Suomi NPP VIIRS SDR Provisional Product Highlight

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Suomi NPP SDR Product Review,
NOAA Center for Weather and Climate Prediction (NCWCP)
5830 University Research Park, College Park, Maryland
October 23 - 24, 2012

Product Maturity Definition

- Beta (L+150)
  - Early release product, initial calibration applied, minimally validated and may still contain significant errors
  - Available to allow users to gain familiarity with data formats and parameters
  - Product is not appropriate as the basis for quantitative scientific publications studies and applications

- Provisional (Beta+2mo)
  - Product quality may not be optimal
  - Incremental product improvements are still occurring as calibration parameters are adjusted with sensor on-orbit characterization
  - General research community is encouraged to participate in the QA and validation of the product, but need to be aware that product validation and QA are ongoing
  - Users are urged to contact NPP Cal/Val Team representatives prior to use of the data in publications

- Validated/Calibrated (L+20mo)
  - On-orbit sensor performance characterized and calibration parameters adjusted accordingly
  - Ready for use by the Centrals, and in scientific publications
  - There may be later improved versions

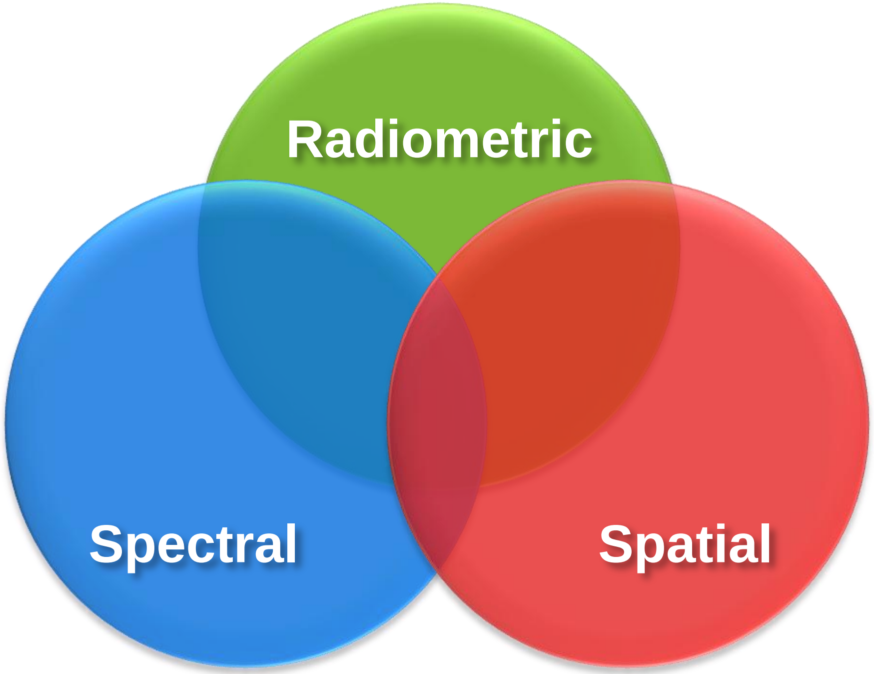
VIIRS SDR Maturity Assessment

The VIIRS SDR team:

- Verifies and ensures well-calibrated, & well-navigated SDR data

- Ensure SDR data quality and science integrity in the following areas:

  - Radiometric calibration
  - Spectral calibration
  - Geo-spatial calibration/ navigation
  - Verification of SDR data
  - Instrument performance issues



VIIRS Sensor Specification

- RSB sensitivity

Table: 3.1.5.6.1-1 Sensitivity requirements for VIIRS Sensor reflective bands

Band	Center Wavelength (nm)	Gain Type	Single Gain		Dual Gain			
.	.	.	.	.	High Gain		Low Gain	
.	.	.	Ltyp	SNR	Ltyp	SNR	Ltyp	SNR
M1	412	Dual	-	-	44.9	352	155	316
M2	445	Dual	-	-	40	380	146	409
M3	488	Dual	-	-	32	416	123	414
M4	555	Dual	-	-	21	362	90	315
M5	672	Dual	-	-	10	242	68	360
M6	746	Single	9.6	199	-	-	-	-
M7	865	Dual	-	-	6.4	215	33.4	340
M8	1240	Single	5.4	74	-	-	-	-
M9	1378	Single	6	83	-	-	-	-
M10	1610	Single	7.3	342	-	-	-	-
M11	2250	Single	0.12	10	-	-	-	-
I1	640	Single	22	119	-	-	-	-
I2	865	Single	25	150	-	-	-	-
I3	1610	Single	7.3	6	-	-	-	-

Notes:
The units of spectral radiance for Ltyp are watt m^{-2} sr^{-1} μm^{-1}.
The SNR column shows the minimum required (worst-case) SNR that applies at the end-of-scan. Elsewhere in the scan, aggregation will yield a larger SNR.
Within the same gain setting, at radiances larger than Ltyp, the SNR will be larger than what is specified in this table.

Absolute radiometric calibration uncertainty for uniform scenes: < 2%

Source: JPSS VIIRS Performance Requirement Document Code 472 472-00124

VIIRS Sensor Specification

- TEB sensitivity

Table: 3.1.5.6.2-1 Sensitivity requirements for VIIRS Sensor emissive bands

Band	Center Wavelength (nm)	Gain Type	Single Gain		Dual Gain			
.	.	.	.	.	High Gain		Low Gain	
.	.	.	Ttyp	NEdT	Ttyp	NEdT	Ttyp	NEdT
M12	3700	Single	270	0.396	-	-	-	-
M13	4050	Dual	-	-	300	0.107	380	0.423
M14	8550	Single	270	0.091	-	-	-	-
M15	10763	Single	300	0.070	-	-	-	-
M16	12013	Single	300	0.072	-	-	-	-
I4	3740	Single	270	2.500	-	-	-	-
I5	11450	Single	210	1.500	-	-	-	-

Notes:
The NEdT column corresponds to the minimum required (worst-case) SNR that applies at the end-of-scan. Elsewhere in the scan, aggregation will yield a larger SNR.
Within the same gain setting, at scene temperatures larger than Ttyp, the SNR will be larger than at Ttyp.
For reference, the NEdT values in Table 15 are related to the noise equivalent spectral radiance (NEdL) by the following formula:

Source: JPSS VIIRS Performance Requirement Document Code 472 472-00124

VIIRS Sensor Specification
- TEB Uncertainty

Table: 3.1.5.9.2.3-1 Absolute radiometric calibration uncertainty of spectral radiance for moderate resolution emissive bands

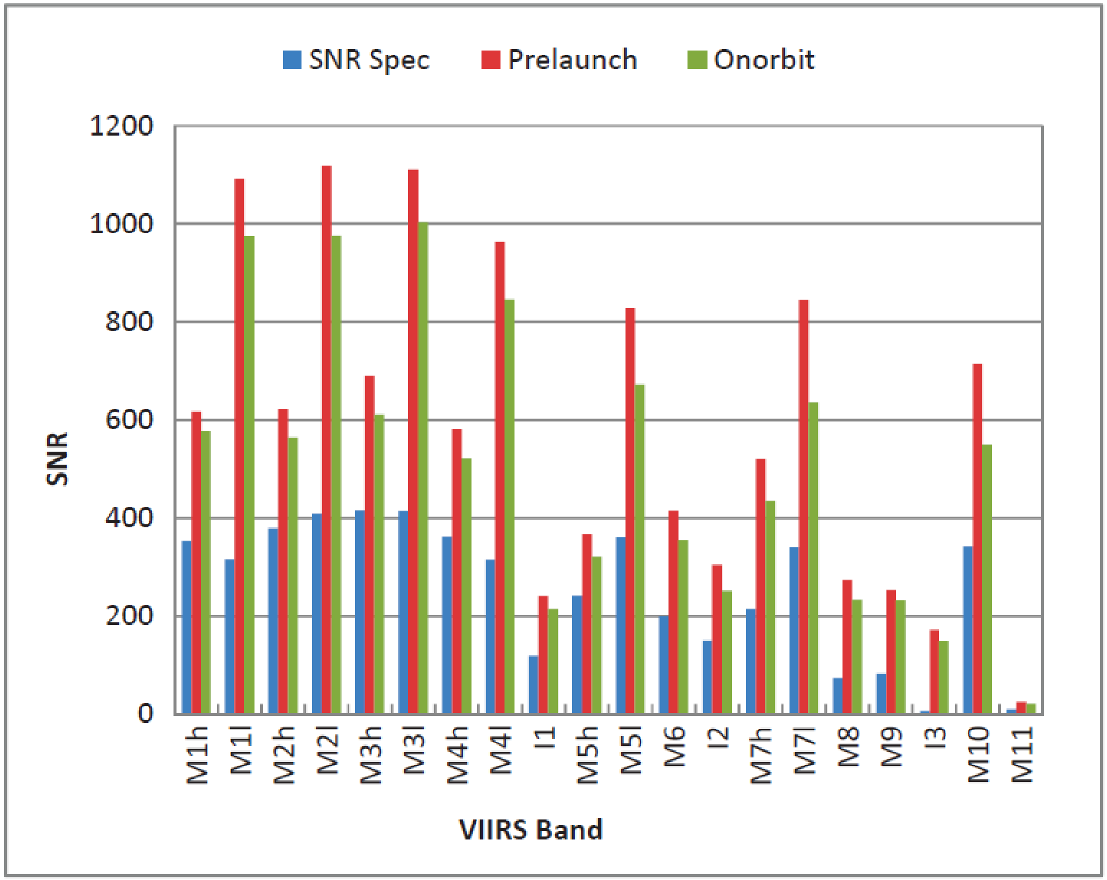
Band	λc (μm)	Scene Temperature				
.	.	190K	230K	270K	310K	340K
M12	3.7	N/A	7.0%	0.7%	0.7%	0.7%
M13	4.05	N/A	5.7%	0.7%	0.7%	0.7%
M14	8.55	12.3%	2.4%	0.6%	0.4%	0.5%
M15	10.763	2.1%	0.6%	0.4%	0.4%	0.4%
M16	12.013	1.6%	0.6%	0.4%	0.4%	0.4%

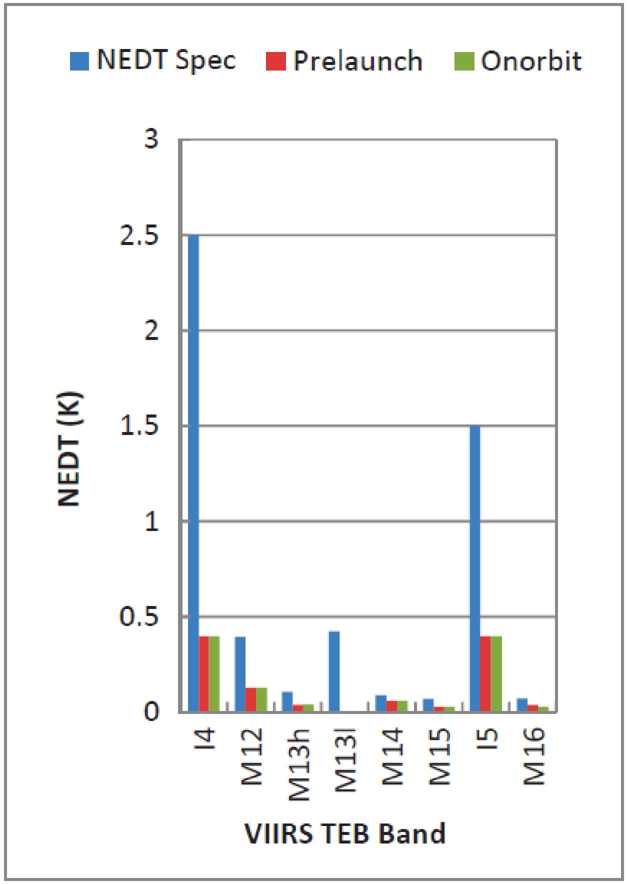
Table: 3.1.5.9.2.4-1 Radiometric calibration uncertainty for imaging emissive bands

