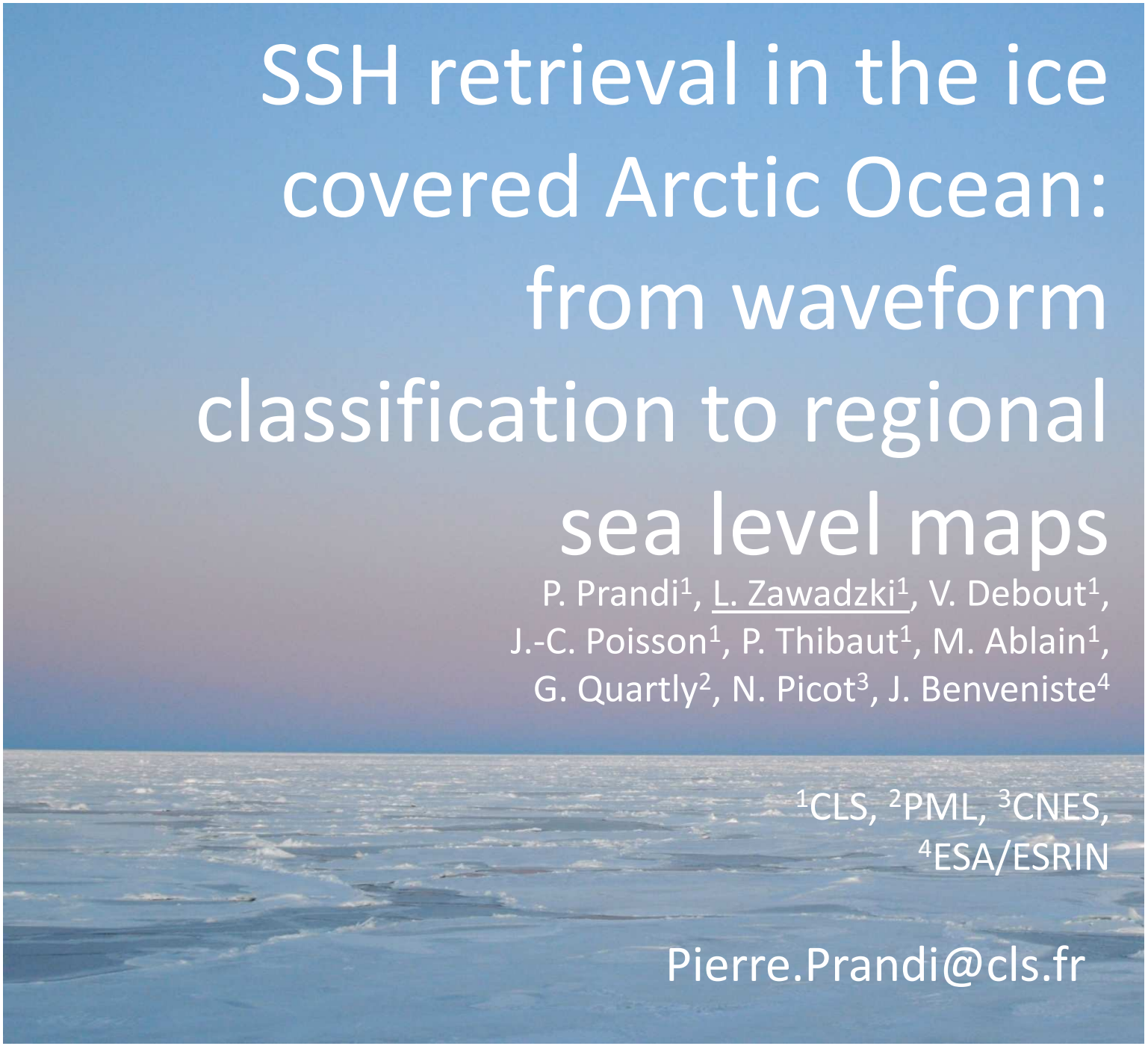
SSH retrieval in the ice covered Arctic Ocean: from waveform classification to regional sea level maps

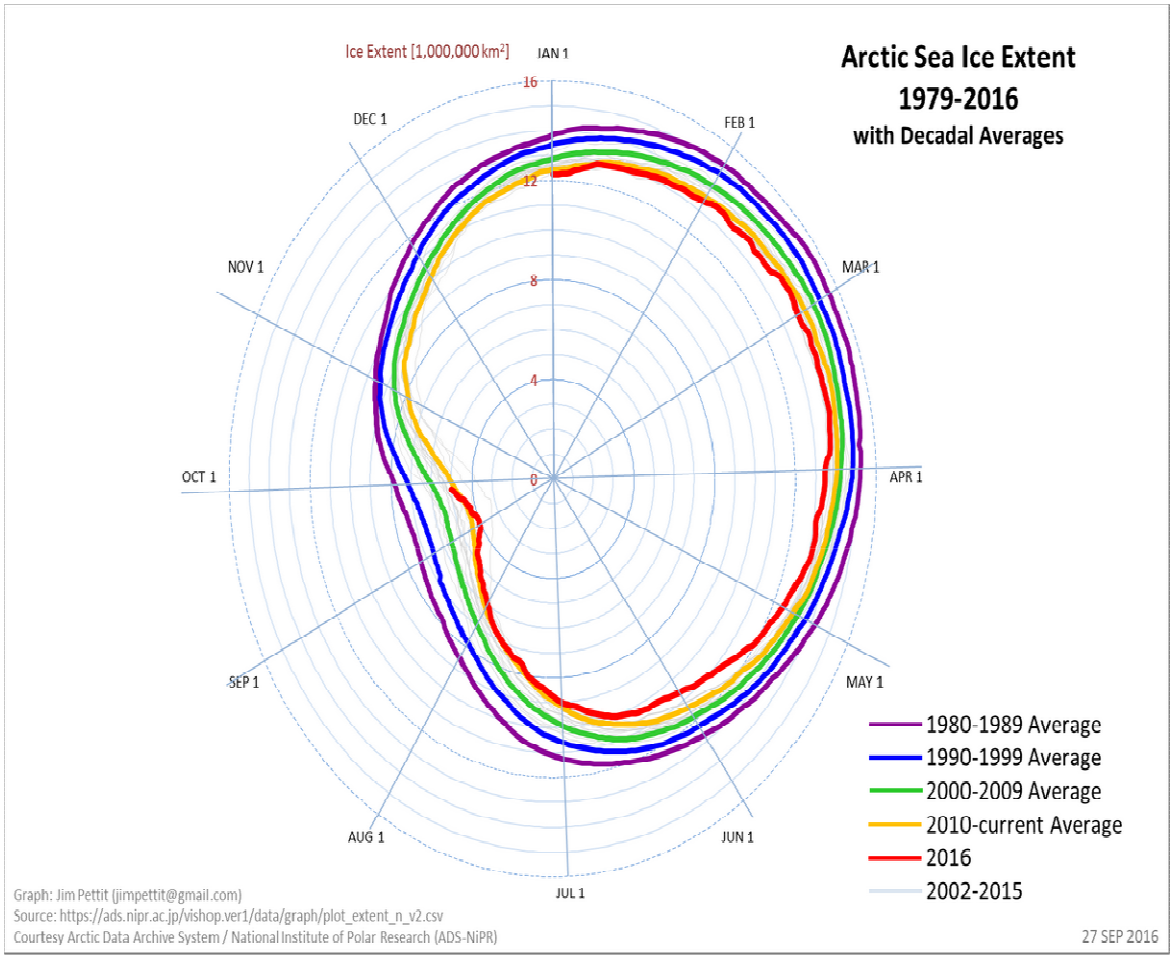
P. Prandi[1], L. Zawadzki[1], V. Debout[1], J.-C. Poisson[1], P. Thibaut[1], M. Ablain[1], G. Quartly[2], N. Picot[3], J. Benveniste[4]

