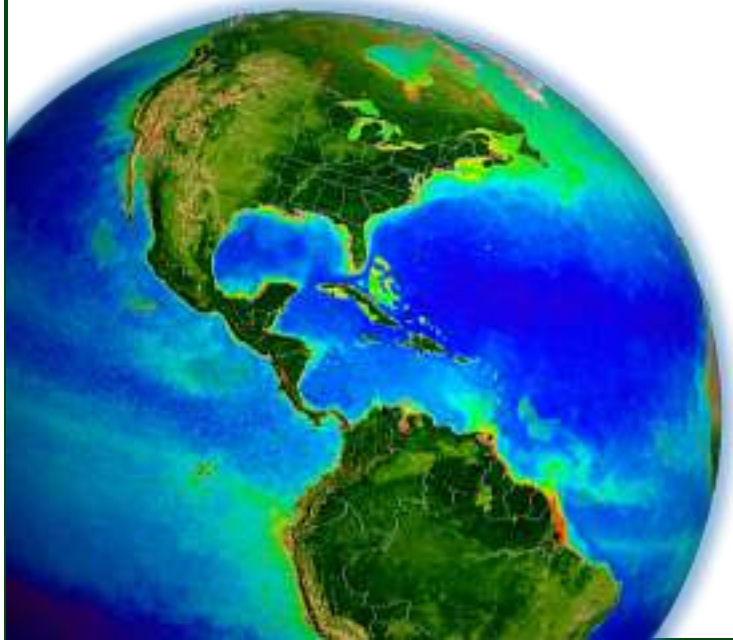


SeaWiFS Calibration Update

Fred Patt

a story of less than one digital count

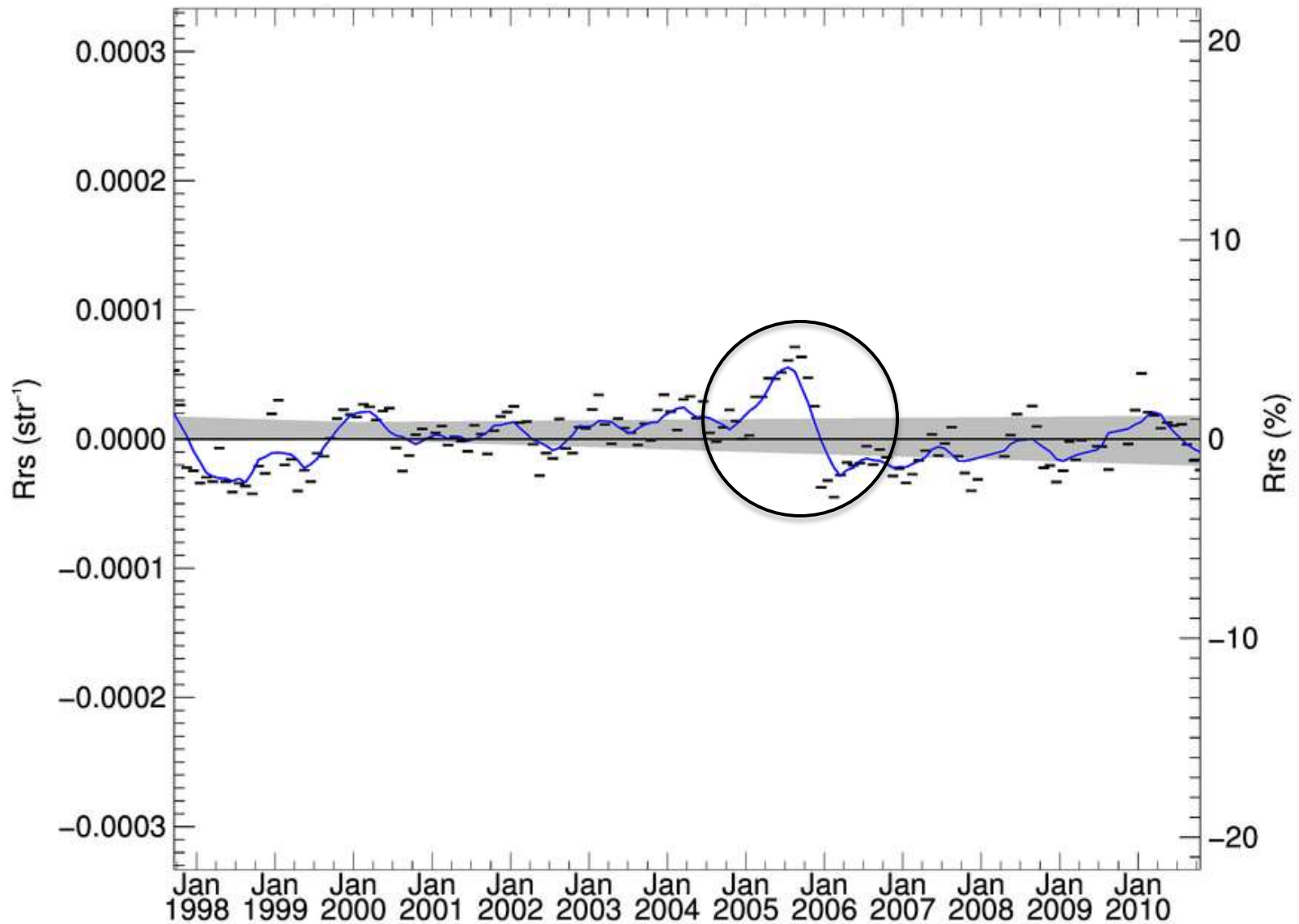


International Ocean Colour Science Meeting
San Francisco, CA, June 2015

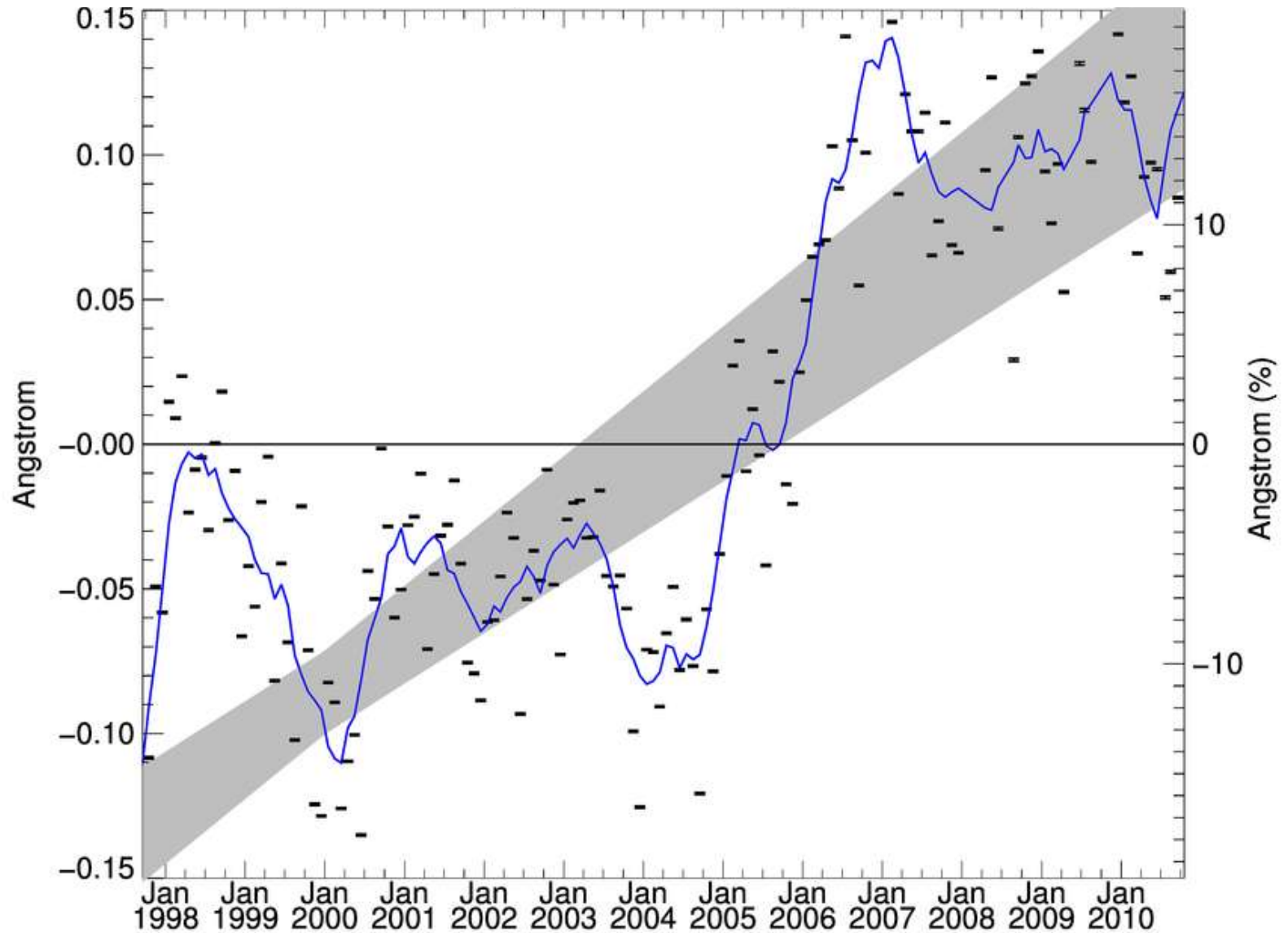
The Problem

- The SeaWiFS radiometry has shown remarkable overall stability over the mission (1997 – 2010).
 - The temporal response has been based on the lunar calibration.
- There have been persistent artifacts near the 2005 – 2006 transition in the retrieved parameters from the last reprocessing (2010).
- Past efforts to determine and correct the cause of this were unsuccessful.
- The OBPG took a fresh look at the problem in 2014. Analysis showed that the artifact was present in the TOA radiances.

