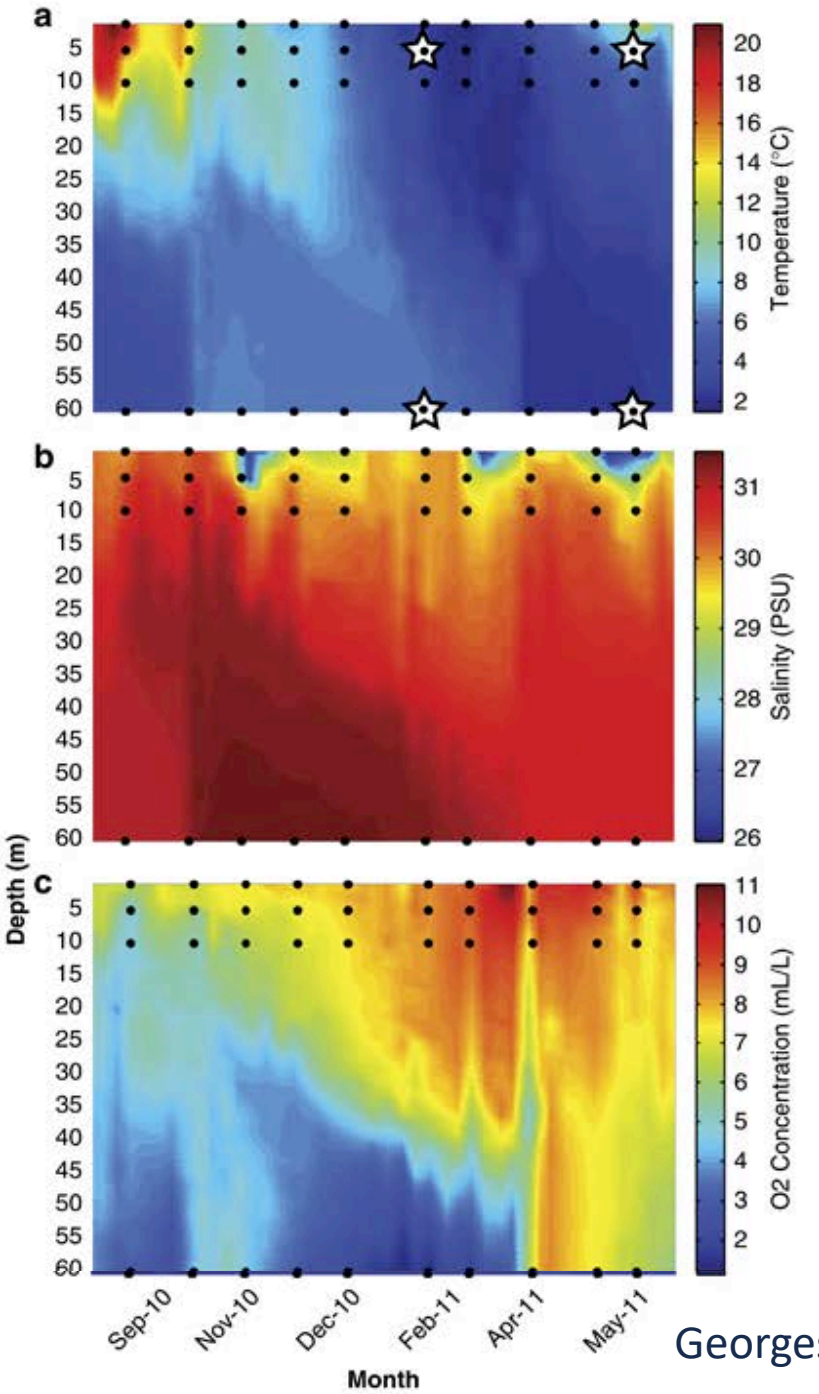
Field Validations

Bedford Basin, NS



Compass Buoy Station
(44°41′37′′N, 63°38′25′′W)

Strong seasonal variation of dissolved oxygen

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Georges et al. 2014

Mooring

Deployed in partnership between Dalhousie University and DFO Bedford Institute of Oceanography