[1]CLS, [2]PML, [3]CNES, [4]ESA/ESRIN

Pierre.Prandi@cls.fr

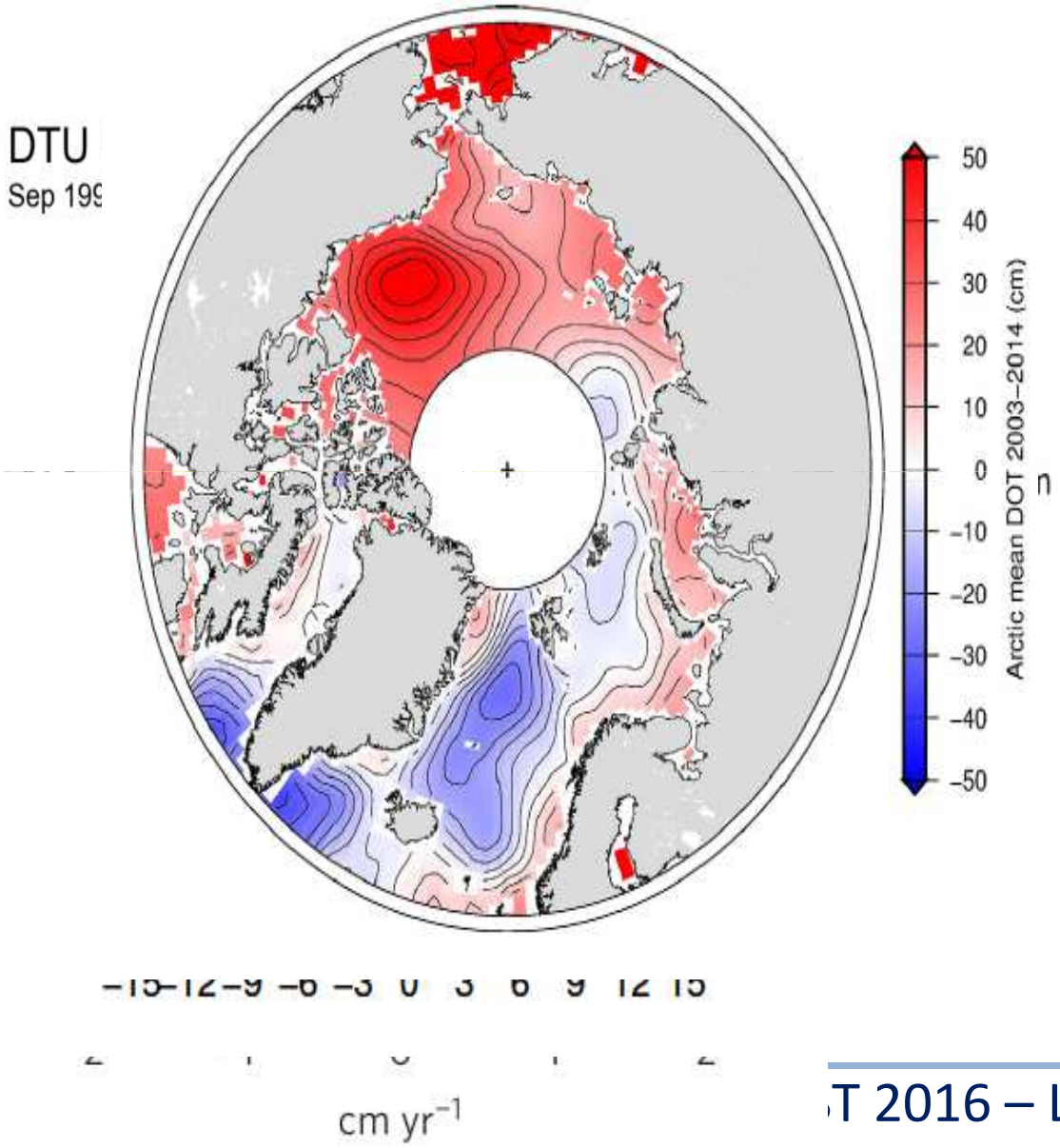


Arctic SIE status



- 2nd lowest on record with 4.14 10^6 km²
- Reached on september 10th

Recent history of arctic altimetry

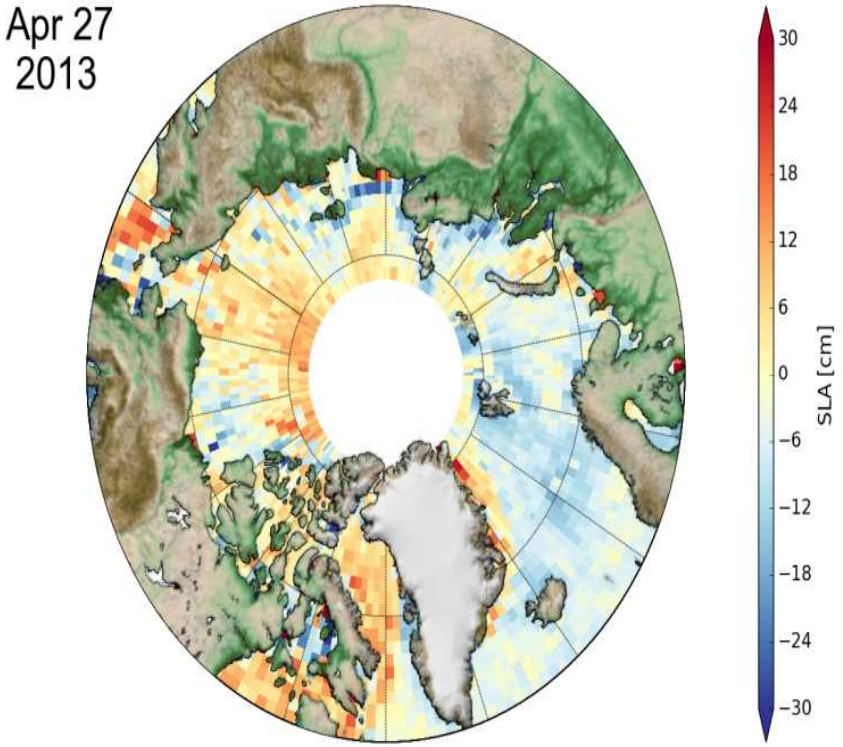


- Peacock & Laxon, 2004
- Scharroo, 2006,
- Giles *et al.*, 2012
- Prandi *et al.*, 2012
- Cheng *et al.*, 2015
- Armitage *et al.*, 2016

- Here comes another one…


PROCESSING

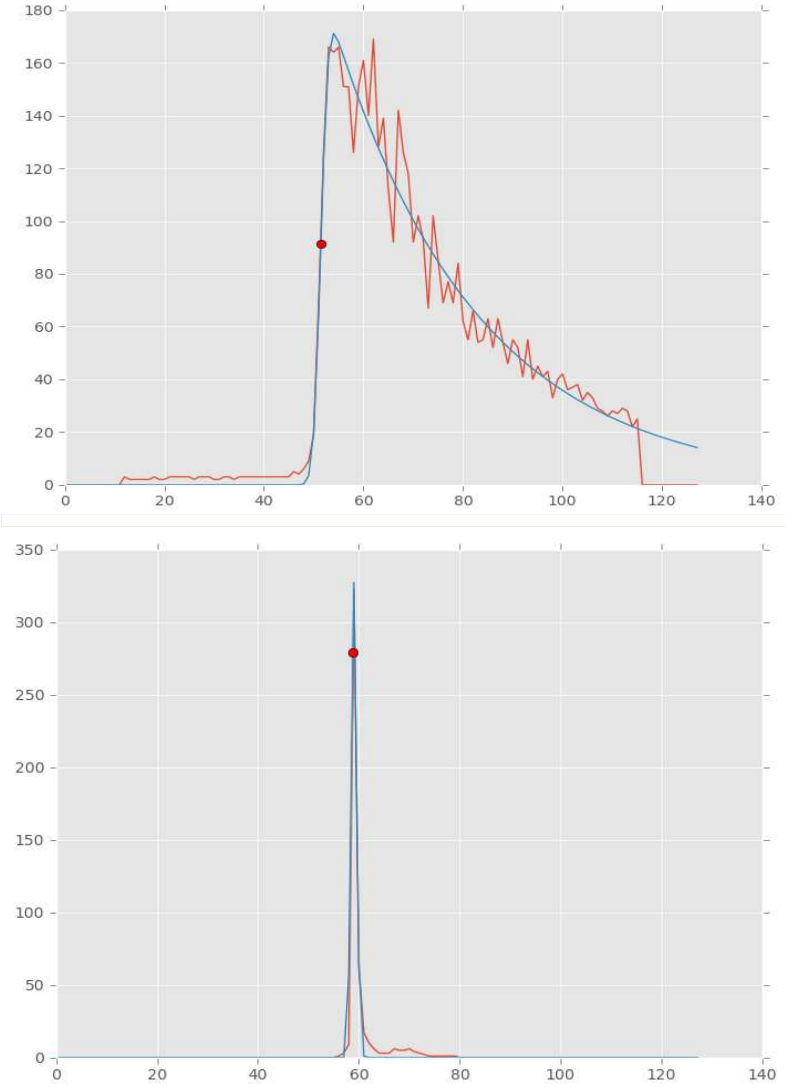
Processing strategy



- Waveform classification,
- Dedicated retracking,
- Geophysical corrections,
- Data editing,
- Gridding,

