PATMOS-X SOLAR REFLECTANCE CHANNEL CALIBRATION – USE OF GLOBAL MEAN REFLECTANCE

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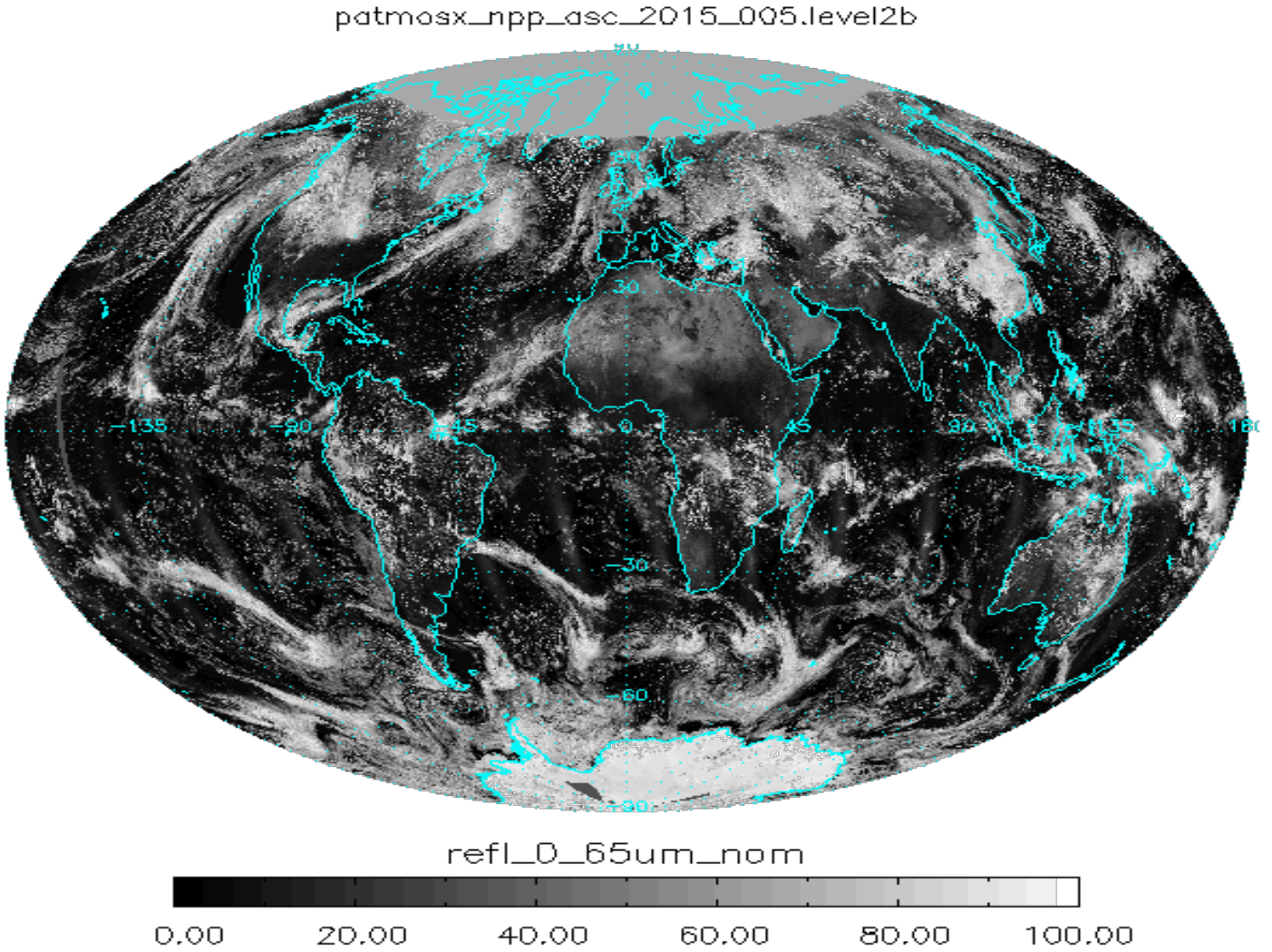
Outline

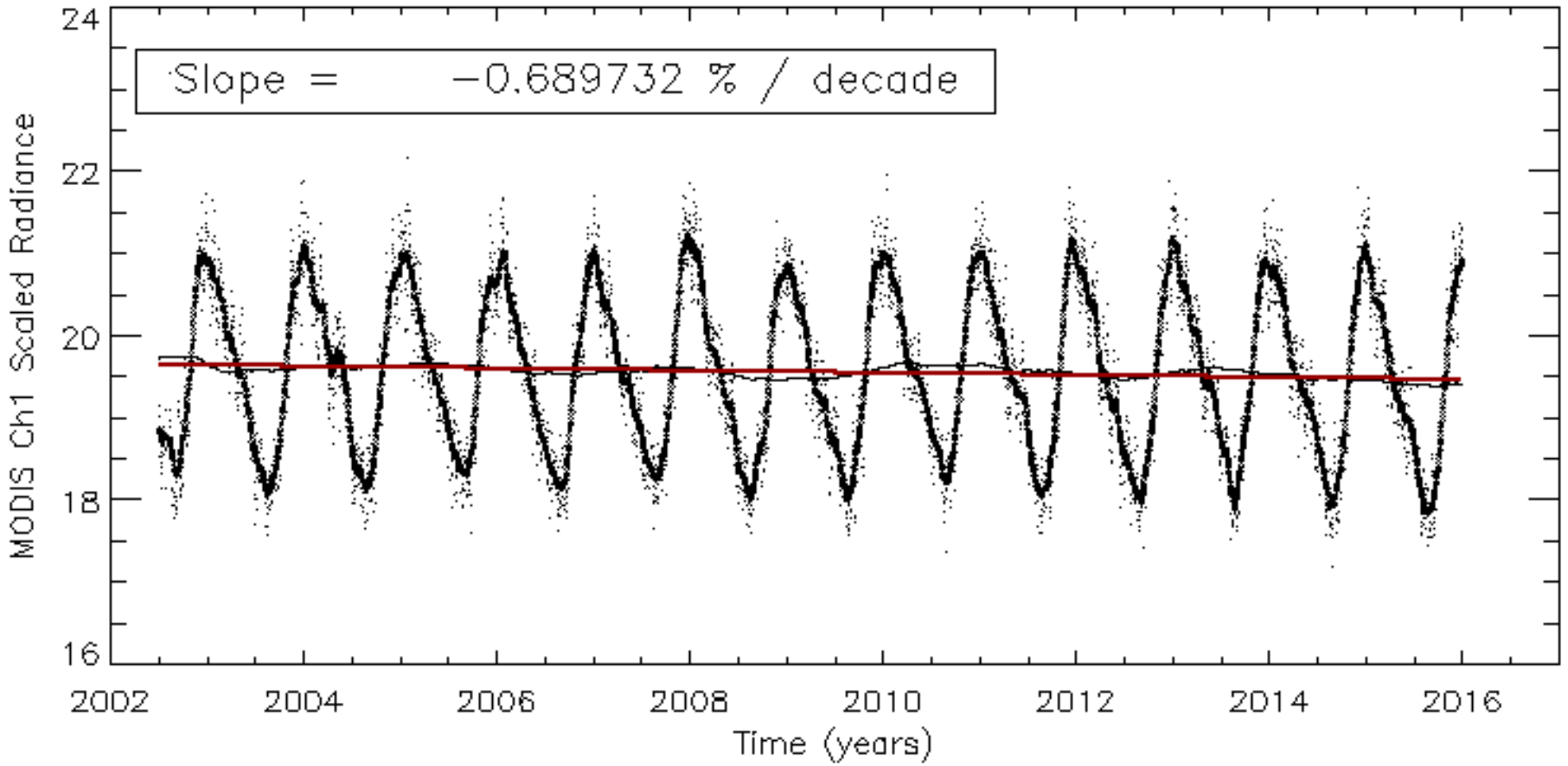
- Analysis of Global Mean Reflectance from MODIS AQUA
- Application to VIIRS M5 comparisons
- Application to AVHRR Ch1
- PATMOS-x Calibration Update

