Cheat Sheet

Data distribution

biogeochemical Argo
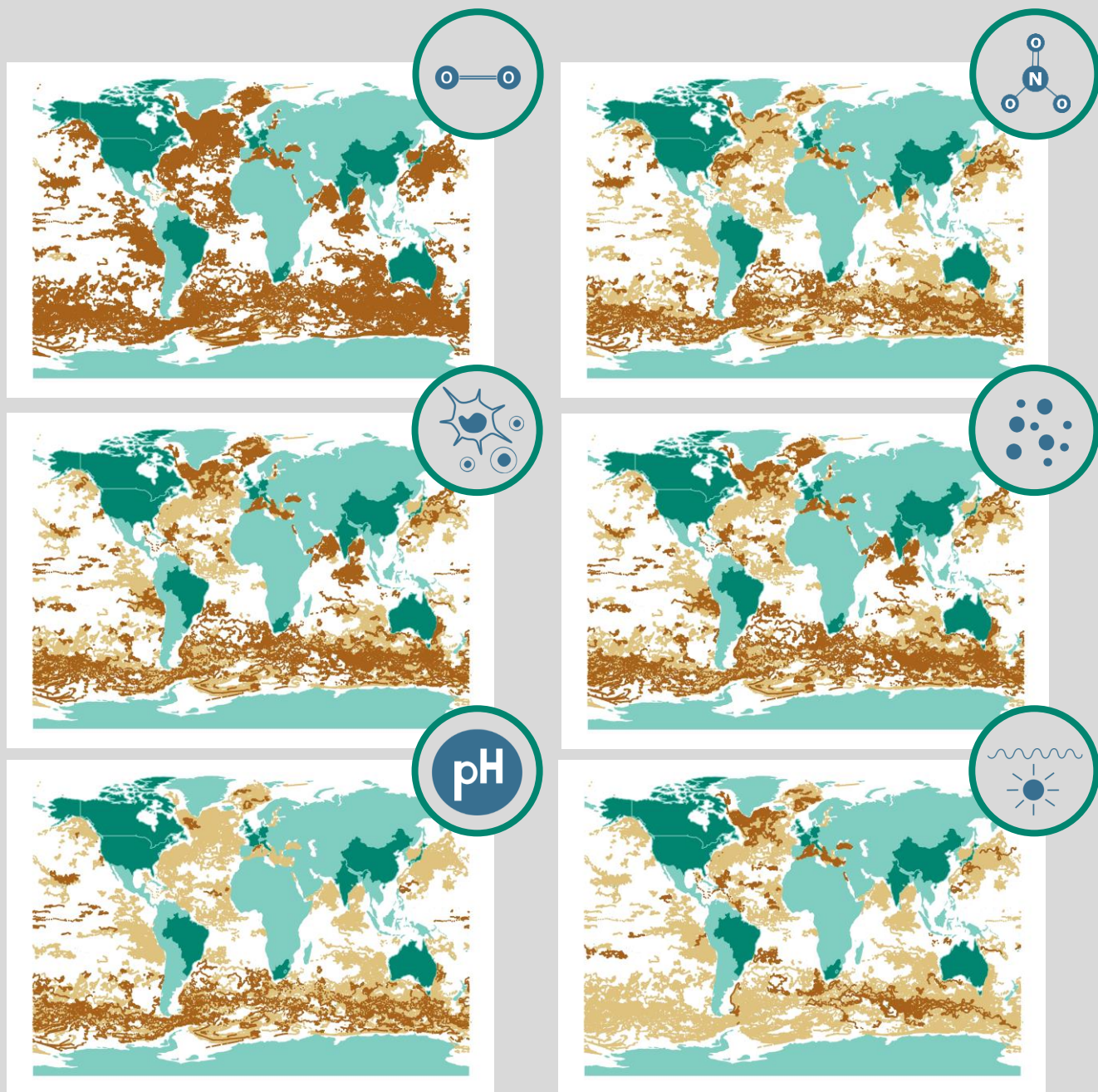
Jan 2021

Cheat Sheet

Quality Control and GDAC

biogeochemical **Argo**

- **Real-time quality control (RTQC)** is performed on data within 24 hours, which is followed by **delayed mode quality control (DMQC)** procedure.
- The **Argo Data Management Team (ADMT)** provides advice on these procedures argo-dm@jcommops.org
- Detailed information is outlined in the **BGC-Argo Guide**
Bittig et a. (2019) *Front. Mar. Sci.* 10.3389/fmars.2019.00502

