Getting the best of your RBR instruments

state-of-the-art post-processing for RBR CTDs and optodes.

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IUGC2024

G ments

state- nd optodes.

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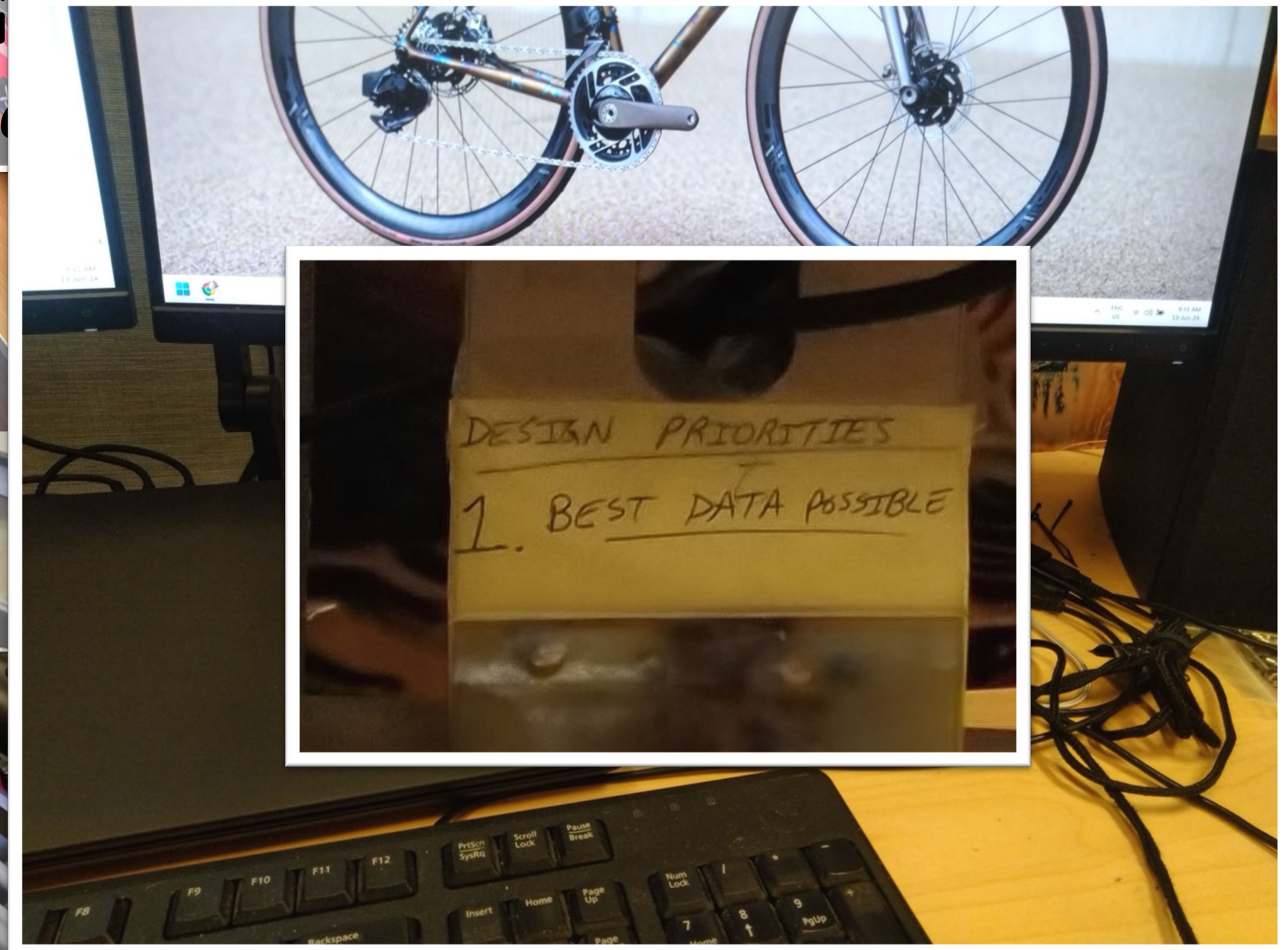

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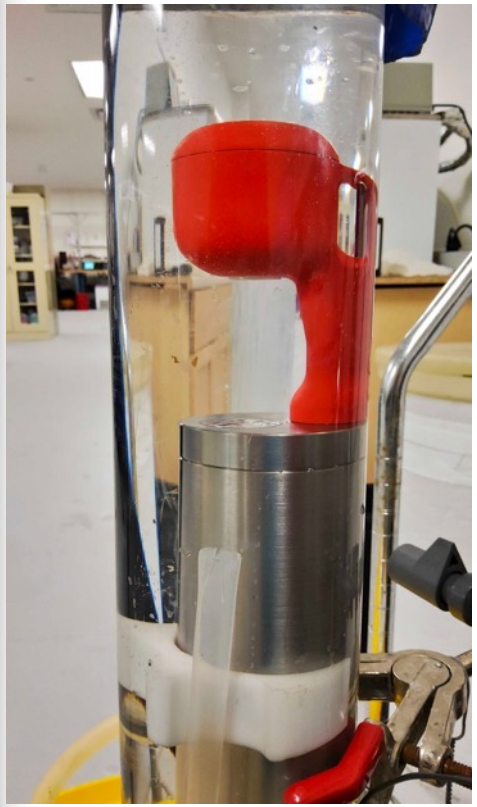
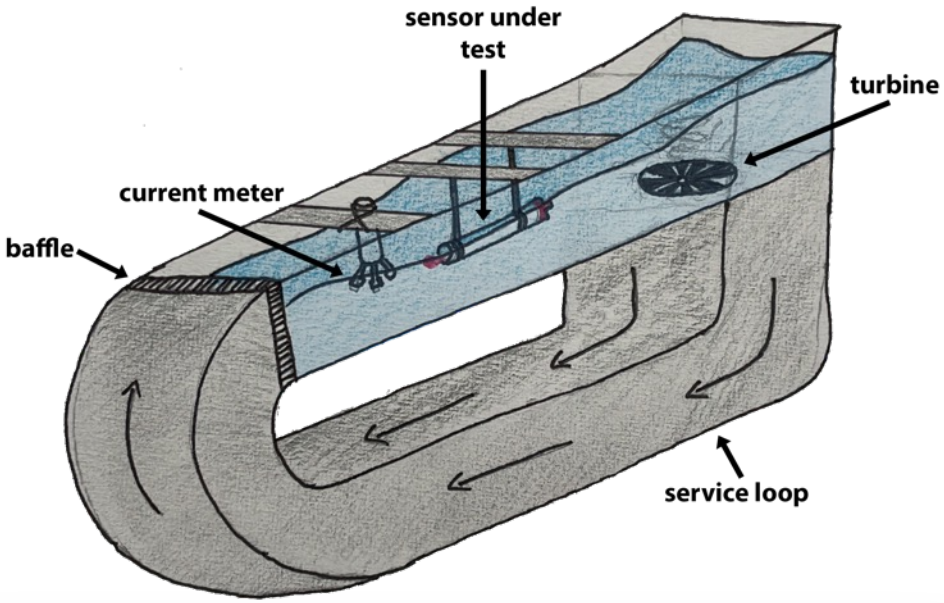
RBR and the ARGO program

Compressibility calibration



Thermal Inertia Response



RBR and the glider community

RBR*legato* C.T.D.

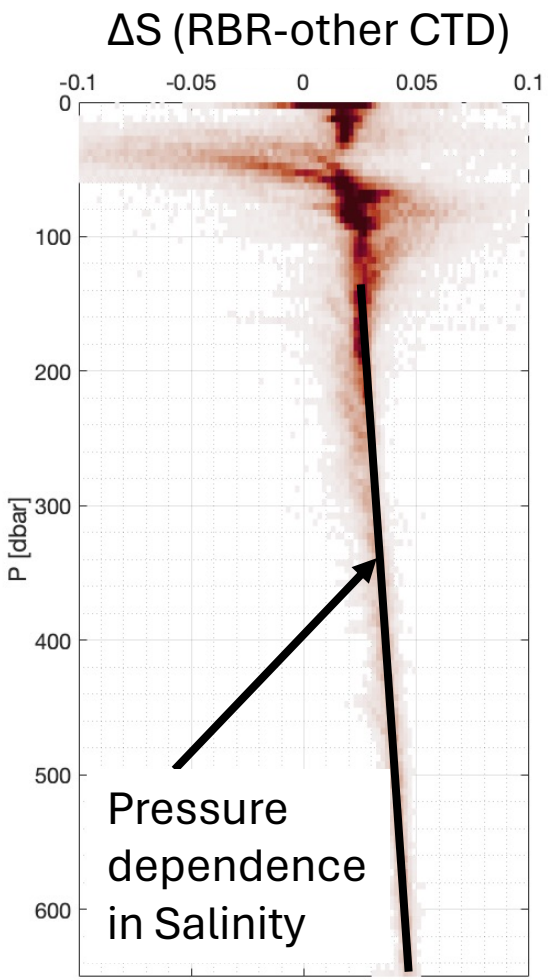
- Compressibility errors
- Dynamic errors in temperature
- Dynamic errors in conductivity