Why Do This

- NCEI asked the PATMOS-x team to monitor the calibration of the AVHRR.
- While doing this we noted it was very stable and decided to pursue it as another calibration data source.
- It has the benefit of
  - available every day in real-time
  - Independent of atmospheric correction, angular adjustments and cloud mask.
  - Could be important for the pre-EOS AVHRR data.

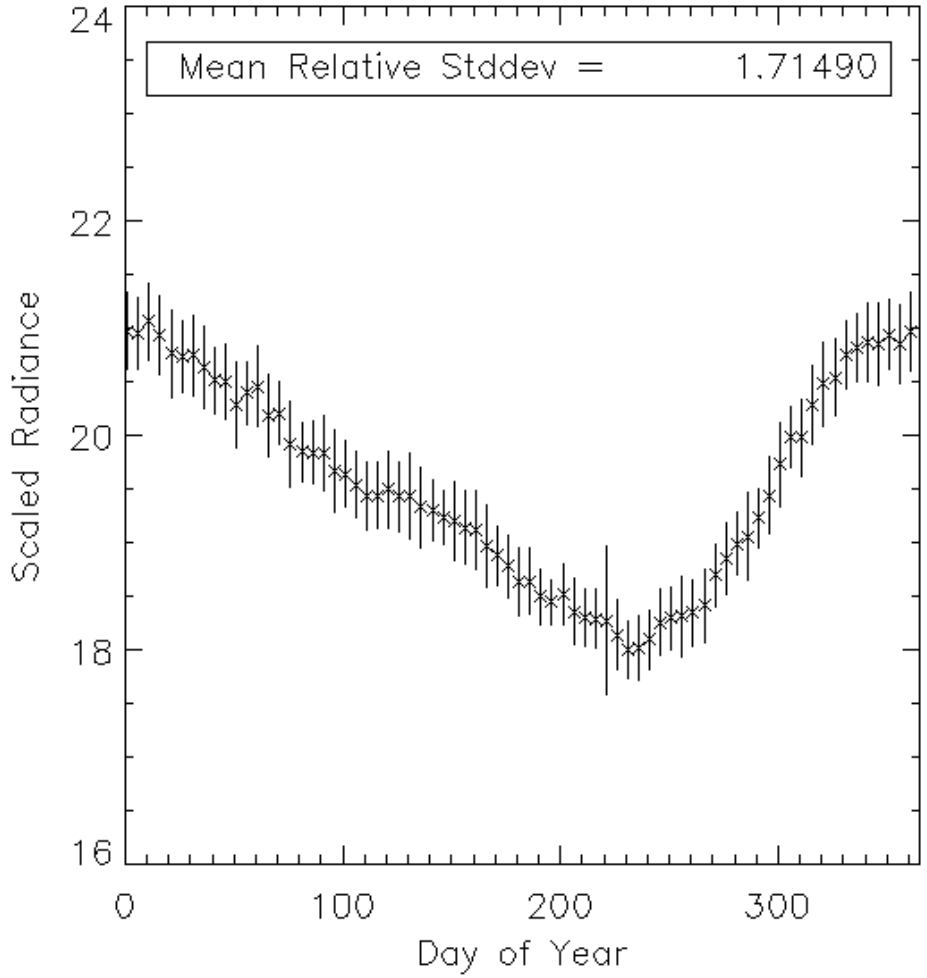


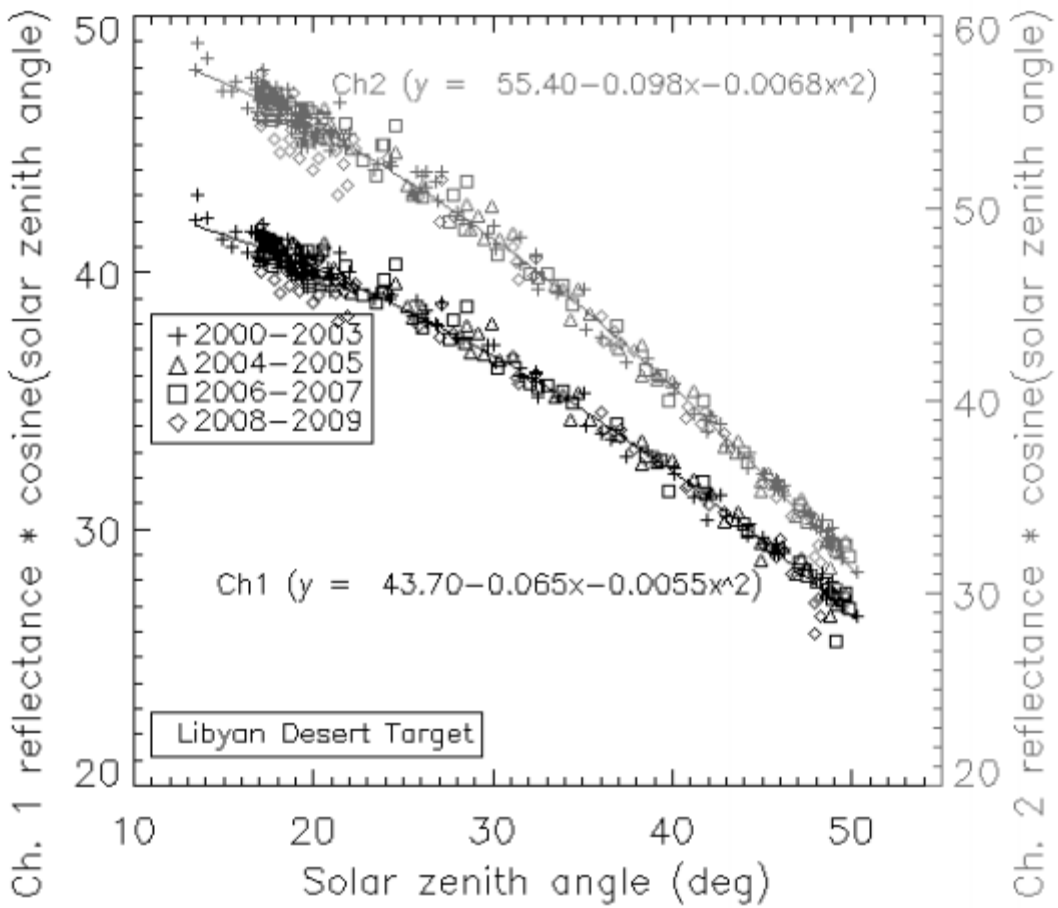
Stability of the Global Reflectance for AQUA/MODIS Ch1



So over 15 years, MODIS AQUA dropped about 1%.