DMQC dynamic climatologies
To improve data accuracy

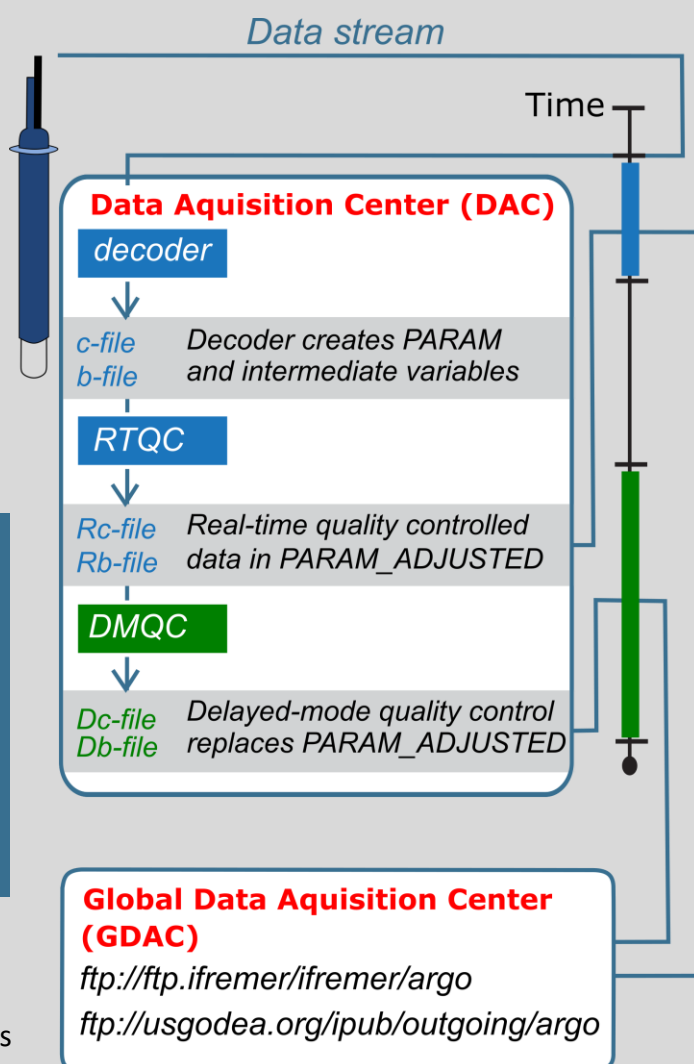CANYON-B
github.com/HCBScienceProducts/
LIARv2
github.com/BRCScienceProducts/LIRs/
regional MLR
e.g. Williams et al. (2016) *Geo. Res. Lett*

User QC considerations

- DMQC is performed to the expertise of the data manager and ADMT recommendations
- The accuracy of raw data is not suitable for scientific application
- For specific applications, users should perform their own QC
- Contact the ADMT if you develop a procedure that improves data accuracy

Tip: Check the "SCIENTIFIC_CALIB_EQUATION", "SCIENTIFIC_CALIB_COEFFICIENT" and "SCIENTIFIC_CALIB_COMMENT" in b-files or contact data managers for further details on applied calibration and QC procedures

Data stream

Time

Data Aquisition Center (DAC)

decoder

c-file
b-file — *Decoder creates PARAM and intermediate variables*

RTQC

Rc-file
Rb-file — *Real-time quality controlled data in PARAM_ADJUSTED*

DMQC

Dc-file
Db-file — *Delayed-mode quality control replaces PARAM_ADJUSTED*

Global Data Aquisition Center (GDAC)
ftp://ftp.ifremer/ifremer/argo
ftp://usgodea.org/ipub/outgoing/argo

Cheat Sheet

Chlorophyll-a

Jan 2021

Fluorometer
Targeted to chlorophyll fluorescence

Expected Bias and RMSE*
Highly variable and < 6%

Community composition, nutrient state and light conditions affect returning red light