Band	Center Wavelength (nm)	Calibration Uncertainty
I4	3740	5.0%
I5	11450	2.5%

Source: JPSS VIIRS Performance Requirement Document
Code 472 472-00124

VIIRS On-orbit Performance
-SNR and NEDT





VIIRS On-orbit Performance Table

- SDRs = L1b = calibrated, geolocated radiance, reflectanc and brightness temperature
- 22 types of SDRs
  - 16 moderate resolution (MOD),
    - 11 Reflective Sola Bands (RSB)
    - 5 Thermal Emissi Bands (TEB)
  - 5 imaging resolution (IMG),
    - 3 RSB; 2 TEB
  - 1 Day Night Band (DNE imaging, broadband
- 6 non-gridded geolocation products
  - DNB, IMG, IMG terrain corrected, MOD, MOD terrain corrected, MOD unaggregated
- 2 gridded geolocation products
  - MOD, IMG

				Specification							Prelaunch	On Orbit	
		Band No.	Driving EDR(s)	Spectral Range (um)	Horiz Sample Interval (km) (track x Scan) Nadir	Horiz Sample Interval (km) (track x Scan) End of Scan	Band Gain	Ltyp or Ttyp (Spec)	Lmax or Tmax	Spec SNR or NEdT (K)	Measured SNR or NEdT (K) (2)	Measured SNR or NEdT (K) (1)	Measured SNR or NEdT (K) (2)
Reflective Bands	VisNIR	M1	Ocean Color Aerosol	0.402 - 0.422	0.742 - 0.259	1.60 x 1.58	High	44.9	135	352	616.8	578	588.9
							Low	155	615	316	1092	974	1045.78
		M2	Ocean Color Aerosol	0.436 - 0.454	0.742 - 0.259	1.60 x 1.58	High	40	127	380	622.4	564	572.02
							Low	146	687	409	1118	975	1010.76
		M3	Ocean Color Aerosol	0.478 - 0.498	0.742 - 0.259	1.60 x 1.58	High	32	107	416	690	611	628.46
							Low	123	702	414	1111	1003	988.54
		M4	Ocean Color Aerosol	0.545 -0.565	0.742 - 0.259	1.60 x 1.58	High	21	78	362	581.1	522	534.96
							Low	90	667	315	963.2	846	856.51
		I1	Imagery EDR	0.600 - 0.680	0.371 - 0.387	0.80 x 0.789	Single	22	718	119	240.7	215	214.07
		M5	Ocean Color Aerosol	0.662 - 0.682	0.742 - 0.259	1.60 x 1.58	High	10	59	242	366.6	321	336.13
							Low	68	651	360	827.9	673	631.26
		M6	Atmosph. Correct.	0.739 - 0.754	0.742 - 0.776	1.60 x 1.58	Single	9.6	41	199	415.2	355	368.4
		I2	NDVI	0.846 - 0.885	0.371 - 0.387	0.80 x 0.789	Single	25	349	150	304.1	251	264.01
		M7	Ocean Color Aerosol	0.846 - 0.885	0.742 - 0.259	1.60 x 1.58	High	6.4	29	215	519.8	435	457.54
							Low	33.4	349	340	845.6	636	631.24
	S/WMIR	M8	Cloud Particle Size	1.230 - 1.250	0.742 x 0.776	1.60 x 1.58	Single	5.4	165	74	273	233	221
		M9	Cirrius/Cloud Cover	1.371 - 1.386	0.742 x 0.776	1.60 x 1.58	Single	6	77.1	83	253	231	227
		I3	Binary Snow Map	1.580 - 1.640	0.371 x 0.387	0.80 x 0.789	Single	7.3	72.5	6	172	149	149
		M10	Snow Fraction	1.580 - 1.640	0.742 x 0.776	1.60 x 1.58	Single	7.3	71.2	342	714	550	586
		M11	Clouds	2.225 - 2.275	0.742 x 0.776	1.60 x 1.58	Single	0.12	31.8	10	25	21.8	22
Emissive Bands		I4	Imagery Clouds	3.550 - 3.930	0.371 x 0.387	0.80 x 0.789	Single	270	353	2.5	0.4	0.4	0.4
		M12	SST	3.660 - 3.840	0.742 x 0.776	1.60 x 1.58	Single	270	353	0.396	0.13	0.13	0.13
		M13	SST Fires	3.973 - 4.128	0.742 x 0.259	1.60 x 1.58	High	300	343	0.107	0.04	0.042	0.04
							Low	380	634	0.423			
	LWIR	M14	Cloud Top Properties	8.400 - 8.700	0.742 x 0.776	1.60 x 1.58	Single	270	336	0.091	0.06	0.06	0.05
		M15	SST	10.263 - 11.263	0.742 x 0.776	1.60 x 1.58	Single	300	343	0.07	0.03	0.03	0.03
		I5	Cloud Imagery	10.500 - 12.400	0.371 x 0.387	0.80 x 0.789	Single	210	340	1.5	0.4	0.4	0.4
		M16	SST	11.538 - 12.488	0.742 x 0.776	1.60 x 1.58	Single	300	340	0.072	0.04	0.03	0.03

(1) The Aerospace Corporation (2) NASA NICSE

HSI uses 3 in-scan pixels aggregation at Nadir

Source: VIIRS user's guide. On orbit values (last two columns for March 8, 2012) are updated based on the Murphy table for RSB, provided by Aerospace; TEB values are provided by STAR and NASA.

Updated 05/01/2012

Major Progress Since Beta

- Implemented the scan-by-scan updates of the RSB radiometric calibration coefficients (F-factors) for a better mitigation of the RTA throughput degradation anomaly, with continued weekly updates of the look-up tables
- Updates to the SD and SDSM attenuation screens transmission look-up tables for improved offline derivation of the radiometric calibration coefficients
- Updates of the radiometric gain coefficients for RSB and DNB
- SZA limit for production of TOA reflectance data extended from 85 to 89 degrees
- Partial correction of handling on-board calibrator measurements during Moon in Space View events
- MX6.3&6.4 implementation (require further validation):
  - Corrected gain switching sequences problem
  - New quality flagging for HAM/RTA sync loss and sector rotation events
- Continued bias time series analysis between VIIRS and MODIS
- Continued longterm trending and monitoring

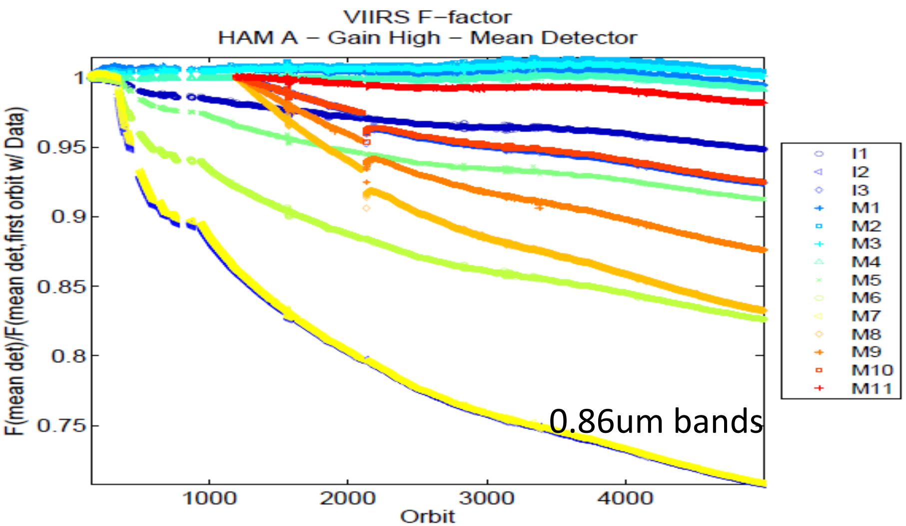
VIIRS Rotating Telescope Assembly (RTA) Mirror Degradation

• VIIRS RTA mirror degradation continues as predicted (currently about ~30% in the 0.86 bands)

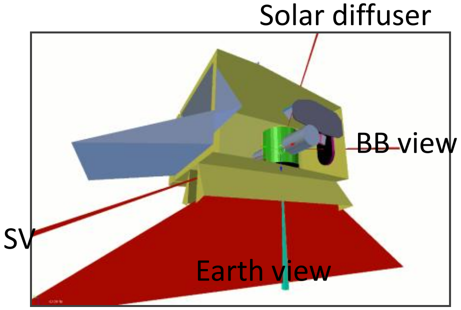
• Root cause of the degradation is traced to Tungsten/Tungsten oxide contamination in the manufacturing process prelaunch

•The impact of the responsivity degradation is mitigated through weekly calibration updates

• The remaining effect of the degradation is decreased signal to noise ratio, although its impact to products is still negligible

