MODIS and VIIRS Instrument Status

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Contributions:

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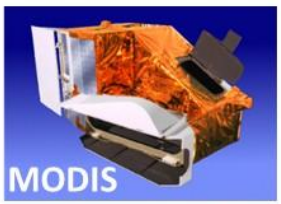
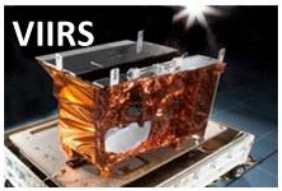
VIIRS Characterization Support Team (VCST), NASA GSFC

Outline

- **Terra and Aqua MODIS**
  - On-orbit Operation, Calibration, and Performance
- **Suomi-NPP VIIRS**
  - On-orbit Operation, Calibration, and Performance
- **JPSS-1 VIIRS**
  - Pre-launch Testing Status
- **Summary**



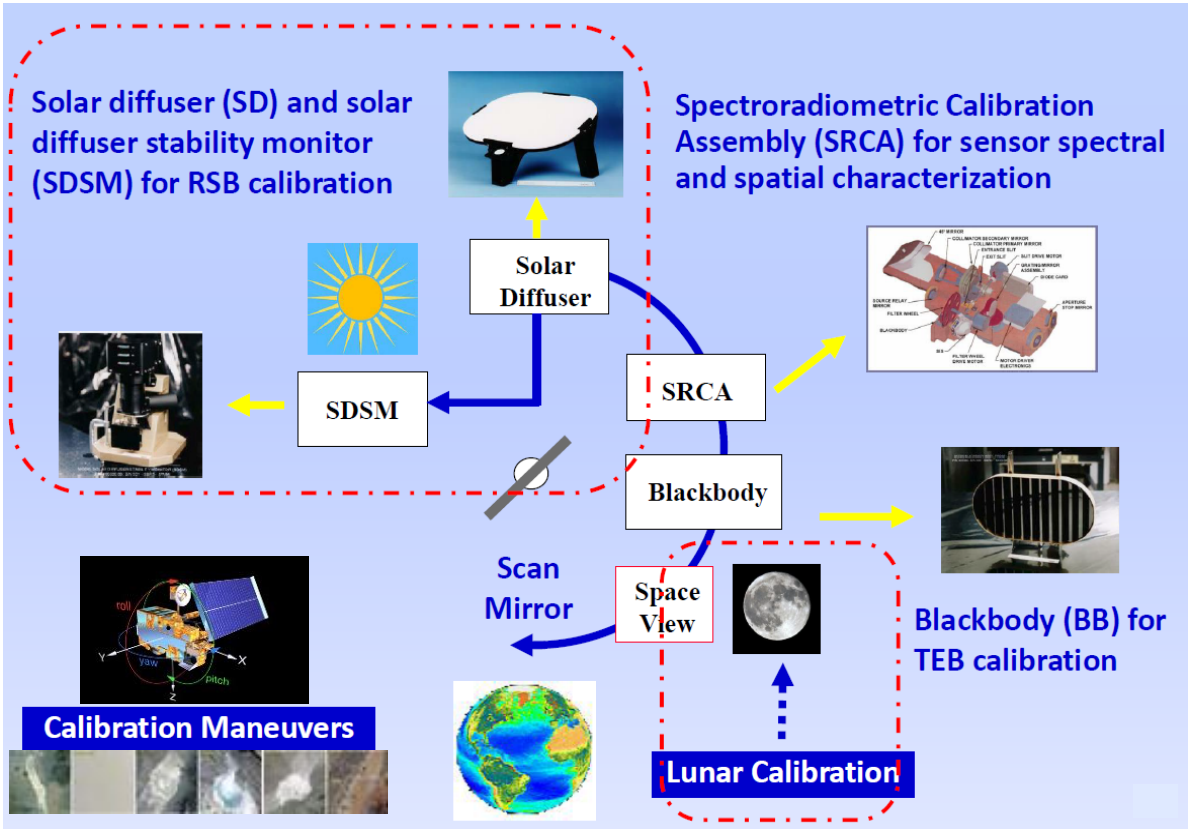


MODIS Highlights

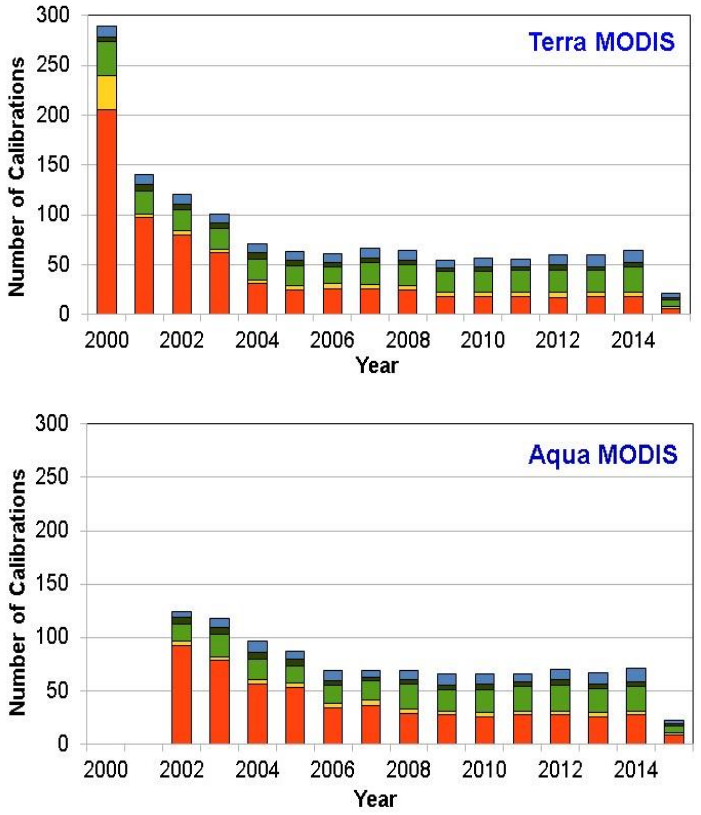
- **Instrument Operations and OBC Functions – Normal**
  - No changes to instrument operation configurations in recent years
  - 3 new noisy detectors (Aqua (B21 D2, D3, and D9) since last STM
- **Dedicated Calibration Effort and Frequent L1B LUT Updates**
  - Terra MODIS: C5/C6/OBPG LUT updates: 19/19/18 (14/14/6 in previous year)
  - Aqua MODIS: C5/C6/OBPG LUT updates: 17/16/14 (11/12/11 in previous year)
- **2015 Senior Review for Terra and Aqua**
  - Details in presentation by Parkinson and Thome
  - Previous SR for both Terra and Aqua missions: 2007; 2009, 2011, and 2013
- **Technical Meetings and Workshops**
  - Joint MODIS and VIIRS Calibration Workshop on May 18, 2015
  - Aqua MODIS CFPA Performance and Operation Review on April 14, 2015 (previous reviews held in 2010, 2012, 2013, and 2014)
  - Aqua MODIS (B1-4) RVS Update Strategy Technical Meeting on Jan 14, 2015
  - Regular MsWG Meeting (bi-weekly)
- **Steady Increase of MODIS Publications**
  - 9240 tech articles and 12738 tech article and proc. combined (Web of Science)
  - 1840 new technical articles last year (1200 in previous year)
  - 2660 new tech articles and proc. combined (1100 in previous year)

MODIS On-orbit Operation and Calibration

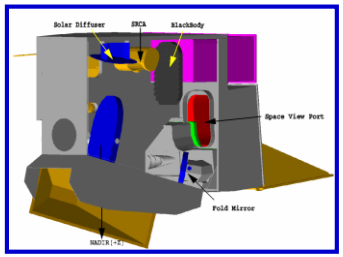
Calibration Methodologies



Calibration Activities

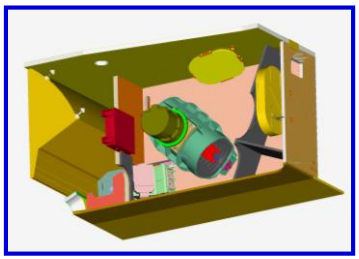


MODIS



Similar Approaches for VIIRS

VIIRS



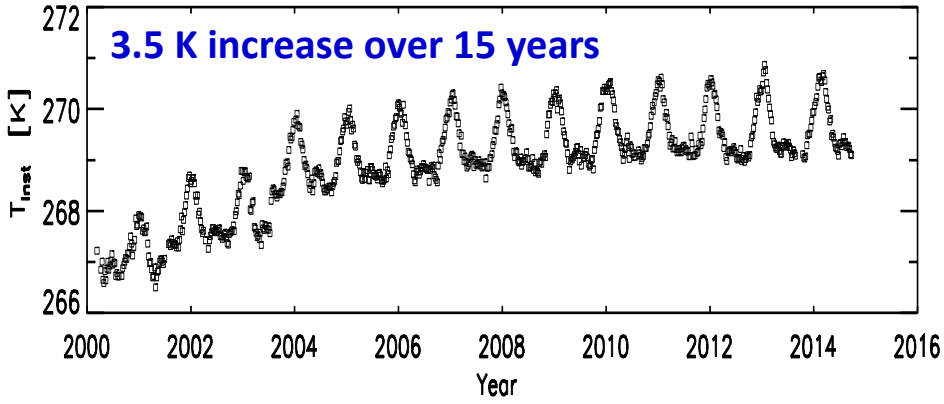
	Terra	Aqua
Lunar Roll:	149	123
PV Ecal:	88	67
SRCA:	412	289
BB:	95	57
SD/SDSM:	91	536

MODIS On-orbit Performance

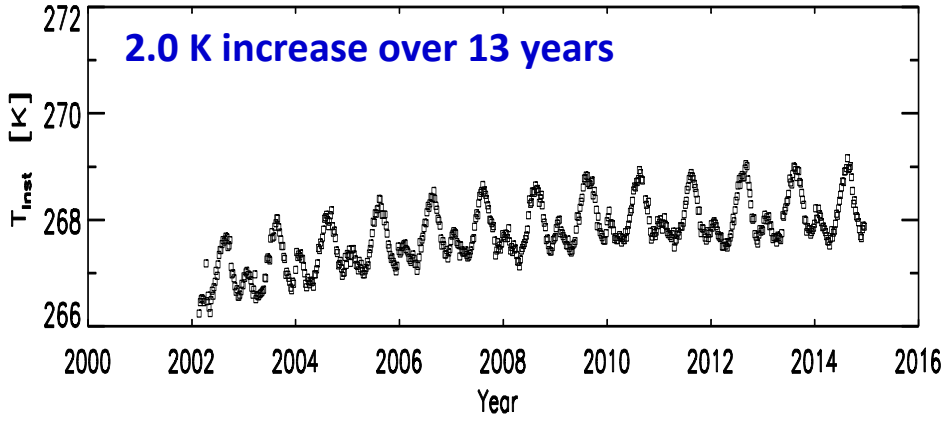
- **Instrument and Focal Plane Assembly (FPA) Temperatures**
- **BB Temperature and SD Degradation**
- **Radiometric**
  - Spectral band responses
  - Detector noise characterization
- **Spectral and Spatial**
  - Center wavelengths and bandwidths
  - Band-to-band registration (BBR)
- **Geolocation**

MODIS Instrument and CFPA Temperatures

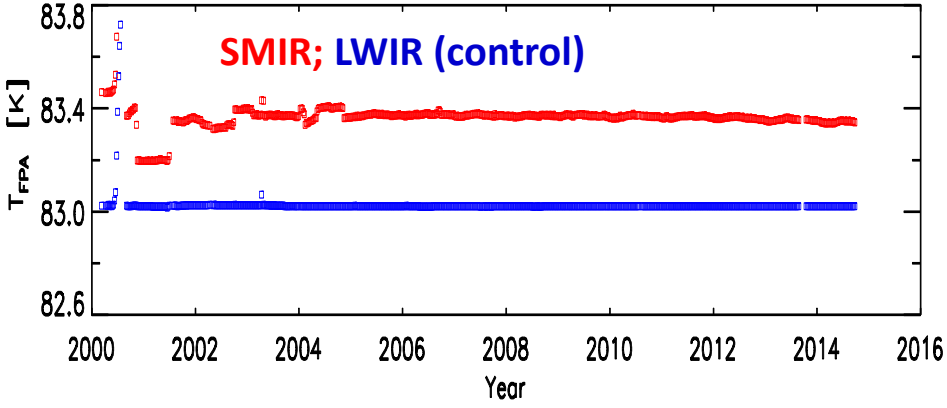
Terra MODIS Instrument Temperature



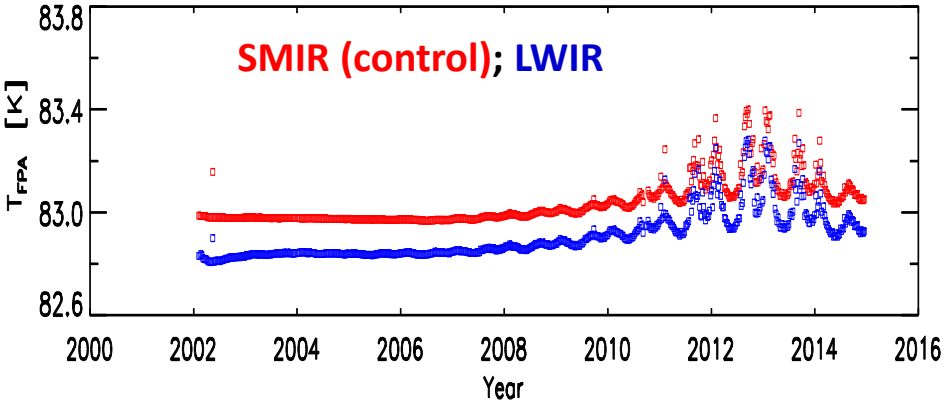
Aqua MODIS Instrument Temperature



Terra MODIS CFPA Temperature



Aqua MODIS CFPA Temperature

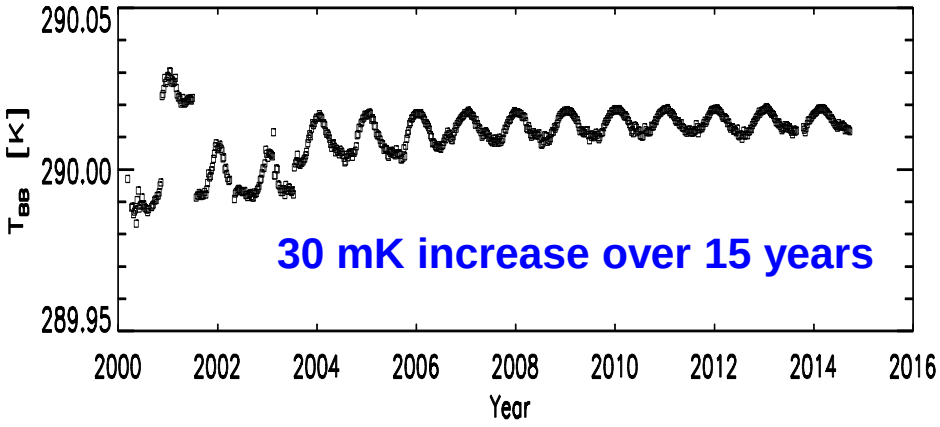


Scan Mirror, Cavity, VIS and NIR FPA Temperature Trends: Similar to Instrument Temperature