Daytime non-photochemical quenching (NPQ) suppresses fluorescence

emitter

detector

fluorescence   chlorophyll

Depth
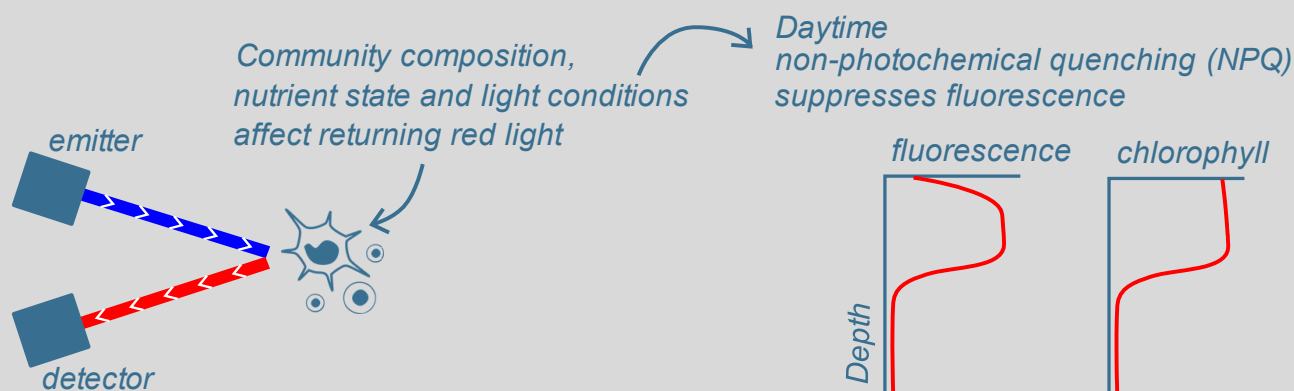
RTQC	DMQC
• Dark offset	• In progress
• NPQ correction (Xing 2012)	• Recommend user adjusts gain regionally and performs visual checks
• Gain adjustment of factor 0.5	
• Range test: [-0.1, 50] µmol kg^{-1}	
• Negative spike test	

* If corrected to regional ship-based measurements, biases < 10 %. If not corrected, biases up to 300 %.

Resources

Schmechtig et al. (2014) Argo Data Management Team   10.13155/35385
Mignot et al. (2019) *Geophys. Res. Lett.*   10.1029/2018gl080541
Xing et al. (2012) *Limnol. Oceanogr.-Methods*   10.4319/lom.2012.10.483
Roesler et al. (2017) *Limnol. Oceanogr.-Methods*   10.1002/lom3.10185
Johnson et al. (2017) *J. Geophys. Res.-Oceans*   10.1002/2017jc012838
To go further...
Thomalla et al. (2018) *Limnol. Oceanogr.-Methods*   10.1002/lom3.10234
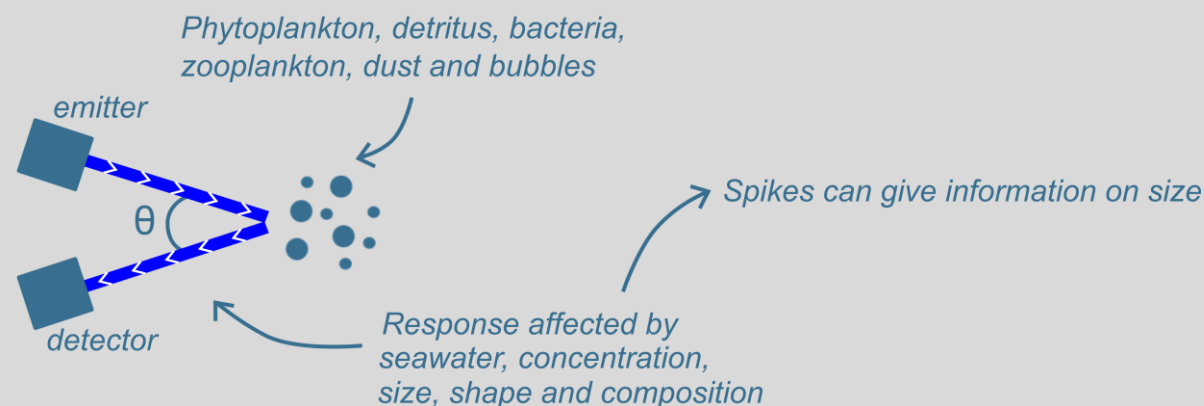
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Cheat Sheet