Stability of the Annual Cycle in Global Mean Reflectance



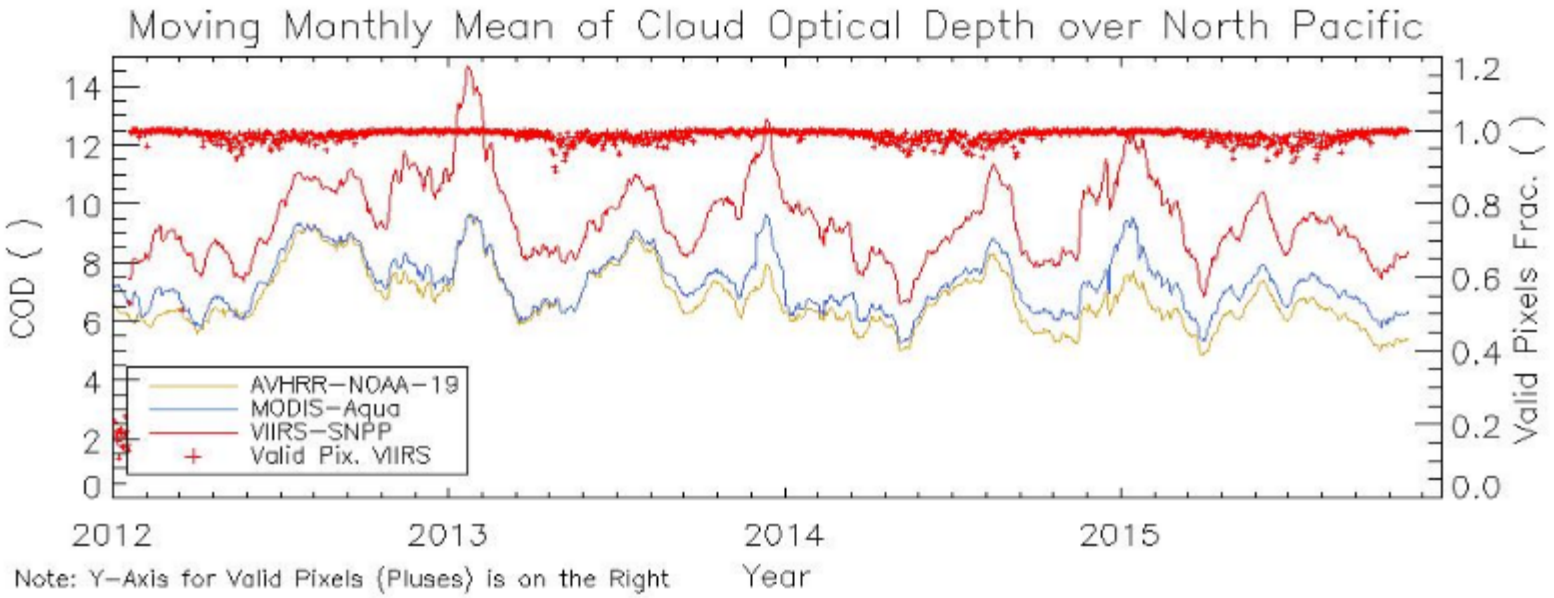


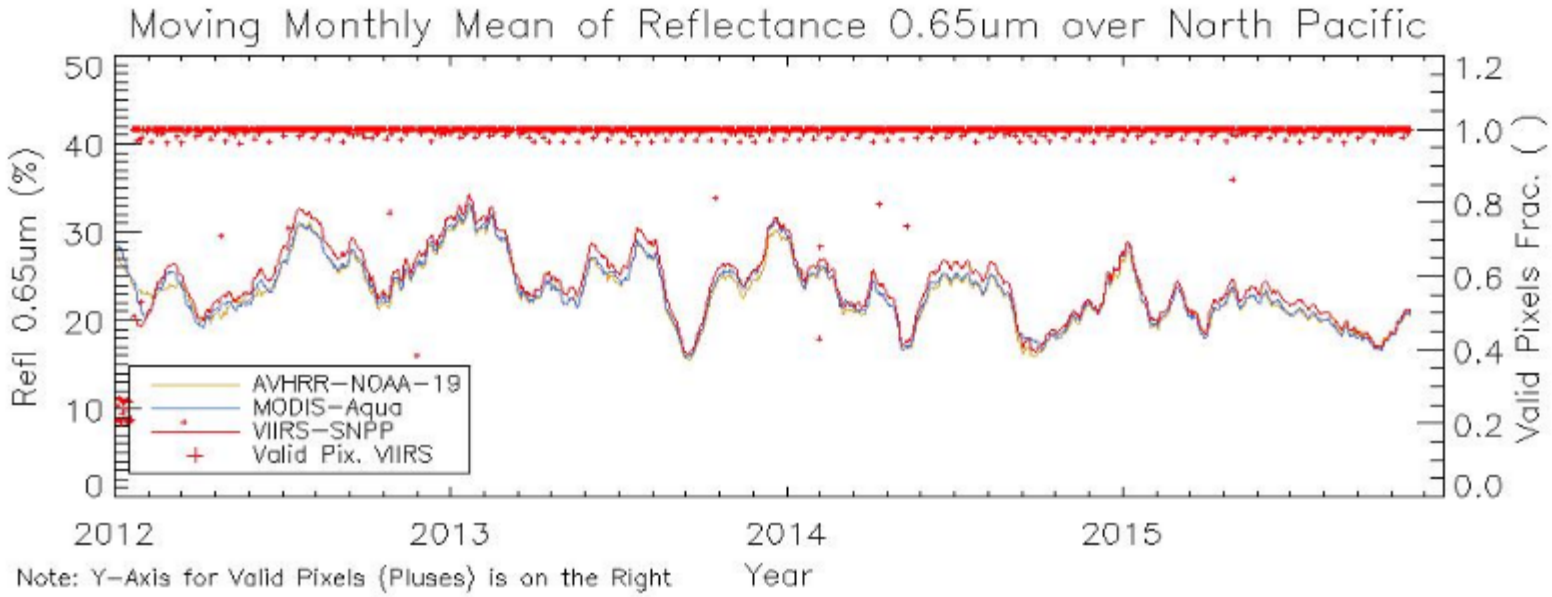
Variability of Global Mean Reflectance is comparable to that scene with clear-sky stable targets.