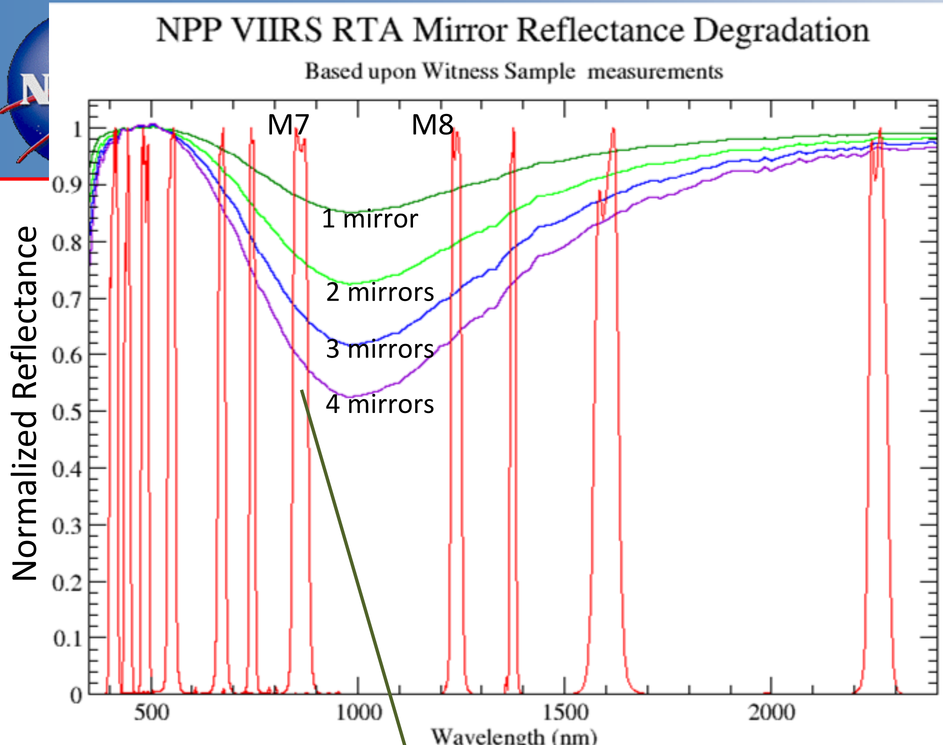


VIIRS RTA mirror degradation since launch

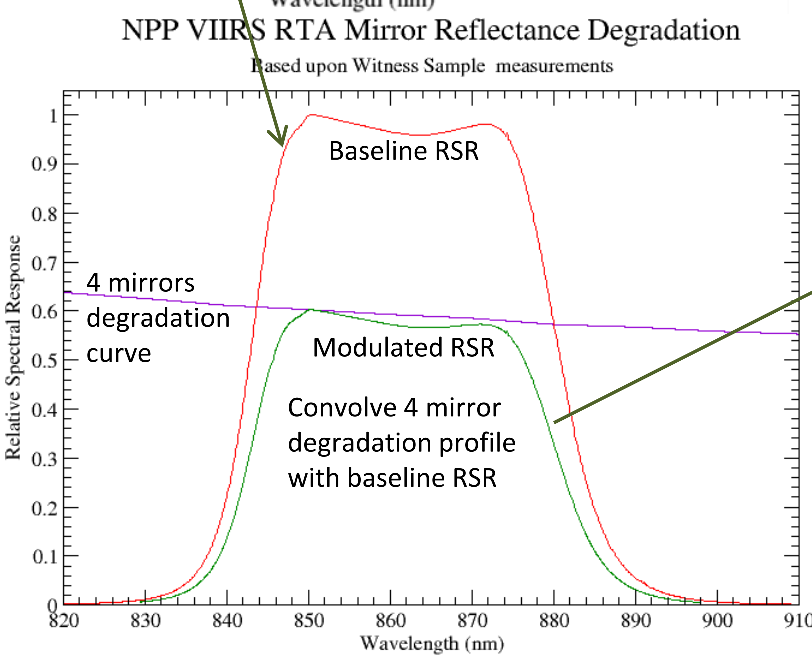


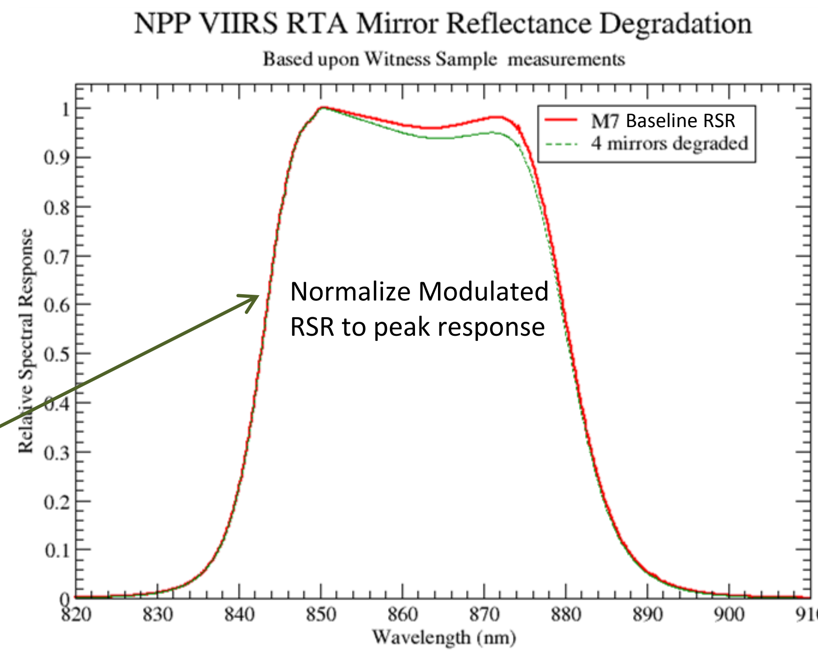
The VIIRS RTA degradation is quantified by its response to the onboard solar diffuser

RTA Mirror Reflectance Modulates VIIRS RSR



On-orbit degradation (UV light interacting with tungsten) of RTA mirror reflectance modulates VisNIR and SWIR RSR.

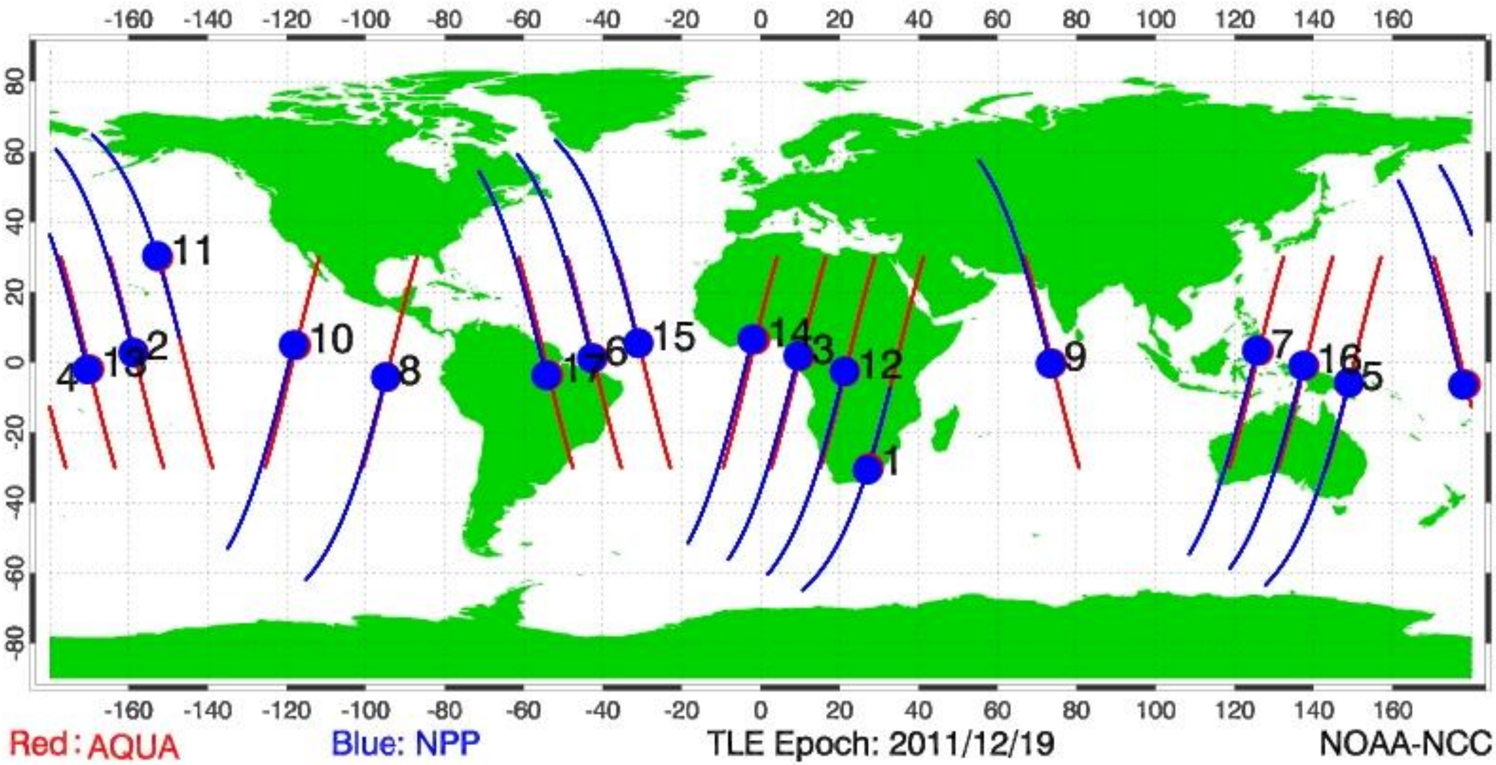




Reflectance degradation example here based upon using RTA primary mirror "TWM" witness sample measurements extrapolated to 4 mirrors by power law

Cross Comparison with Aqua/MODIS

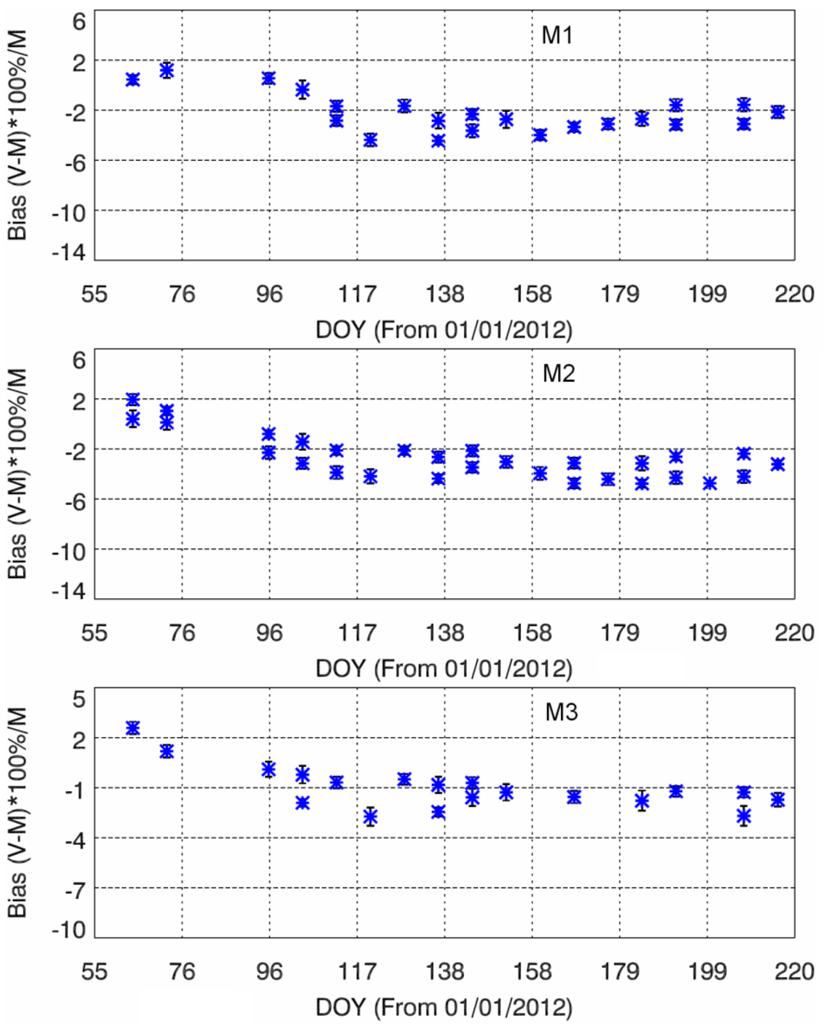
For on-orbit radiometric uncertainty evaluation