RBR*coda* T.ODO

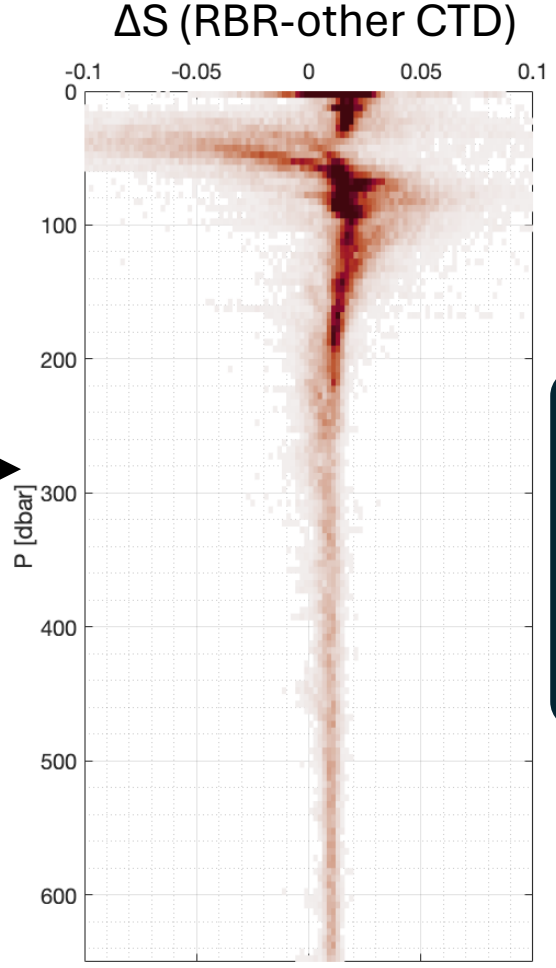
- Phase-temperature calibration
- Salinity correction
- Pressure correction
- Dynamic errors

Pressure effects on conductivity

Compressibility



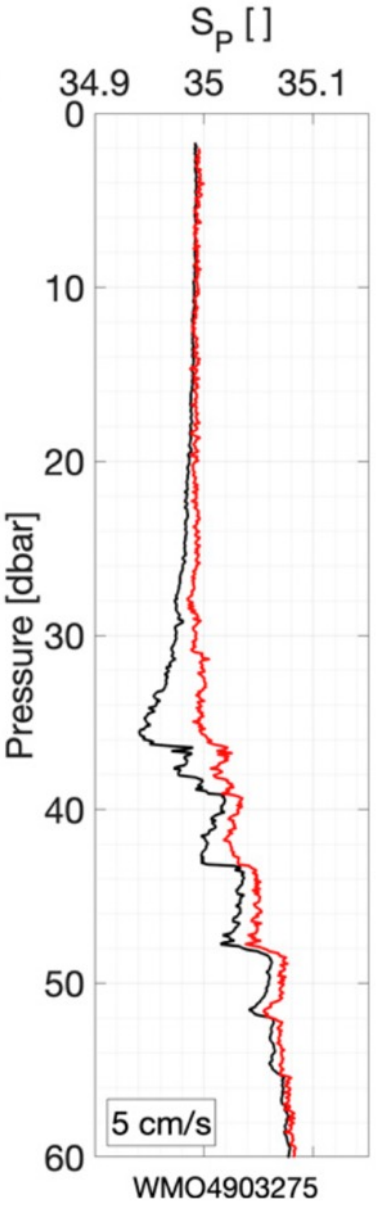
Corrective model derived for **every** RBR*legato* C.T.D.



Starting on June 11th 2023, compressibility calibration is directly applied to your data onboard

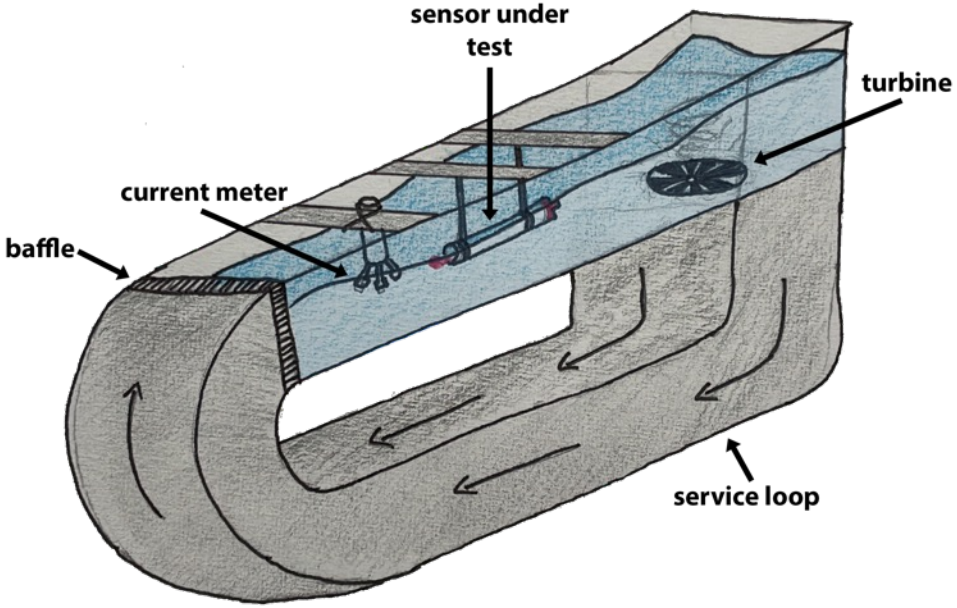
Data courtesy of Clark Richards, Department of Fisheries and Ocean CANADA

Dynamic corrections



Three different sources of errors:

1. CNDC – TEMP misalignment (a.k.a. C-T lag)
2. Thermal inertia on TEMP measurements
3. Thermal inertia on CNDC measurement



Saltwater flume

Dever et al. 2022

Dynamic correction on temperature

CNDC – TEMP misalignment (C-T lag)

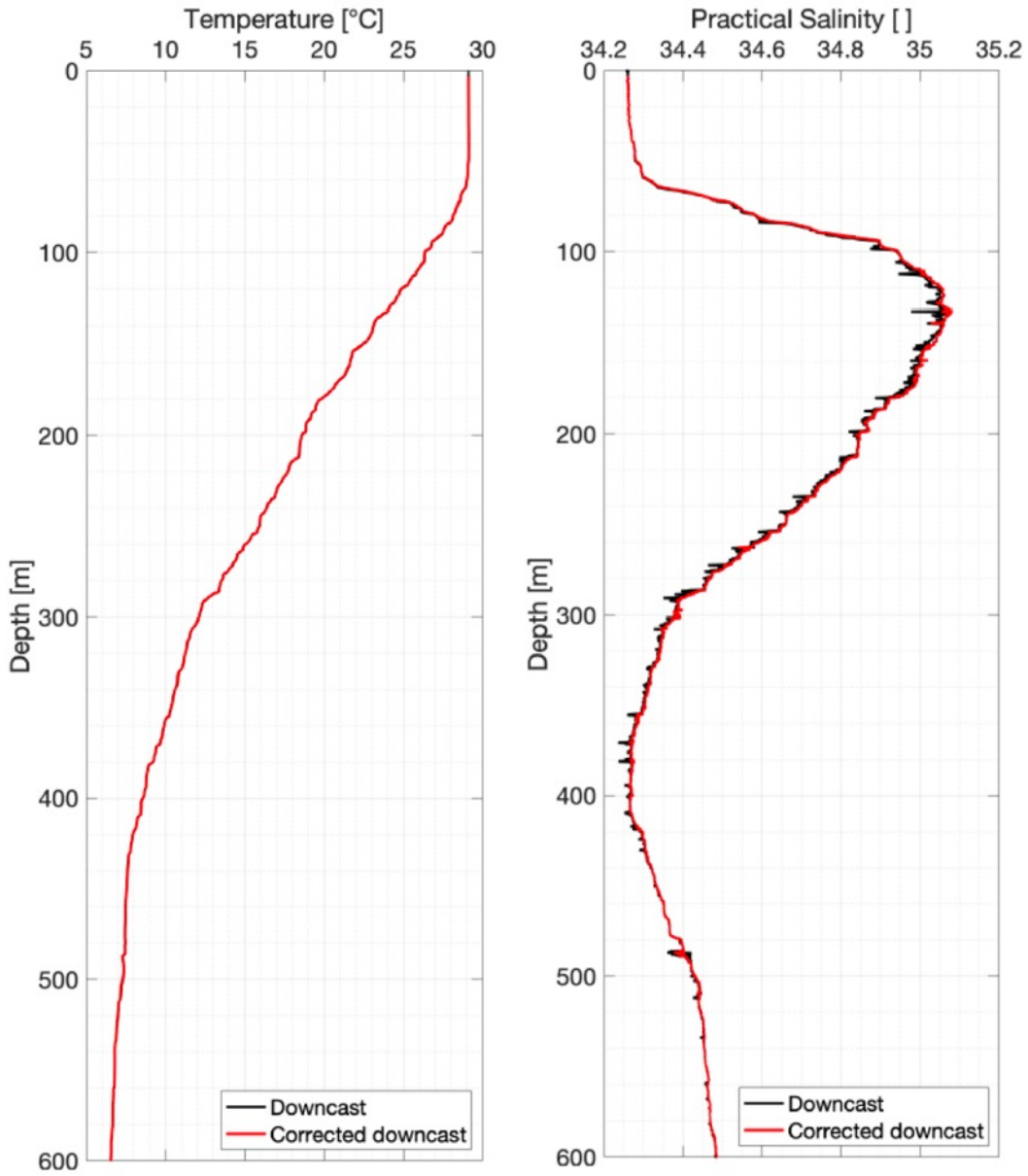
Standard thermistor

$\Delta t = 0.90$ s

```
# APPLY C-T LAG
CTlag = 0.90
TEMP = np.interp(etime,etime-CTlag,TEMP)
```