Optical Backscatter

Jan 2021

Optical backscatter sensor
In oceanic conditions, it is a good regional proxy for POC

Expected Bias and RMSE*
N/A and 35 mg POC m^{-3}

Phytoplankton, detritus, bacteria, zooplankton, dust and bubbles

emitter

θ

detector

Spikes can give information on size

Response affected by seawater, concentration, size, shape and composition

Note: Different sensors are deployed in BGC-Argo, with alternate θ and emitted light

RTQC	DMQC
• Range test: [-0.01, 0.1] m^{-1}	• Recommend user adjusts to POC regionally and performs visual checks based on application

* Error estimate based on DMQC data compared to regional ship-based measurements.

Resources

Schmechtig et al. (2015) Argo Data Management Team   10.13155/39459
Briggs et al. (2020) *Science*   10.1126/science.aay1790
Johnson et al. (2017) *J. Geophys. Res.-Oceans*   10.1002/2017jc012838
Briggs et al. (2011) *Deep Sea Res.-Pt. 1*   10.1016/j.dsr.2011.07.007
To go further...
Bellacicco et al. (2019) *Geophys. Res. Lett.*   10.1029/2019gl084078
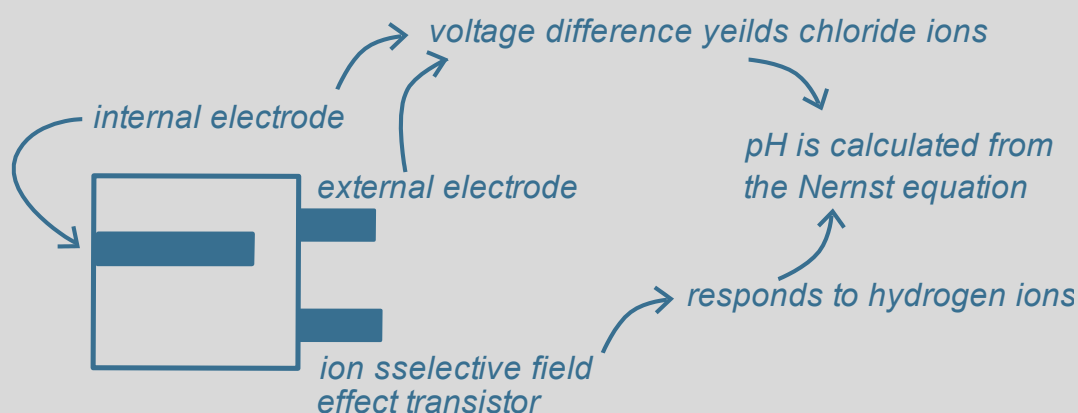Wojtasiewicz et al. (2018) *J. Atmos. Ocean. Tech.*   10.1175/JTECH-D-18-0027.1

Cheat Sheet

pH

Potentiometric Electrodes

Expected Bias and RMSE*
0.005 and 0.007

internal electrode

voltage difference yeilds chloride ions

external electrode

pH is calculated from the Nernst equation

ion sselective field effect transistor

responds to hydrogen ions

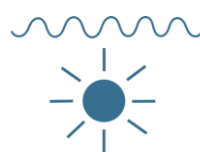| RTQC	DMQC
• Range test: [7.3, 8.5] • Spike test: 0.04	• Offset adjustment with dynamic climatology • Visual check

* Error estimate based on DMQC data compared to regional ship-based measurements.

