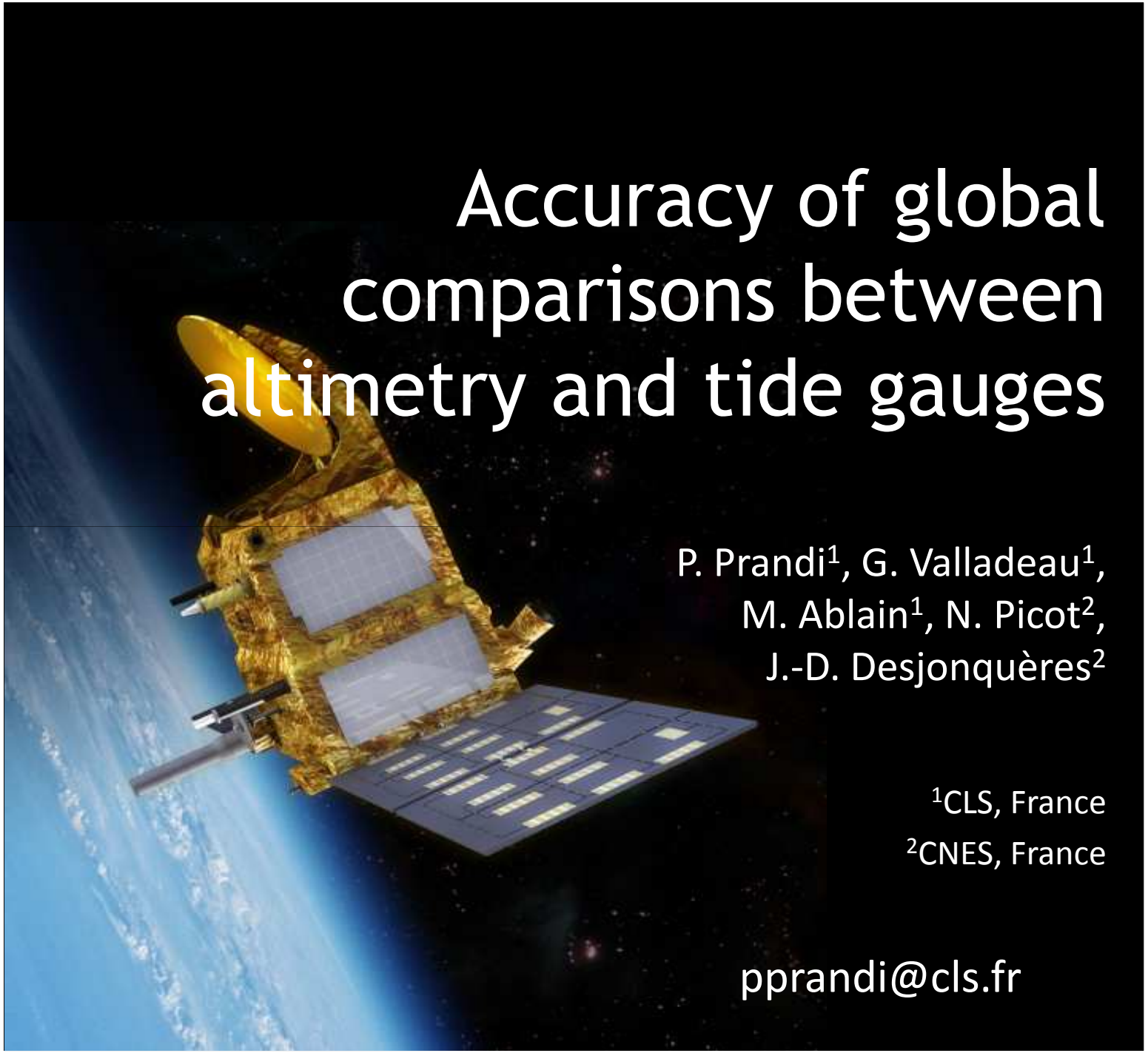


Accuracy of global comparisons between altimetry and tide gauges

P. Prandi[1], G. Valladeau[1],
M. Ablain[1], N. Picot[2],
J.-D. Desjonquères[2]

[1]CLS, France
[2]CNES, France

pprandi@cls.fr

CLS
COLLECTE LOCALISATION SATELLITES

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

SALP
Service Altimetrie & Localisation Precise

OST/ST 2015

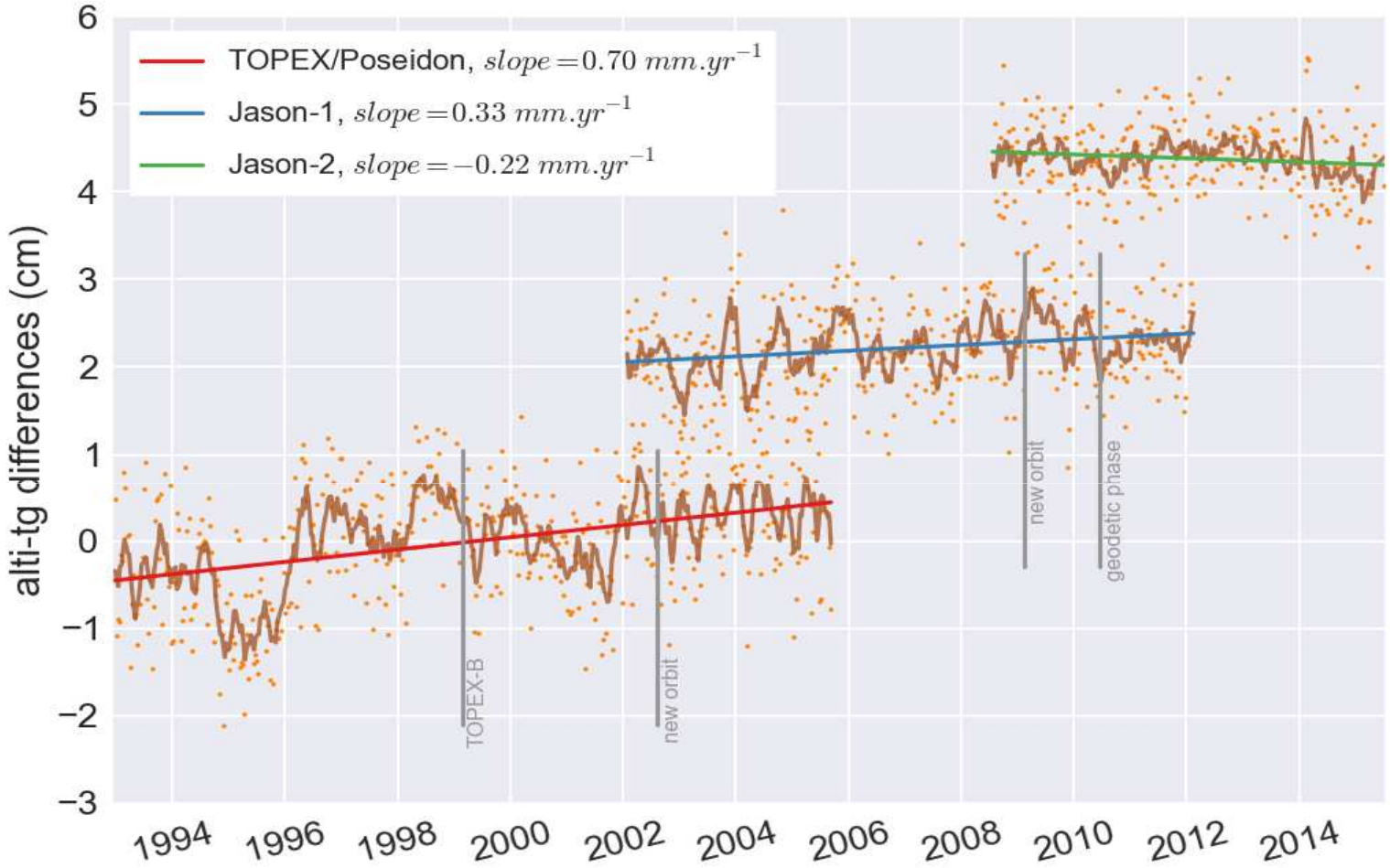
October 19-24, 2015
Reston, VA

Alti/TG comparison activities at CLS

- Routine comparisons between altimetry and tide gauges as part of the CNES SALP project,
- They provide a tool for the validation of altimetry missions
  - Detection of drifts/shifts in altimetry data,
  - Evaluation of new standards/processings
- Also provides a QC for in-situ time series,
  - Information cards available through AVISO website