Fast thermistor

No correction required

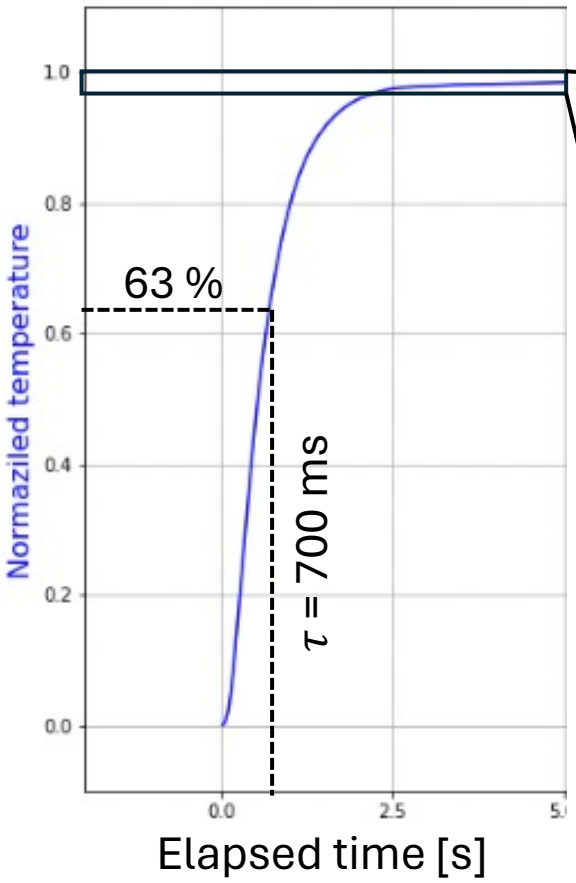


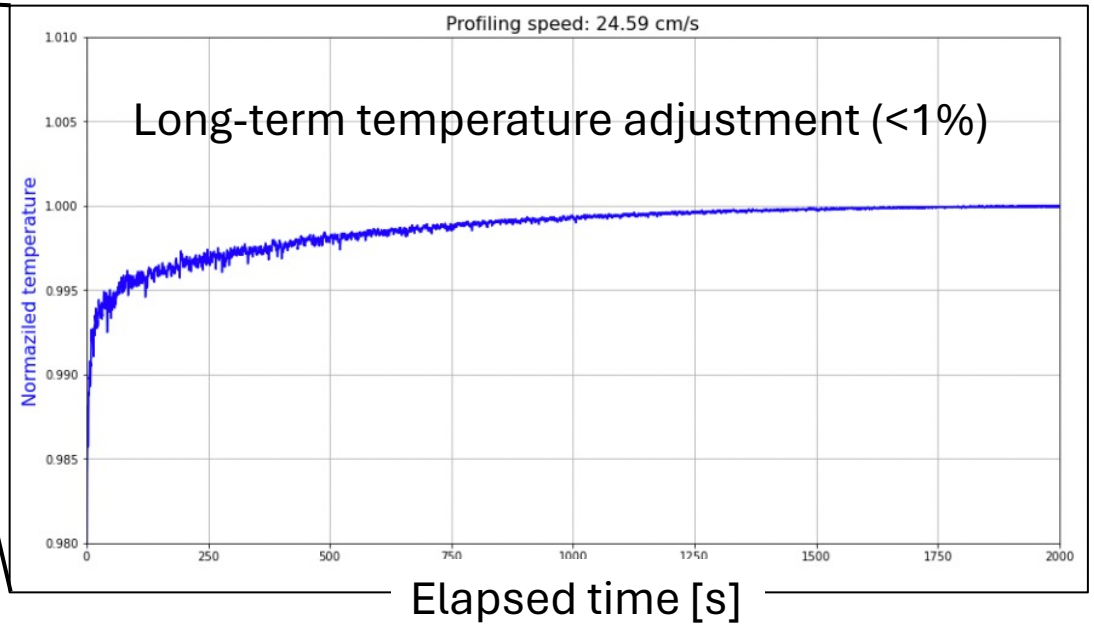
Data courtesy of Luc Rainville, University of Washington.