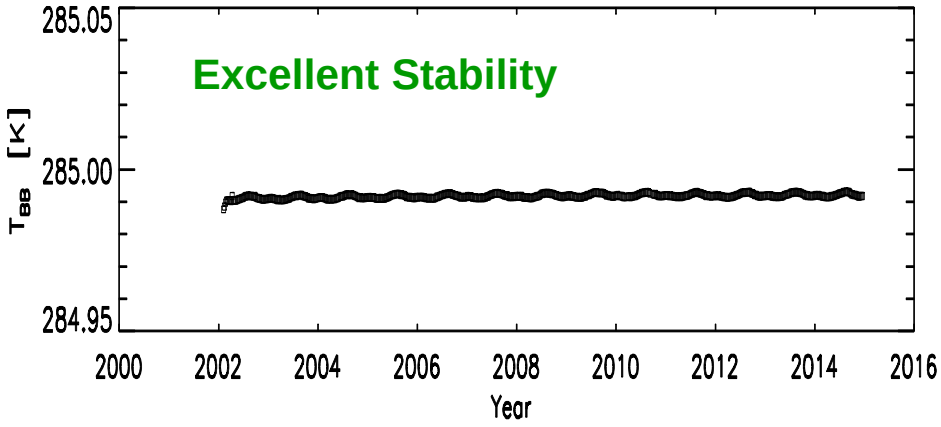
Small Increase of Aqua MODIS CFPA Temperature: < 0.7 K (Recent Recovery)

MODIS BB Temperature and SD Degradation

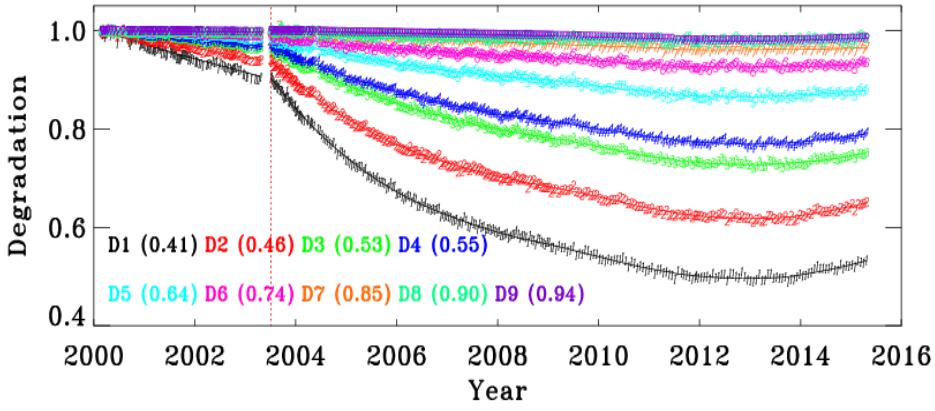
Terra MODIS BB Temperature



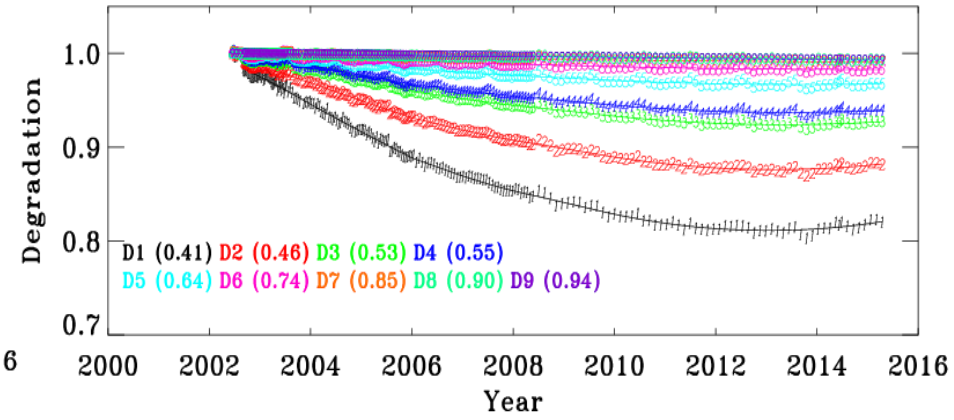
Aqua MODIS BB Temperature



Terra MODIS SD Degradation



Aqua MODIS SD Degradation



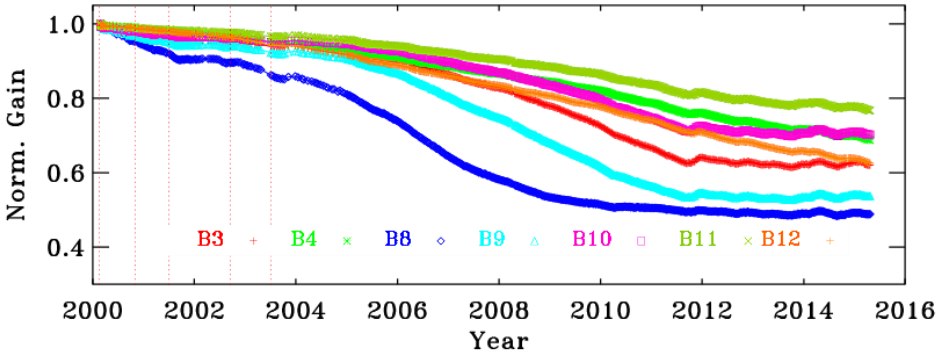
Large SD degradation at short wavelength

Increased SD degradation in Terra MODIS after its SD door fixed at "Open"

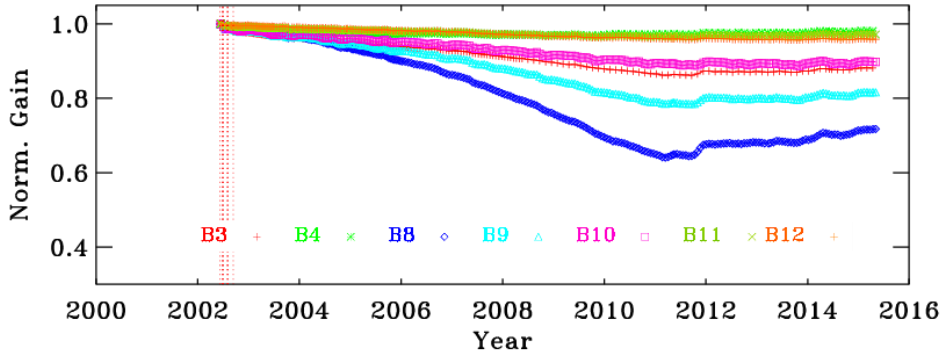
Recent increase of BRF (wavelength dependent)

MODIS Spectral Band Responses (Gains)

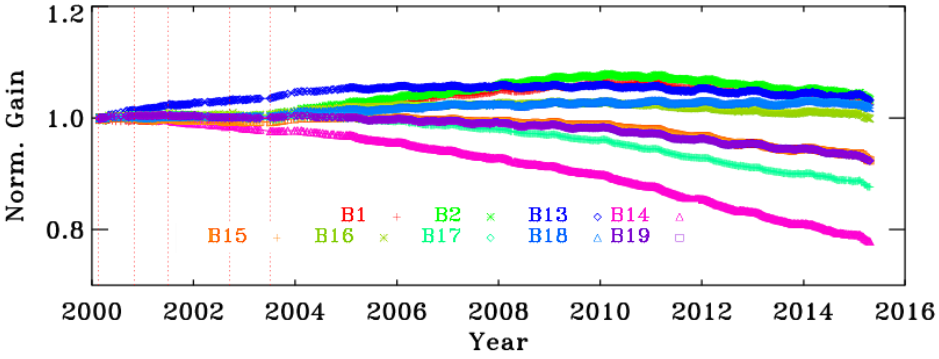
Terra MODIS VIS Band Avg. Gains (MS1)



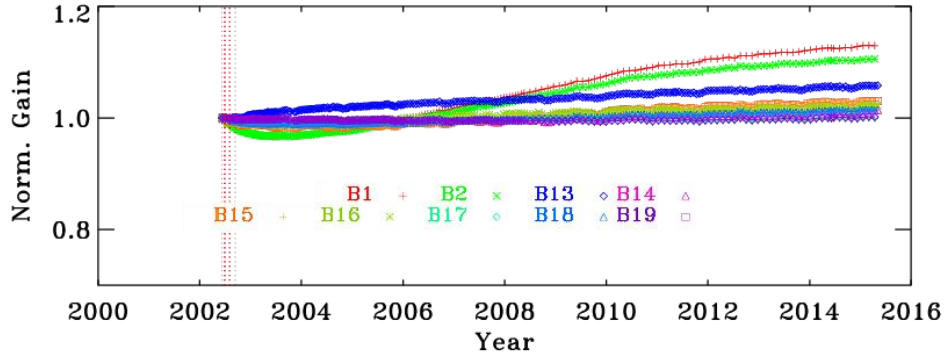
Aqua MODIS VIS Band Avg. Gains (MS1)



Terra MODIS NIR Band Avg. Gains (MS1)



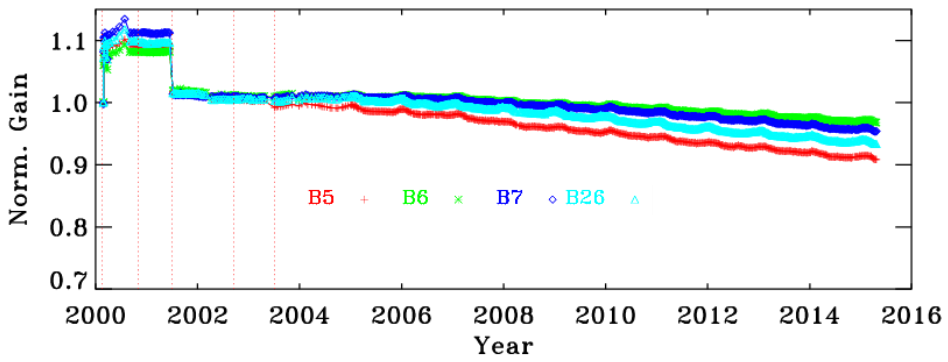
Aqua MODIS NIR Band Avg. Gains (MS1)



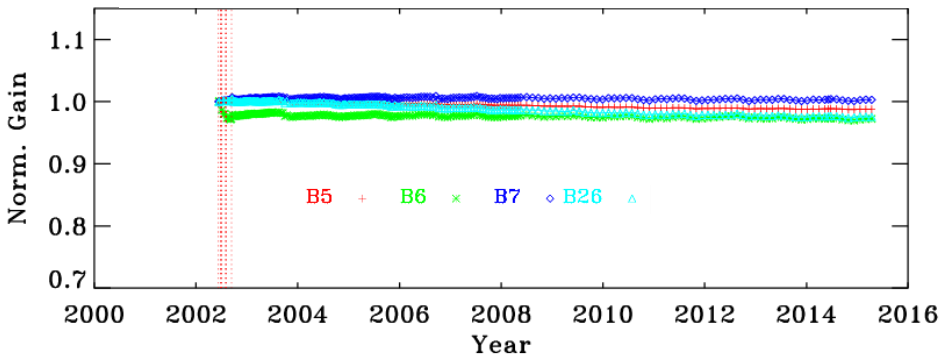
- Larger changes (AOI and MS dependent) at shorter wavelengths for VIS bands
- Gain increases seen in some NIR bands
- Changes are small in SWIR and MWIR bands
- Large changes in Terra LWIR PV (bands 27-30) due to noisy detectors and xtalks
- Variations in Aqua LWIR PC bands (bands (B33-36) correlated with CFPA temperatures

MODIS Spectral Band Responses (Gains)

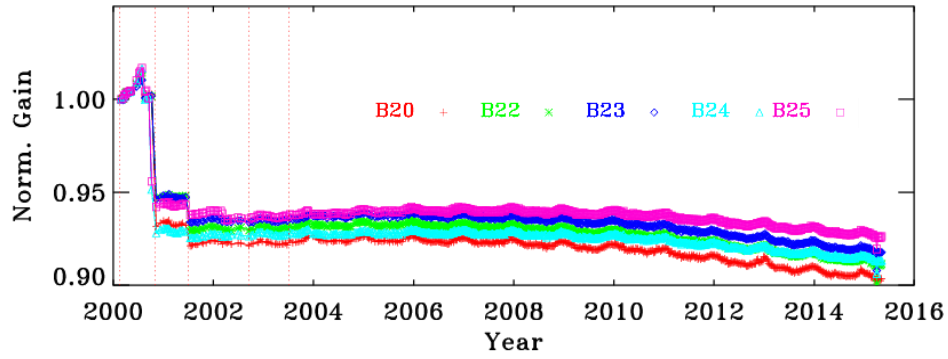
Terra MODIS SWIR Band Avg. Gains (MS1)



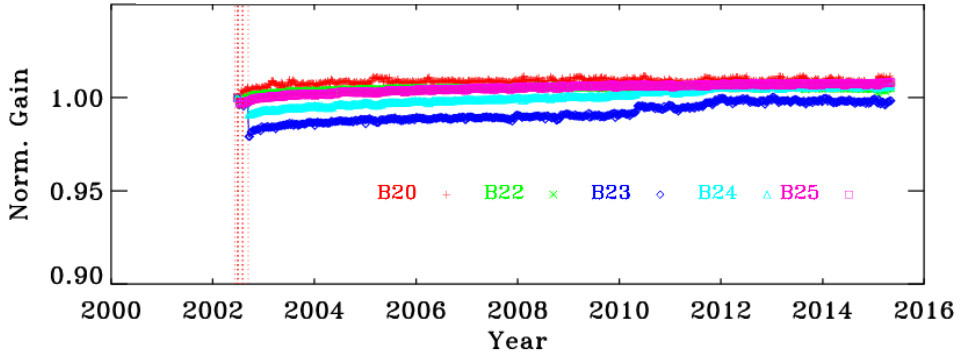
Aqua MODIS SWIR Band Avg. Gains (MS1)



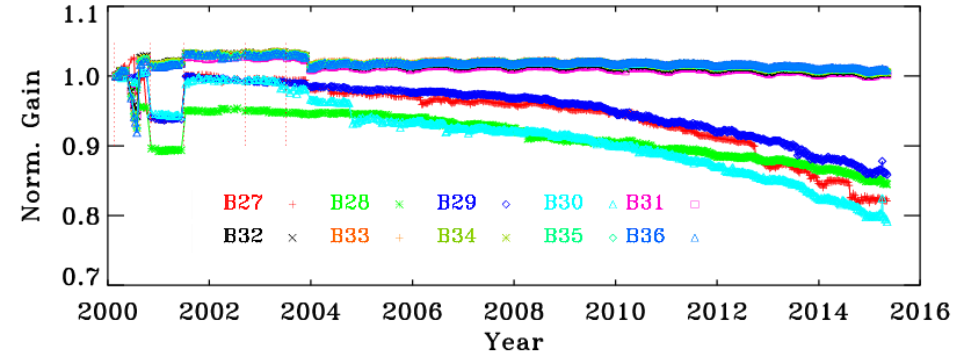
Terra MODIS MWIR Band Avg. Gains (MS1)