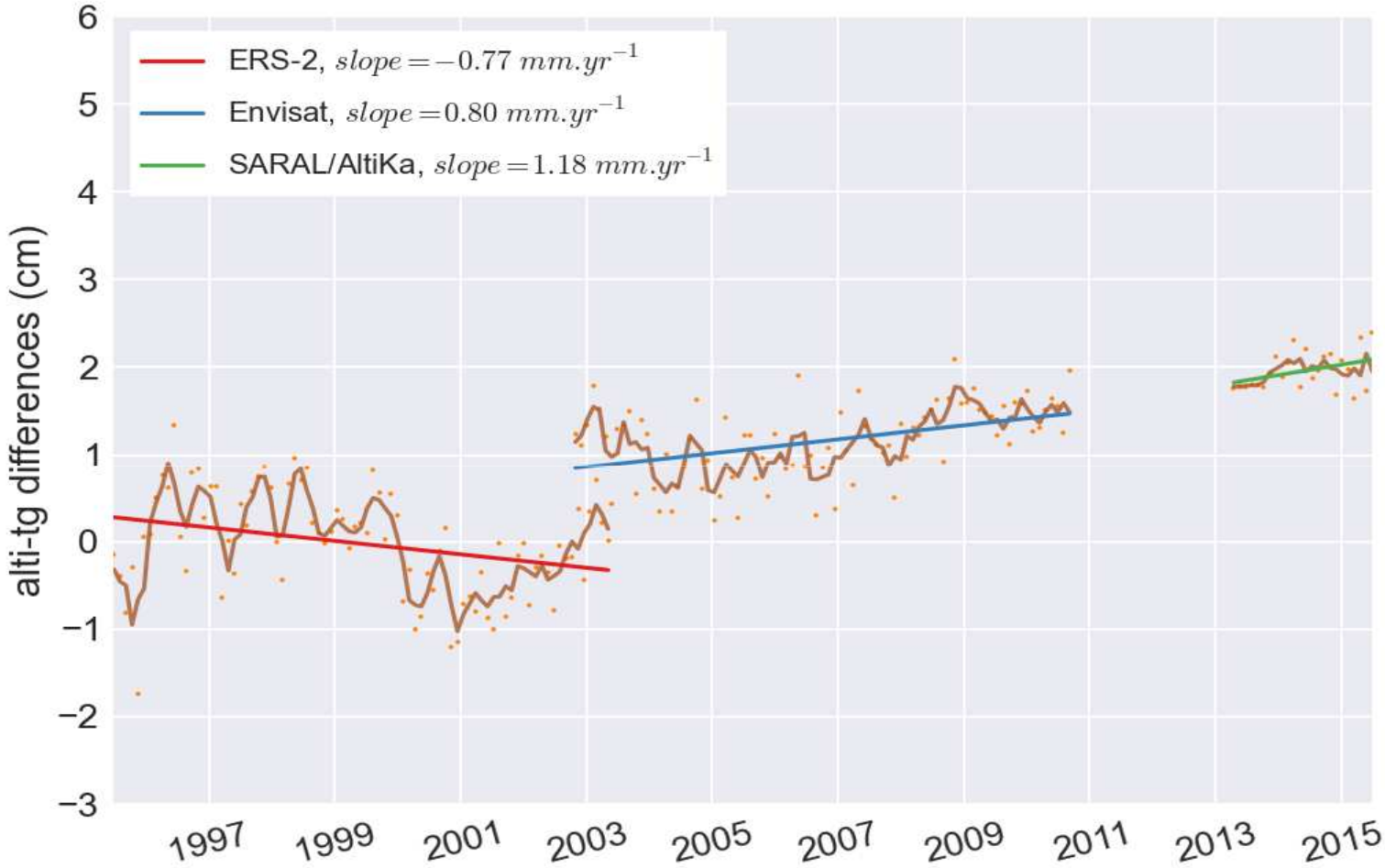
RESULTS OF ROUTINE ALTI/TG COMPARISONS

TOPEX Orbit



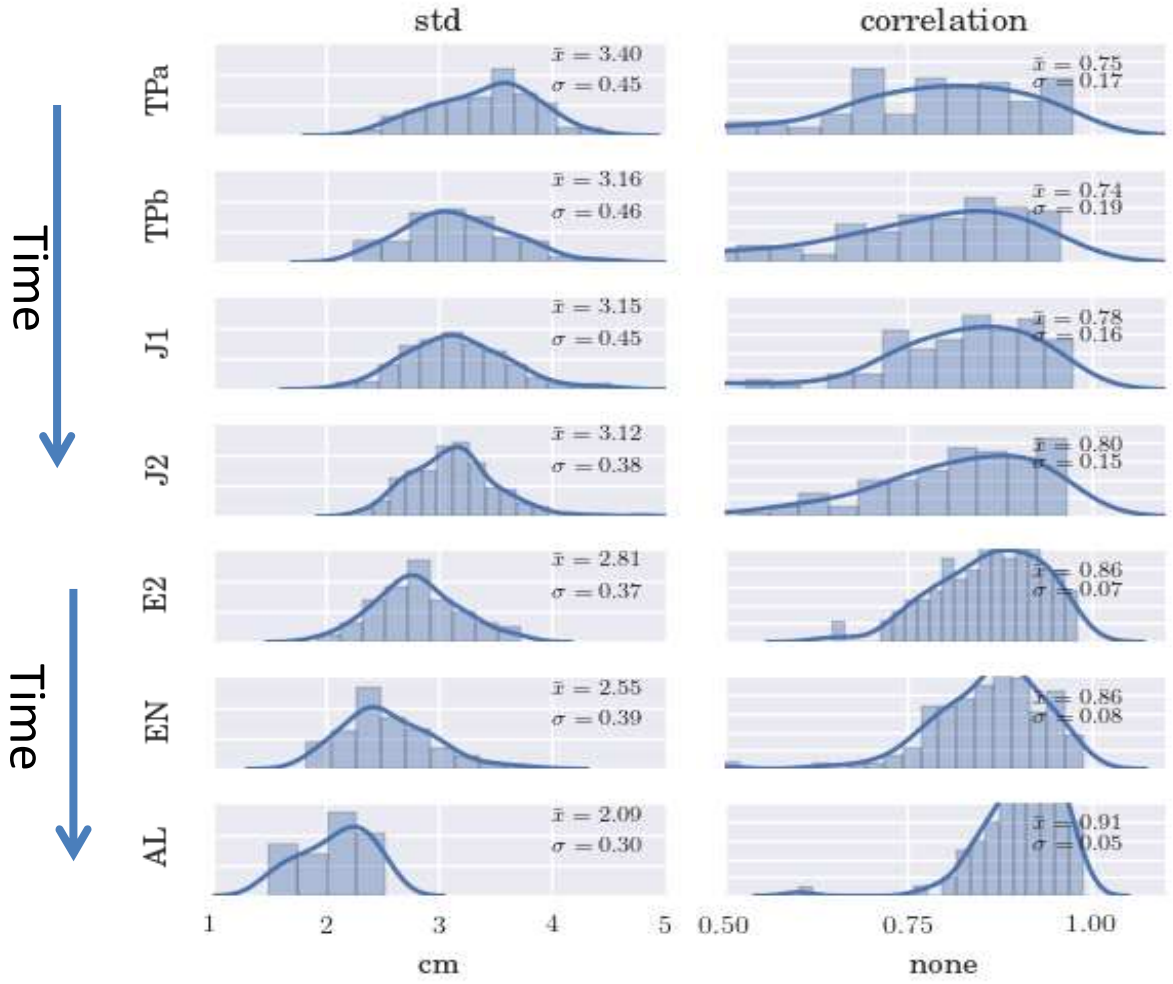
- Slightly positive drift on TOPEX, larger on TOPEX-A
- No drift on Jason-1 and Jason-2

