SERVICE ALTIMETRIE & LOCALISATION PRECISE

Quality assessment of tide gauge and altimeter measurements through SSH comparisons

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Overview

- Purpose : SSH comparison from a global approach between tide gauges and each altimeter mission : Jason-1, Jason-2, TOEX/Poseidon, Envisat
- This activity is supported by CNES (SALP project) and ESA
- Objectives :

  ⇒ Monitoring the SSH bias between altimeter missions and in-situ tide gauge measurements in order to detect potential drift or jumps in MSL

  ⇒ Estimate the quality of new altimeter standards analyzing the SSH consistency between tide gauges and altimeters

  ⇒ Detect anomalies on tide gauges time data series thanks to a cross-comparison with all the altimeters

1 - Method and data used

- The comparison method is composed of the following steps :

⇒ Calculation of the altimeter and tide gauge SSH applying DAC and tidal corrections, MSS

⇒ Collocation of altimeter and in-situ data selecting the closest altimeter measurements for each tide gauge

⇒ Calculation of SSH differences at each tide gauges after removing colocated time data series not well correlated enough (due geophysical processes or jump in tide gauges)

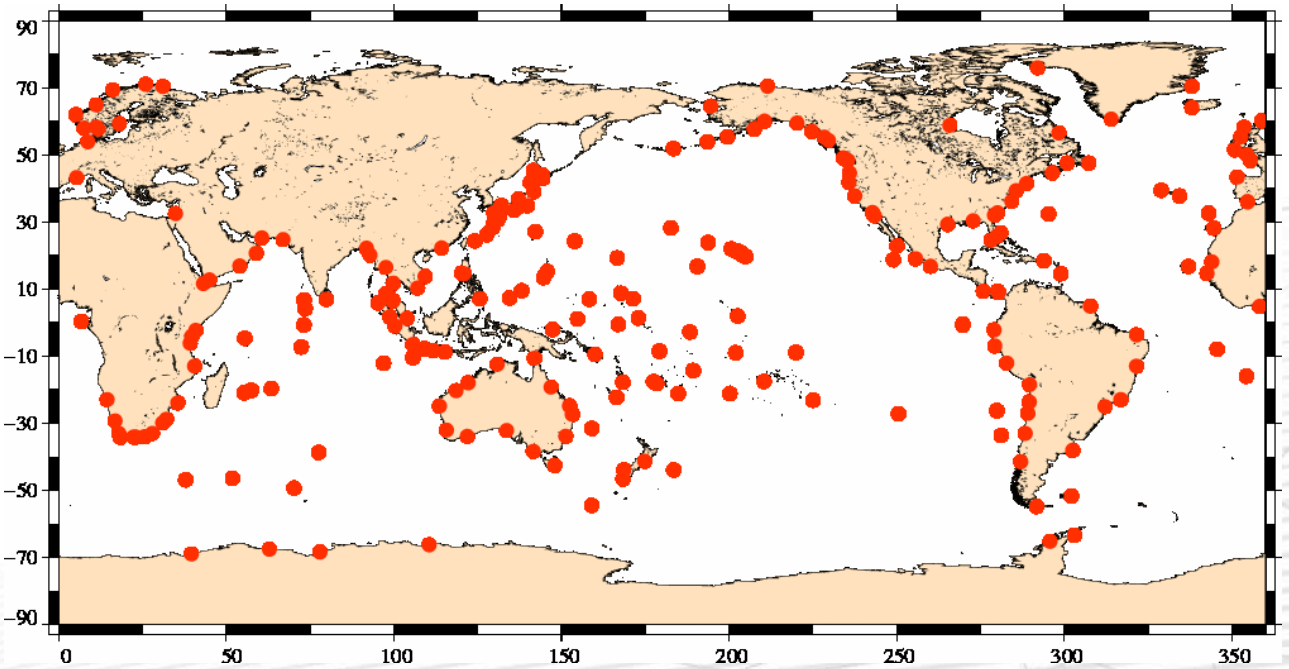
⇒ Computation of the altimeter SSH drift from all the remaining time data series (after editing)

⇒ Application of a drift correction to take into account the vertical movements only observed by tide gauges (GIA, tectonic phenomena,…) : this correction has been estimated close to -0.2 mm/yr (thanks to GPS station network).

