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.
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 than MODIS Ch1 for a global mean reflectance.

Based on SCHIMACHY, AVHRR Ch1 should be 1% smaller than 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
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.
• Method appears to work well with NOAA-16 over its 2 hours of drift from 2001 to 2007.
• 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