ERS Orbit



- Negative drift on ERS-2, positive on Envisat,
- SARAL too short

Evolution over time

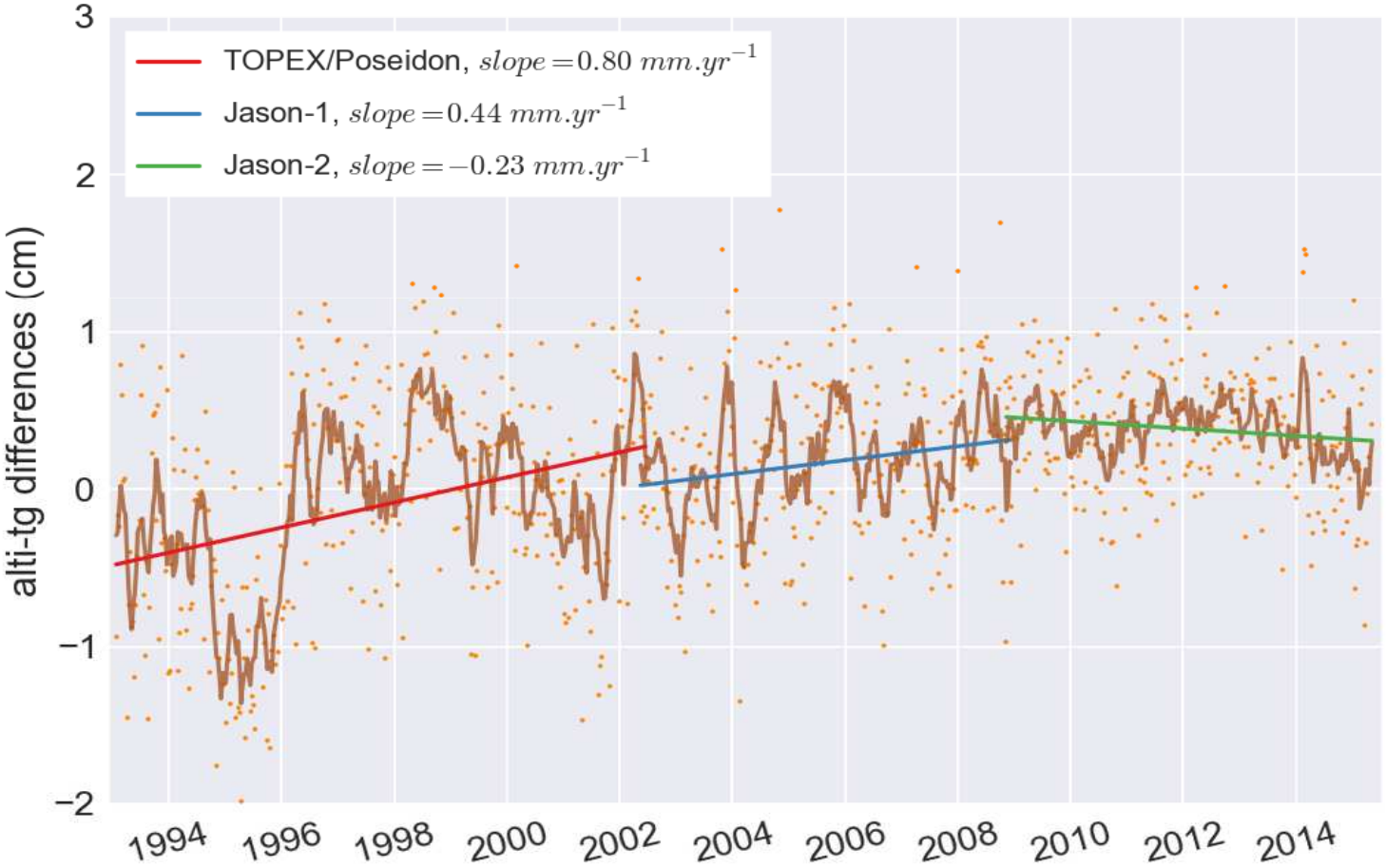


- General evolution towards a better agreement between altimetry and tide gauges

Reference MSL drift detection

- Several errors affect the method,
- What level of drift can we detect ?

- 0.4 mm/yr (Leuliette et al., 2004)
- 0.7 mm/yr (Valladeau et al., 2012)
- 0.4 mm/yr (Watson et al., 2015)



