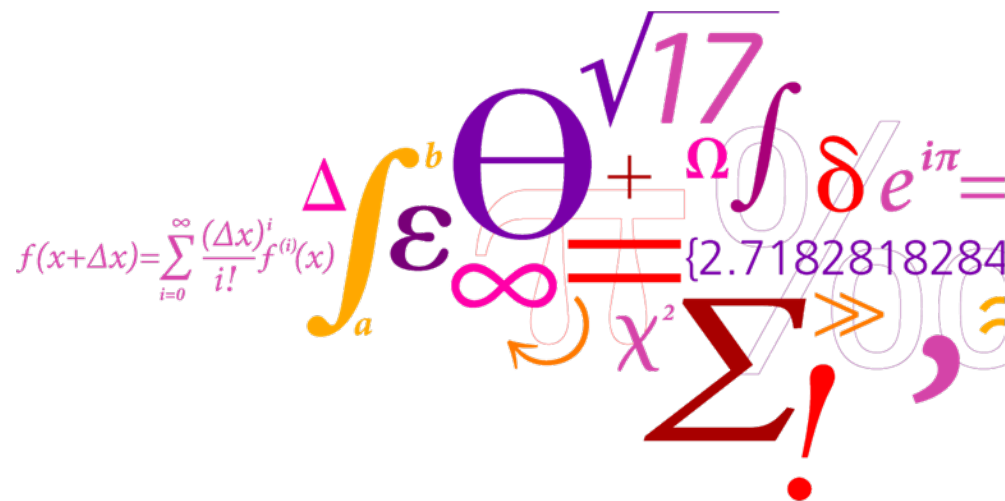
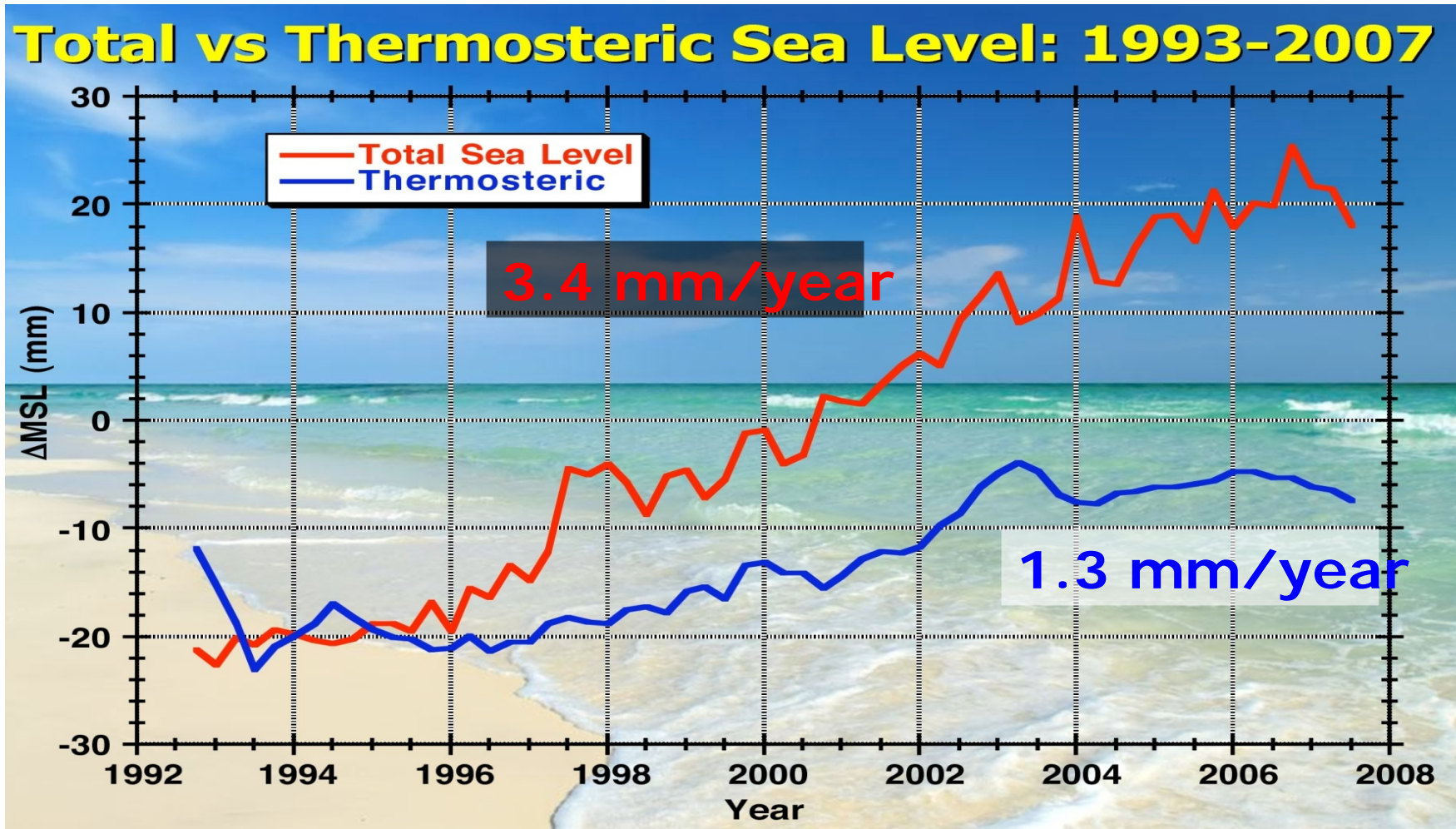


ON LONG TERM VARIATION IN THE SEA STATE BIAS CORRECTION

Ole B. Andersen and Y. Cheng



- **Background**
- **Sea level trend from 18 year TOPEX-Jason record(1993-2010)**
- **SSB (BM 4 vs CLS non parametric models)**
- **Altimetric SL change correlation with thermosteric SL change**
- **Altimetric SL / SSB change coherency with zonal averaged SWH**
- **Summary**



Glacier melting ~ 0.9-1.2 mm/year (1993-2008), Khan, Velicogna, Cazenave
GIA ~ 0.3 mm. Misfit is ~ 0.8 mm / year (+/- 0.5 mm/year).

Some potential causes of Misfit

Instrumental causes

- Instrument degrading
- Inter-mission calibration issues
- etc etc

Thermosteric computation

Total amount of glacial melt (particularly prior to GRACE)

Drift in range and geophysical correction.