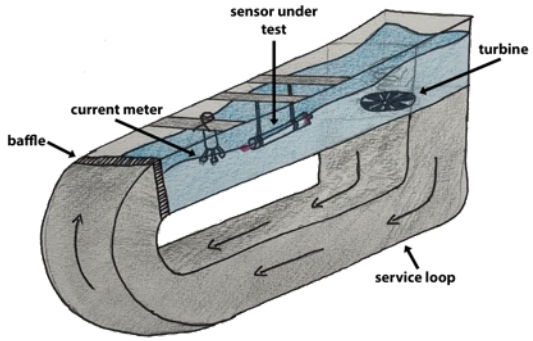
Dynamic correction on temperature

Thermal inertia on TEMP measurements

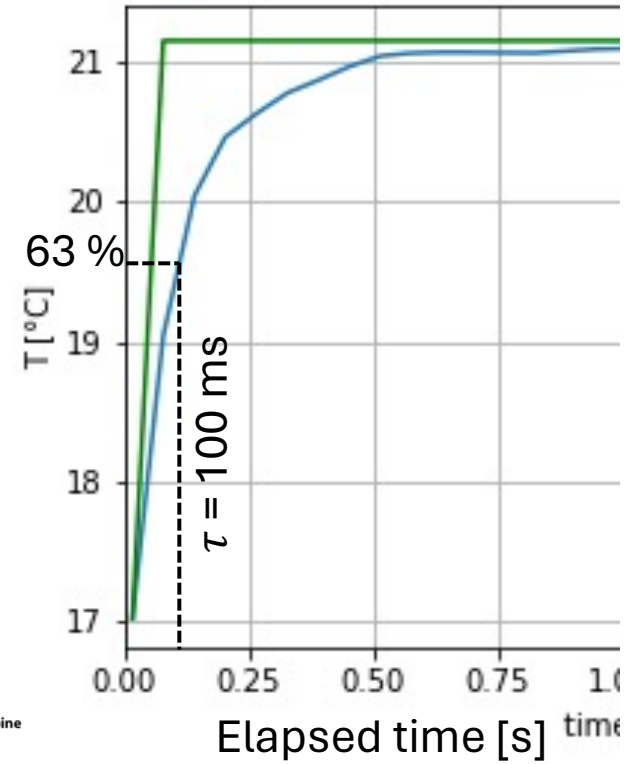
Standard thermistor





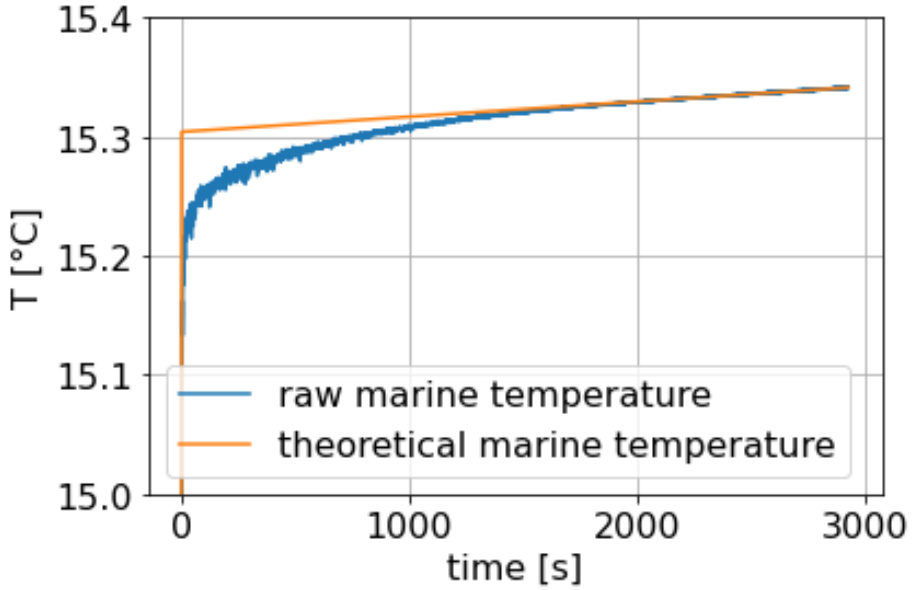


Fast thermistor



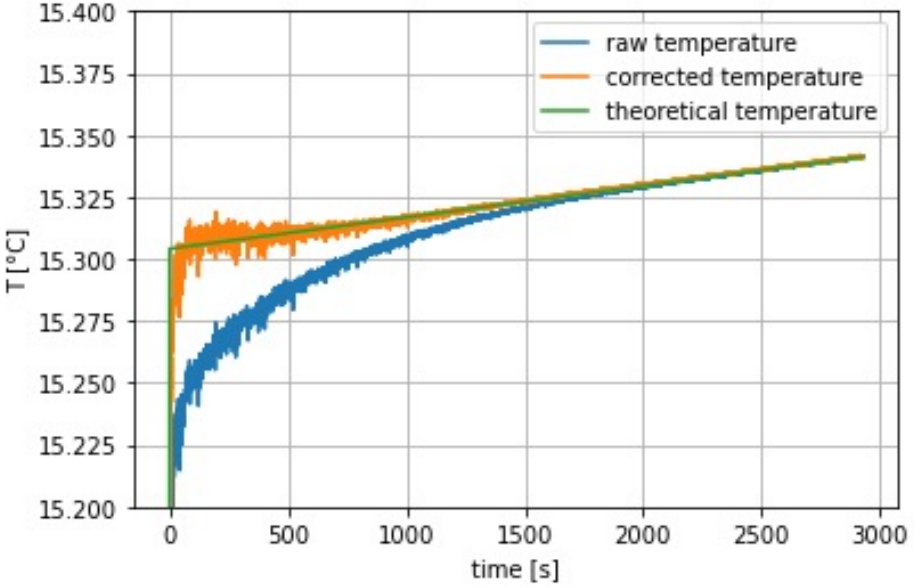
Dynamic correction on temperature

Standard thermistor

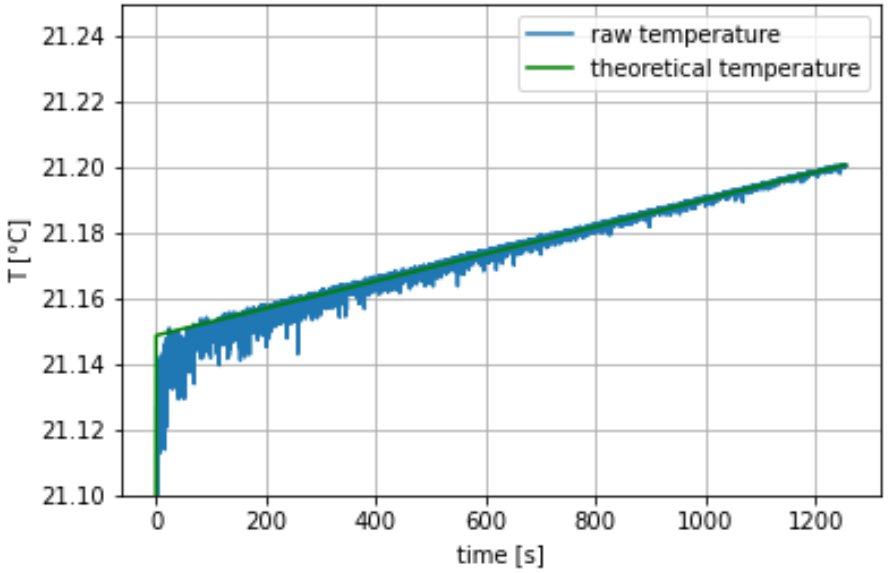


IIR filter
from Lueck and Picklo (1990)

α_T (amplitude)
τ_T (timescale)



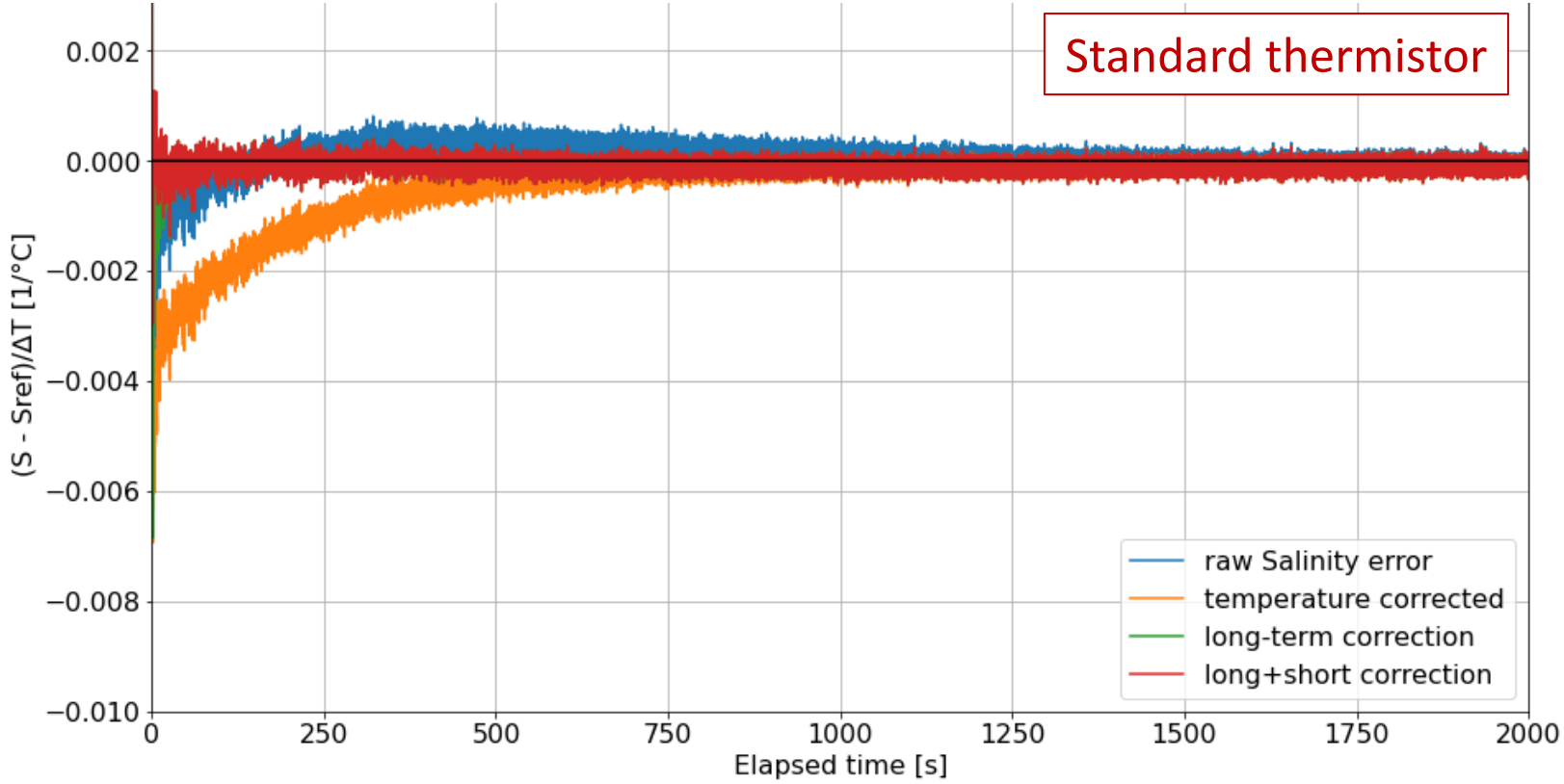
Fast thermistor

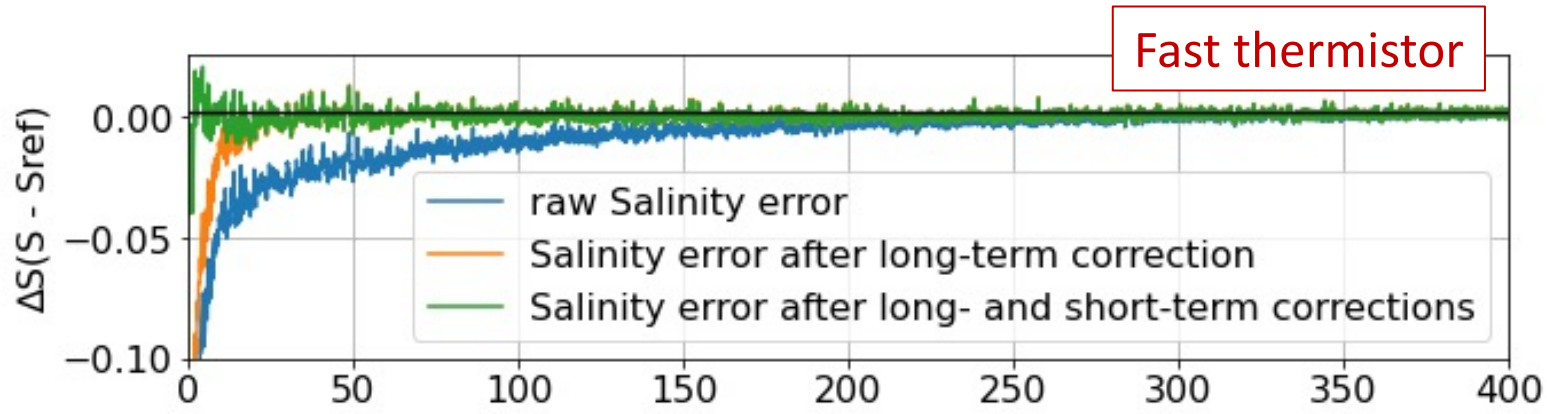


No need for thermal inertia correction on fast thermistor

Dynamic correction on conductivity

Thermal inertia on CNDC measurements





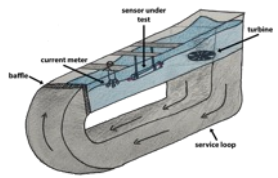
Long-term
+
Short-term
corrected salinity