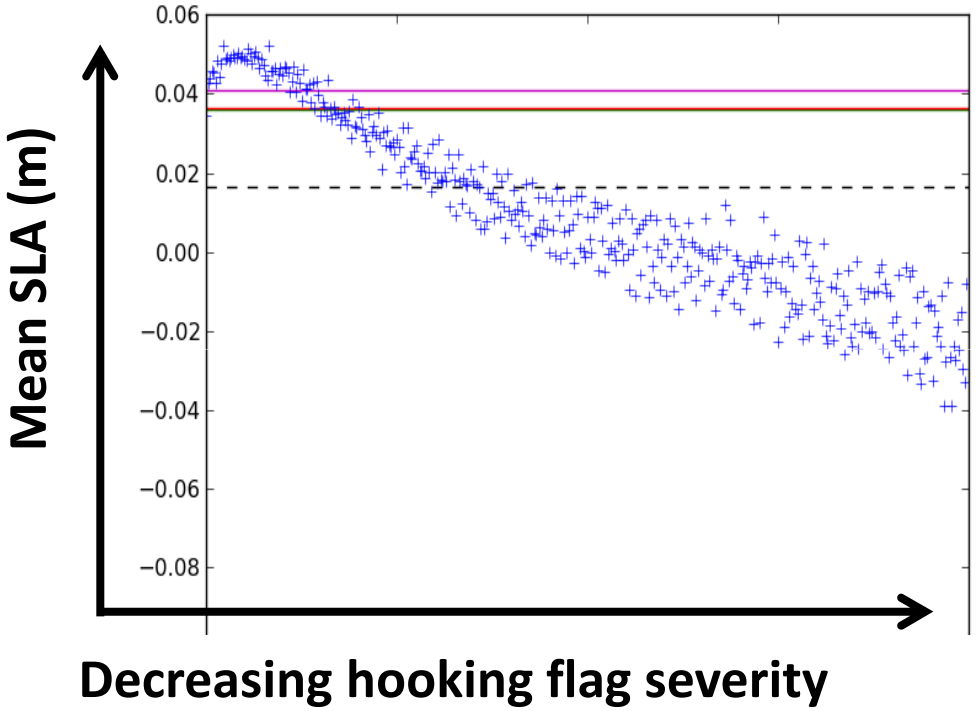
Waveform selection & retracking

- Brownian (open ocean) and specular (leads) returns selected,
- **One** adaptive retracker to rule them all (cf. P. Thibaut's talk: « Adopt the Adaptive »),
- No need for a open ocean/lead bias

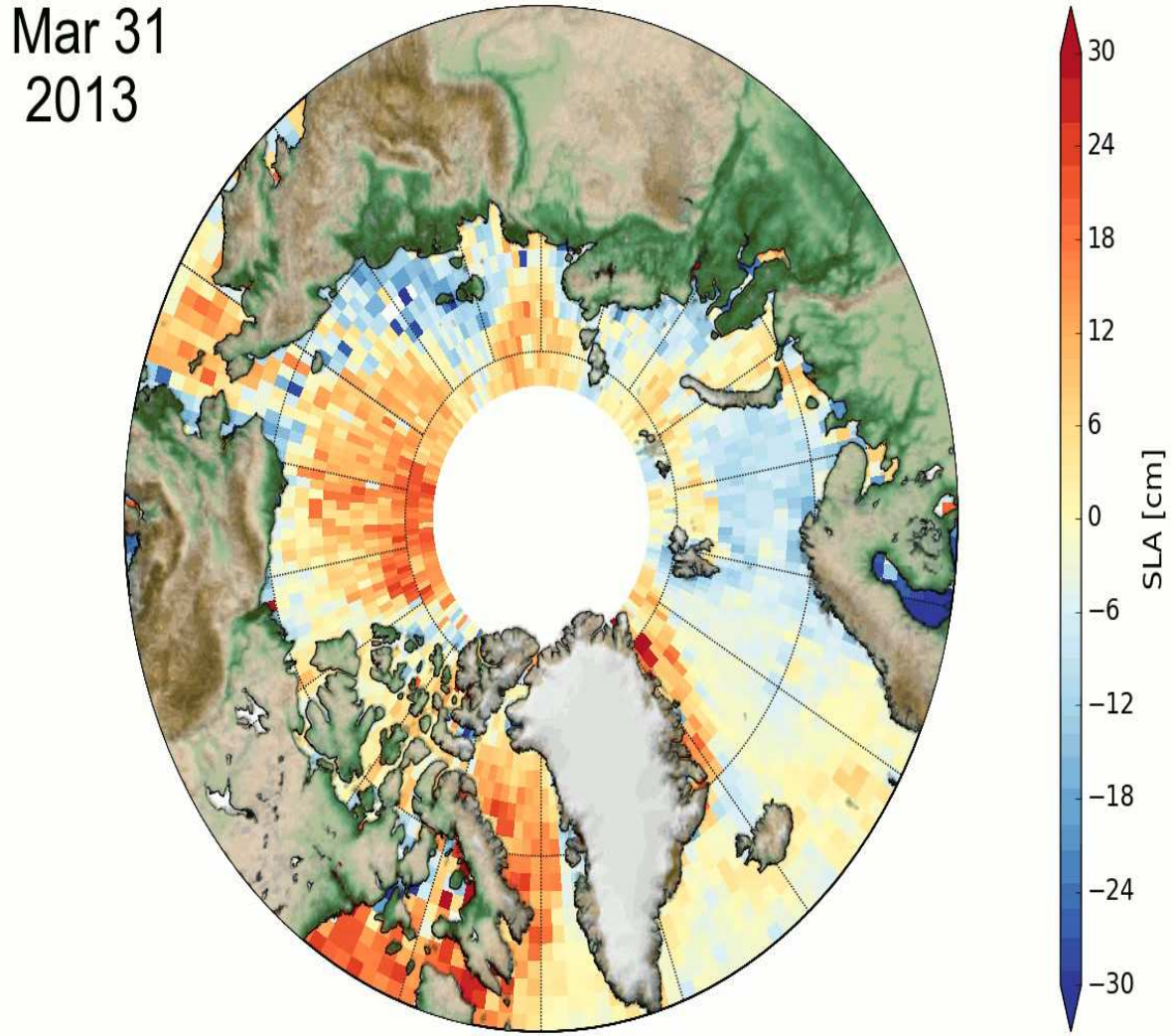


Data editing

- Classic: MQE and backscatter,
- Hooking points through backscatter variations,
- Temporal editing based on local SLA variance