Resources

Johnson et al. (2017) Argo Data Management Team   10.13155/57195
Williams et al. (2017) *Global Biogeochem. Cy.*   10.1002/2016gb005541
Williams et al. (2016) *Geophys. Res. Lett.*   10.1002/2016GL068539
Johnson et al. (2017) *J. Geophys. Res.-Oceans*   10.1002/2017jc012838
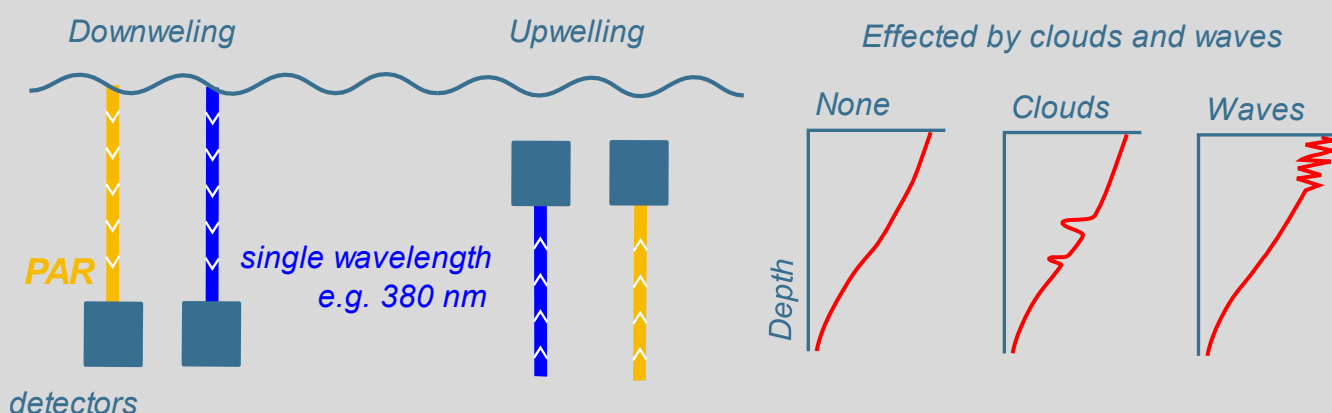
Cheat Sheet

Irradiance

Radiometer

Expected Bias and RMSE*
<20 µW cm^{-2} nm^{-1} and 7-27%

Downweling   Upwelling   Effected by clouds and waves

PAR   single wavelength
e.g. 380 nm

None   Clouds   Waves

Depth

detectors

RTQC	DMQC
• Range test	• In progress

* Dependent on wavelength and calculated by comparison to modelled data.

Resources

Poteau et al. (2019) Argo Data Management Team   10.13155/62466
Schmechtig et al. (2017) Argo Data Management Team   10.13155/51541
To go further…
Organelli et al. (2016) *J. Atmos. Oceanic Technol.*   10.1175/jtech-d-15-0193.1
Wojtasiewicz et al. (2018) *Remote Sens. Environ.*   10.1016/j.rse.2018.02.057
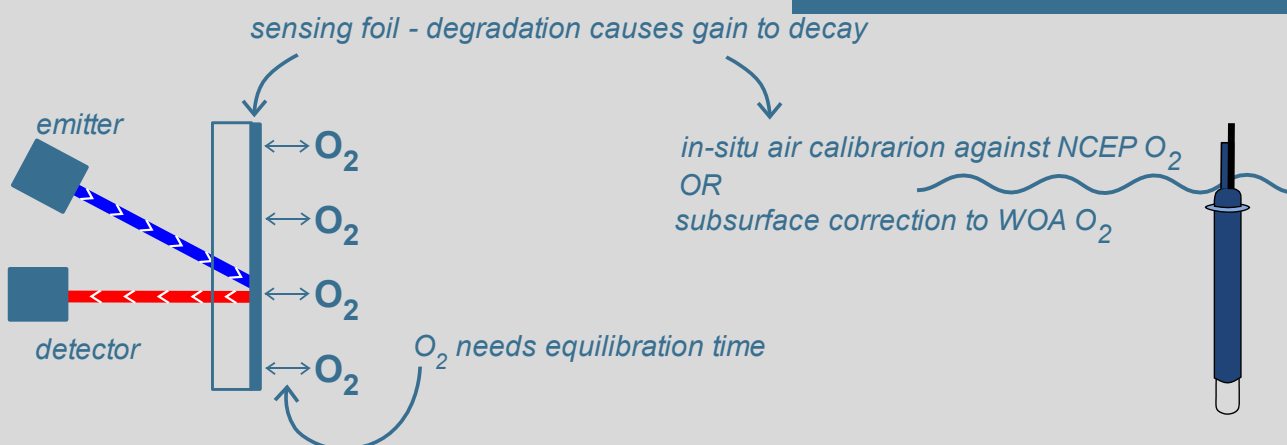
Cheat Sheet