$T_{short} = f(T, T_{short})$

Long-term
corrected salinity

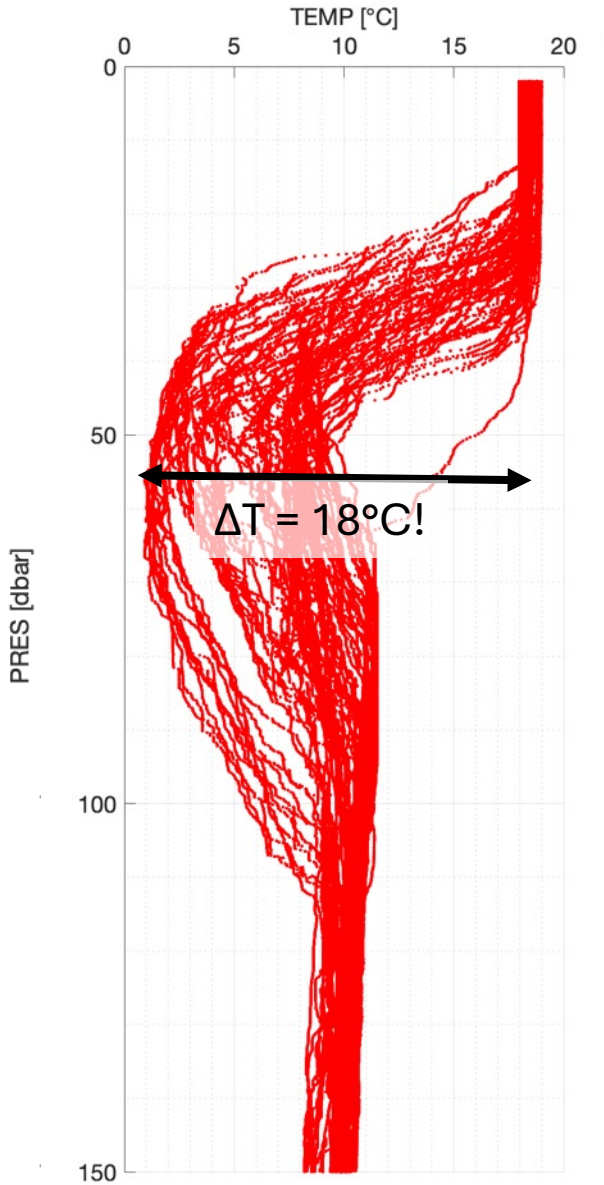
$T_{long} = f(T, T_{long})$

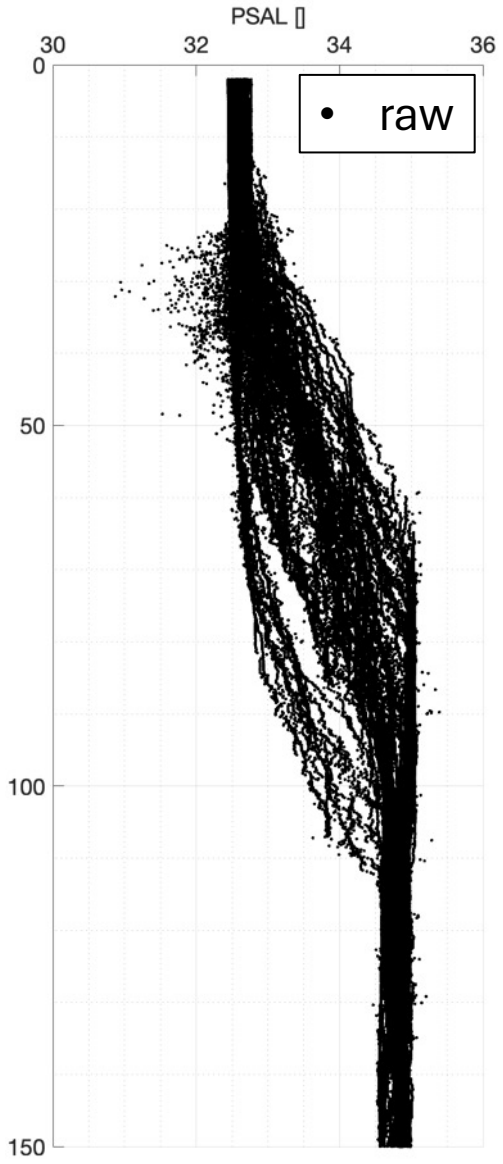
Temperature-corrected salinity



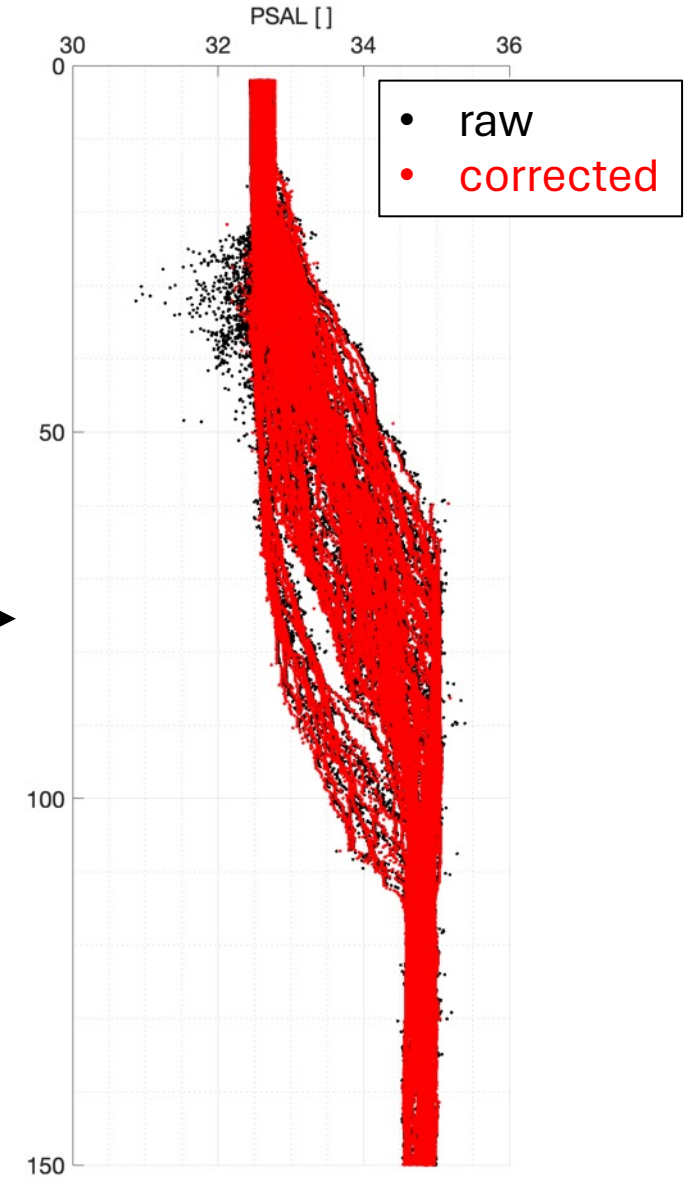
Dynamic correction on conductivity

Field validation



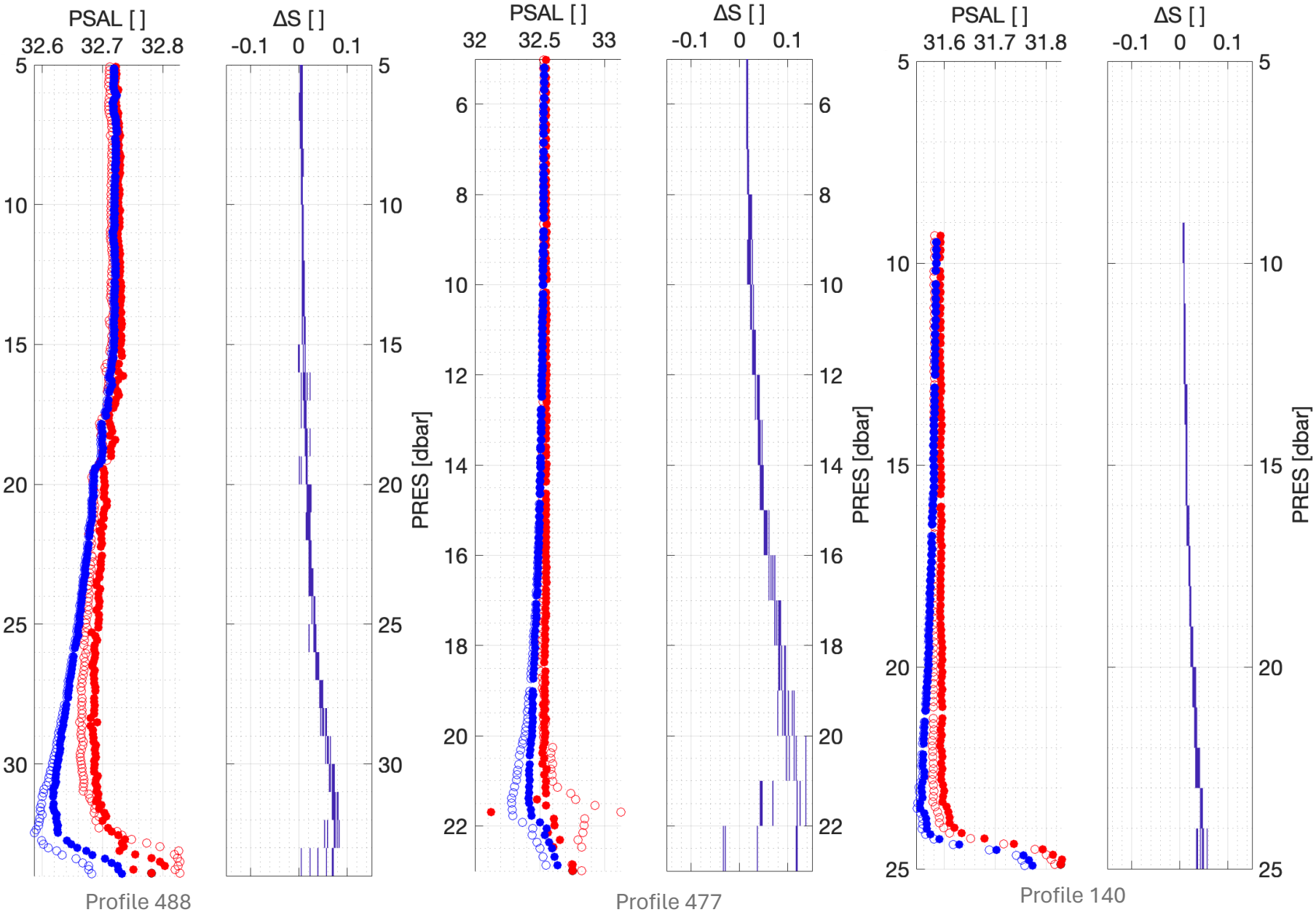


Dynamic corrections



Data courtesy of Clark Richards,
Department of Fisheries and Ocean CANADA

Dynamic correction on conductivity



- Raw data
- Corrected data
- RBRlegato
- Co-located pumped CTD

Data courtesy of Clark Richards,
Department of Fisheries and Ocean CANADA

Thermal inertia correction on RBR*legato*^{3}

How do I implement it to my data?

Step 1: Estimate water speed.