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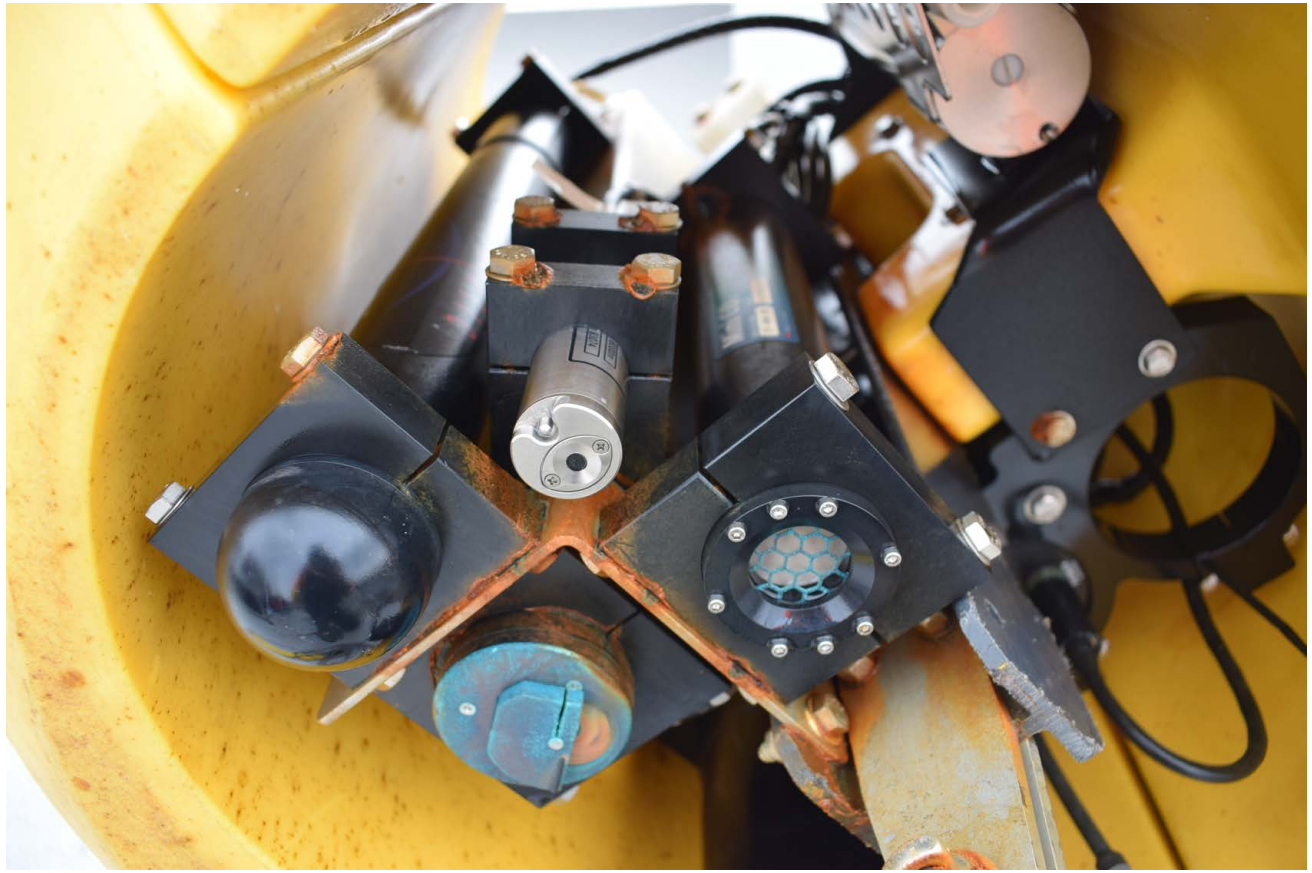
Mooring



- RBR*coda* T.ODO|slow (30s time constant)
- SBE-37 CTD
- 60m depth
- Sep – Dec 2018
- Sample at 1Hz for the first minute of every hour

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Deployed in partnership between Dalhousie University and DFO Bedford Institute of Oceanography

Profiling

- Bedford Basin Monitoring Program
- Weekly vertical profiles over mooring
- Date: Oct 24, 2018
- Instruments:
  - RBR*coda* T.ODO (8s time constant)
  - RBR*coda* T.ODO|fast (1s time constant)
  - SBE-25 CTD
  - SBE-43 DO
  - Water bottles