1 - Method and data used

- We use the GLOSS/CLIVAR TG network : 255 TG very well spread out along coastal areas

- After removing T/G with jump or abnormal strong drift, it remains close to 120 TG

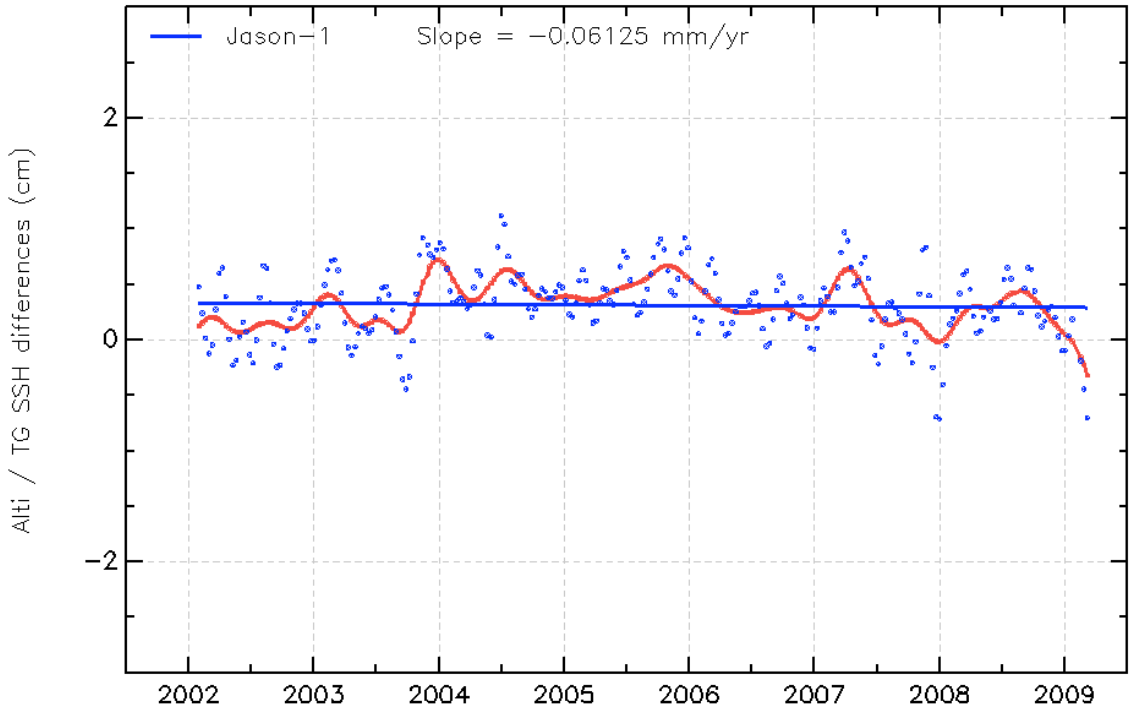


2 – Estimation of the MSL drift : Jason-1

- For Jason-1 :

⇒ GDR B / GDR C products are used (linking together at cycle 232)

⇒ No significant drift with TG is observed : **-0.1 mm/yr**



2 – Estimation of the MSL drift : Jason-2

- For Jason-1 :

⇒ GDR B / GDR C products are used (linking together at cycle 232)