Step 2: Compute correction coefficients from equations provided by RBR

- Paper in progress that documents all the analysis
- Reach-out to RBR at oem@rbr-global.com

Step 3: Apply thermal inertia corrections

- Example code available in Python or MATLAB

RBR and the glider community

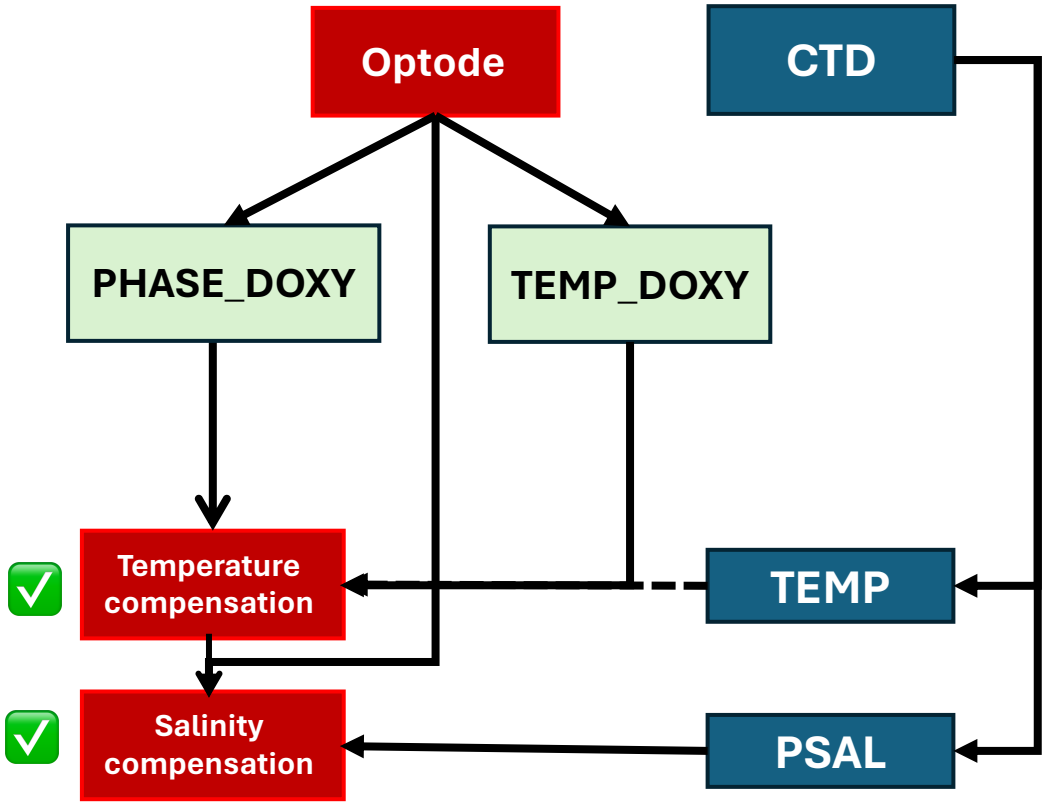
RBR*legato* C.T.D.

- Compressibility errors
- Dynamic errors in temperature
- Dynamic errors in conductivity

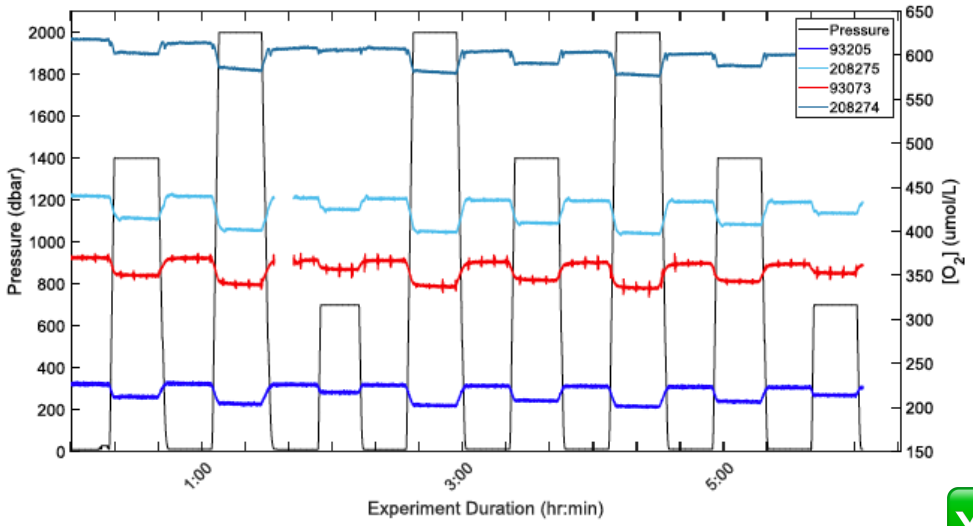
RBR*coda* T.ODO

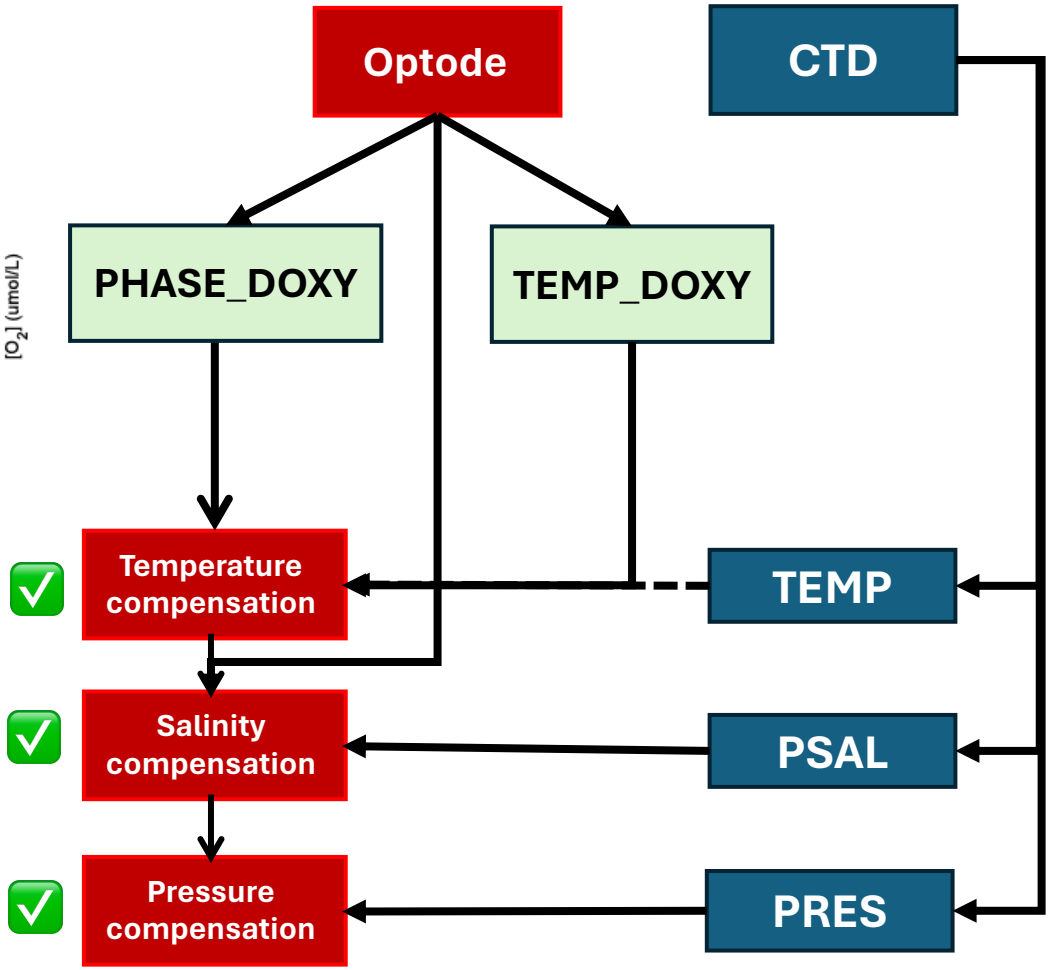
- Phase-temperature calibration
- Salinity correction
- Pressure correction
- Dynamic errors

How is dissolved oxygen derived?



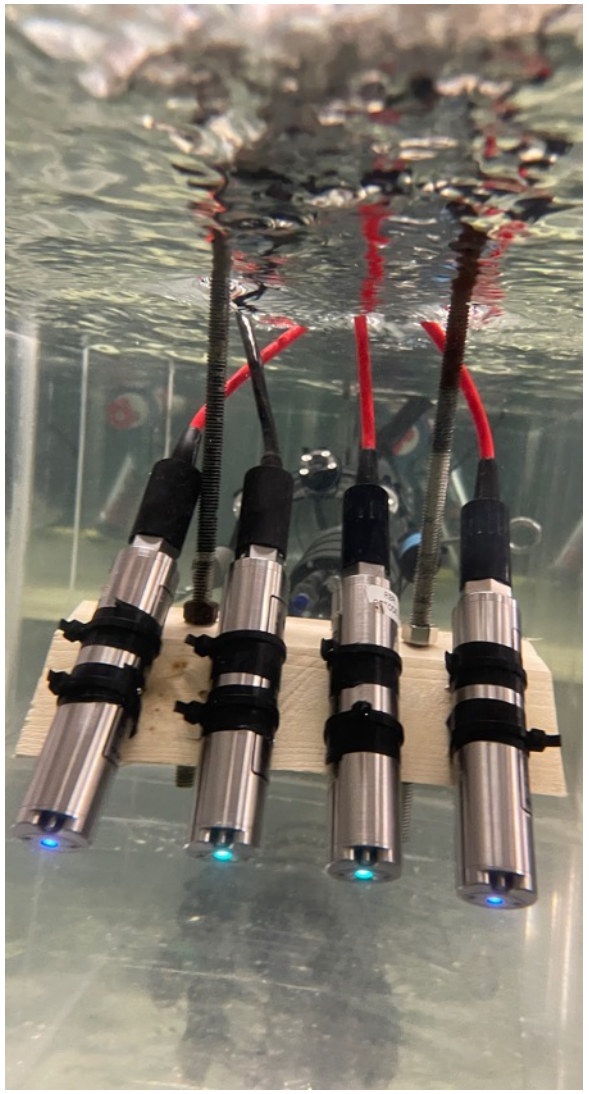
How is dissolved oxygen derived?



