

On the use of satellite altimeter data in Argo quality control

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1 - Summary

- Objectives :**
 - to check the quality of the Argo observations
 - to perform a general consistency check of the Argo data set
- CALVAL (CALibration/ VALidation) :**
 - mono-obs : T/S fields/observations are used to control Argo T/S observations [1,2]
 - multi-obs : other observations (than T/S) are used to control Argo T/S observations – like satellite altimeter measurements [3] - this study !
 - model-obs : model outputs are used to control Argo T/S observations - to be further developed ...
- Method :** compares co-located Altimeter Sea Level Anomalies (SLA) and Dynamic Height Anomalies (DHA) calculated from Argo T/S profiles.

2 - Data and Method

- For each Argo float time series :

$$DHA = DH - \text{Mean-DH} / SLA$$

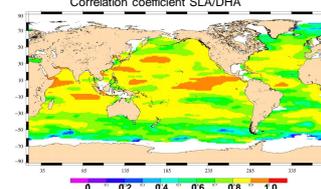
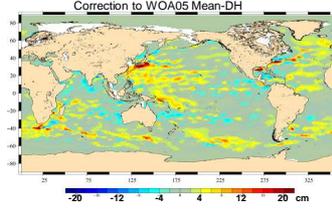
DH : Argo Coriolis-GDAC data base
DH calculated from T/S profile using a reference level of: 200, 400, 900, 1200 or 1900 dbar (= mean max depth of each float)

Mean-DH : Argo climatology
SLA : AVISO combined maps – co-located in time and space to the Argo measurements

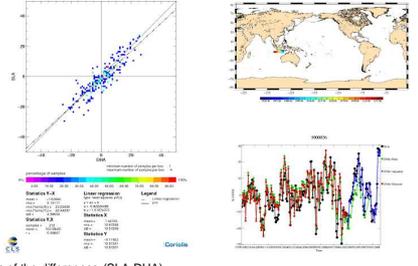
- Differences between DHA and SLA can arise from :**

- Differences in the physical content of the two data sets
- Problems in SLA (assumed to be perfect for the study)
- Problems in the Mean-DH / Inconsistencies between Mean-DH and DH
- **Problems in DH** (i.e. the Argo data set)
 - **To take into account the differences in the physical content of the two data sets → mean representative statistics of these differences are used**

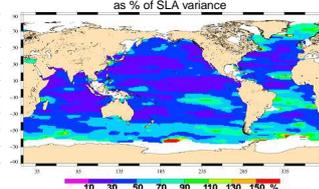
- To minimize the problems in the Mean-DH → an Argo Mean-DH is used**
Very important parameter for bias identification



- Example for WMO 5900026 float :**



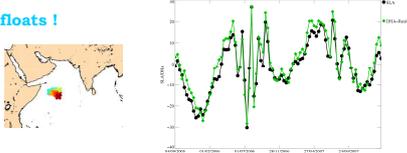
Rms of the differences (SLA-DHA) as % of SLA variance



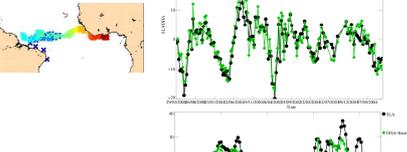
3 - Very good consistency

- The majority of floats !**

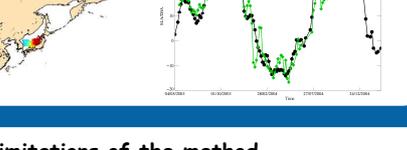
Float : 1900586
r : 0.96
rms-diff : 12.53 %
mean-diff : -2.27 cm
samples : 90



Float : 3900133
r : 0.91
rms-diff : 20.44 %
mean-diff : -0.73 cm
samples : 147



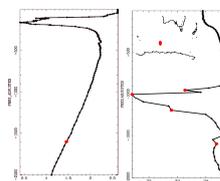
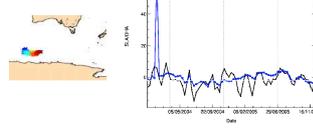
Float : 2900138
r : 0.94
rms-diff : 6.53 %
mean-diff : 1.20 cm
samples : 112



