JPSS VIIRS SDR SCIENCE OVERVIEW

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Outline

- The VIIRS SDR team
- Sensor/Algorithm/Product Overview
- Top accomplishments
- JPSS-1 Readiness
- Calibration reanalysis for reprocessing
- Summary and Path Forward

Cal/Val Team Members

PI	Organization	Team Members	Roles and Responsibilities
C. Cao	STAR		Team lead, calibration algorithms, SDR science
W. Wang/S. Blonski	STAR/ERT	J. Choi, Y. Gu, B. Zhang, A. Wald	VIIRS SDR calibration/validation for S-NPP, J1. (Prelaunch studies; software code changes and ADL tests; Postlaunch monitoring and LUT update)
I. Guch	Aerospace	G. Moy, E. Haas, and many others	RSB autocal maintenance
J. Xiong	VCST	J. McIntire, G. Lin, N. Lei,	VIIRS TV data analysis; prelaunch characterization; LUT development, geolocation
X. Shao$_{(PT)}$	UMD/CICS	Y.Bai, S. Uprety, W. Zhuo	DNB operational calibration, geolocation validation, intercomparisons, solar/lunar calibration
C. Moeller	U. Wisconsin	C. Moeller, J. Li	VIIRS RSR, DCC weekly calibration
JPSS	JPSS	R. Marley, C. Rossiter	Collaboration

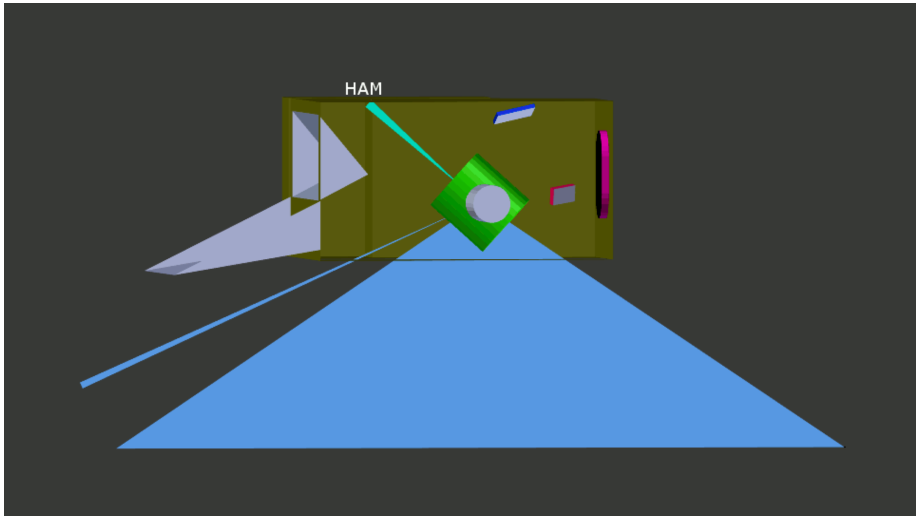
VIIRS Instrument Overview

•VIIRS is a scanning imaging radiometer onboard the Suomi NPP, and JPSS satellites in the afternoon orbits with a nominal altitude of 829km at the equator, with a swath width of ~3000km;

•VIIRS Onboard calibration relies on the solar diffuser (SD), solar diffuser stability monitor (SDSM), space view (SV), and the blackbody (BB);

•Vicarious calibration also used (lunar, dark ocean for DNB, and cal/val sites);

•Calibration is performed per band, per scan, per half angle mirror side (HAM), and per detector.



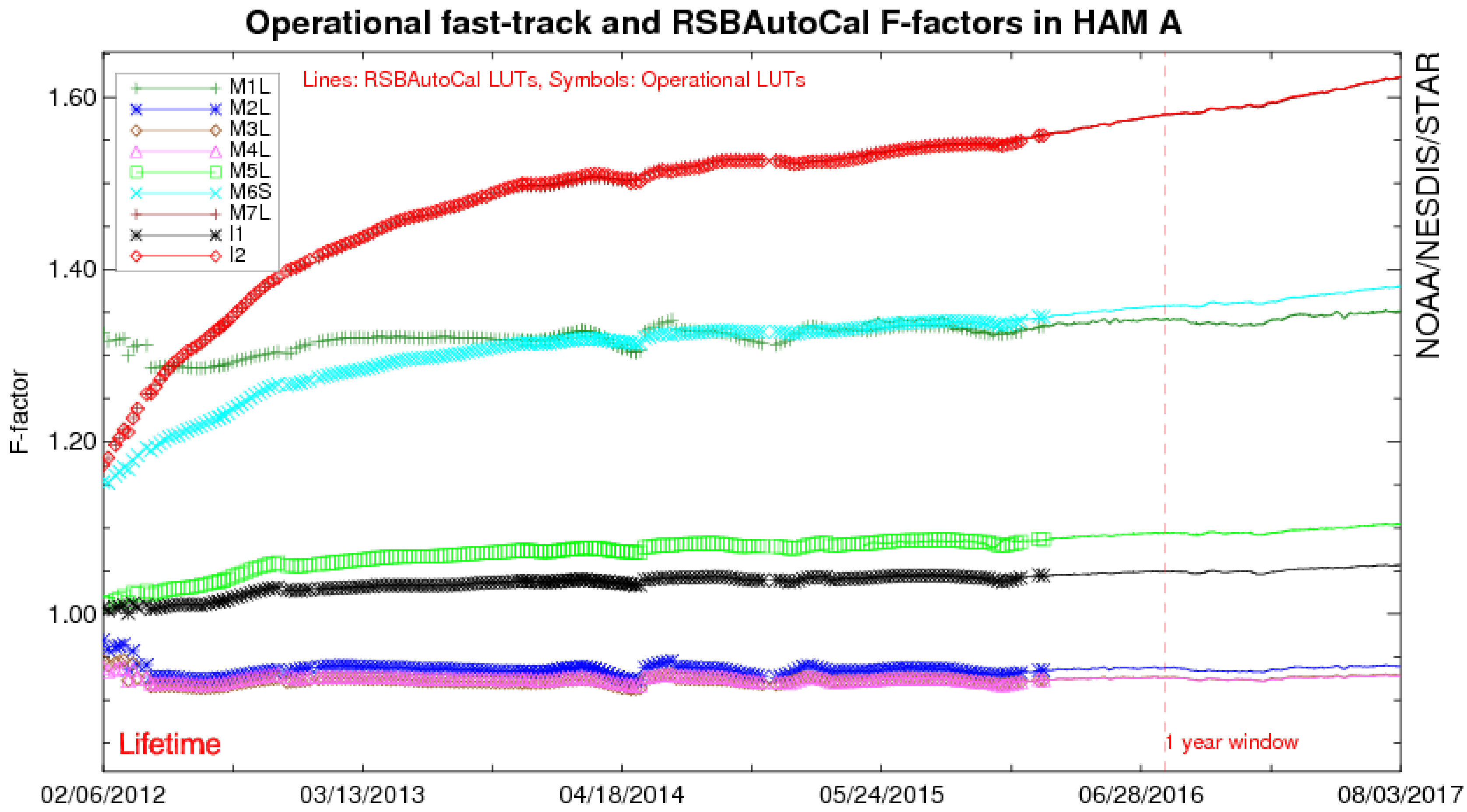
VIIRS has 22 types of SDRs:

- *16 moderate resolution (750m), narrow spectral bands (11 Reflective Solar Bands (RSB); 5 Thermal Emissive Bands (TEB))*
- *5 imaging resolution(375m), narrow spectral bands (3 RSB; 2 TEB)*
- *1 Day/Night Band (DNB) imaging (750m) broadband*

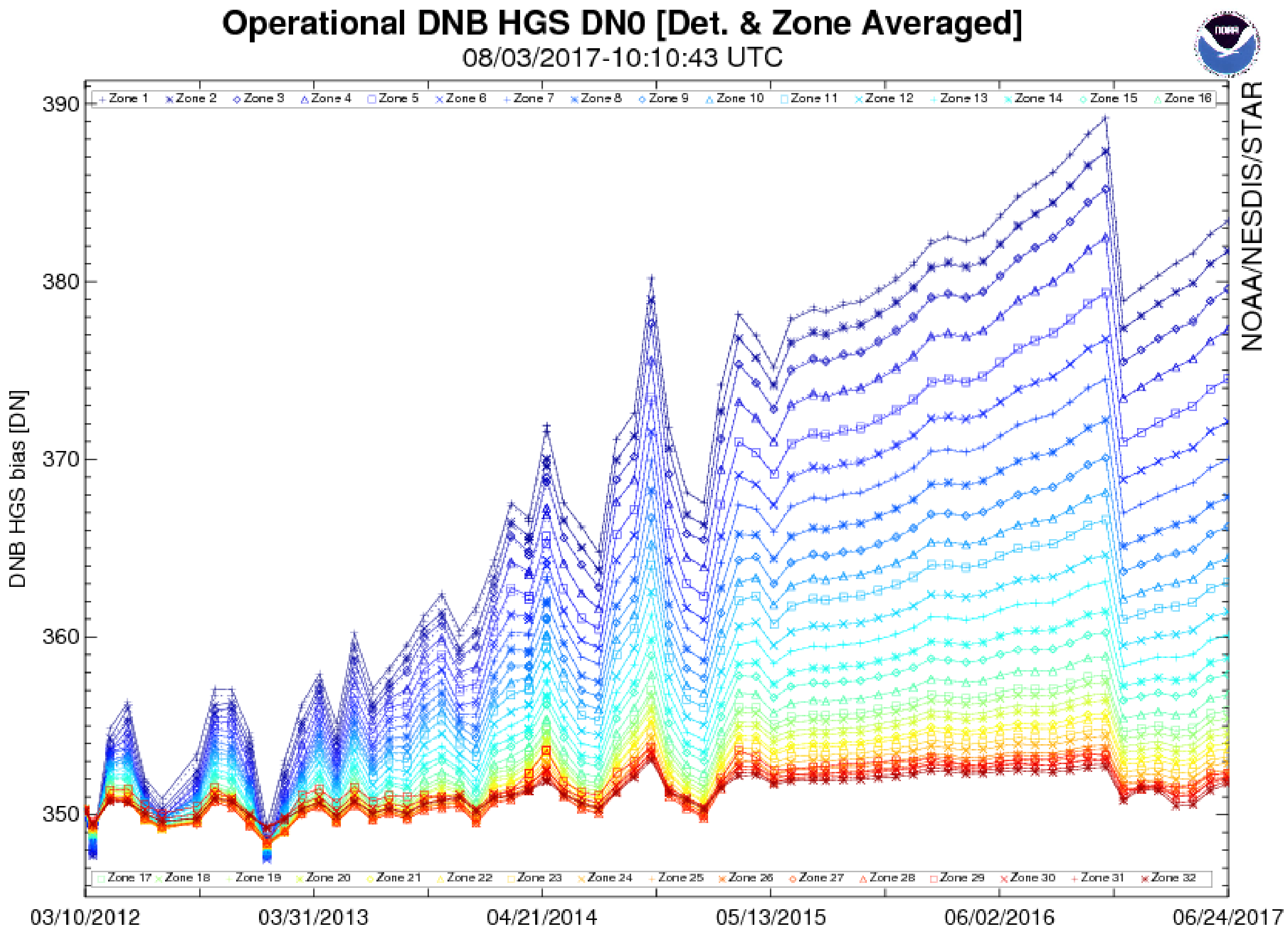
VIIRS SDR Product Requirements from JPSS L1RD

Attribute	Threshold	Objective
Center Wavelength	412 to 12,013 nm	412 to 12,013 nm
Bandpass	15 to 1,900 nm	15 to 1,900 nm
Max. Polarization Sensitivity	2.5 to 3.0 %	2.5 to 3.0 %
Accuracy @ Ltyp	0.4 to 30 %	0.4 to 30 %
SNR @ Ltyp or NEdT @ 270 K	6 to 416 or 0.07 to 2.5 K	6 to 416 or 0.07 to 2.5 K
FOV @ Nadir	0.4 to 0.8 km	0.4 to 0.8 km
FOV @ Edge-of-Scan	0.8 to 1.6 km	0.8 to 1.6 km
Ltyp or Ttyp	0.12 to 155 $W \cdot m^{-2} \cdot sr^{-1} \cdot mm^{-1}$ or 210 to 380 K	0.12 to 155 $W \cdot m^{-2} \cdot sr^{-1} \cdot mm^{-1}$ or 210 to 380 K
Dynamic Range	0.12 to 702 $W \cdot m^{-2} \cdot sr^{-1} \cdot mm^{-1}$ or 190 to 634 K	0.12 to 702 $W \cdot m^{-2} \cdot sr^{-1} \cdot mm^{-1}$ or 190 to 634 K