SLA estimation



Final SARAL product

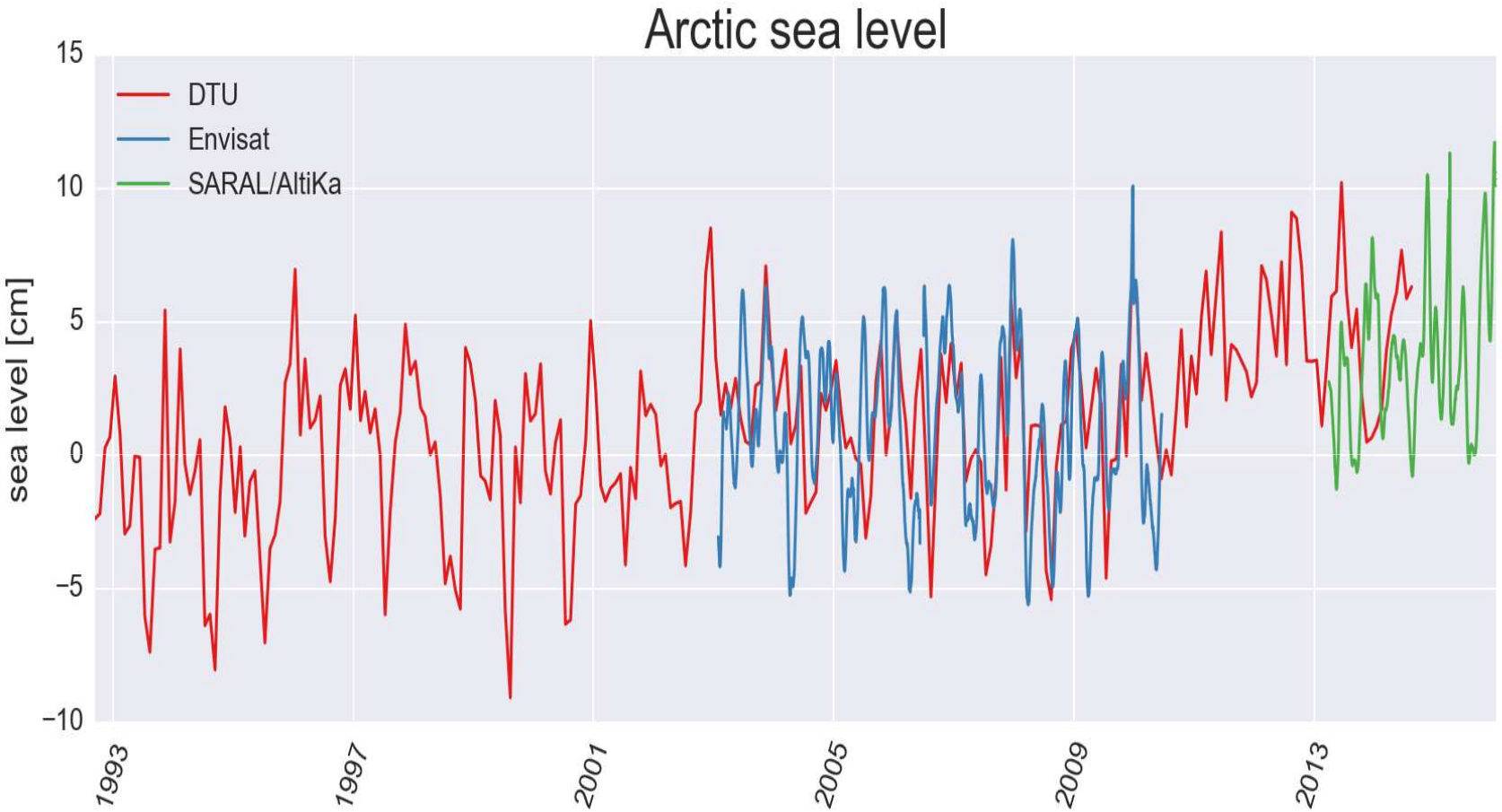
- Geophysical corrections based on models as much as possible,
- Missions referenced to the global MSL between 50° and 66°
- Daily 2°x1° grids,
- **Not** independent (30-day avg),

SLA estimation

- Only SARAL and Envisat at the moment,
- CryoSat-2 expected in the near future,
- Why not ERS, Sentinel-3 ?