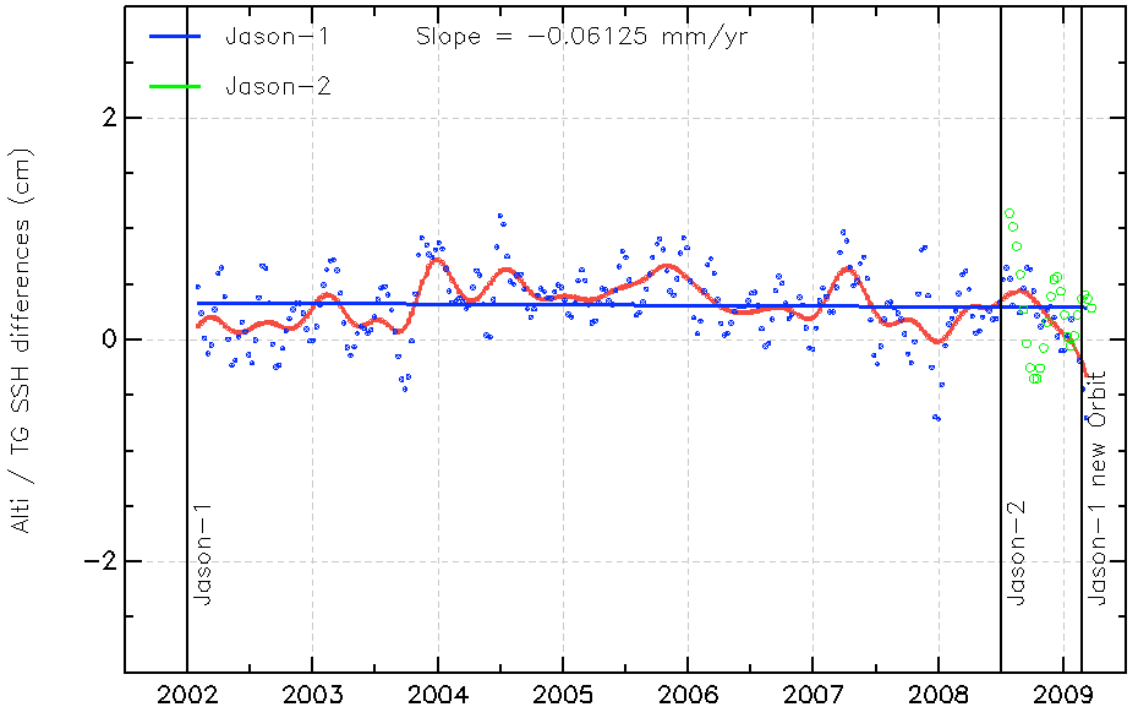
⇒ No significant drift with TG is observed : **-0.1 mm/yr**

- For Jason-2 :