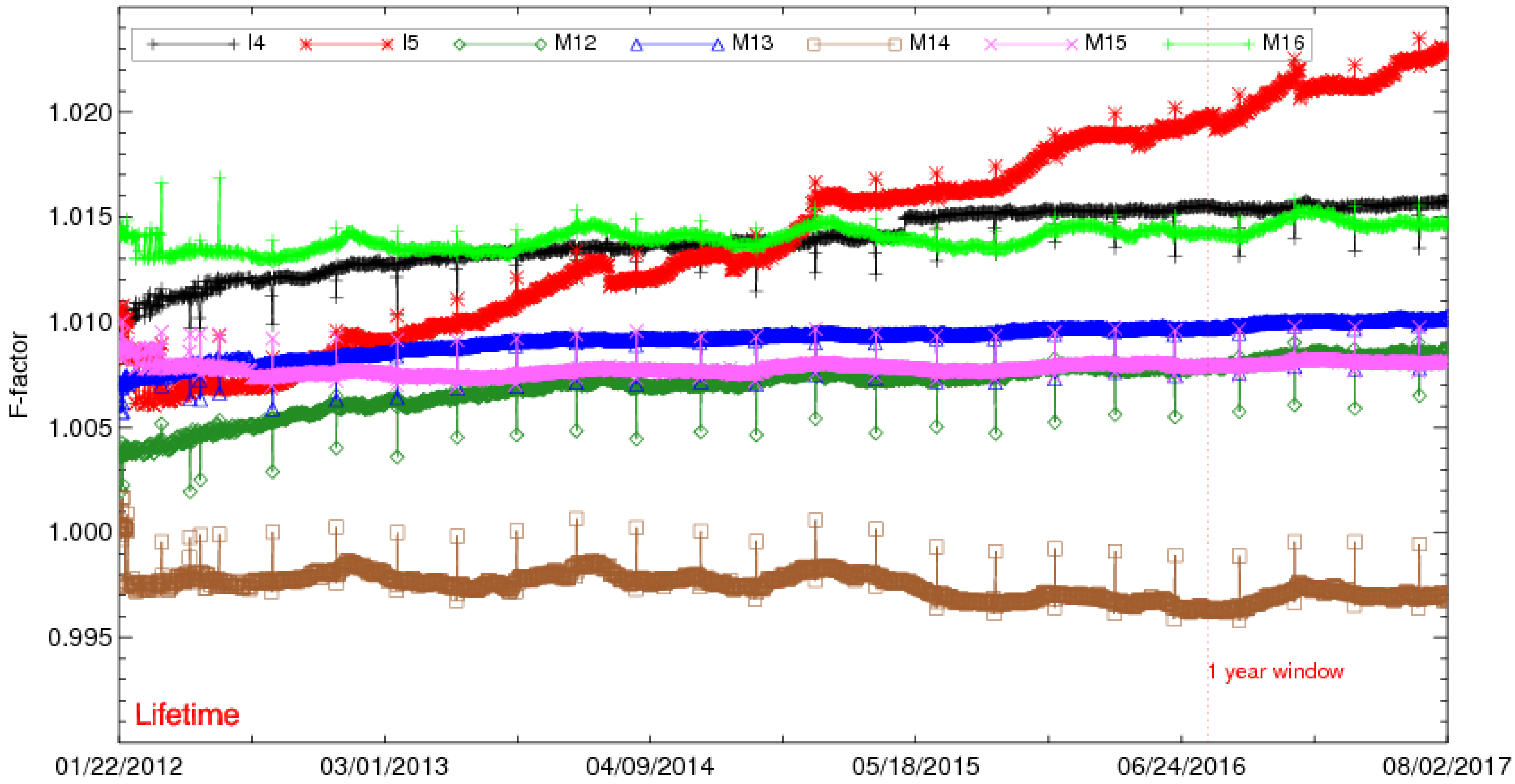
VIIRS RSB Longterm Trend



VIIRS DNB Offset Changes by Aggregation Zone

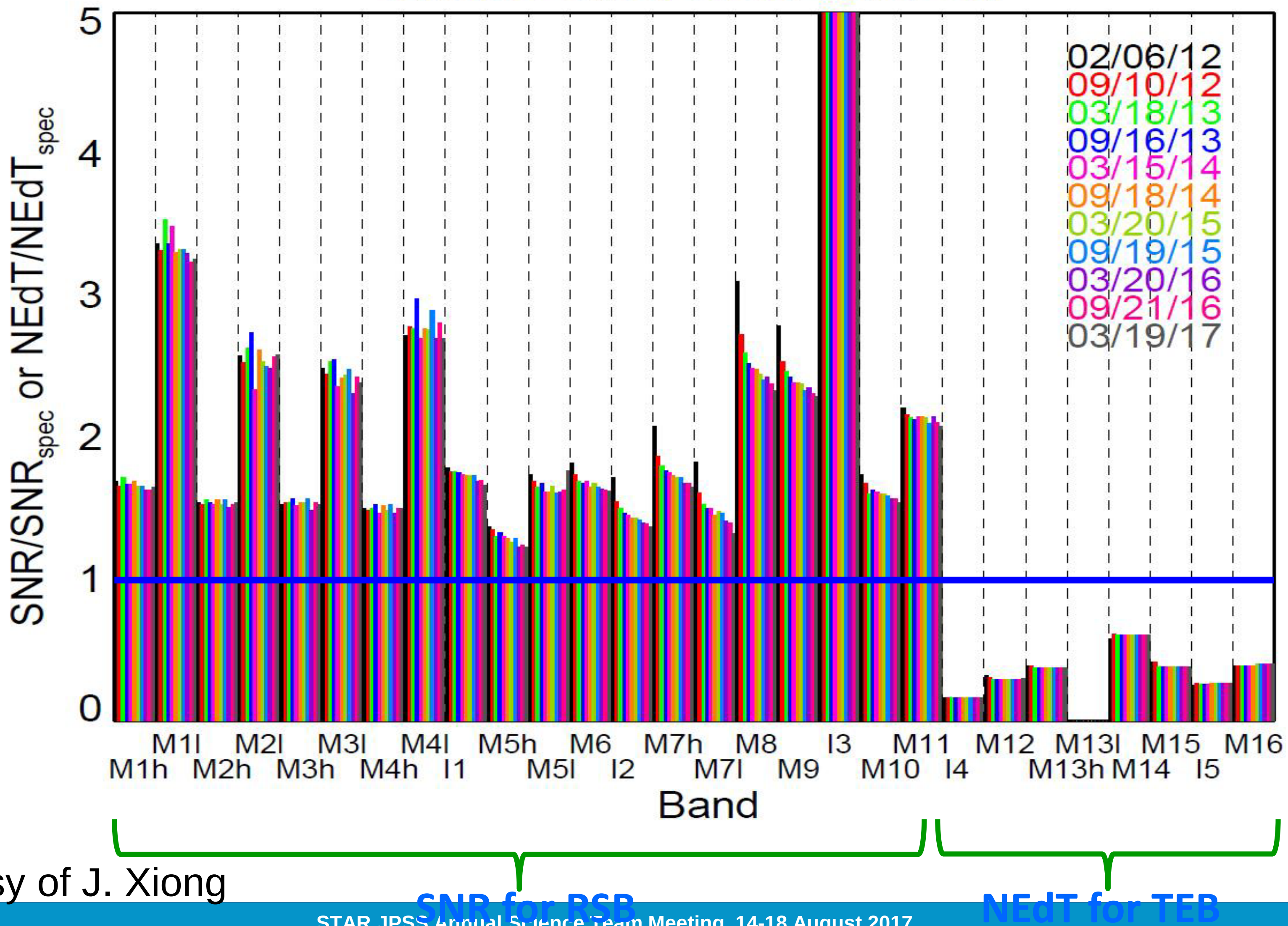


VIIRS TEB Responsivity Longterm Monitoring



VIIRS Noise Performance

(SNR/SNR_{SPEC} > 1) or ($NEdT/NEdT_{SPEC}$ < 1): better performance



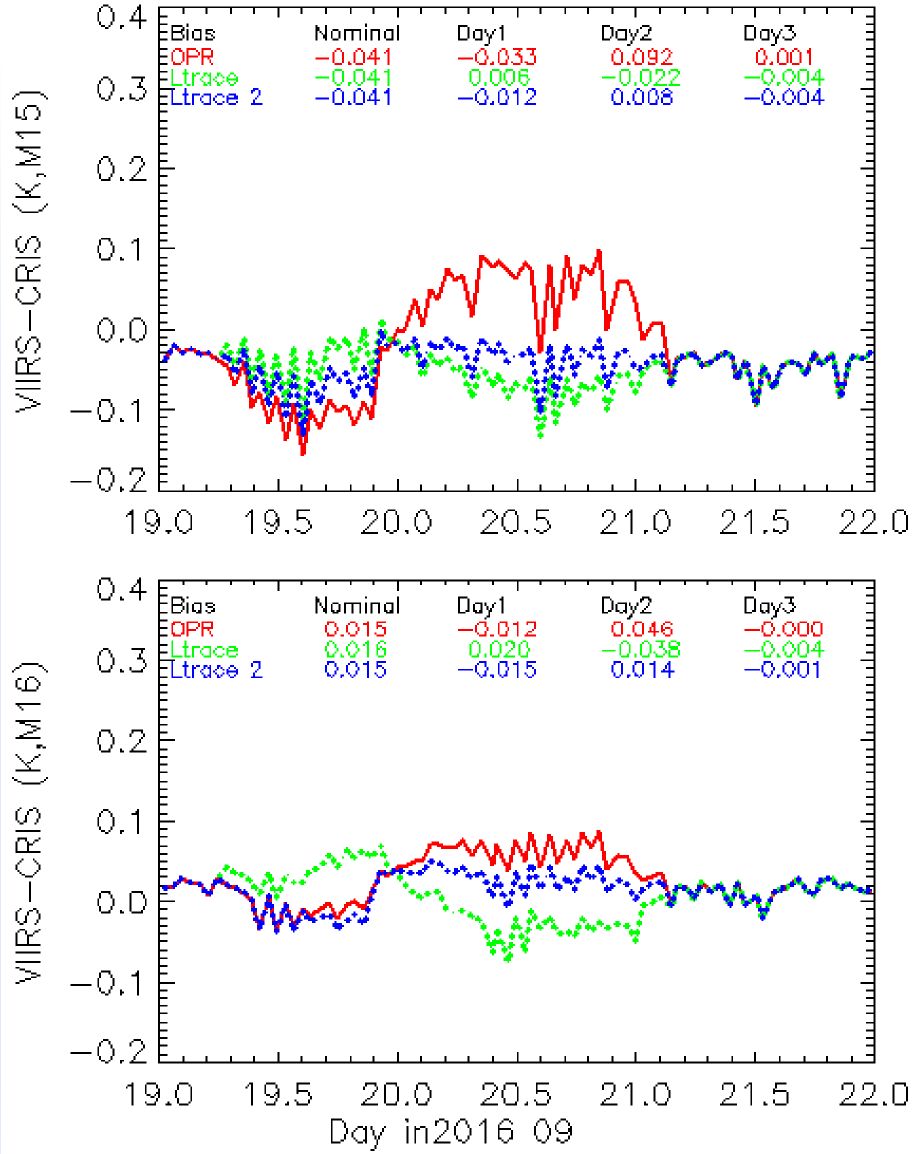
Courtesy of J. Xiong

VIIRS SDR Team Accomplishments (FY17)

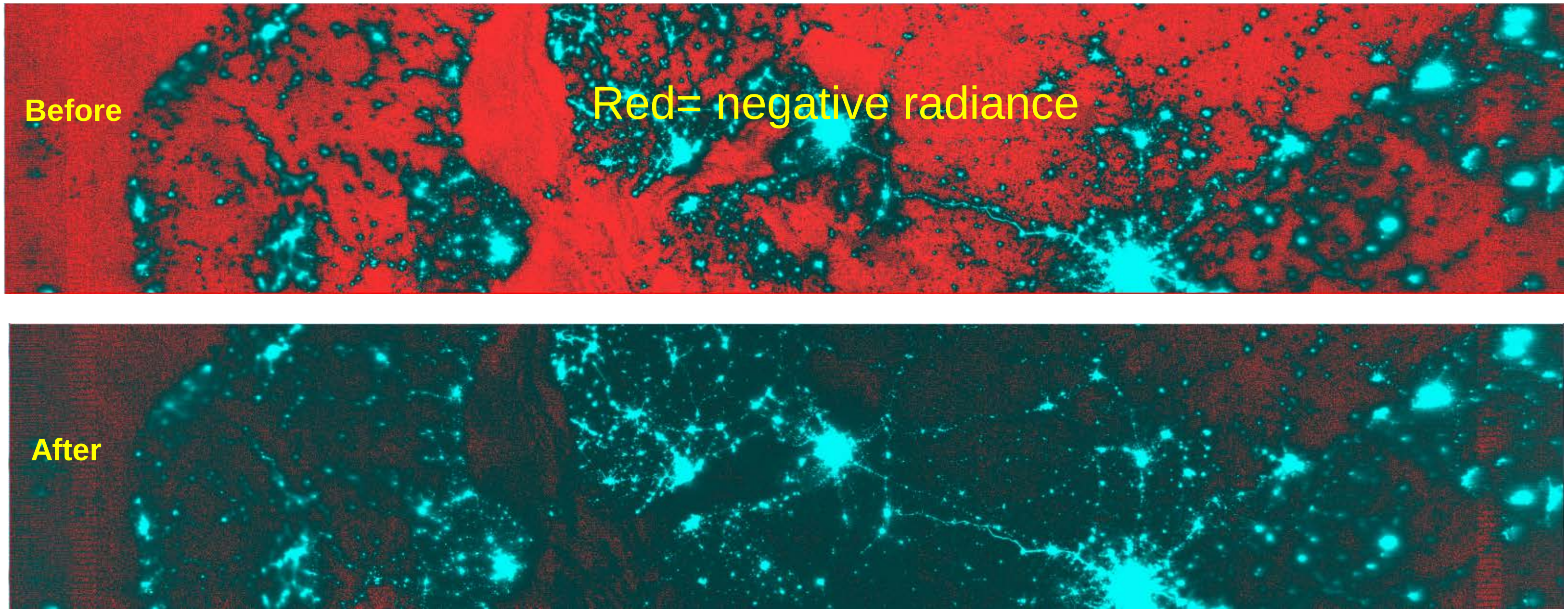
- VIIRS TEB band blackbody Warm/up Cool/down correction algorithm, implementation, validation which mitigates SST biases in time series;
- VIIRS DNB methodology change in offset determination which led to significant reduction in negative radiances;
- VIIRS RSB study of residual biases:
  - Collaboration with OC, VCST, and Aerospace teams;
  - Developed mitigation strategy using radiometric bias correction;
  - Developing Kalman Filter for real time forward predictive calibration;
  - Resolving M5/M7 biases through validation using multiple datasets;
- Developed super computing capabilities for VIIRS reprocessing;
- Reprocessed VIIRS SDR using the latest algorithms/LUTs from 2012 to fall 2016, significantly ahead of schedule;
- Well prepared for JPSS 1 VIIRS postlaunch cal/val;

WUCD Correction and Comparison with CrIS

- WUCD correction algorithm developed (Ltrace)
- Correction implemented in reprocessing, and results validated with CrIS:
  - Before: warm bias during blackbody cooldown;
  - After: bias removed during blackbody cool-down which becomes consistent with normal operations.
- Methodology published in peer reviewed journal (Cao et al., 2017, JGR);
- Ltrace v2 algorithm further improves performance for all TEB bands.



VIIRS/DNB 70% Reduction in Negative Radiance



Sample Data acquired: 01/03/2017 @00:31 UTC

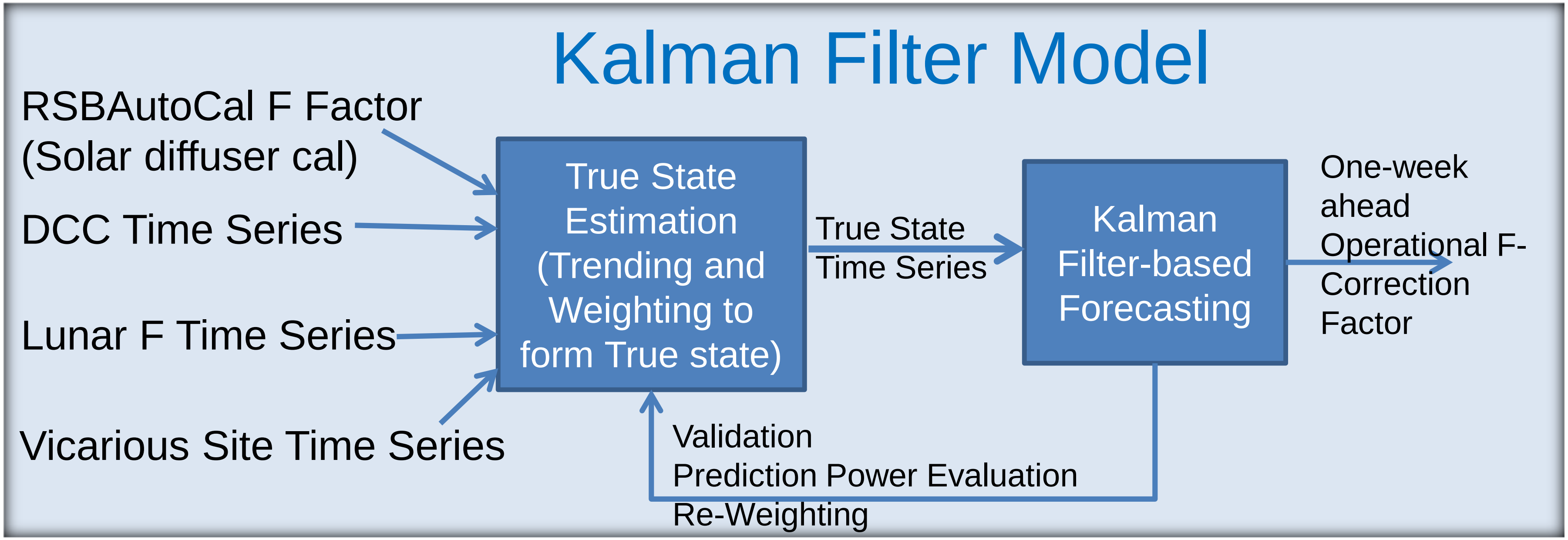
A success story:

- STAR VIIRS SDR team deep dive studies in collaboration with NASA/VCST;
- New calibration method reduced negative radiance by 70%;
- Advancing calibration science as well as supporting air glow science;
- Remarkable instrument low noise floor, thanks again to the vendor.

Notes to users

- *Improved operational VIIRS SDR data since Jan. 12, 2017*
- *Reprocessing using new method is near completion*

Going Forward: Improving Stability for Real Time RSB Processing



- Multiple inputs characterizing instrument response changes (subject to measurement uncertainty and noise)
- Different Time Resolution (some at irregular interval)
- Key steps:
    - Kalman Smoother for trending
    - True State estimation and Weighting Determination
    - Maximum likelihood state parameter estimation for Kalman Filter
    - Correction factor Prediction (Kalman filter prediction)

VIIRS will see you near Nashville for the unforgettable Solar Eclipse next week !

For more about VIIRS, please tune in for the rest of the talks. There is also a splinter meeting Tuesday afternoon 1-4:30 on the 4th floor NCWCP.

JPSS-1 VIIRS LAUNCH READINESS: SDR

Presented by Slawomir Blonski, ERT
On behalf of the VIIRS SDR Cal/Val Team:
NOAA STAR, NASA VCST, Aerospace, Univ. Wisconsin

Outline

- Cal/Val Timeline
- LUT Development Summary
- SDR Production Testing
- Post-Launch Testing Preparations
- Summary

JPSS-1 VIIRS Cal/Val Timeline

	Flight Activity	Ground Activity
L + 0 (LRD 10/2x/2017)	JPSS-1 Launch	Begin Cal/Val Tasks: Orbit Onboard Calibrators Basic Functionality SDSM Image Quality VNIR Calibration Geolocation
L + 10	VIIRS Activation	
L + 24	Nadir Doors Open	
L + 35		1st Delivery of Updated LUTs: VNIR Cal.
L + 45	Cryoradiator Door Open	
L + 48	All Detectors Stable	Beta Maturity
	WUCD DNB New Moon Calibration Maneuvers: Lunar Yaw Pitch	Continue Cal/Val Tasks: SWIR and TEB Calibration DNB Calibration DNB Straylight Inter-Satellite Comparisons
L + 69		2nd Delivery of Updated LUTs: SWIR/DNB Cal., GEO
L + 90		Provisional Maturity

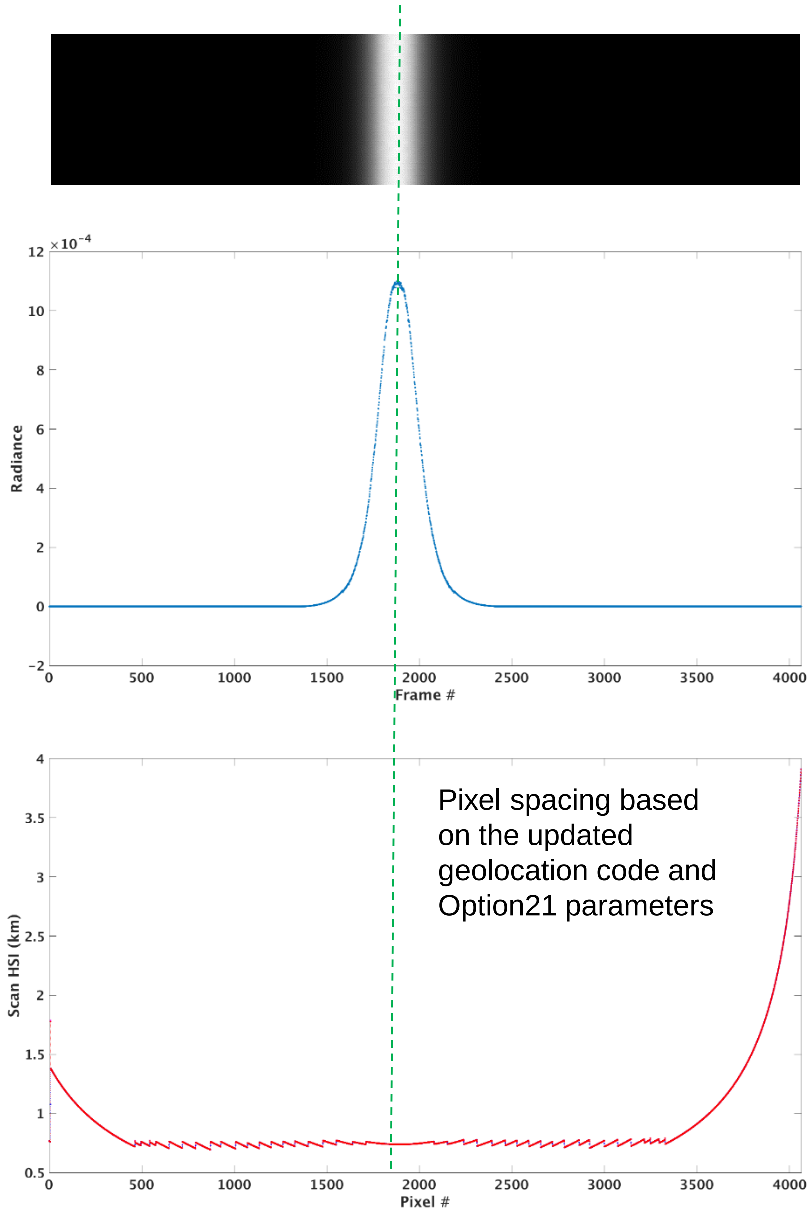
Processing Coefficients Development

- Initial prelaunch versions of 46 lookup tables (LUTs) delivered in July 2015
- 40 launch-ready LUTs delivered in July 2016 based on thorough analyses of prelaunch test data
  - More precise angular dependence of solar attenuation screens transmittance and solar diffuser bidirectional reflectance
  - Thuillier solar irradiance spectrum instead of the MODTRAN-based one
  - DNB geolocation code and parameters updated for the limited set of aggregation modes (mitigating non-linearity of DNB radiometric response)
- 4 LUTs updated in May 2017
  - VIIRS-SDR-RADIOMETRIC-PARAM-V3 revised to mitigate the incorrect "poor quality" flagging for LWIR bands due to hard-coding of the S-NPP nominal cold FPA temperature set-points (will be appropriate for any set-point selected)
  - VIIRS-SDR-DNB-DN0-LUT revised using data from the spacecraft TVAC tests to reduce risk of striping in DNB images
  - VIIRS-SDR-RELATIVE-SPECTRAL-RESPONSE-LUT revised to remove an incorrect spectral shift for band M9
  - VIIRS-RSBAUTOCAL-BRDF-SCREEN-TRANSMISSION-PRODUCT-RTA-VIEW-LUT revised based on data received from the instrument manufacturer after the previous version was generated
- 3 GEO LUTs to be updated before launch (two weeks before the Hard Freeze date)
  - If schedule allows, the LUTS will be based on post-TVAC instrument alignment measurements (otherwise – on pre-TVAC data)