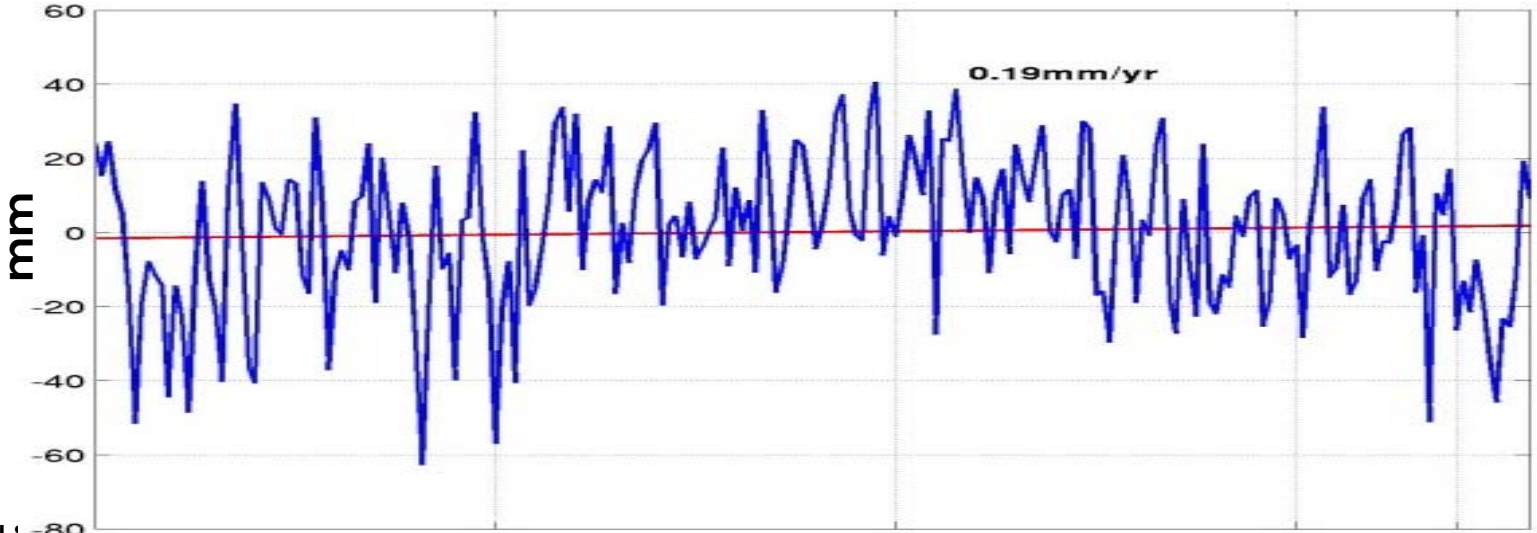
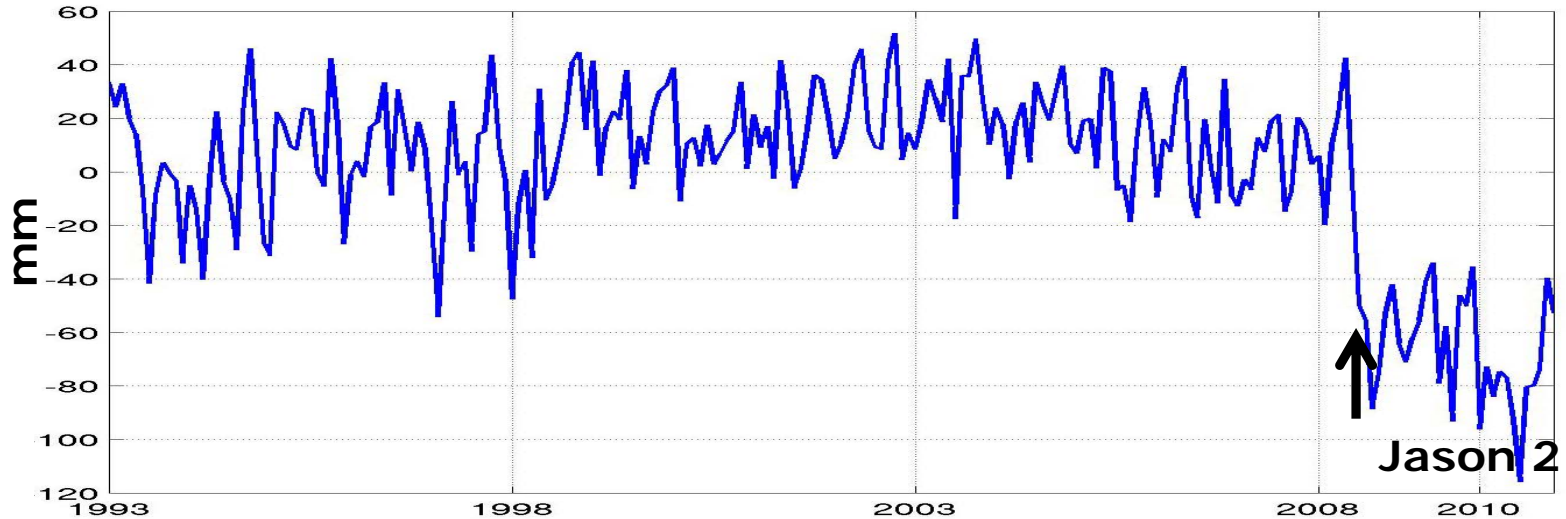
- Microwave related corrections (i.e., S. Brown)
- Models (ECMWF, MOG2D) etc
- Tides (probably not)

SSB BM4 based on SWH and U

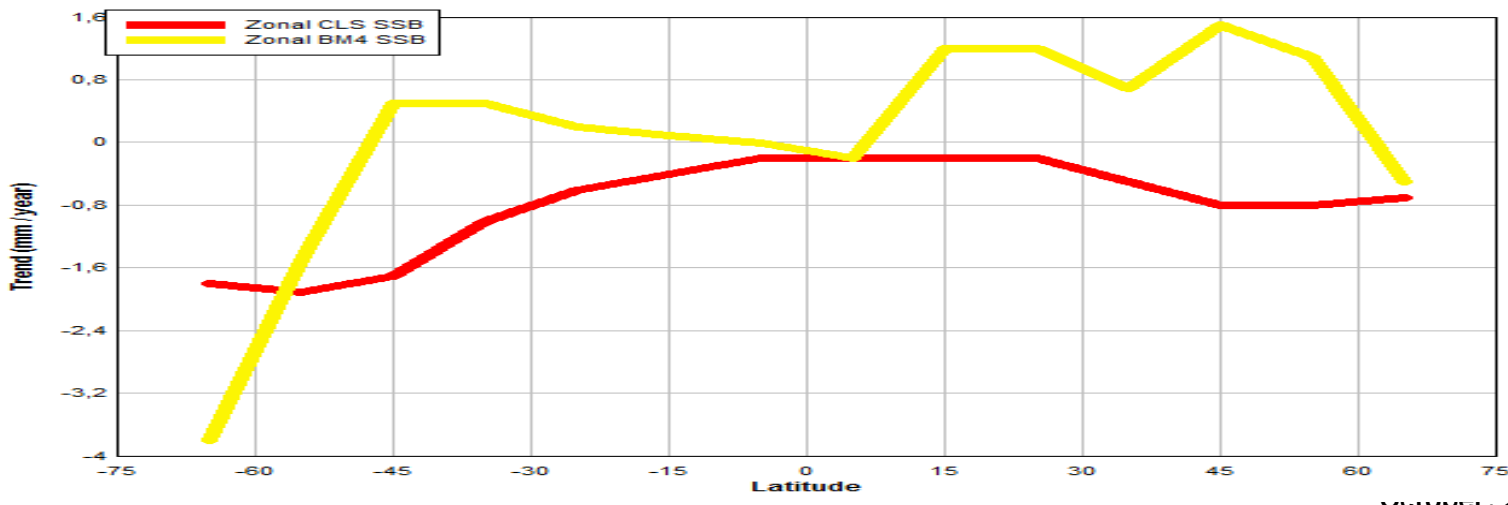
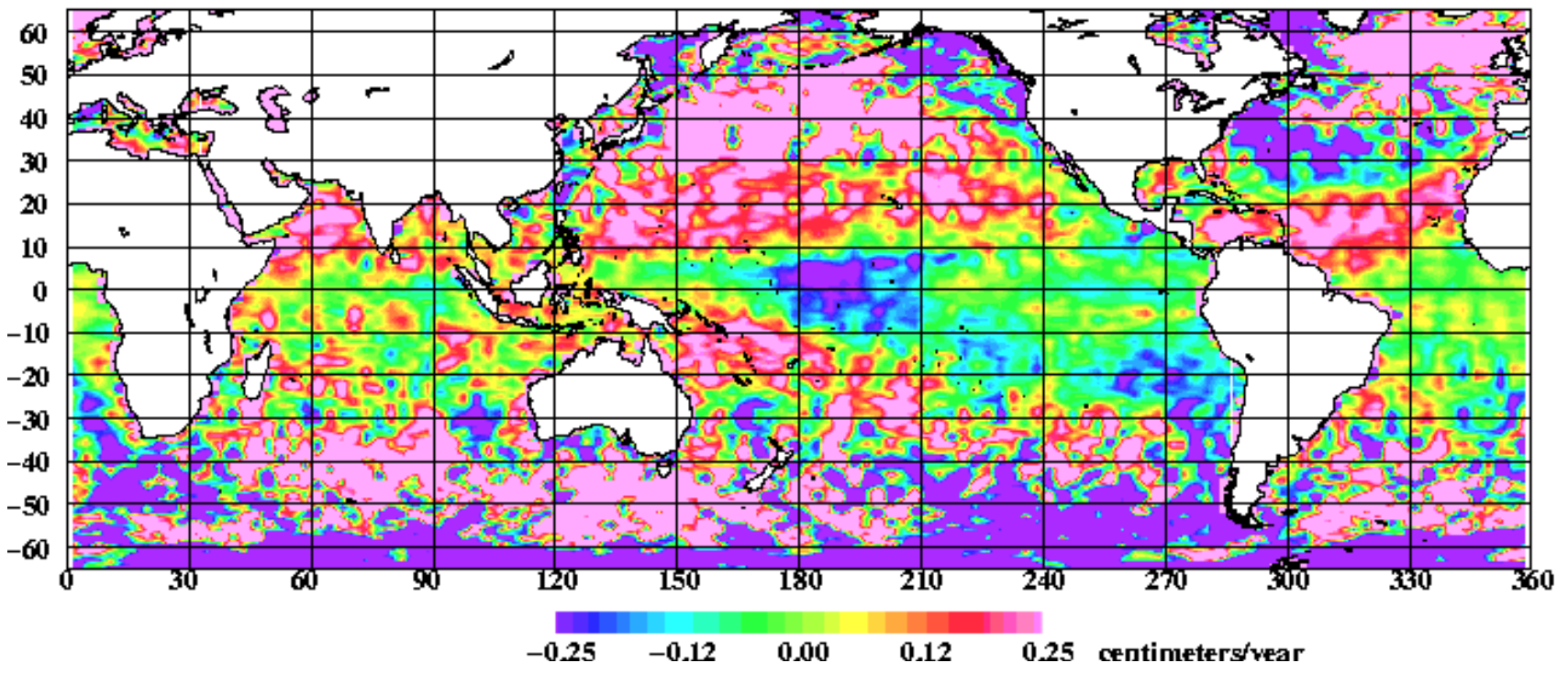
Non-parametric: based on SSH observations