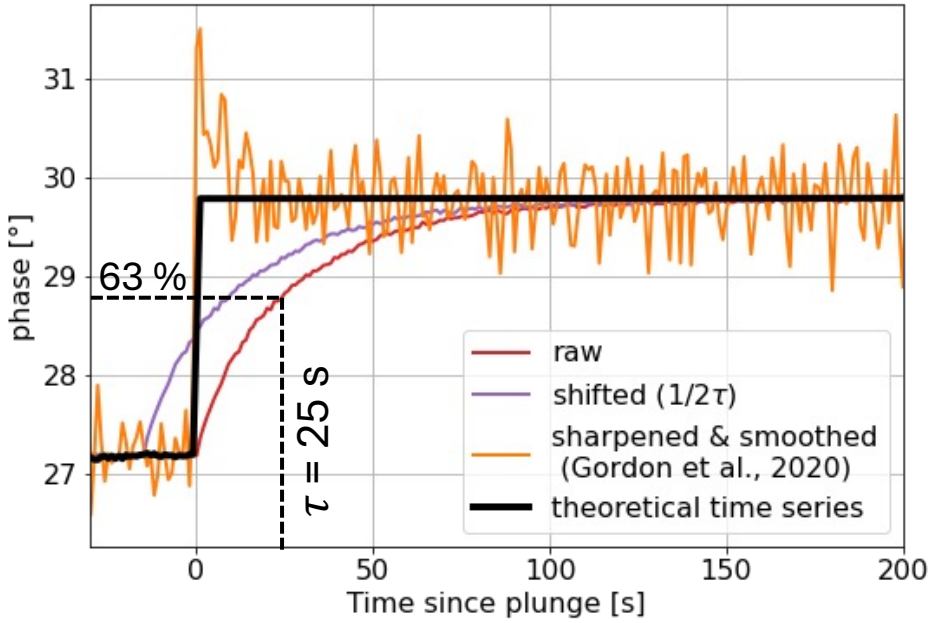


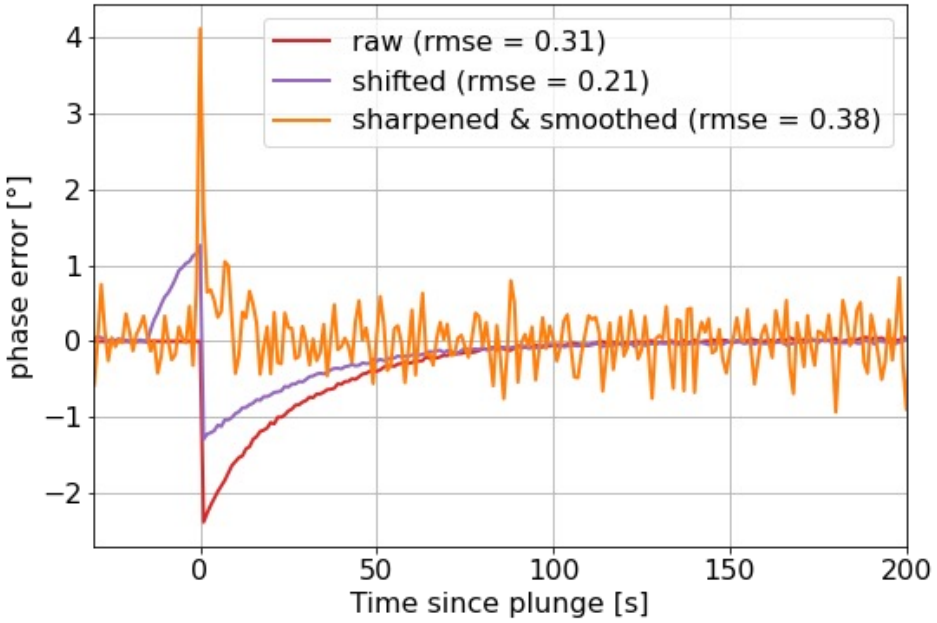
Coefficient	Literature	RBR*coda* T.ODO|fast	RBR*coda* T.ODO|slow
C_p	3.2% per 1000 dbar Uchida (2008)	1.063% per 1000 dbar Since FW 2.20.9 (Jan 2024)	3.2% per 1000 dbar