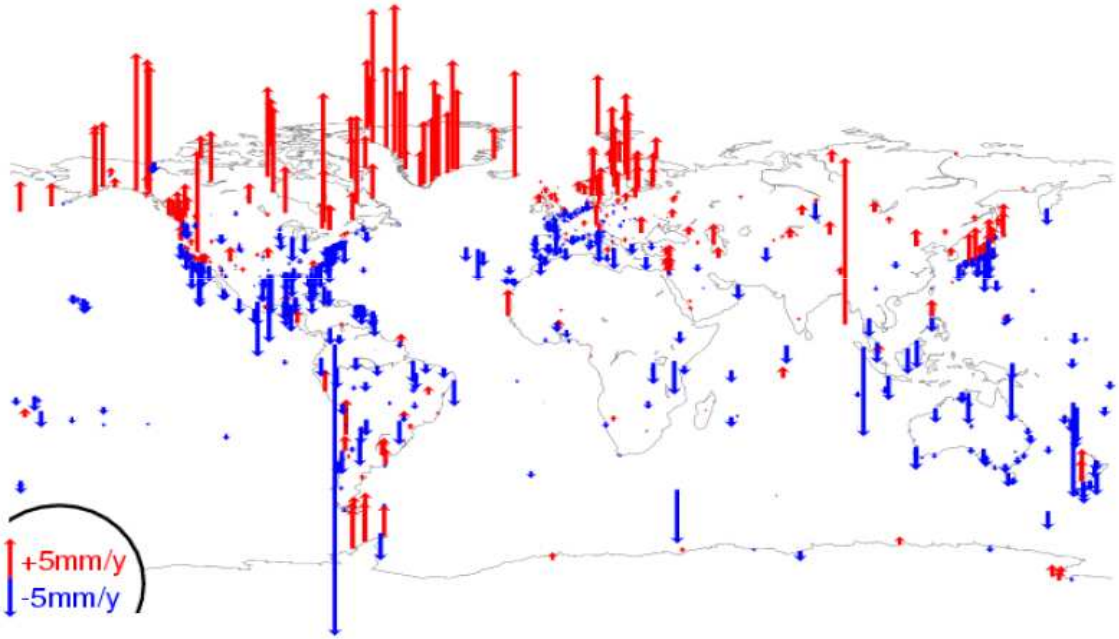
ERROR SOURCES & UNCERTAINTIES

Error sources

- Vertical land motion
  - Questions on how to correct for them
- In-situ spatial sampling
  - How we estimate a global mean
- In-situ QC
  - The in-situ network used
- Altimetry and TG colocation
- Short time series

Vertical Land Motion

Vertical velocities of GPS stations in ITRF2014



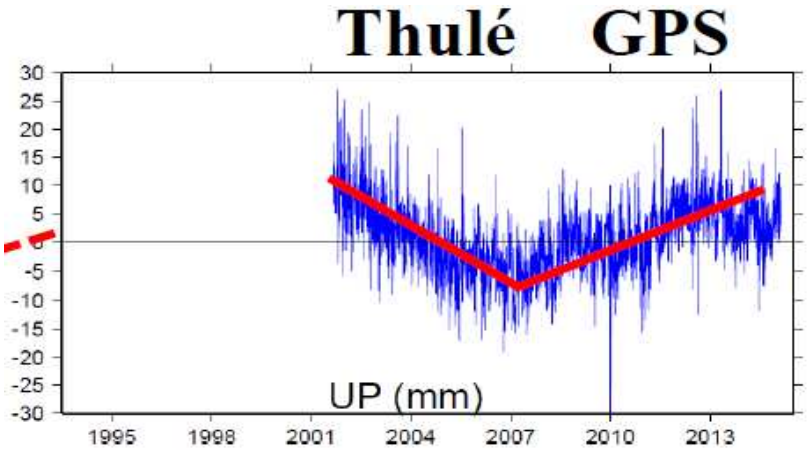


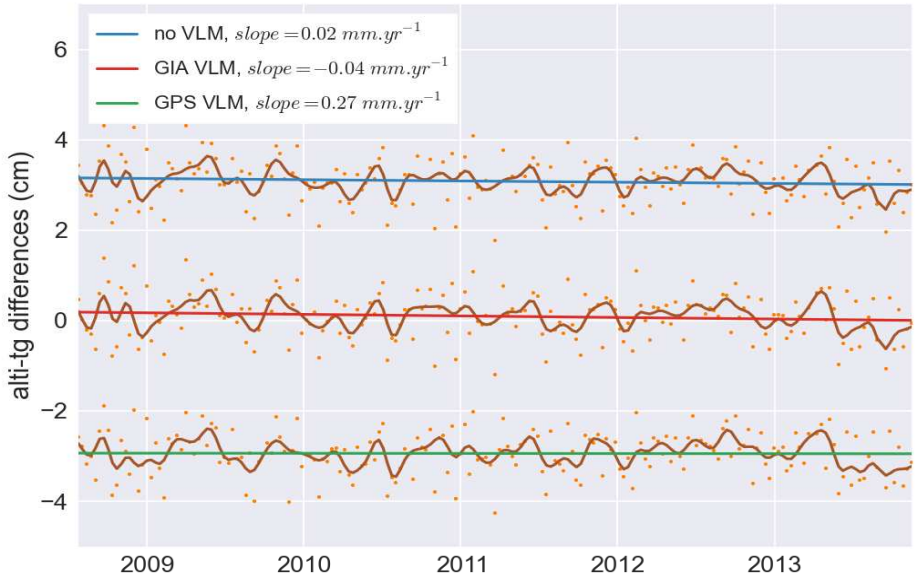
Figure courtesy of Z. Altamimi

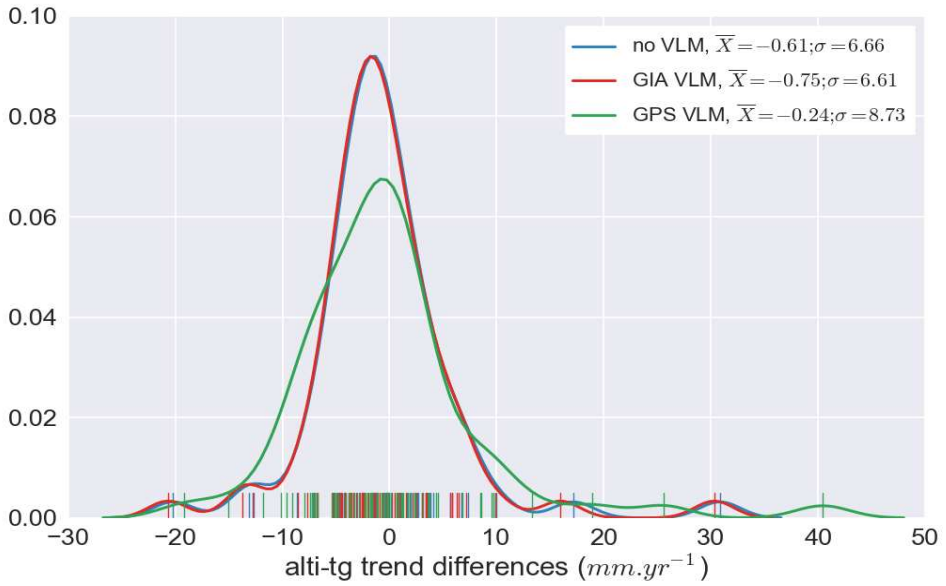
- GIA models are not enough,
- Linearity assumption questionnable,