$H_{ssb} = SWH (a_1 + a_2 U + a_3 U * U + a_4 SWH)$

	Jason-1	TOPEX (side A)	TOPEX (side B)	ERS-1	ERS-2	GFO
a_0	0.110106	0.012450	0.028889	0.054265	0.107618	0.092034
a_1	-0.034376	-0.030578	-0.032113	-0.075043	-0.068219	-0.055742
a_2	0.001145	0.002776	0.002992	0.001413	0.001465	0.002743
a_3	-0.001969	-0.002962	-0.002780	-0.001790	-0.001701	-0.003756
a_4	0.000083	0.000127	0.000101	0.000098	0.000082	0.000153

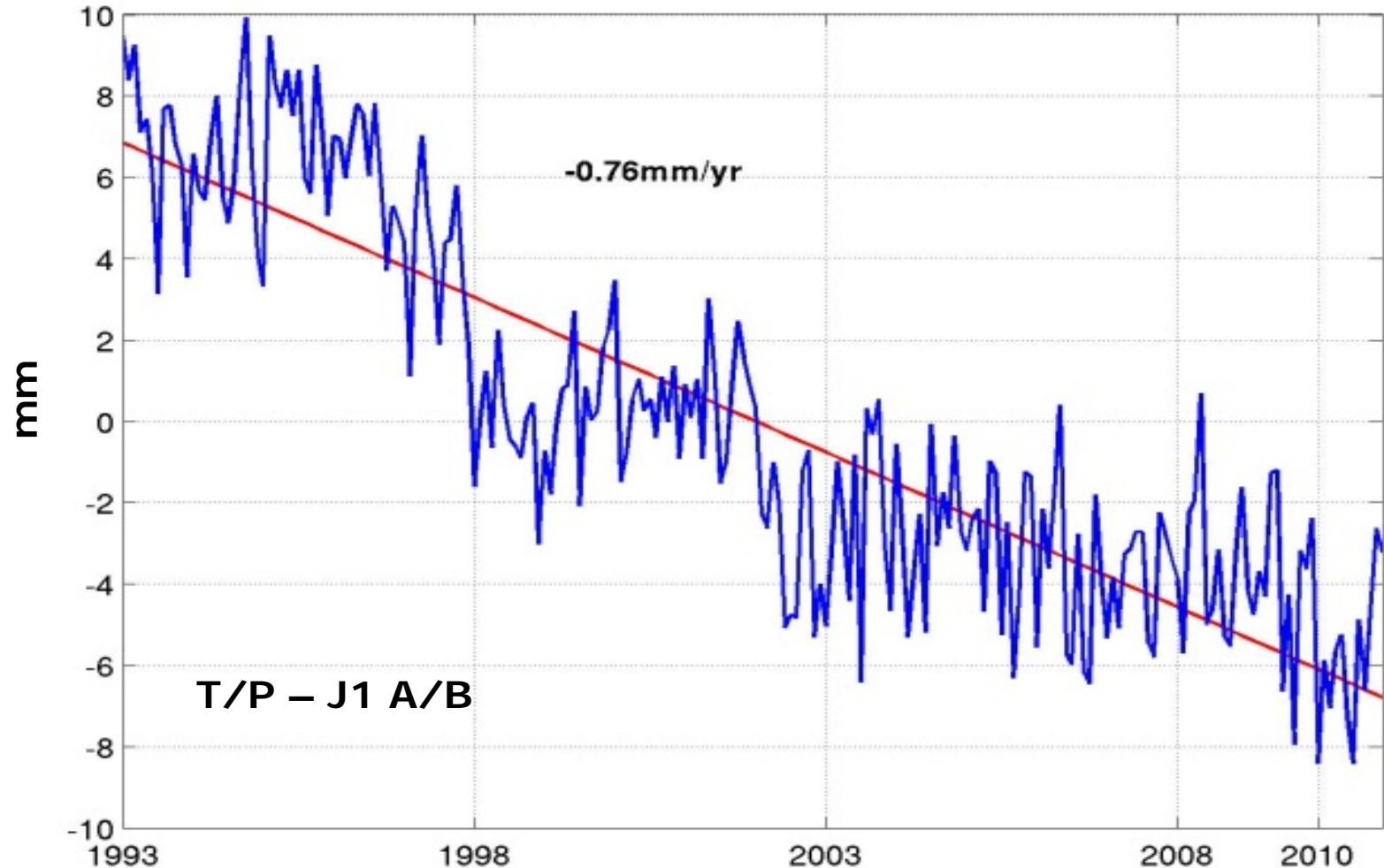


From RADS



CLS Non-parametric SSB trend

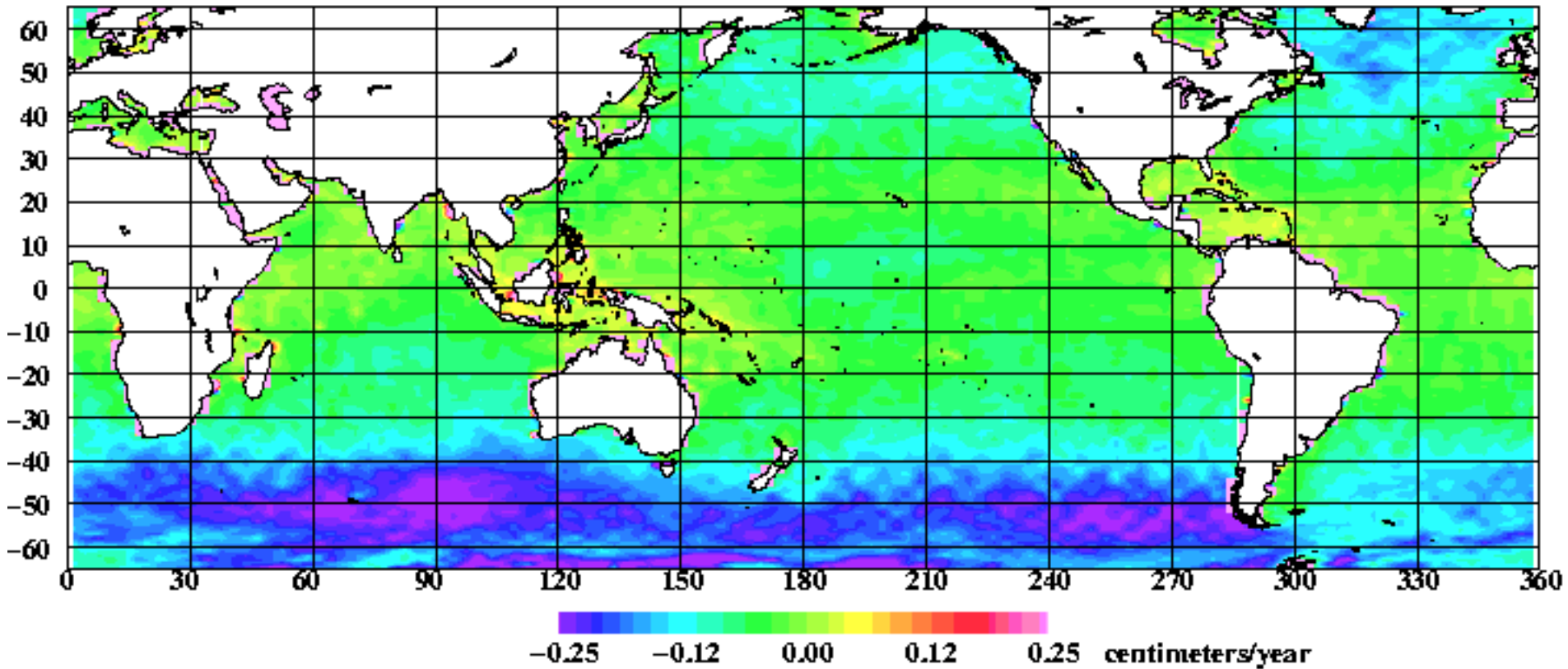
Empirical determined from colinear SSH obs (N Tran et al, 2010)



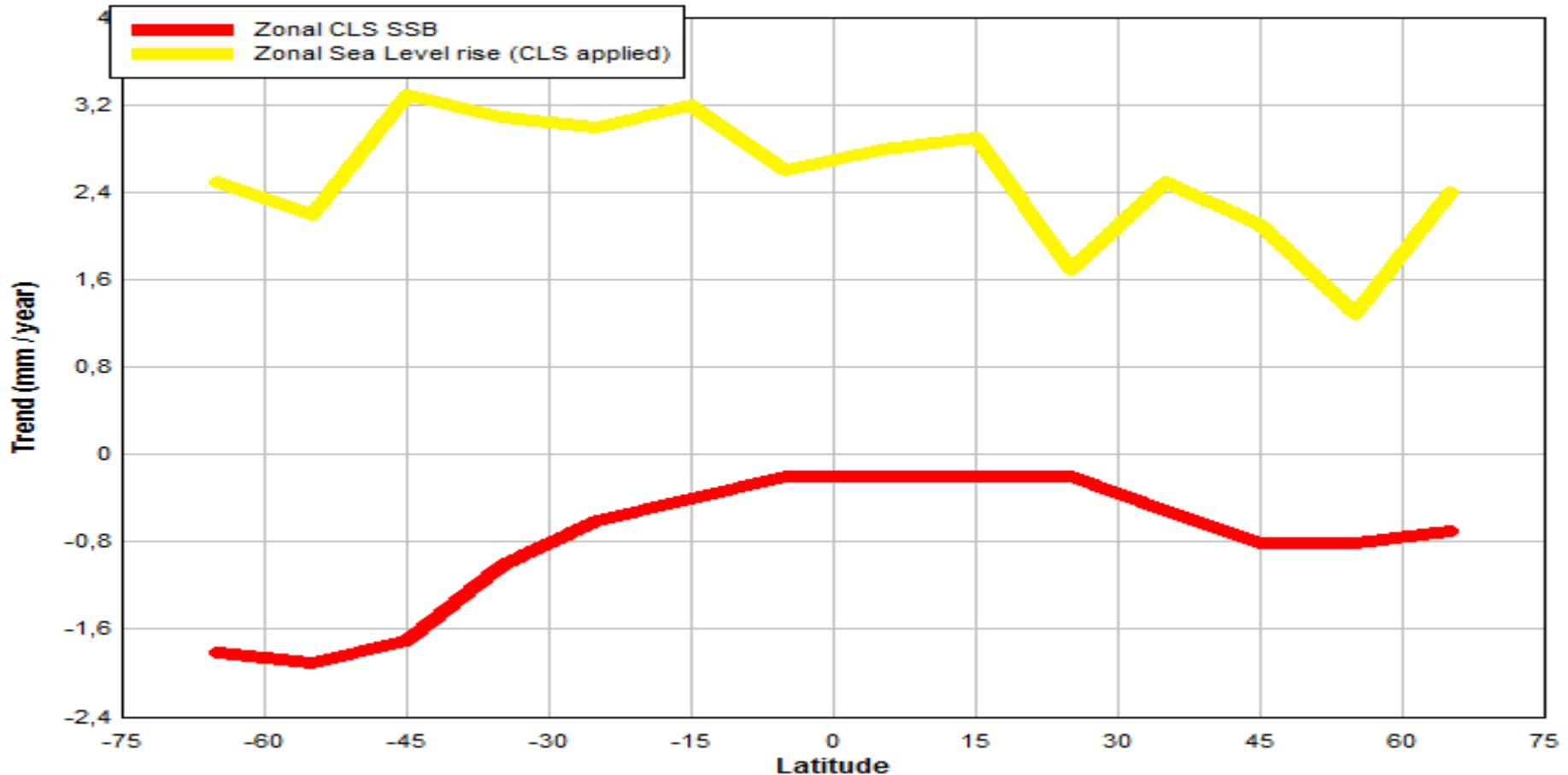
From
RADS

Global average $1 \times 3^\circ$, cosine weighted $\pm 65^\circ$

Trend CLS SSB



Zonal integrated linear trend.