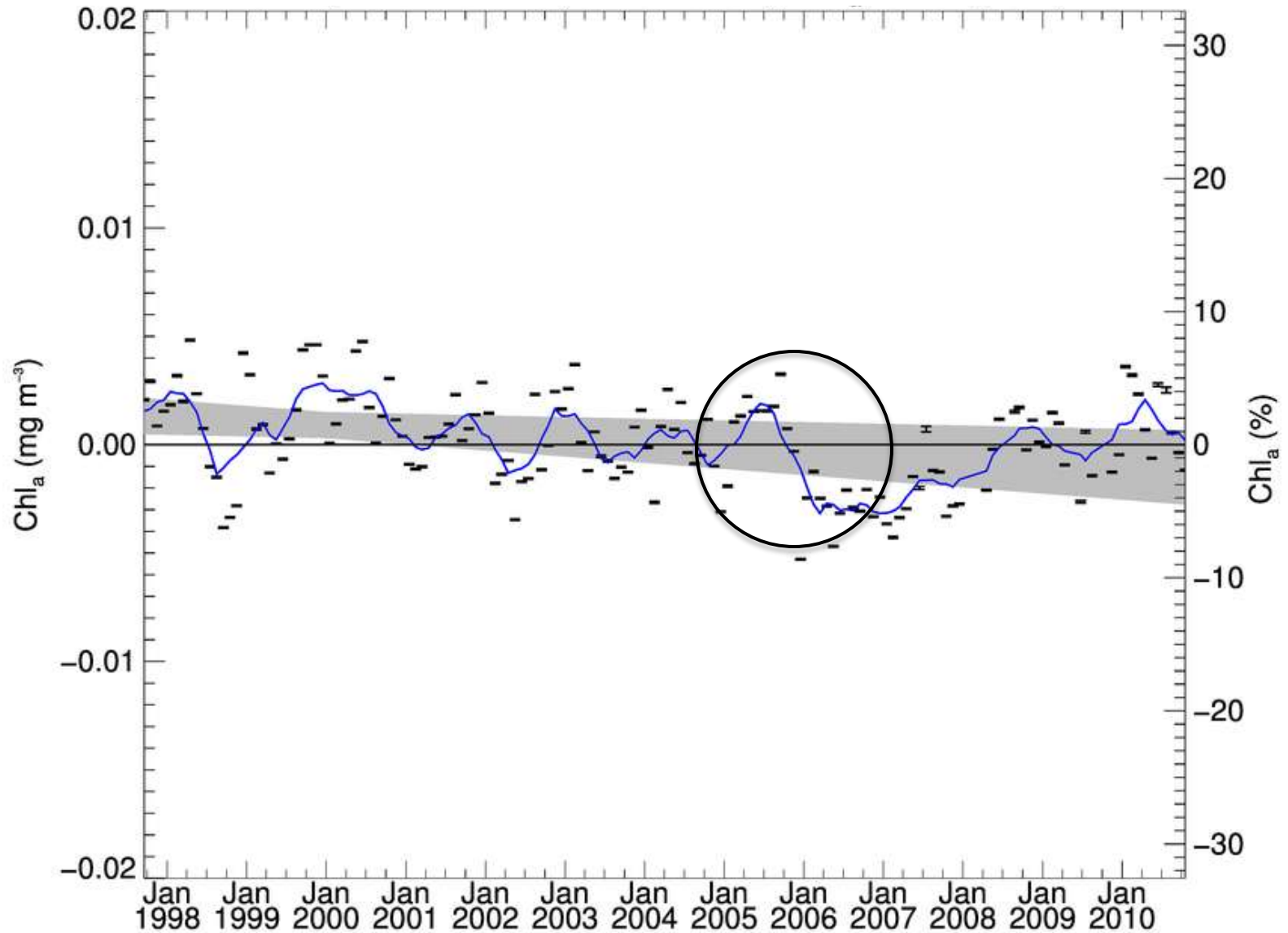
Clear-Water Rrs(555) Anomaly Trend



Aerosol Angstrom Anomaly Trend



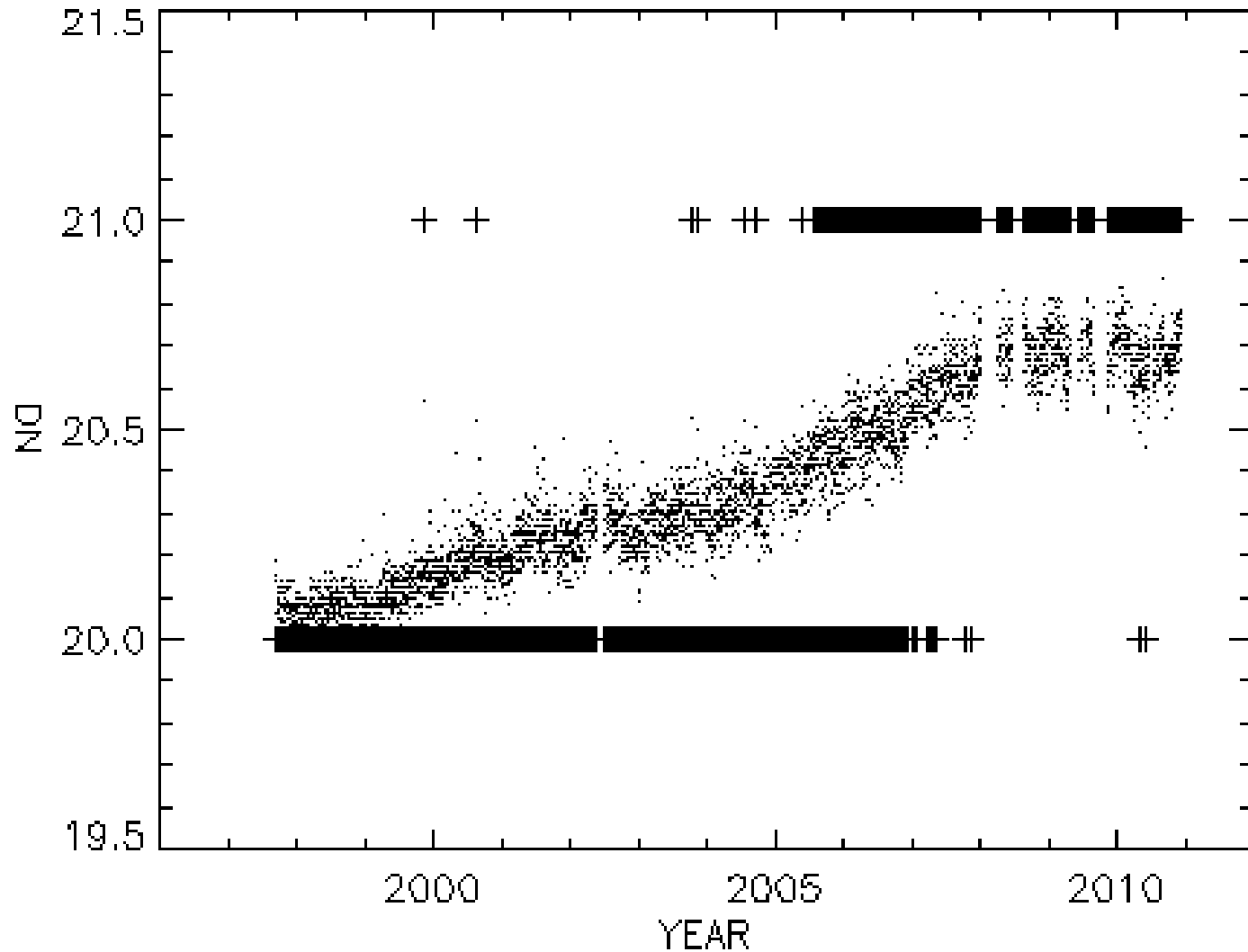
Chlorophyll-a Anomaly Trend



The Cause

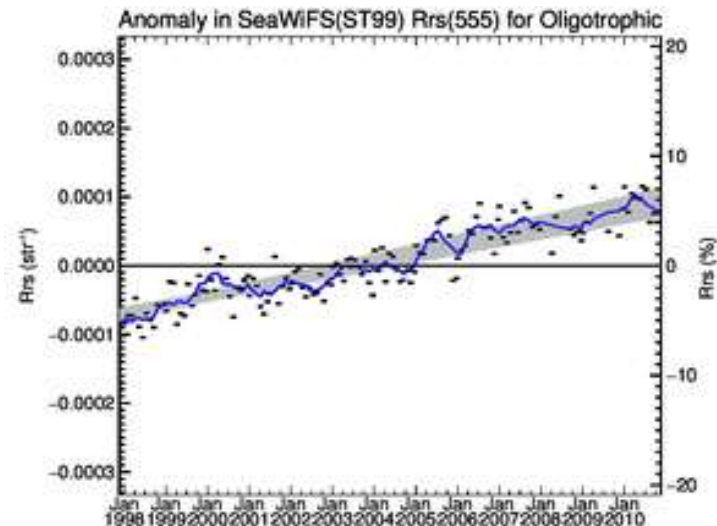
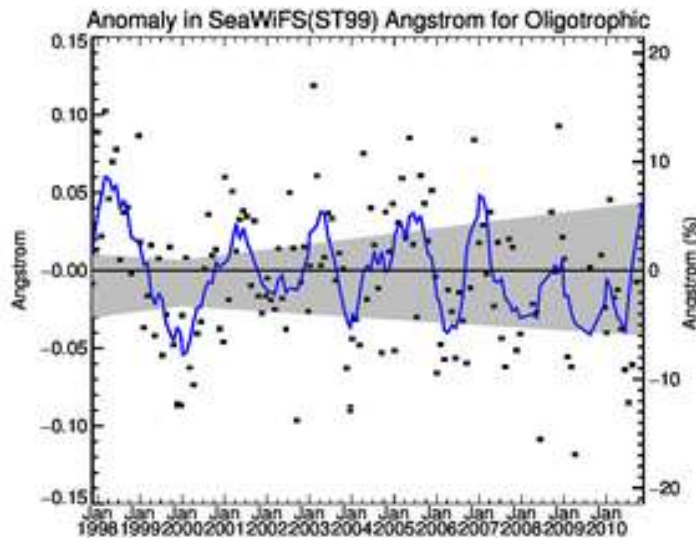
- The SeaWiFS Dark Restore value is provided as a single sample per band and scan during Earth observation.
 - The digitization of the dark restore is the same as for the Earth view data (10 bits).
- Early in the mission, the calibration processing implemented the dark restore processing as the median of all of the samples in a granule for each band.
- Examination of the dark restore counts over the mission showed that the values changed by less than one count in all bands.
 - 1 count = 0.2% of L_{typ} at 555 nm, 0.5% at 865 nm.
- The median value changed by one count in some bands and none in others.
 - For example, the Band 7 (765 nm) median dark restore did not change during the mission, while the Band 8 (865 nm) median changed by one count around the 2005 – 2006 transition.
- This resulted in the rapid change in the Angstrom and Rrs.