Vertical Land Motion

- Changing the VLM impacts the global drift
- On Jason-2 by 0.3 mm/yr (0.5 on Envisat)
- No reduction of the spread of alti-tg trends

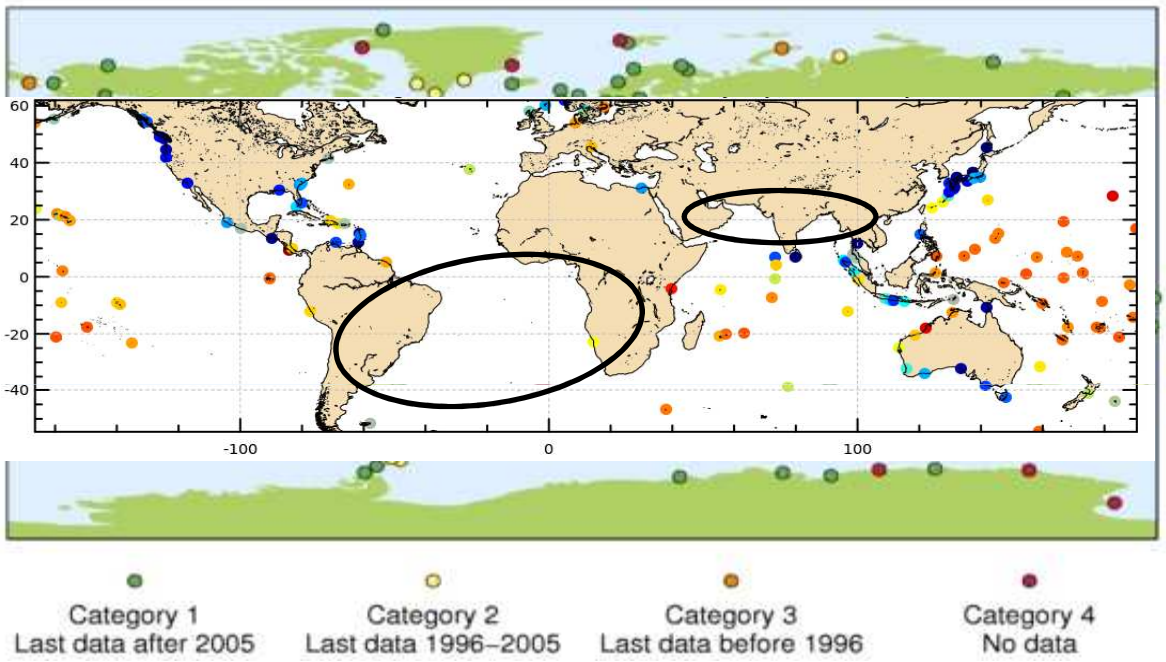
=> not able to establish that GPS VLM improves the method