Application VIIRS

VIIRS M5 Issues

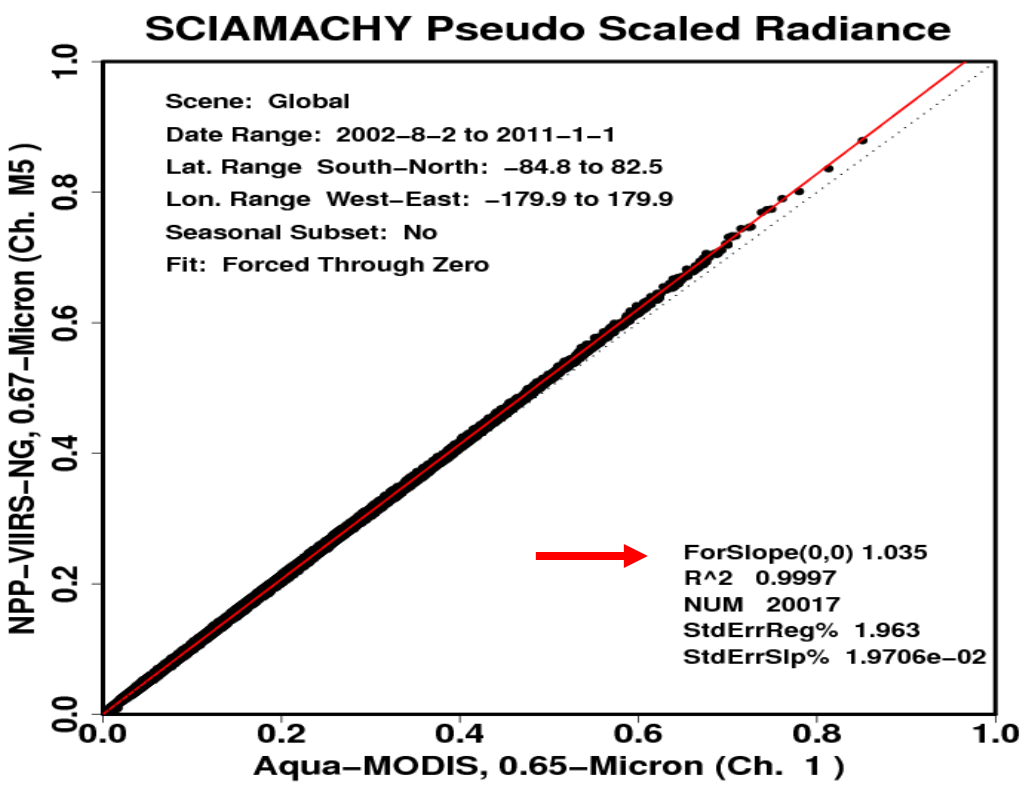
- We continually see the cloud optical depths being higher from VIIRS than MODIS. (Both derived from NOAA Enterprise Algorithms).
- Similar difference to that seen on Sunny Sun-Mack's poster (CERES-VIIRS).
- Cloud optical depth is highly non-linear with reflectance and calibration errors.
- We think a 2-3% error accounts for this difference.



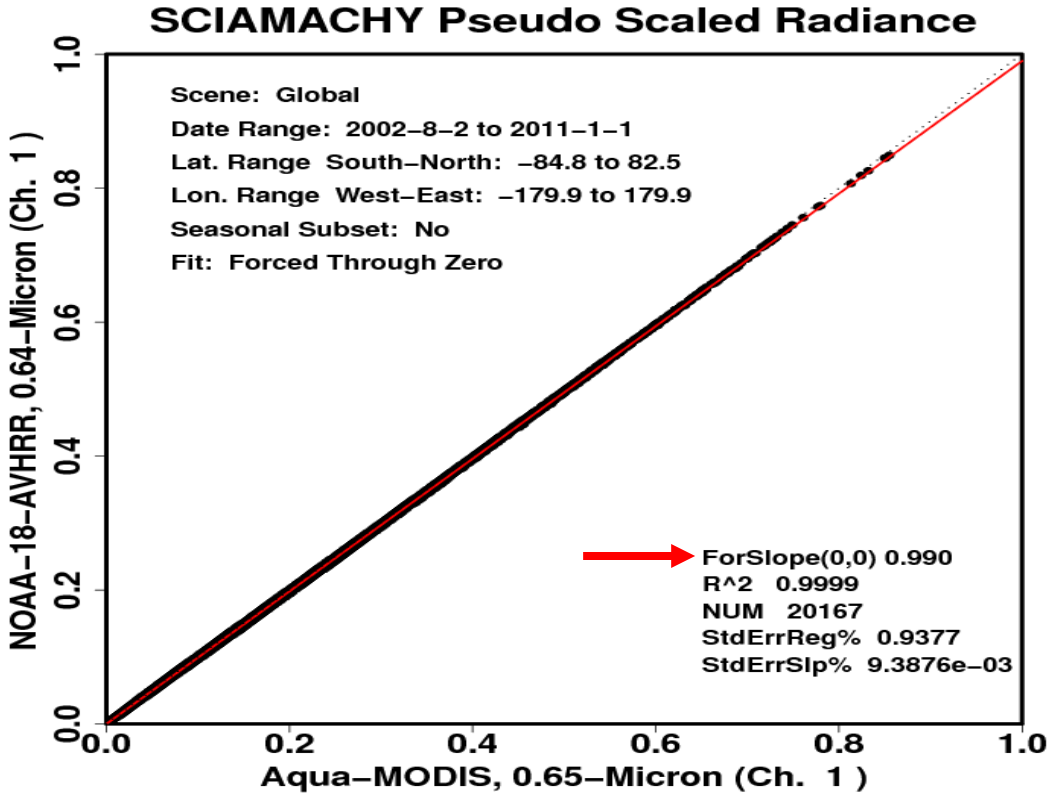


Spectral Conversion from MODIS Ch1 to VIIRS M5 and AVHRR Ch1

NASA Langley (Ben Scarino) runs a very nice site where SCHIMACHY-derived spectral conversions are available for many sensors and many surface regions including global. These plots are from that site.

