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:
  - DH = DH - 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

3 - Very good consistency

- The majority of floats:
  - Diff float = 1900586
    - r : 0.94
    - max-diff: 12.53 %
    - mean-diff: -0.27 cm
    - samples: 99

  - SPA float = 3900133
    - r : 0.94
    - max-diff: 20.44 %
    - mean-diff: -0.75 cm
    - samples: 147

  - Diff float = 2900128
    - r : 0.94
    - max-diff: 6.53 %
    - mean-diff: -1.20 cm
    - samples: 112

4 - Representative anomalies

- Extremes (section 6) show that detected anomalies corresponds to large drift/offset in the pressure/salinity fields (> 15 dbar, -0.2 psu)

- Theoretical study - using WOAS05 fields

  Salinity offset
  - Impact of a salinity offset of +0.15 psu on a (0-900) dbar DH

  Pressure offset
  - Impact of a pressure offset of -10 dbar on a (900-1900) dbar DH

- Little geographical variations of the impact
- Impact with reference level and offset
- Large geographical variations of the impact
- Impact with offset, small differences with ref level

- Observed mean SLA-DHA differences

  - Min pressure offset that can be detected
  - Min salinity offset that can be detected

5 - Limitations of the method

- Examples (section 6) show that detected anomalies corresponds to large drift/offset in the pressure/salinity fields (> 15 dbar, -0.2 psu)

- Theoretical study - using WOAS05 fields

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


- List of floats to be checked:
  - 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

Figure: courtesy of Bone Wang