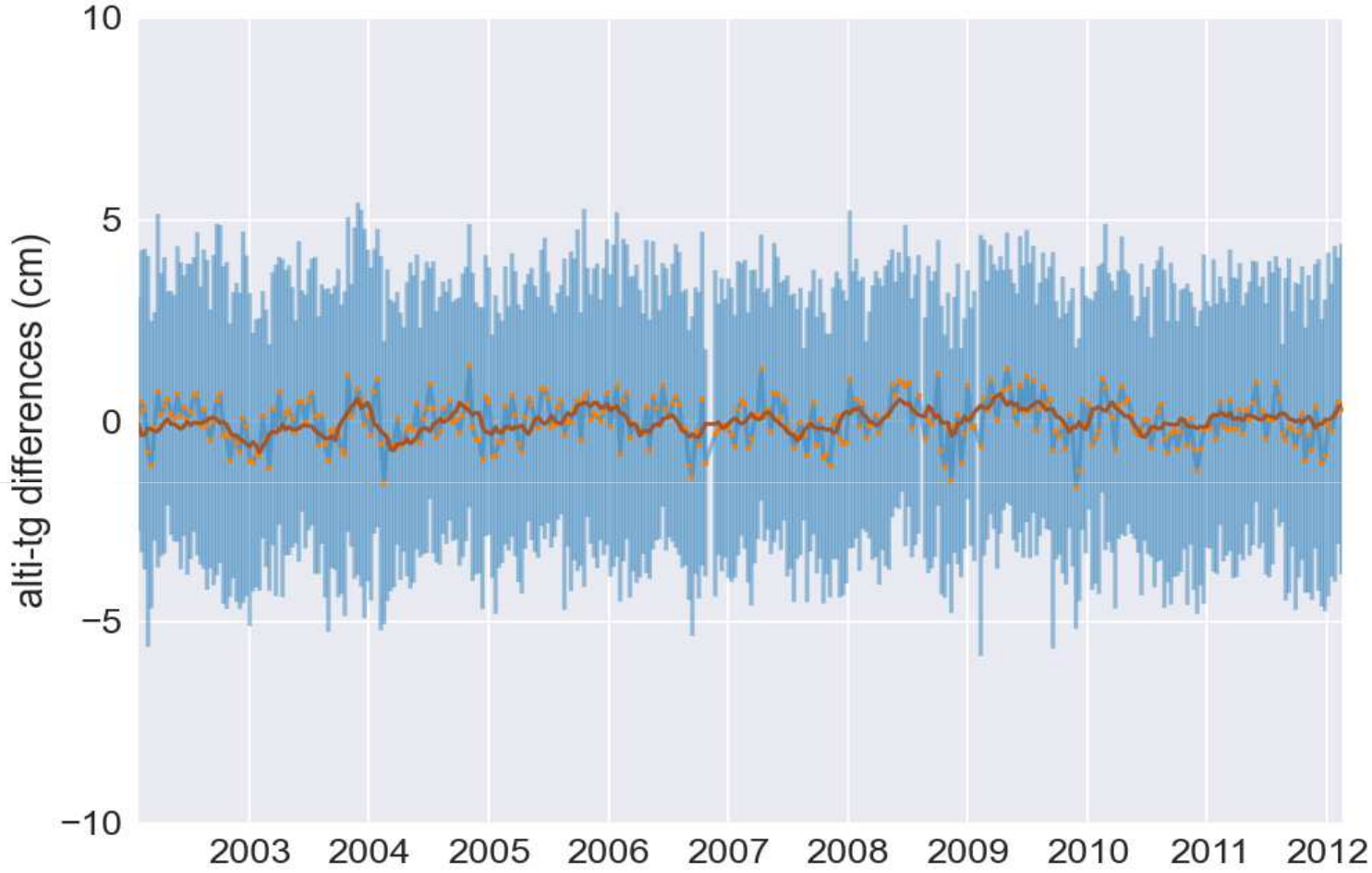
In-situ sampling

- GLOSS Core Network: 300 stations
- Current global analysis
  - CLS: ≈150 stations
  - Mitchum, 2000: 64 stations
  - Watson, 2015, 96 stations



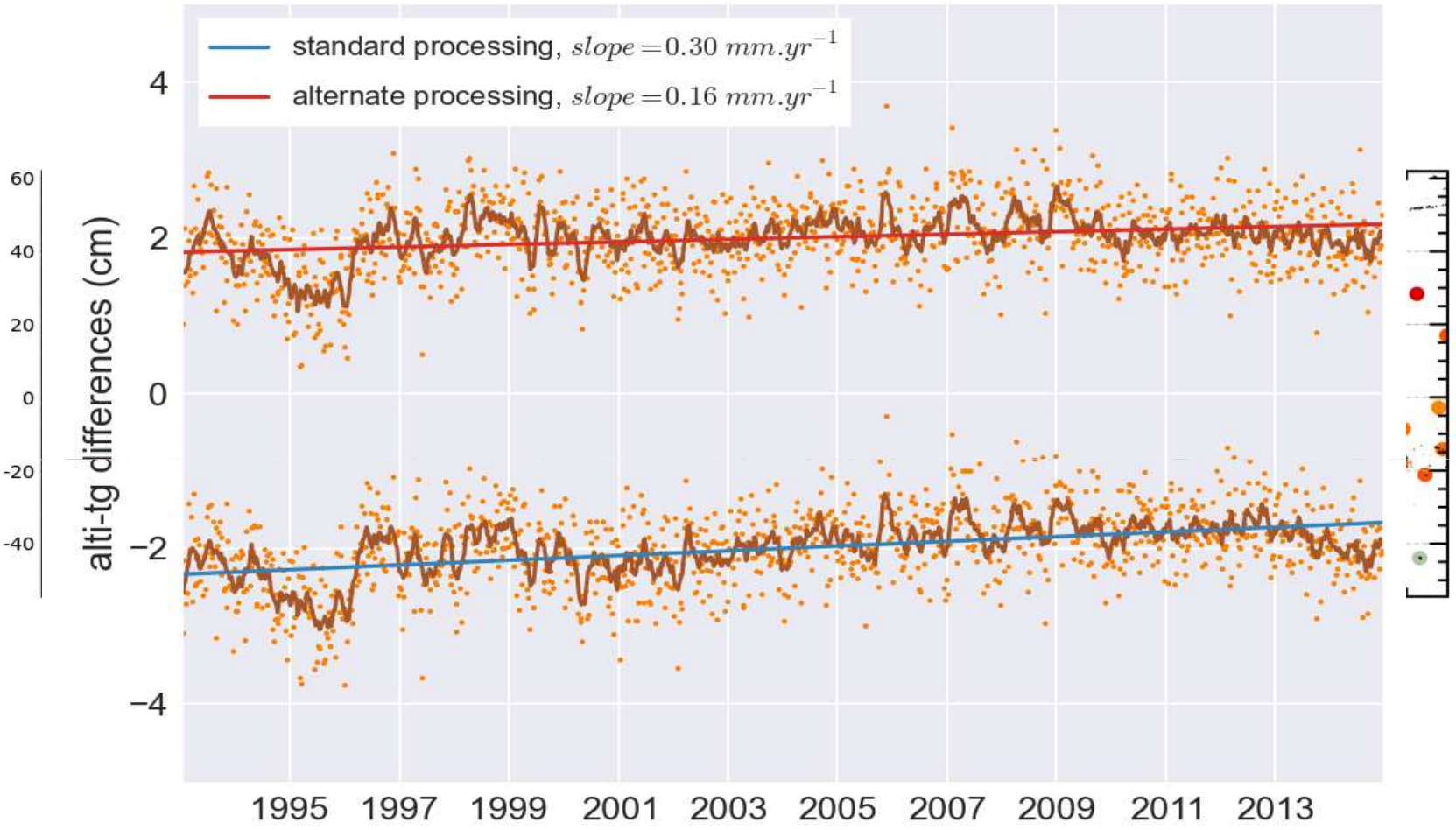
- Estimating the ensemble mean from station-wise comparisons might introduce global drift differences

Ensemble Mean Estimation



- Global mean computed from ensemble with large spread,
- Possibly underestimating trend uncertainty (CI ± 0.2 mm/yr).