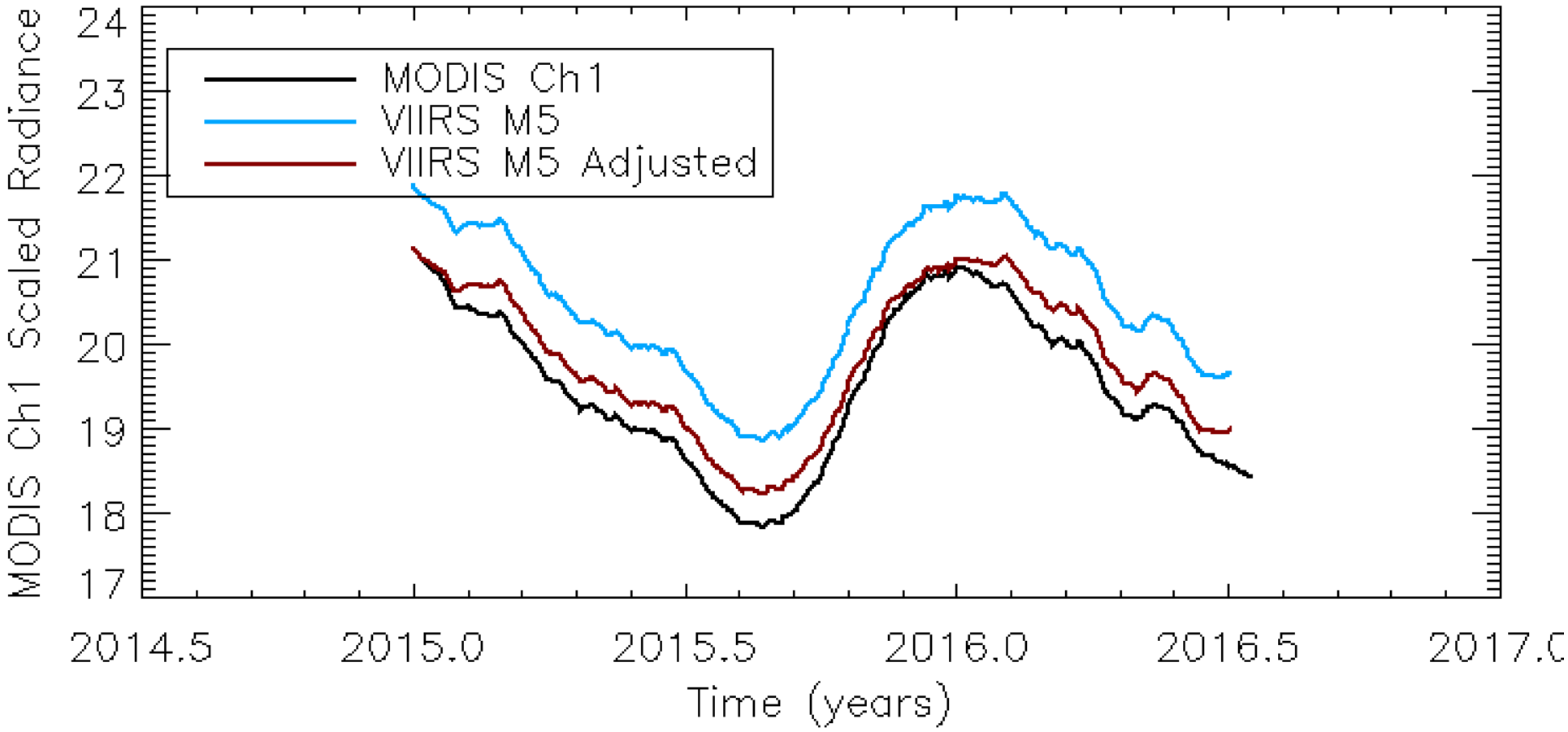


Based on SCHIMACHY, VIIRS M5 should be 3.5% larger then MODIS Ch1 for a global mean reflectance



Based on SCHIMACHY, AVHRR Ch1 should be 1% smaller then MODIS Ch1 for a global mean reflectance

Applying Global Reflectance Analysis to VIIRS M5.