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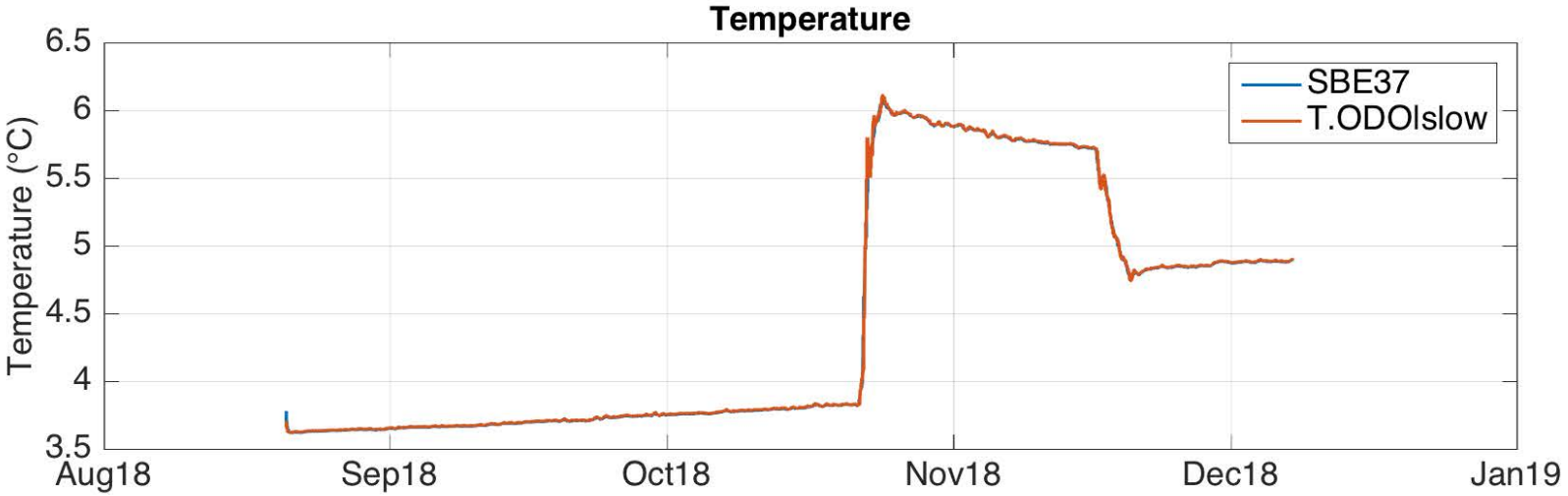
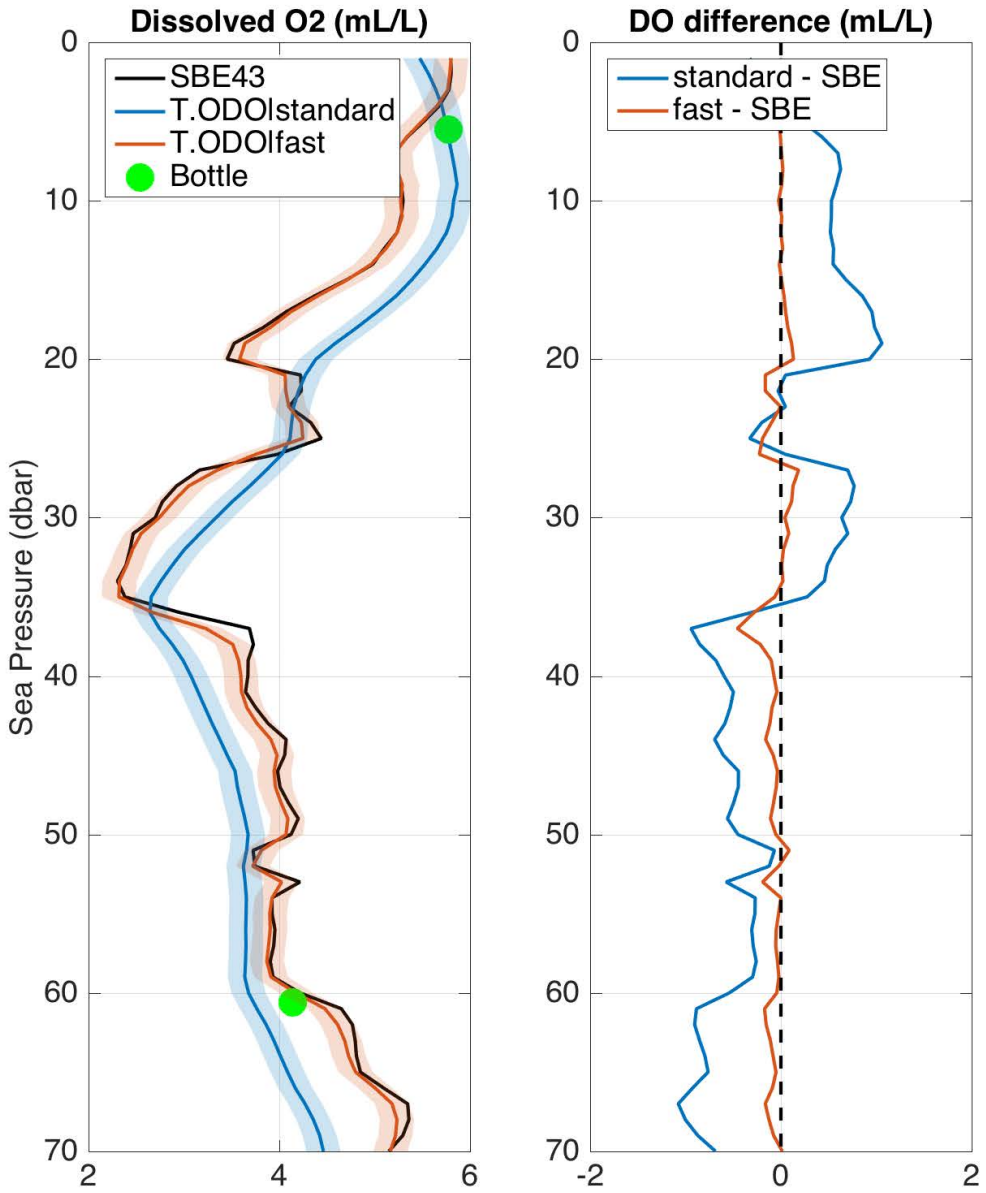
Results - Mooring