SDR Production Testing

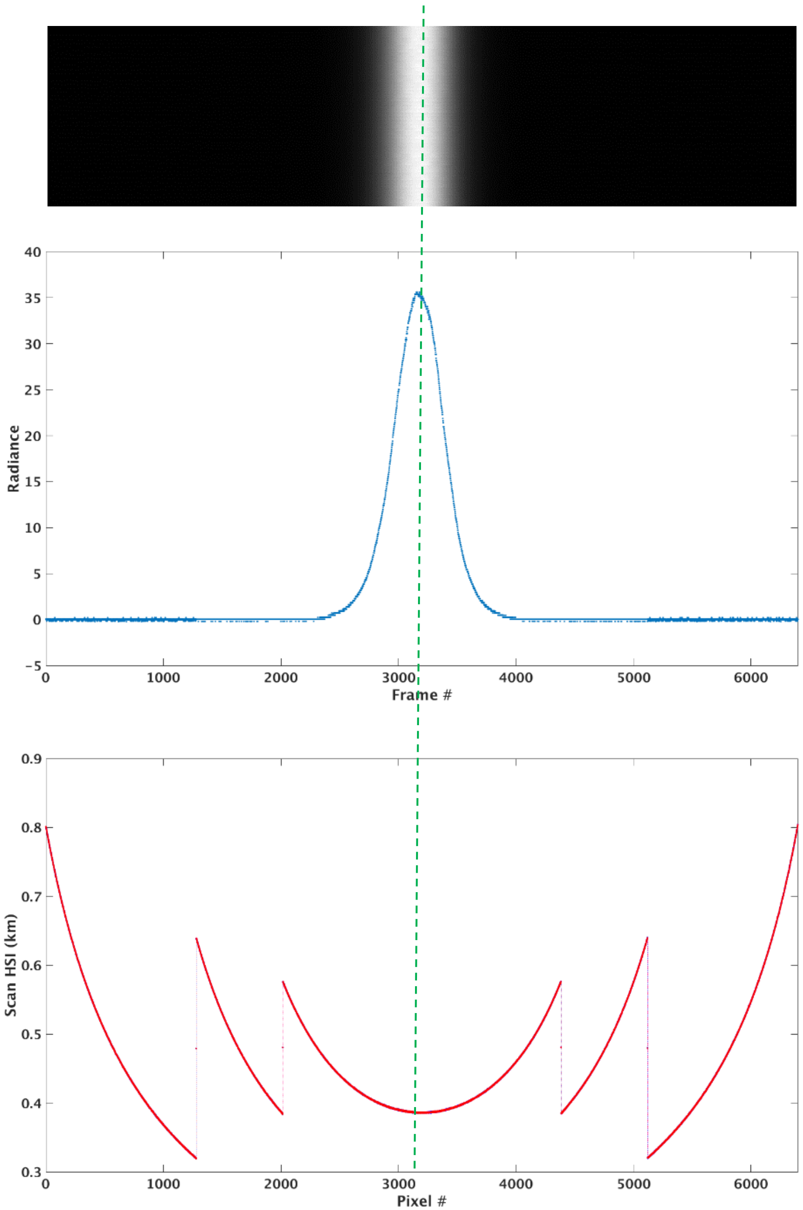
- Conducted using the latest version of the ADL software: more successful SDR production than in IDPS during JCT4, JCT5, E2E, …
- Several datasets were needed to test all SDR products:
  - Provided by the JPSS Test Data & Tools Working Group
  - **MDR28**: simulated JPSS-1 VIIRS RDR files created from the S-NPP VIIRS data acquired on January 21, 2012
  - **MDR47**: simulated JPSS-1 VIIRS RDR files created by combining actual JPSS-1 VIIRS data from the instrument thermal vacuum (TVAC) testing with S-NPP spacecraft ephemeris and attitude data acquired at the same time (no time shift required)
  - **TVAC/TVAC2**: actual JPSS-1 VIIRS RDR files created by IDPS from data acquired during JPSS-1 spacecraft TVAC and TVAC2 testing (after unsuccessful initial conversion with the direct-broadcast RT-STPS software)
- Lessons learned for JPSS-2 and beyond:
  - Share with the VIIRS SDR Cal/Val Team software used to produce MDR47
  - Improve RT-STPS software to streamline conversion of spacecraft raw data to RDR

DNB Production Testing



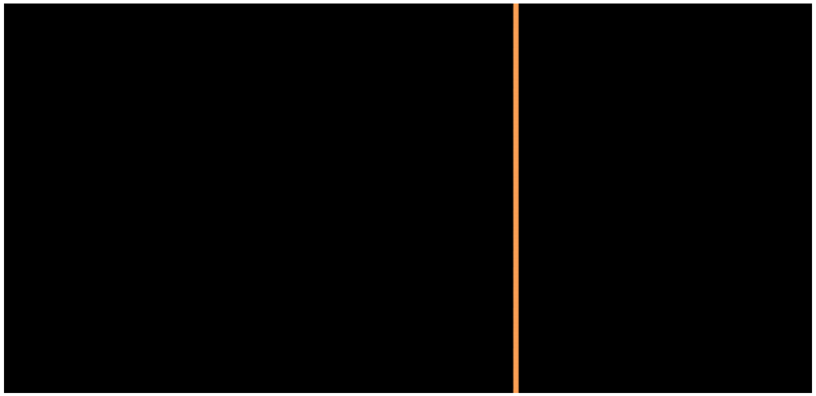
- Used ADL to process RDRs created in IDPS from the JPSS-1 Spacecraft TVAC2 data
- Artificial scene with Flat Panel Illuminator visible through the Earth View port
- Shift in the DNB nadir position consistent with the Option21 limited set of the DNB aggregation modes (1 to 21)
- Geographic location data produced based on spacecraft attitude and ephemeris data

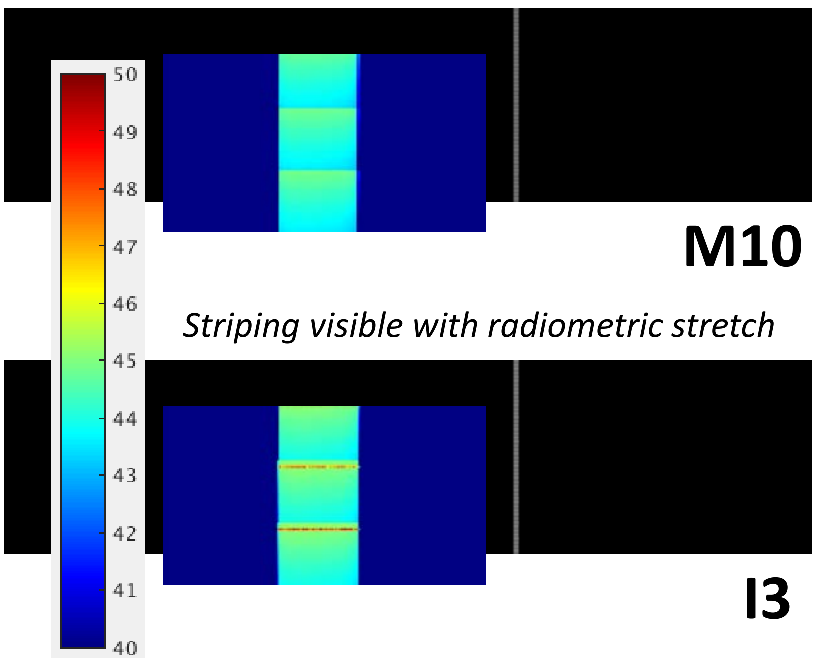
RSB Production Testing



- Used ADL to process RDRs created in IDPS from the JPSS-1 Spacecraft TVAC2 data
- Artificial scene with Flat Panel Illuminator visible through the Earth View port
- Nadir position near center frame
- Geographic location data produced based on spacecraft attitude and ephemeris data

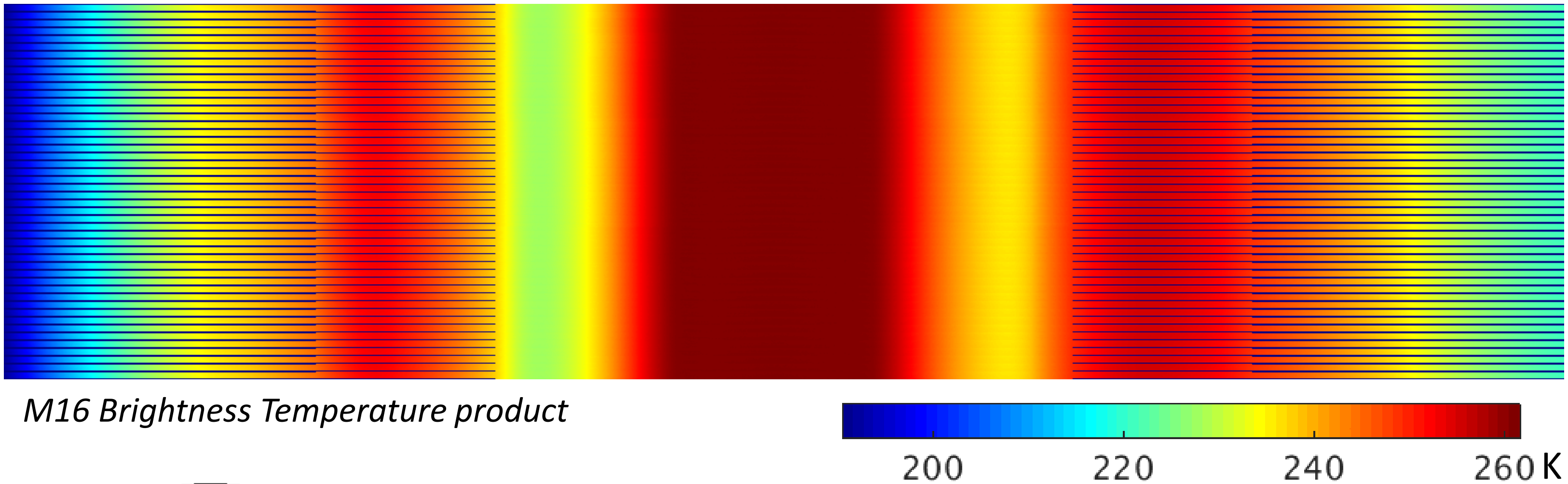
RSB Production Testing





- Image created by the radiance data produced with ADL: bands M5-M4-M3 are shown as the RGB colors (two granules)
- MDR47 proxy RDR inputs are based on:
  - JPSS-1 VIIRS data from the instrument TVAC tests (TV-FOP, acquired during transitions between thermal plateaus, UAID 4302727)
  - S-NPP spacecraft ephemeris and attitude data acquired at the same time as the TVAC data
- Bright calibration source (TMC-SIS) placed at approx. -23° or -7° scan angle
- <10% radiometric error for the out-of-family I3 detector: difficult to calibrate because of higher noise and lower gain

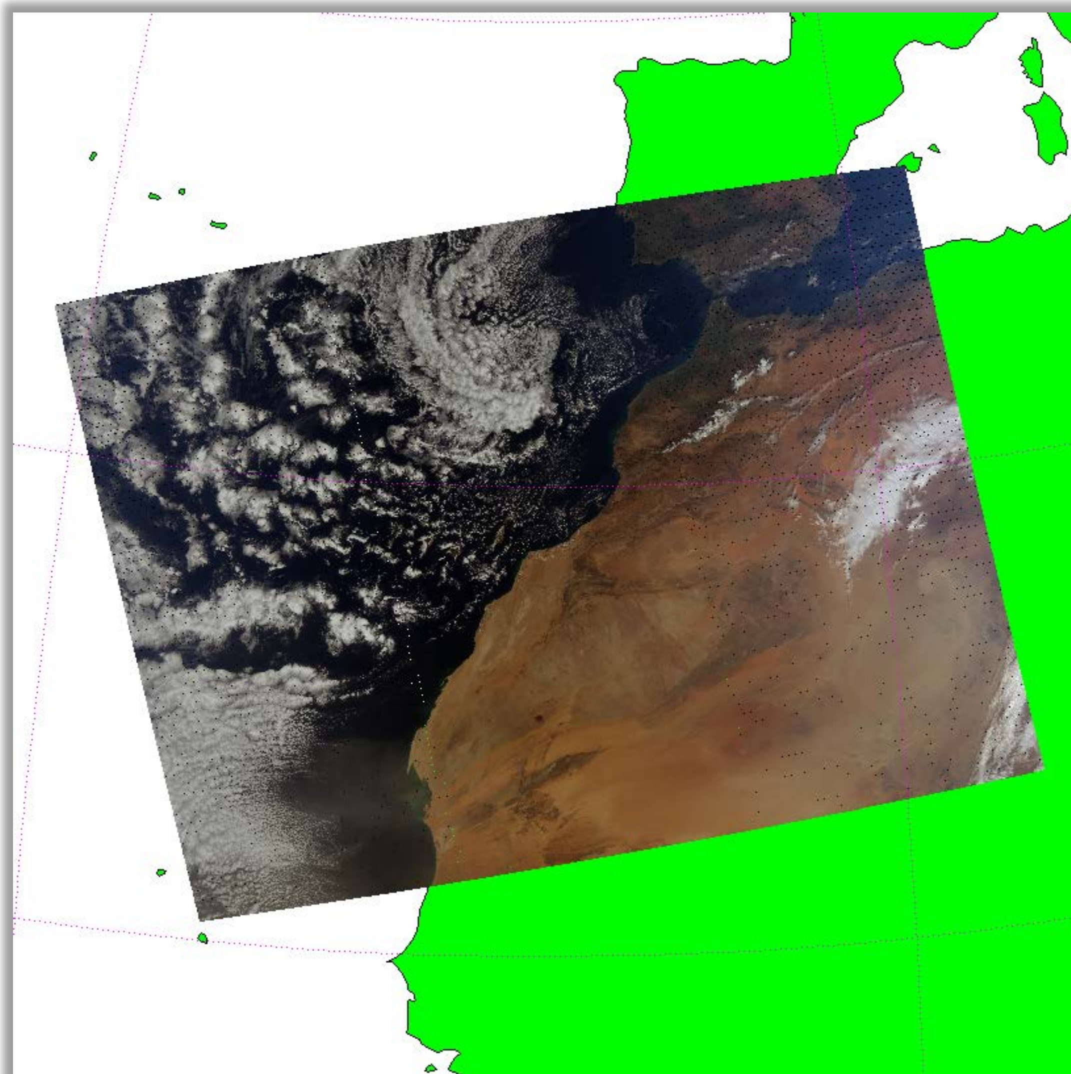
TEB Production Testing



M16 Brightness Temperature product

- Used ADL to process RDRs created in IDPS from the JPSS-1 Spacecraft TVAC2 data
- Artificial scene with Flat Panel Illuminator visible through the Earth View port: provides a dynamic input despite not being a blackbody
- Geographic location data produced based on spacecraft attitude and ephemeris data
- No “poor quality” flags with the latest LUTs

Geolocation Product Testing



- Image generated from the SDR reflectance data produced using ADL with the current JPSS-1 VIIRS GEO LUTs
- Bands M5-M4-M2 are shown as the RGB colors
- MDR28 proxy RDR inputs were created from S-NPP data
- Image projected using the terrain-corrected latitude and longitude coordinates: coastlines provide a crude test of the geolocation accuracy
- Similar results obtained during the 8-day Flight Operations testing, but with lower geolocation accuracy

4-granule aggregate: 2012-01-21 13:53.2-13:58.6 UTC, orbit 1209 (NW Africa)

Post-Launch Testing Preparations

- Identified 47 Post-Launch Test (PLT) Cal/Val tasks essential for achieving Provisional Validation 90 days after launch (L+90)
  - Divided the PLT tasks into three phases defined by the major instrument events:
    - Instrument Activation (L+10)
    - Nadir Doors Open (L+24)
    - Cryo-radiator Door Open (L+45)
  - Many tasks will start in a particular phase and then continue until the complete Validation
- Participated in development of PLT documents by the Mission Operations Support Team
- The objective is to evaluate performance, and if necessary generate adjusted LUTs for IDPS by:
  - Day L+35
    - VIIRS-SDR-F-PREDICTED-LUT (update for VNIR bands only)
    - VIIRS-SDR-DG-ANOMALY-DN-LIMITS-LUT
  - Day L+69
    - VIIRS-SDR-F-PREDICTED-LUT (update will include SWIR bands)
    - VIIRS-SDR-DNB-LGS-GAINS-LUT
    - VIIRS-SDR-DNB-DN0-LUT
    - VIIRS-SDR-DNB-GAIN-RATIOS-LUT
    - VIIRS-SDR-DNB-STRAY-LIGHT-CORRECTION-LUT
    - VIIRS-SDR-GEO-DNB-PARAM-LUT
    - VIIRS-SDR-GEO-IMG-PARAM-LUT
    - VIIRS-SDR-GEO-MOD-PARAM-LUT