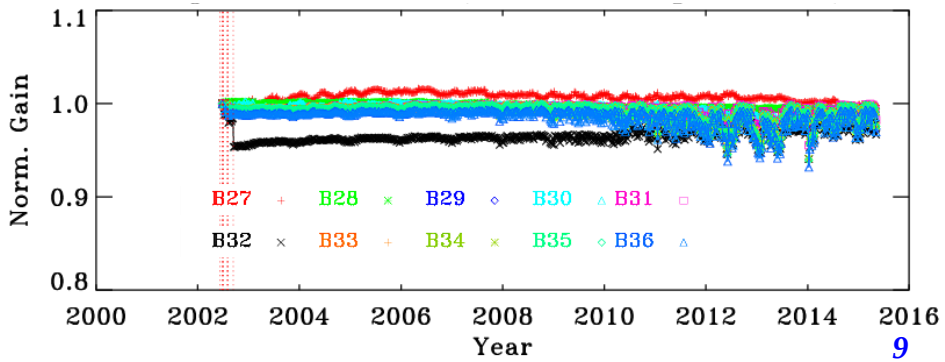
Aqua MODIS MWIR Band Avg. Gains (MS1)



Terra MODIS LWIR Band Avg. Gains (MS1)



Aqua MODIS LWIR Band Avg. Gains (MS1)



MODIS Detector Noise Characterization

- 36 spectral bands with a total of 490 individual detectors
- Terra: 45 noisy detectors (30 from pre-launch; 35 at launch) and no inoperable detectors (B29 D6 set to inoperable in 2006)
- Aqua: 10 noisy detectors (2 from pre-launch; 3 at launch) and 15 inoperable detectors (13 in Band 6)

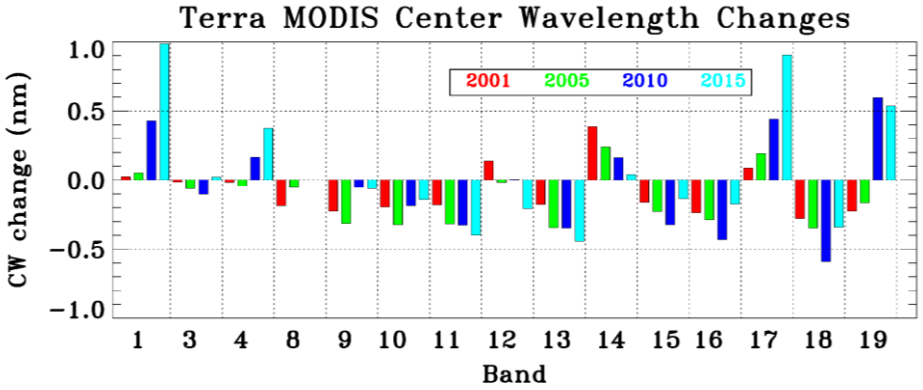
Time	Event	Noisy Band (Detector)
Pre-launch		B7(all), B36(all)
2000055.1527	Nadir Door Open	B5(4,16), B7(all), B33(1), B34(7,8), B36(all)
2000160.0000	CFPA Lost Control	B5(4,16), B7(all), B30(5) B33(1), B34(7,8), B36(all)
2000218.2210	Formatter Anomaly	B5(4,16), B7(all), B27(6), B30(5), B33(1), B34(6,7,8), B36(all)
2000304.1420	Switch to B-Side	B5(4,16), B7(all), B27(6), B30(5), B33(1), B34(6,7,8), B36(all)
2001019.1415	N/A	B5(4,16), B7(all), B27(6), B30(5, 8), B33(1), B34(6,7,8), B36(all)
2001183.2245	Switch to A-Side	B5(4), B7(all), B27(6), B30(5, 8), B33(1), B34(6,7,8), B36(all)
2002078.1615	Safe Mode	B5(4), B7(all), B27(6), B28(3), B30(5,8), B33(1), B34(5,6,7,8), B36(all)
2003350.1305	Safe Mode	B5(4), B7(all), B27(1,6), B28(8), B30(5,8), B33(1), B34(6,7,8), B36(all)
2005130.1345	SAA (Day)	B5(4), B7(all), B27(1,6), B28(1,8), B29(6), B30(5,8), B33(1), B34(6,7,8), B36(all)
2005309.1510	N/A	B5(4), B7(all), B27(1,6), B28(8,9), B29(6), B30(5,8), B33(1), B34(6,7,8), B36(all)
2006155.0210	SAA (Night)	B5(4), B7(all), B27(1,6), B28(8), B29(6), B30(3,5,8), B33(1), B34(6,7,8), B36(all)
2007193.1155	SAA (Day)	B5(4), B7(all), B27(1,6), B28(8), B29(6), B30(3,5,8), B33(1), B34(6,7,8), B36(all)
2008308.0900	SAA (Night)	B5(4), B7(all), B27(1,2,6), B28(8), B29(6), B30(1,3,5,8), B33(1), B34(6,7,8), B36(all)
2013125.1740	SAA (Night)	B5(4), B7(all), B27(1,2,6), B28(8), B29(6), B30(1,3,5,7,8), B33(1), B34(6,7,8), B36(all)

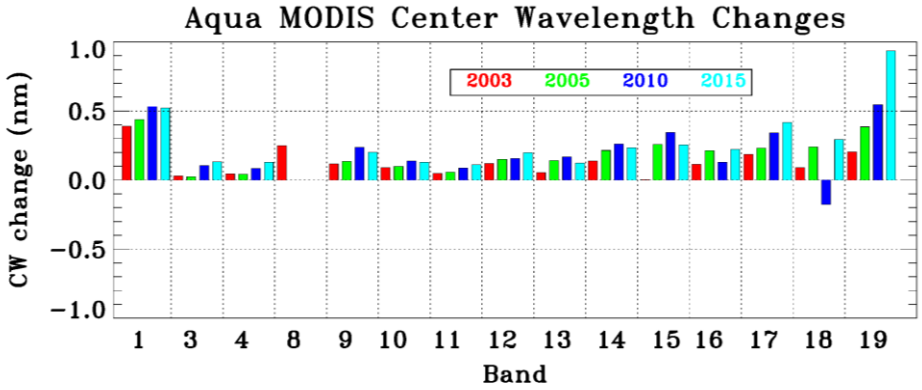
Time	Event	Noisy Band (Detector)	Inoperable Band (Detector)
Pre-launch		B6(17), B20(10)	B5(20), B6(2,12-14,16,18-20), B36(5)
2002175.2324	Nadir Door Open	B6(7,9,17)	B5(20), B6(2,4-6,10,12-16,18-20), B36(5)
2005010.1715	SAA (Day)	B6(7,9,17), B27(3)	B5(20), B6(2,4-6,10,12-16,18-20), B36(5)
2007359.1020	N/A	B6(7,9,17), B27(3), B29(8)	B5(20), B6(2,4-6,10,12-16,18-20), B36(5)
2008038.1750	SAA (Day)	B6(7,9,17), B27(3), B29(2,8)	B5(20), B6(2,4-6,10,12-16,18-20), B36(5)
2012022.1510	SAA(Day)	B6(7,9,17), B27(3), B29(2,6,8)	B5(20), B6(2,4-6,10,12-16,18-20), B36(5)
2015031.2100	N/A	B6(7,9,17), B21(2,3,9), B27(3), B29(2,6,8)	B5(20), B6(2,4-6,10,12-16,18-20), B36(5)

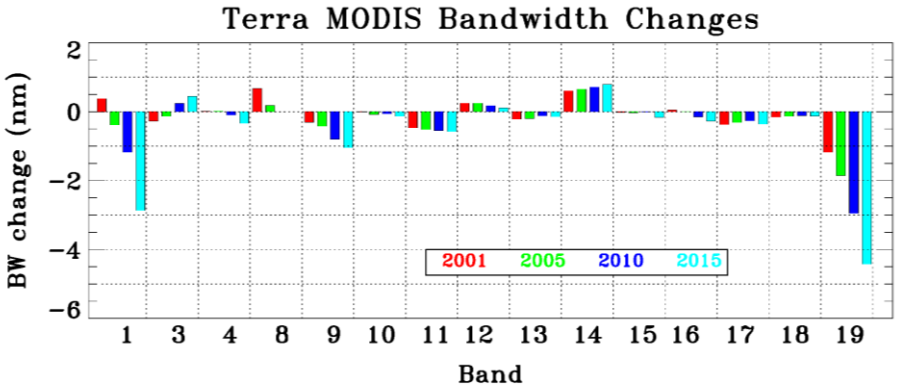
Terra MODIS: No new noisy or inoperable detectors since 2013

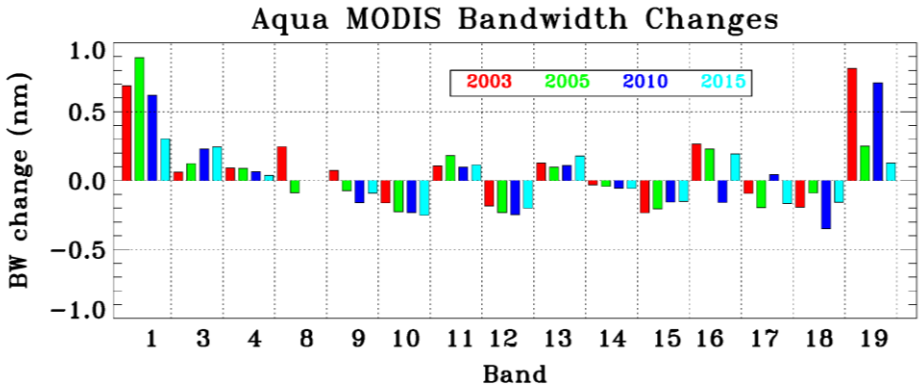
Aqua MODIS: 3 new noisy detectors since 2012 (Band 21 D2, D3, and D9)

MODIS Spectral Characterization Performance





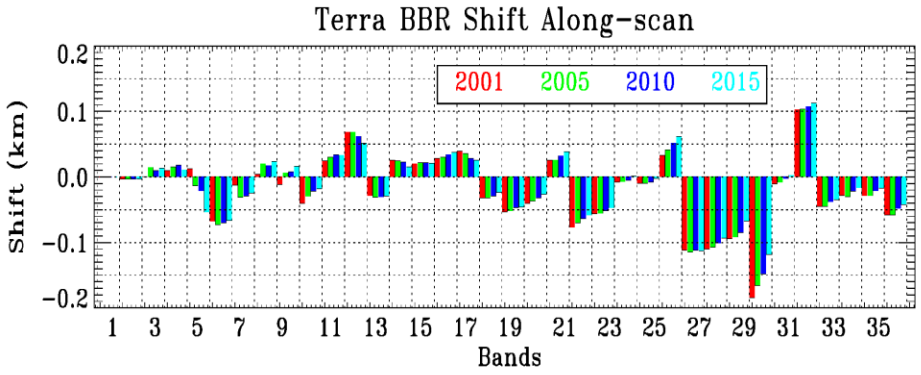


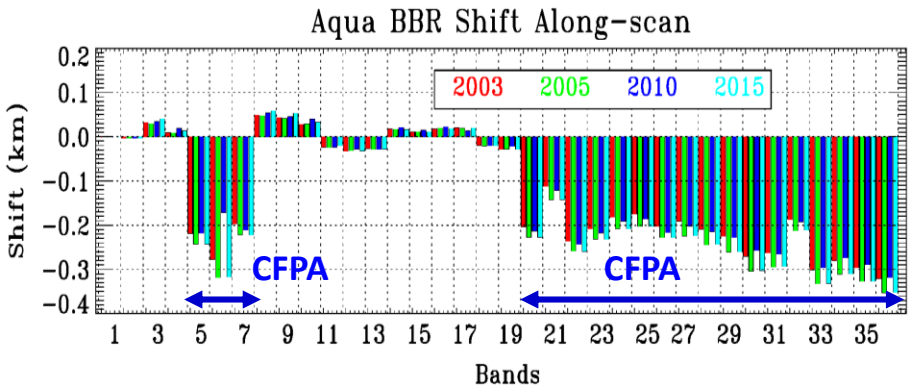


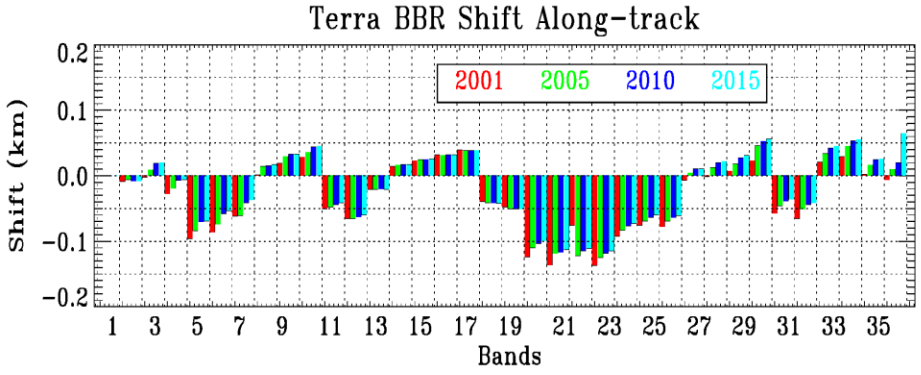
CW and BW changes are within 0.5 nm and 1.0 nm, respectively, for most VIS/NIR bands

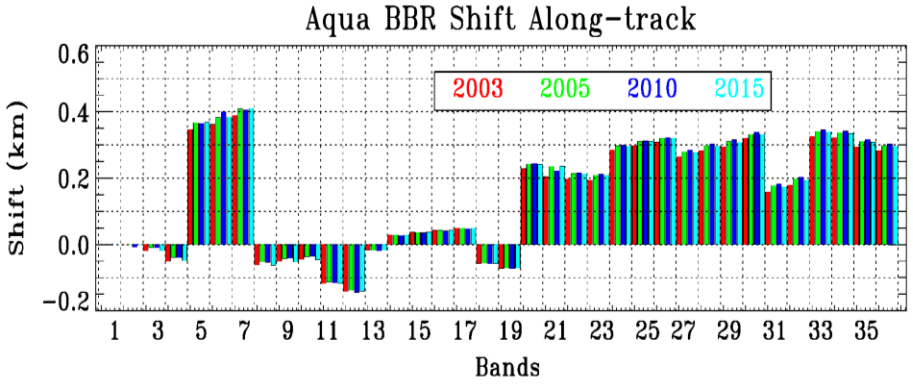
Relatively large changes are observed for bands with broad bandwidths (bands 1, 18, 19)