Results - Profiling



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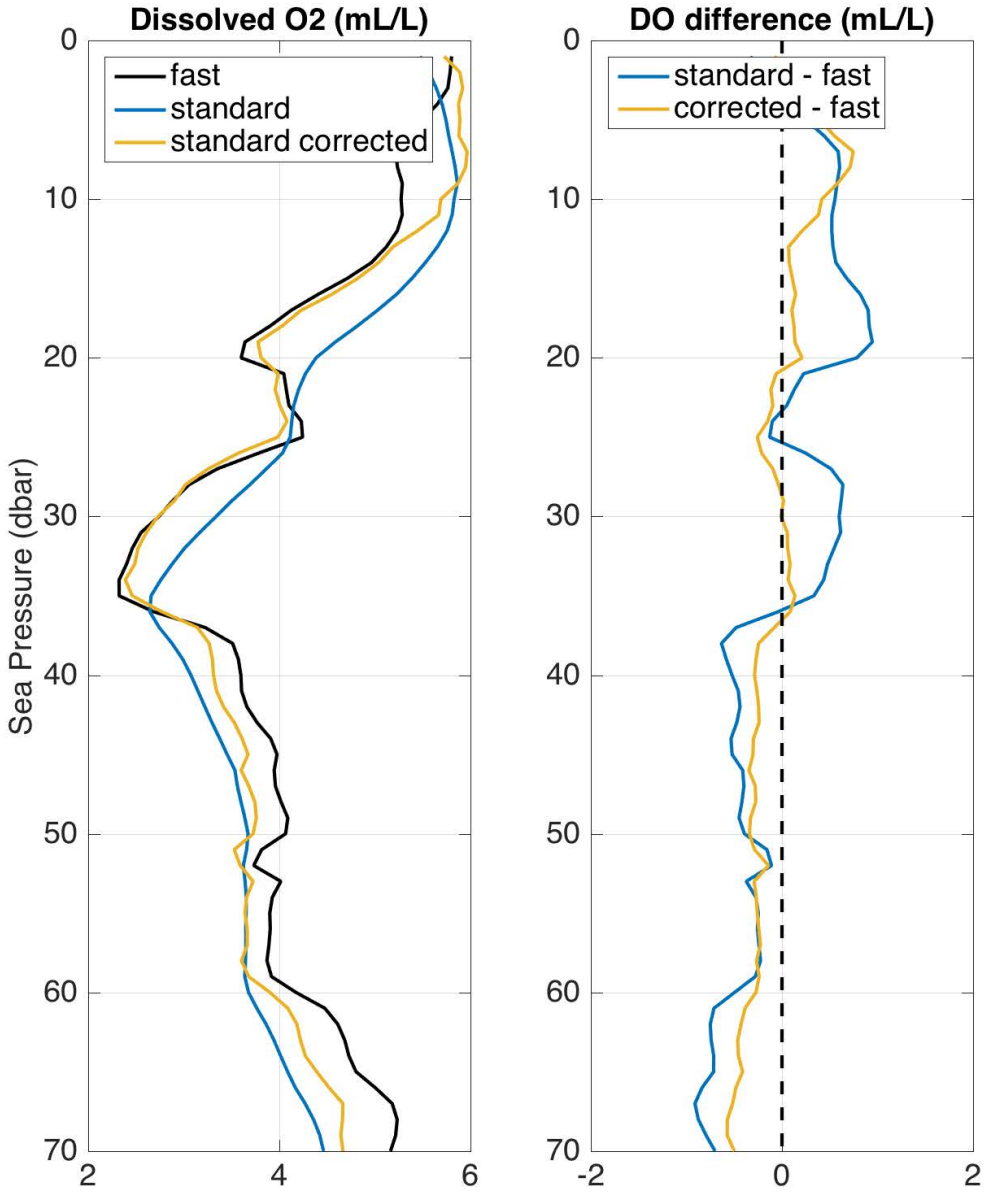
Results - Profiling



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Field Validation Summary

- RBR*coda* T.ODO|slow – Stable for mooring application
- RBR*coda* T.ODO|fast – Accurate for profiling application
- RBR*coda* T.ODO standard – Expected time constant lag during profiling which can be improved in post-processing

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Acknowledgements

- Coastal Environmental Observation Technology and Research (Dalhousie University)
  - Richard Davis, Madison Evans, Darrell Adams, Anna Haverstock

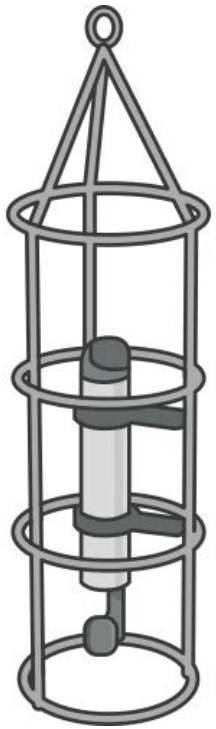
- Bedford Institute of Oceanography
  - Clark Richards, Kevin Pauley, Andrew Cogswell, Peter Thamer
  - Captain and crew of *Sigma T*