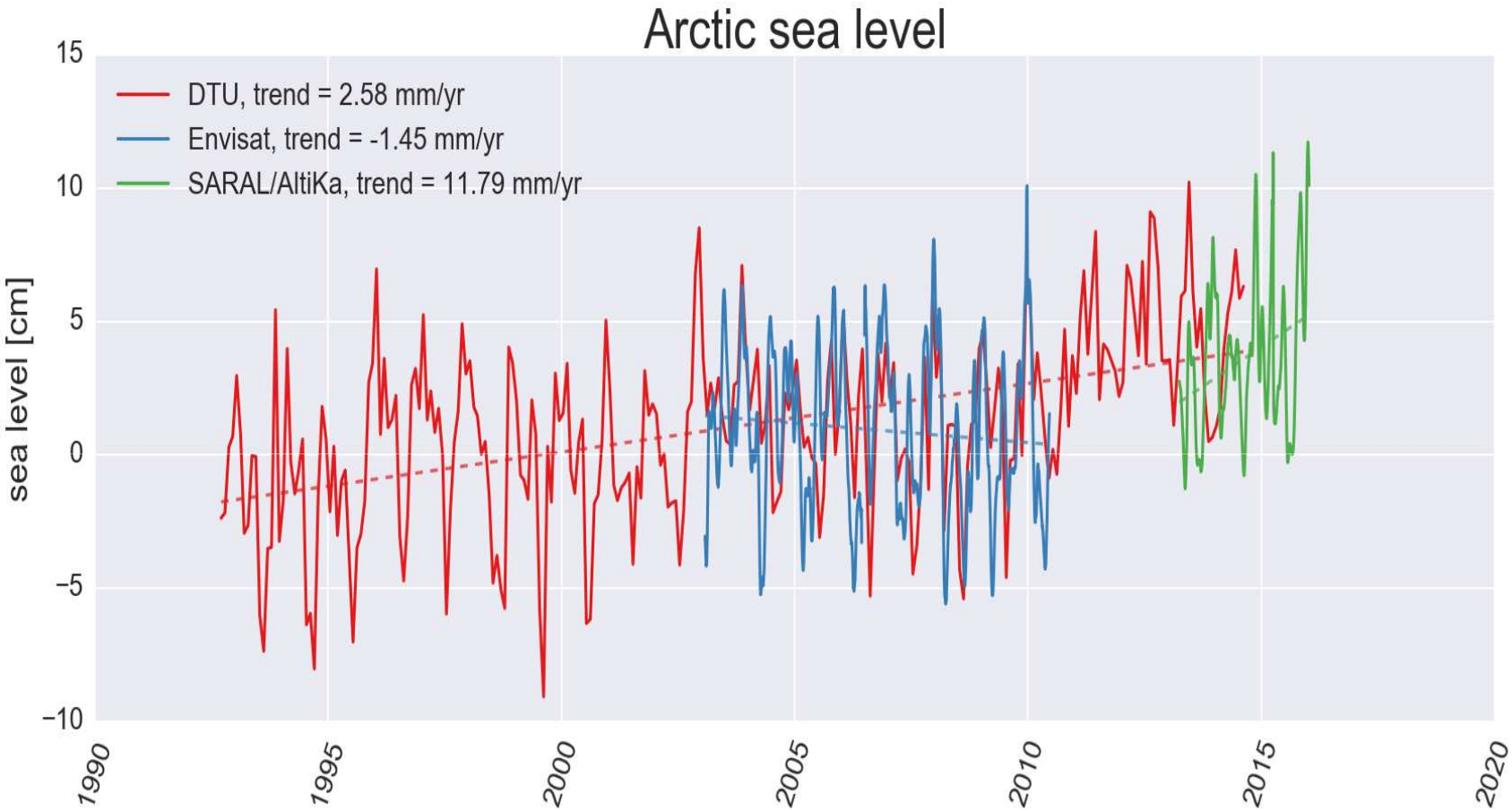

REGIONAL AVERAGES

Arctic sea level variability



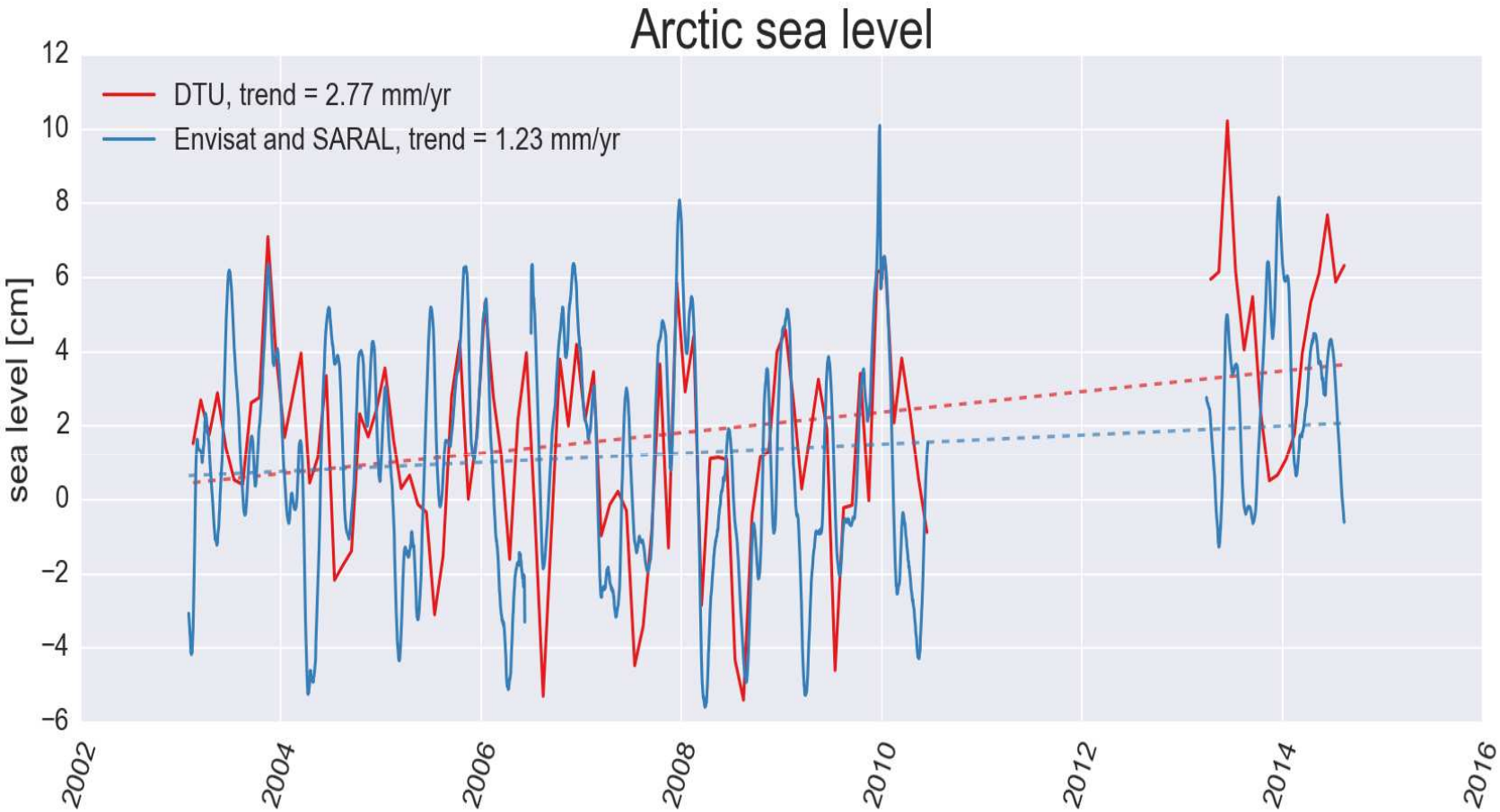
- Variability in agreement with DTU,
- Trends are slightly different (but uncertainties are likely high)

Arctic sea level variability



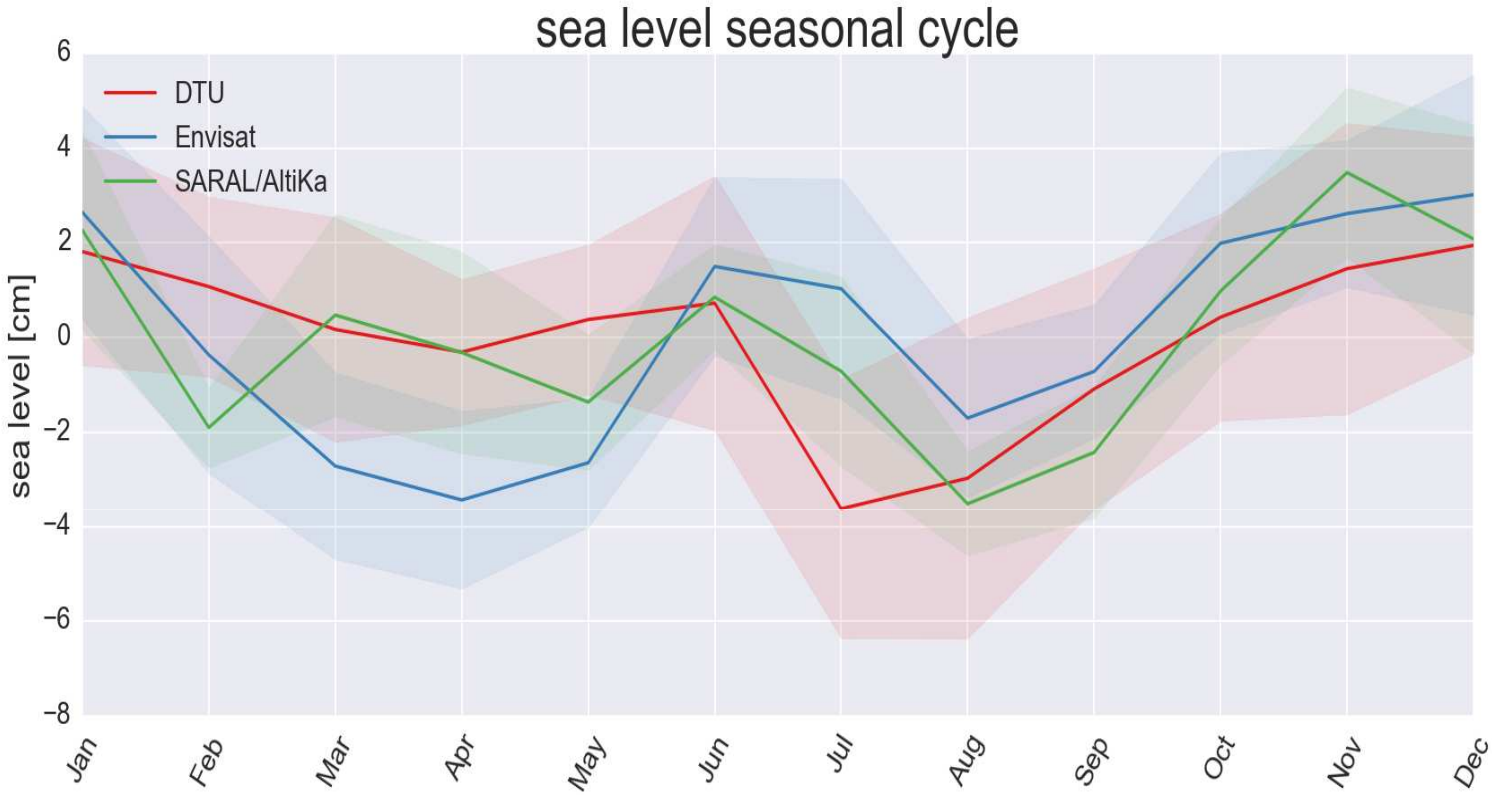
- Variability in agreement with DTU,
- Trends are slightly different (but uncertainties are likely high)

Arctic sea level variability



- Variability in agreement with DTU,
- Trends are slightly different (but uncertainties are likely high)

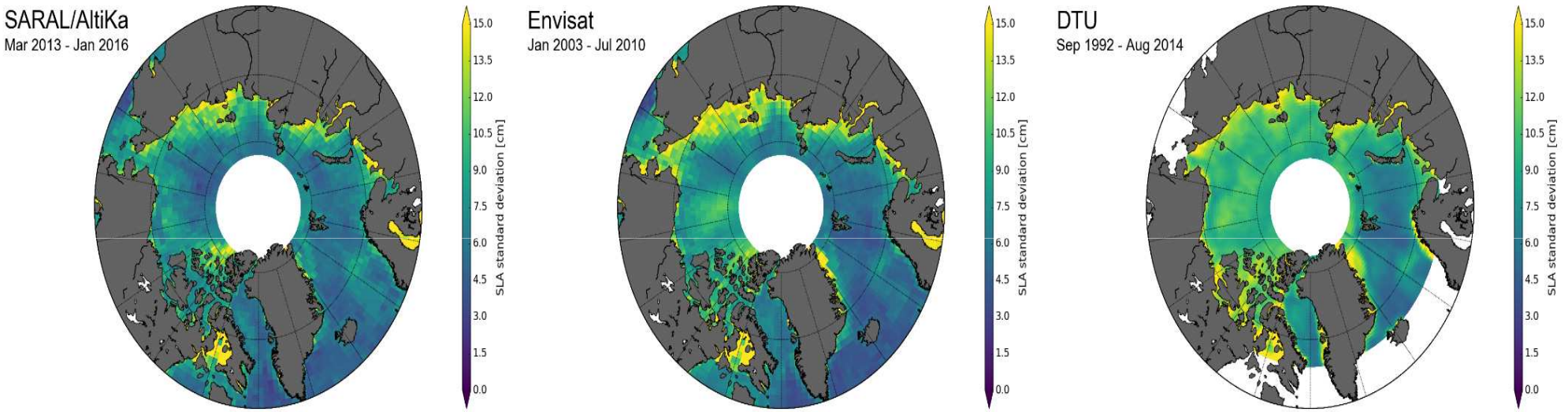
Seasonal signal



- Some differences, but scatter is large,
- Maximum reached late fall/early winter,