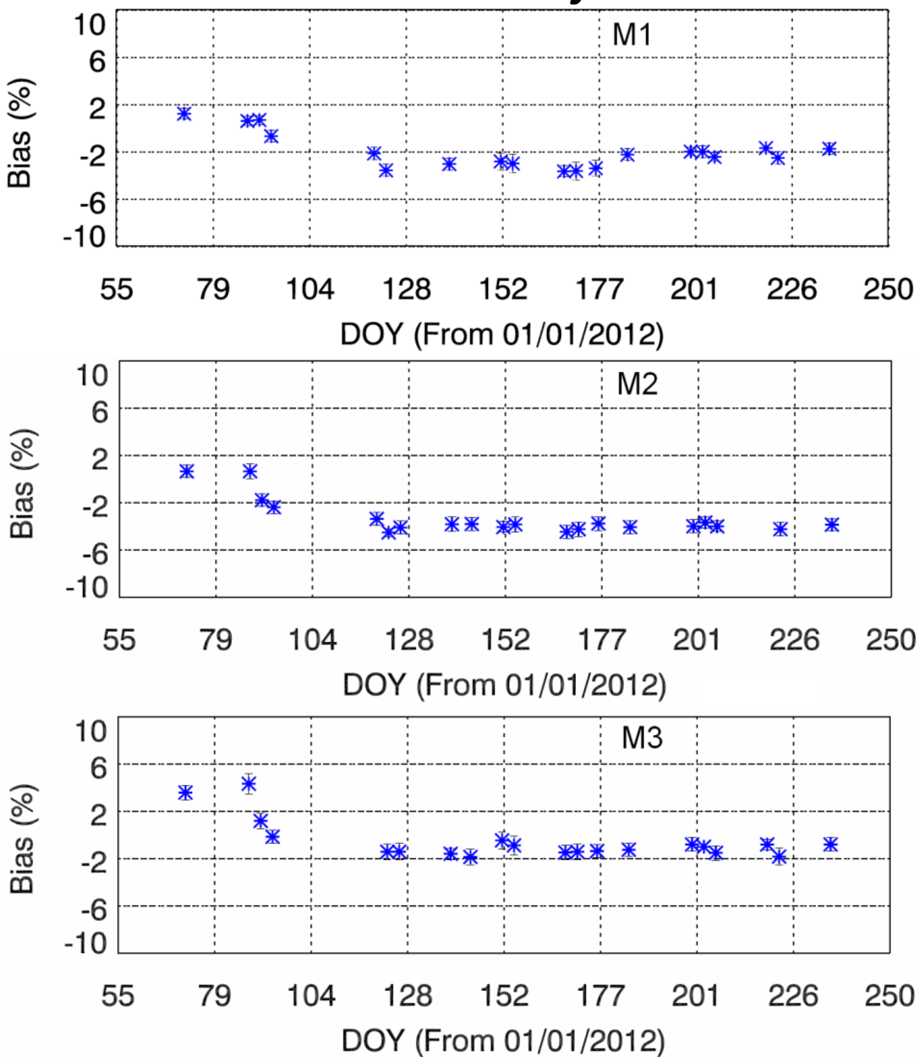
https://cs.star.nesdis.noaa.gov/NCC/SNOPredictions

VIIRS Bias Time Series Using SNO-X

Desert



Ocean Surface



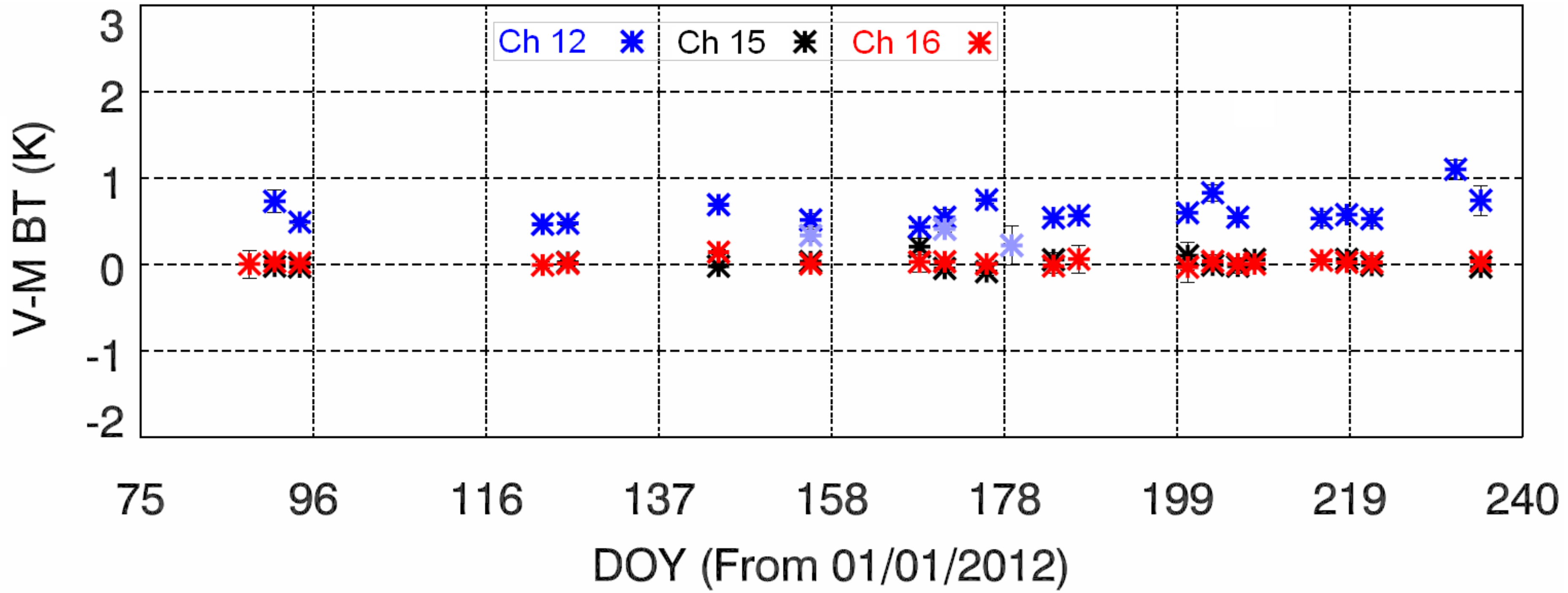
- VIIRS bias relative to MODIS decreased by 4% during early April.
- The decreasing bias trend is consistent at ocean surface and Desert.

Cross Comparison with Aqua/MODIS

VIIRS		MODIS		Bias (V-M)×100%/M	
Band	Wavelength (µm)	Band	Wavelength (µm)	Ocean	Desert
M1	0.402 - 0.422	8	0.405 - 0.420	-2.0% ± 0.6%	-2.6% ± 0.7%
M2	0.436 - 0.454	9	0.438 - 0.448	**-4.0% ± 0.3%**	**-3.1% ± 0.8%**
M3	0.478 - 0.498	10	0.483 - 0.493	-1.1% ± 0.4%	-1.3% ± 0.6%
M4	0.545 - 0.565	4	0.545 - 0.565	**4.0% ± 0.8%**	-2.2% ± 0.6%
M5	0.662 - 0.682	1	0.620 - 0.670	**-5.6% ± 1.2%**	8.8% ± 0.7%
M6	0.739 - 0.754	15	0.743 - 0.753	-1.2% ± 1.7%	Saturate
M7	0.846 - 0.885	2	0.841 - 0.876	**-1.2% ± 1.2%**	2.3% ± 0.5%
M8	1.230 - 1.250	5	1.230 - 1.250		1.5% ± 0.5%

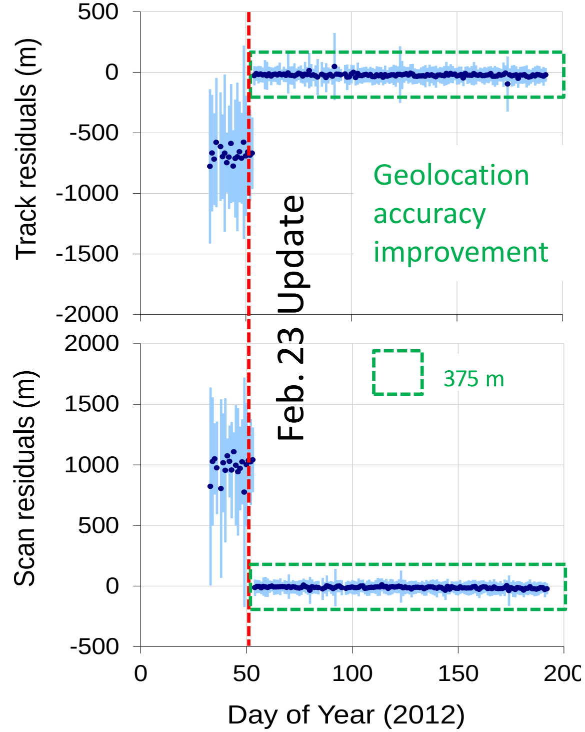
VIIRS Bands	Desert Bias(V-M)×100%/M		VIIRS Bands	Ocean Bias(V-M)×100%/M	
	Hyperion	*MODTRAN*		AVIRIS	*MODTRAN*
M1 (402m-422nm)		*1.50%*	M1 (402nm-422nm)	-1.10%	*-0.90%*
M2 (436nm-454nm)	0.28% ± 0.07%	*2.30%*	M2 (436nm-454nm)	0.50%	*0.40%*
M3 (478nm-498nm)	0.36% ± 0.08%	*0.70%*	M3 (478nm-498nm)	-0.45%	*-0.40%*
M4 (545nm-565nm)	0.47% ± 0.18%	*1.20%*	M4 (545nm-565nm)	1.10%	*0.80%*
M5 (662nm-682nm)	7.82% ± 0.02%	*9.80%*	M5 (662nm-682nm)	-1.70%	*-0.90%*
M6 (739nm-754nm)	Saturated		M6 (739nm-754nm)	-0.50%	*0.11%*
M7 (846nm-885nm)	2.68% ± 0.24%	*3.30%*	M7 (846nm-885nm)	3.50%	*4.00%*
M8 (1230nm-250nm)	4.80% ± 0.17%	*3.30%*			

