

# Comparison of Altimeter-Based Global Mean Sea Level Time Series

R. Steven Nerem, J. Choe  
University of Colorado

M. Ablain, CLS

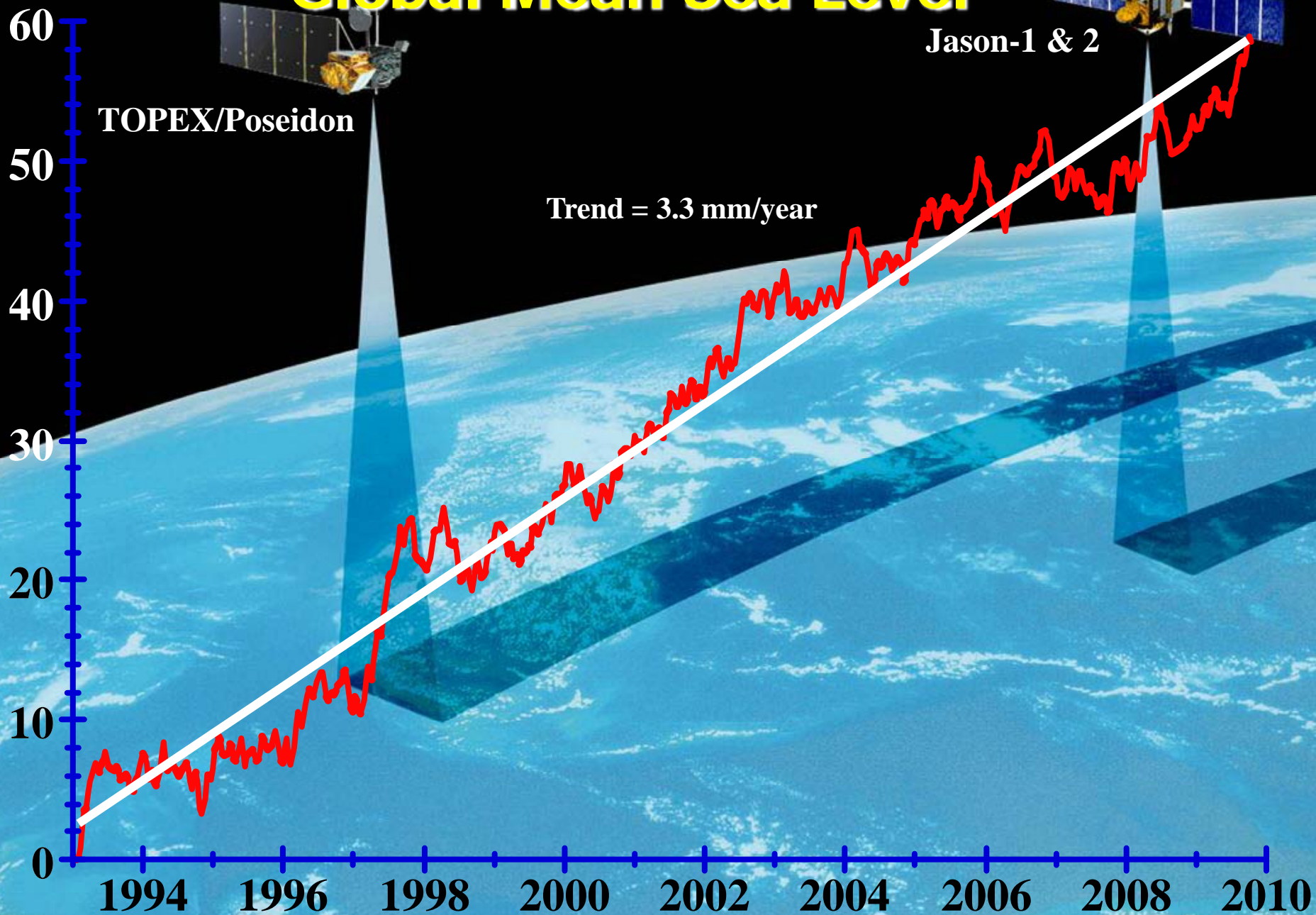
B. Beckley, NASA/GSFC

E. Leuliette, NOAA

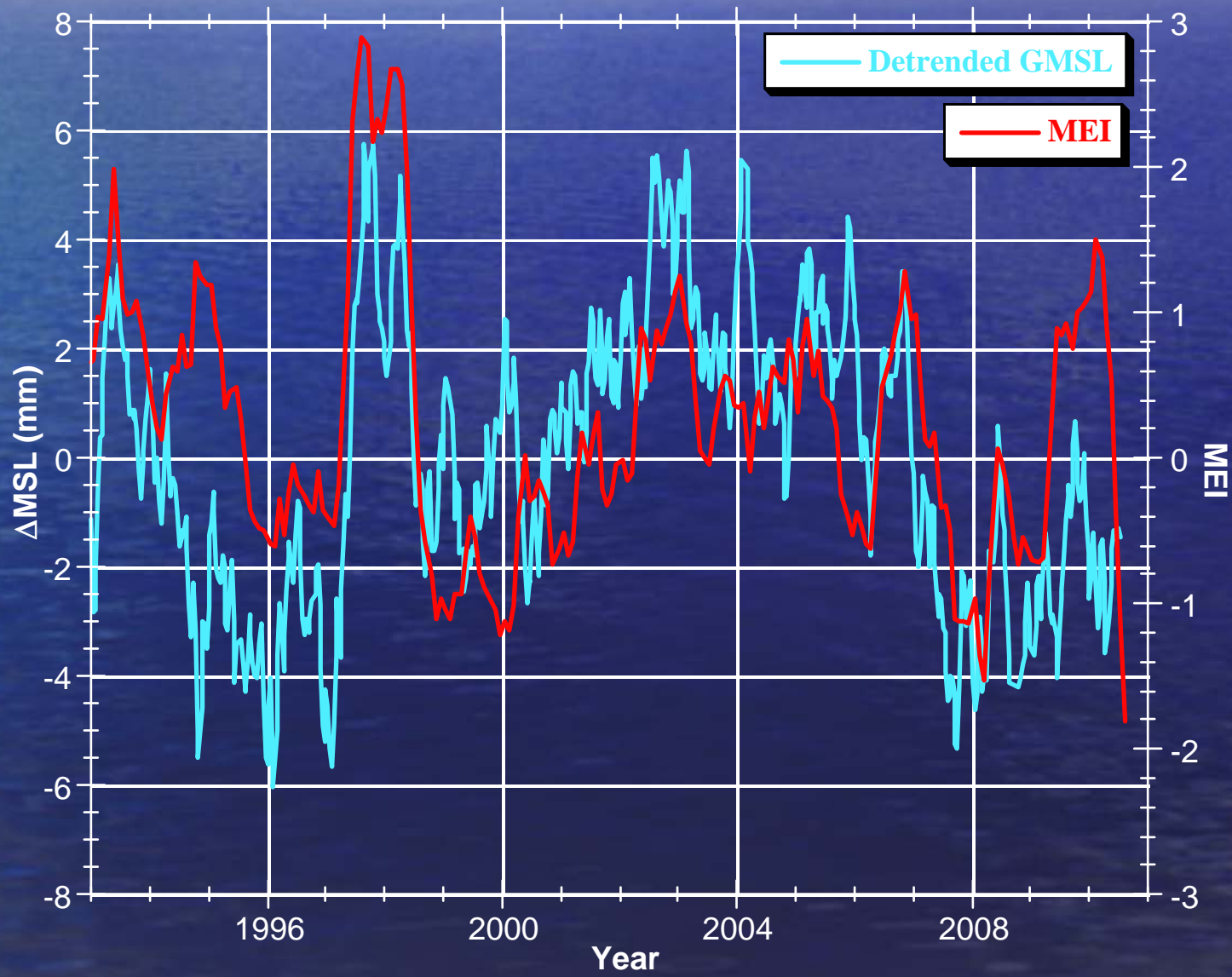
N. White, CSIRO



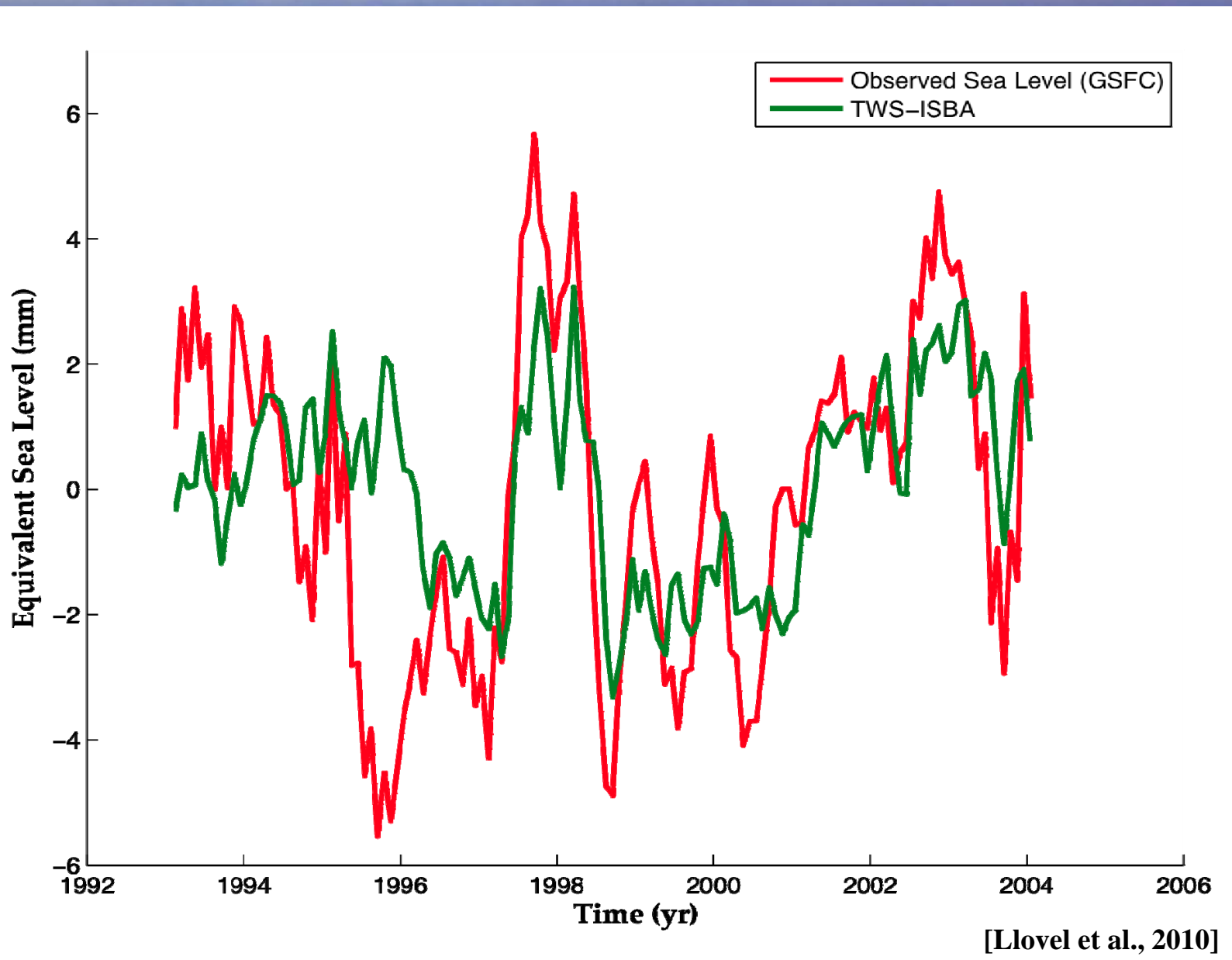
# Global Mean Sea Level



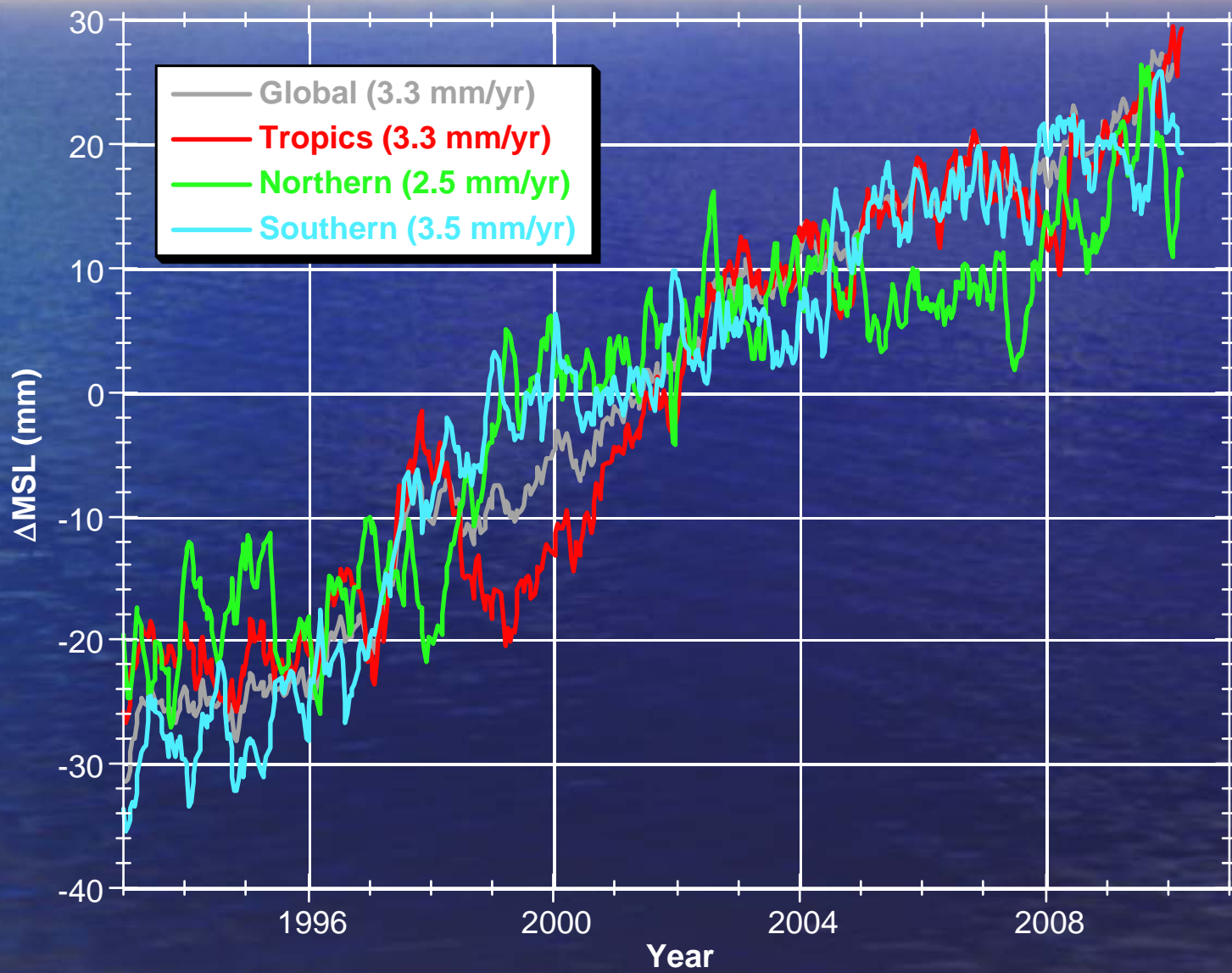
# Detrended GMSL and MEI



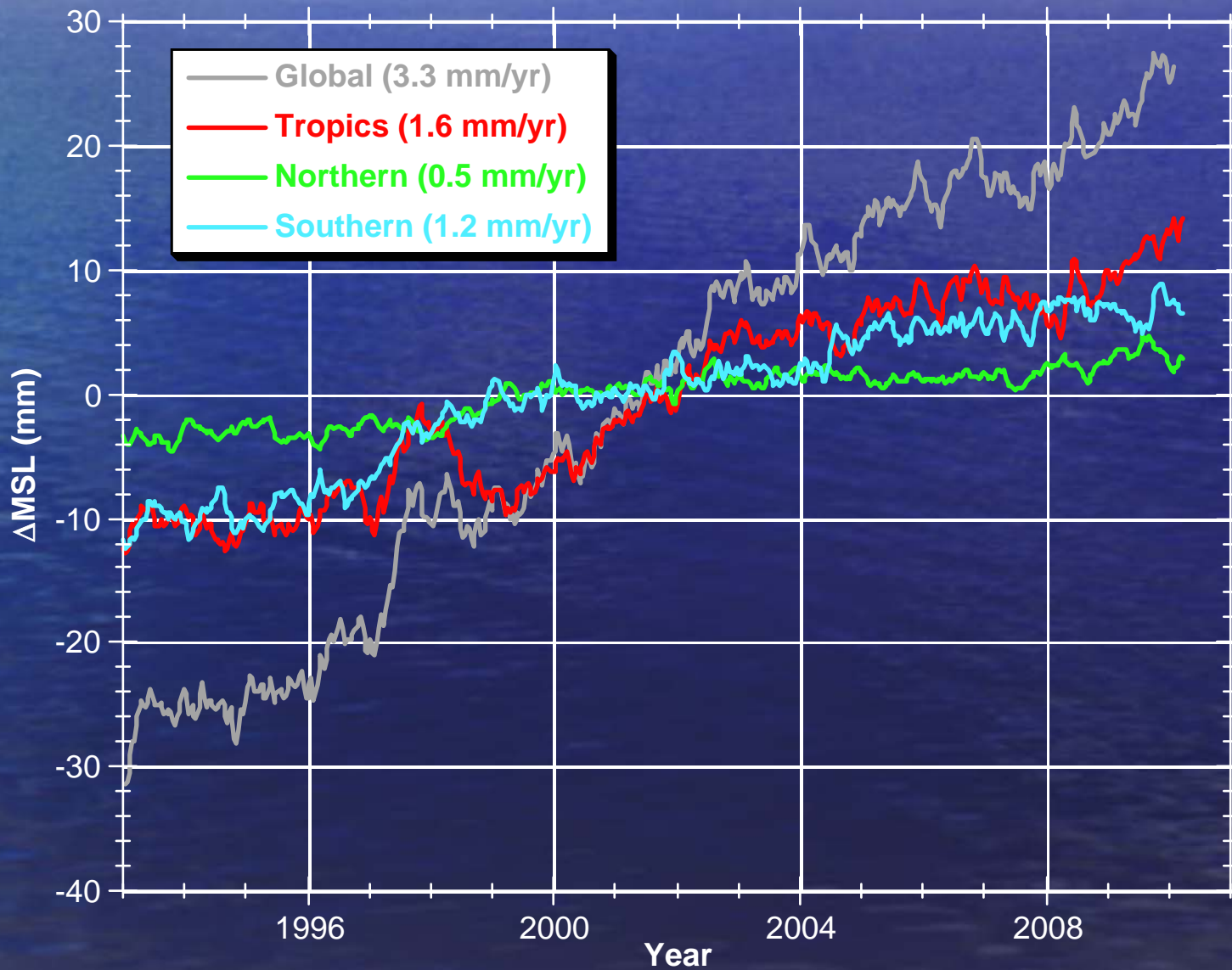
# Hydrology Model vs Altimeter GMSL



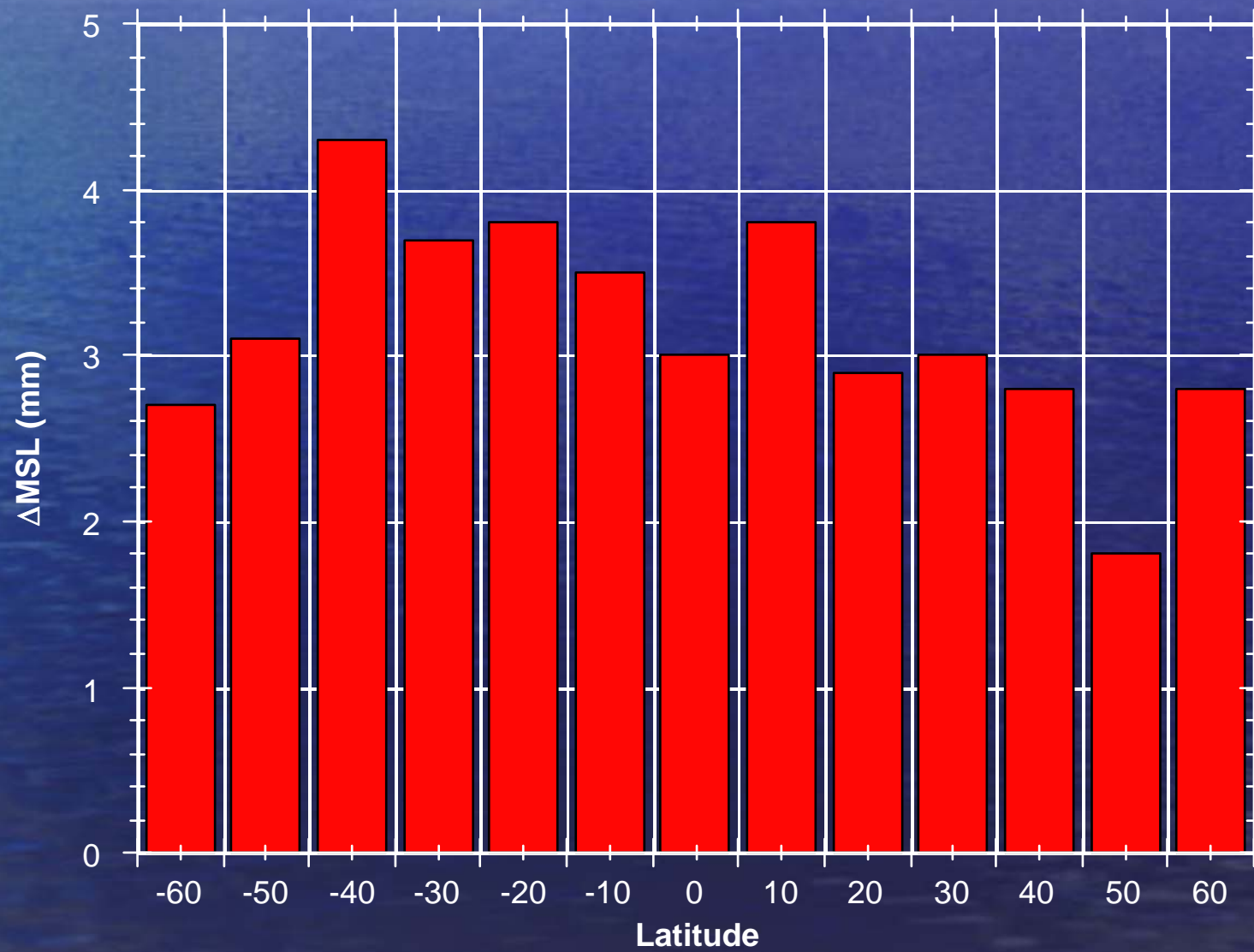
# Mean Sea Level



# Area-Weighted Contribution to GMSL



# MSL Rates in 10° Latitude Bands



# IPCC AR5

- The writing of the next IPCC Climate Assessment (AR5) begins in November 2010 in Kunming, China.
- In addition to an Ocean Observations chapter (Chapter 3), there will be a chapter dedicated to Sea Level Change (Chapter 13).
- Satellite measurements of sea level change (altimetry, GRACE, etc.) will be prominently featured.
- Journal articles must be submitted by July 31, 2012, and must be in press or published by March 15, 2013.