Dynamic errors: time-response

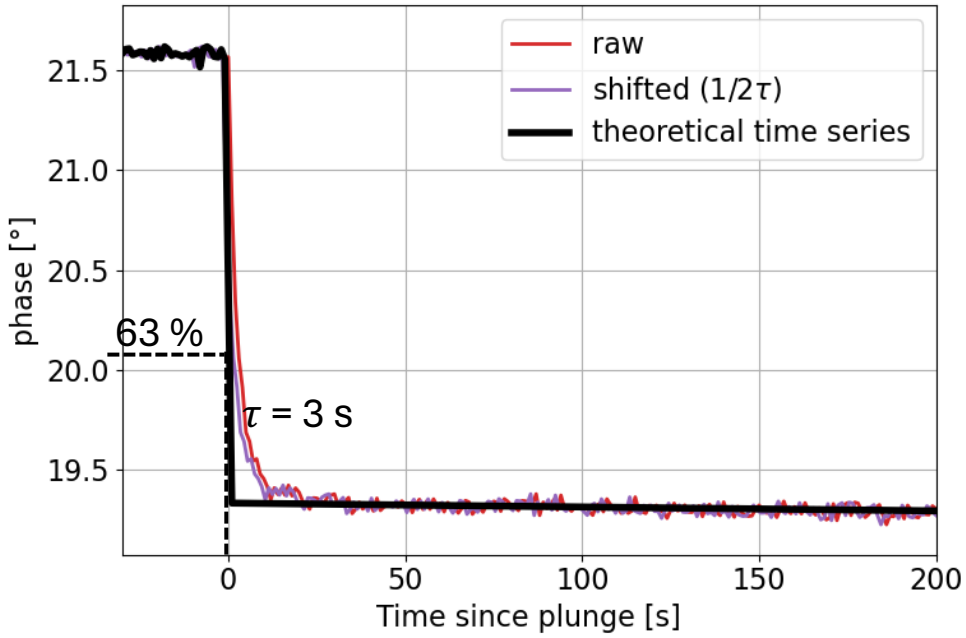


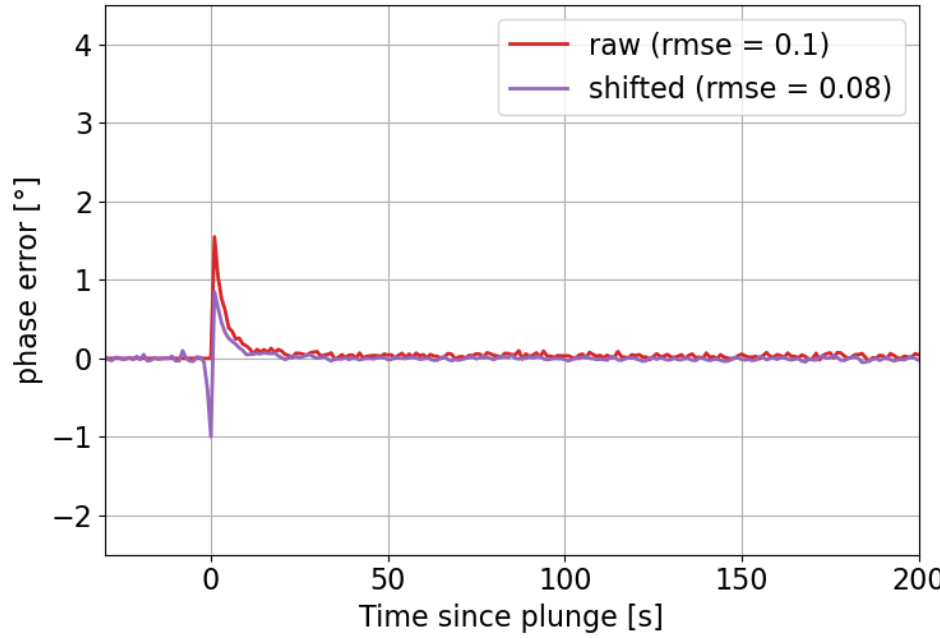
RBR*coda* T.ODO|slow



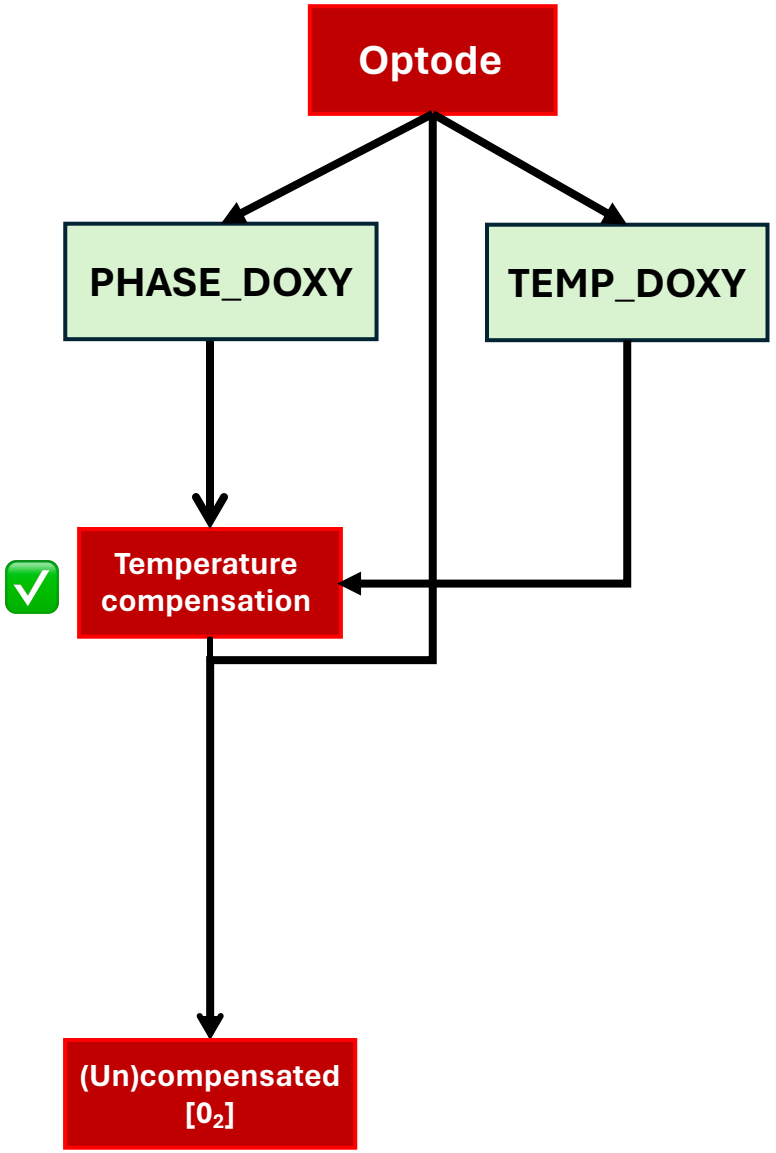


RBR*coda* T.ODO|fast





Combining RBR*legato* with RBR*coda* T.ODO



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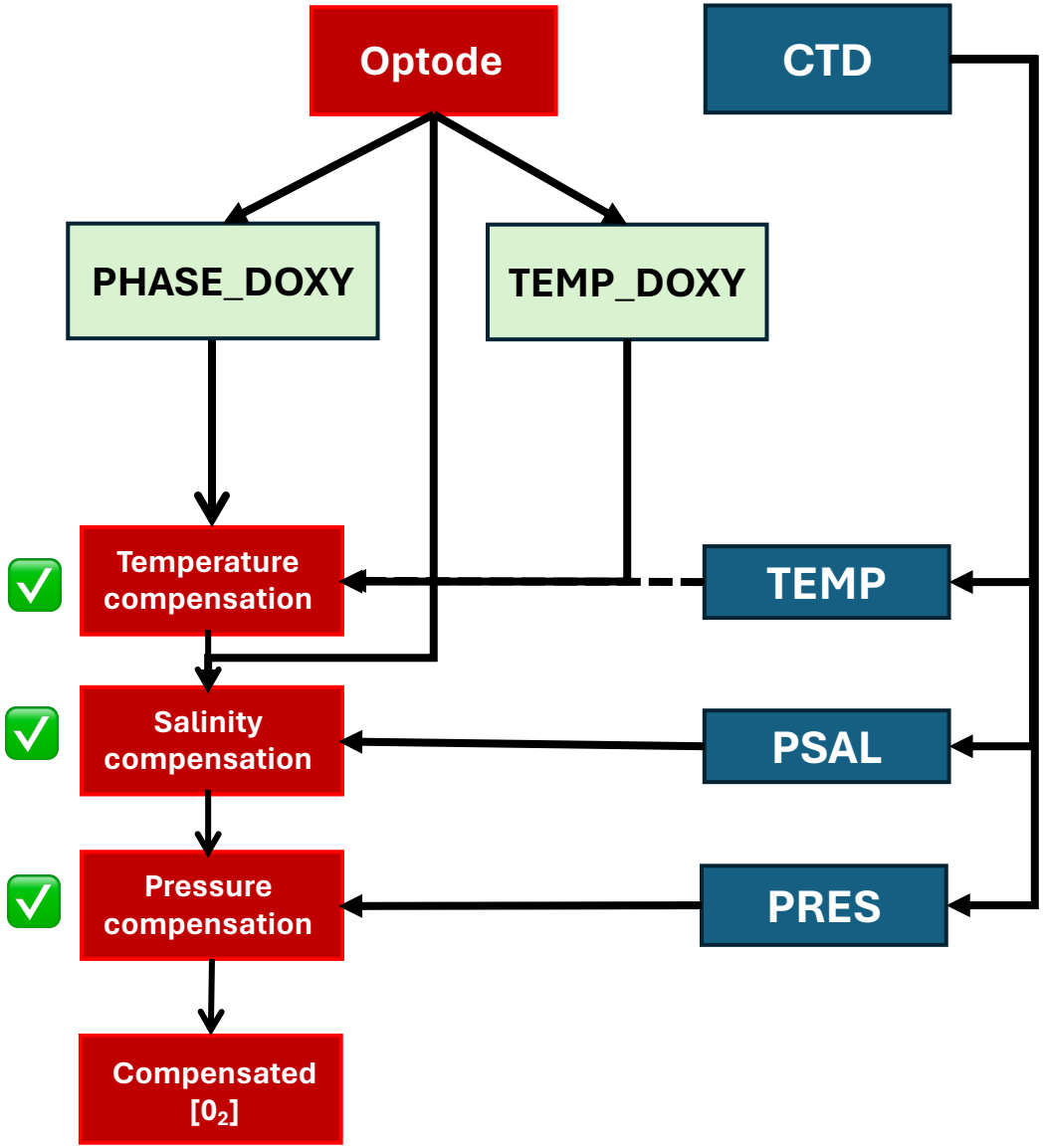
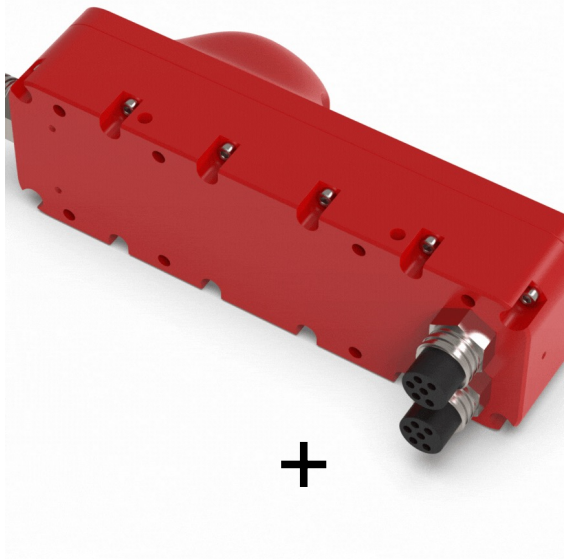
-
- Up to 1 Hz ODO data
- (un)compensated [O_2]
  - Uncompensated
  - Compensated with default constant values

Combining RBR*legato* with RBR*coda* T.ODO





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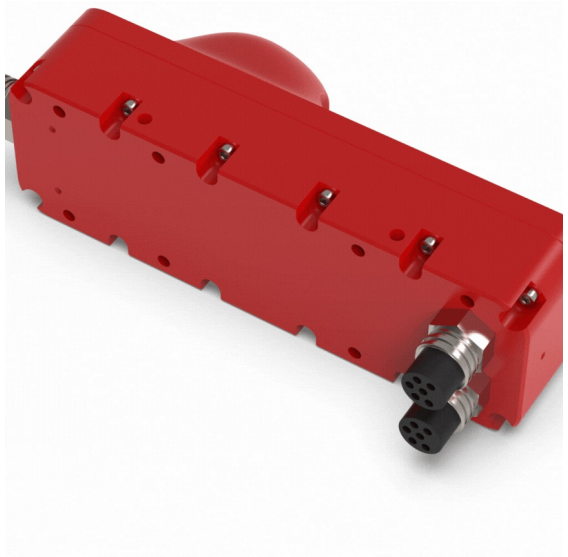
- Up to 16Hz CTD data
- Up to 1 Hz ODO data
- Fully compensated [O_2] (temperature, salinity, pressure)

Combining RBR*legato* with RBR*tridente*



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fluorescence

backscatter

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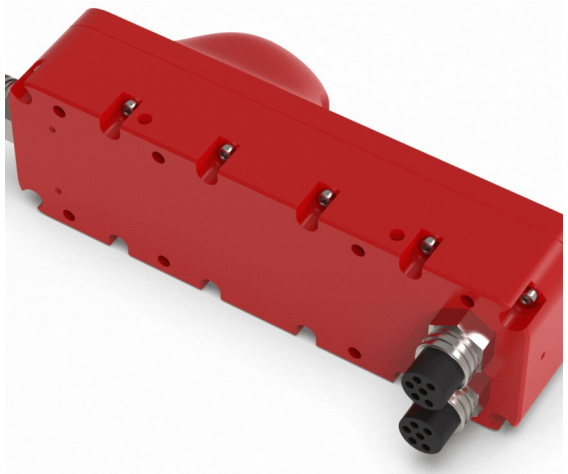
Combining RBR*legato* with RBR*tridente*



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THANK YOU

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GREG JOHNSON
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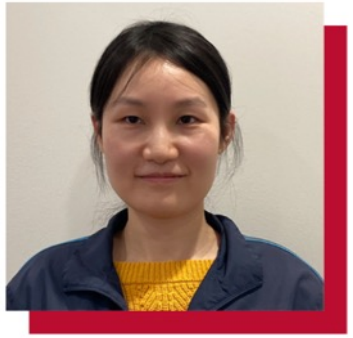
OEM, SYSTEMS, AND SCIENCE ENGINEERING MANAGER



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