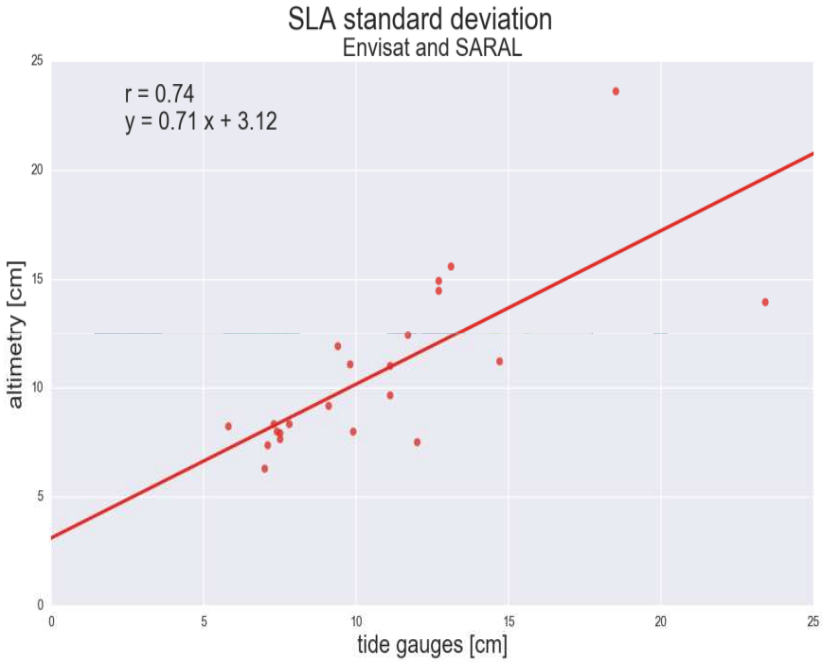

REGIONAL DISTRIBUTION

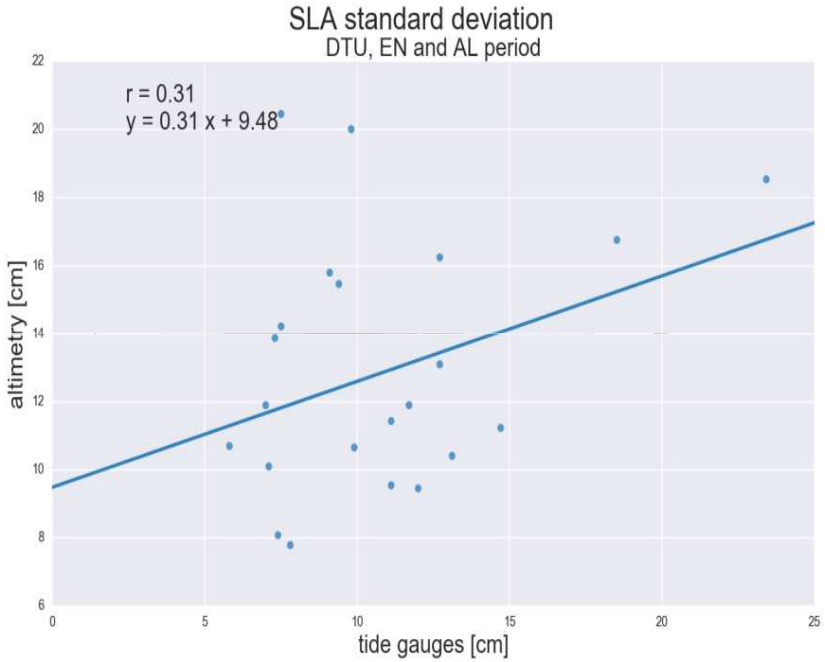
Arctic sea level variability



- Variability trapped at the coast for CLS/PML, homogeneous for DTU
- Beaufort gyre visible in Envisat record,

- Comparing variability levels to the few tide gauges available

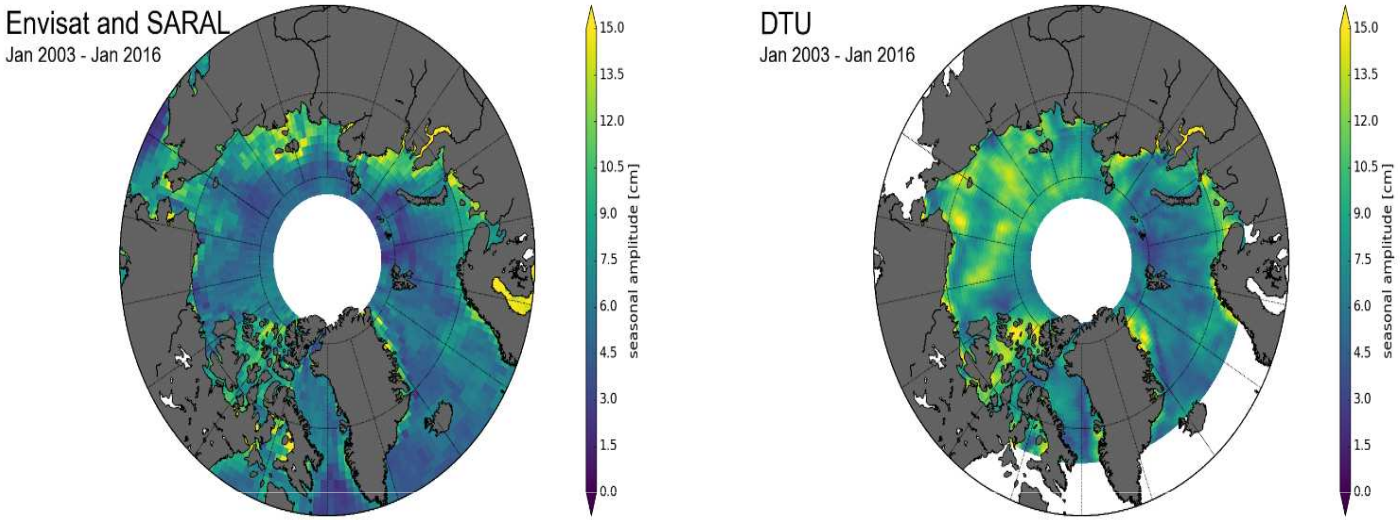




- Comparison sample is (very) small,
- Slightly better agreement than with DTU dataset, is it significant ?