Fisheries and Oceans Canada

Applications

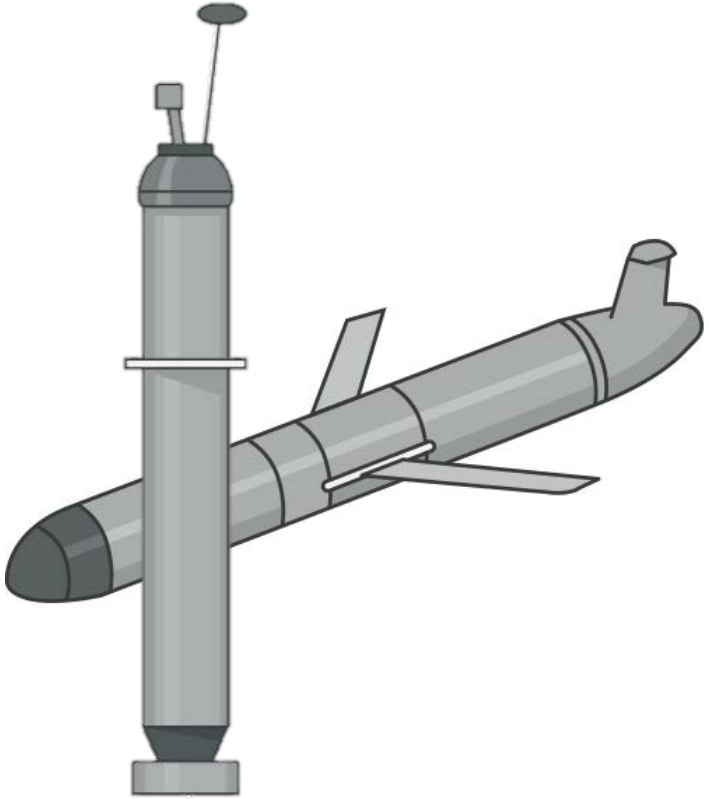
Applications

T.ODO|fast



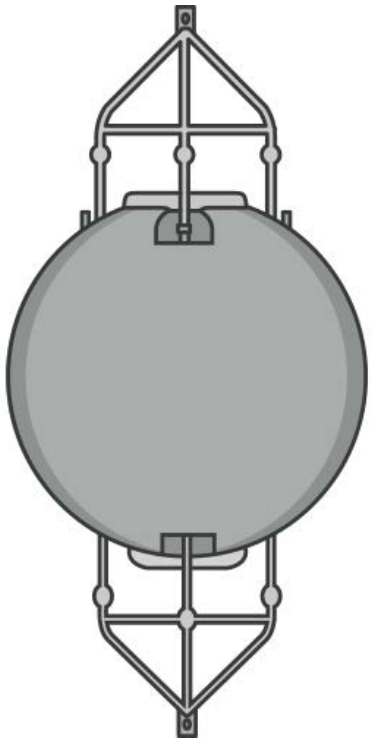
Vertical Profiling

T.ODO



Vehicles & Floats

T.ODO|slow



Moorings

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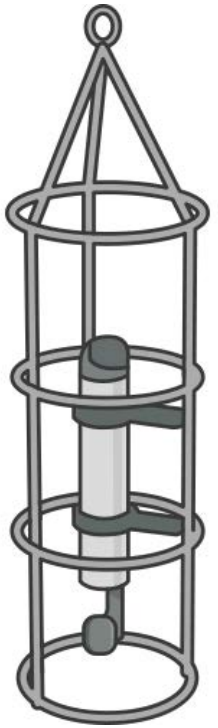
Vertical Profiling

T.ODO|fast



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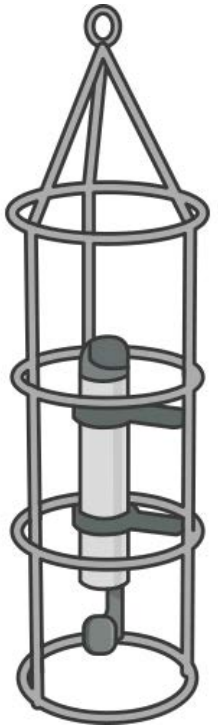
Vertical Profiling

Photo from Nature Trust of British Columbia

T.ODO|fast



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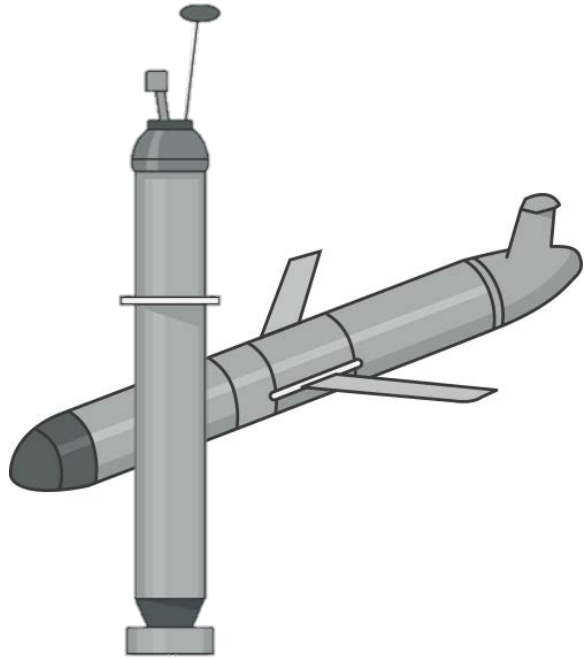
Vehicles and Floats