MODIS Spatial Characterization Performance









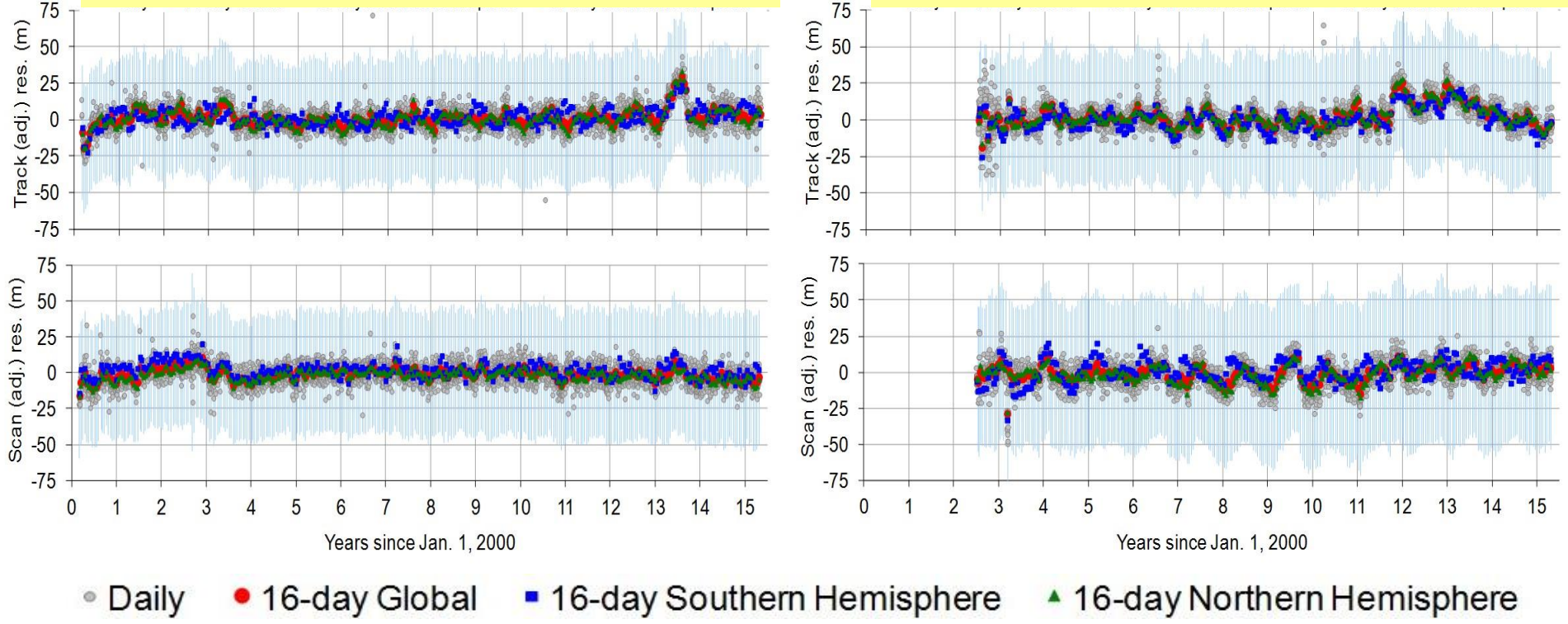
Terra BBR: within spec (±0.1 km) for all band pairs (except for along scan B30 and B32)

Aqua BBR: a known issue since pre-launch

MODIS Geolocation Performance

Terra MODIS RMSE (C6)
Track: 43 m Scan: 44 m

Aqua MODIS RMSE (C6)
Track: 46 m Scan: 53 m



Terra track direction jump - due to a delayed implementation/update of Geo LUTs (from 1/1/2013 to Aug 10, 2013).

Aqua track direction jump at the end of 2011 (now it's back to "normal") - need to model it and update the LUT.

MODIS C5/C6 Data Product Processing and Reprocessing

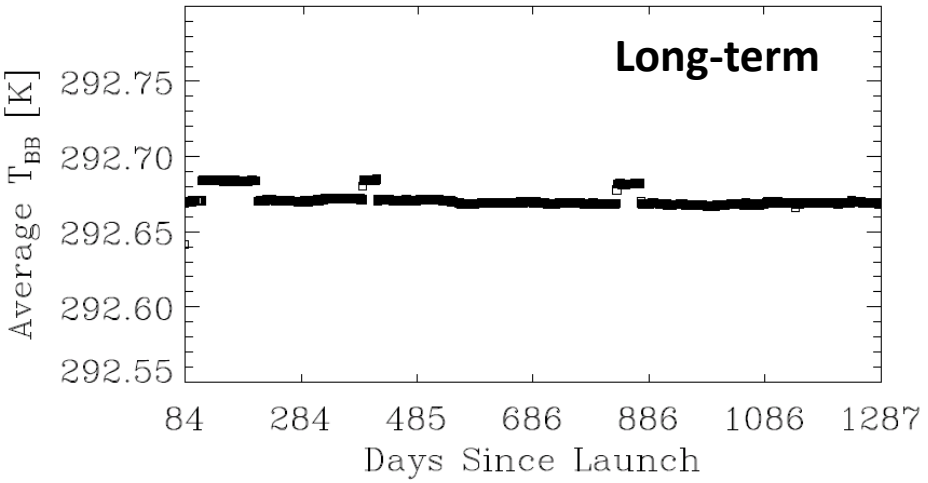
- **C5 data processing**
  - Forward processing is typically 1-2 days behind real time
  - Products from C5 processing are expected to be available from DAAC for a year after completion of the C6 land reprocessing
- **C6 data reprocessing and processing**
  - C6 L1 reprocessing of Aqua and Terra MODIS completed in 2012 and their forward processing started in 2012 and is currently at leading edge
  - C6 L1 products have been available to public since late 2012 from LAADS
  - Terra L1B reprocessed in August 2014 to address trending in band 5
  - Reprocessing of atmosphere C6 L2 products from Aqua/Terra MODIS completed in April 2014/March 2015, respectively
  - Reprocessing of atmosphere C6 L3 products completed in April 2015
  - C6 atmosphere products have been available to public from LAADS since Jan 2014/Dec 2014 for Aqua/Terra MODIS
  - Reprocessing of land C6 products details to be reported in discipline breakouts)

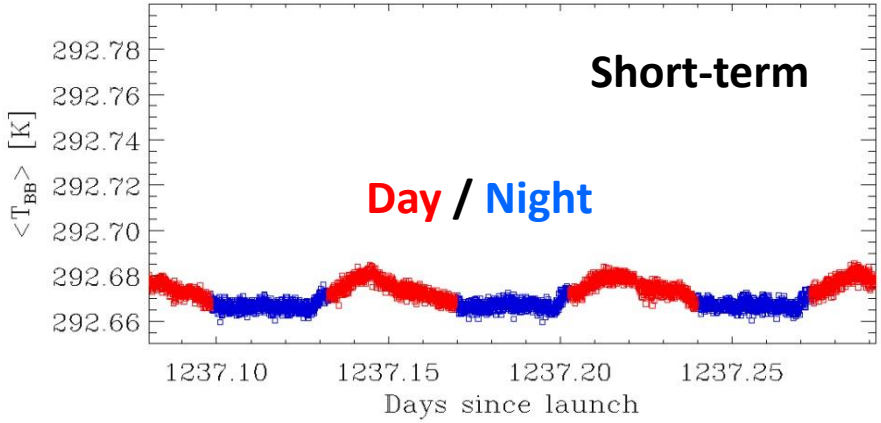
S-NPP VIIRS On-orbit Operation, Calibration, Performance

- **S-NPP Operation and Calibration (similar to MODIS)**
  - "Petulant Mode": 12 events since launch (reset to normal in next orbit)
  - "Scan Sync Loss" between RTA and HAM: 46 events since launch (2-3 min)
  - SD calibration performed each orbit through a fixed attenuation screen (no SD door); SD degradation regularly tracked by the SDSM (currently 3/week)
  - BB WUCD: 13 events since launch
  - Lunar calibration maneuvers: 32 scheduled lunar observations
  - Monthly VROP for DNB calibration
  - Maneuvers: Calibration Pitch/Yaw/Roll and Operation DMU, IAM, RMM
- **Performance**
  - Initial large degradation of mirror throughput in the NIR/SWIR region has leveled off; sensor continues to meet the design requirements
  - A number of improvements have been made for the reflective solar calibration, including SD/SDSM screen transmission, modulated RSR, and DNB calibration and stray light correction
- **Ongoing Effort on L1B Algorithm and Formatting**
  - Details in presentation by Patt and Chiang

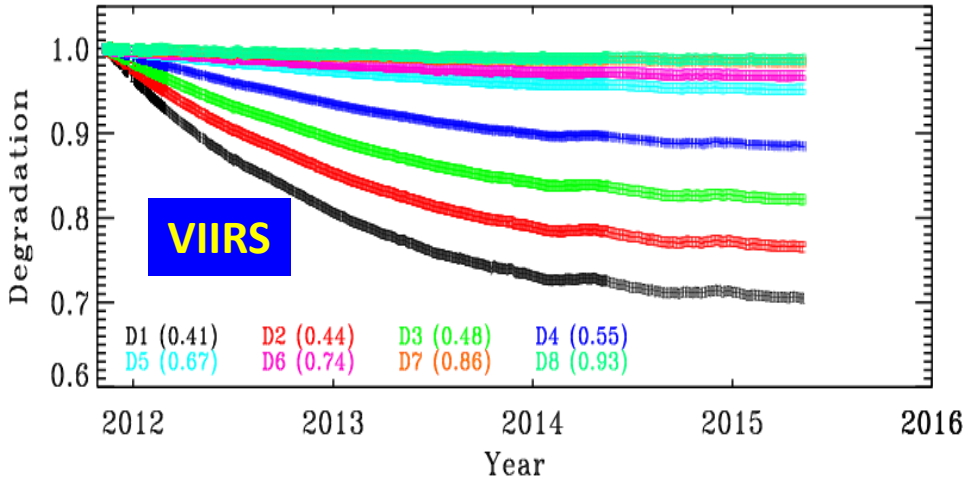
S-NPP VIIRS BB Temperature and SD Degradation