⇒ 24 first Jason-2 GDR have been used

⇒ The period is too short to estimate the drift

⇒ Jason-1 / Jason-2 inter- comparisor is more precise



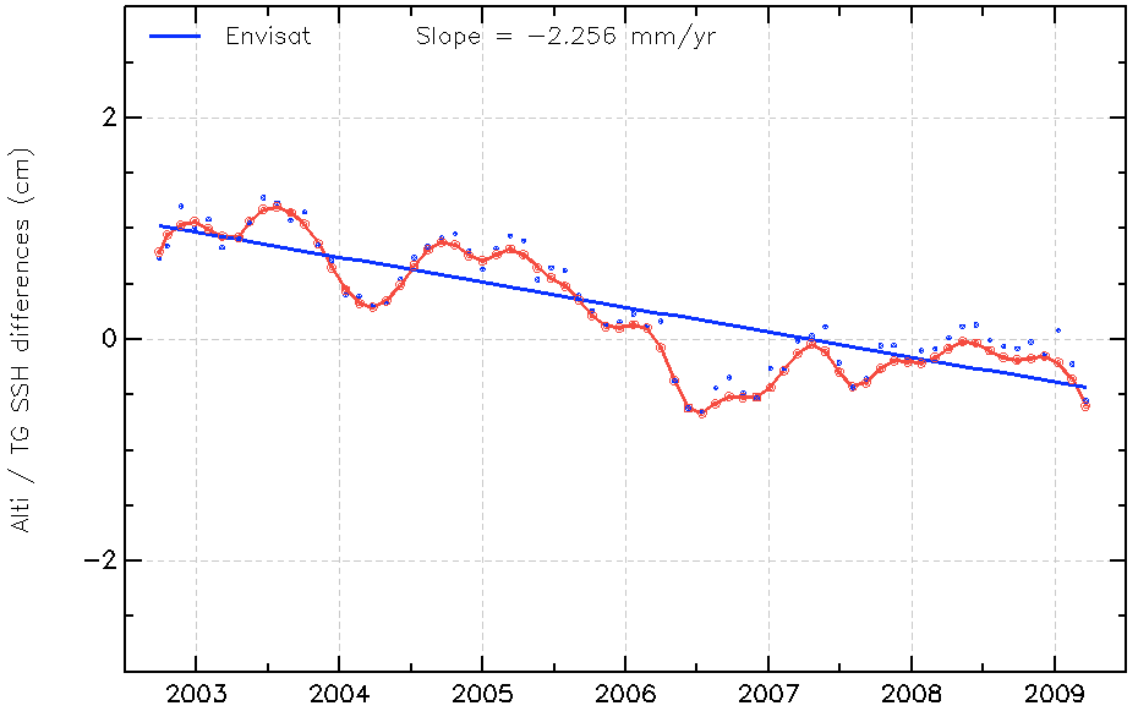
- **This result highlights the Jason-1 reliability to calculate the global MSL trend**

4 – Estimation of the MSL drift : Envisat

- For Envisat:

⇒ As Envisat GDR are not homogenous, SSH have been calculated with homogenous corrections updated over all the period (when it's possible)

⇒ Significant drift with TG is observed close to **-2.2 mm/yr** over all the period.



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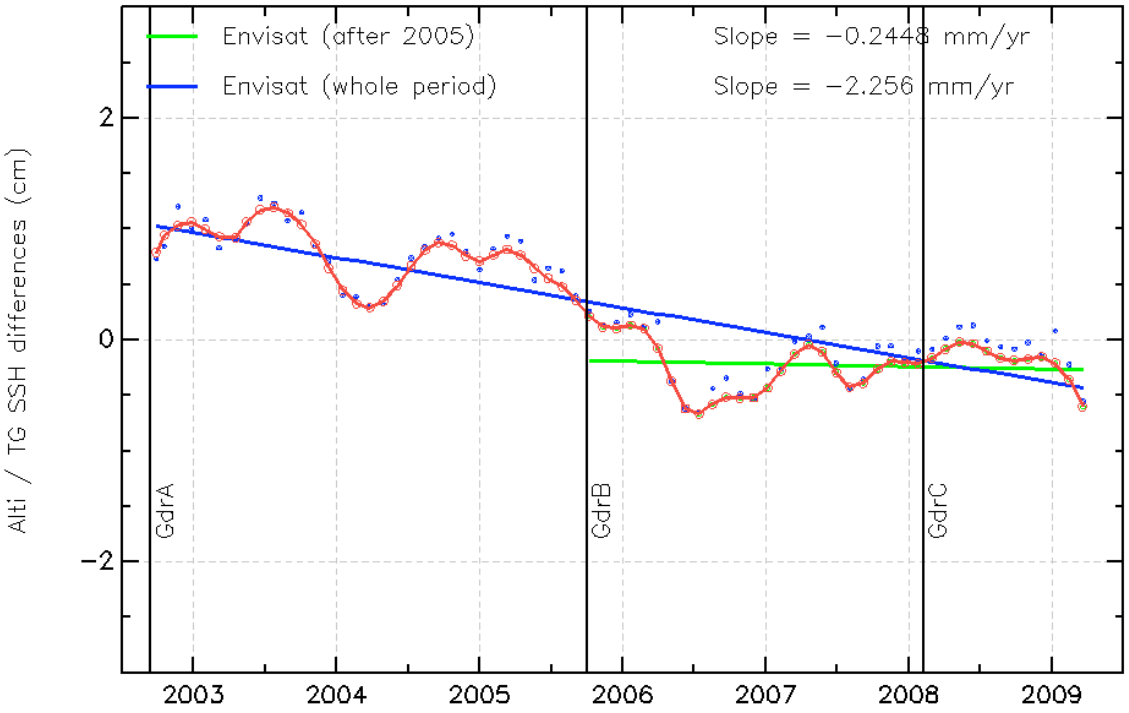
- Separating GDR A and GDRB/C periods :