Band 8 Mean (.) and Median (+) Dark Restore per Orbit



Initial Verification

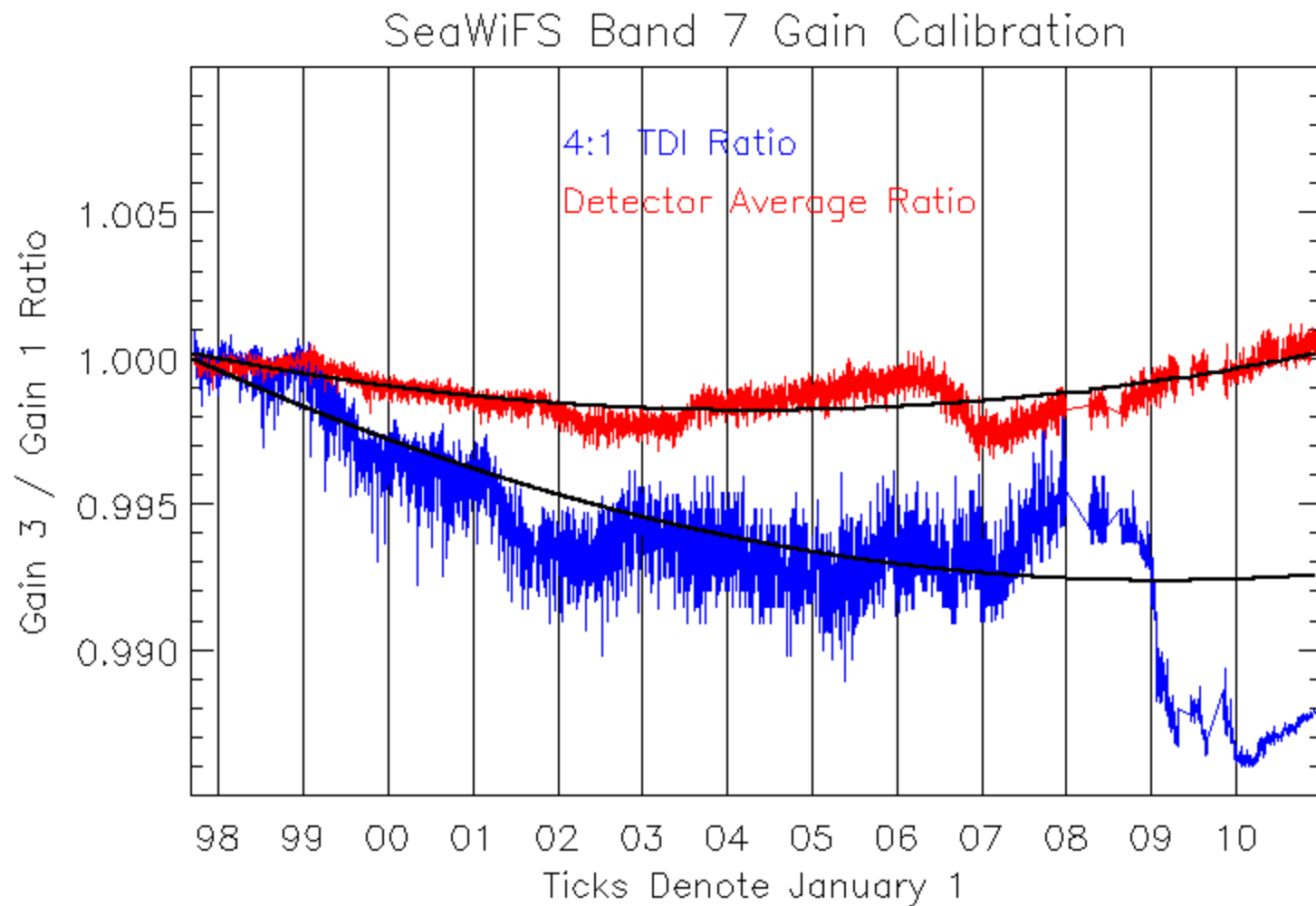
- A test was run with a constant dark restore value.
- This had the desired result of removing the mid-mission artifact.
- It also had the undesired result of introducing a trend in the results.
 - This indicated a need to re-evaluate the lunar calibration data using the dark restore update.



Band 7 Gain 3 Drift Correction Update

- For Band 7, the lunar calibration gain (3) has shown a mission-long drift relative to the Earth view gain (1). This drift has been applied to the calibration of Band 7.
- The radiometric resolution for the gain measurements resulted in significant uncertainty in the gain drift results.
- Following the re-analysis of the dark restore, the Band 7 gain 3 drift was also re-analyzed using the average of individual detector measurements. The result was an improved estimate of the gain drift.