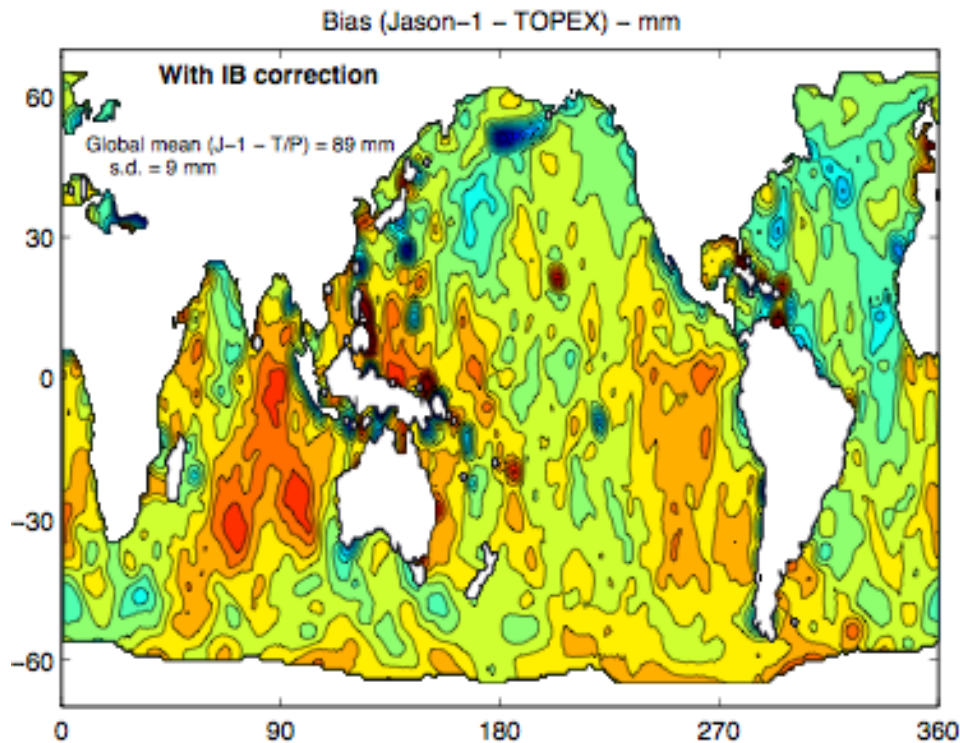


# Differences in Solutions

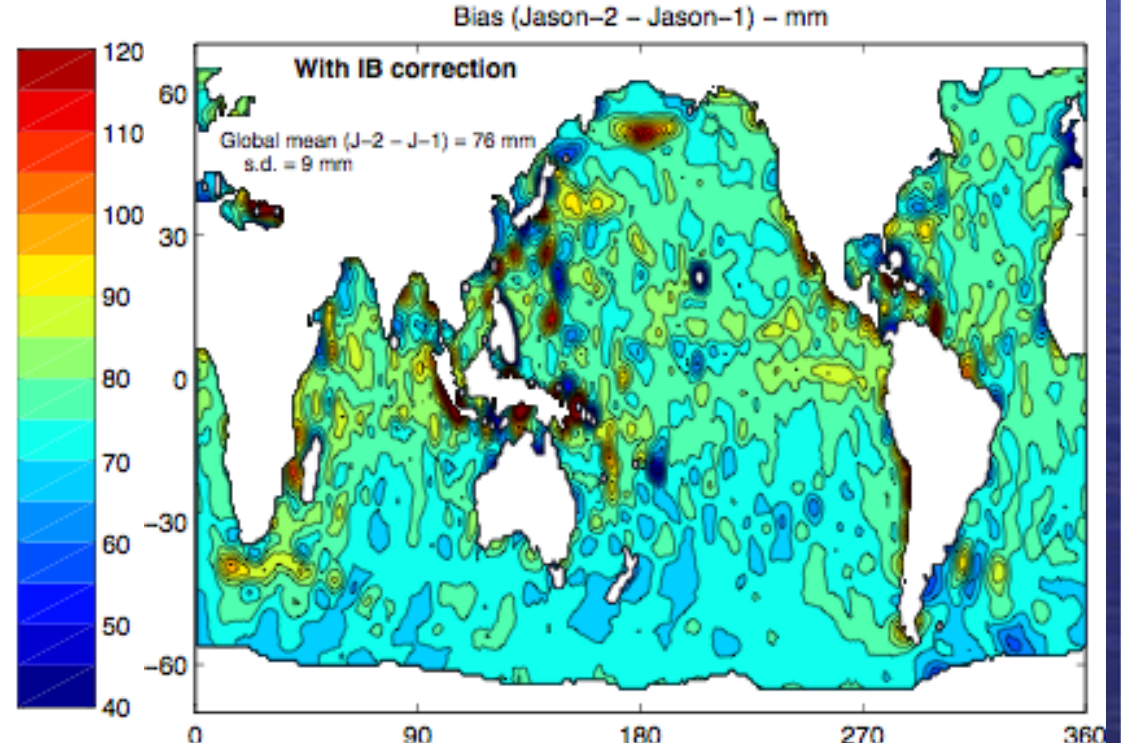
- Time series examined from AVISO, CCAR, CSIRO, GSFC, and NOAA (almost all publicly available)
- Some solutions average the along-track data (CCAR, GSFC) while others compute averages from a gridded field (AVISO, CSIRO, NOAA)
- Significant differences in SSB models, orbit solutions & reference frames, data editing, depth mask, and inter-mission biases.
- 60-day smoothing applied (e.g. issues of Center-of-Gravity corrections and tide models are left to another session!).
- Standard deviation of the GMSL differences is  $\sim 2.5\text{-}3$  mm,  $\sim 1.3\text{-}2$  mm after 60-day smoothing is applied.

# Inter-mission Biases

## Jason-1 minus TOPEX



## Jason-2 minus Jason-1



	CCAR	AVISO	CSIRO	GSFC	NOAA
J1-TP	99.6	84.5	89.0	97.0	83.0
J2-J1	75.3	75.4	75.7	76.3	75.8

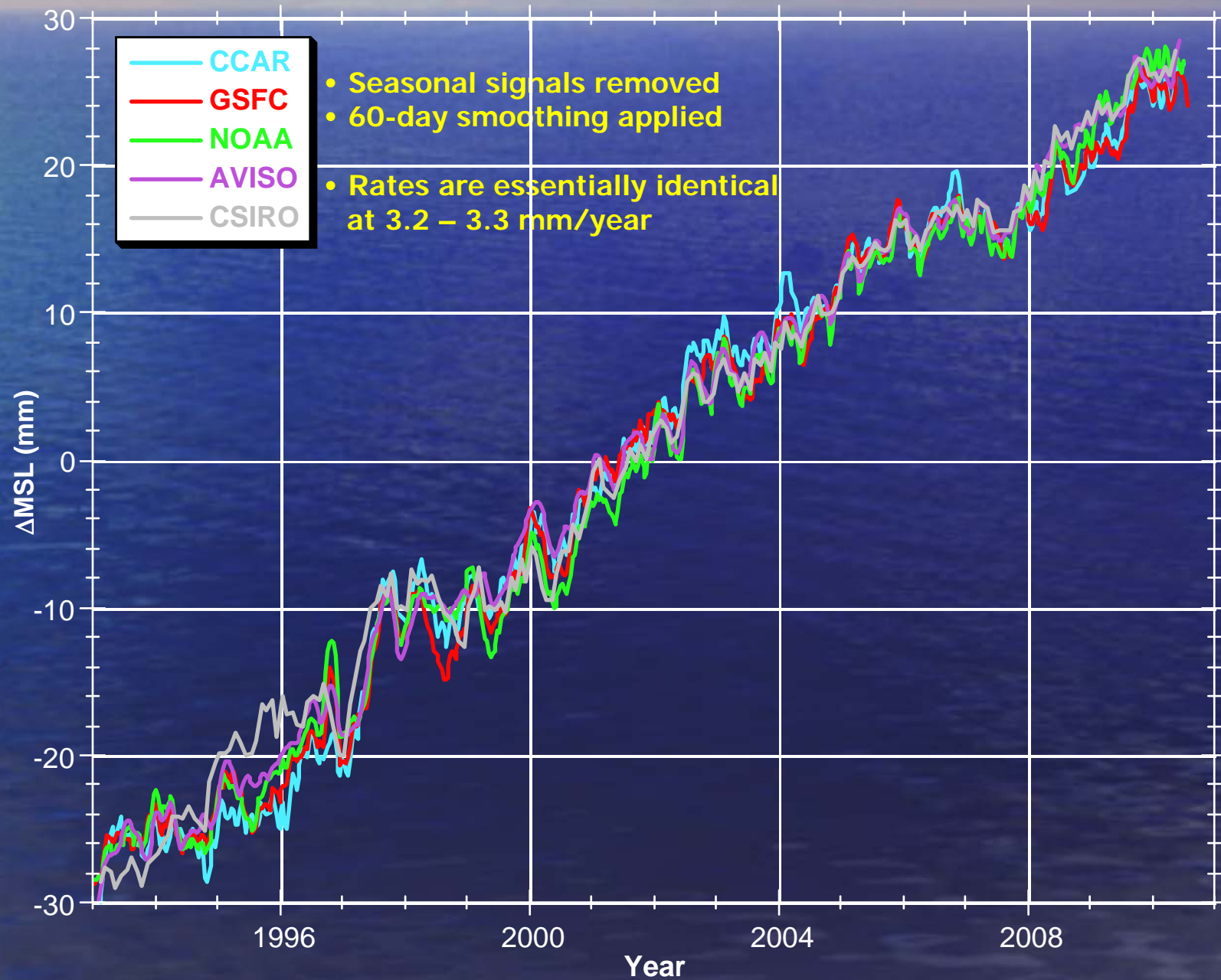
# Seasonal Variations in GMSL

Group	Annual (mm)	Annual (degrees)	Semi-Annual (mm)	Semi-Annual (degrees)
<b>AVISO</b>	6.4	299	1.7	236
<b>CCAR</b>	4.7	284	1.6	208
<b>CSIRO</b>	5.3	288	1.6	231
<b>GSFC</b>	4.0	287	1.9	199
<b>NOAA</b>	5.7	299	1.6	226