MRV ALTO profiling float

T.ODO



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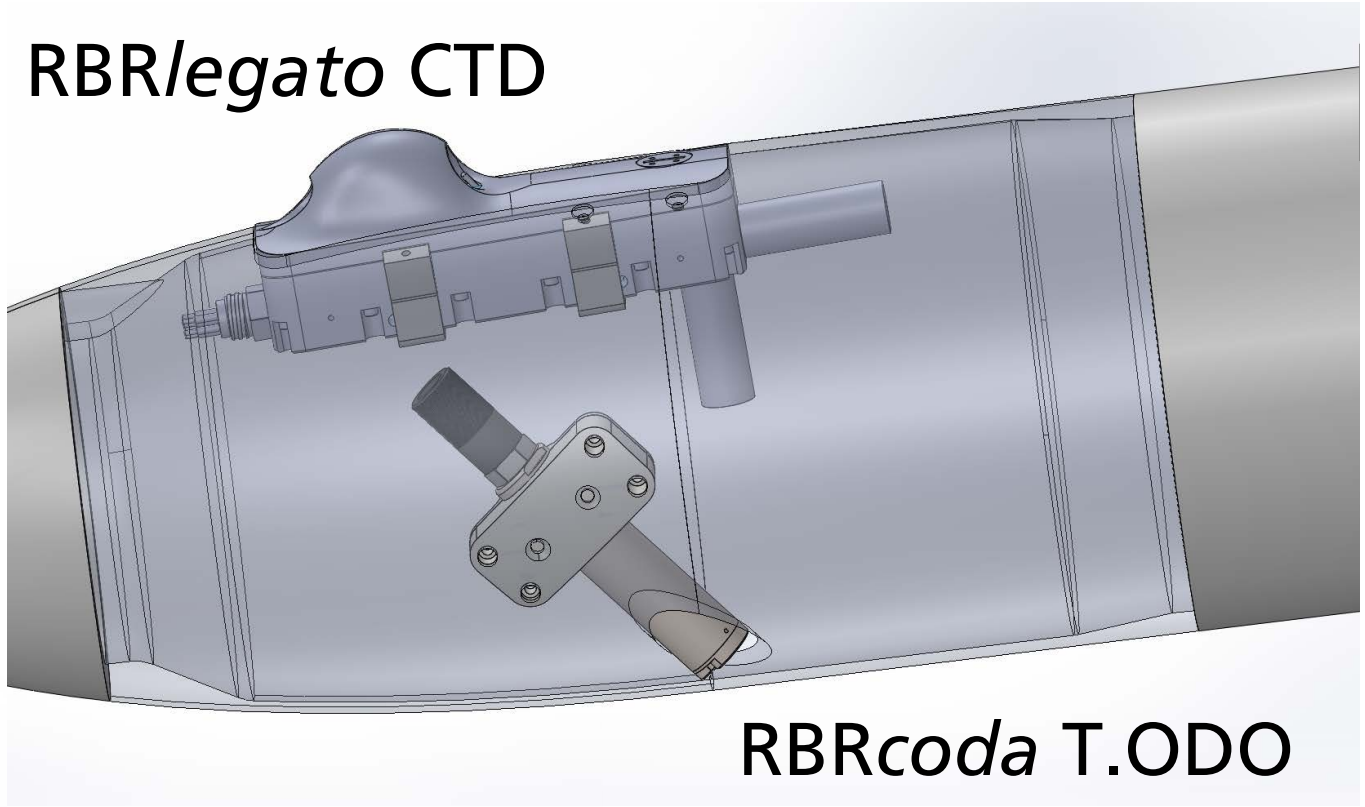
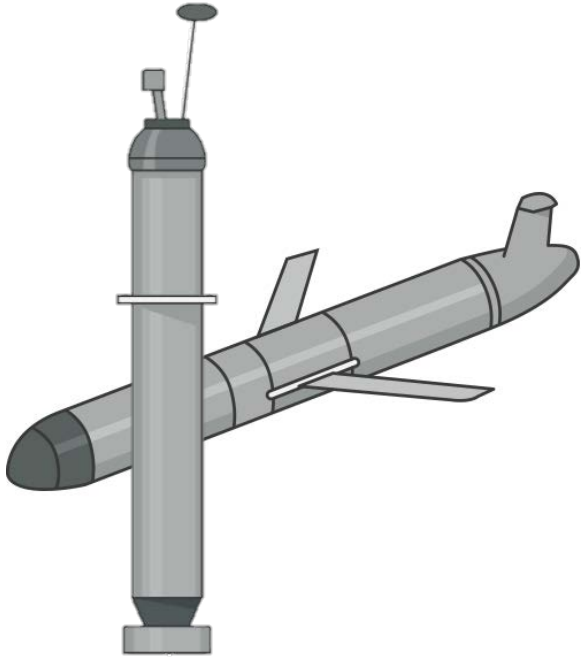
Vehicles and Floats