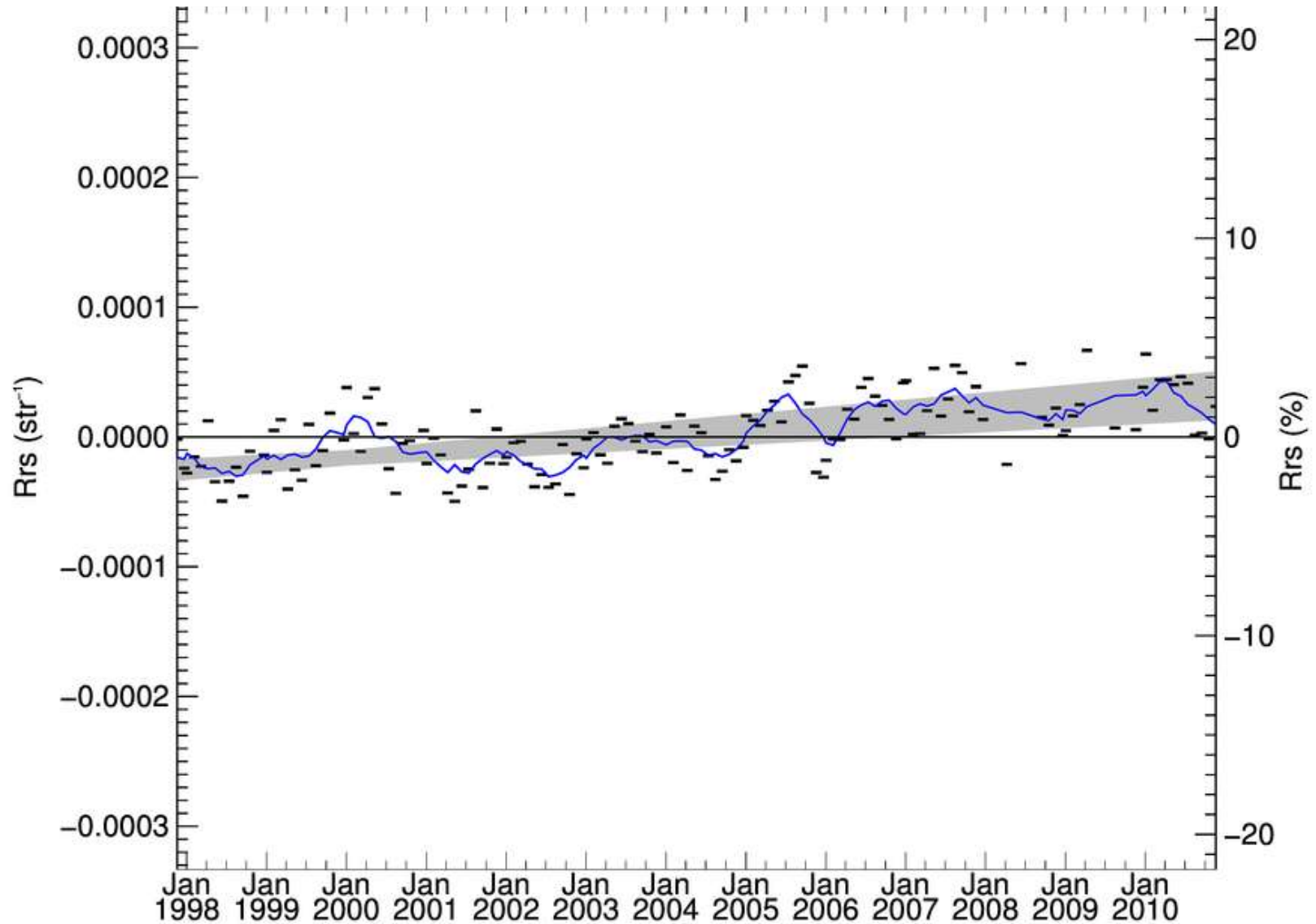
Band 7 Gain 3 Drift Correction Update (cont.)