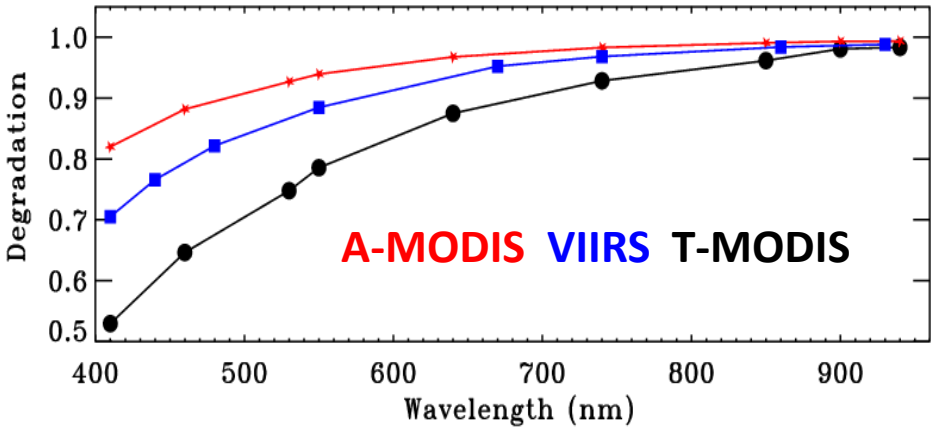
BB Temperatures



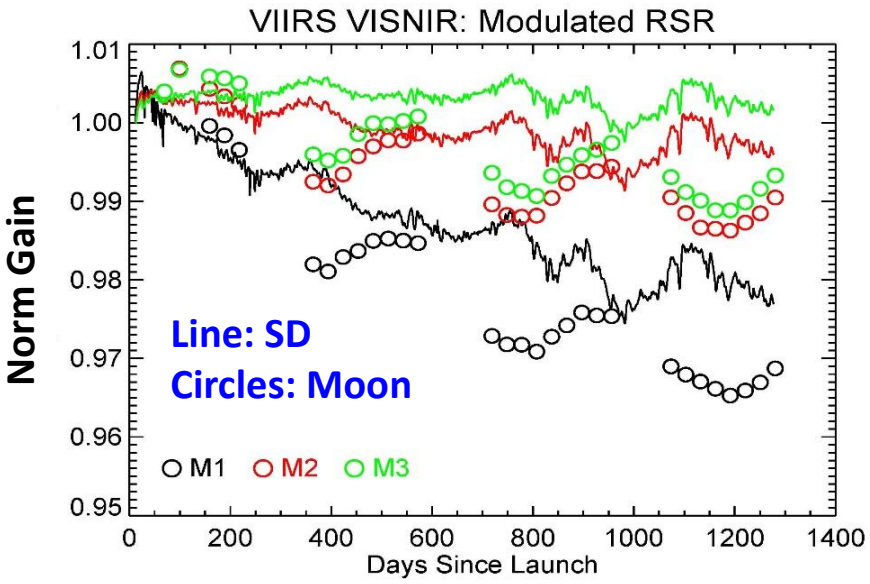


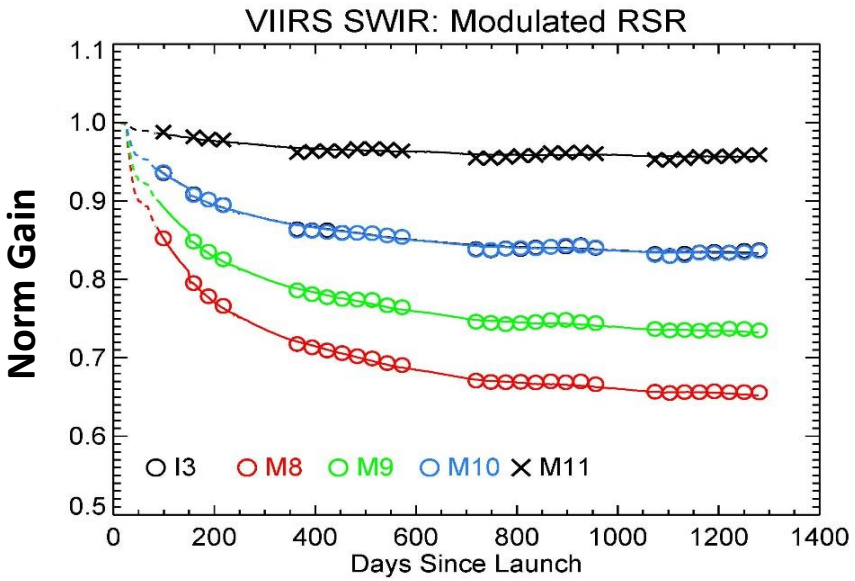
SD Degradation

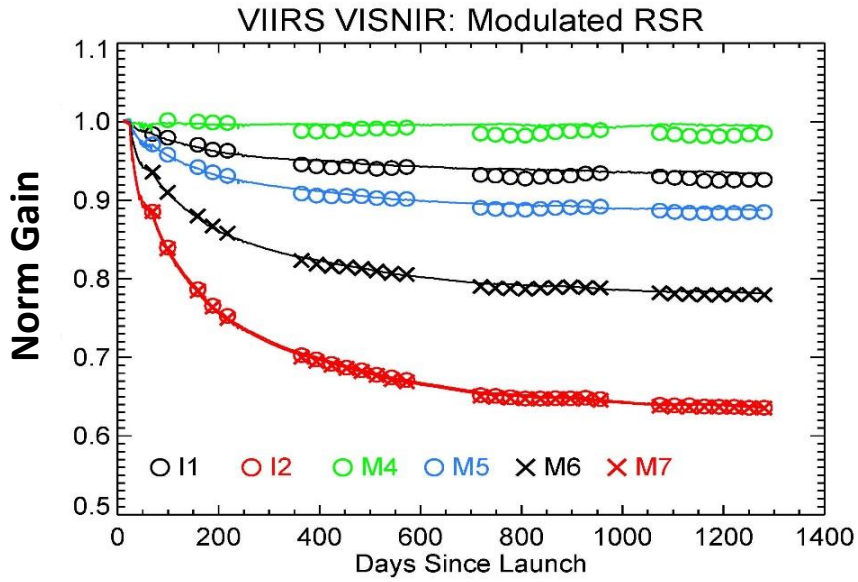


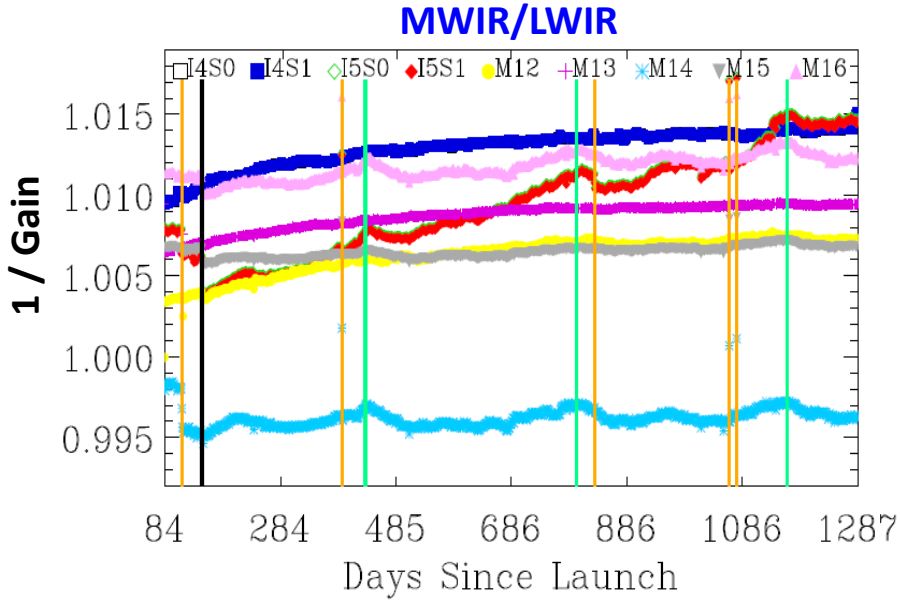


S-NPP VIIRS Spectral Band Responses (Gains)



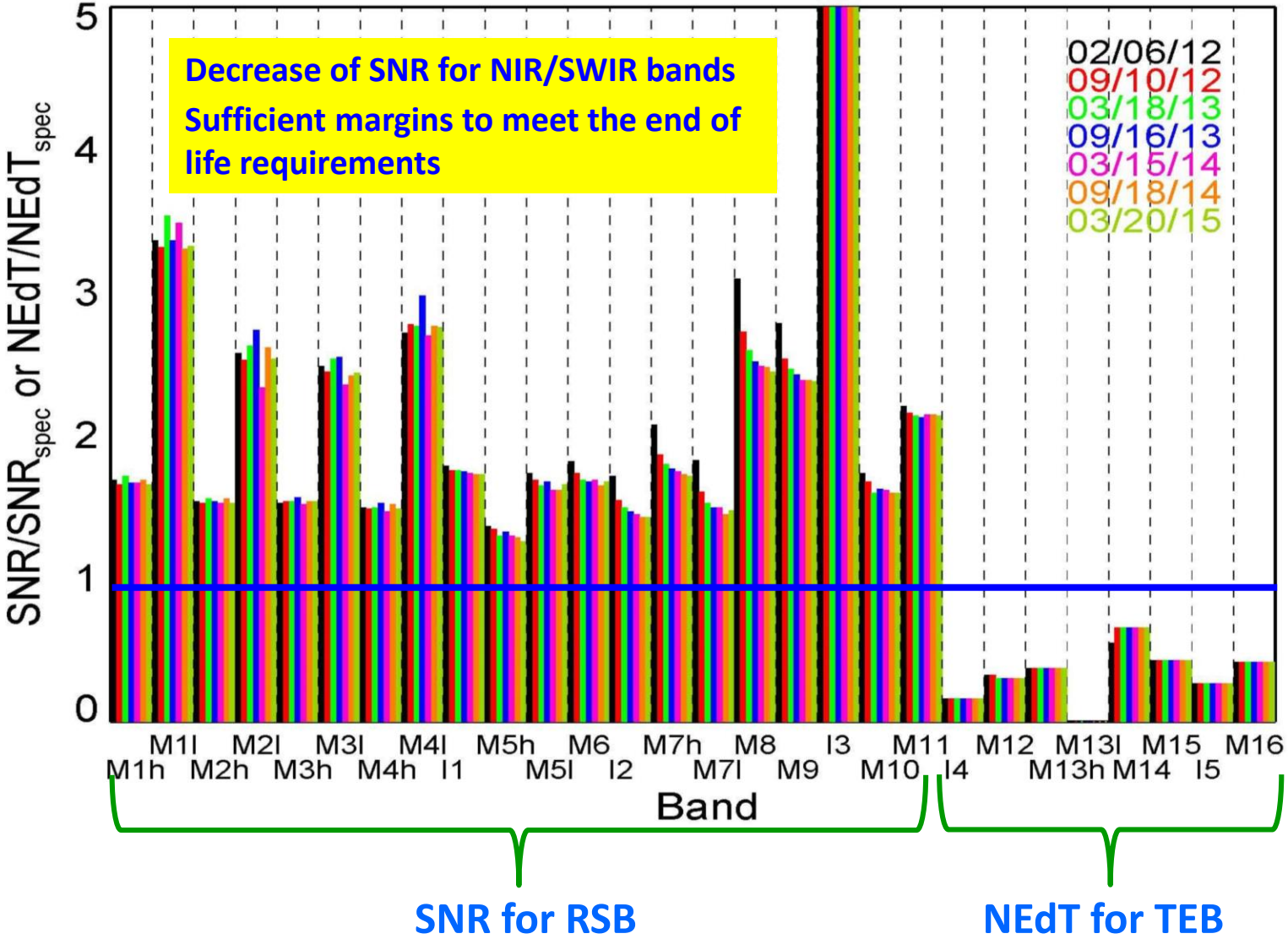






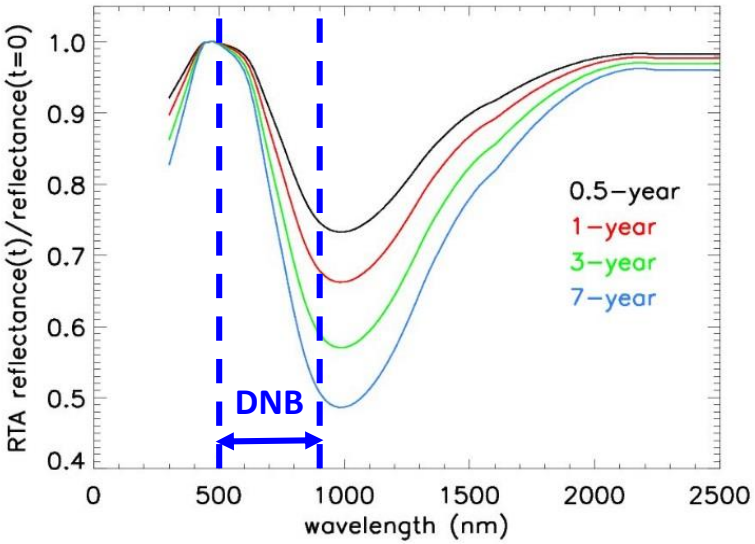
S-NPP VIIRS Detector Noise Characterization

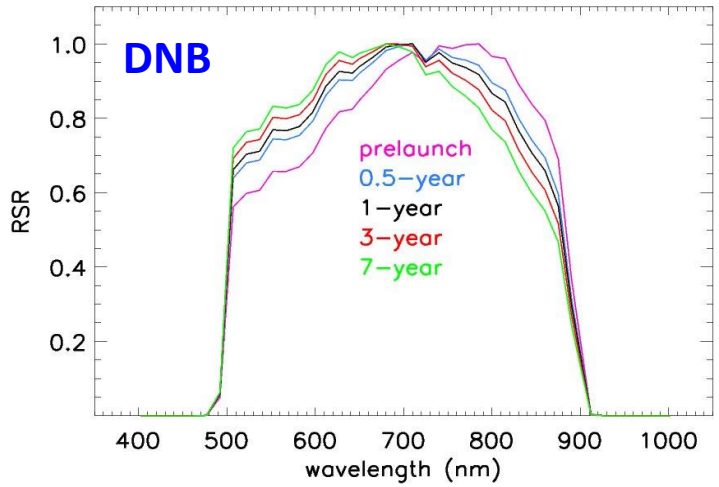
$SNR/SNR_{SPEC} > 1$ or $NEdT/NEdT_{SPEC} < 1$: performance better than design requirements

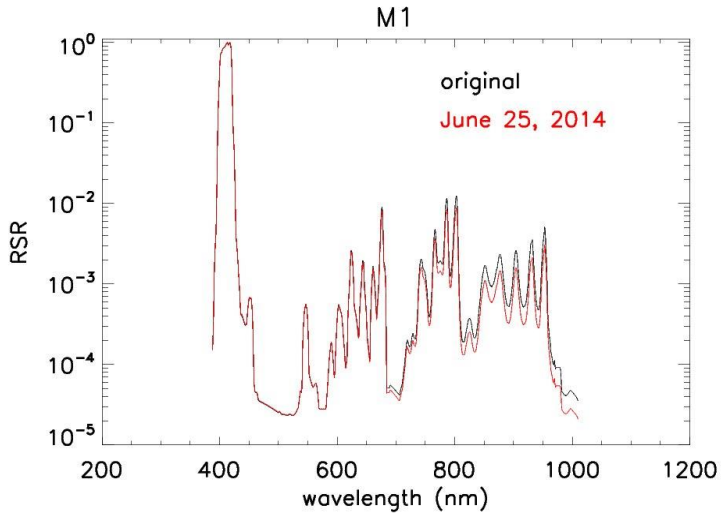


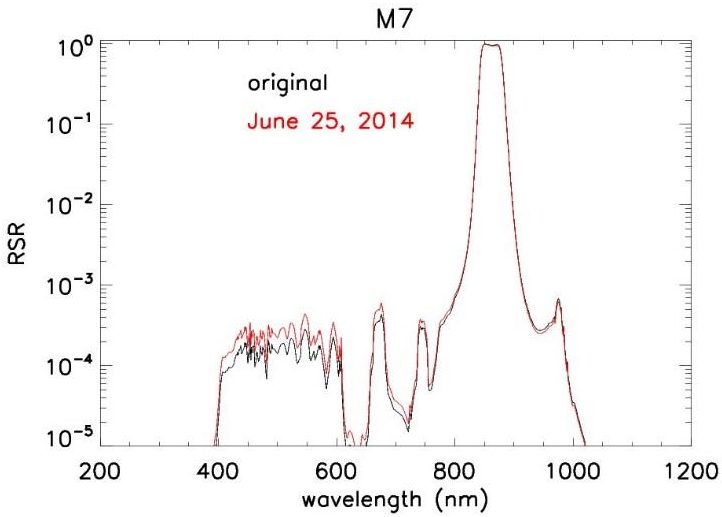
S-NPP VIIRS Spectral Characterization Performance

λ dependent optics degradation led to Modulated RSR





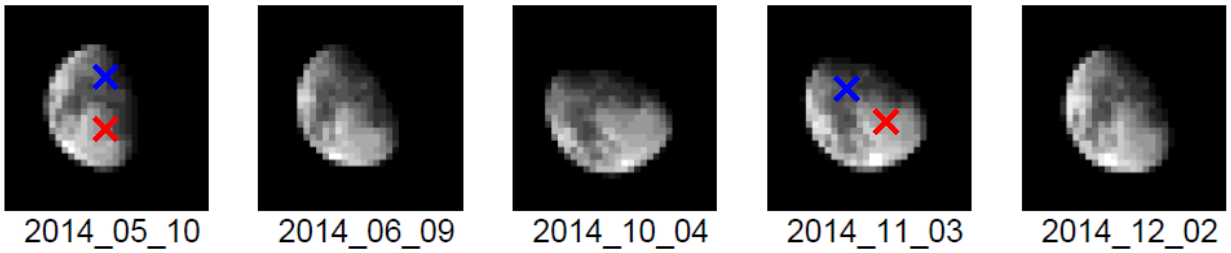


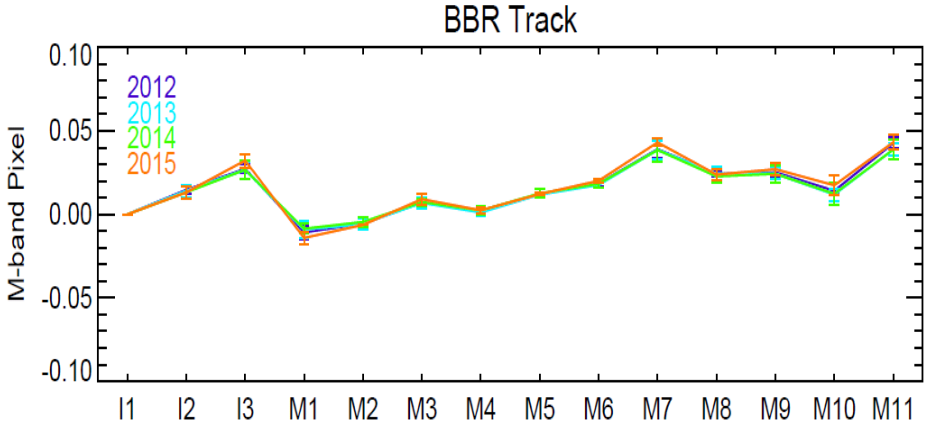


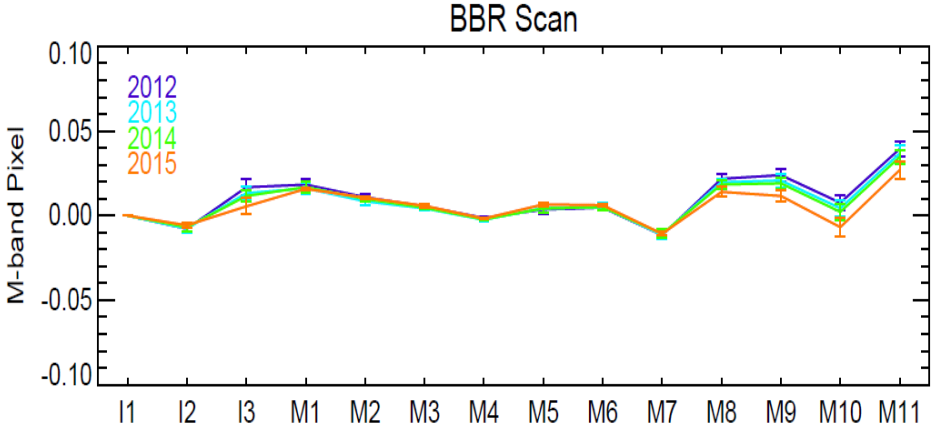
Small impact on bands with narrow bandwidths and small OOB responses; large impact on DNB (broad bandwidth)