RBR*legato* CTD



RBR*coda* T.ODO

T.ODO



Kongsberg/Hydroid Seaglider

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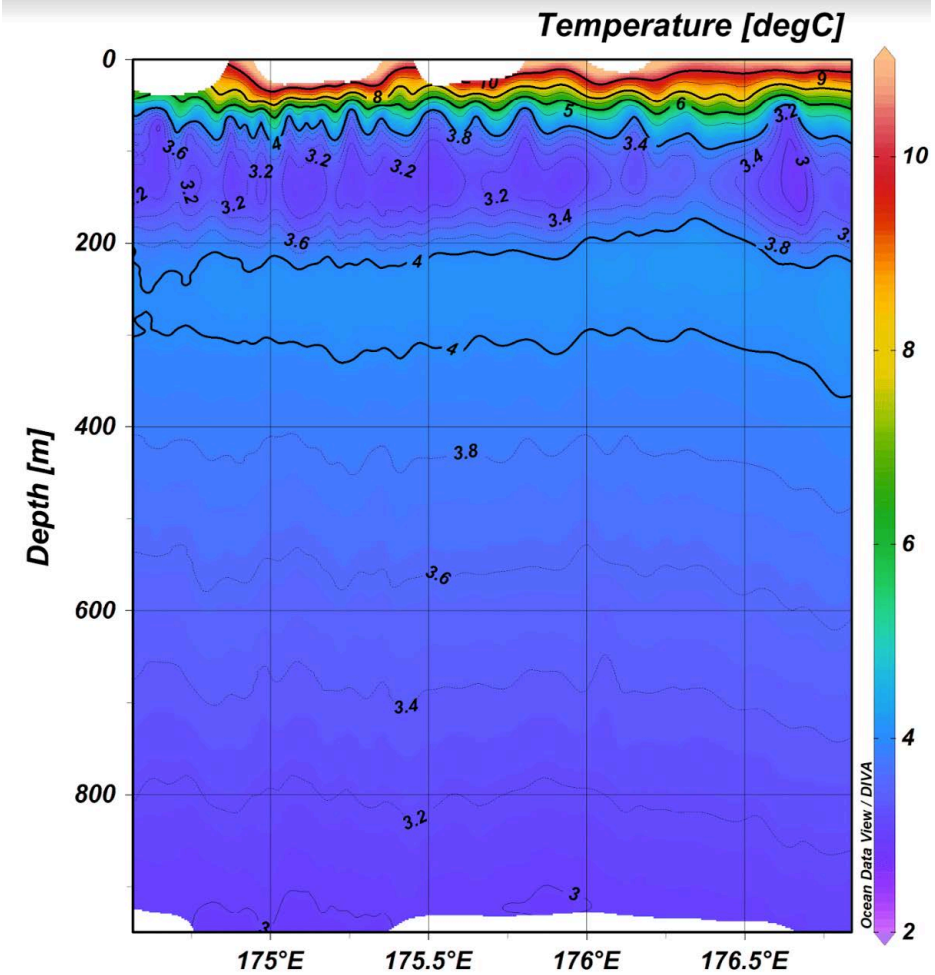
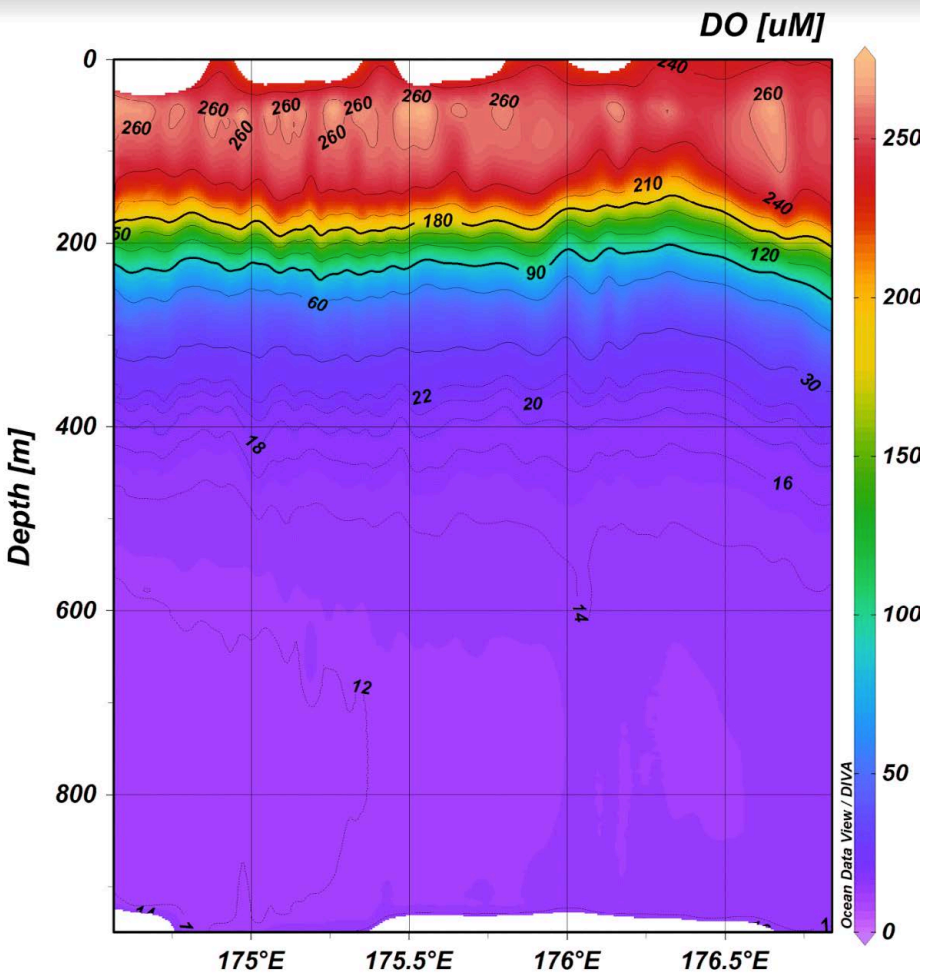
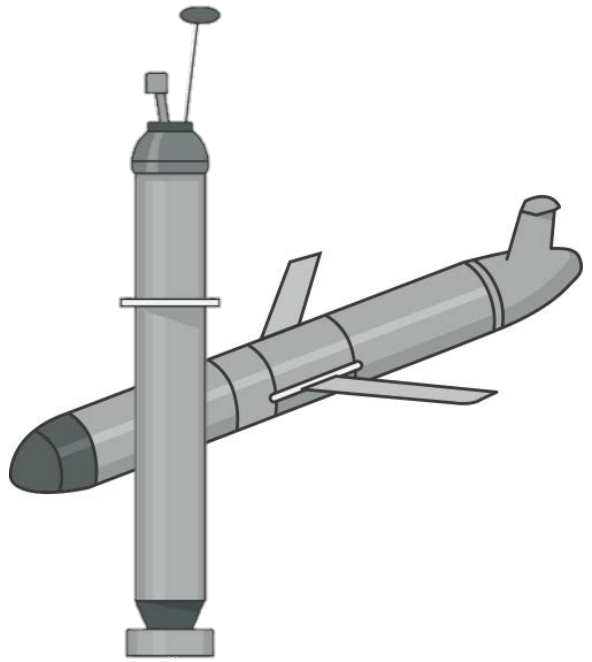
Vehicles and Floats