PLT Cal/Val Tasks

Tasks Starting After Instrument Activation

Task ID	Title
GEO-1	Initial Validation of Spacecraft Ephemeris and Attitude Data
GEO-2	Initial Validation of VIIRS Encoder Data, Scan Time, Scan Period, and Scan Rate Stability
FPF-2	Detector Operability and Noise Verification with Nadir Door Closed: RSB VNIR, DNB
FPF-6	DC-Restore Functionality and Performance Check
FPF-7	Calibrator Visual Inspection
PLT-X	DNB Straylight with Nadir Doors Closed (using sector rotation)
CSE-1	SD and SDSM Characterization
CSE-2	Onboard Calibrator Black Body (OBCBB) Temperature Uniformity
CSE-4	Temporal Analysis of SD Signal over Polar Region
CSE-5	Temporal Analysis of Solar Diffuser Stability Monitor (SDSM) Data
PTT-1	Operability, Noise, SNR Verification
PTT-6	Telemetry Trending Monitoring
PTT-10	RSBAutoCal Calibration Object Trending, Evaluation & LUT Updates

- Reviewed plans for the PLT Cal/Val tasks data analyses
- Began conducting rehearsals and reviewing readiness of all tools necessary to conduct the tasks
- Planning to update RDR Toolkit to accommodate new DNB APIDs for the HGA/HGB stages

Tasks Starting After Nadir Doors Open

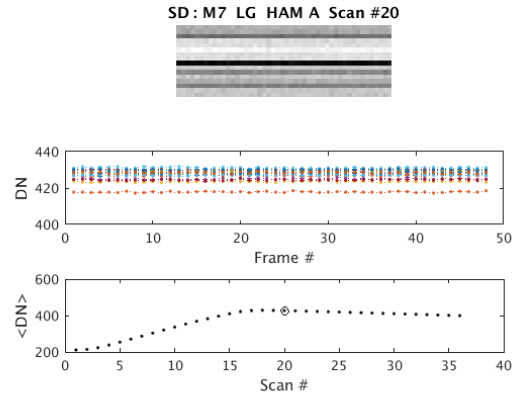
Task ID	Title
FPF-3	In-Scan Aggregation Verification – non-DNB bands
FPF-4	Dual Gain Band and DNB Transition Verification
FPF-5	On-Board Bow-Tie Deletion Verification
CSE-3	Earthshine Contamination of Solar Diffuser Data
IMG-1	Crosstalk, Echo, and Ghost Investigation
IMG-2	Image Analysis (Striping, Glints and Other Artifacts)
RAD-3	Dynamic Range and Linearity
RAD-4	Response vs. Scan Angle (RVS)
RAD-7	SDR Comparison with SNPP-VIIRS
RAD-8	SDR Comparison with MODIS
RAD-8'	SDR Comparison with AVHRR
GEO-3	Assess Reasonableness of First- Period SDR Geolocation
GEO-4 to 7	Analyze First-Period VIIRS GCP Residuals
GEO-9	Develop and Test Initial Geolocation LUT Updates
PTT-2	RDR Histogram Analysis
WAV-1	J1 DNB aggregation mode verification
WAV-2	J1 DNB geolocation vs. aggregation zone

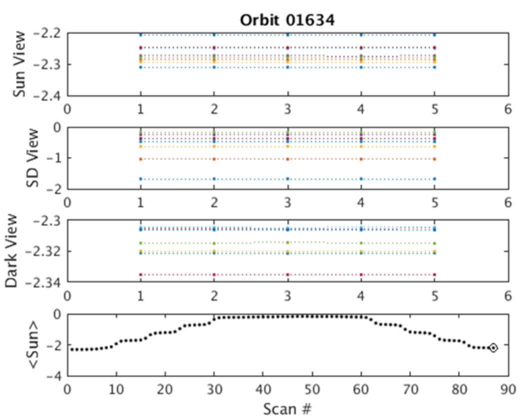
Tasks Starting After Cryoradiator Door Open

Task ID	Title
IMG-3	Moon Echo and Ghost Check
CSE-6	Yaw Maneuver Analysis
RAD-1	Out-of-Band (OOB) Spectral Leakage
RAD-2	Crosstalk from Emissive Bands to Reflective Bands
RAD-6	SDR Comparison with Model
RAD-9	RSB Radiance/Reflectance Validation – Radiometric Sites
RAD-10	Brightness Temperature Validation Using Buoy Data
RAD-11	In-Band Spectral Radiance Comparison with CrIS
RAD-14	Emissive Band Response Characterization (WUCD)
RAD-15	Moon in Space View Correction
RAD-18	Lunar Data Analysis - Roll Maneuver
RAD-19	Analysis of Pitch Maneuver Data
RAD-20	SDR Reprocessing and Updates
RAD-23	Dual Gain Band Anomaly Analysis
RAD-24	Offline F/H Factor Analysis, Prediction and Validation Tool
PTT-4	DNB Offset Verification
WAV-4	J1 DNB straylight assessment and correction LUT development

Cal/Val Tasks Rehearsals

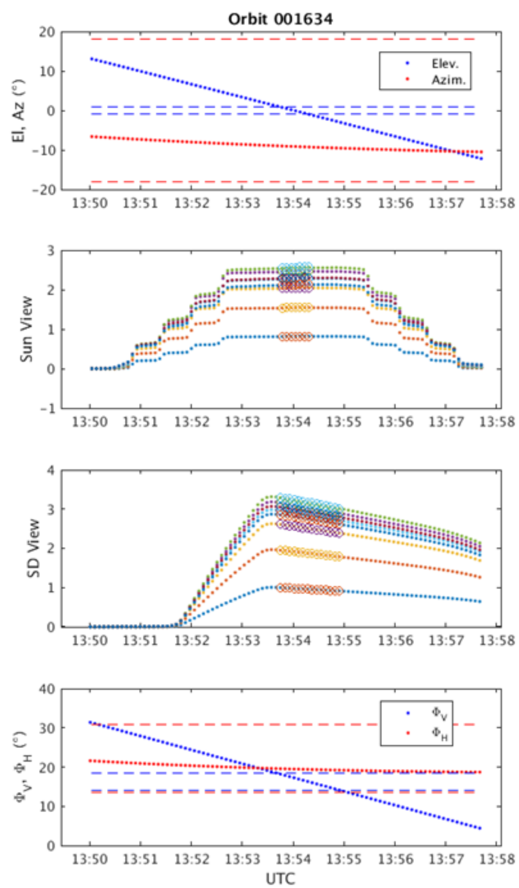
FPF-7: Calibrator Visual Inspection



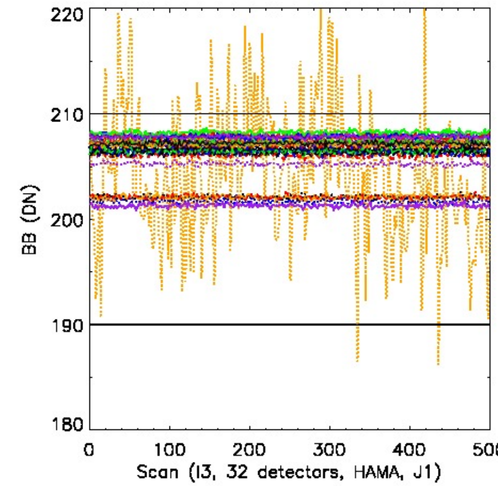


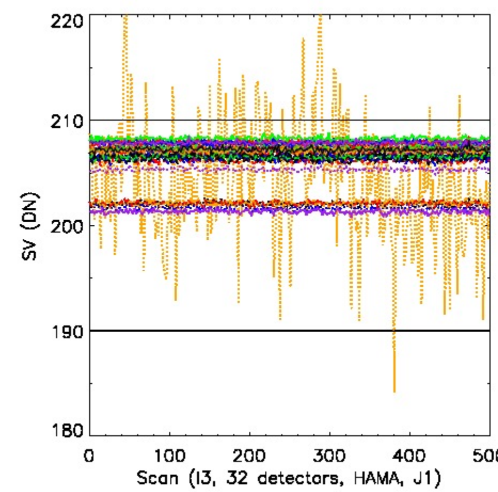
SDSM 5 Samples Consistency

CSE-1: SD and SDSM Characterization



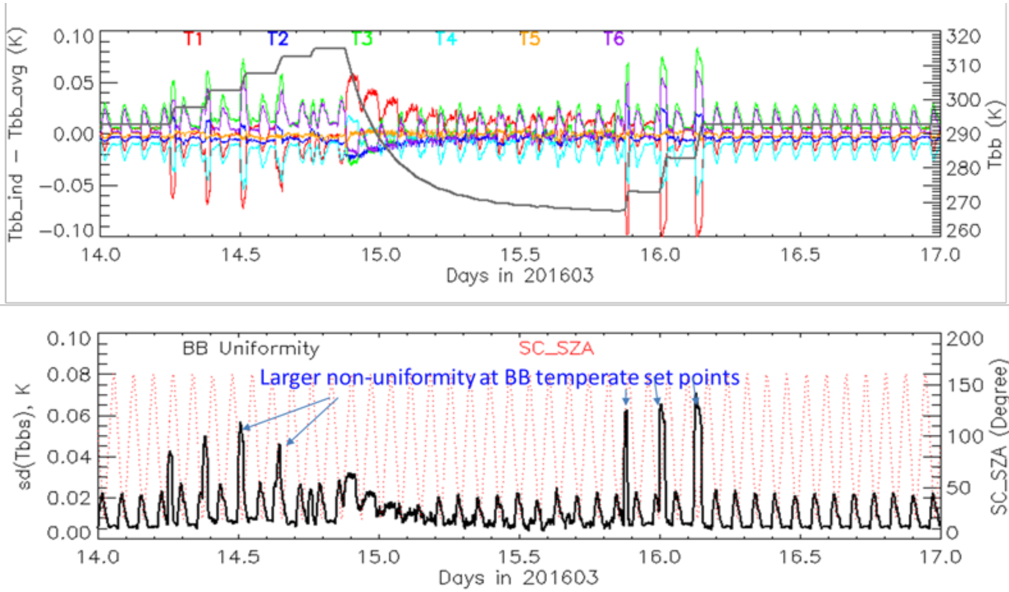
FPF-6: DCR Functionality Check



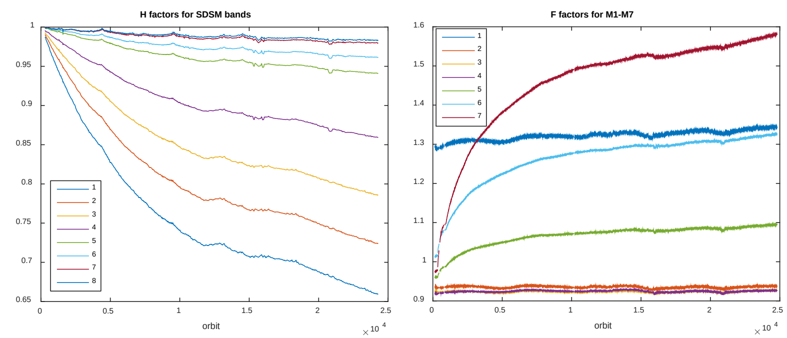


Cal/Val Tasks Rehearsals

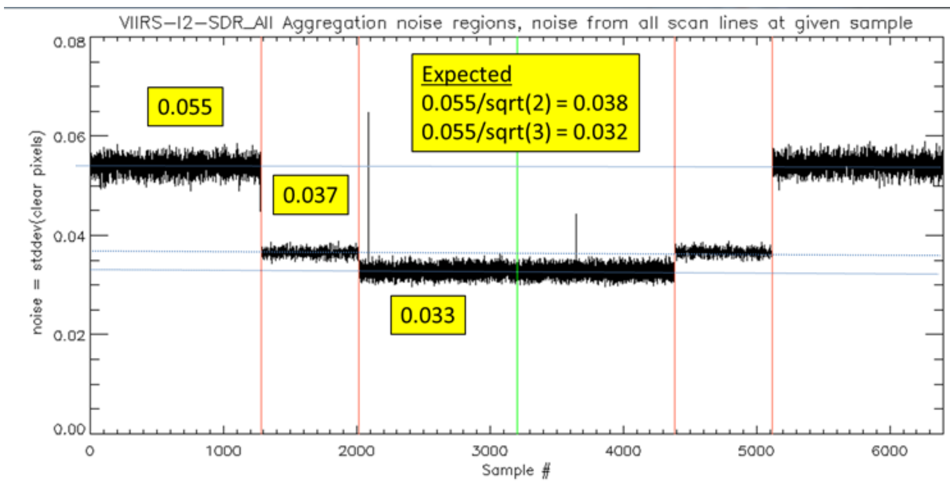
CSE-2: OBC BB Temperature Uniformity



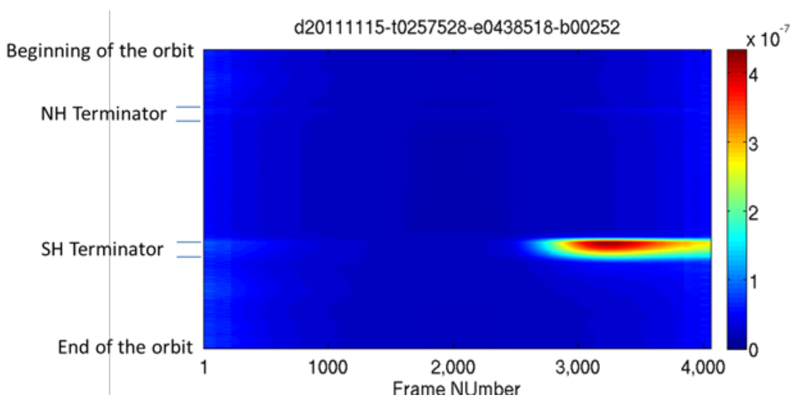
RAD-24: Offline F/H Factor Analysis, Prediction and Validation



FPF-3: In-scan Aggregation Verification



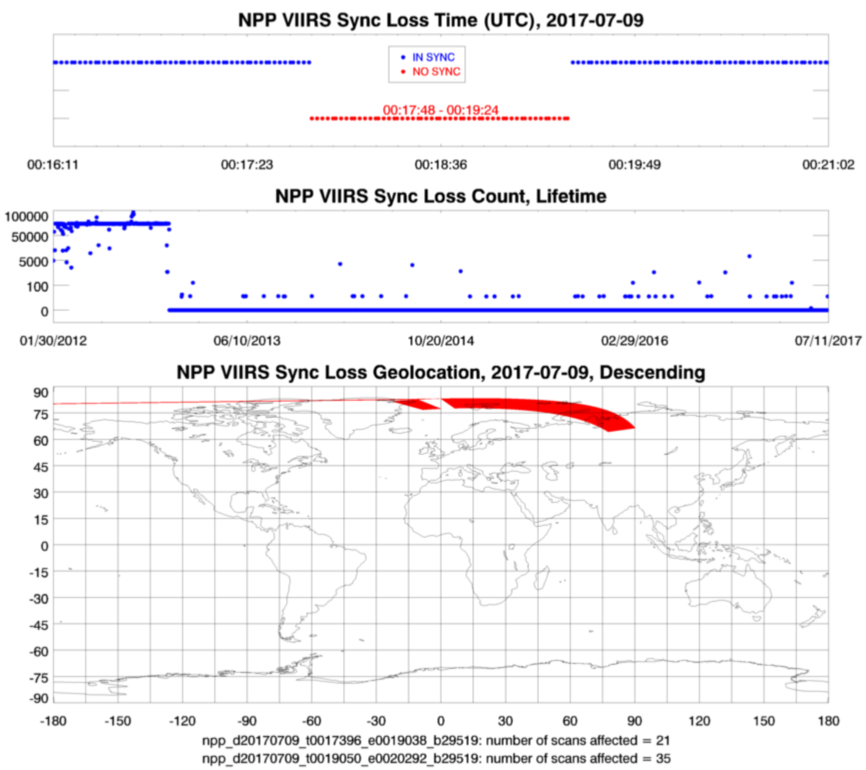
PLT-X: DNB Stray Light with Nadir Doors Closed

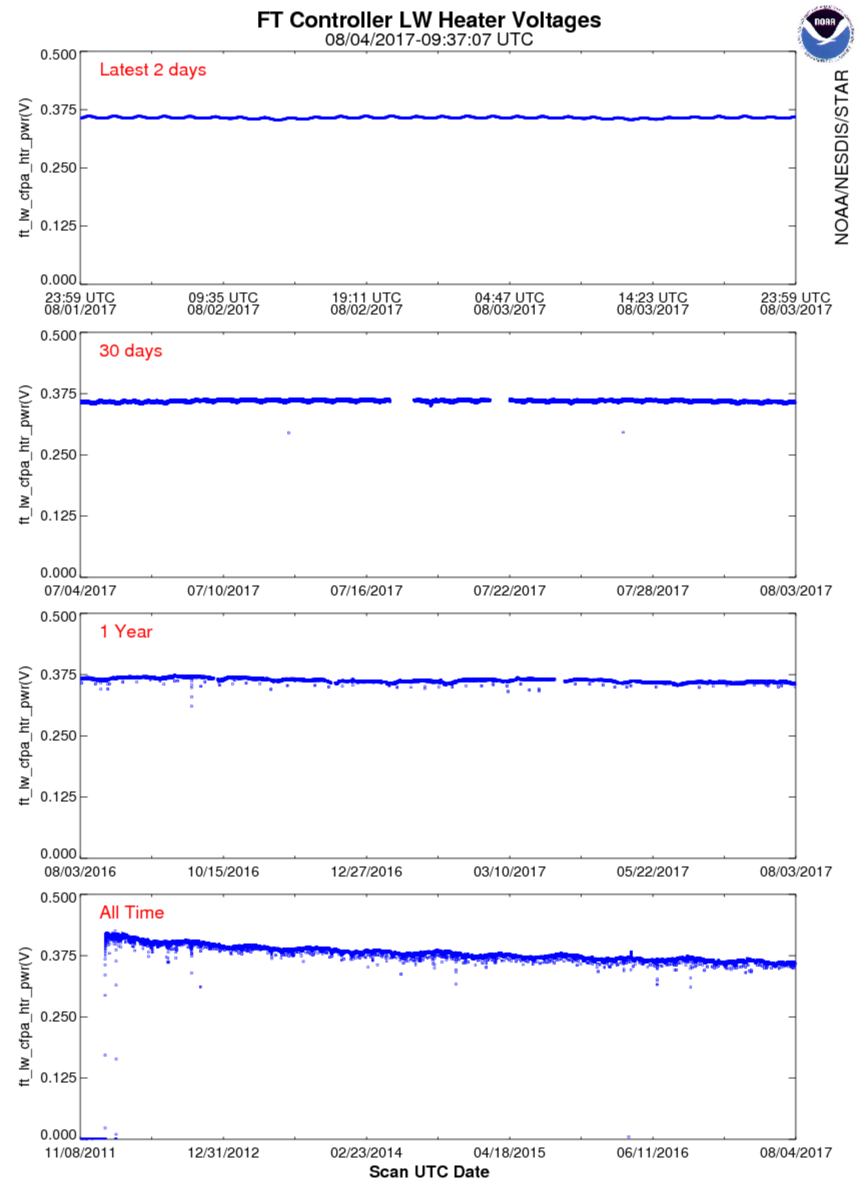


Cal/Val Tasks Rehearsals

PTT-6: Telemetry Trending Monitoring

- Provided by the NOAA STAR ICVS system
- Enables tracking vital instrument parameters to assess sustainability of VIIRS SDR products, e.g., ability to maintain TEB detector temperature