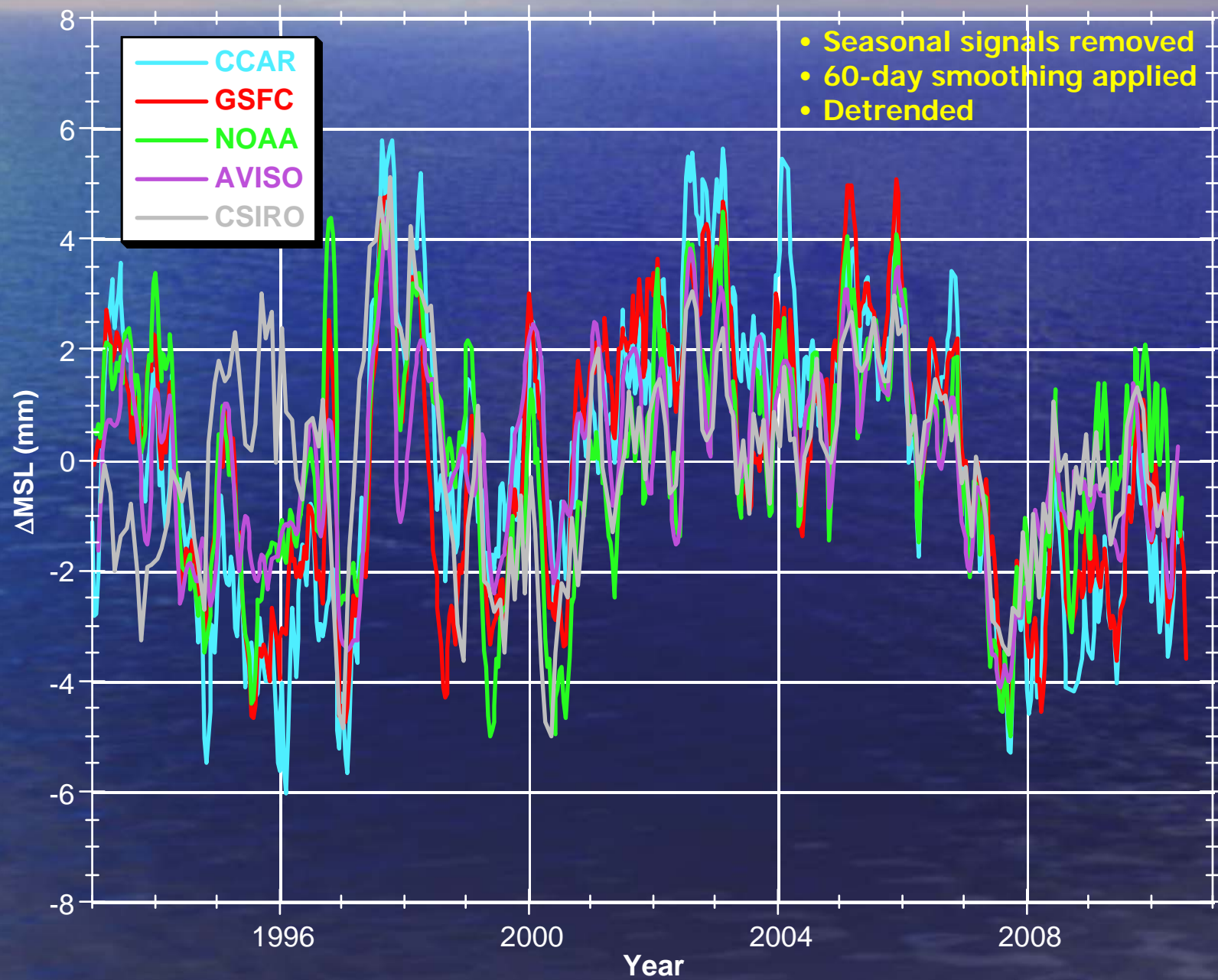
# Effect of Depth Mask on Seasonal Variations

Depth Mask (m)	Annual (mm)	Annual (degrees)	Semi-Annual (mm)	Semi-Annual (degrees)
0	5.5	293	1.6	217
120	4.7	284	1.6	208
200	4.7	283	1.6	196