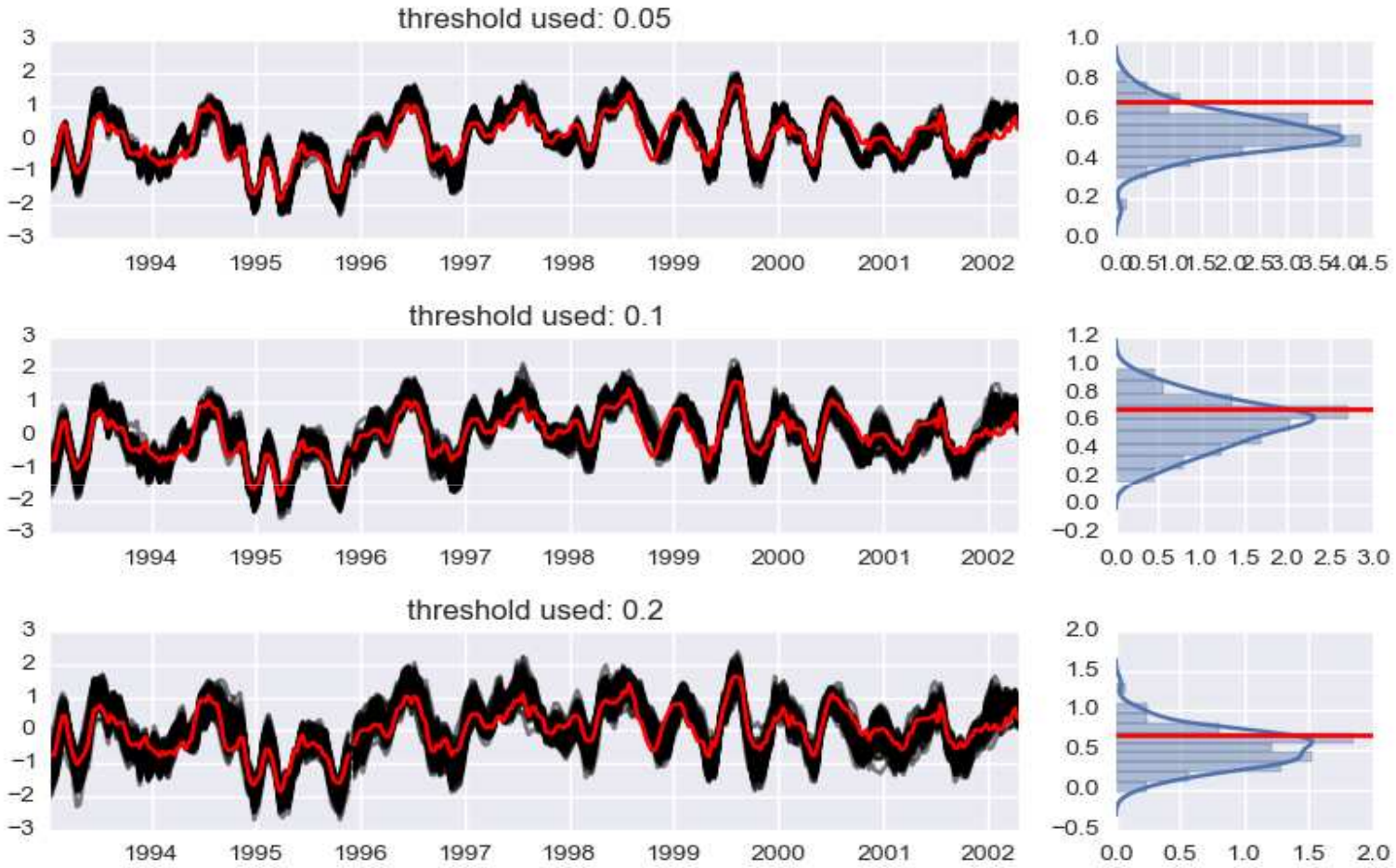
Ensemble Mean Estimation



- Global mean from non-uniformly distributed (alti;in-situ)pairs,
- Trend sensitive to the averaging (weighing) scheme

In-situ network

5 %



10 %

20 %

- Large sensitivity to a small network change,
- Faithful estimate of global altimeter drift ?

Conclusions

- Tide gauges are important for altimetry validation,
  - dedicated calibration sites & global analysis

- Able to demonstrate the stability of satellite altimeter records

- Advocate for maintining/improving the current network.

Conclusions

- Need to assess errors and related uncertainties if we want to demonstrate GCOS requirement (0.3 mm/yr)

Error	Uncertainty
VLM	0.3/0.5 mm/yr
Regression CI	0.2 mm/yr
Averaging	0.15 mm/yr
Network	0.2/0.4 mm/yr
Total (RSS)	0.4/0.7 mm/yr

- We try to adopt a probabilistic approach to evaluate some uncertainties,
- Besides trends, where do inter-annual signals arise from ?

Thank you

pprandi@cls.fr

CLS
COLLECTE LOCALISATION SATELLITES

cnes
CENTRE NATIONAL D'ÉTUDES SPATIALES

SALP
Service Altimetrie & Localisation Precise

OST/ST 2015

October 19-24, 2015
Reston, VA