Summary

- All LUTs needed for JPSS-1 VIIRS SDR production delivered
  - GEO LUTs still to be updated based on latest instrument alignment measurements
- All SDR products generation successfully tested – detected issues corrected or mitigated
- Plans for post-launch Cal/Val tasks reviewed and updated: rehearsals of data analyses started
- VIIRS SDR Cal/Val team ready for the JPSS-1 launch

Latest update on J1 VIIRS geolocation

NASA VIIRS Characterization Support Team (VCST)
Geometric Calibration Group

Guoqing (Gary) Lin, SSAI/GSFC Code 619
Robert E. Wolfe, NASA/GSFC Code 619
John Dellomo & Blanche Pfarr, GST/GSFC Code 619
Ping Zhang & Bin Tan, SSAI/GSFC Code 619
James C. Tilton, NASA/GSFC Code 606

NASA Ocean Biology Processing Group (OBPG)

Fred Patt, SAIC/GSFC Code 616

NOAA STAR JPSS STM
College Park, Maryland
Monday, 14 August 2017

Acknowledgements

- Thanks to NOAA STAR, NASA JPSS Project Science Office, NASA VCST Radiometric Calibration Team, UW spectral calibration team, Aerospace team, instrument on-site team & SC I&T on-site team for cooperation and assistance.
- Thanks to the NASA VIIRS Land SIPS Team for processing control point residuals in forward-&re-processed VIIRS geolocation products, and testing Geo LUTs updates.
- Thanks to the JAM, Rosalie Marley, for helping us resolving DRs in the DPE/AMP/GRAVITE.
- Thanks to NOAA JPSS MOT, NASA FDF, BATC for assistance in understanding the SNPP orbit dynamics and attitude issues.
- And thanks to other members of the JPSS family… …

Outline

1. J1 updates from SNPP VIIRS geolocation
   - Mounting matrix & possible on-orbit correction
   - Differences from SNPP
     - LSF/FOV, BBR, focal length, scan rate
     - DNB – thanks to STAR colleagues for code update
2. SNPP updates for J1 VIIRS geolocation
   - Improvements completed
   - Improvements in the making
3. Concluding Remarks

- Extra: Posters 1) J2 VIIRS test data analysis results
  2) On-Orbit Measurement of the Focal Length of the SNPP VIIRS Instrument

Part 1: J1 updates from SNPP VIIRS geolocation

- Mounting matrix & possible on-orbit correction
- Differences from SNPP
  - Optical performance, BBR
  - Focal length, scan rate, scan-to-scan underlaps
  - DNB geolocation with options in reduced aggregation mode – thanks to STAR colleagues for code update

J1 Post-vibe, PreTV data from BATC report

IMF Delta from Average (arcsec)				+0G			
	Bias	VIIRS	ATMS	CrIS	CERES	OMPS	Average-bias
ΘX		17.5	-94.1	47.9	10.9	18.0	49
ΘY		41.6	-11.0	66.0	-70.5	-27.8	-600
ΘZ	-50	-51.8	180.6	3.1	-260.6	-123.4	-202

- Mounting coef T_inst2sc =

```
 0.99999997 0.00019698  0.00015131
-0.00019698 0.99999998 -0.00005173
-0.00015132 0.00005170  0.99999999
```

Equivalent to Euler angle correction (arcsec)

Angle	At-launch	Measured Delta
Yaw	40.6, postTV?	?
Roll	-10.7, postTV?	?
Pitch	-31.2, postTV?	?

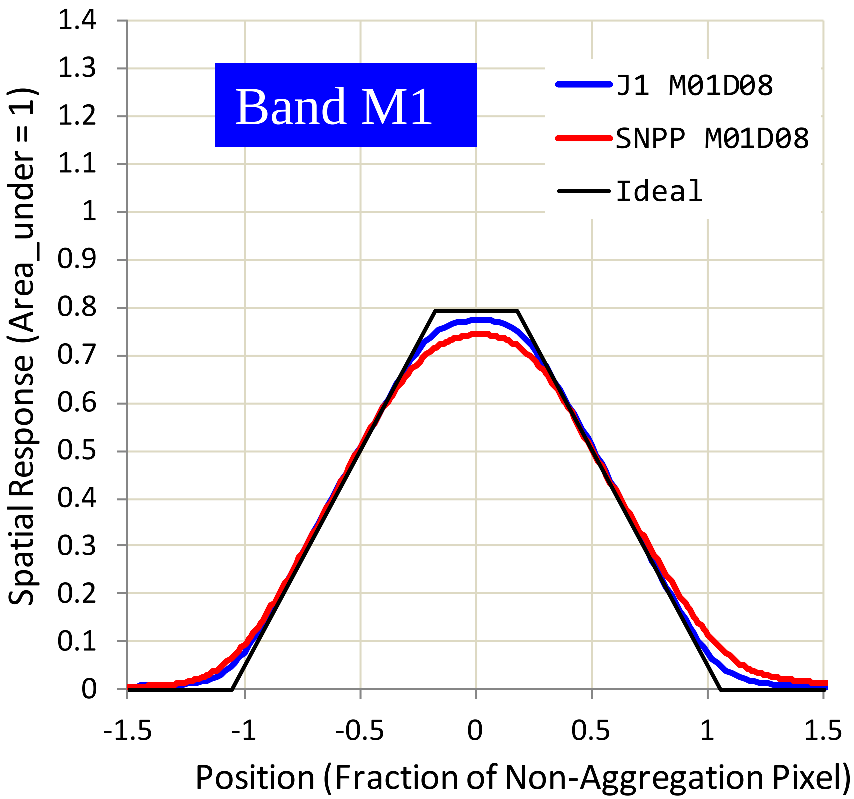
SNPP initial on-orbit geolocation correction

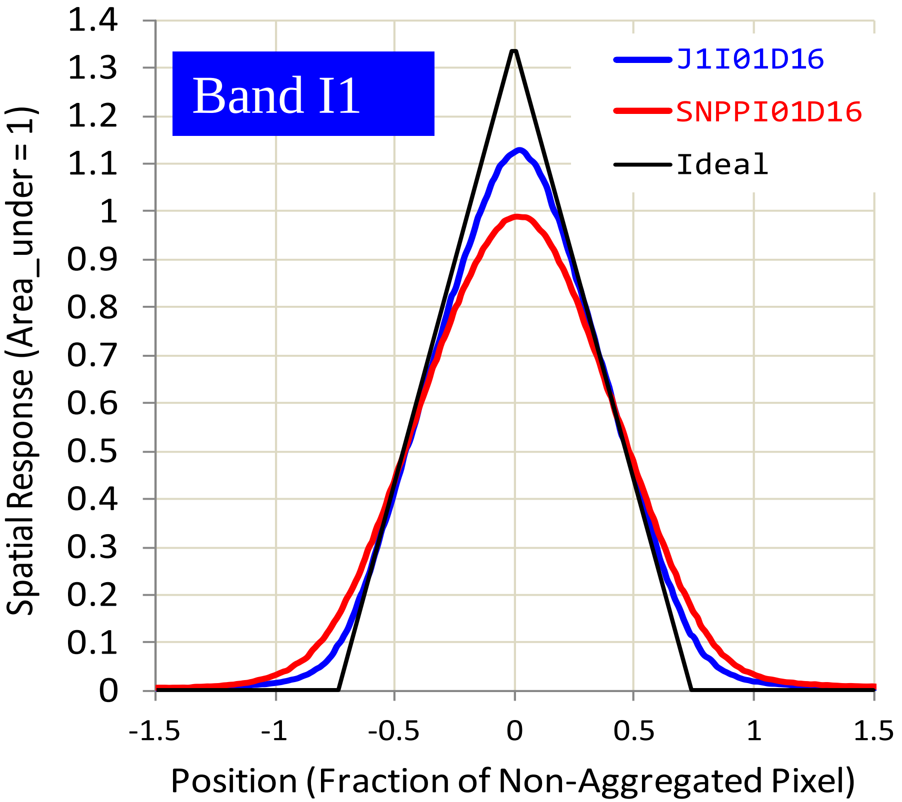
Correction to Instrument to Spacecraft Alignment (arcsec)

Angle	At-launch	Measured Delta
Yaw	33.2	62.2
Roll	41.2	-268.5
Pitch	-59.3	212.5

Nadir equivalent:
Δtrack -775 m,
Δscan 1,118 m

Optical calibration – Scan LSFs

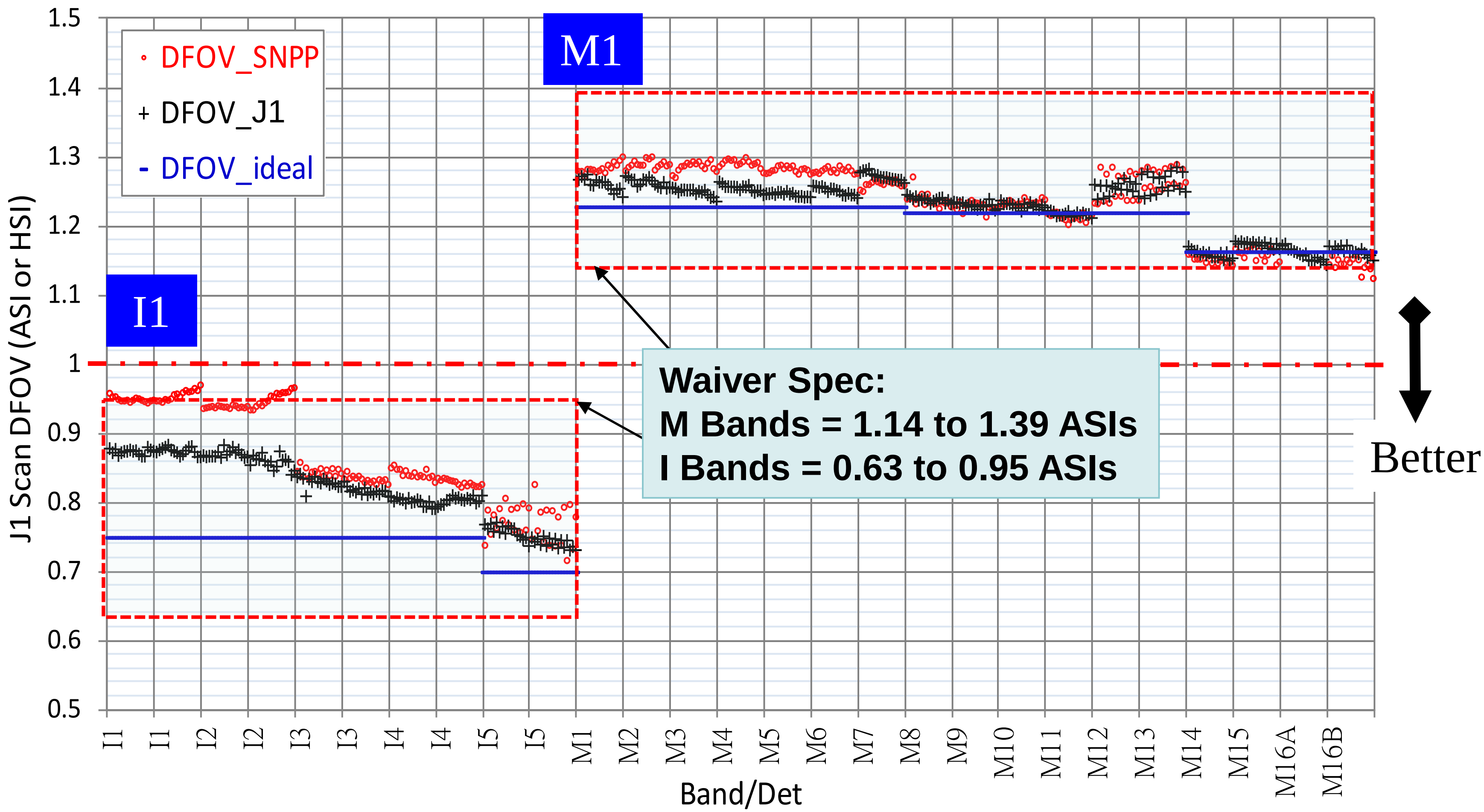




- J1 VIIRS has improved optical performance over SNPP, which shows up in band I1 LSFs more prominently

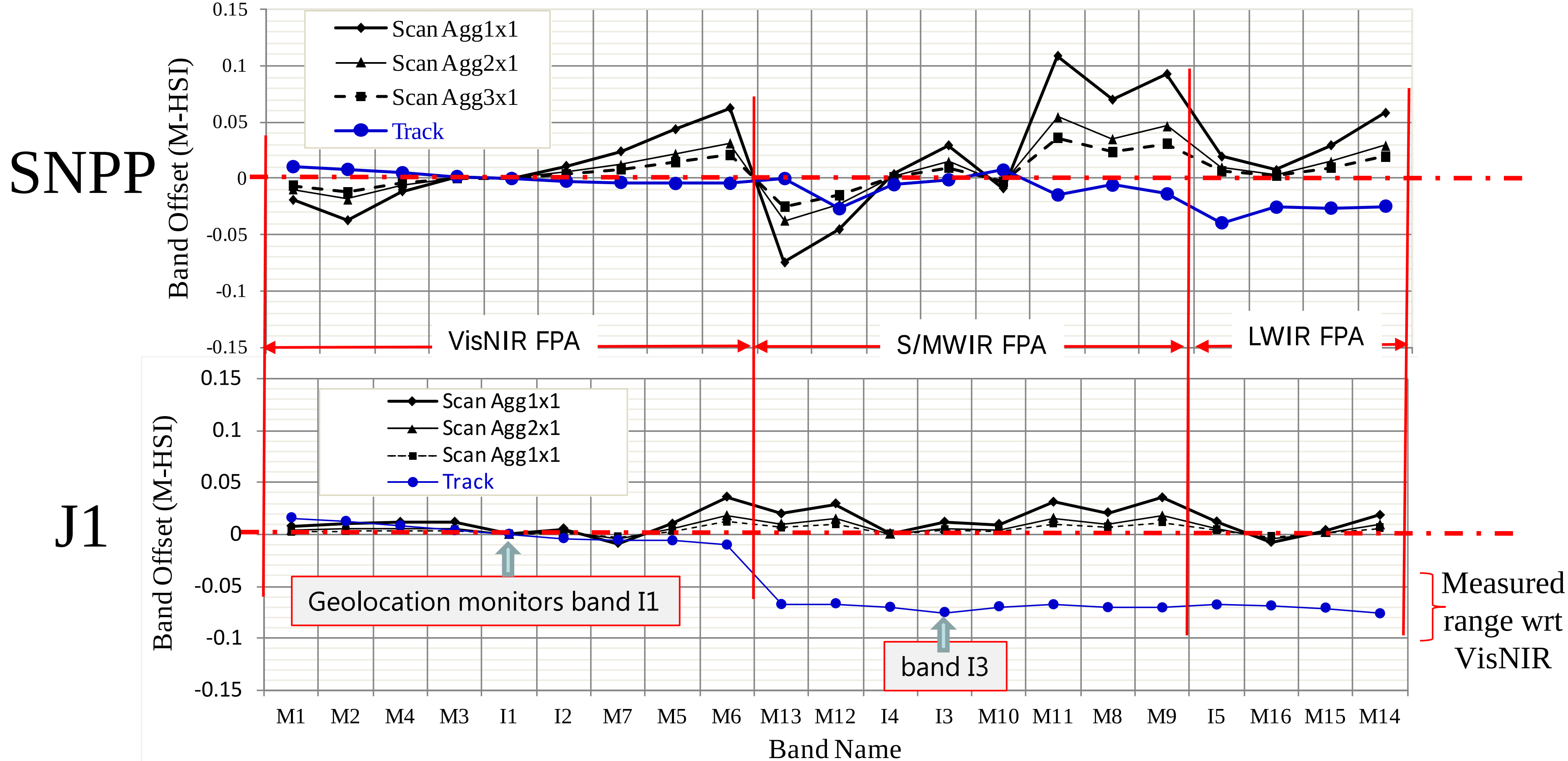
LSF = Line Spread Function

Scan LSF → DFOV(Dynamic Field Of View)



- J1 VIIRS has better focus while SNPP VIIRS has de-focus in VisNIR bands → a "trade" in focal length : scan rate : scan-to-scan underlap
- I-bands under-sample while M-bands over-sample the earth in the un-agg zones

BBR: M/I band offsets wrt I1



- J1 BBR performance is better than SNPP BBR in the scan direction
- In the track direction, J1 Bands on cold FPAs shifted ~ 50 m from bands on VisNIR FPA.
- Additional geolocation monitoring of band I3 is planned to monitor the shift