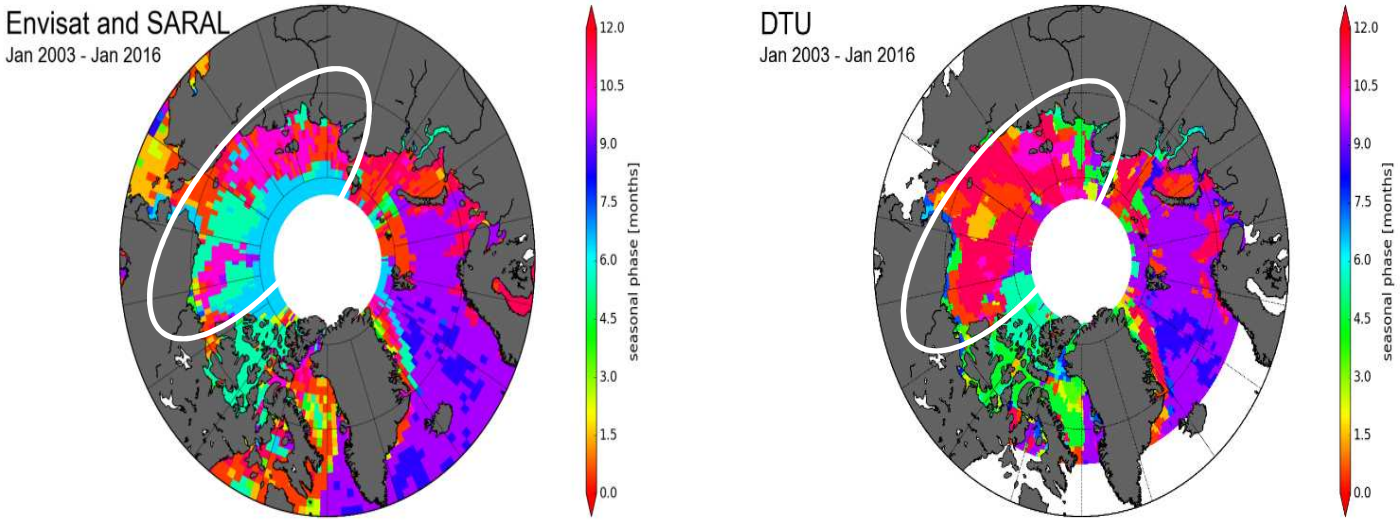
Seasonal signal

Amplitude

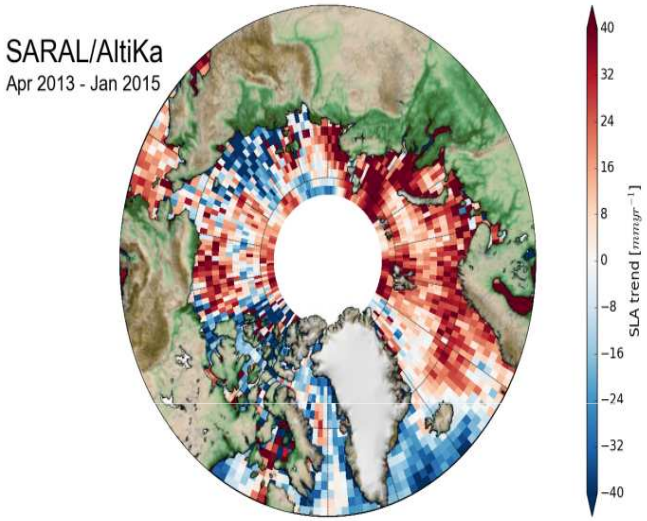


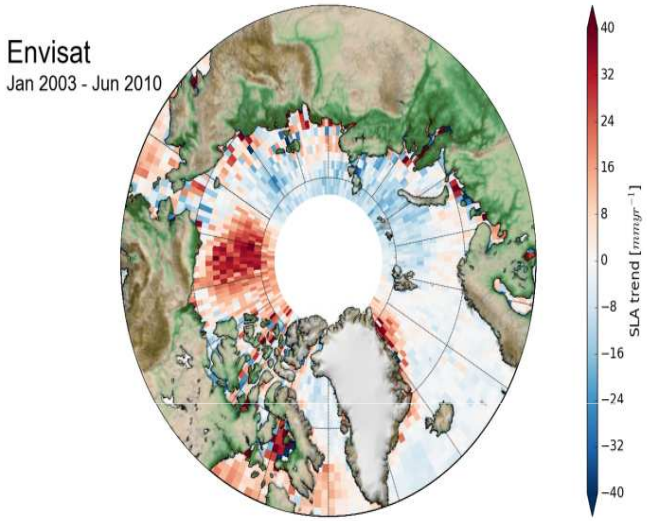
Phase

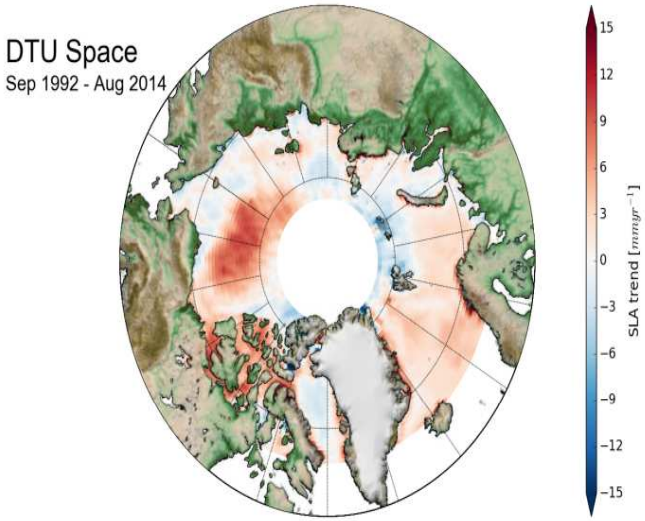
(month of max)