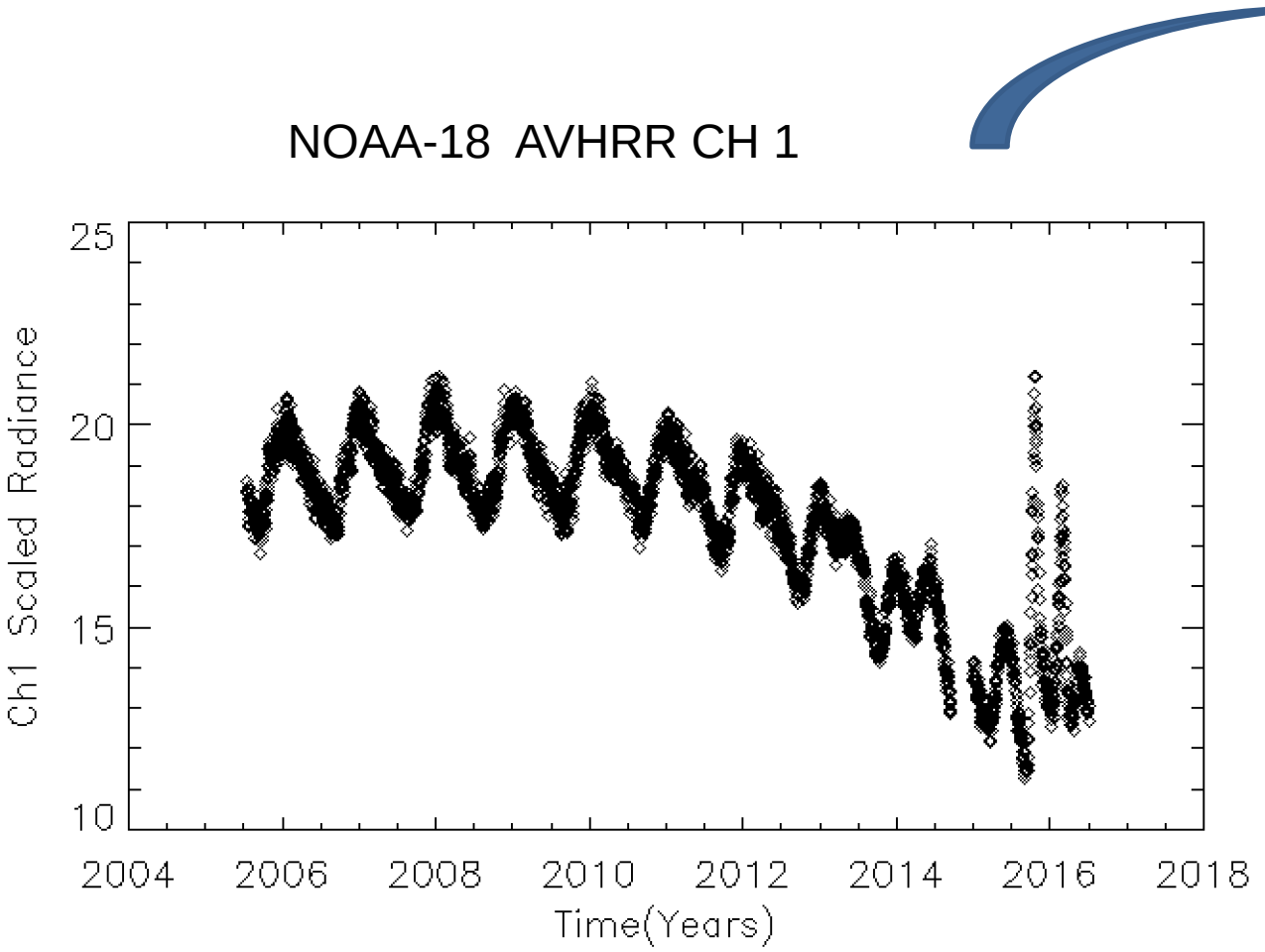


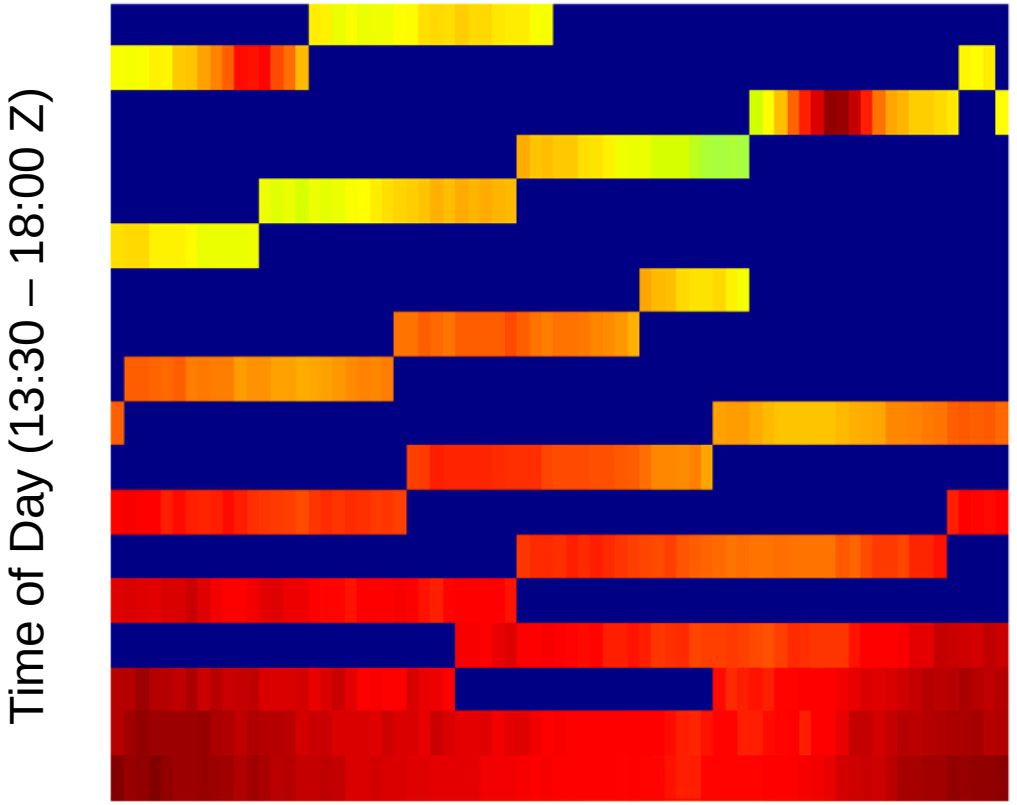
VIIRS M5 after adjustment is 1.5% higher than MODIS Ch1

- More than the computed degradation in MODIS Ch 1 (1%)
- Less than we expected from the cloud optical depth analysis (2%)

Application AVHRR Solar Channels

Application to AVHRR for Inclusion in PATMOS-x





Since NOAA-18 has drifted so far, can we use it as a reference for the other AVHRR sensors?

Method for Application AVHRR

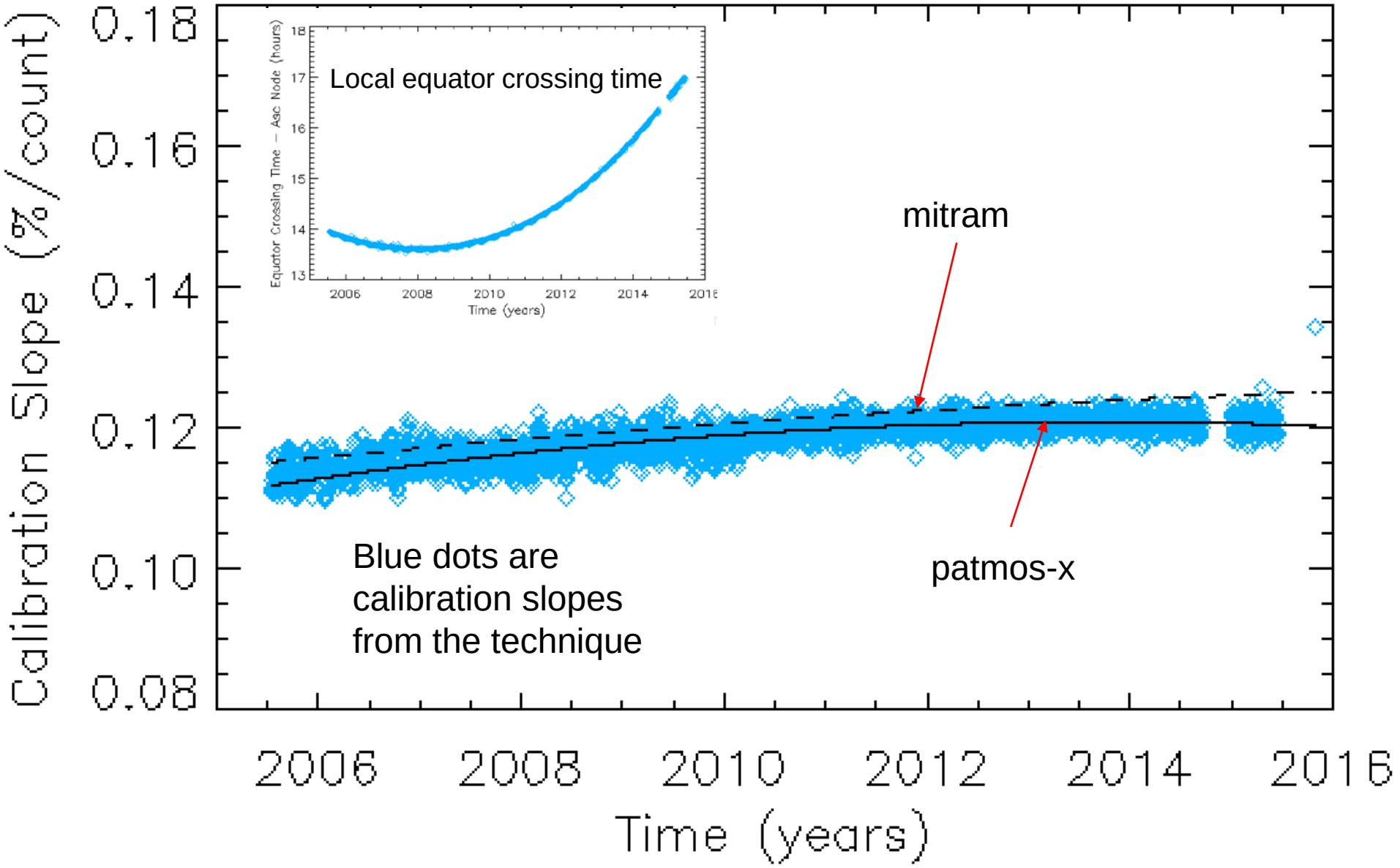
1. Compute mean global count from any AVHRR