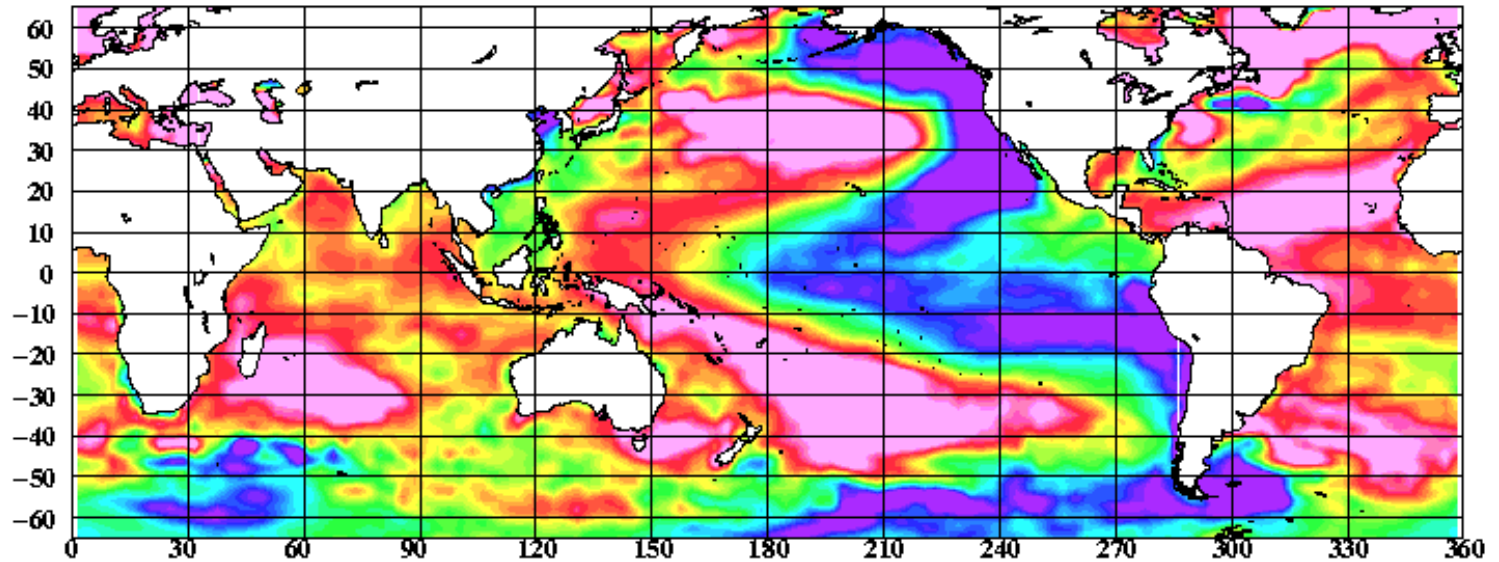


South of 40°S

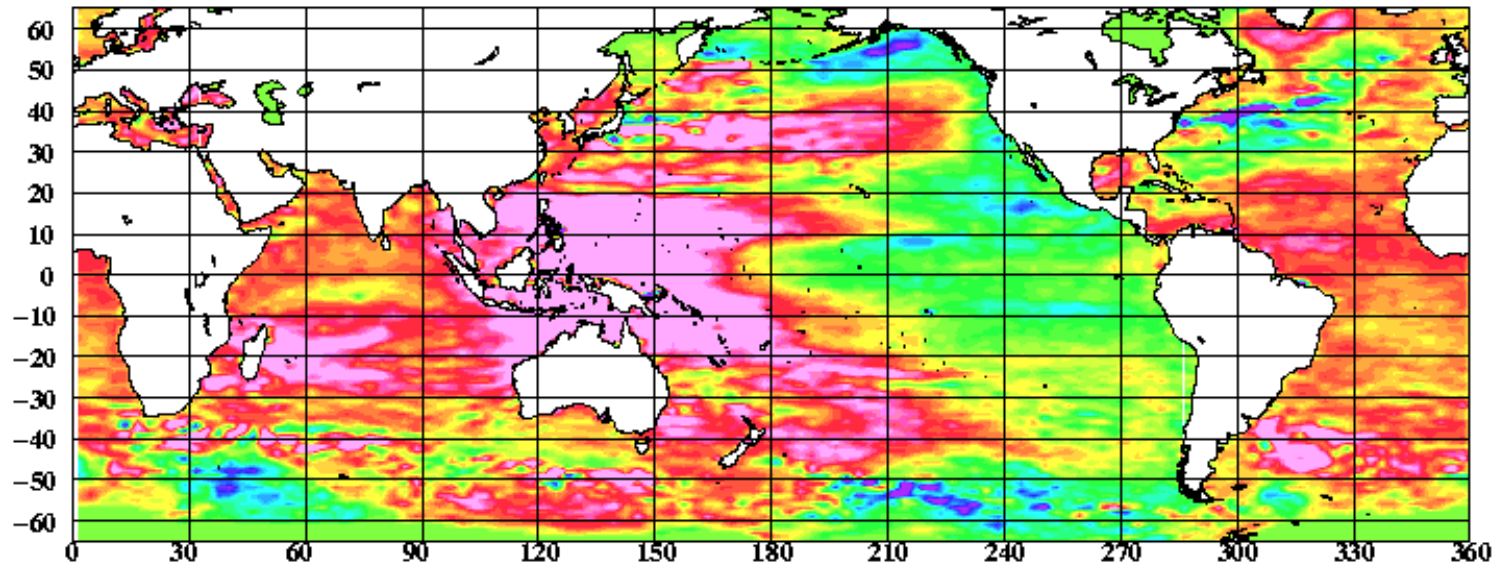
"> Half of the observed sea level trend can be contributed to SSB trend"

