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 – Mean-DH **/ SLA**

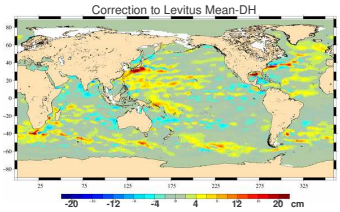
DH : Argo Coriolis-GDAC data base
DH calculated from T/S profile using a reference level at 900-m
Mean-DH : Argo climatology
SLA : AVISO combined maps – co-located in time and space to the Argo measurements

- **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)

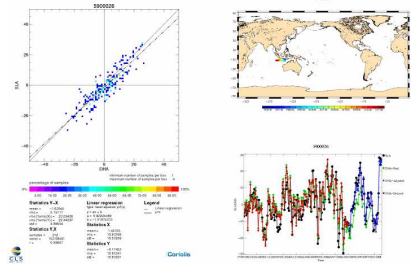
- **To take into account the differences in the physical content of the two data sets ➔ mean representative statistics of these differences are used**

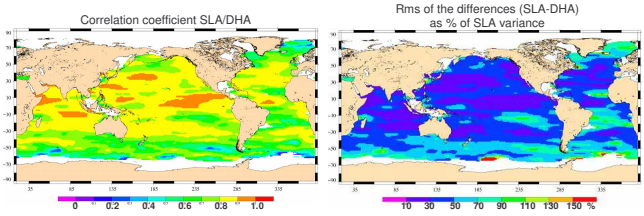
- **To minimize the problems in the Mean-DH ➔ an Argo Mean-DH is used**

Very important parameter for bias identification



- **Example for WMO 5900026 float :**

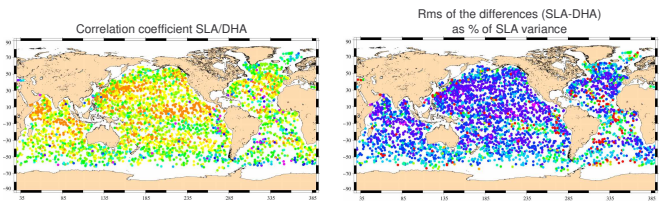




3 - Global results

- **The same statistics are calculated for each Argo float time series :**

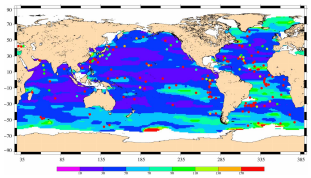
One point represents a time series at its mean position



➔ **Questionable** floats can already be extracted by comparing to the neighbors

- **Comparison with the mean representative statistics :**

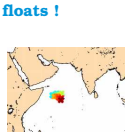
➔ Extraction of 111 anomalous floats

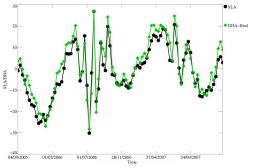


4 - Very good consistency

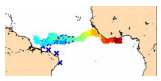
- **The majority of floats !**

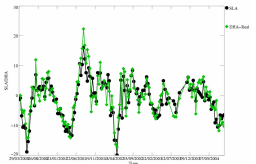
Float : **1900586**
r : 0.96
rms-diff : 12.53 %
mean-diff : -2.27 cm
samples : 90



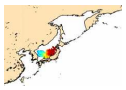


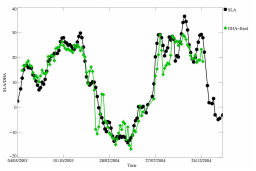
Float : **3900133**
r : 0.91
rms-diff : 20.44 %
mean-diff : -0.73 cm
samples : 147





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

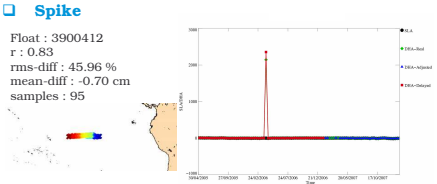




5 - Representative anomalies*

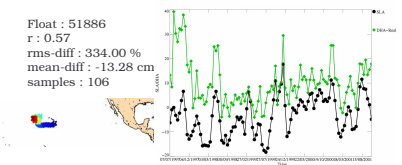
- **Spike**

Float : 3900412
r : 0.83
rms-diff : 45.96 %
mean-diff : -0.70 cm
samples : 95



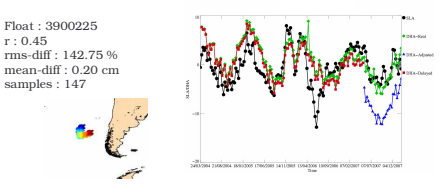
- **Bias**

Float : 51886
r : 0.57
rms-diff : 334.00 %
mean-diff : -13.28 cm
samples : 106



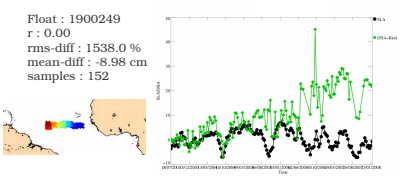
- **Offset in the adjusted time series**

Float : 3900225
r : 0.45
rms-diff : 142.75 %
mean-diff : 0.20 cm
samples : 147



- **Drift**

Float : 1900249
r : 0.00
rms-diff : 1538.0 %
mean-diff : -8.98 cm
samples : 152



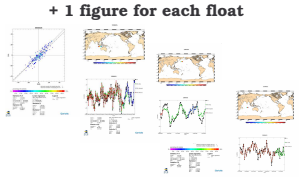
*** Floats have been corrected**

5 - Diffusion of the results

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

List of floats to be checked : **+ 1 figure for each float**

DAC	WMO	INST-TYPE
kma	2900434	846
meds	4900116	846
meds	51886	831
meds	51887	831
incois	2900783	846
coriolis	1900651	846
coriolis	69039	842
bodc	1900141	842
bodc	1900454	842
.....		



➢ **The AIC monthly report for May / updated in August**

7 - Conclusions

➢ Errors mainly detected in the real-time data set – big big errors (because of the very conservative criteria used)
➢ Only a few isolated examples for adjusted values ➔ additional qualification needed
➢ Only a few isolated example for delayed-mode files ➔ additional qualification needed

➢ The method is efficient for big big errors (spikes, offset, drift) – but only says that at least one of the field has a problem (P, S) ➔ additional analyses are need
➢ The method is complementary to the real-time and delayed-mode QC

➢ What the method is not able to do : extract small errors in high variability regions and very small bias (~2-3 cm) in lower variability regions

8 - Perspectives

➢ To update the results on a regular basis (every 4 months)

➢ To quantify the limitation of the method – what kind of signals in term of T/S/P the method is able to detect ? – might depend on the area

➢ Method to be adapted to the mean max depth of each float

References

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