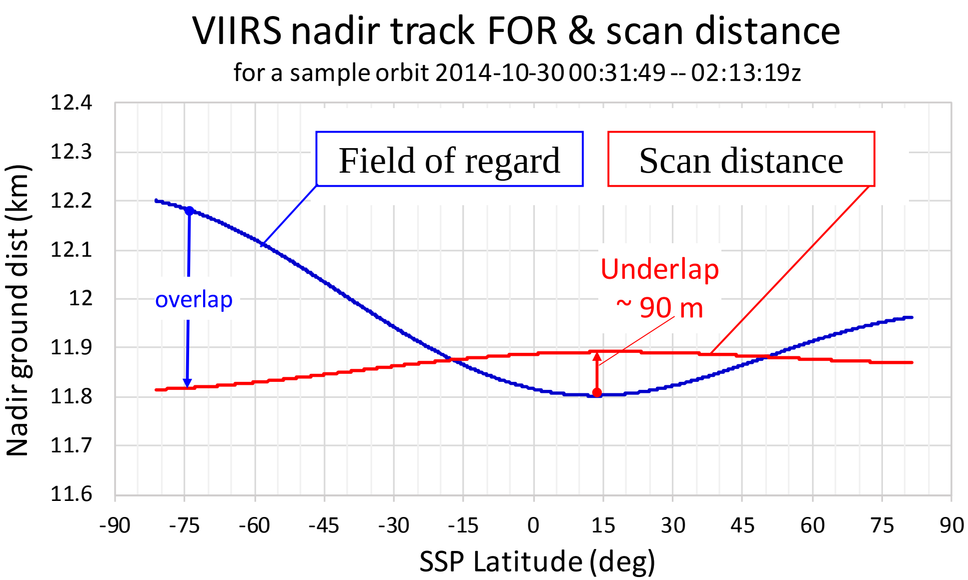
Focal length, scan rate (1/2)

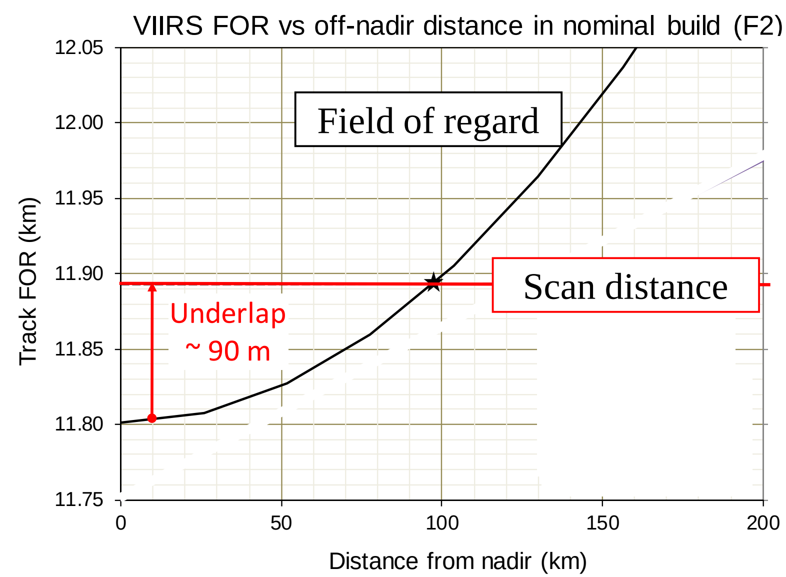
	EFL (mm)	Scan rate (rad/s)	Scan period (s)	EV scan angle (deg)	EV ground distance (km)
SNPP	1135	3.531	1.7793	+/- 56.28	+/- 1528
J1	1141	3.517	1.7867	+/- 56.04	+/- 1510

- Focal length affects scan rate per BBR requirements
- SNPP focal length is too short so that the scan rate is maxed out (+0.4%)
  - On-orbit measurement for SNPP EFL is ~ 0.5% shorter than nominal, see poster
- J1 focal length is nominal, which will be assessed on-orbit

Focal length, scan rate (2/2)

- J1 VIIRS built to nominal optical performance results in unexpected scan-to-scan underlap[1,2]



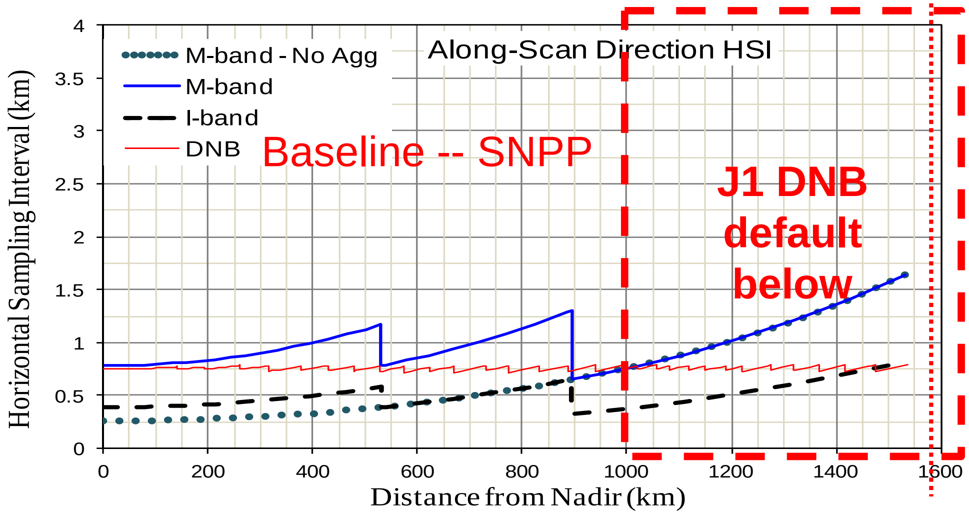


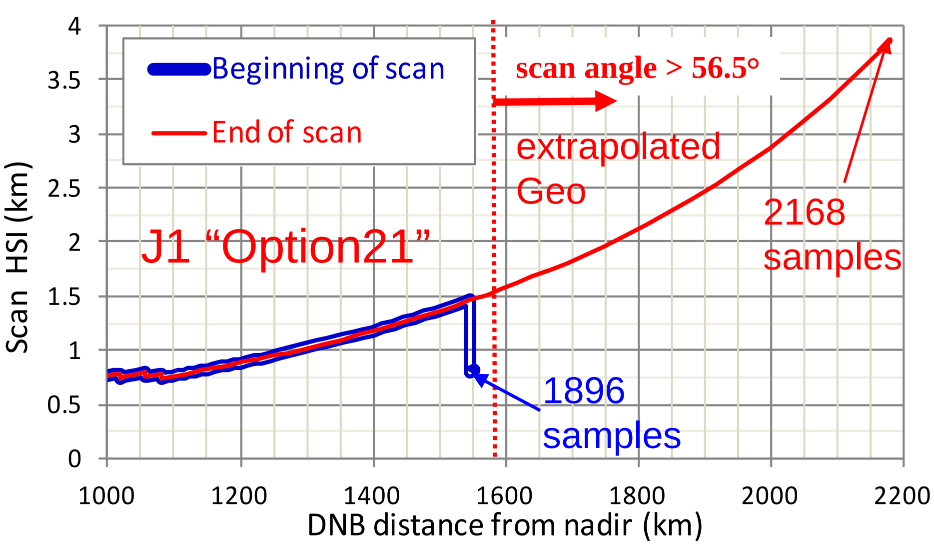
- Largest underlap occurs at nadir and ~15° N in the ground track
- Higher terrain opens up underlap more, ~ 14 m/km terrain height
- Spacecraft jitter makes underlap more in one scan but less in the next

1. Lin, G., R.E. Wolfe, J. C. Tilton, (2016),"Trending of SNPP ephemeris and its implications on VIIRS geometric performance", Proc. of SPIE, Vol. 9972, 99721K, doi: 10.1117/12.2239043.
2. My eRooms > JPSS Science > J3-J4_VIIRS_Performance-Improvement > JPSS Orbit Parameters and Variations

J1 DNB aggregation mode change

-- Thanks to STAR colleagues for code update





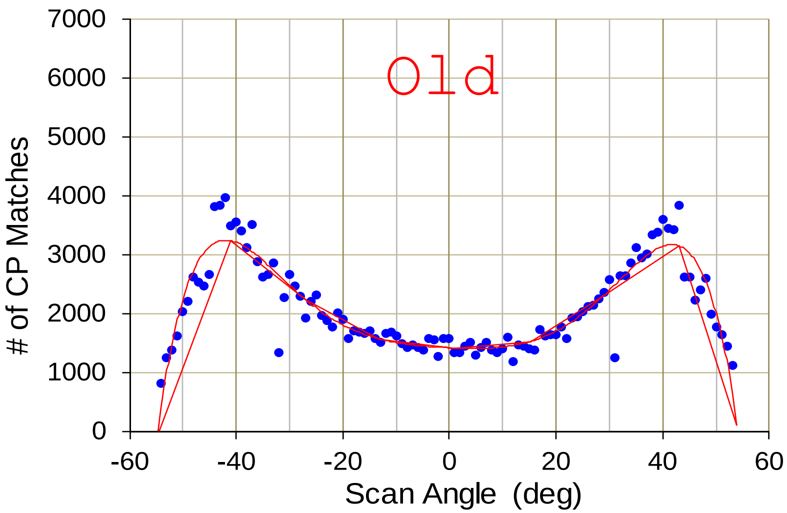
- SNPP baselined pixel size is ~ 750 m
- J1 "Option21" has pixel size growing larger to the end of scan
- Geolocation is extrapolated (no encoder data) post-nadir for scan angle > 56.5°

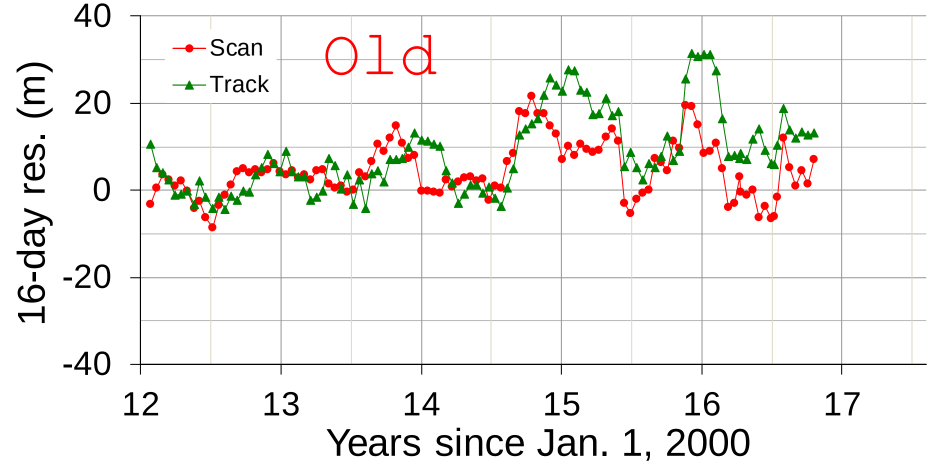
- We will assist validating J1 DNB on-orbit geolocation

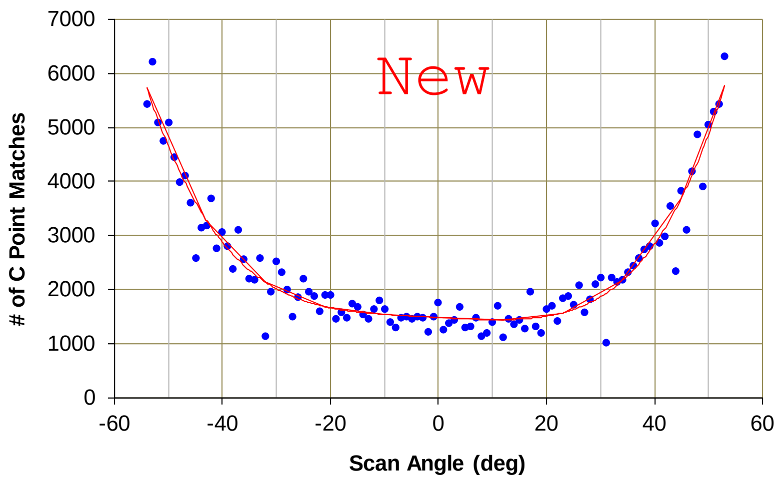
Part 2: SNPP updates for J1 VIIRS geolocation

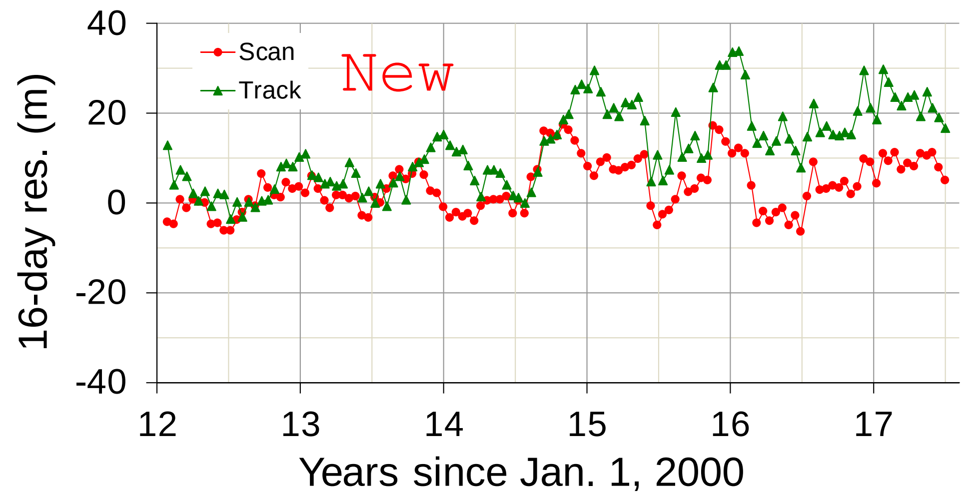
- Improvements completed for SNPP → J1
  - Ground-truthing tool, the Control Point Matching (CPM)
  - Timely delivery of spacecraft diary data
  - One-sided star tracker re-alignment - - no more
  - SNPP star tracker cooling - - reduced frequency of attitude excursions
  - Leap second insertion
- Improvements in the making for SNPP → J1
  - Position error after inclination adjust maneuvers
  - Imagery EDRs using ellipsoidal vs TC geolocation input

CPM code update



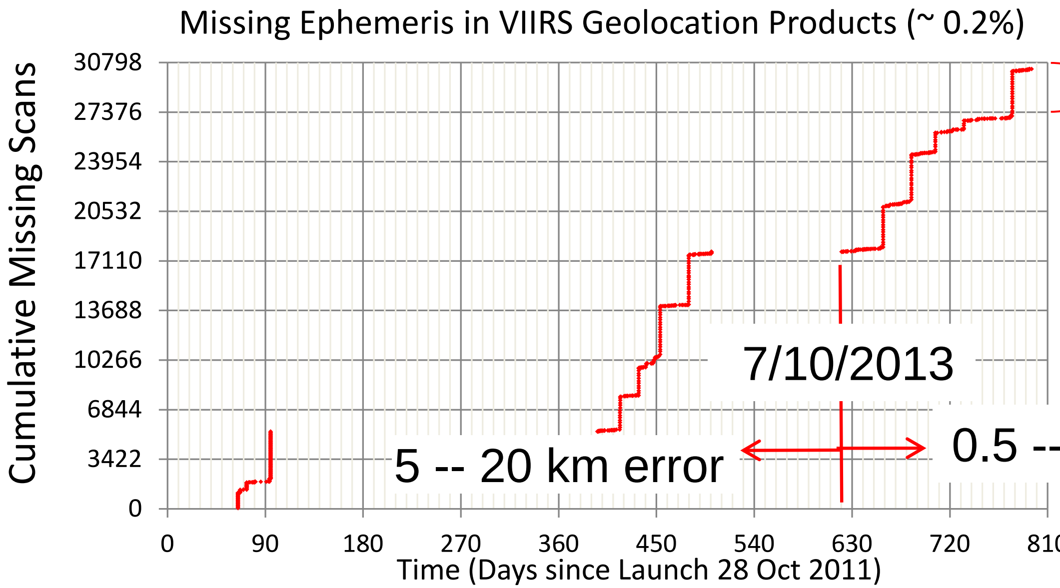






- Bugs are fixed in handling the cross-aggregation zone and cross-scan boundaries (& fixed a few other bugs)
- Measurements of biases are about the same -- drifts in the track (pitch) direction

