4\textsuperscript{nd} Bio-Argo Workshop
November 2-3 2015, Bermuda

Chla : RT and DM-QC
Chla DM QC: outcomes / recommandations of ADMT 14/15

• Evaluation of the use of
  – Data bases of reference
  – Remote sensing of Ocean color
  – Additional « onboard » measurement (e.g. optics)

• Develop Metrics
  – to identify (anomalous) drift/changes in the time serie of the Chla profile (1)
  – to compare surface float data with remote sensing Chla (2)
  – When appropriate, compare (1) and (2) to identify e.g. a sensor issue
Comparison with databases of reference
Development of databases

Data base of HPLC measurement. International effort to merge quality-controlled Chla data in a single open access data base

Figure 6. (a) Climatological mean (2000–2007) chlorophyll a concentration (mg m\(^{-3}\)) from SeaWiFS (scaled to 1° resolution) and (b) surface TCHLA (mg m\(^{-3}\)) from MAREDAT (averaged over the upper 20 m and scaled to 1° resolution.)
Comparison with databases of reference
Development of databases

Number of Chl a fluorescence profiles within 3°x 3° boxes:
~ 40,000 un-calibrated profiles over the 1970-2012 period.

**Required** : development of methods to make dataset from various origin calibrated and consistent
Comparison with databases of reference
Development of databases

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RESEARCH ARTICLE
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Key Points:
- Chlorophyll a concentration is retrieved from fluorescence profiles
- Phytoplankton communities size indices are retrieved from

Retrieving the vertical distribution of chlorophyll a concentration and phytoplankton community composition from in situ fluorescence profiles: A method based on a neural network with potential for global-scale applications

R. Sauzède1,2, H. Claustre1,2, C. Jamet3, J. Uitz1,2, J. Ras1,2, A. Mignot4, and F. D’Ortenzio1,2

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Vertical distribution of chlorophyll a concentration and phytoplankton community composition from in situ fluorescence profiles: a first database for the global ocean

R. Sauzède1,2, H. Lavigne3, H. Claustre1,2, J. Uitz1,2, C. Schmechtig1,2, F. D’Ortenzio1,2, C. Guinet4, and S. Pesant5,6
Comparison with databases of reference. Using bioregions for a more efficient use of existing data?

Sauzède et al., 2015 ESSD
DM-Chla Comparison with databases of reference

• Making historical (and heterogeneous) Chla fluorescence databases interoperable is an ongoing work

• The amount Chla fluorescence profiles in these database nevertheless remains a limitation to develop reference climatologies (e.g. 3° x 3°)

• Presently it seems that climatologies can only be developed at a regional scale (e.g. biogeochemical provinces) to envisage possible use in DM-QC
  – They will be restricted to perform /refine control on the range (regional test) and on the (seasonal) shape of the vertical profile
DM-Chla: comparison with satellite

- The OCR satellite “sees” the upper 1/5 of the euphotic zone (layer between surface and depth where 1% of the surface radiations still subsist)
  - ~ 5 m in a rich eutrophic system (NA bloom, upwelling)
  - ~ 30 m in the clearest waters (South Pacific Gyre)
- The comparison with float data thus only holds for such “surface” layers
- Here we use the globcolour product 4 km x 4 km, one-day matchup (other combination possible, not tested yet).
DM-Chla: comparison with satellite.
The data base used

- ~100 floats with Eco-triplet [(Chla, bb(700))] essentially deployed as part of EU, France, Italy, UK projects.
- Acquisition of a wide range of trophic (Chla range) and environmental conditions (O2 minimum).
- => the database analyzed is assumed to be representative of open ocean conditions
DM-Chla: comparison with satellite.
http://seasiderendezvous.fr/mapmatchupcomp
DM-Chla: comparison with satellite.
http://seasiderendezvous.fr/mapmatchupcomp
Biais in float vs satellite

This biais might be due to:

- Quenching correction issue
- Chla Satellite estimation
- Sensor calibration issue
Labrador Sea

North Atlantic
Sub-tropical gyre

Austral Ocean
Kerguelen area

Chla
non-photochemical quenching of fluorescence
SOCCOM: Chla overestimation by a factor of 7

From soccom group
Fluo / 7.6, Johnson pers.comm.
SOCLIM deployments during OISO
Labrador deployments along AR07E

\[
y = 4.0835x, \\
R^2 = 0.973
\]
Various deployments in the Med Sea

- For dataset 1: $y = 1.686x$, $R^2 = 0.7339$
- For dataset 2: $y = 1.875x$, $R^2 = 0.8225$
South Pacific Gyre

Lovbio086d

Lovbio086d

Chlorophyll a [mg.m^{-3}]

Chlorophyll a [mg.m^{-3}]

Depth [m]

Depth [m]

Lovbio086d

Lovbio089d

Chla Float (mg.m^{-3})

Chla Rosette (mg.m^{-3})

y = 1.875x

R^2 = 0.8225
Xing et al., (2011) JGR: retrieving Chla through a combined used of fluorescence, & radiometry profiles together with a bio-optical model.
Overestimation of Chla by fluorescence

Summary for Chla Bias

- There is presently a bias in the satellite vs float Chla (adjusted) relationships.
- This bias is not the consequence of the quenching correction which is a legitimate correction (profiling at night is not necessary).
- Rather, the Wetlabs calibration is questionable and an overestimation factor of 2 seems systematic (taking into consideration for producing RT-Chla?).
  - Wetlabs representatives are coming at LOV in December.
  - We have requested they do not change anything without any notice.
- Beside the overestimation factor, there is a consistent regional (natural) bias in the relationship (float vs HPLC Chla) or (float vs radiometric Chla) that is of more concern for producing DM-Chla.
Black Sea: issue of deep "Chla"
Increase in fluorescence with depth: e.g. South Pacific Gyre
\[ y = 0.3588x - 0.0006 \]
\[ R^2 = 0.9530 \]
• DM: there is a possibility to correct the « non-Chla » fluorescence increase with depth using information on the slope of CDOM increase. We begin to have sufficient data to make a **regional test and correction**?

• This correction might be especially appropriate (required) for sub-tropical gyres where it would impact the surface (extremely) low values..
Conclusions

Opportunities for joint use of Bio-Argo and Ocean Color

Ocean color side

- Flagging
- New calibration
- Detection of optical anomalies
- Regional algorithms
- Bioregions identification

Bio-Argo side

- Cross QC
- Cross validation
- Flagging
- New calibration
- Deployment
- Detection of optical anomalies
- Deployment strategy
- Bioregions confirmation

The common 3D picture

Assimilation/modelling/blending/statistical assemblage
To make available a tool to annotate/flag/label data

• The tool « seasiderendezvous.eu » is presently « in development » to be come a tool for helping in Chla and bb DM-QC.

• Any return suggestion on how to make it adapted to the user community is welcome