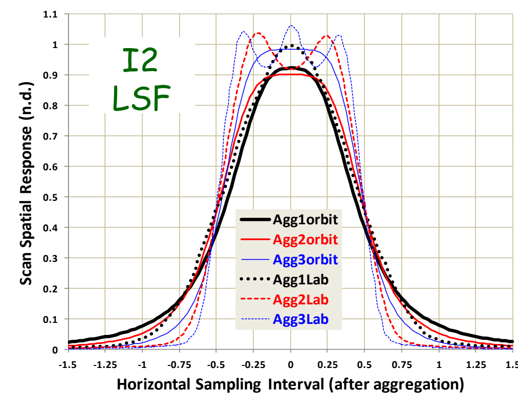
TEB band Biases at SNOx



Geo-Spatial Maturity

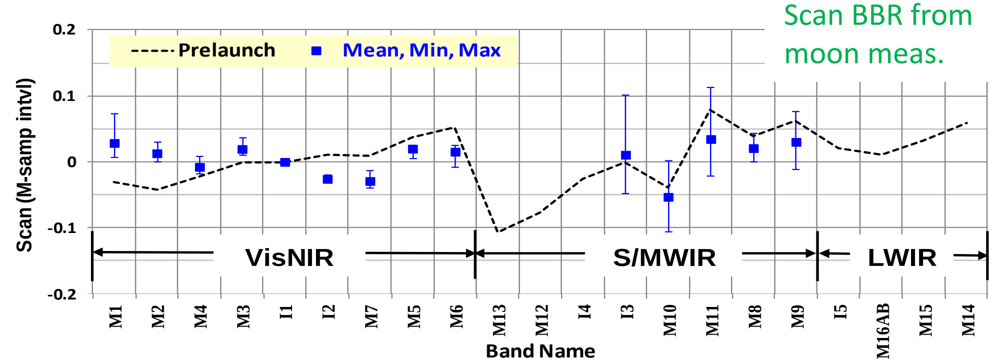
- Geo Cal/Val focuses on Geolocation, BBR and LSF
- Filed, supported and/or resolved over 20 geometric related DRs (major ones listed on following slide)
- Achieved high geolocation accuracy (~80 meter)
- Updating the VIIRS SDR User's guide with latest information





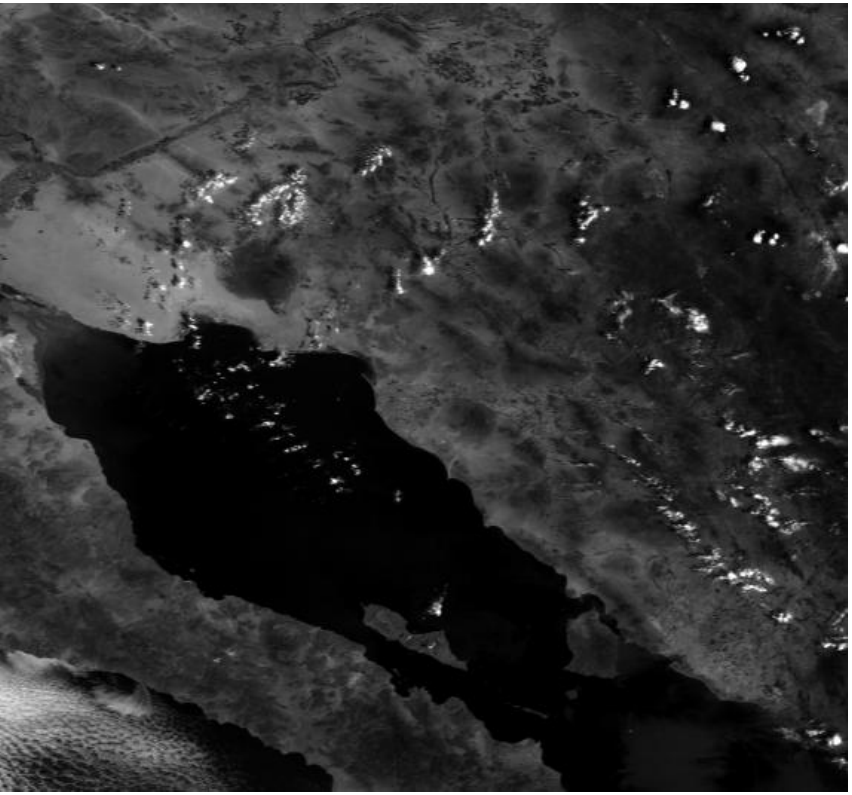
On-orbit LSF from ground targets vs. pre-launch

Scan BBR from moon meas.