Altimetric vs Thermosteric sea level change

Thermo
Steric
SLT

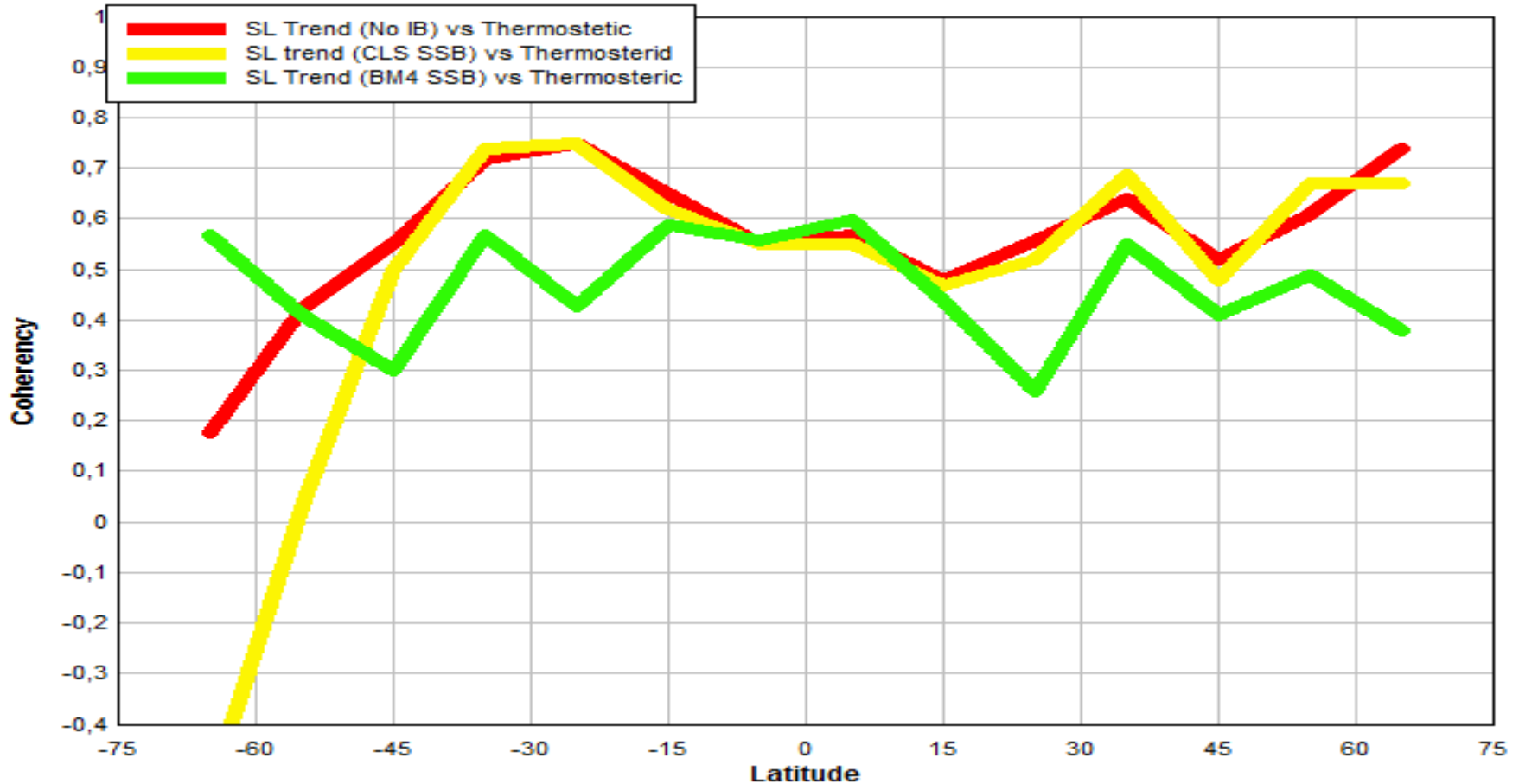


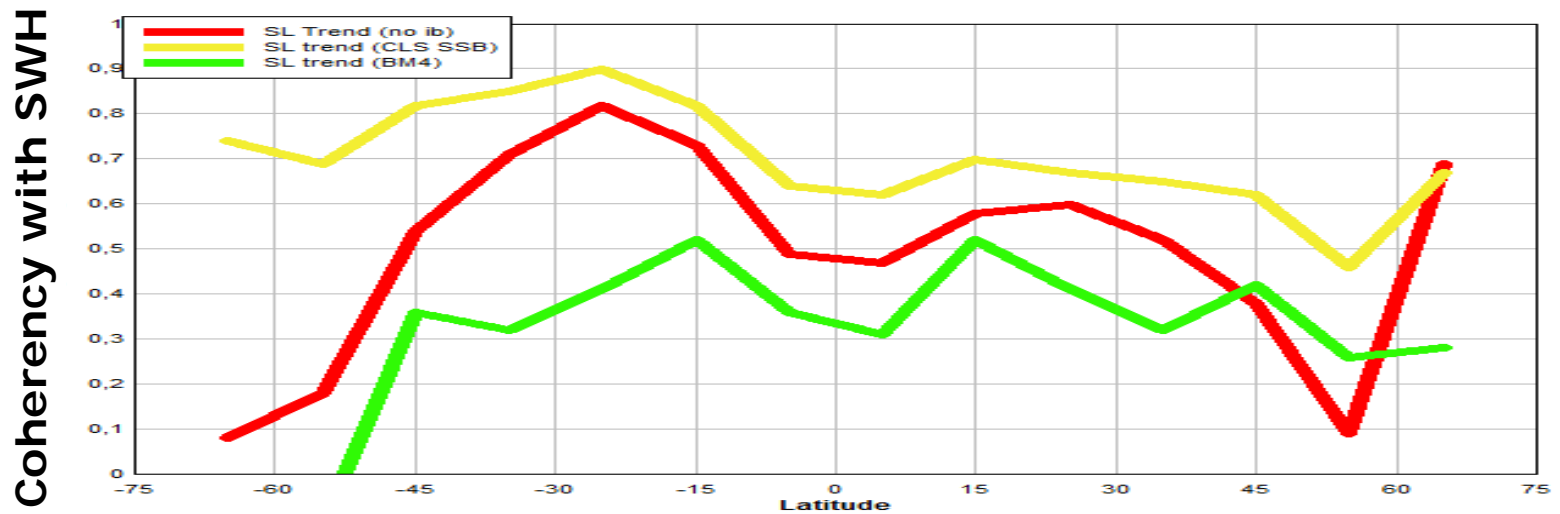
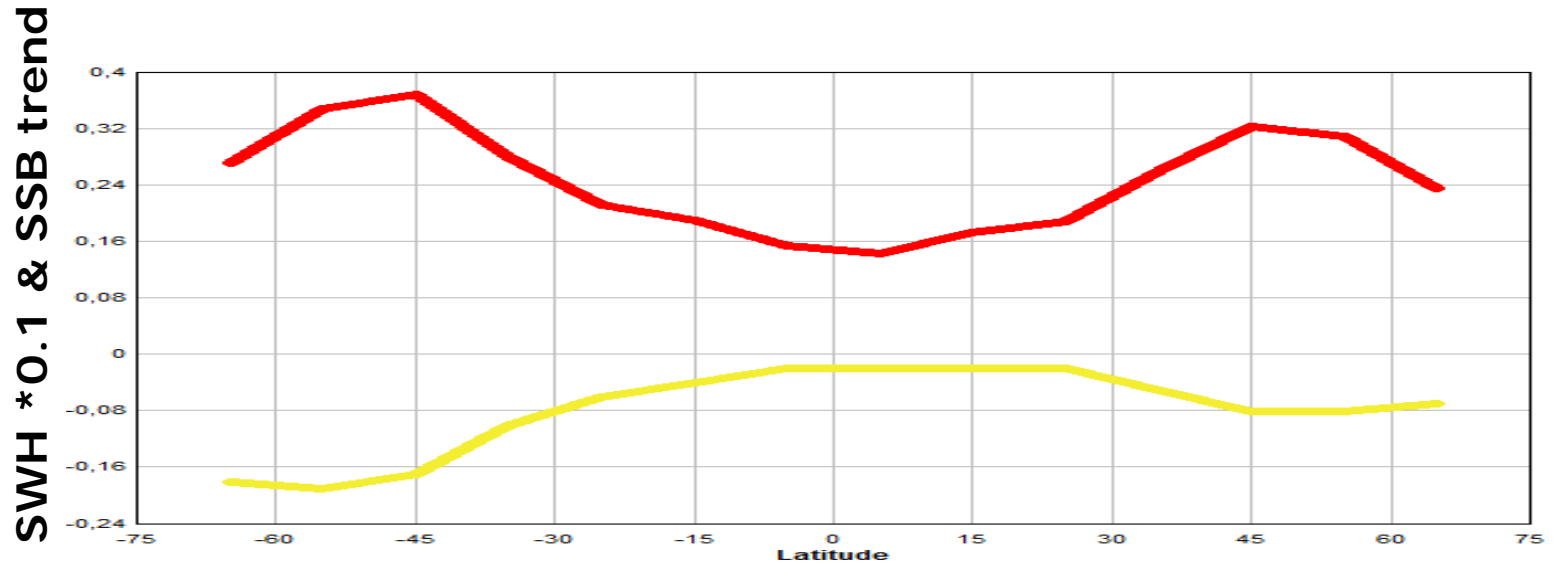
Altimetric
SLT
(NO SSB
Applied)



-0.50 -0.25 0.00 0.25 0.50 centimeters/year

Spatial coherency – Thermosteric SL change





Why observe sea level change in regions with largest SWH (accidental?)