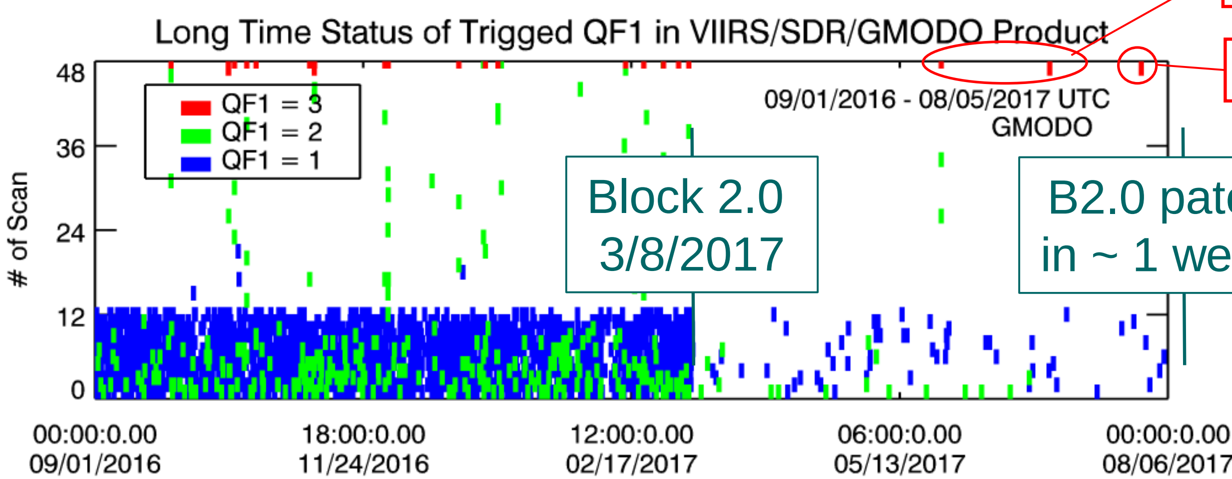
Timely spacecraft diary delivery



One orbit diary data delivery delay
➔ TLE data use
➔ geolocation inaccuracy

Data re-transmissions

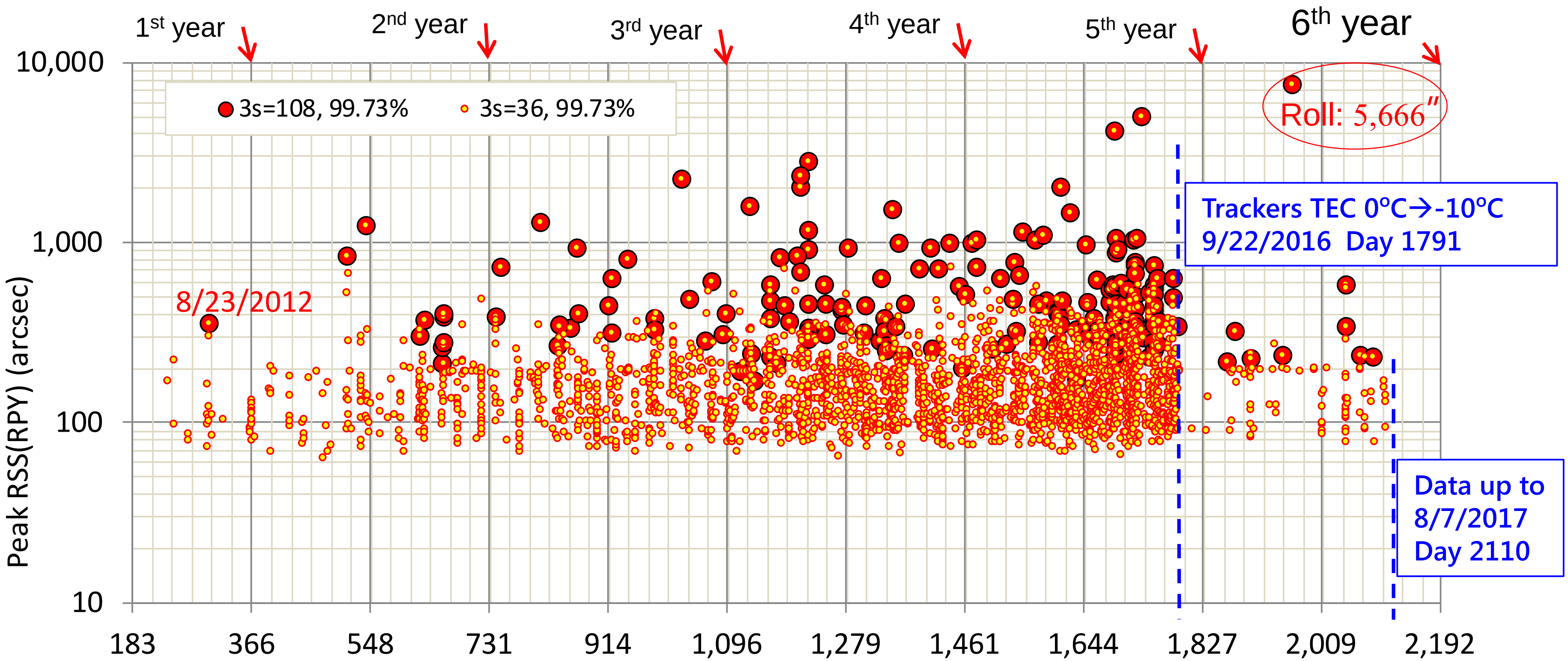
Mx3 TTO human error



➔ Hope no more data delays

Credit: https://www.star.nesdis.noaa.gov/icvs/status_NPP_VIIRS.php

Improvements in SC attitude performance
- - Spec outage and trend

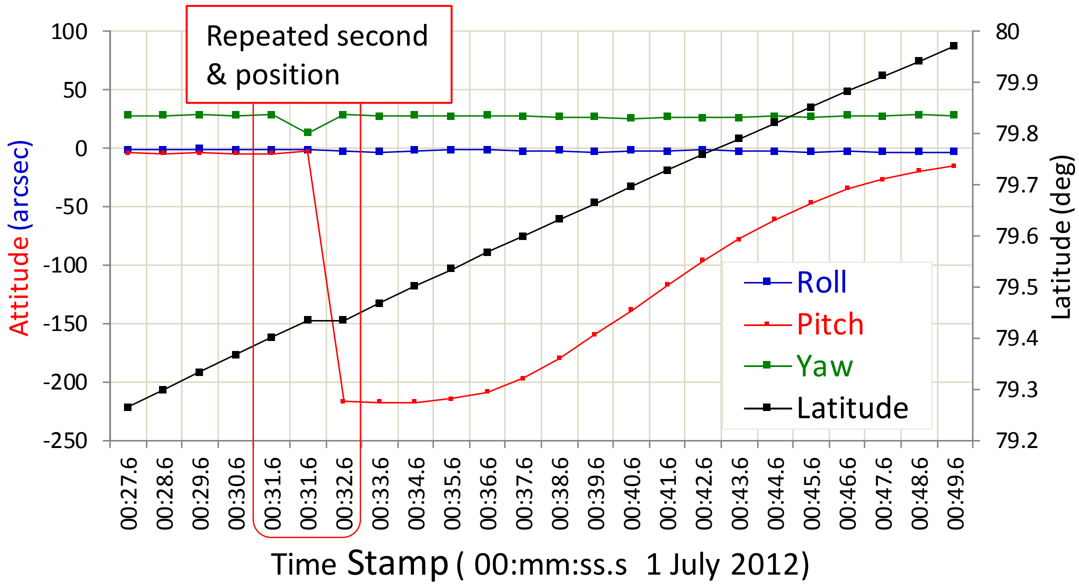


using ~90% data

- Large circles for control spec outage; Small dots hint knowledge spec outage
- Star tracker cooling improved SNPP attitude performance
- We are seeking for further improvements[3]
- We are developing SW with Kalman filter to refine the attitude for NASA SIPSs
- J1 is expected to perform better but we need to monitor/verify

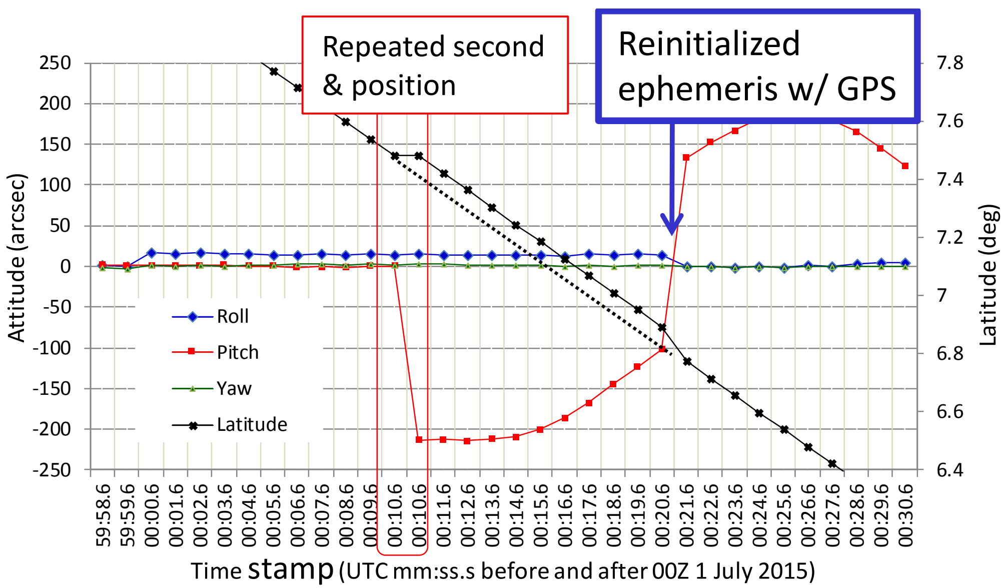
3. My eRooms > S-NPP Flight Operations and Support > FARB > All Discussion Topics--Artifacts and Minutes > DR 6348--SNPP STAR TRACKER DEGRADATIONS OVER MISSION LIFE: ATTITUDE EXCURSIONS AND LUNAR INTRUSIONS > SNPP ADCS and Geolocation Report

Impact from leap second insertion



Original

Leap second insertion at the start of **1 July 2012** impacted geolocation for ~ **3 hours**, primarily due to convergent time in shifted position of ~ 7 km.



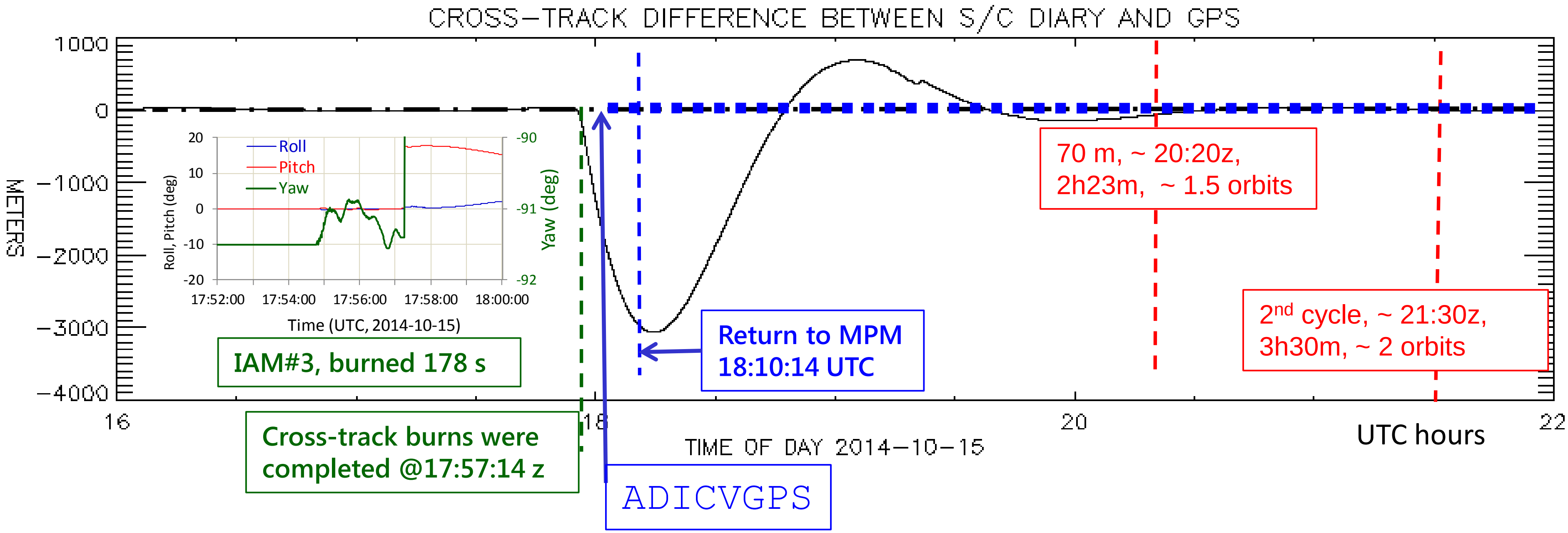
Improved

Leap second insertion at the start of **1 July 2015** and later events impacted geolocation only **1-min**, with ephemeris re-initialized to GPS (command ADICVGPS)

Part 2: SNPP updates for J1 VIIRS geolocation

- Accomplished improvements
  - Ground-truthing tool, the Control Point Matching program (CPM)
  - Timely delivery of spacecraft diary data
  - One-sided star tracker re-alignment - - no more
  - SNPP star tracker cooling - - reduced frequency of attitude excursions
  - Leap second insertion
- Improvements in the making for SNPP → J1
  - Position error after inclination adjust maneuvers
  - Imagery EDRs using ellipsoidal vs TC geolocation input

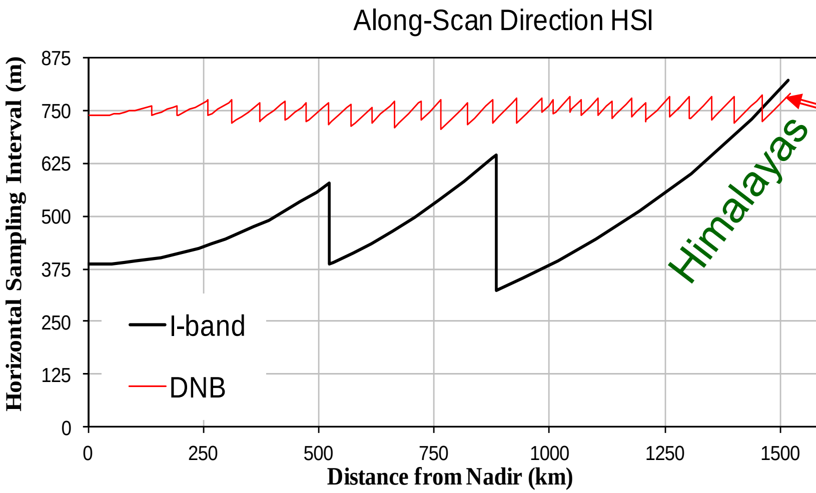
Minimize errors after IAMs

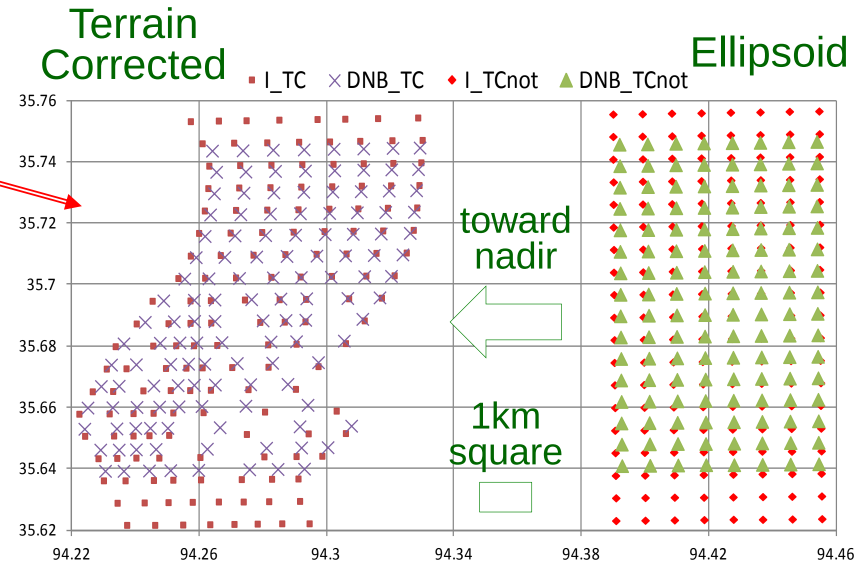


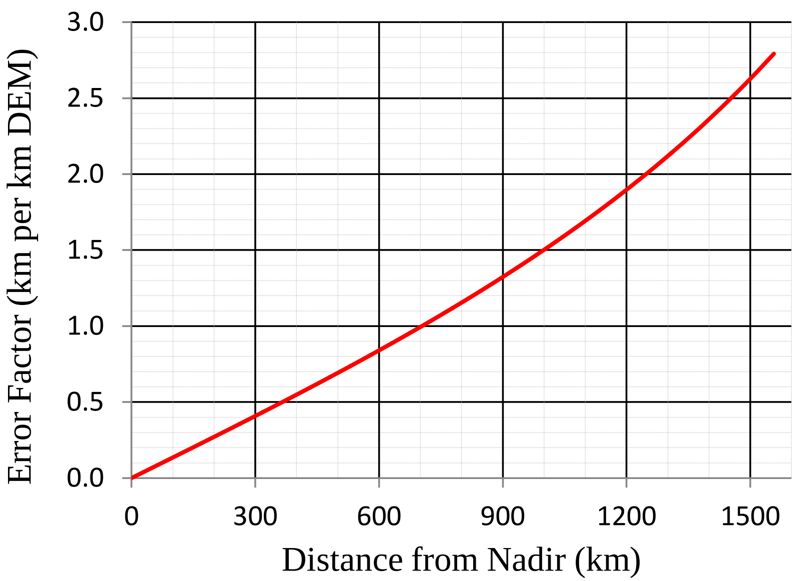
- An Inclination Adjust Maneuver (IAM) pushes the orbit sideway, making the orbit plane to incline toward earth rotation axis (once per year)
- The on-board orbit propagator does not respond to the position change quick enough, yielding position error up to **3000 m** in this case
- Orbit knowledge convergence takes about 1.5 to 2 orbits.

- The MOT folks "are looking to into being able to" re-initialize ephemeris with GPS with command ADICVGPS for IAM planned on 9/20/2017
- The same could be applied to DMUs/RMMs (~ 5 times per year), that have position errors ~ 150 m

Assisting Imagery EDR Team:
Terrain To be or not to be corrected?