Trends

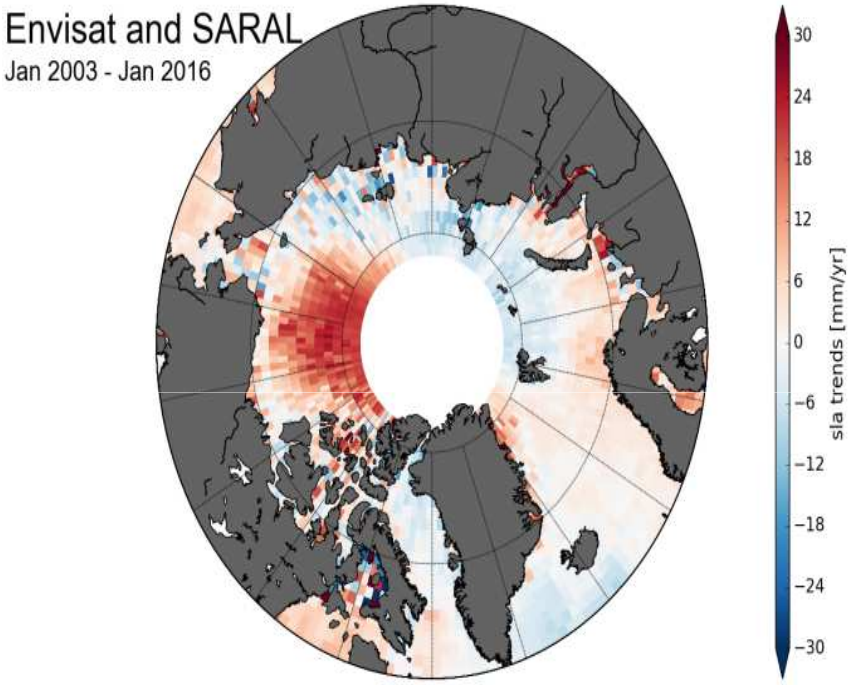


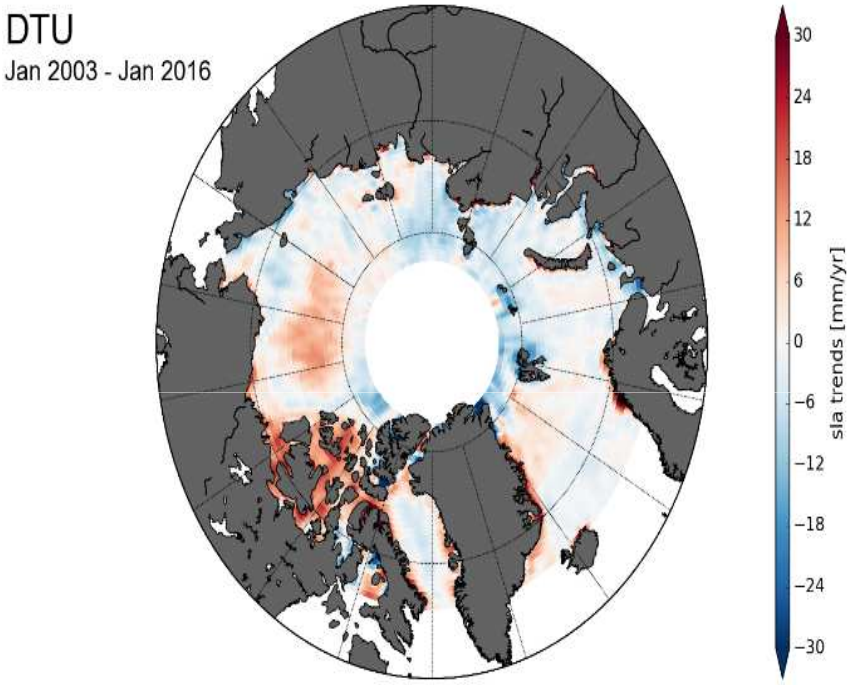




- Consistent trends distribution,
- But slightly larger amplitudes

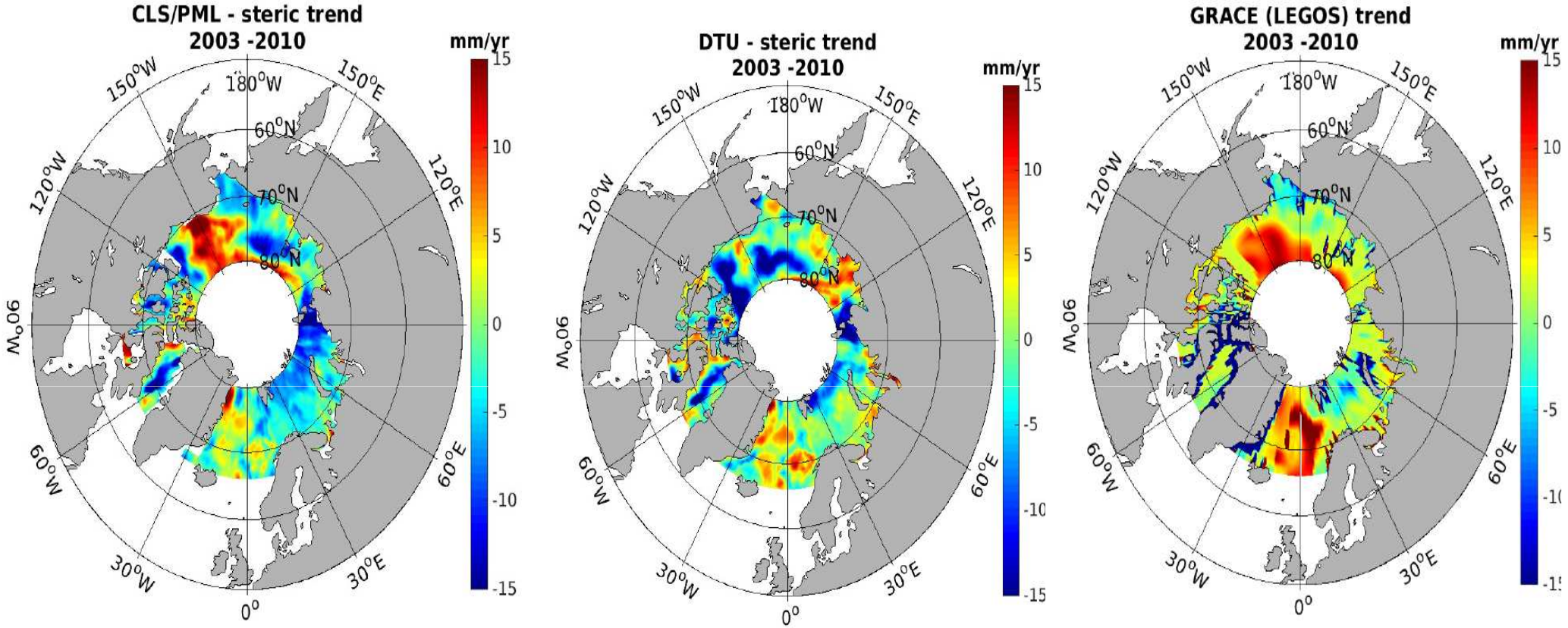
Trends





- Consistent trends distribution,
- But slightly larger amplitudes

Regional SL budget



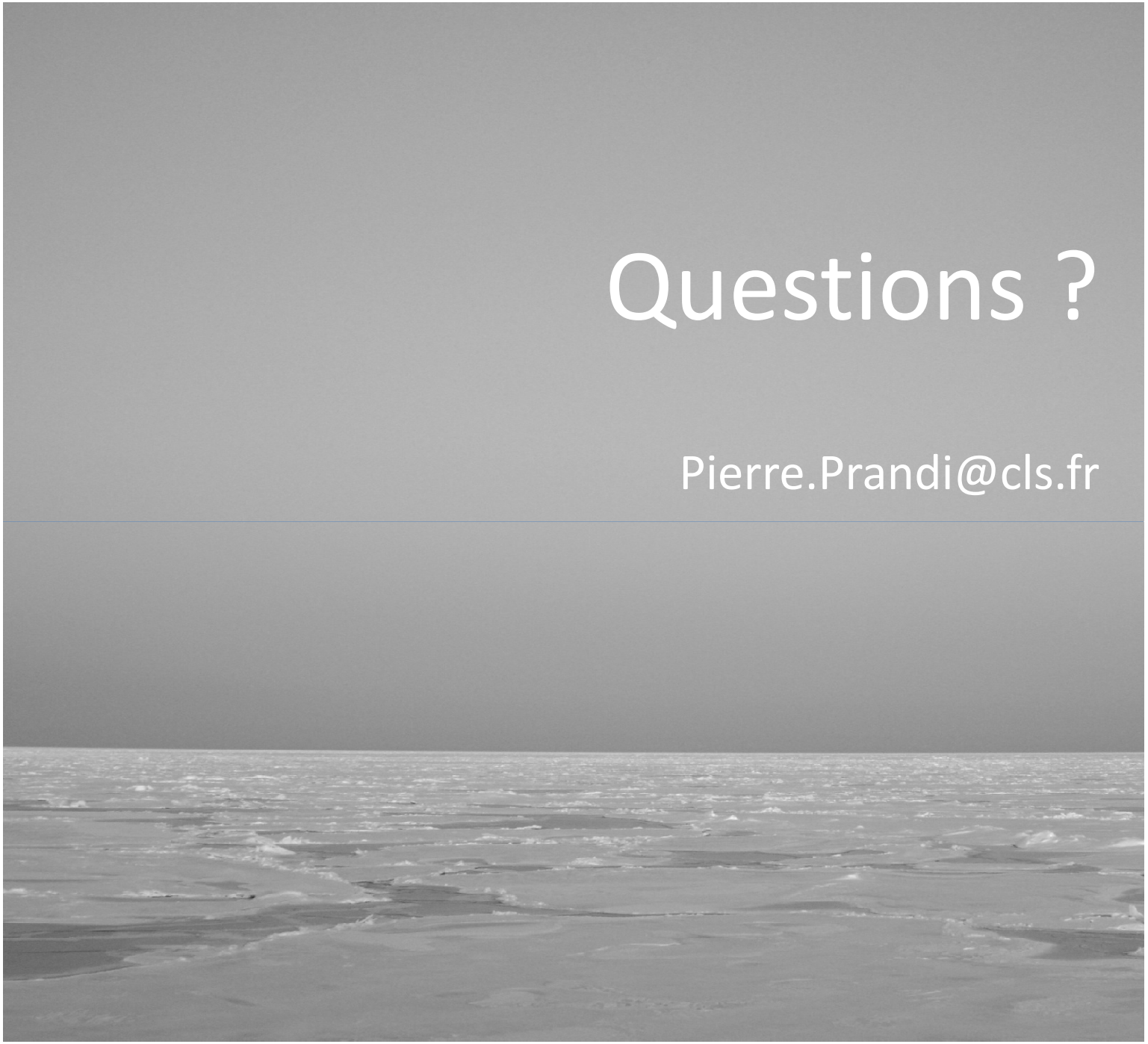
- From Carret et al. (submitted),
- Comparisons between altimetry minus steric and GRACE ocean mass trends

Conclusions

- There's a new Arctic sea level dataset,
- Mono-mission but consistent with GMSL record (no extra referencing effort needed)

- Based on waveform classification & new retracker
- First validation results suggest a good performance,
- More geophysical validation in Carret *et al.,* submitted

- Freely available upon request to info-sealevel@esa-sealevel-cci.org,
- We are happy to get feedbacks from science users



Questions ?

Pierre.Prandi@cls.fr