S-NPP VIIRS Spatial Characterization

Methodology developed and enhanced from MODIS BBR characterization using lunar observations

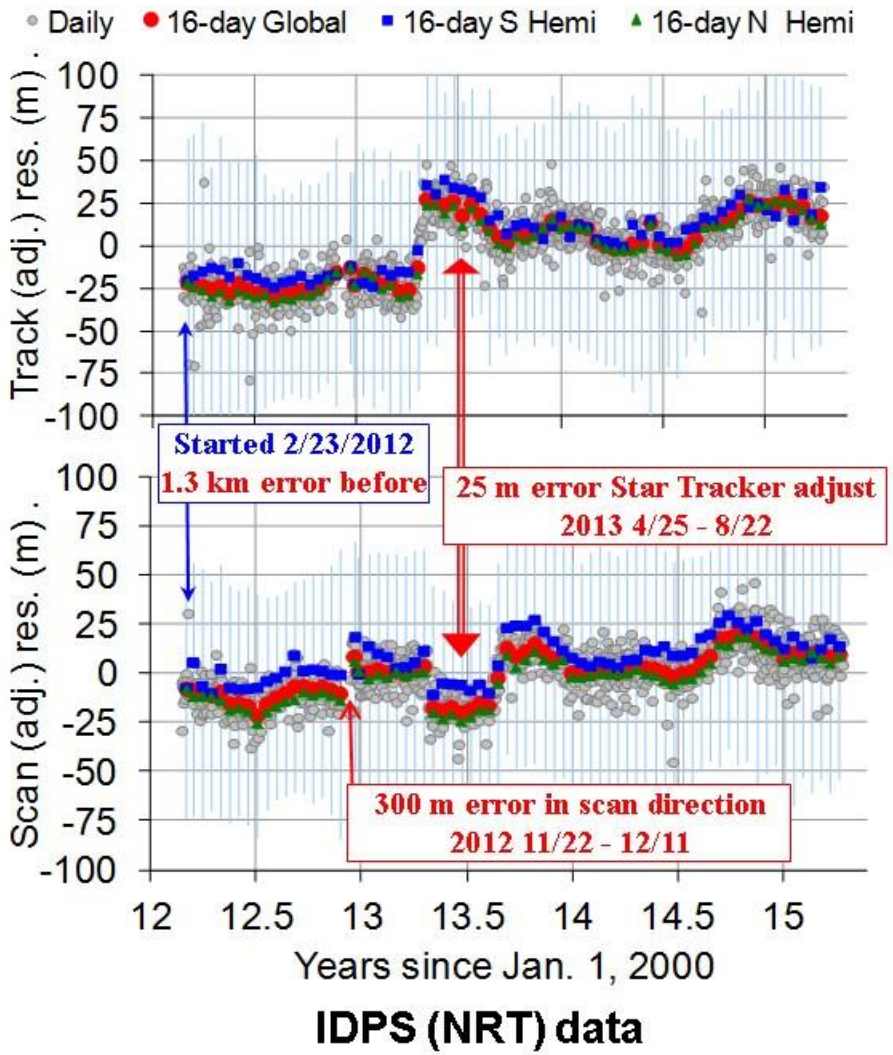






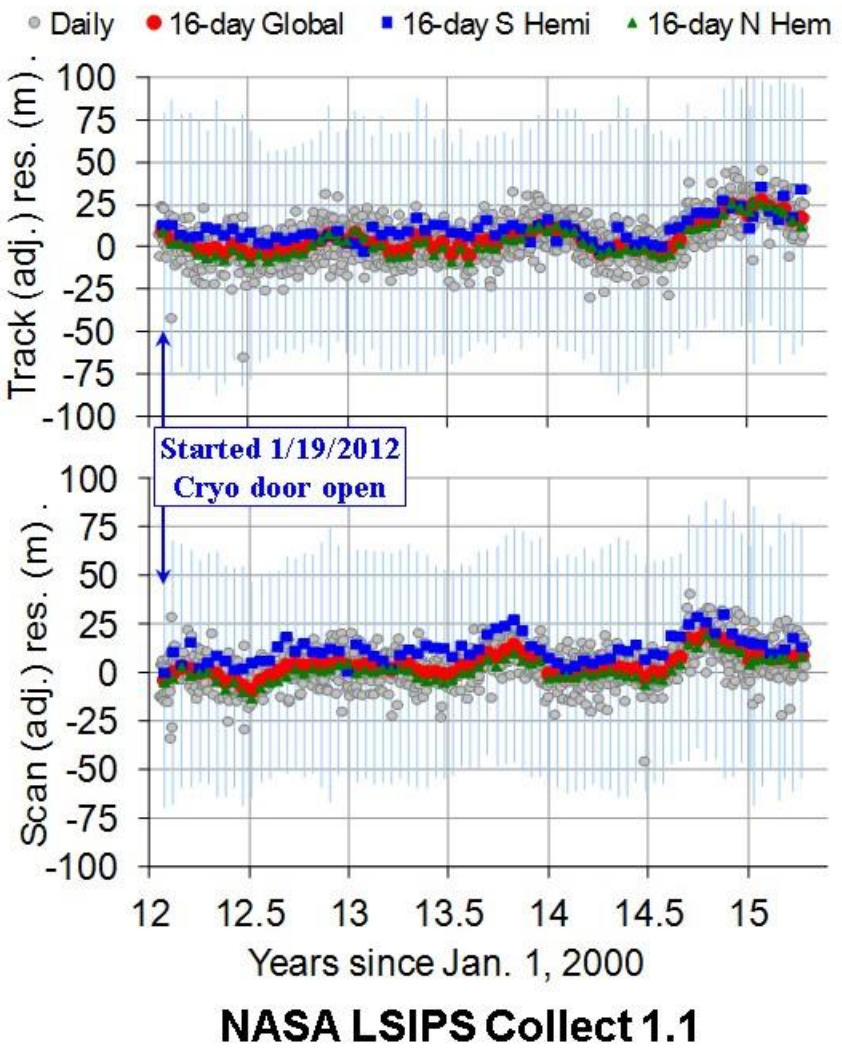
On-orbit BBR is very stable in both scan and track directions

S-NPP VIIRS Geolocation Performance



IDPS (NRT) data

RMSE: track, 75 m; scan 61 m, nadir equivalent



NASA LSIPS Collect 1.1

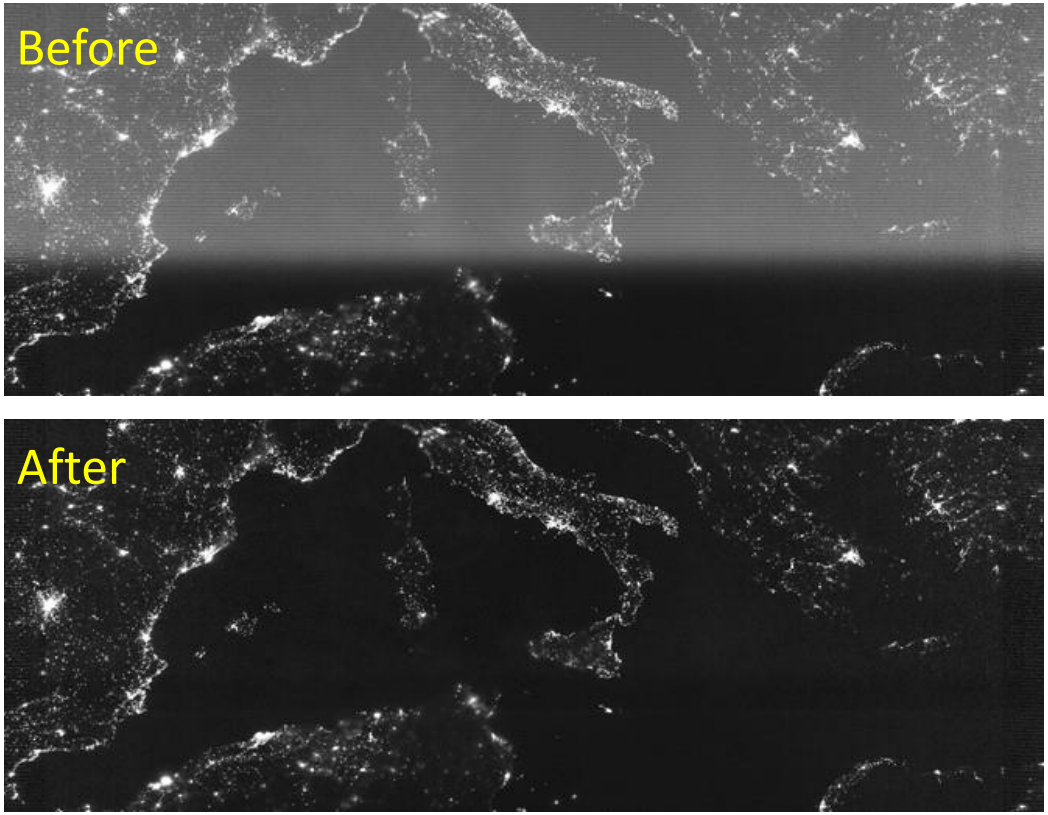
RMSE: track, 70 m; scan 60 m, nadir equivalent

S-NPP VIIRS DNB Calibration and Stray Light Correction

- **Consistent calibration coefficients are computed using:**
  - Time dependent modulated RSR
  - Smooth LGS gains calibrated with SD
  - Gain ratios of MGS/LGS & HGS/MGS
- **Stray light correction has been implemented in L-SIPS reprocess C1.1 with good result**
- **Future effort**
  - HGS, MGS gain calibration improvements
  - Stray light correction enhancements
  - Calibration uncertainty studies

Details in a separate presentation at calibration workshop

data d20140726_t0109



JPSS 1 VIIRS Pre-launch Testing Status

- J1 VIIRS successfully completed key performance testing (radiometric, spectral, and spatial) in sensor ambient and thermal vacuum environment.
- J1 VIIRS Instrument was integrated onto the spacecraft at Ball (CO) as of 02/20/2015, and has successfully completed its initial ambient testing on 03/17/2015.
- Comprehensive testing in spacecraft thermal vacuum environment (as-you-fly configuration with all instruments on) expected early 2016.

J1 VIIRS Key Performance Testing Phases	
Ambient Testing Complete:	08/24/2013 - 01/19/2014
Pre-TV Testing Complete:	05/16/2014 - 07/16/2014
TV Testing Complete:	07/16/2014 - 10/30/2014
Cold Perf.	08/18/2014 - 09/02/2014
Nominal Perf.	09/02/2014 - 10/07/2014
Hot Perf.	10/07/2014 - 10/30/2014
Post-TV Testing Complete:	11/24/2014 - 12/15/2014
Delivery to Spacecraft Facility: February 6, 2015	

J1 test program collected complete and good quality calibration and characterization data
J1 performance is as expected, and all deviations were characterized and understood

JPSS 1 VIIRS Performance Summary (1/2)

- **Key Decisions during J1 VIIRS Testing**
  - A-side electronics was designated as the primary electronics (B-side as the redundant), though both sides are comparable.
  - The CFPA operation temperature was set to 80.5 K
  - Some changes: SpaceWire replaced the 1394 communication bus, a new single board computer (SBC) was installed; RTA mirrors changed from Ni coated to VQ; dichroic 2 coatings redesigned
- **RSB Radiometric Performance:**
  - J1 VIIRS meets "all" requirements for SNR, dynamic range, and gain transition (as good as S-NPP VIIRS)
    - Minor non-compliances for dynamic range: M8 (72%) and I3 (91%), while I3 Det4 is a bad detector (very noisy and lower responsivity).
    - Polarization non-compliance: Four bands (M1-M4). Enhanced characterization was performed post TV with NIST T-SIRCUS to support EDR polarization correction.
    - Shortwave bands non-linearity: High residuals at low radiance. Issue can be mitigated using higher order calibration equation.
    - DNB HGS/MGS non-linearity: shown only at higher agg modes (22-32). Mitigation approach identified (agg. mode 21, agg. mode 21-26).