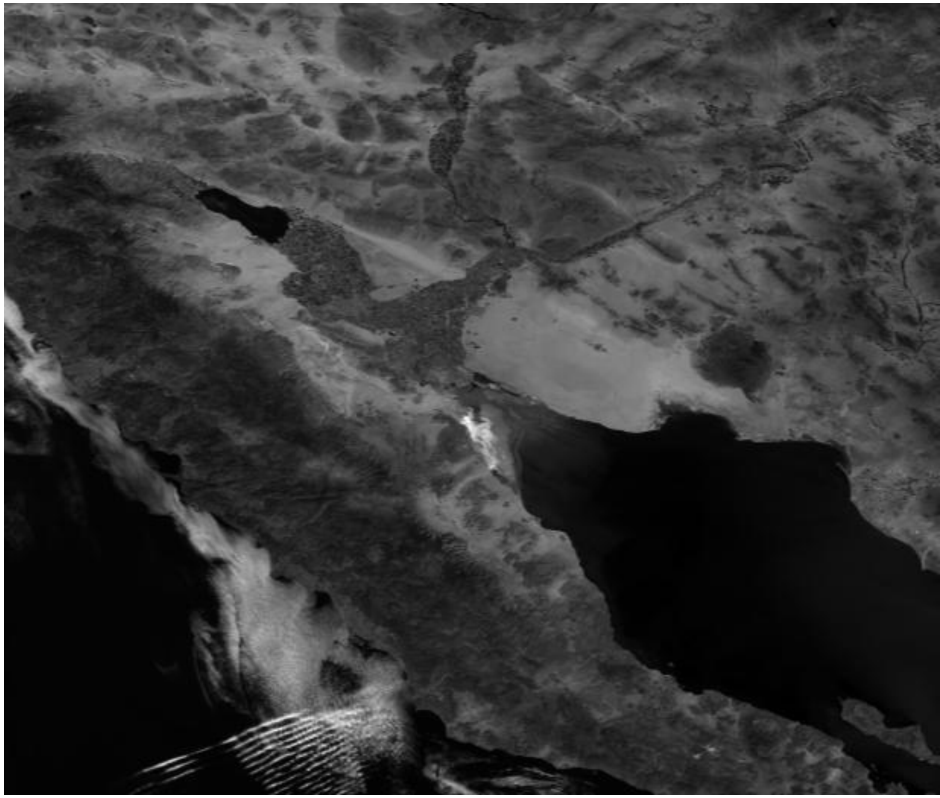


VIIRS as Geolocation Reference Standard Assessing MetOP-B/AVHRR

VIIRS vs. MetOp-A

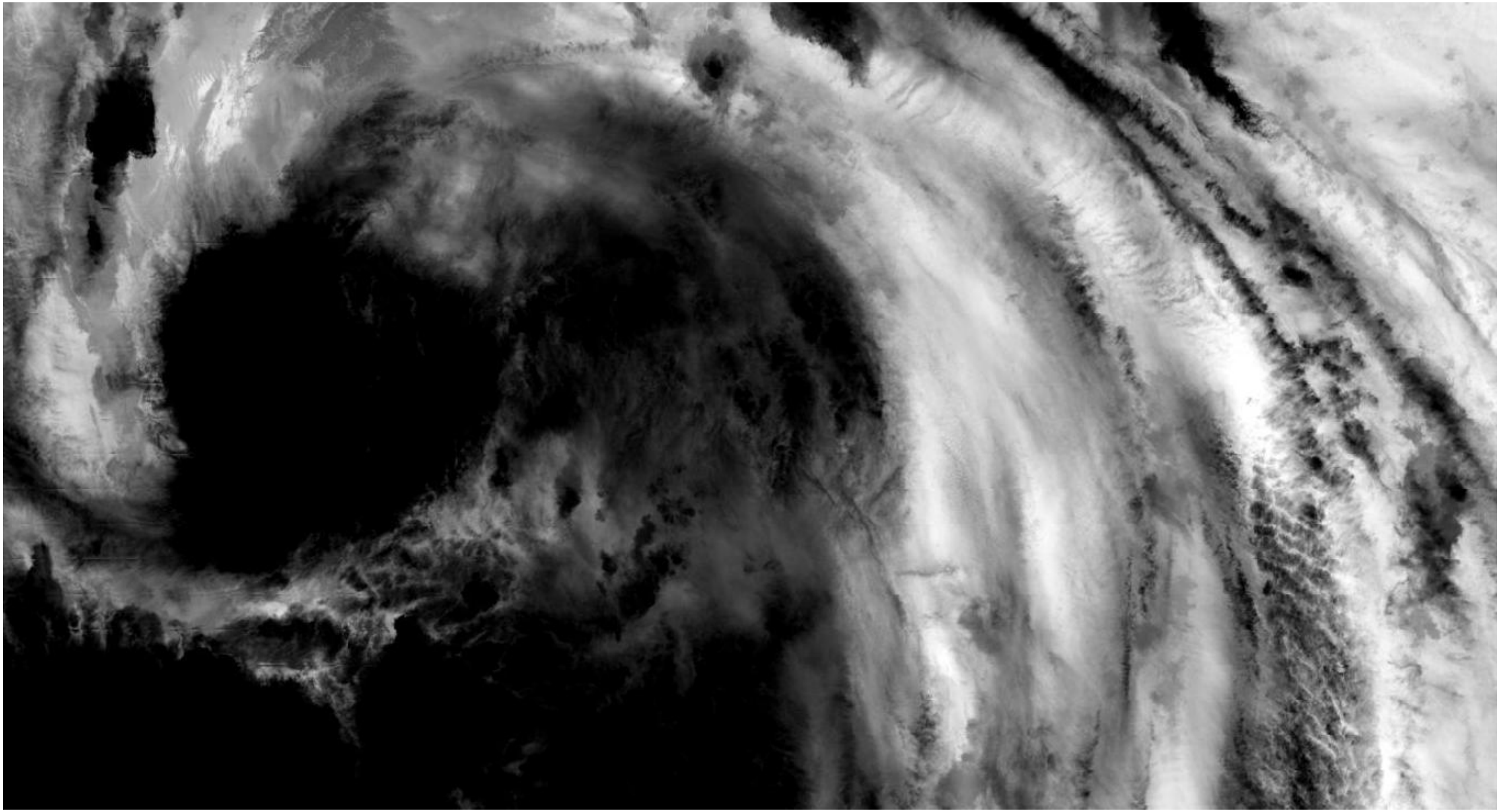


VIIRS vs. MetOp-B



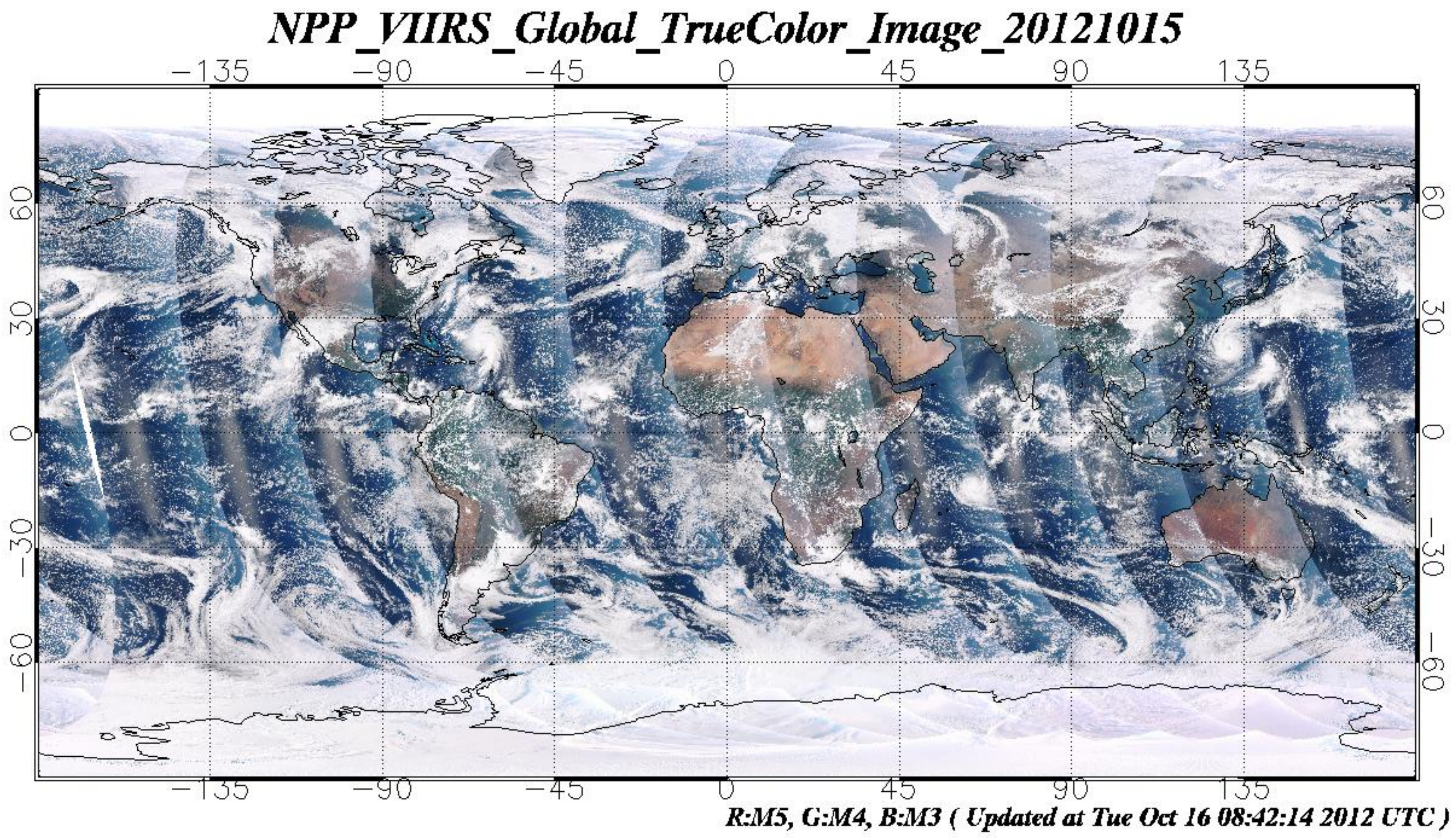
Metop-A on Sep 26 at 17:25 | Metop-B on Oct 3 at 17:31 | VIIRS on Oct 3 at 20:42

Observing Hurricane Isaac with unprecedented 375m resolution in the infrared

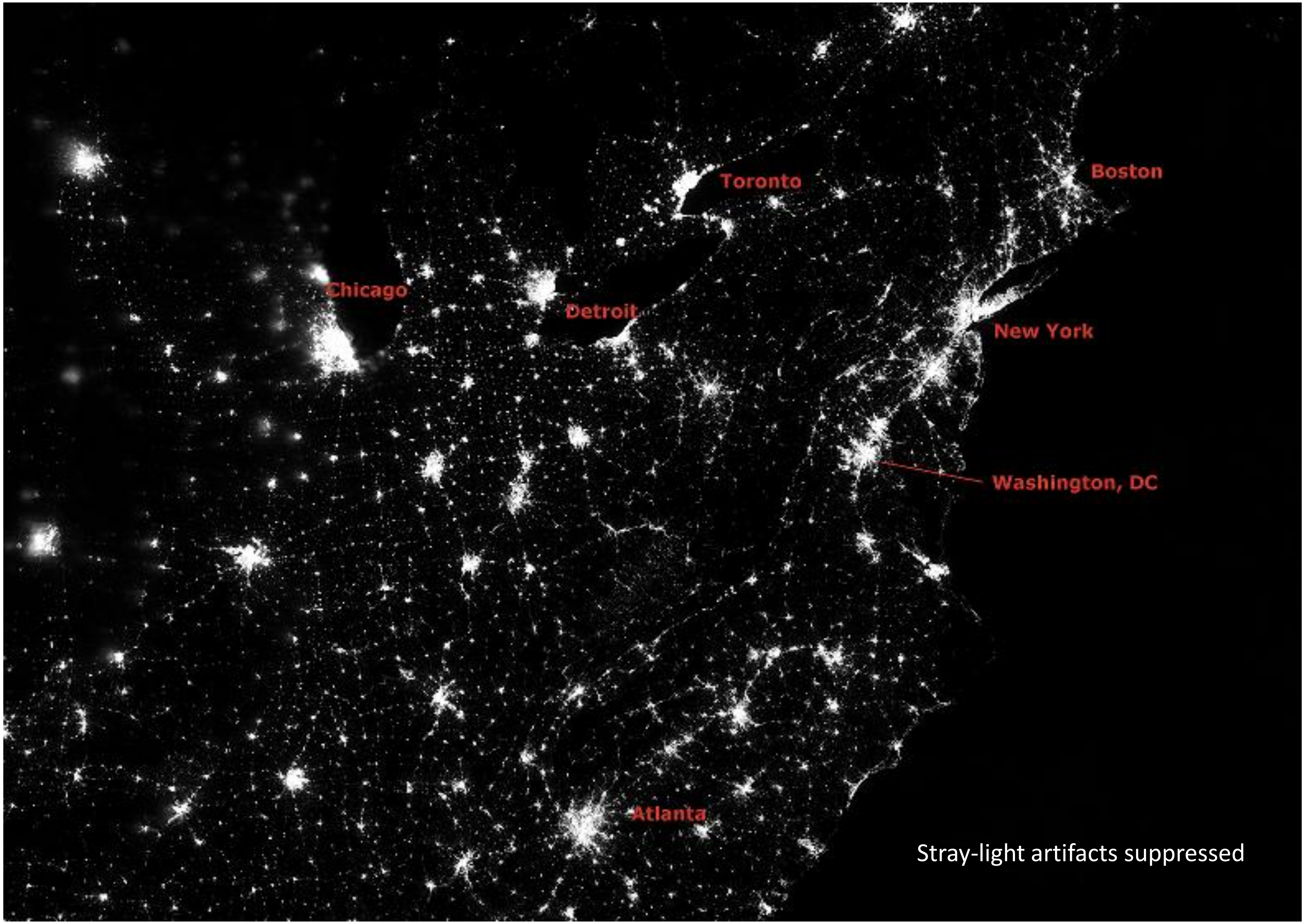


Aug. 28, 2012

VIIRS Global Image



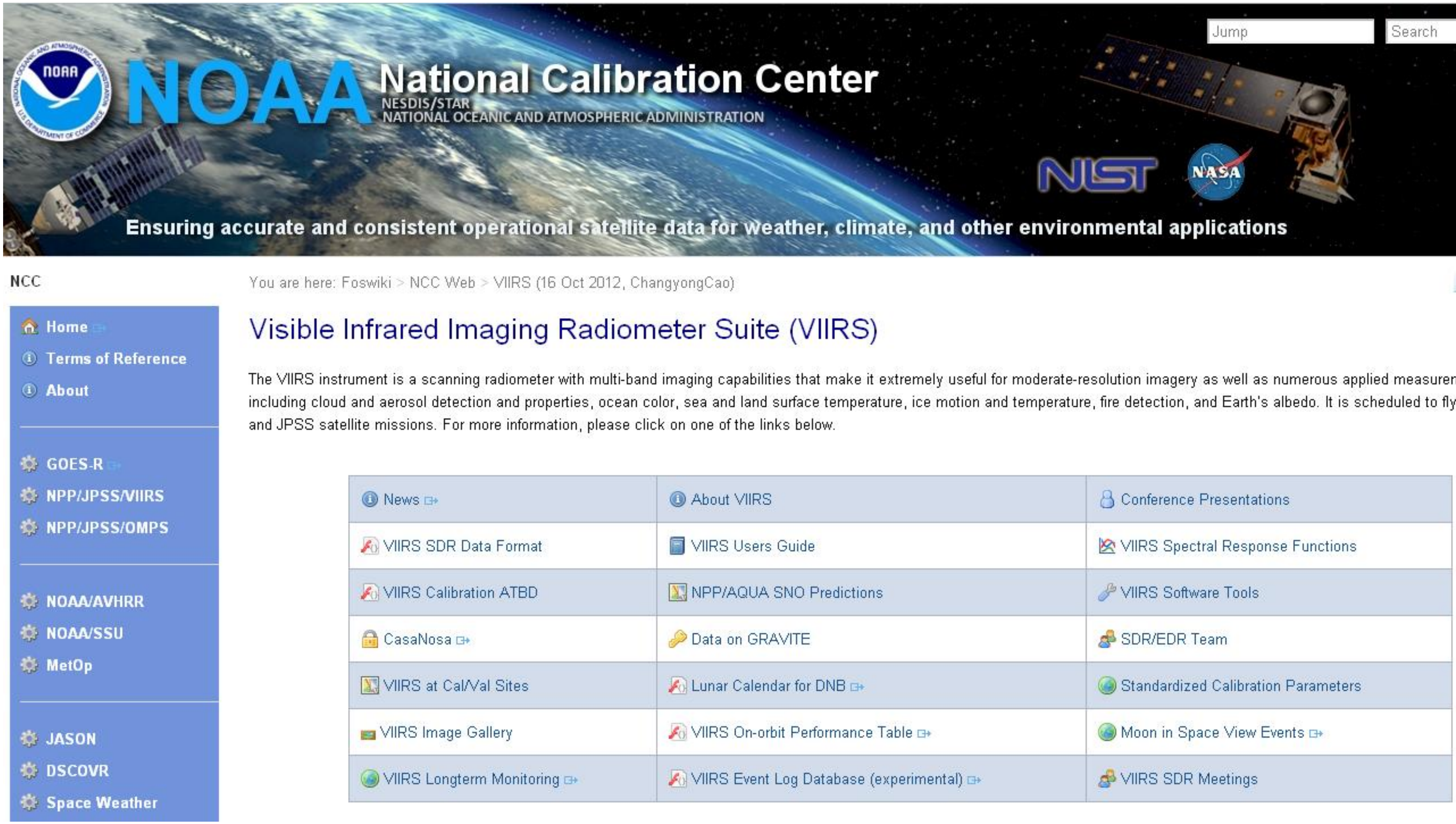
VIIRS Day Night Band



8/05/2012

VIIRS Calibration Knowledge Base

One stop shop for VIIRS SDR information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Ensuring accurate and consistent operational satellite data for weather, climate, and other environmental applications