4 - Representative anomalies

- Spike**

Float : 5900155

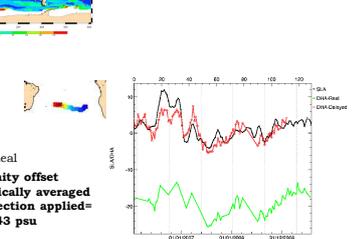


Spike corresponding T/S profile
red dots corresponds to flag > 1

- Offset**

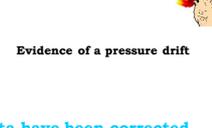
Float : 1900581
r : 0.61
rms-diff : 2187.00 %
mean-diff : 15 cm
samples : 69
* Statistics on DHA-Real

Comparison with the mean representative statistics



- Drift**

Float : 5900963



Evidence of a pressure drift

* Data have been corrected

Salinity offset
Vertically averaged
correction applied = -0.243 psu

Figure : courtesy of Annie Wong

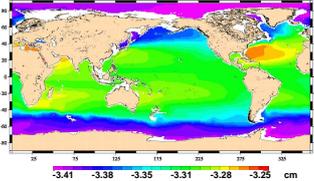
5 - Limitations of the method

- Examples (section 4) show that detected anomalies corresponds to large drift/offset in the pressure/salinity fields (> 15 dbar, -0.2 psu)

- Theoretical study – using WOA05 fields**

Salinity offset

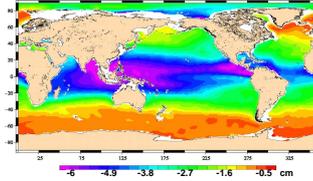
Impact of a salinity offset of +0.05 psu on a (0-900)dbar DH



- Little geographical variations of the impact
- Impact ↗ with reference level and offset

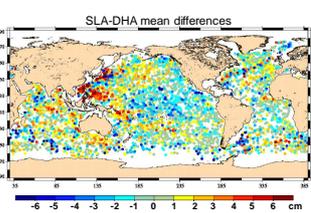
Pressure offset

Impact of a pressure offset of -10 dbar on a (0-900)dbar DH



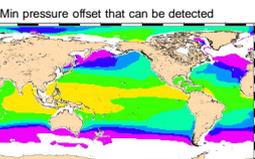
- Large geographical variations of the impact
- Impact ↗ with offset, small differences with ref level

- Observed mean SLA-DHA differences**



- Limitations of the method**

If 5 cm is considered to be the smallest offset to be detected between SLA and DHA



Reference level (dbar)	Min salinity offset (psu)
200	0.3
400	0.17
900	0.08
1200	0.06
1900	0.04

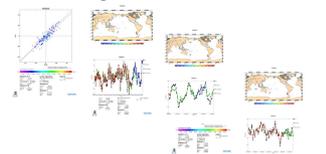
6 - Diffusion of the results (updated every 4 months)

- ftp://ftp.ifremer.fr/ifremer/argo/etc/argo-ast9-item13- AltimeterComparison

List of floats to be checked :

DAC	WMO	INST-TYPE
kma	2900434	846
meds	4900116	846
meds	51887	831
incalis	2900783	846
coriolis	69039	842
bodc	1900141	842
.....		

+ 1 figure for each float



- In the AIC monthly report

7 - Conclusions

- Method very complementary to the real-time and delayed-mode existing QC procedures
- DHA time series → quick look at the general behavior of the time series
- Floats mainly extracted in the real-time data set – big offset, large drift
- Limitations of the method: small drift and offset not detectable + in high variability regions
- Perspectives :
 - Regular update of the results
 - Work on the Mean-DH to reduce SLA-DHA mean differences
 - Perform a global temporal consistency check between SLA and DHA

References

- Gaillard, F., E. Autret, V. Thierry, P. Galaup, C. Coatanoan, T. Loubrieu, 2009: Quality control of large Argo data sets, J. Atmos. Oceanic. Technol., 26, doi: 10.1175/2008JTECH0552.1.
- Wong, A.P.S., G.C. Johnson, and W.B. Owens, 2003: Delayed-mode calibration of autonomous CTD profiling float salinity data by 0-S climatology, J. Atmos. Oceanic. Technol., 20, 308-318.
- Guinehut, S., C. Coatanoan, A.-L. Dhomps, P.-Y. Le Traon and G. Larnicol, 2009: On the use of satellite altimeter data in Argo quality control, J. Atmos. Oceanic. Technol., 26, doi: 10.1175/2008JTECH048.1.