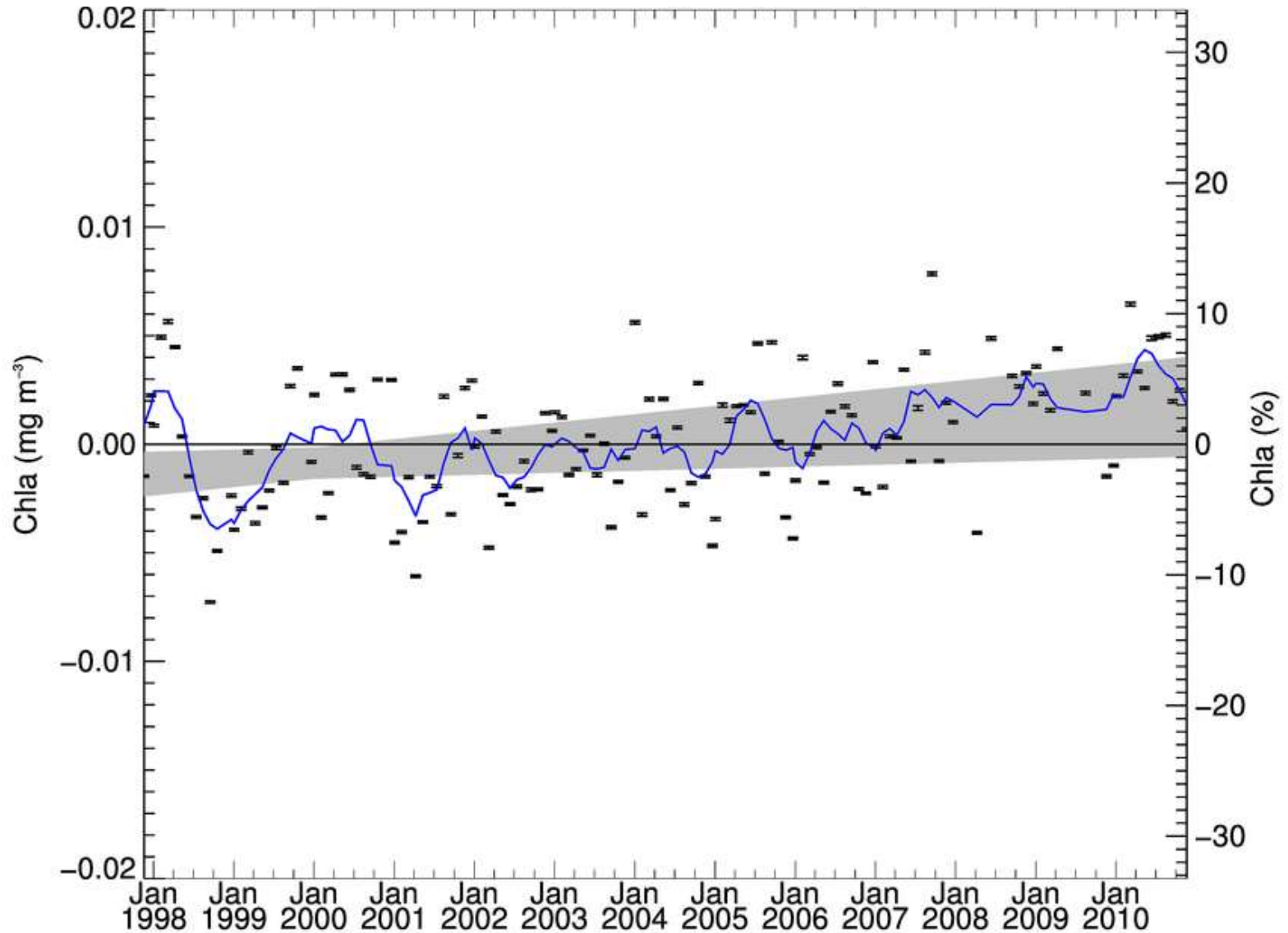
Updated SeaWiFS Calibration

- The dark restore was incorporated into the calibration processing as a set of look-up tables.
 - Individual tables for each band/gain combination
- The lunar calibration data were re-analyzed using the updated dark restore processing.
- The Band 7 Gain 3 correction was updated using a quadratic fit to the re-analyzed gain ratio.

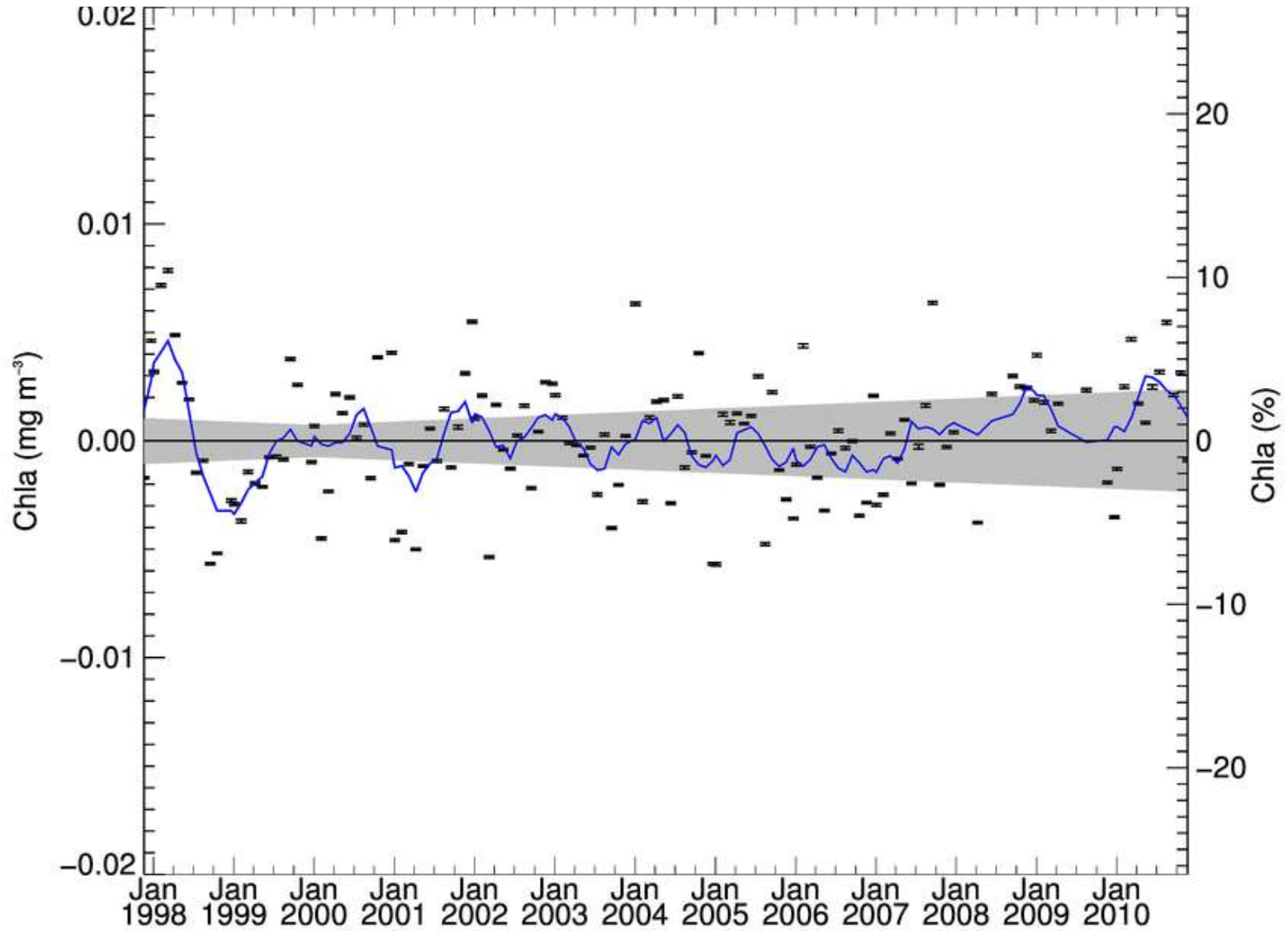
Updated Clear-Water Rrs(555) Anomaly Trend