NCC

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- GOES-R
- NPP/JPSS/VIIRS
- NPP/JPSS/OMPS

- NOAA/AVHRR
- NOAA/SSU
- MetOp

- JASON
- DSCOVR
- Space Weather

You are here: Foswiki > NCC Web > VIIRS (16 Oct 2012, ChangyongCao)

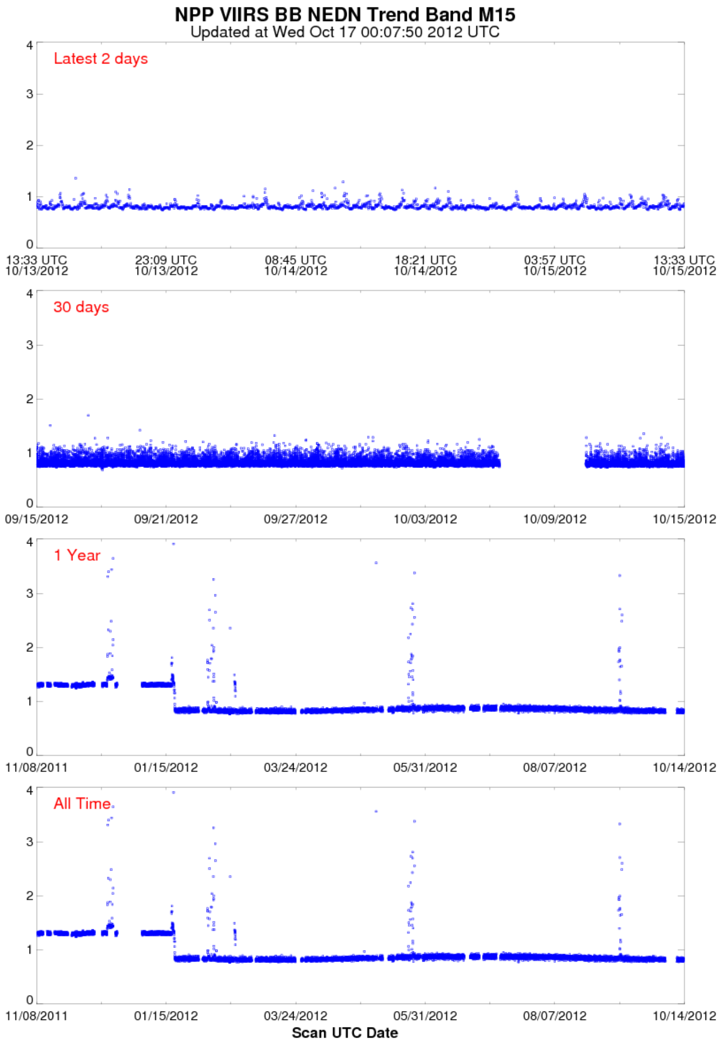
Visible Infrared Imaging Radiometer Suite (VIIRS)

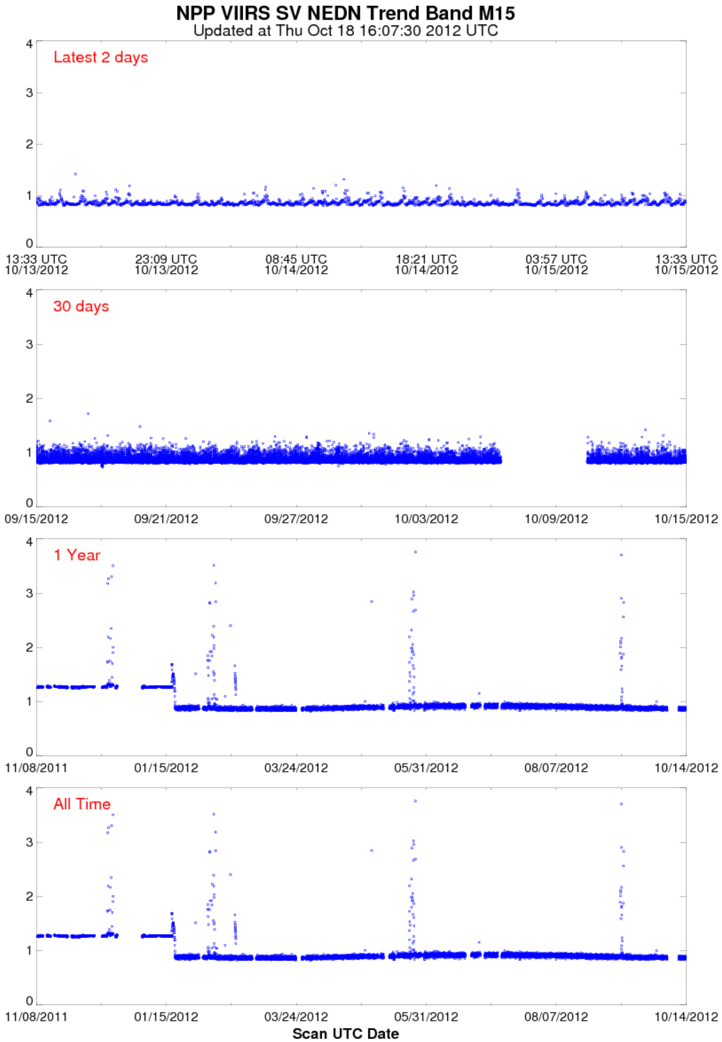
The VIIRS instrument is a scanning radiometer with multi-band imaging capabilities that make it extremely useful for moderate-resolution imagery as well as numerous applied measureme including cloud and aerosol detection and properties, ocean color, sea and land surface temperature, ice motion and temperature, fire detection, and Earth's albedo. It is scheduled to fly o and JPSS satellite missions. For more information, please click on one of the links below.

News	About VIIRS	Conference Presentations
VIIRS SDR Data Format	VIIRS Users Guide	VIIRS Spectral Response Functions
VIIRS Calibration ATBD	NPP/AQUA SNO Predictions	VIIRS Software Tools
CasaNosa	Data on GRAVITE	SDR/EDR Team
VIIRS at Cal/Val Sites	Lunar Calendar for DNB	Standardized Calibration Parameters
VIIRS Image Gallery	VIIRS On-orbit Performance Table	Moon in Space View Events
VIIRS Longterm Monitoring	VIIRS Event Log Database (experimental)	VIIRS SDR Meetings

Google “NOAA NCC”

VIIRS Performance Monitoring





Noise is not a significant function of the target signal for the TEB bands

VIIRS SDR 58 Cal/Val Tasks

STAR

- SDR VALIDATION
  - SDR COMPARISON WITH MODEL (RAD-7)
  - SDR COMPARISON WITH AVHRR (RAD-8)
  - SDR COMPARISON WITH MODIS (RAD-9)
- Performance and Telemetry Trending (PTT-1-5- all)

UNIVERSITY OF WISCONSIN

- SPECTRAL EVALUATIONS
  - OUT-OF-BAND (OOB) SPECTRAL LEAKAGE (RAD-1)
  - IN-BAND SPECTRAL RADIANCE COMPARISON WITH CRIS (RAD-12)
  - RELATIVE SPECTRAL RESPONSE REFINEMENTS
- HAM REFLECTANCE (RVS) INFLUENCE ON RADIOMETRIC CALIBRATION (RAD-04)
- AIRCRAFT BASED CAL/VAL OF VIIRS SDR RADIANCE (RAD-18,-20, -21)

NGAS

- ASF/PGE DEVELOPMENT
- CODE EVALUATION AND SUPPORT
- RADIOMETRIC EVALUATIONS
- DNB IMAGE ANALYSIS
- DNB CALIBRATION SUPPORT (RAD-26)
- DUAL GAIN ANOMALY FLAGGING (RAD-25)
- GEOMETRIC ANALYSIS SUPPORT (GEO-X)
- QUALITY FLAG VALIDATION & UPDATE (RAD-27)
- BRIGHT PIXEL ALGORITHM VERIFICATION

LINCOLN LABORATORY

- STRAYLIGHT VIIRS RSB SOLAR DIFFUSER STRAYLIGHT - ANALYSIS OF NON-POLAR SD DATA (CSE-3)

RAYTHEON

- IDPS Support
- ADL Support

VIIRS SDR 58 Cal/Val Tasks -continued

AEROSPACE

- EOC TASKS
  - OPERABILITY, NOISE, SNR VERIFICATION WITH NADIR DOOR CLOSED (FPF-2)
  - DUAL GAIN BAND AND DNB TRANSITION VERIFICATION (FPF-4)
  - DC-RESTORE FUNCTIONALITY AND PERFORMANCE CHECK (FPF-6)
  - CALIBRATOR VISUAL INSPECTION (FPF-7)
- RSB CALIBRATION
  - SD AND SDSM CHARACTERIZATION (CSE-1)
  - TEMPORAL ANALYSIS OF SD SIGNAL OVER POLAR REGION (CSE-4)
  - TEMPORAL ANALYSIS OF SOLAR DIFFUSER STABILITY MONITOR (SDSM) DATA (CSE-5)
  - DNB OFFSET VERIFICATION (PTT-4)
  - DNB OFFSET/GAIN DETERMINATION (RAD-26)
- TEB CALIBRATION
  - EMISSIVE BAND RESPONSE CHARACTERIZATION (RAD-15)
- RADIOMETRIC EVALUATIONS
  - OPERABILITY, NOISE, SNR VERIFICATION (PTT-1)
  - RDR HISTOGRAM ANALYSIS (PTT-2)
  - NOISE AND SNR FOR UNIFORM EV SCENES (PTT-3)
  - ELECTRONIC GAIN MEASUREMENT (PTT-5)
  - CROSSTALK, ECHO, AND GHOST INVESTIGATION (IMG-1)
  - CROSSTALK FROM EMISSIVE BANDS TO REFLECTIVE BANDS (RAD-2)

