Report for the Bio-Argo workshop

Prepared by

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With the help / contribution of ADMT
Beside O2, the biogeochemical community has identified the first variables ready to be implemented on Argo

- **Oxygen**: exchange with atmosphere, marine photosynthesis and respiration.

- **Nitrate**: New production (build up of organic material); remineralization; biogeochemical modeling

- **Chlorophylle a**: Proxy of phytoplankton biomass, photosynthesis

- **Particulate scattering (b_{bb})**: Stock of particulate matter (detrital and living). Proxy of Particulate Carbon (POC) and Suspended Particulate Matter (SPM)

*Selection of these variables through an international consensus: IOCCG Working group “Bio-optical sensors on Argo floats Argo”, OceanObs09*
Deep-Sea DuraFET pH sensor built at MBARI & Honeywell, tested by SIO, integrated to float by UW, deployed by HOT (Hawaii Ocean Time-series)

42 vertical profiles over 140 days. All data on FLOATVIZ web site in real time.
Outline

• Variable naming
• For Chlorophyll a, $b_{bp}$ and NO3
  – Processing at the DAC level
  – Real-time QC
  – Delayed mode QC
• Additional documentation
• Next step
Important prerequisite

- N_VALUES for the spectral dimension of some measurements ($\text{NO}_3$, $b_{bp}$)
- Naming of variables
  - Put a suffix the so-called “parameter family” to better define the measurement (e.g. NITRATE, BACKSCATTERING, CHLA...)
  - This recommendation also apply for other variables which are not “core Bio-Argo variables” e.g. radiometry, pH...

$\Rightarrow$ Argo manual accordingly be updated

- As soon as these actions are closed the first definitive version of the documents (Chla, $b_{bp}$, $\text{NO}_3$) will be produced.
Other points

• Vertical_Pressure_Offset_Sensor vs CTD
Processing Chla

• Adding wavelength of fluorescence sensor (anticipate evolving sensors)
  – in the attribute of the parameter
  – in the sensor model description in the metadata file

• New calibrations (e.g. prior to deployment) should be stored in the profile file and in the SCIENTIFIC_CALIB_EQUATION. The last calibration will be the one to be used.

• As soon as “naming” is OK, the “final” version of the document “processing Chla at the DAC level” will be produced (action 3 closed)
Chla RT QC
actions 4, 7, 8

• Correction with the deep value
  – If it is not possible to determine the deep value (MLD >>) then CHLA and CHLA_ADJUSTED will be flag = 2
  – If calculated deep value > 20% of the DARK_CHLA then CHLA and CHLA_ADJUSTED will be flag = 2
Chla RT QC
actions 4, 7, 8

• Correction with the deep value
• The global -0.1-50 mg m⁻³ is adopted
  – A point outside is flagged =4
• The spike test is relevant for « negative » spikes only: flag = 4
• Positive « spikes » are OK. No need to flag
• Gradient test is not relevant
• « Jumps » (rare) can not be treated in RT.
Chla RT QC
actions 4, 6

• NPQ mean correction is recommended
Reference paper Xing et al., 2012
• On the profile part affected by NPQ
  – CHLA will be flag = 3
  – CHLA_ADJUSTED will be flagged 2
  – Action for Xiaogang: restablish the variance after the correction.
Chla DM QC: the use of remote sensing

• To identify problems
• Not to correct for float
• Both data set (in situ and satellite) have to be « prepared » independently
Chla DM QC metrics

- Find metrics to identify (anomalous) drift/changes in the deep values (1)
- Find metrics to compare surface float data with remote sensing Chla (2)
- When appropriate, compare (1) and (2) to identify a mixing problem from a sensor drift

Action for LOV (and Nick? and Xiaogang?)
Chla DM QC
Use of « sparse data bases »

• Method of data aggregation / classification into « biogeochemical provinces » have to be tested
  – IOCCG, 2009
  – Hardman-Mountford et al., 2008
  – Dowell et al., 2009
  – D’Ortenzio and Dalcala. 2009

• => action to be taken Nick and LOV
Chla DM QC
Use of additional « onboard » measurement

- e.g. when radiometry is present, combined used of FLUO_CHLA and Ed(490) is a way to get a better DM Chla product.
  – Xing et al., 2011
- Advantage: make consistent database originating from different float (a single “calibration” for all of them)
- Drawback: the use of a global bio-optical prevents to identify potentially interesting regional anomalies.
- Test have to be undertaken for the floats having both measurements = > action for Xiaogang
Processing $b_{bp}$

- Cf Argo update
- Length of the calibration equation
Real-time $b_{bp}$ QC

- At the moment it is **not recommended to correct for deep values** in RT.
  - It might be possible to correct as part of DM-QC (return of experience still needed)
- Presently, for real-time QC, the main test/flag remains **range: $5 \times 10^{-5}$-$10^{-1} \text{ m}^{-1}$**.
- As for Chlorophyll a, it is not relevant to remove/flag positive spikes. **Negative spikes** flagging (4) is recommended.
Find metrics to identify (anomalous) drift/changes in the deep values (1)

Find metrics to compare surface float data with remote sensing Chla (2)

When appropriate, compare (1) and (2) to identify a mixing problem from a sensor drift

Action for LOV (and Nick? and Xiaogang?)
Processing NO3

• Require to have comments on the draft presented by ken Johnson by the Argo community: Thierry, Ann, Claudia, LOV: **New Action XXX**

• Require to translate the calibration equation in less than 1024 characters. **New action for Ken**

• Sensor Model
  – SUNA_WITH_SCOOP
  – SUNA
  – ISUS_IN_PUMP_STREAM
  – ISUS
Real-time NO3 QC

• 2 proposed tests to be tested implemented
  – Range: 0-46 ± 5 µM kg\(^{-3}\) (-5 to 51)
  – Spike / gradient test in steep gradients (including Vertical_Pressure_Offset_Sensor)

• Spectral quality test
  – Either: SUNA_Absorbance_Fit_Residual: threshold at 0.004
  – Or better: Absorbance_At_240: threshold at 0.8
  – Action: Ken + LOV to test these tests
NO3 DM QC

• WOA is for the moment the best reference especially for deep values
• Takeshita et al. JGR 2013 as an initial reference.
Bio-Argo float « good practice »

• Produce a document of reference (pre-deployment, sensor management, metadata, deployment....) that can be used for « capacity building » and for helping any user.

=> action for Antoine Poteau and others (?)
Session 085 - Towards a Global Ocean Biogeochemical Observing System Based on Profiling Floats and Gliders
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~ 30 abstracts received

Tutorial - TOWARD A GLOBAL OCEAN BIOGEOCHEMICAL OBSERVING SYSTEM BASED ON PROFILING FLOATS
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WG 142  Quality Control Procedures for Oxygen and Other Biogeochemical Sensors on Floats and Gliders
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