JPSS 1 VIIRS Performance Summary (2/2)

- **TEB Radiometric Performance**
  - TEB showed excellent calibration performance based on the TV testing; comparable to SNPP performance.
  - Minor non-compliances include M12 not meeting the absolute radiometric calibration (ARD) at low temperature. Similar to SNPP, J1 did not meet the characterization uncertainty for many bands.
  - Out of family detectors (minor noise increase) were identified, M16B D5 and M15 D4 (low risk), but could lead to striping in products such as SST.
- **Spectral and Spatial Performance**
  - Successful spectral and spatial testing with minor non-compliance (low risk). J1 performance is in general better than SNPP.
  - J1 RSRs Version 0 (V0) was released on 02/26/2015 by Data Analysis Working Group (DAWG) team based on Raytheon processing.
  - Work is ongoing to release enhanced J1 RSRs Version 1 (V1) by June 2015. Further release (TSIRCUS) is also planned before J1 Launch.
  - Electrical and optical crosstalk generated from spectral testing is overall comparable to or better than SNPP performance

Examples in backup slides and presentation at Calibration Workshop

Summary

- Both Terra MODIS (15 years) and Aqua MODIS (13 years) and key on-board calibrators continue to operate and function normally
- Dedicated effort by MCST and close interaction with science discipline representatives remain critical to calibration/data quality and in support of C5/C6/OBPG data production
- Future work to address existing and new challenging issues in MODIS
  - VIS/NIR response versus scan-angle (RVS) and polarization sensitivities
  - Uncertainty due to correction for large SD degradation and SD degradation correction for SWIR bands
  - Potential issues due to aging instruments
  - Terra LWIR PV Xtalk correction (in C7?)
- Overall SNPP VIIRS on-orbit performance (3.5 years) has been satisfactory
  - A number of updates have been made to improve calibration quality and applied to produce consistent SDR LUTs used at L-SIPS
  - Support for NASA L1 improvement effort
  - Continue to monitor potential changes in RVS
  - Understand and resolved SD and lunar calibration difference

Summary

- J1 VIIRS sensor level testing has successfully completed and will soon undergo comprehensive spacecraft level testing
  - Sensor overall performance is comparable to or better than S-NPP VIIRS
  - Ongoing effort to support SDR LUTs development and delivery
  - Launch in December 2016

Details in MODIS Calibration Workshop (May 18, 2015)

Backup Slides

MODIS Instrument Operation

☺ **No Changes to both Instrument Operation Configurations since Last Science Team Meeting (details on MCST website)**

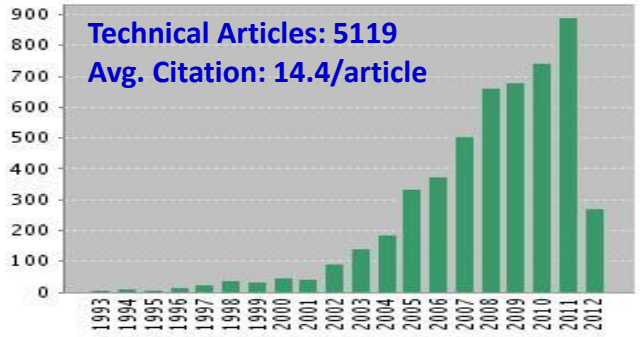
Terra MODIS

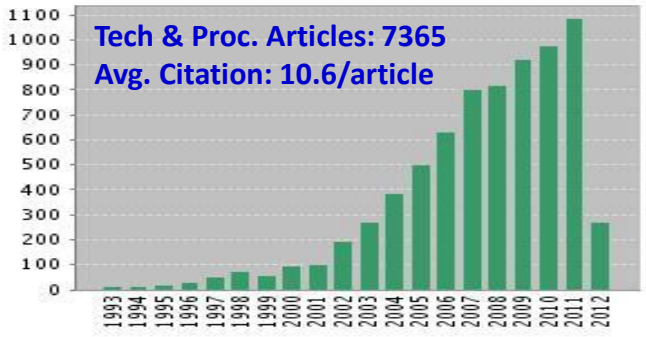
- Launch: Dec 18, 1999
- First light: Feb 24, 2000
- A-side: launch - Oct 30, 2000
- B-side: Oct 30, 2000 - June 15, 2001
- A-side: July 02, 2001 - Sept 17, 2002
- A-side electronics & B-side formatter: since Sept 17, 2002
- BB nominally set at 290 K
- SD door fixed at "open" since July 02, 2003
- SRCA operated with 2 10-W lamps since 2006
- CFPA controlled at 83 K (briefly at 85 K: 3-5 Aug 2000)

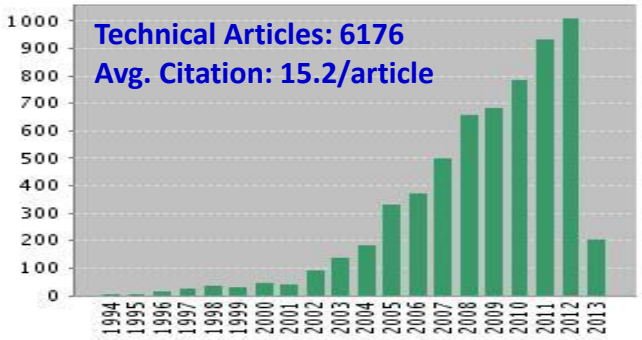
Aqua MODIS

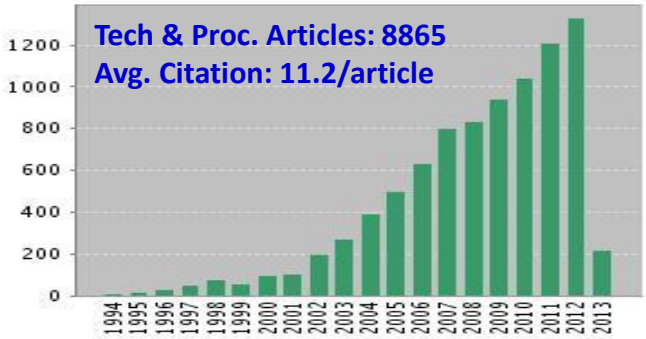
- Launch: May 04, 2002
- First light: June 24, 2002
- B-side: launch - present
- BB nominally operated at 285 K
- SD calibration: gradually reduced frequency
- SRCA operated with 2 10-W lamps since 2005
- CFPA controlled at 83 K (small increase of CFPA temperatures since 2007)

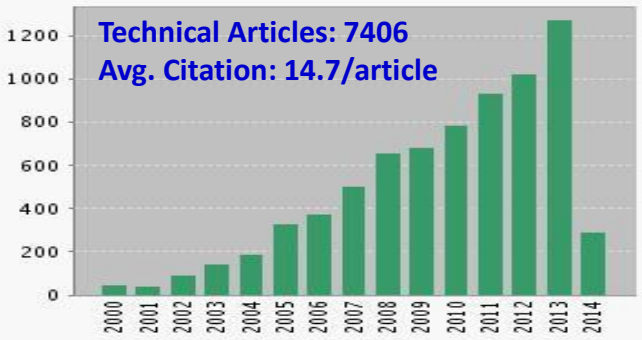
MODIS Publication Metrics

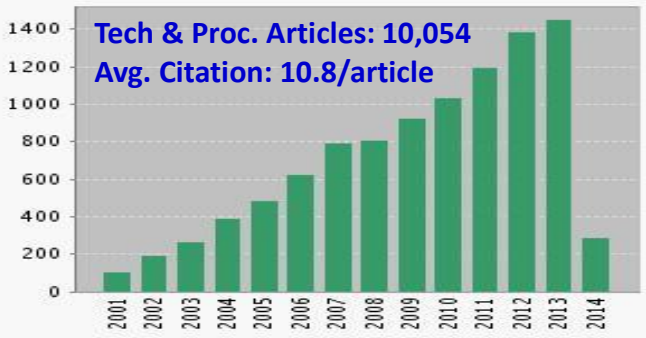


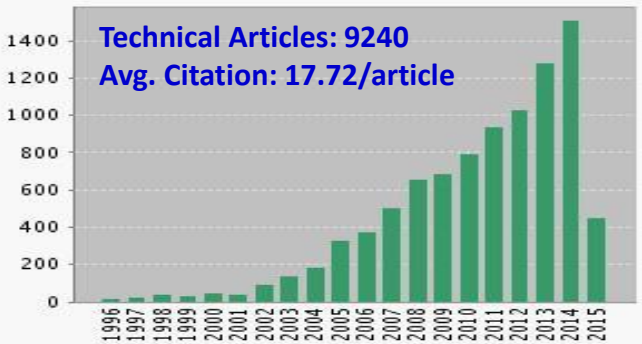


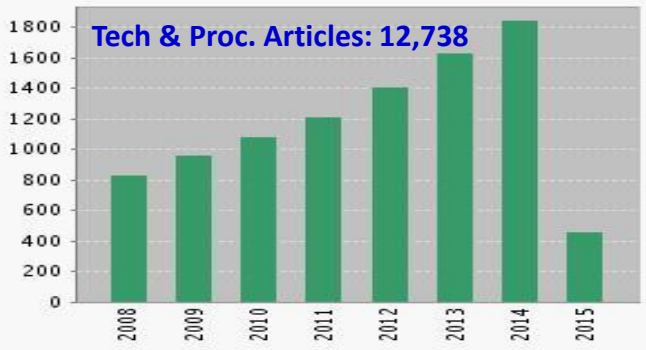












Goggle Scholar (05/12/2015)

NASA Hubble: 114,000

NASA MODIS: 76,500

NASA Landsat: 54,800

Collection 5 (C5) Forward Processing Status

- **Forward processing (C5 Land, C51 and C6 Atmosphere) is typically 1-2 days behind real time.**
- **The C4.1 LST (C4 code with C5 L1 input) is processed and archived at LAADS**
- **C5/C5.1/C4.1 processing to be continued for a year after completion of the C6 land and atmosphere reprocessing.**
- **Products from C5 processing are expected to be available from DAAC for a year after completion of the C6 land reprocessing.**
- **NRT processing (C5 Land and C51 Atmosphere) is completed typically 2 hours after acquisition of data.**

Collection 6 (C6) Reprocessing Status

- **L1, Geolocation, and L1B**
  - C6 reprocessing of Aqua and Terra completed in 2012.
  - Forward processing of Terra and Aqua L1B started in 2012 and is currently at leading edge.
  - Terra L1B reprocessed in August 2014 to address trending in Band 5.
  - C6 Products have been available to public since late 2012 from LAADS.
  - Terra and Aqua L1B process with code change to correctly identify the sector rotation period put in forward processing from May 2015.
  - MCST continues to derive and deliver forward LUT updates for the two processing streams as needed.

Collection 6 (C6) Reprocessing Status

- **Atmosphere Products**
  - Reprocessing of L2 products from Aqua MODIS was started in Dec 2013 and completed in April 2014.
  - Reprocessing of L2 products from Terra MODIS was started in Oct 2014 and completed in March 2015.
  - Reprocessing of L3 products completed in April 2015.
  - C6 Products have been available to public from LAADS: Aqua MODIS since Jan 2014 and Terra MODIS since Dec 2014.

Details in Reports at the Atmosphere break out session

Collection 6 (C6) Reprocessing Status

- **Land Products**
  - Reprocessing of Tier1 block of products started in Feb 2015. Completed processing through day 224 (Aug 12) of year 2007 from Terra and Aqua.
  - Teir1 block includes Land Surface Reflectance, Vegetation Index, BRDF-Albedo, LAI/FPAR, GPP, Land Surface Temperature, and Active Fire.
  - Reprocessing used C6 L1B corrected for the polarization.
  - Products are expected to be released to public in July 2015, after completion of the on-going re-reprocessing of products from the early period of the mission (2000 – 2003).
  - Reprocessing of Teir1 block of products expected to complete in Feb 2016.
  - Teir2 block includes snow, MAIAC, LST from JPL, Burned Area, Land Cover and Land Cover Dynamics, VCF, Evapotranspiration.
  - C6 Algorithm changes for products in the Tier 2 block are currently under development and science testing. Reprocessing of these products will start following approval of the C6 algorithms by the product PIs.

Details in Reports at the Land Break out session

VIIRS and MODIS Spectral Bands

16 Moderate (radiometric) bands, 5 Imaging bands, 1 DNB

VIIRS Band	Spectral Range (um)	Nadir HSR (m)	MODIS Band(s)	Range	HSR
DNB	0.500 - 0.900				
M1	0.402 - 0.422	750	8	0.405 - 0.420	1000
M2	0.436 - 0.454	750	9	0.438 - 0.448	1000
M3	0.478 - 0.498	750	3 10	0.459 - 0.479 0.483 - 0.493	500 1000
M4	0.545 - 0.565	750	4 or 12	0.545 - 0.565 0.546 - 0.556	500 1000
I1	0.600 - 0.680	375	1	0.620 - 0.670	250
M5	0.662 - 0.682	750	13 or 14	0.662 - 0.672 0.673 - 0.683	1000 1000
M6	0.739 - 0.754	750	15	0.743 - 0.753	1000
I2	0.846 - 0.885	375	2	0.841 - 0.876	250
M7	0.846 - 0.885	750	16 or 2	0.862 - 0.877 0.841 - 0.876	1000 250
M8	1.230 - 1.250	750	5	SAME	500
M9	1.371 - 1.386	750	26	1.360 - 1.390	1000
I3	1.580 - 1.640	375	6	1.628 - 1.652	500
M10	1.580 - 1.640	750	6	1.628 - 1.652	500
M11	2.225 - 2.275	750	7	2.105 - 2.155	500
I4	3.550 - 3.930	375	20	3.660 - 3.840	1000
M12	3.660 - 3.840	750	20	SAME	1000
M13	3.973 - 4.128	750	21 or 22	3.929 - 3.989 3.929 - 3.989	1000 1000
M14	8.400 - 8.700	750	29	SAME	1000
M15	10.263 - 11.263	750	31	10.780 - 11.280	1000
I5	10.500 - 12.400	375	31 or 32	10.780 - 11.280 11.770 - 12.270	1000 1000
M16	11.538 - 12.488	750	32	11.770 - 12.270	1000

1 DNB

14 RSB
(0.4-2.3 μm)

Dual Gain Bands:
M1-M5, M7, M13

7 TEB

Status of VIIRS SDR Code/LUTs

- **IDPS VIIRS SDR Code/LUTs (radiometric)**
  - 23 major code revisions (current Mx8.8); numerous LUT updates.
  - Improved LUT update strategy: on demand (post launch) -> weekly prediction (Mx6, Aug 2012)-> automated (future, TBD).
- **VCST Support Land SIPS SDR Code/LUTs and data reprocess (C1.0 and C1.1)**
  - Independent validation for SDR code and improvements in LUTs derivation.
  - 26 sets of LUTs for VISNIR/SWIR/DNB have been delivered to Land SIPS for data reprocess and SDR/EDR assessments.
    - Jan 31, 2013: LUTs launch to Jan 2013 based on Mx6.3 algorithm with smoothed functions to remove outliers for consistent Land SIPS reprocess C1.0.
    - Nov 13, 2013: LUTs launch to Oct 2013 based on Mx6.4 improvements, including SD/SDSM screen transmission, SD BRDF, RTA mirrors degradation model, and modulated RSRs.
    - Mar 12, 2014: LUTs launch to Nov 2013 based on Mx7.2 algorithm for Land SIPS reprocess Collection 1.1, including DNB Stray Light Correction algorithm and improved fitting functions.
    - May 14, 2015 – Latest LUTs update V7.2.0.16 for the month of April 2015.
  - Collection 1.2 mission LUTs delivery (May 2015): Based on Mx8, including solar vector error fix, on-orbit SD/SDSM screen transmission & SD BRDF, and modulated RSR.