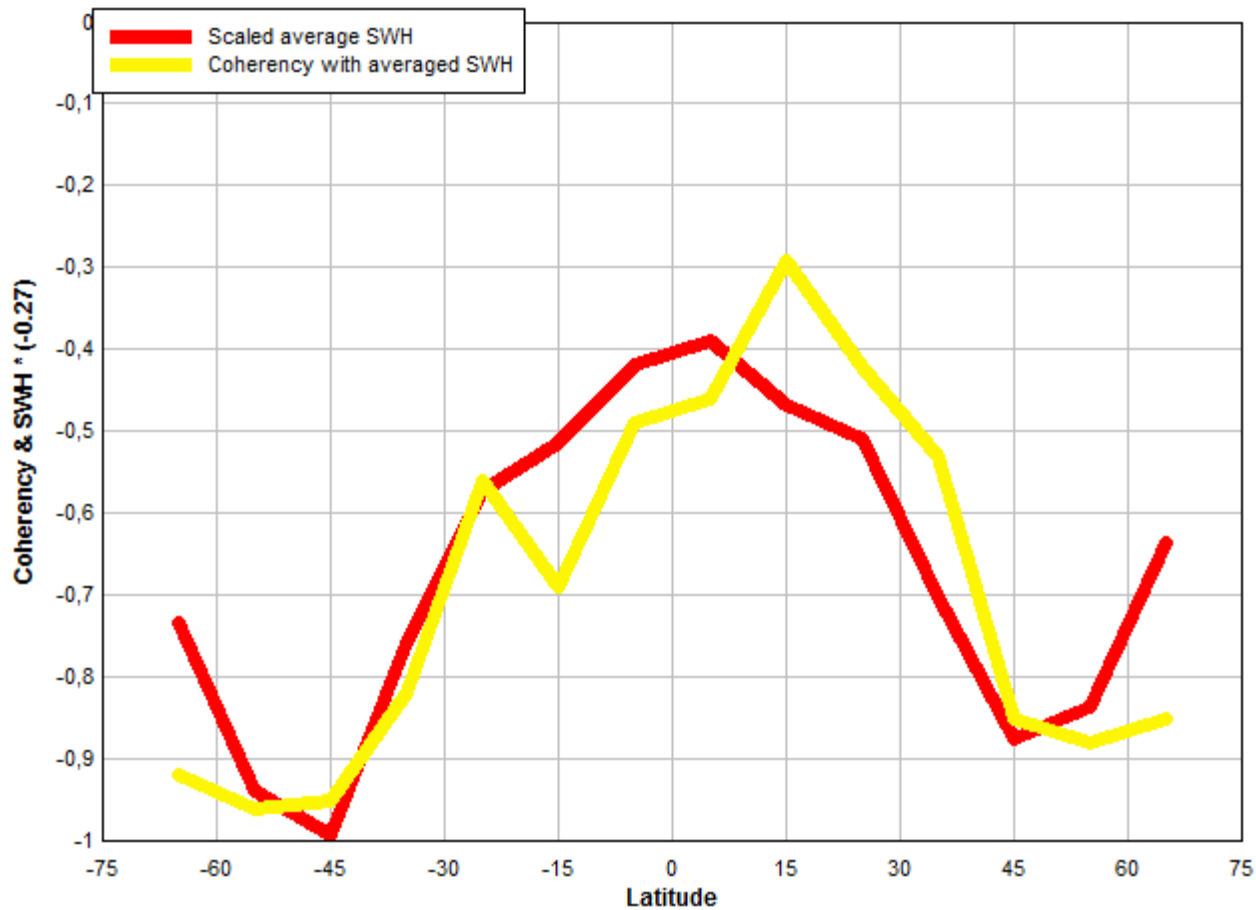
Summary

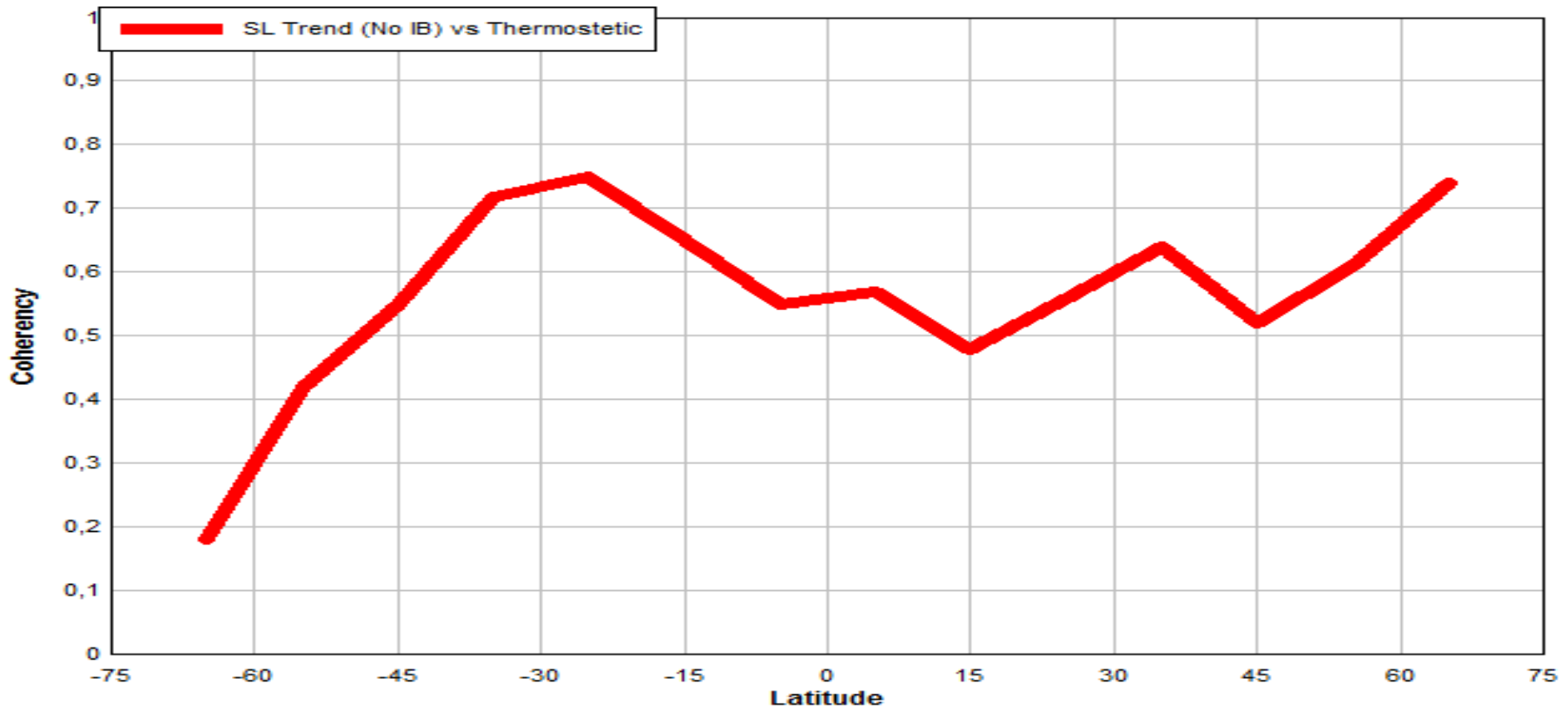
- Using Non-parametric CLS SSB more than half of the observed current day sea level rise below 40S can be contributed to trend in the SSB correction.
- Substituting CLS nonparametric SSB model with BM4 model closes the sea level change budget far better.
- Observe lower coherency with Thermosteric SL change when SSB applied
- Observe higher coherency with SWH when CLS SSB is applied
- New updated SSB correction by N. Tran to be investigated.

"Disclaimer":

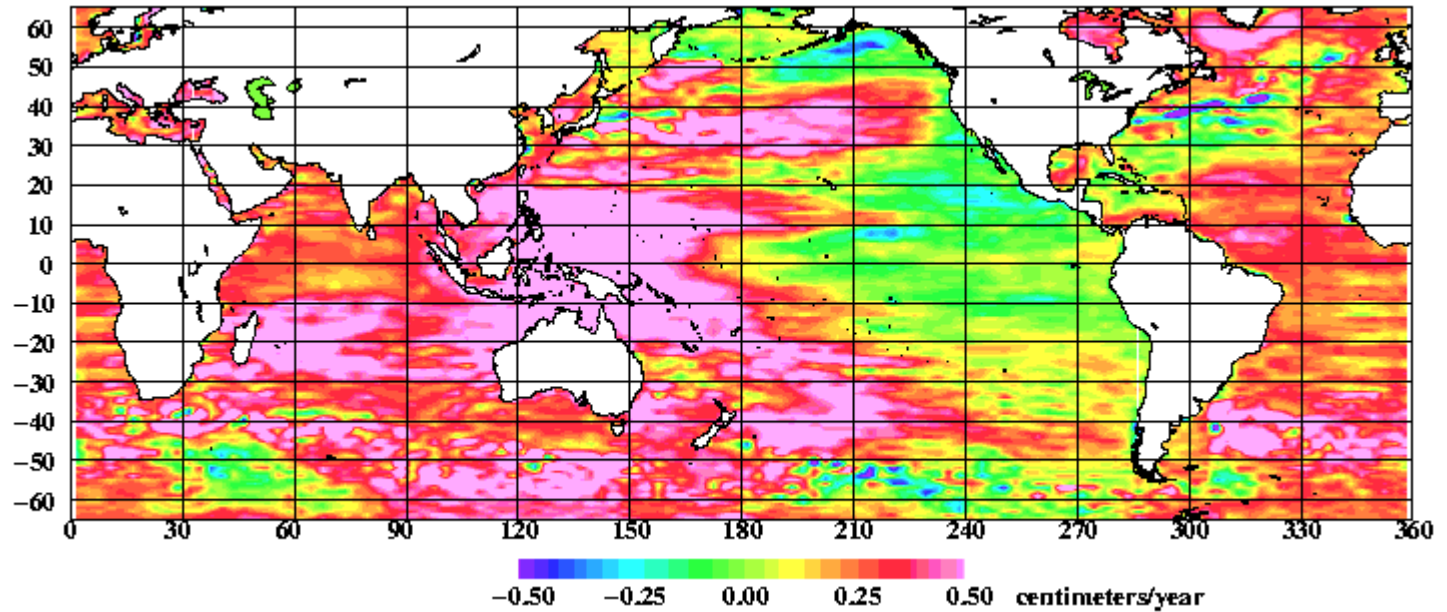
- I do not find BM4 to be superior to CLS non parametric SSB model for oceanographic studies, I only raise a flag of concern of use of SSB models for long term sea level change studies.