2. Compute mean global scaled radiance from the NOAA-18 table for a given day-of-year and the equator crossing time.

3. Generate a calibration slope.

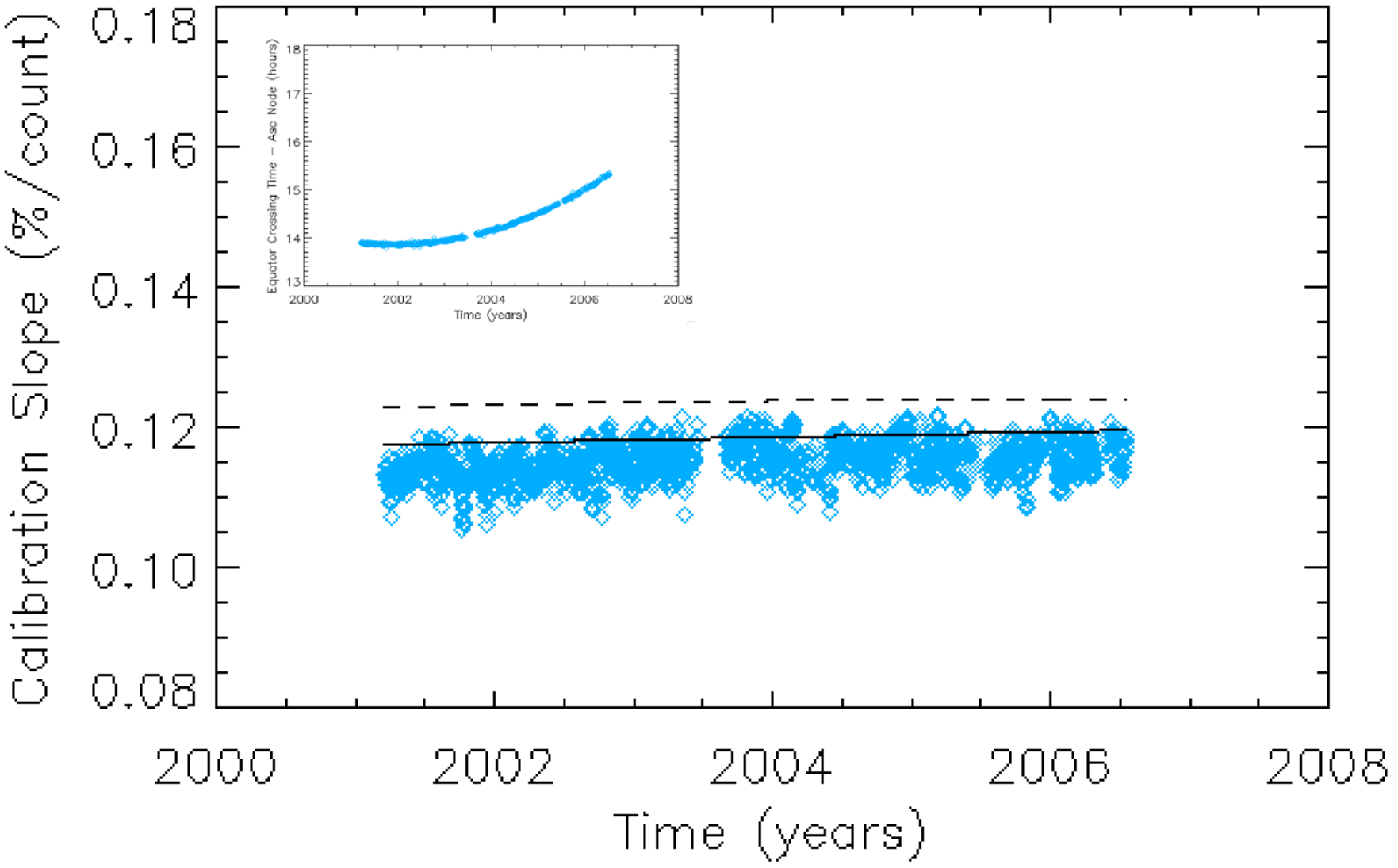
NOAA-18 Ch1 Results

- Since NOAA-18 is the reference, we expect NOAA-18 to agree perfectly with the PATMOS-x calibration.