Oxygen

Fluorescence life-time based sensor

Expected Bias and RMSE*
3 and 0.1 µmol kg^{-1}

sensing foil - degradation causes gain to decay

emitter

O_2

O_2

O_2

detector

O_2

O_2 needs equilibration time

in-situ air calibrarion against NCEP O_2
OR
subsurface correction to WOA O_2

Note: SBE43_IDO is not a fluorescence life-time based sensor. All others are.

RTQC	DMQC
• Range test: [-5, 600] umol/kg • Spike test: 50 umol/kg • Gradient test: 50 umol/kg • Gain adjusted (WOA)	• Gain and drift *in-situ* air calibration (NCEP) • Hook removal • Visual check

* Error estimate based on DMQC data compared to regional ship-based measurements.

Resources

Thierry et al. (2018) Argo Data Management Team   10.13155/46542
Mignot et al. (2019) *Geophys. Res. Lett.*   10.1029/2018gl080541
Bittig et al. (2018) *Front. Mar. Sci.*   10.3389/fmars.2017.00429
Johnson et al. (2017) *J. Geophys. Res.-Oceans*   10.1002/2017jc012838
Bushinsky et al. (2016) *Limnol. Oceanogr.-Methods*   10.1002/lom3.10107
Bittig et al. (2014) *Limnol. Oceanogr.-Methods*   10.4319/lom.2014.12.617
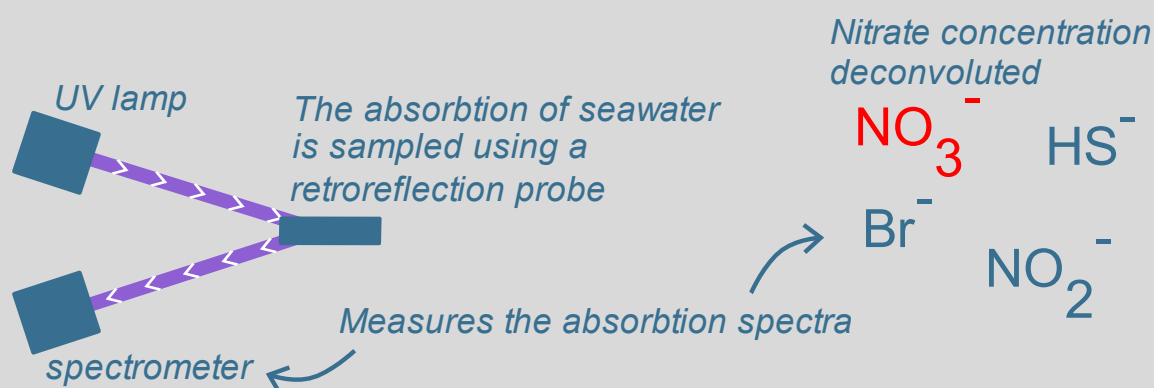
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Cheat Sheet

Nitrate

Jan 2021

Optical nitrate sensor

Expected Bias and RMSE*
0.5 and 0.5 µmol kg^{-1}

Nitrate concentration deconvoluted

NO_3^- HS^-

Br^-

NO_2^-

UV lamp

The absorbtion of seawater is sampled using a retroreflection probe

Measures the absorbtion spectra

spectrometer

RTQC	DMQC
• Not standardised by ADMT	• Drift correction with dynamic climatology • Visual check

* Error estimate based on DMQC data compared to regional ship-based measurements.

Resources

Johnson et al. (2018) Argo Data Management Team   10.13155/46121
Mignot et al. (2019) *Geophys. Res. Lett.*   10.1029/2018gl080541
Johnson et al. (2017) *J. Geophys. Res.-Oceans*   10.1002/2017jc012838