⇒ Drift seems inexistent after October 2005 : **-0.2 mm/yr** (but the period length is short …)



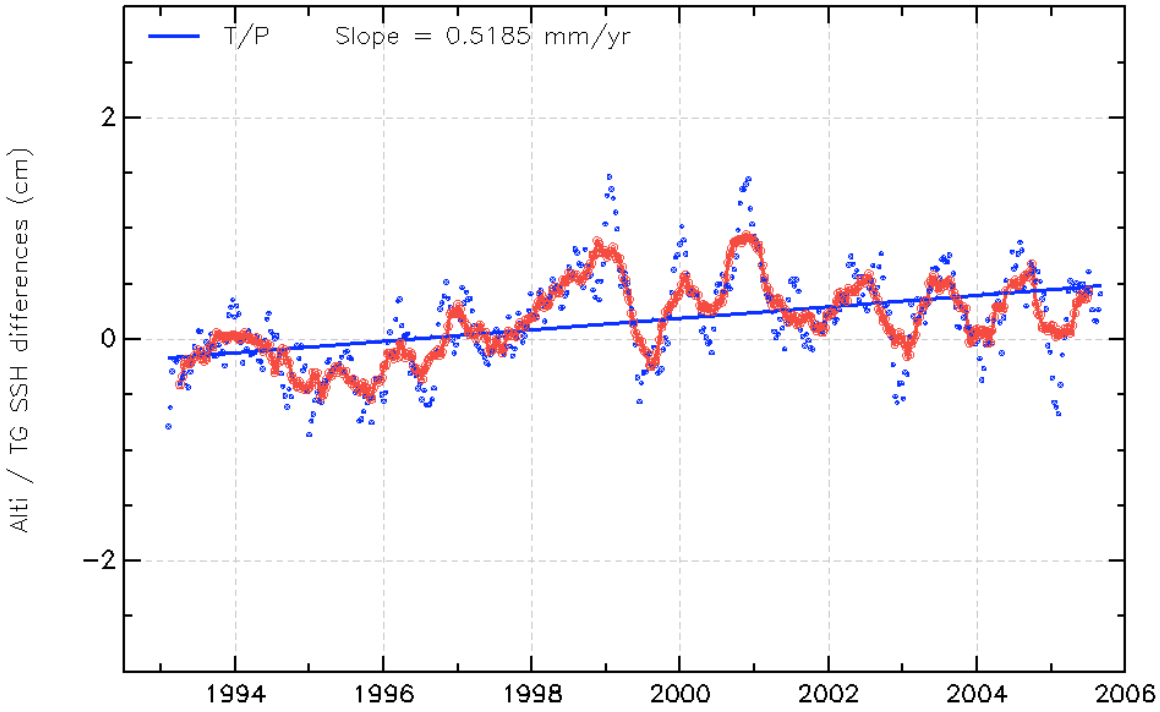
- This result is consistent with global CalVal analyses showing the Envisat MSL rise 1.8 mm/yr weaker than for Jason-1 : see Ollivier's Envisat Calval poster

5 – Estimation of the MSL drift : TOPEX/Poseidon

- For TOPEX/Poseidon:

⇒ SSH have been calculated from updated M-GDR products : GSFC orbit (2008), new tidal and DAC corrections, corrected TMR, …

⇒ A weak drift with TG is observed close to **+0.5 mm/yr** over all the altimeter period