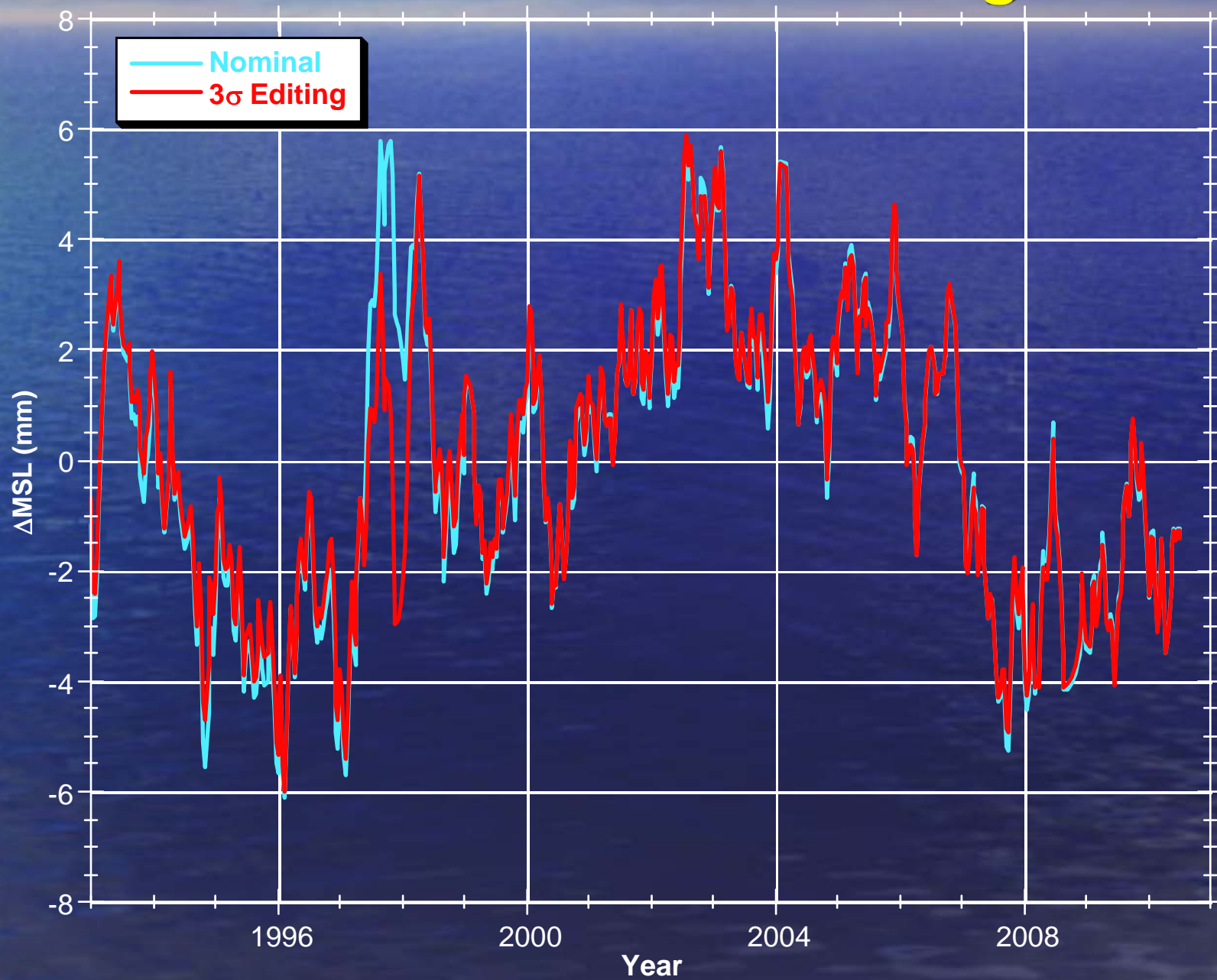
# Global Mean Sea Level Variations



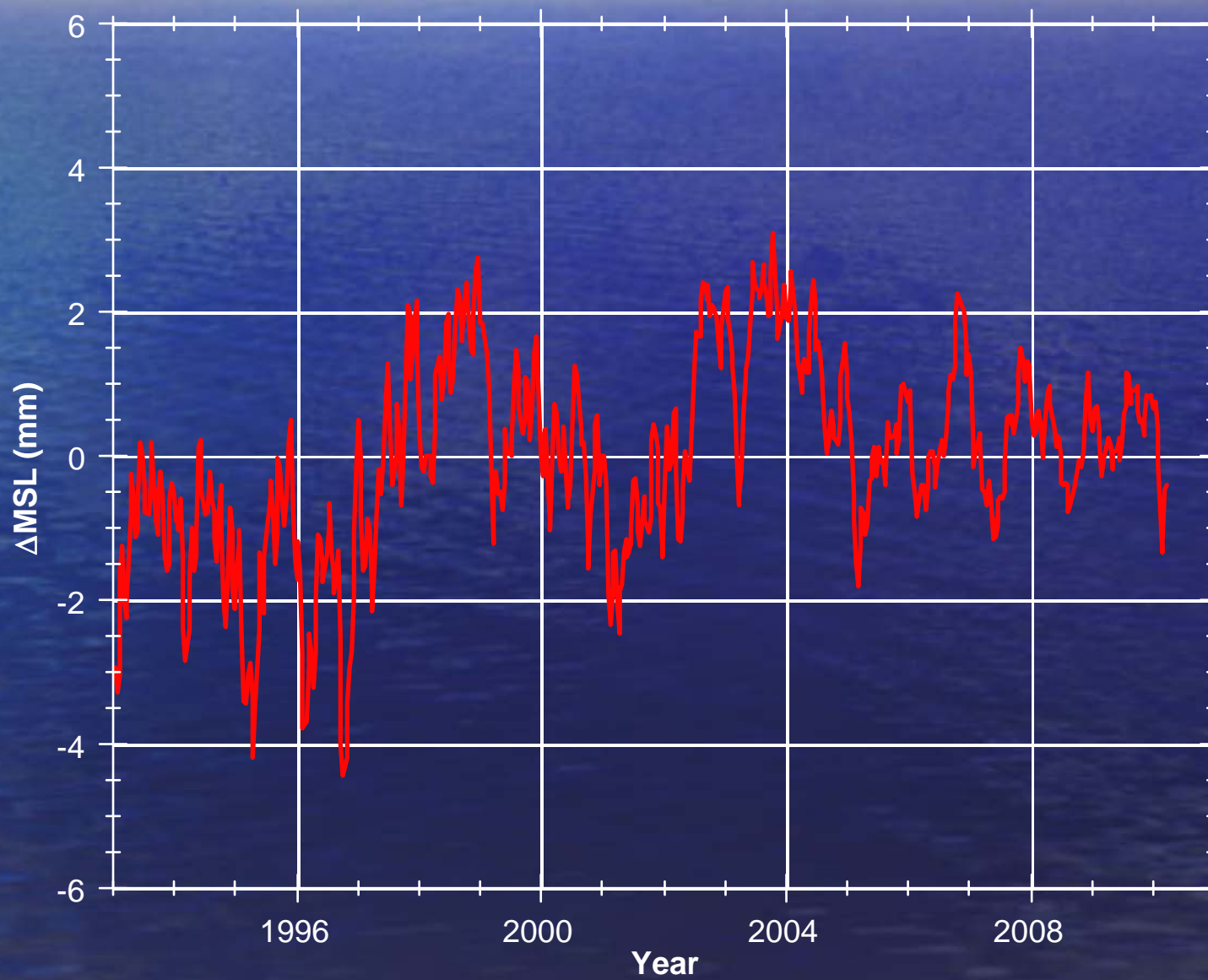
# Detrended GMSL Variations



# Effects of $3\sigma$ Data Editing



# CCAR minus GSFC MSL Differences

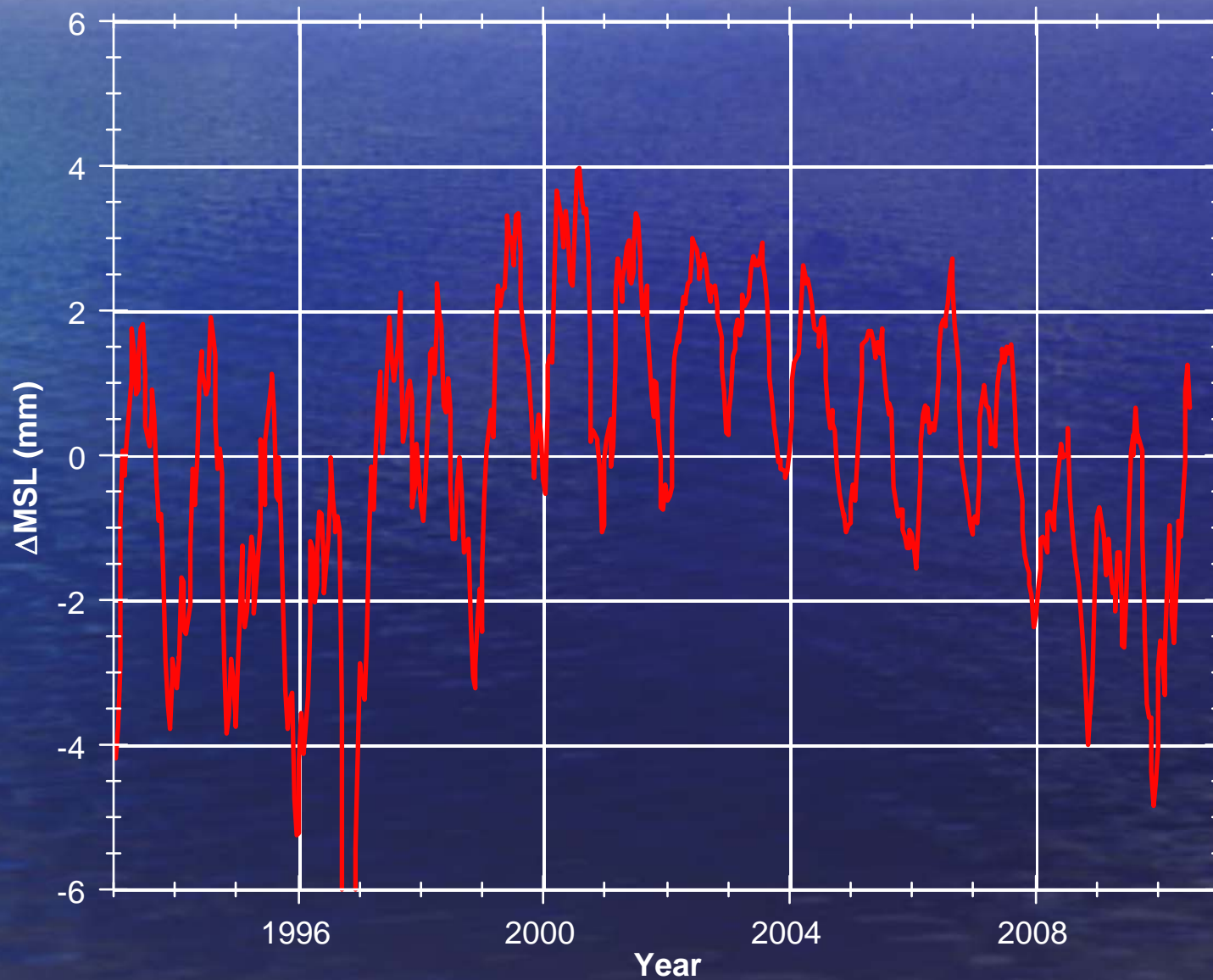




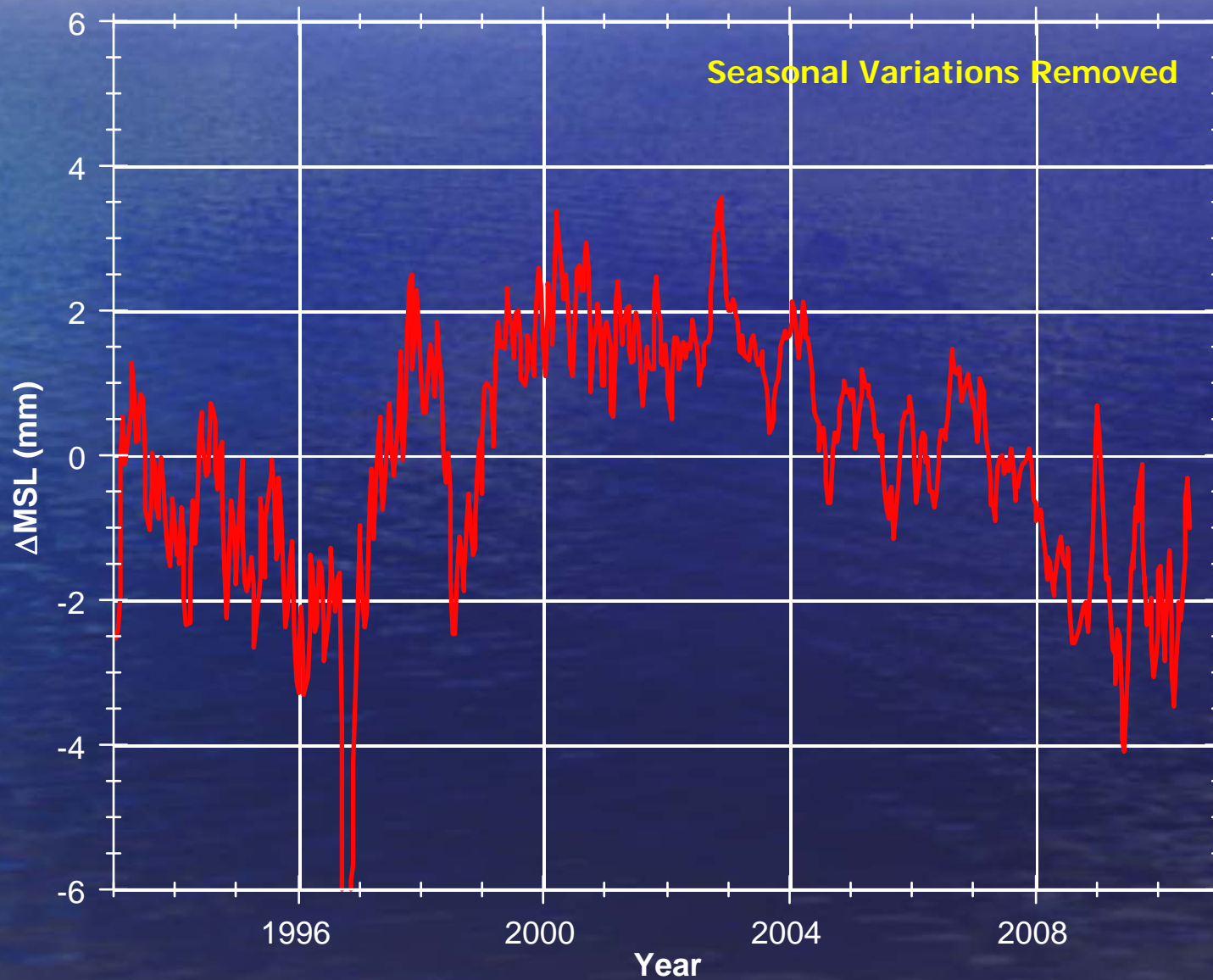
# Orbit and Reference Frame Effects

	TX+J1			TOPEX			Jason-1		
	ann	trend	rms	ann	trend	rms	ann	trend	rms
GGM02C/ITRF2000	5.67	2.97	3.57	5.81	2.89	2.97	5.83	1.99	3.52
GGM02C/ITRF2005	5.68	2.97	3.40	5.83	2.82	2.98	5.80	2.14	3.26
CNES EIGEN-GL04C	5.65	2.87	3.41	5.79	2.82	2.98	5.63	2.36	3.63
GSFC GDR-C Prime	5.70	2.93	3.34	5.84	2.83	2.98	5.74	2.36	3.43