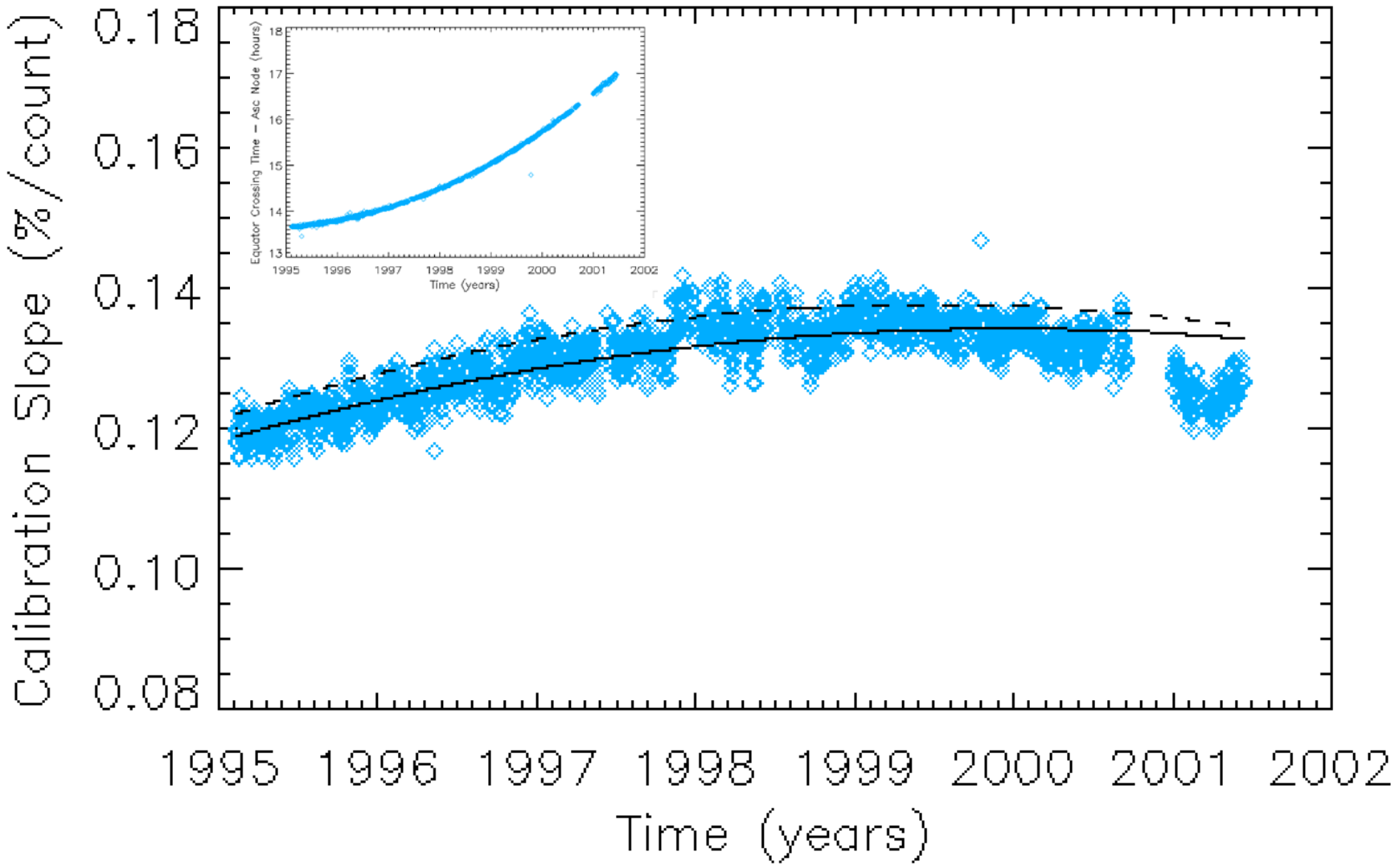
Application to NOAA-16 Ch1

- Method appears to work well with NOAA-16 over its 2 hours of drift from 2001 to 2007.



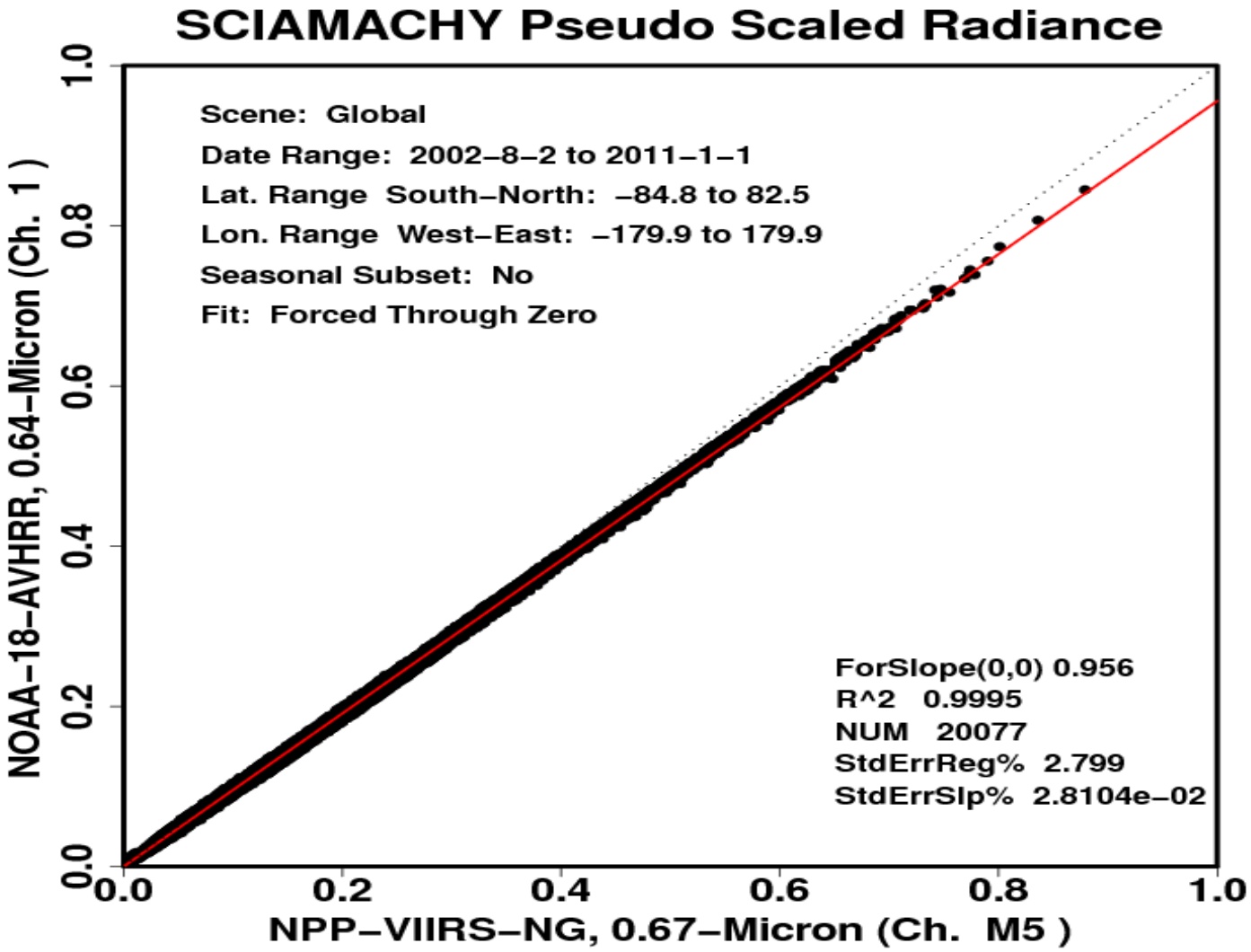
Application to NOAA-14 Ch1

- Issues arise after 2000 when the drift exceeds 3 hours.



Conclusions

- Mean global reflectance from a sun-synchronous polar orbiter is very stable. Warrants a look as a GSICS monitoring tool.
- We can use this to compare MODIS and VIIRS. VIIRS M5 appears to be 1.5% too high.
- Our optical depth analysis indicated VIIRS M5 is 2% too high relative to MODIS AQUA Ch1.
- Long term analysis shows MODIS AQUA Ch1 gradually dropped 1%.
- Application to AVHRR, which drifts, also shows promise.
- PATMOS-x would like to use this as an independent monitoring tool and may use it in the calibration.
- PATMOS-x owes an AVHRR calibration update to NCEI in September.


SCIAMACHY Pseudo Scaled Radiance
Scene: Global
Date Range: 2002–8–2 to 2011–1–1
Lat. Range South–North: –84.8 to 82.5
Lon. Range West–East: –179.9 to 179.9
Seasonal Subset: No
Fit: Forced Through Zero
ForSlope(0,0) 0.956
R^2 0.9995
NUM 20077
StdErrReg% 2.799
StdErrSlp% 2.8104e–02
NOAA–18–AVHRR, 0.64–Micron (Ch. 1)
NPP–VIIRS–NG, 0.67–Micron (Ch. M5)
0.0
0.2
0.4
0.6
0.8
1.0