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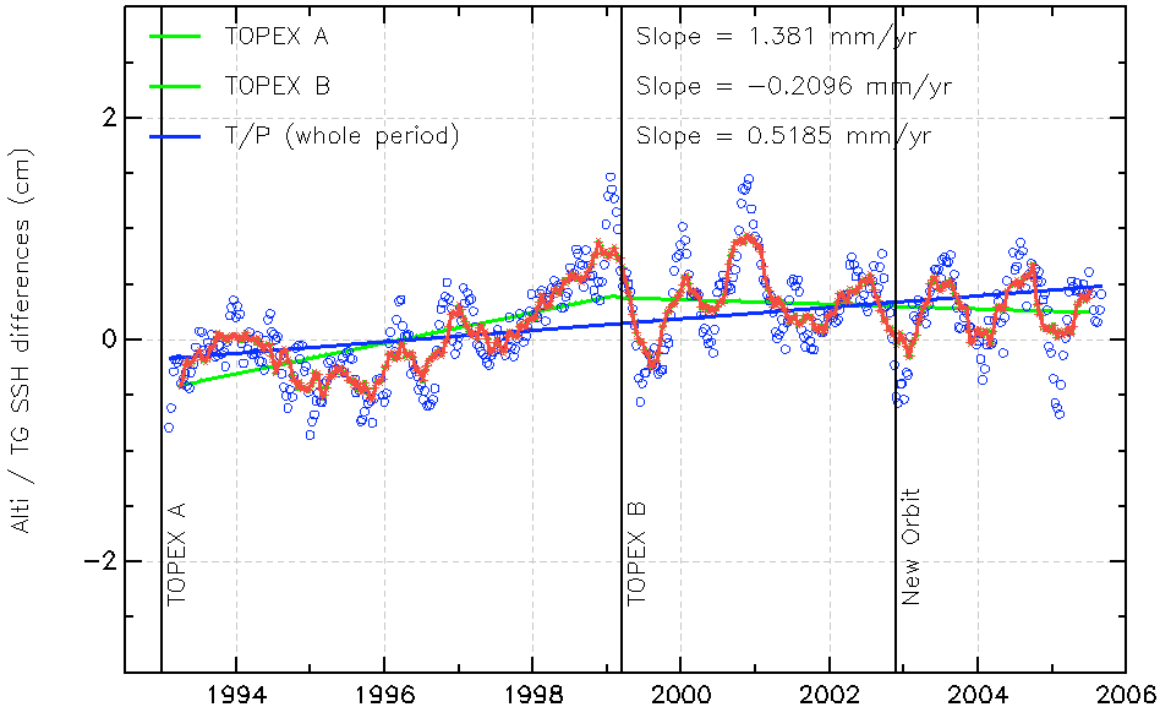
- The drift is very weak (**-0.2 mm/yr**) over the 7-year TOPEX B period whereas it is stronger over the 6-year TOPEX A period (**+1.3 mm/yr**)



- The TOPEX-A SSH drift detected seems well correlated with the SWH and Sigma0 drifts aslo observed on the same period due to TOPEX-A anomalies.

Conclusion

- This study demonstrates the ability of the method to detect a SSH altimeter drift :
  - ⇒ Envisat MSL drift = -2.2 mm/yr : consistent with global Cal/Val analyses
  - ⇒ TOPEX A drift = +1.3 mm/yr : this result has to be analyzed thoroughly, especially testing the impact of retracked T/P data.

- But the error of the method is significant :
  - ⇒ The formal error adjustment (on the order of 0.2 mm/yr)
  - ⇒ The uncertainty to take into account the vertical movements
  - ⇒ Sensitivity to the tide gauges number impacting the drift around ± 0.2 mm/yr

- Finally, the drift accuracy is close to ± 0.5 mm/yr over the whole altimeter period
  - ⇒ It is larger than the GMSL drift observed combining Jason-1 and T/P (+0.2 mm/yr)

- The accuracy of the method could be improved using tide gauges corrected from jumps, using an extended GPS station network, and improving the colocation method.