Backup slides

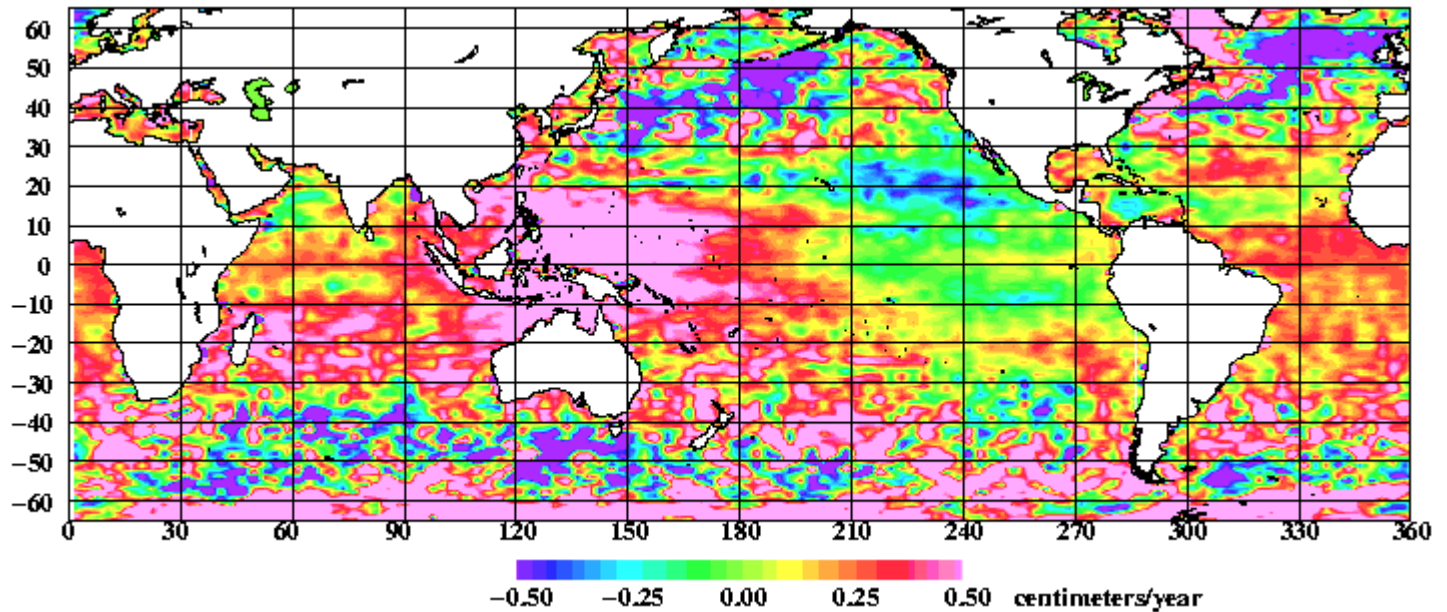




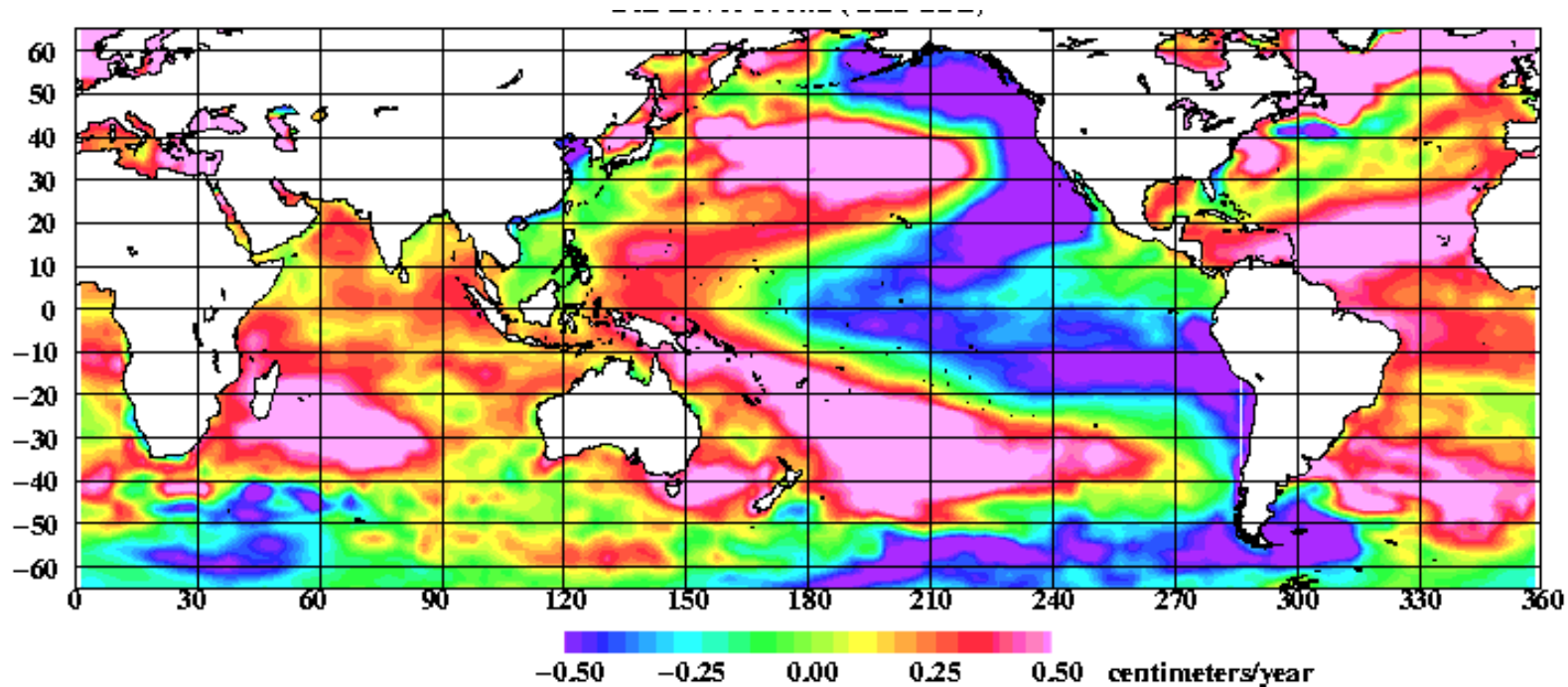
- Sea level trend
- CLS SSB.



- BM4 SSB



Sea level trend vs thermosteric sea level



- No SSB applied