NASA

- EOC TASKS
  - IN-SCAN AGGREGATION VERIFICATION – NON-DNB BANDS (FPF-3)
  - ON-BOARD BOW-TIE DELETION VERIFICATION (FPF-5)
- MANEUVER PLANNING & ANALYSIS
  - YAW MANEUVER ANALYSIS – SOLAR ATTENUATION SCREEN (SAS) TRANSMISSION(CSE-6)
  - ANALYSIS OF SDSM DATA WITH MODEL ASSISTED EXTRAPOLATION OF SCREEN CALIBRATION DATA(RAD-22)
  - LUNAR DATA ANALYSIS - ROLL MANEUVER (RAD-19)
  - ANALYSIS OF PITCH MANEUVER DATA (TEB RVS)(CSE-5)
- RADIOMETRIC EVALUATIONS
  - DYNAMIC RANGE AND LINEARITY(RAD-3)
  - RESPONSE VS. SCAN ANGLE (RSB) (RAD-4)
  - RELATIVE BAND-TO-BAND CALIBRATION ANALYSIS USING LUNAR DATA (RAD-5)
  - RELATIVE BAND-TO-BAND CALIBRATION ANALYSIS USING SD DATA (RAD-6)
  - MOON IN SPACE VIEW CORRECTION (RAD-16)
  - IMAGE ANALYSIS (STRIPING, GLINTS AND OTHER ARTIFACTS (IMG-2)
- GEOLOCATION & GEOMETRIC ANALYSIS
  - INITIAL VALIDATION OF SC AUXILIARY EPHEMERIS AND ATTITUDE DATA(GEO-1)
  - INITIAL VALIDATION OF VIIRS ENCODER DATA, SCAN TIME, SCAN PERIOD, AND SCAN RATE STABILITY(GEO-2)
  - ASSESS REASONABLENESS OF FIRST- PERIOD SDR GEOLOCATION (GEO-3)
  - BUILD FIRST-PERIOD SIMULATED VIIRS IMAGES FROM GCP CHIPS, (5) BUILD FIRST PERIOD VIIRS IMAGE CHIPS FROM SELECTED SDR PIXELS,(6) PERFORM FIRST PERIOD VIIRS SIMULATED IMAGE MATCH-UP (GEO-4-5-6)
  - ANALYZE FIRST PERIOD VIIRS GCP RESIDUALS (GEO-7)
  - ANALYZE INITIAL INTRA-ORBIT THERMAL EFFECTS ON GEOLOCATION (GEO-8)
  - DEVELOP AND TEST INITIAL GEOLOCATION PARAMETER & THERMAL LUT UPDATES (GEO-9)
  - LSF/MTF VALIDATION (IMG-4)
  - BAND-TO-BAND REGISTRATION (BBR) VERIFICATION (RAD-17)

Most Significant Open DRs

DR #	Description	Provisional Status Impact
4663	Modified Operational Code for Increased RSB Calibration Autonomy	No (new algorithm tested)
4911	Moon in Space View of Bounding Granule for RSB Calibration	No (recurring code errors)
4589	Improved SDSM Screen Transmission LUT	No (offline processing)
4716	Day-Night Band Stray Light	No (correction planned)
4890	VIIRS DNB Geolocation Residual Error Recommendation	No (correction planned)
4710	Warm-Up/Cool-Down Tests Need to Be Flagged	No (infrequent occurrence)
4742	Erratic Solar Eclipse Flag	No (infrequent occurrence)
4767	HAM/RTA Sync Loss and Sector Rotation Need to Be Flagged	No (infrequent occurrence)
4894	Unexpected High Values of Satellite Zenith Angles	No (infrequent occurrence)
4913	Missing Terrain-Corrected Geolocation Data	No (unknown solution)
4916	Missing Radiance/Reflectance/Temperature Data	No (unknown solution)
4892	Wrong RSR LUT Used in Mx6.2 from 8/9 to 9/5/2012	No (procedure corrected)
4917	IDPS Incorrect Handling of Leap Seconds	No (procedure corrected)

Issues and Challenges

RTA degradation

- RTA degradation anomaly challenged the RSB calibration team to maintain RSB calibration uncertainty and stability within requirements/desirements.
- F-factor trend change
- Ongoing RTA degradation anomaly is modulating VIIRS VisNIR and SWIR RSR.

Scan Sync Loss

Operational code:

- Uncertainties/errors in IDPS processing software/code may still exist
- Multiple files and missing files are still being found
- Automated calibration for the solar bands

Process and coordination:

- Need to streamline reporting and meetings

NIST support: Flight vs. Ground

- Instrument spec vs. science enhancements
- SDR science peer review process
- Using standardized SOW
- MOU and reporting processes and procedures

Early VIIRS SDR data and reprocessing

OBC-BB Thermistors variation:

F-factor variation during WUCD

F-factor orbital Variations

DNB Stray light Issue

SC Counter overflow anomaly & SBC anomaly (1394)

SDSM Spectral Leak

A-side vs. B-side

Issues and Challenges

- **Geolocation accuracy near spacecraft maneuvers** needs to be better understood (not as accurate)
- **BBR, LSF, and the moon**
  - Accurate assessment of BBR for bands saturated by the moon
  - Additional analyses is needed for better spatial characterization (BBR and LSF) using lunar and ground targets (for all agg modes) – challenging
- **Other**
  - Digital Elevation Model (DEM) and Land/Water (L/W) mask need to be updated
  - Occasional short high frequency attitude oscillations (~1 per orbit for ~2 minutes)
  - Within orbit thermal correction may be needed with additional LUT (mitigation planned via MODIS style correction)

•**DNB geolocation needs to be terrain correction**

•**M13 low gain calibration points**

•**Resources and funding support** to sustain NPP post-launch Cal/Val activities (to compete with J1+ VIIRS pre-launch Cal)

•**Instrument and spacecraft maneuver**

•**Transition to operations**

•**J1, J2 and beyond**

VIIRS SDR Maturity Summary

- Geolocation – Provisional
- Radiometry
  - RSB SDRs – Provisional with the following caveats
    - User community expects 0.3% calibration stability and desires 0.1% stability or better, but current code and LUT update process provide approximately 1% stability
    - Requires continued frequent calibration update to account for the degradation
  - TEB SDRs – Provisional
- Spectral – Provisional (modulated RSR available for user evaluation)
- The VIIRS SDR team will continue assessing the radiometric uncertainties and resolve performance issues, working closely with the user community

- backup

FY-13 Schedule and Milestones

- Task 1: VIIRS SDR Team Management and Coordination (ongoing)
  - Continued support to the DRAT process
  - Lead the VIIRS SDR team
  - Organize sensor evaluation
  - Document performance and progress; recommend changes and updates to software and LUTs
  - Maintain and update the calibration knowledge base on the web
  - Coordinate interactions with other teams (CrIS, EDR) and NIST
  - Reporting and meetings/telecons
  - Taking assigned actions by AERB, DRAT, DPA, PDA, ADP

- Task 2: Update VIIRS SDR Algorithm Theoretical Basis Document (ATBD)
  - Many sections of the ATBD are either out of date or contain erroneous information and need to be updated or rewritten. This include but not limited to the calibration equations (144 calibration equations!)
  - Quality flags need to be updated

FY-13 Schedule and Milestones

- Task 3: VIIRS SDR calibration and validation, cross sensor calibration
  - Routine online SNO predictions and dissemination
  - Continue inter-comparisons with MODIS, CrIS, and AVHRR (including MetOp-B)
  - Mitigation of sensor degradation (version control of F and H LUTs)
  - Collaborate with NASA on lunar calibration
  - Instrument performance matrix and monitoring
  - Collaborate with EDR teams and help general users
  - Image data (including DNB) analysis and evaluation
  - Cal/val using vicarious calibration sites
  - Deliverables (Sept 2013)
    - Reports on instrument performance,
    - Technical reports and journal papers
    - Revised user's guide
    - Extended image gallery
    - Sub-version control of F and H LUTs

FY-13 Schedule and Milestones

- Task 4: JPSS-1 VIIRS Pre-launch Test Support
  - Coordination with prelaunch test segment of the flight project through NASA instrument scientists and managers
  - Coordination of NIST SOW and participation
  - Provide feedback to flight wrt VIIRS onorbit performance and issues
  - Prelaunch test data analysis
  - Participate in TIM with vendor and flight
  - Support anomaly resolution and waiver analysis
  - Mature and fine-tune J1 spectral test program
  - Deliverables
    - Technical reports on findings and results
    - Weekly and monthly reports

- Task 5: NGAS VIIRS SDR Science Transition
  - Transition DNB software to improve straylight reduction and geolocation for operational use

FY-13 Schedule and Milestones Other

- Task 6 Calibration algorithm enhancements & LUT
  - Full automation of RSB calibration targeted for Mx7 IDPS code release in April 2013
  - Improvement of TEB radiometric performance with implementation of ADR 4780 code change in Mx7
  - Data analysis for LUT development
  - Gravite, ADL etc.
  - Ongoing cal/val

- Task 7 Special Sensor Calibration and Operation Support
  - Support planning and scheduling of various calibration maneuvers.
  - Perform data analysis for special calibration and operation activities (e.g. on-orbit lunar observations).
  - Provide documentation review and support for sensor performance evaluation and anomaly resolution.
  - Serve as the POC of VIIRS SDR team with the NPP Operation Team.
  - Prepare and present the VIIRS SDR team with results derived from special test data analsyis

FY-13 Schedule and Milestones

- Task 8 VIIRS On-orbit Calibration Support
  - Evaluate sensor OBC functions and their on-orbit performace.
  - Derive key SDR calibration parameters using data collected from instrument OBC.
  - Help identify and address issues that are critcal for SDR algorithm and look-up-table (LUT) imporvements.
  - Calibration and Validation Review Support
  - Deliverables:
    - Document and report the findings to the VIIRS SDR team.

- Task 9 Aircraft campaigns
  - SDR aircraft based Cal/Val exercise to assess VIIRS (and CrIS) radiometric performance

- Time lines:
  - October 2012: MX6.3 implementation
  - Late fall 2012: VIIRS SDR provisional status review
  - 2013: VIIRS SDR calibrated/validated review
  - 2013-14: transition to operations
  - Summer 2013: J1 prelaunch testing and data analysis

Path Forward (FY-13 thru FY-17)

(assume "FYxx" runs from April 1, 20xx to March 31, 20xx+1)

	Suomi NPP	JPSS J1
FY13	Complete ICV, VIIRS SDR provisional, ATBD, cross calibrated/validated, continue routine cal/val and LTM, aircraft	Prelaunch testing and data analysis, Requirements analysis and ground test plan review
FY14	Transition to operations	Prepare and analyze ground test data, Complete prelaunch tests and data analysis
FY15	Operational cal/val and long-term monitoring	Analyze ground test data and prepare for launch, Instrument delivery and spacecraft level tests
FY16	Operational cal/val and long-term monitoring	Analyze ground test data and prepare for launch and post-launch activities, J1 launch
FY17	Operational cal/val and long-term monitoring	J1 postlaunch check out and intensive cal/val

Team Members' Roles & Responsibilities

SDR	Name	Organization	Funding Agency	Task
Lead	Changyong Cao	NOAA/NESDIS/STAR	NJO	Lead VIIRS SDR Team
Lead	Frank Deluccia	The Aerospace Corp.	NASA	Lead VIIRS SDR Team
Org. lead	Mark Liu	NOAA/NESDIS/STAR	NJO	STAR lead/TEB cal/val
Org. lead	J. Xiong/R. Wolfe	NASA/VCST	NJO and Flight	VCST lead
Org. lead	Chris Moeller	U. Wisc.	NJO	SDR impact/RSR
Org. lead	Bill Johnsen	Raytheon	NJO	
Org. lead	Lushalan Liao	NGAS	NJO	

SDR	Name	Organization	Funding Agency	Task
member	Blonski, Shao, Uprety, Pogo, Bai, Hu, Carey, et al.	NOAA/NESDIS/STAR	NJO	SDR cal/val support, DRAT, SNO&vicarious
member	Oudrari, Wu , Lei, McIntire, Schwarting, Nishihama, Lin, Chiang, et al.	NASA/VCST	NASA/NOAA	Manuver, intercal, SDR cal/val support
member	Rausch, Moyer + 10 Staff (see backup slide)	Aerospace	NASA/NOAA	SDR Cal/Val Support
member	Mills, Chu, et al.	NGAS	NOAA/NASA	SDR Cal/Val Support