T.ODO







Data from AMT

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Moorings

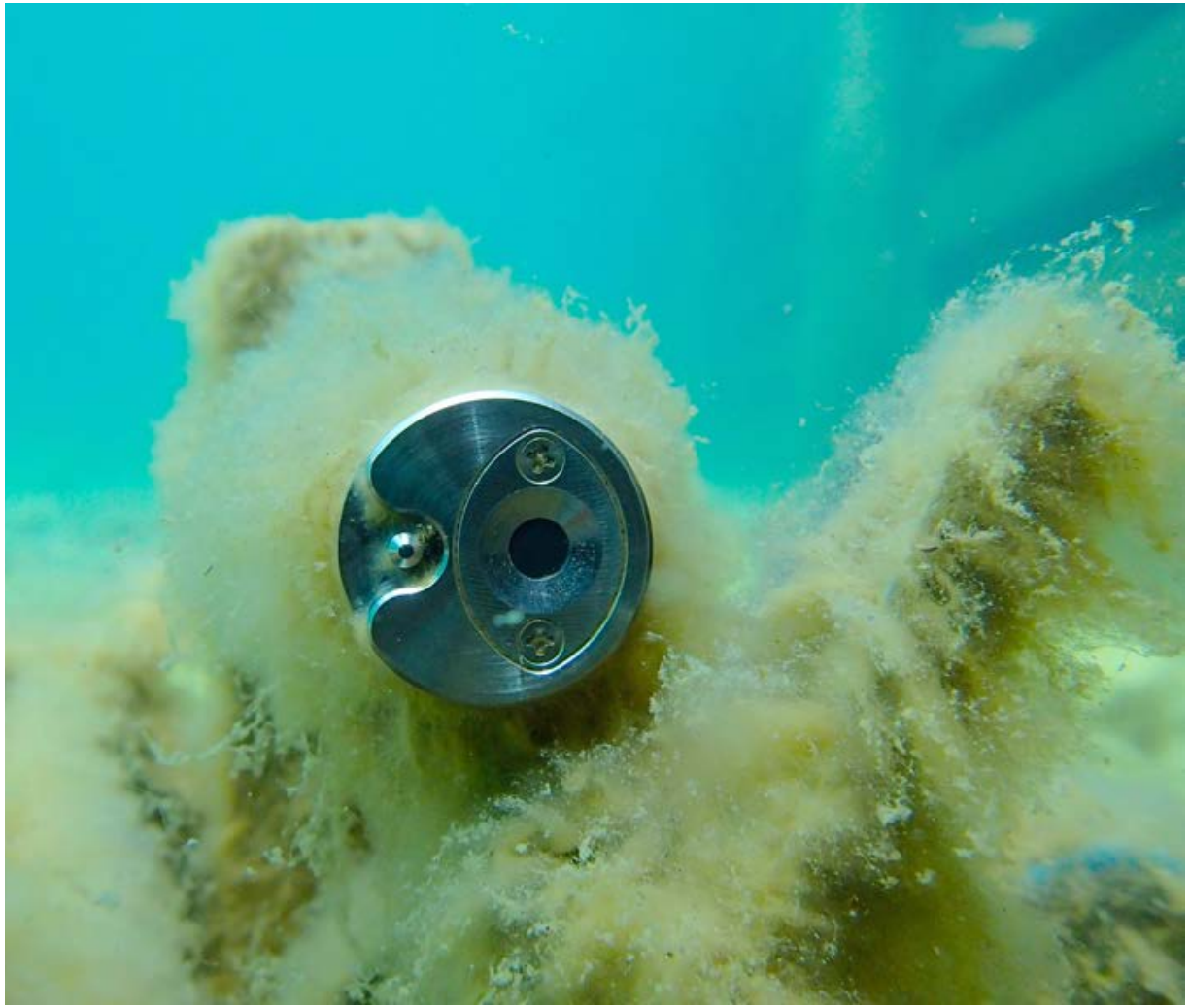
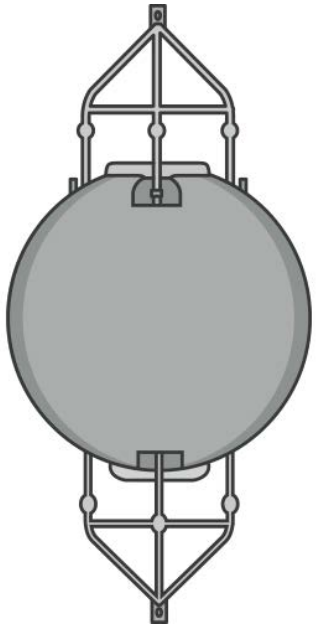


Photo from UC Davis Tahoe Environmental Research Center

Zebra-Tech Hydro-Wiper

T.ODO|slow



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Thank You!

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