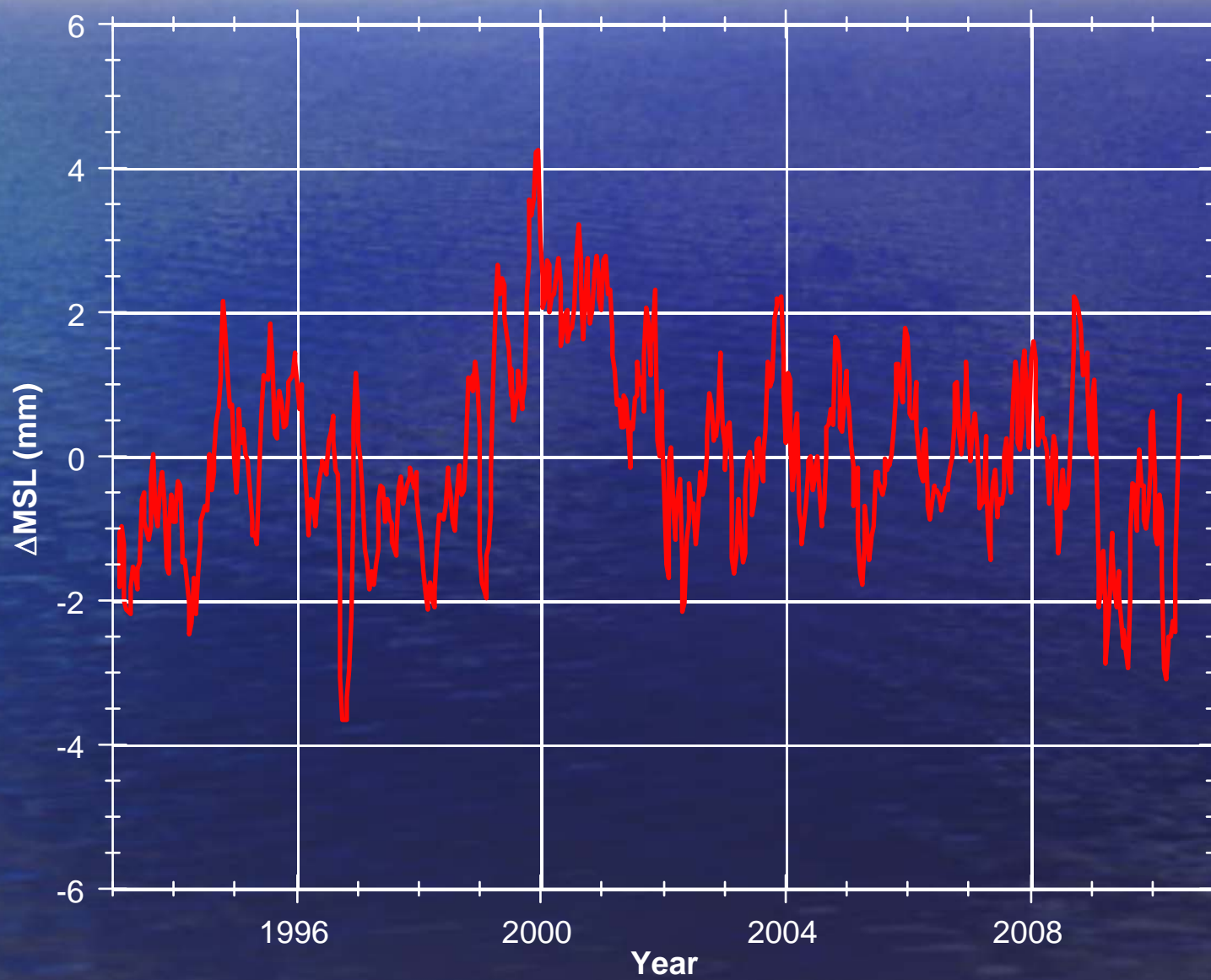
# CCAR minus NOAA MSL Differences



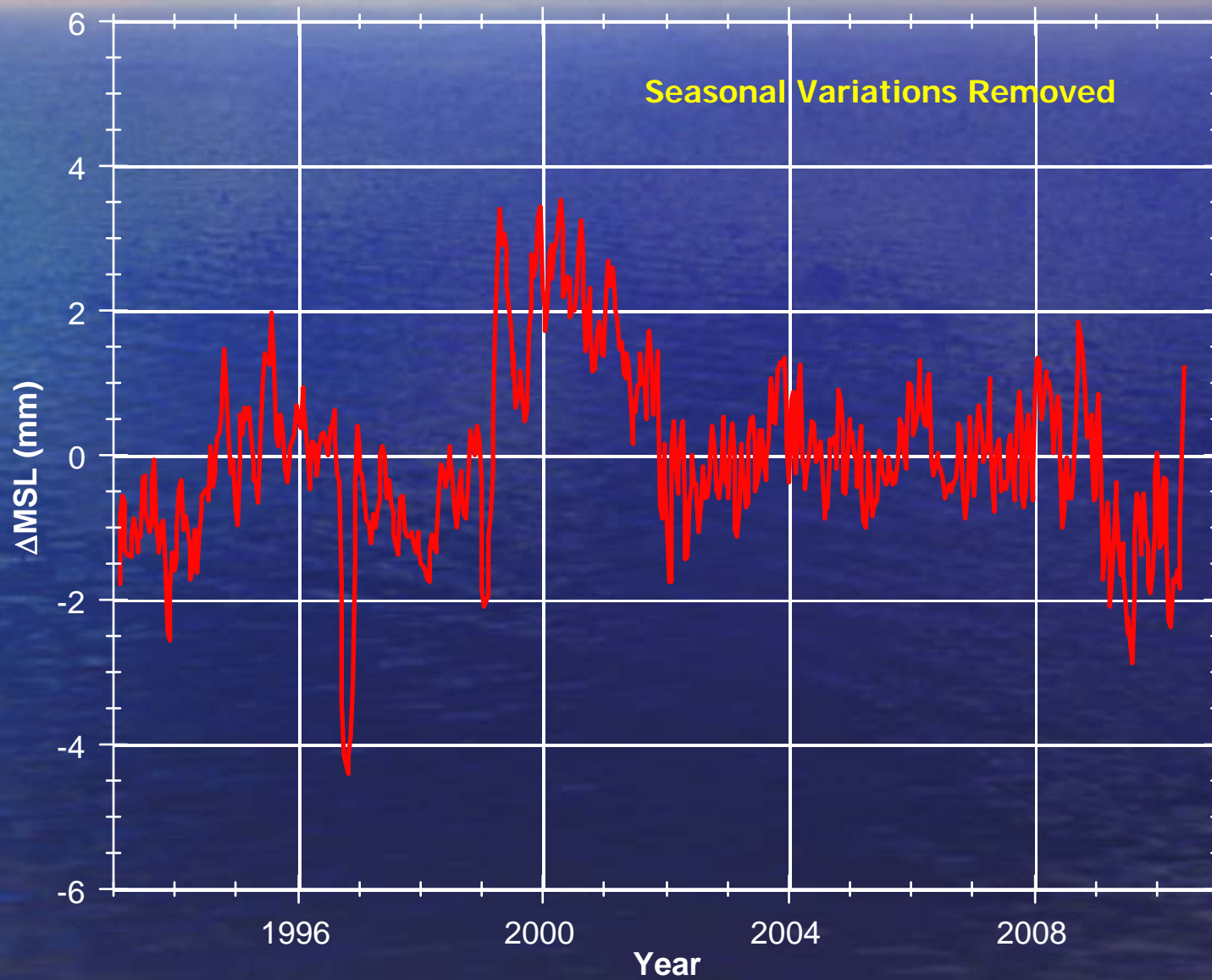
# CCAR minus NOAA MSL Differences



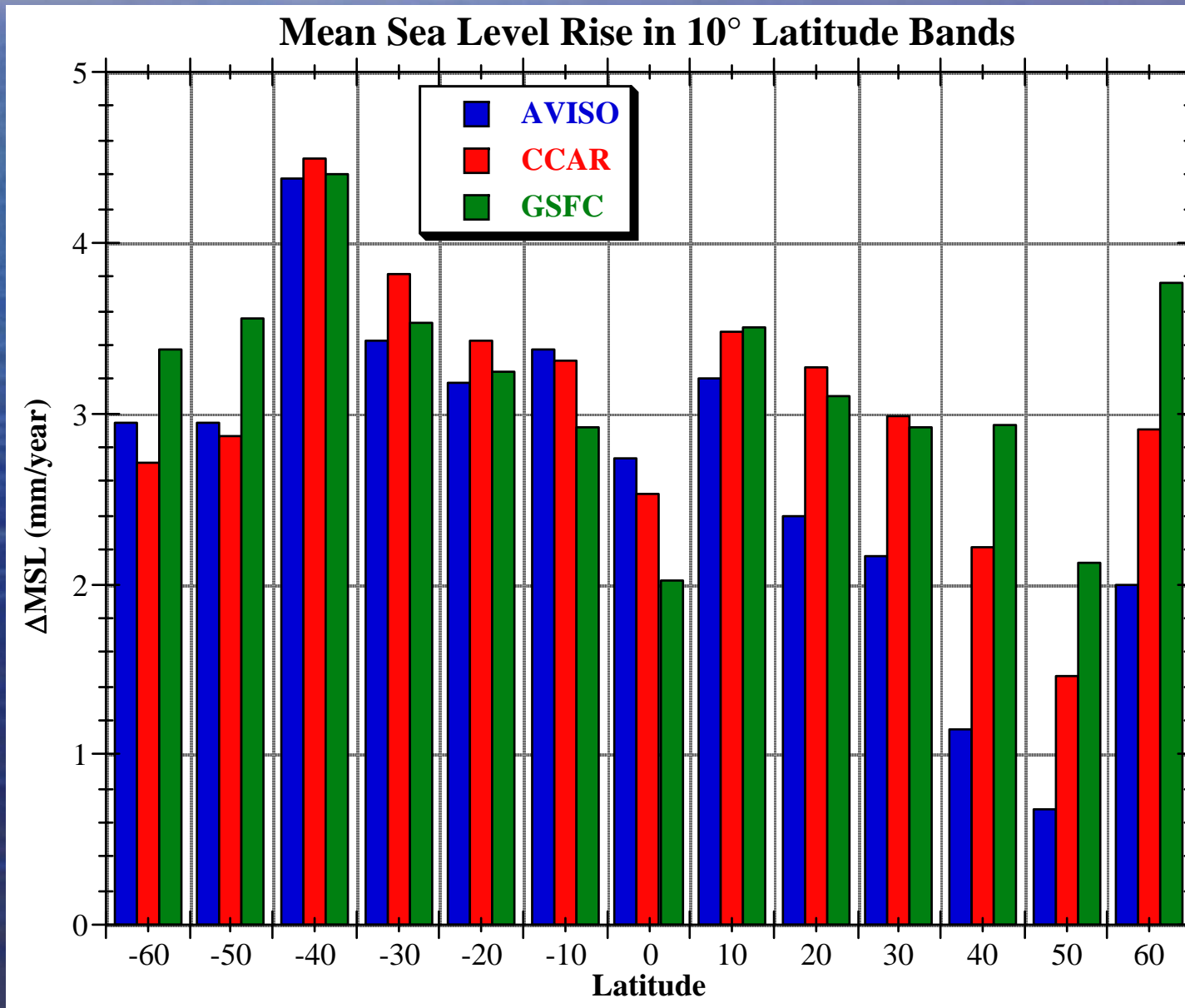
# AVISO minus NOAA MSL Differences



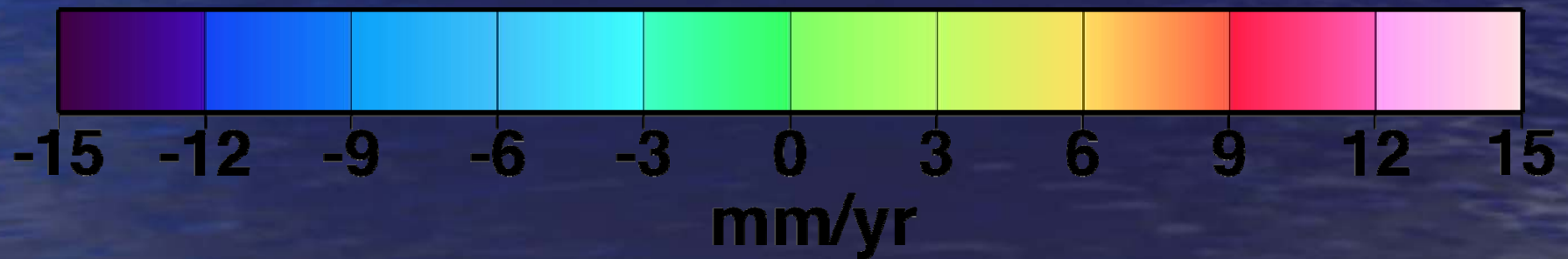
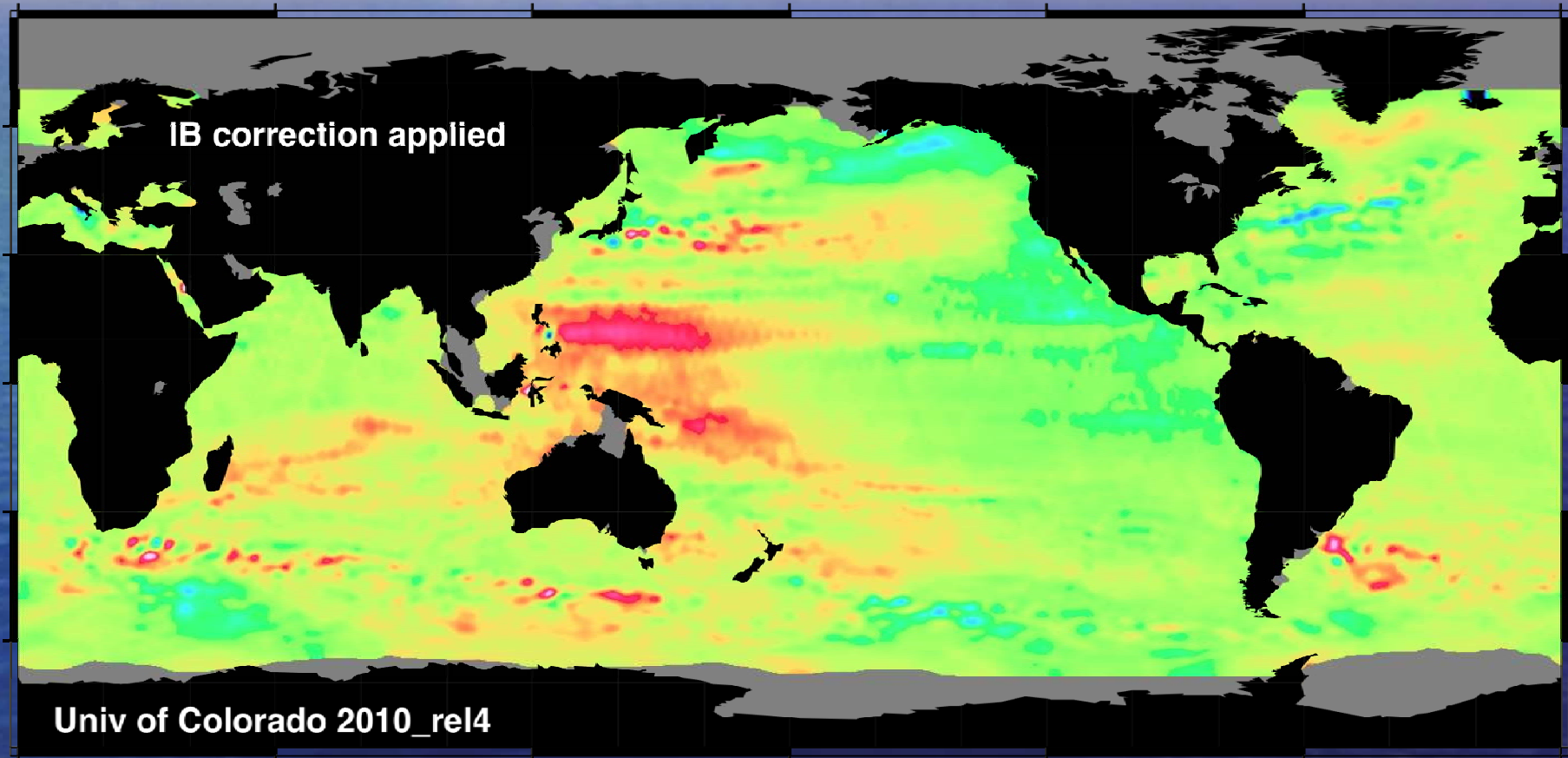
# AVISO minus NOAA MSL Differences



# Spatial Variations in Sea Level Rise



# Spatial Variations in Sea Level Rise



# Summary

- In general, GMSL time series produced by different groups compare very well, though important differences still remain, especially for interannual variations.
- Future efforts should also focus the spatial differences of the observed sea level change, in addition to the GMSL differences.
- The public availability of the different time series serves the OSTST well, and also provides a method for identifying subtleties in the different analyses.

Final Note: The OSTST should try to submit their publications on mean sea level change and related matters by July 31, 2012 (published by March 15, 2013).