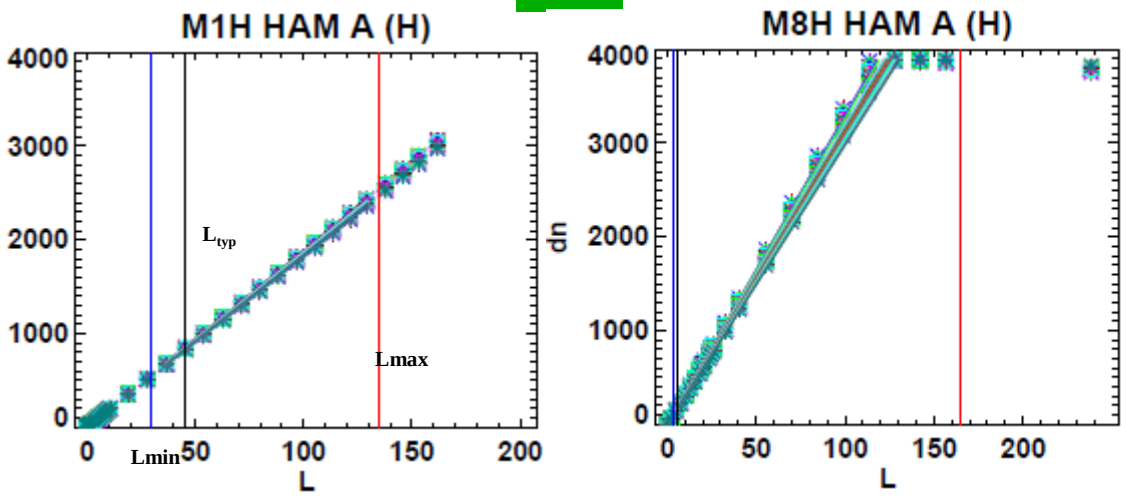
J1 RSB Radiometric Performance

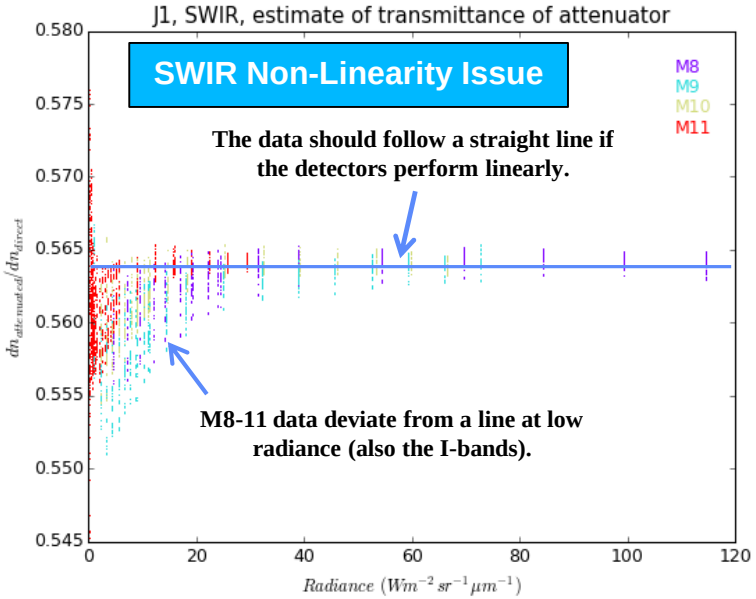
Band	Gain Stage	SNR spec	SNPP SNR	J1 SNR	SNPP SNR/Spec	J1 SNR/Spec	SNPP L_sat/Lmax	J1 L_sat/Lmax
M1	H	352	613	566	1.7	1.6	1.16	1.21
M1	L	316	1042	956	3.3	3.0	1.13	1.10
M2	H	380	554	514	1.5	1.4	1.41	1.40
M2	L	409	963	861	2.4	2.1	1.20	1.30
M3	H	416	683	630	1.6	1.5	1.29	1.31
M3	L	414	1008	868	2.4	2.1	1.20	1.20
M4	H	362	526	486	1.5	1.3	1.42	1.39
M4	L	315	864	695	2.7	2.2	1.31	1.28
M5	H	242	373	316	1.5	1.3	1.24	1.25
M5	L	360	776	591	2.2	1.6	1.12	1.11
M6	H	199	409	382	2.1	1.9	1.16	1.16
M7	H	215	524	467	2.4	2.2	1.28	1.26
M7	L	340	721	595	2.1	1.8	1.19	1.17
M8	H	74	358	273	4.8	3.7	0.77	0.72
M9	H	83	290	271	3.5	3.3	1.09	1.04
M10	H	342	691	627	2.0	1.8	1.14	1.09
M11	H	90	105	180	1.2	2.0	1.09	1.10
I1	H	119	261	184	2.2	1.5	1.07	1.08
I2	H	150	273	251	1.8	1.7	1.18	1.17
I3	H	6	176	154	29	26	0.97	0.91

Dual Gain Transition meets Spec

Band	L_{MAX}	L_{MAX} + 50%	L_trans
M1	135	202.5	154.4
M2	127	190.5	136.8
M3	107	160.5	113.3
M4	78	117	87.3
M5	59	87.5	61.3
M7	29	43.5	30.7

GAIN

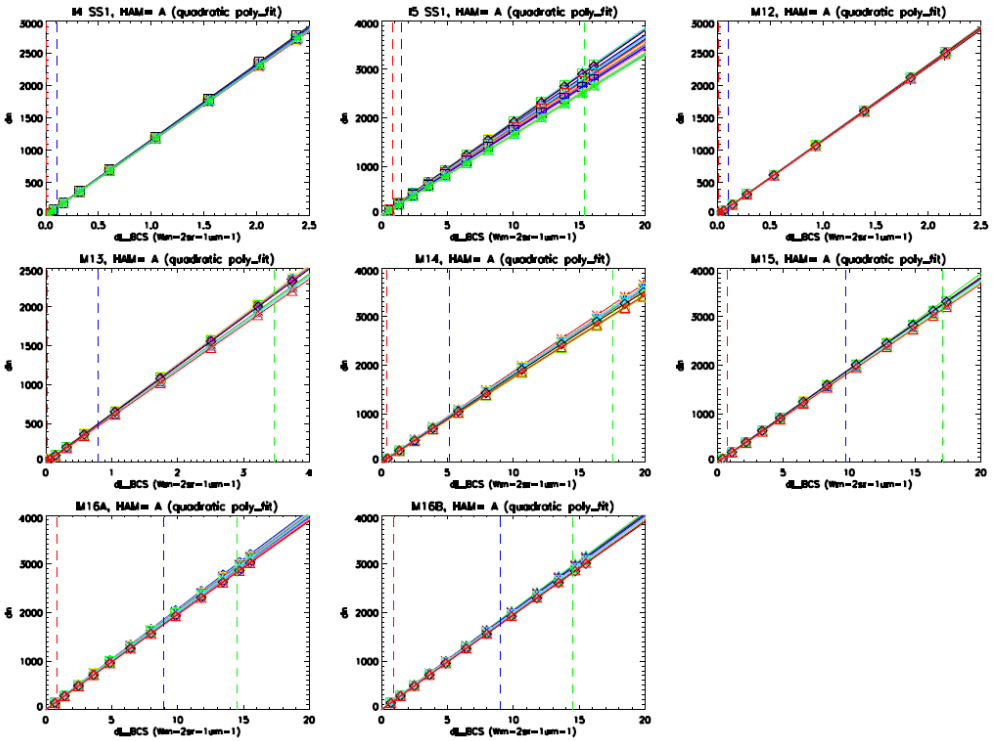




- J1 SNR met requirement with significant margin.
- Dynamic range is not met for M8 and I3, M9 (D1-3)
- Excellent linearity (RRNL) performance (<1%)
- Similar to SNPP, non-compliances seen for characterization uncertainty and uniformity.
- Unexpected DNB and SWIR non-linearity: Solutions found

J1 TEB Radiometric Performance

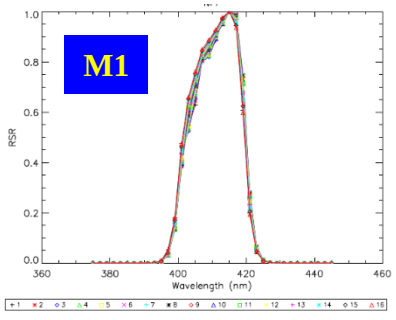
Band	Spec	$NEdT_{Ttyp}$ SNPP	$NEdT_{Ttyp}$ J1	J1 NEdT to Spec Ratio
I4	2.5	0.41	0.42	0.17
I5	1.5	0.40	0.41	0.27
M12	0.396	0.13	0.12	0.30
M13HG	0.107	0.04	0.04	0.40
M13LG	0.423	0.34	0.30	0.72
M14	0.091	0.06	0.05	0.55
M15	0.07	0.03	0.03	0.37
M16A	0.072	0.04	0.04	0.58
M16B	0.072	0.04	0.04	0.63

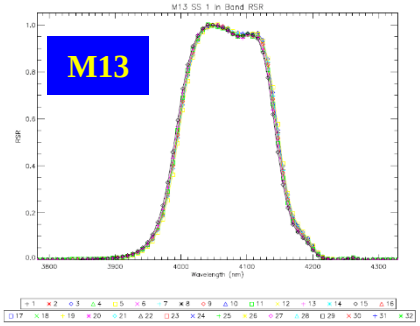


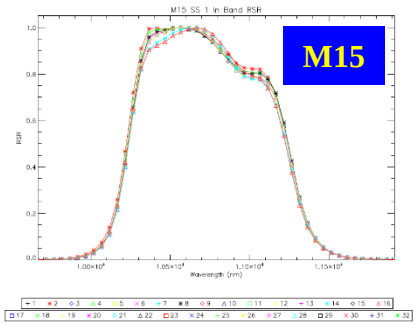
-J1 TEB calibration shows very good overall performance.
-Minor non-compliances observed: T_{MIN} for I4 and M14; M13 gain transition radiance; detector uniformity for M12 – M14; and radiometric characterization uncertainty (Low risk).
-Both electronics sides (A and B) and HAM sides (A and B) show comparable performance.

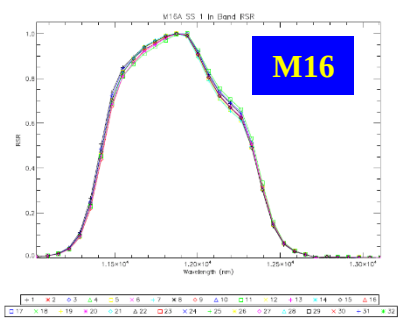
J1 Spectral Performance (VISNIR)

	Band Center (nm)			Bandwidth (nm)			Lower 1%		Upper 1%		IOOB	
Band	Spec	Tolerance	Band Center	Spec	Tolerance	Bandwidth	Spec	Lower 1%	Spec	Upper 1%	Spec	IOOB (%)
I1	640	6	642.5	80	6	78.5	≥565	593.4	≤715	692.9	0.5	0.11
I2	865	8	867.3	39	5	36.3	≥802	841.5	≤928	893.4	0.7	0.14
M1	412	2	410.9	20	2	17.7	≥376	395.2	≤444	425.3	1	0.26
M2	445	3	444.8	18	2	17	≥417	429.3	≤473	457.9	1	0.33
M3	488	4	488.6	20	3	18.9	≥455	473	≤521	504.3	0.7	0.3
M4	555	4	556.2	20	3	18.4	≥523	540	≤589	573.5	0.7	0.25
M5	672	5	667.3	20	3	19.2	≥638	649.8	≤706	685	0.7	0.27
M6	746	2	746	15	2	13.5	≥721	734	≤771	758	0.8	0.27
M7	865	8	867.5	39	5	36.2	≥801	842.9	≤929	892.4	0.7	0.15
DNBLGS	700	14	707.7	400	20	357.5	≥470	481.5	≤960	904.7	0.1	0.03
DNBMGS	700	14	695.3	400	20	377	≥470	489.2	≤960	904.7	0.1	0.04





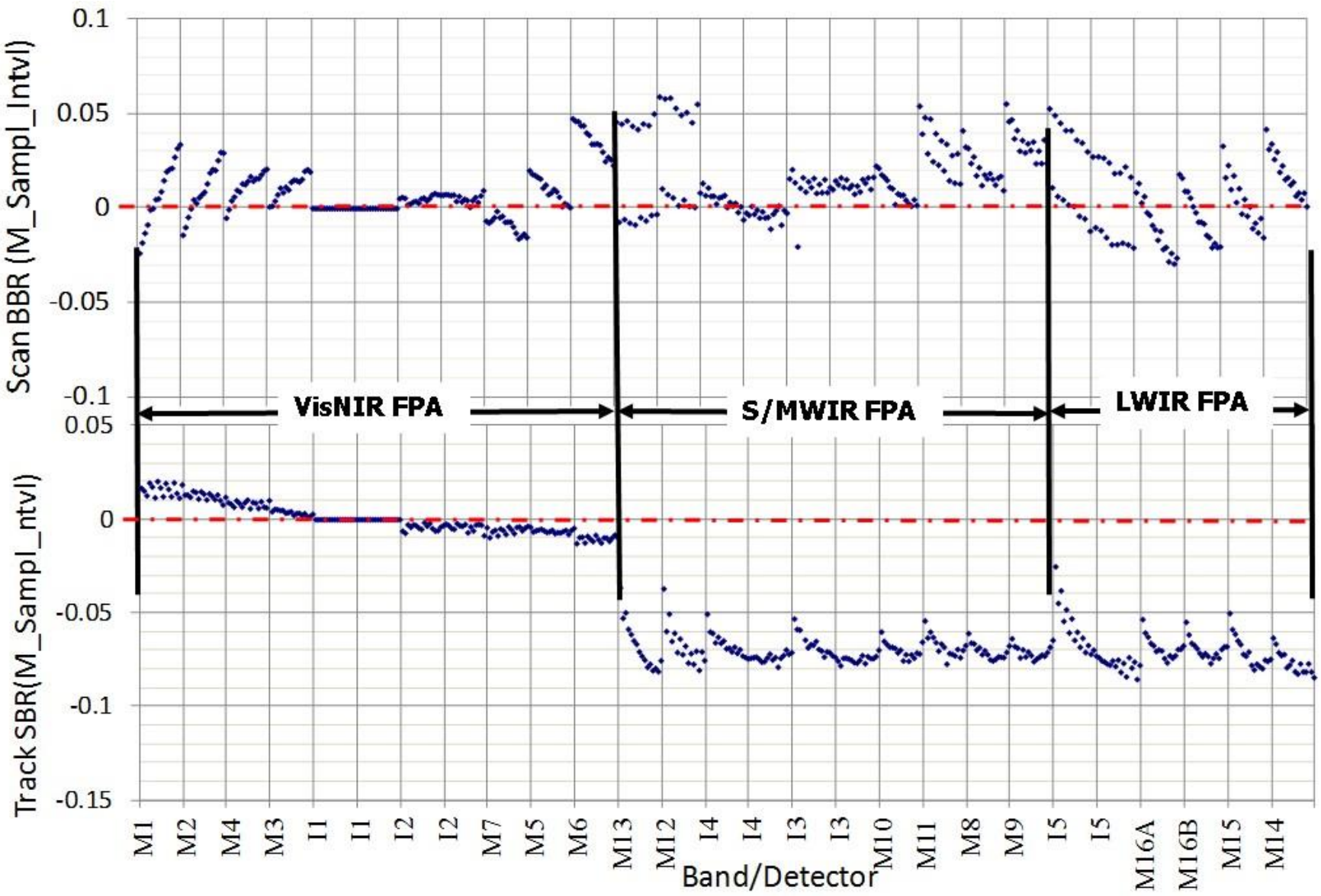




-J1 spectral performance (all 22 bands) was completed successfully with minor non-compliances (low risk).
- J1 overall performance for RSR and crosstalk is better than SNPP.

-J1 RSR version 0 was released to the science community (02/15). At-launch RSR will include higher quality data from TSIRCUS (VisNIR).

J1 VIIRS Band-to-Band Registration (BBR)



J1 VIIRS Spatial Responses