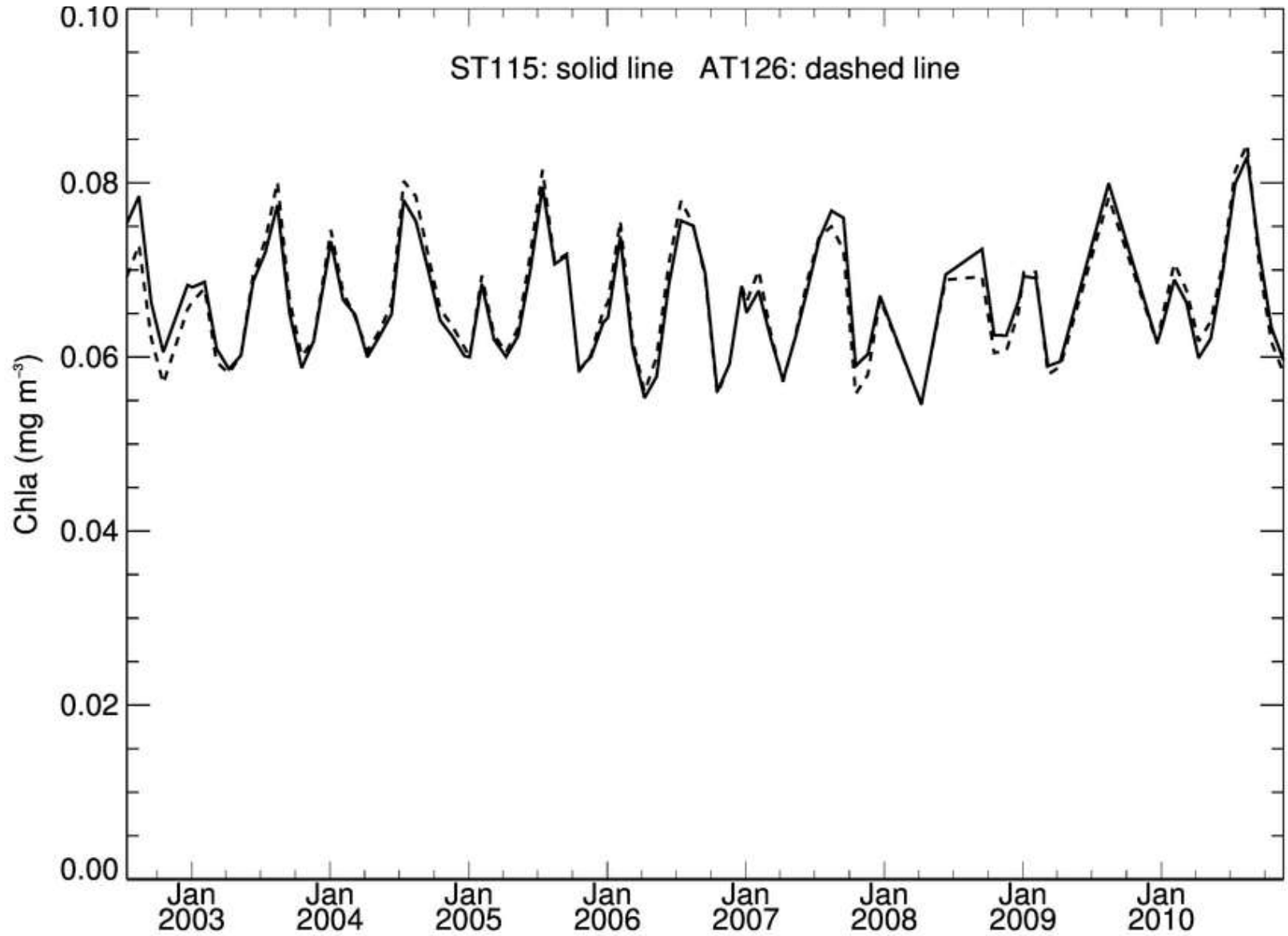
Updated Chlorophyll-a Anomaly Trend (OC4)



Updated Chlorophyll-a Anomaly Trend (OCI)



Comparison of SeaWiFS and MODIS-Aqua Chlorophyll



Conclusions

- A persistent artifact in the SeaWiFS retrieved parameters has been addressed by an improved estimation and application of the dark restore values.
 - The retrievals were sensitive to a 1-count change in the median dark restore value.
- The Band 7 Gain 3 correction has also been revised, and the lunar time series has been re-analyzed.
- The combined effect of these changes is improved stability of the retrievals. These improvements will be incorporated in the upcoming reprocessing of the SeaWiFS mission data set.

QUESTIONS?