- The error in un-corrected ellipsoid geolocation data products depends on position off-nadir and terrain height
- Maximum error factor is ~2.7 km / 1 km terrain height
- Imagery EDR is currently based on ellipsoid geolocation – mountains move from one swath to the next

Note: terrain corrected geolocation products are available for IMG, MOD and DNB

Concluding Remarks

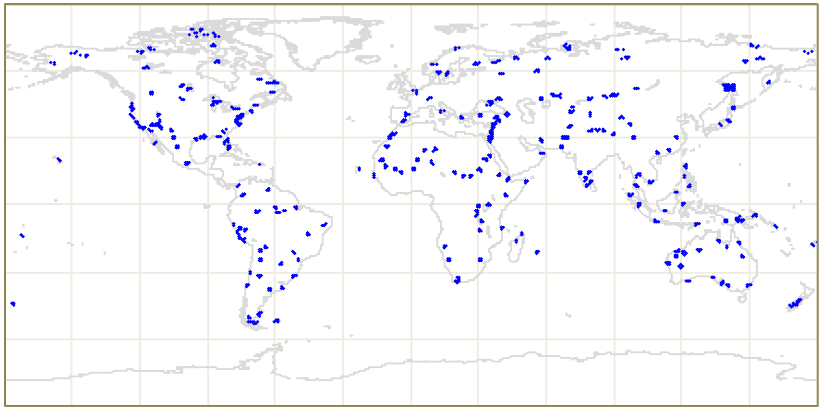
- J1 VIIRS geolocation is expected to perform better than that of SNPP VIIRS, as anomalies (issues) have been resolved, caveats (known deficiencies, challenges and concerns, and curiosities) have been looked into, and lessons learned
  - Due diligence still needs to be performed
- J1 on-orbit geolocation Cal/Val preparation is well underway

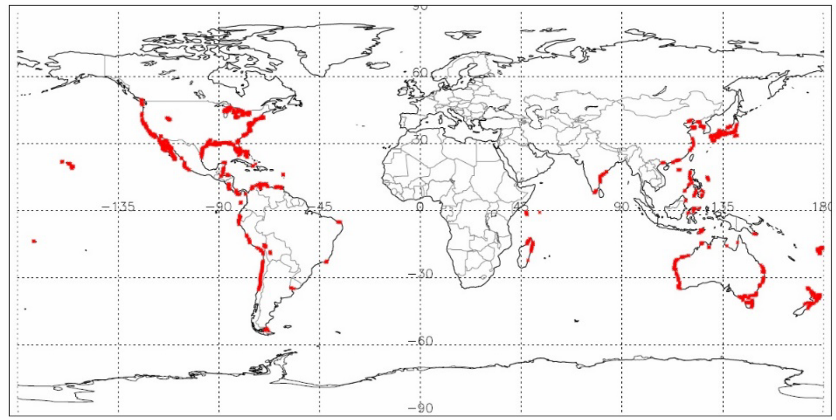
Posters

1) J2 VIIRS ground test data analysis
2) On-Orbit Measurement of the Focal Length of the SNPP VIIRS Instrument

Backup

Control point chips supplements

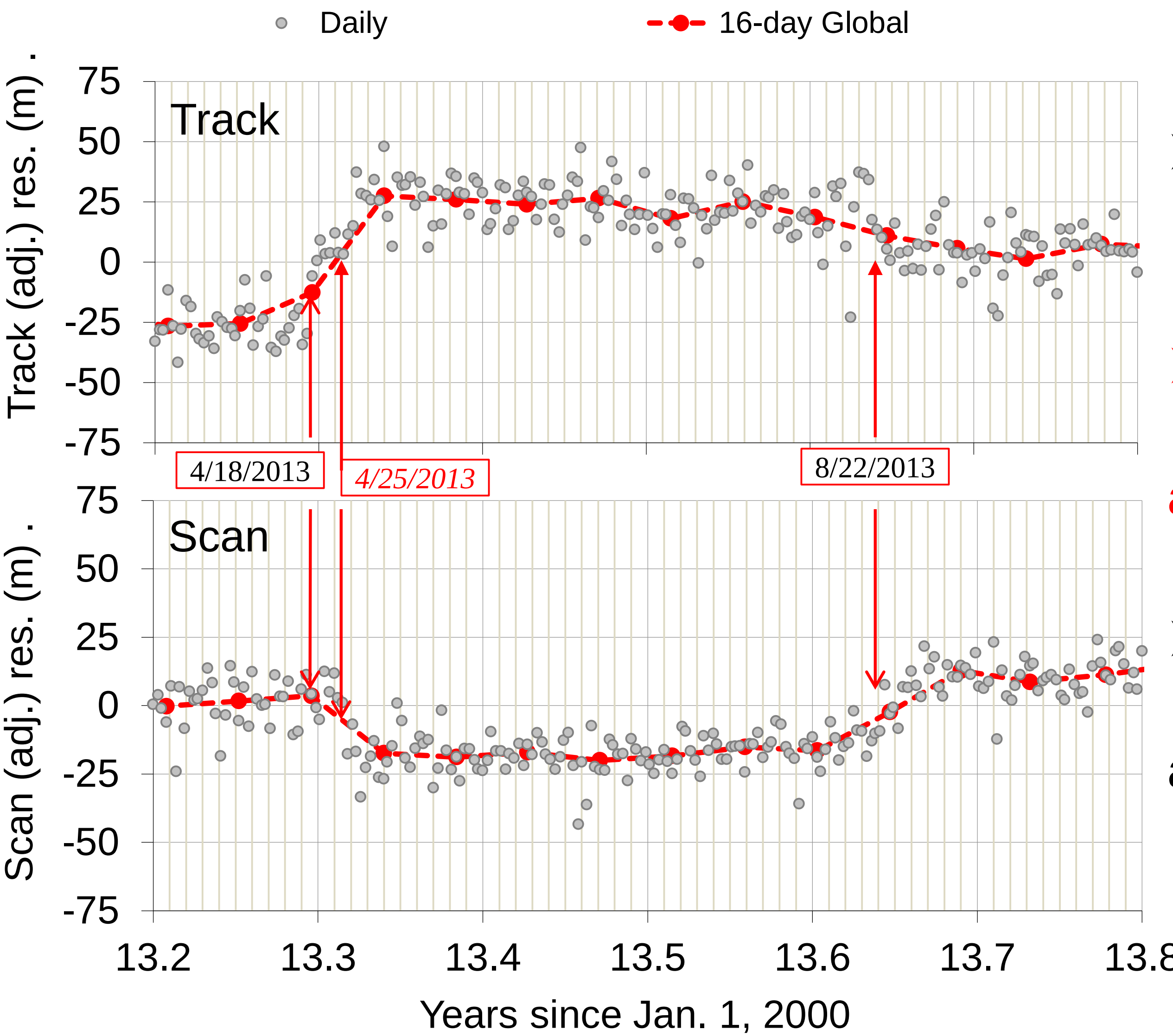




Over 1200 Ground Control Point (GCP) chips of Landsat TM red band (0.64 µm) 30 m nadir resolution, 2003 or earlier. Some chips are out-of-date and are removed from CPM for VIIRS.

To add ~4000 (planned) Ground Control Point (GCP) chips of Landsat-8 30 m nadir resolution. L8 OLI red band 4 (0.64 µm) = VIIRS I1 . Data for all other 10 bands are available. Priority is L8 TIRS band 6 (1.6 µm) = VIIRS I3. Both coastal and inland chips are being acquired.

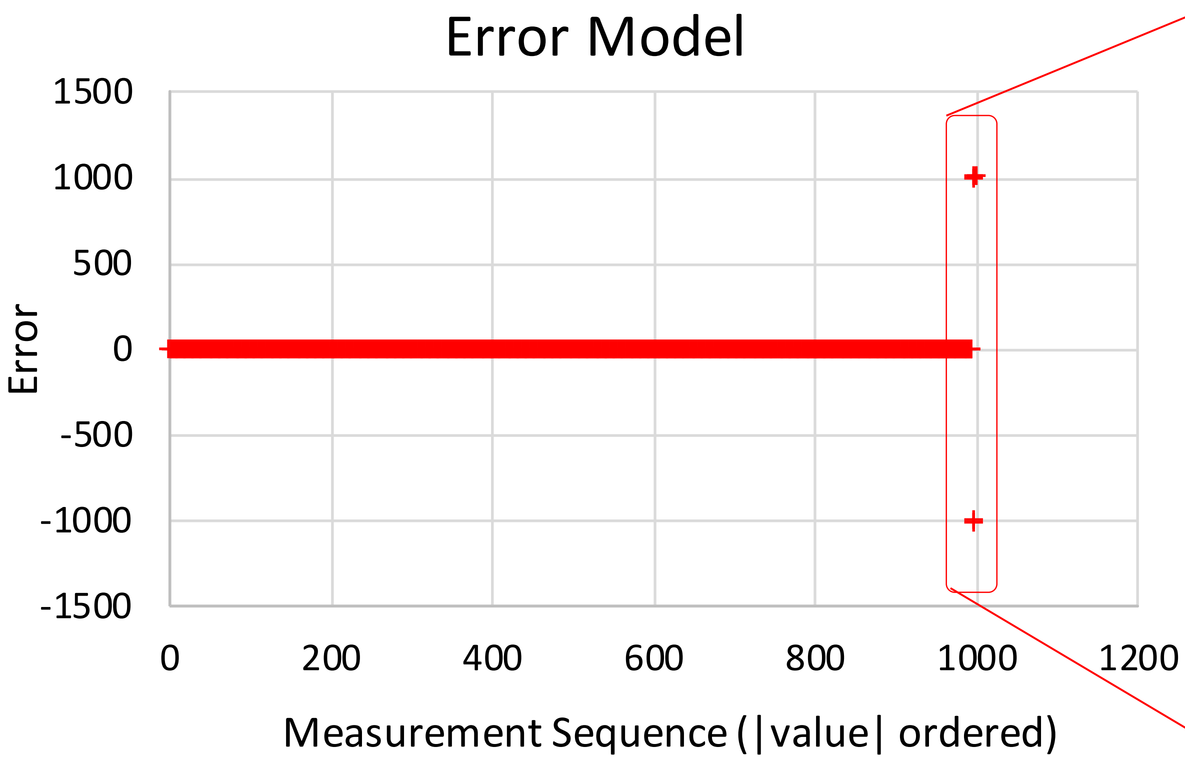
One sided star tracker re-alignment to SNPP and geolocation bias correction



- 4/18/2013: Geo LUTs fine tuned
- 4/25/2013: Star tracker re-alignment
- 8/22/2013 Error ~ 25 m found and corrected

One-sided re-alignment is NOT expected to happen again for SNPP and J1

Improvements & progresses by addressing anomalies, caveats & curiosities



Sequence	Error
1	0
… …	… …
995	0
996	1001
997	-1002
998	1003
999	-1004
1000	1005
mean	1.003
stdev	70.951
RMSE	70.958

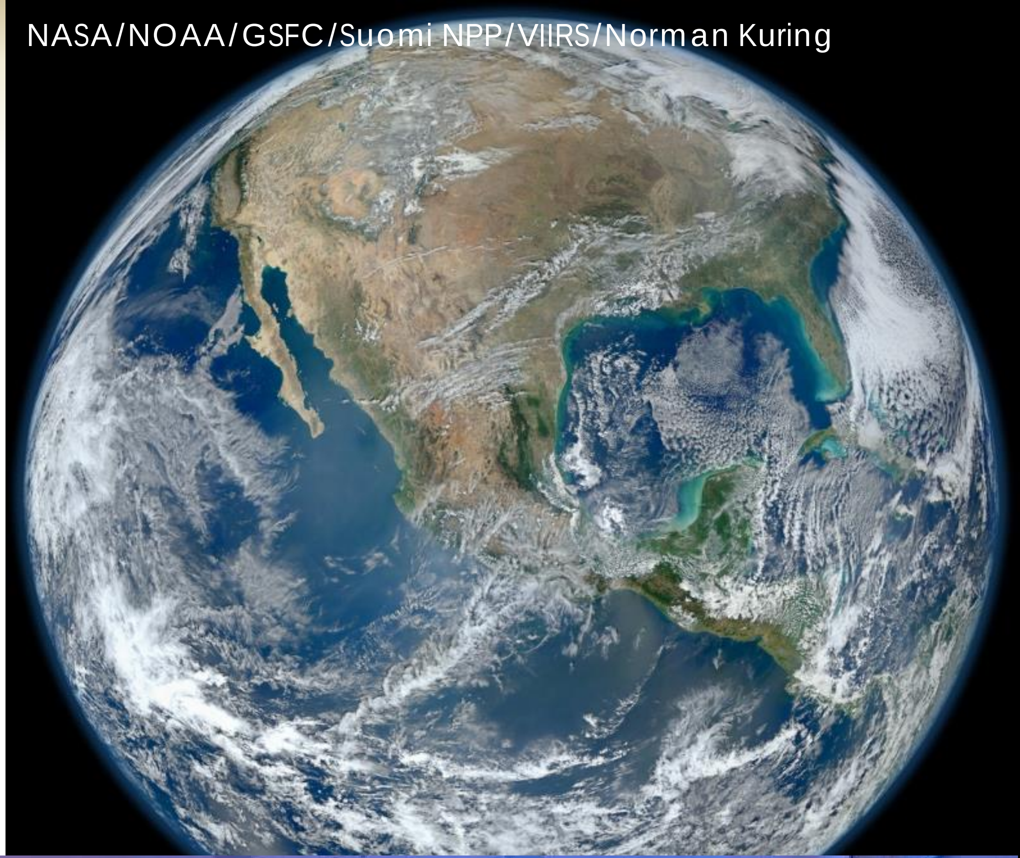
- Rare cases of large errors may not show up well in the mean value
- They do affect “spread” (standard deviation) and uncertainty (RMSE = Root Mean Square Error)
- Specification in “3σ” may be violated when we interpret it as 99.73% of occurrences or detectible measurements

VIIRS J1 - J4 status update

K. Thome, J. McCarthy, H. Oudrari, X. Xiong

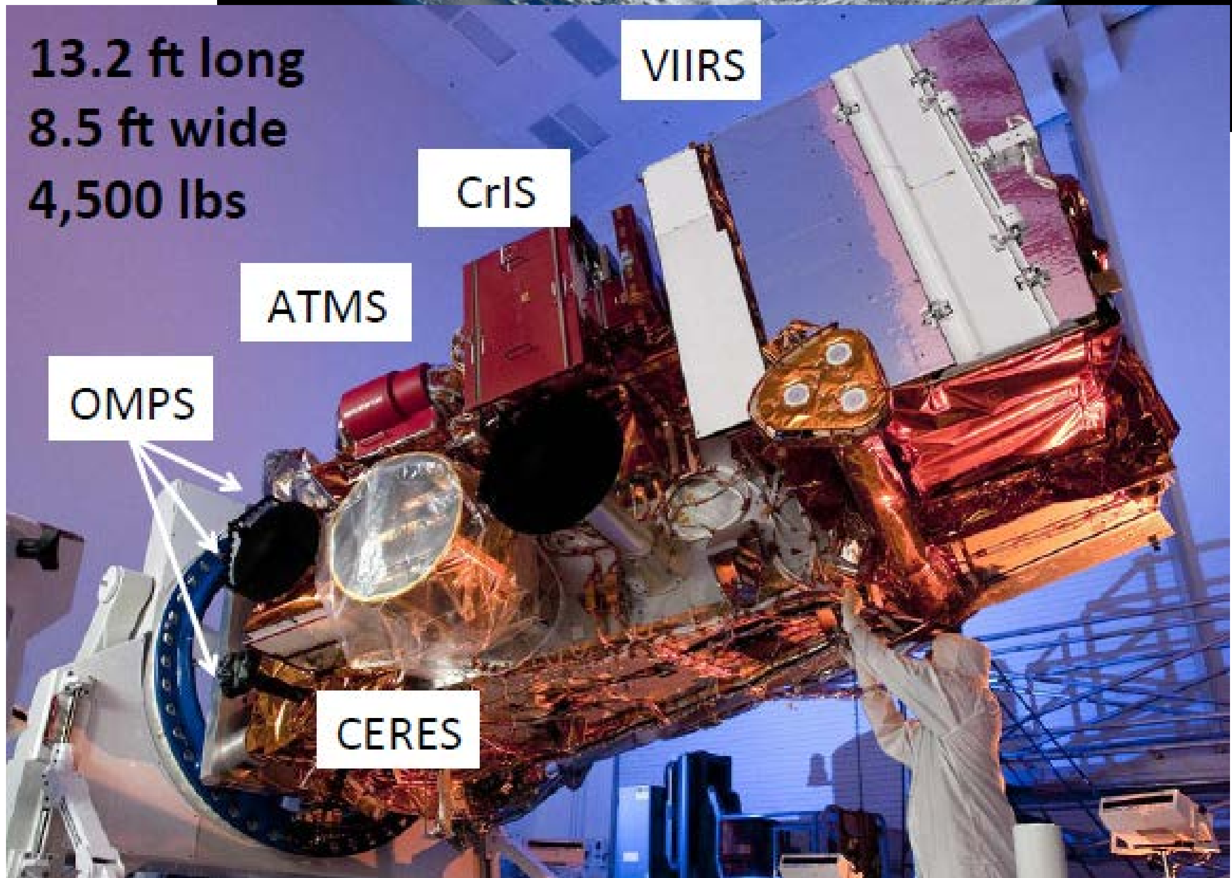
[1]NASA/GSFC, [2]Stellar Solutions, [3]Science Systems & Applications, Inc.

VIIRS reminder



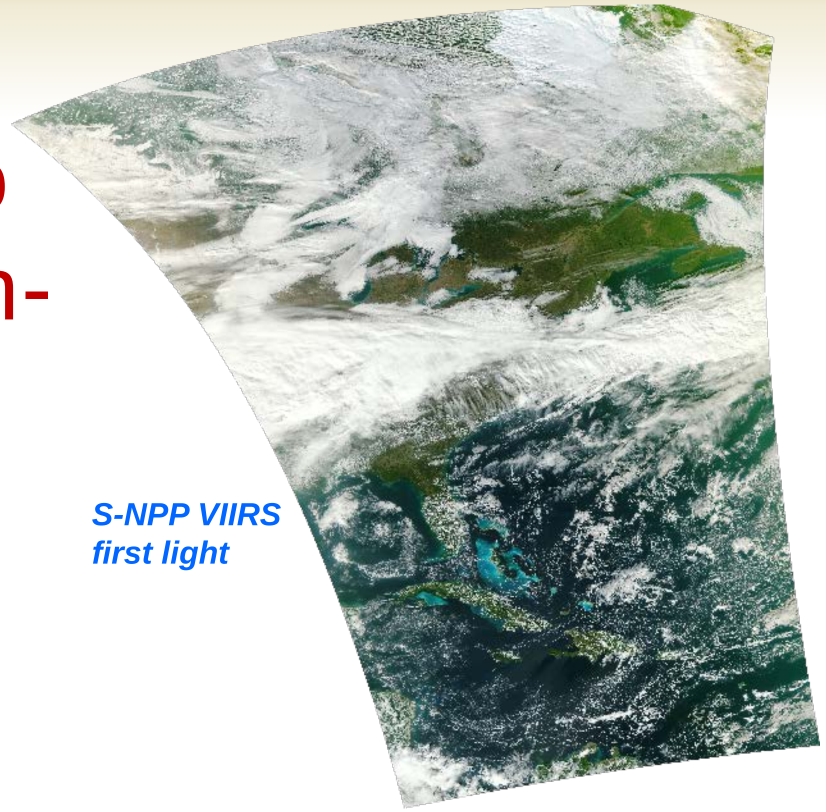
Provides visible and infrared imagery and global observations of land, atmosphere, cryosphere and oceans

- Generates critical environmental products about snow and ice cover, clouds, fog, aerosols, fire, smoke plumes, dust, vegetation health, phytoplankton abundance and chlorophyll
- Extends and improves measurements initiated by AVHRR and MODIS
  - Better spatial resolution
  - Larger swath
  - Day/Night Band



What you should get from this talk

VIIRS is primarily an operational sensor but is also part of a legacy of sensors to understand earth-atmosphere system



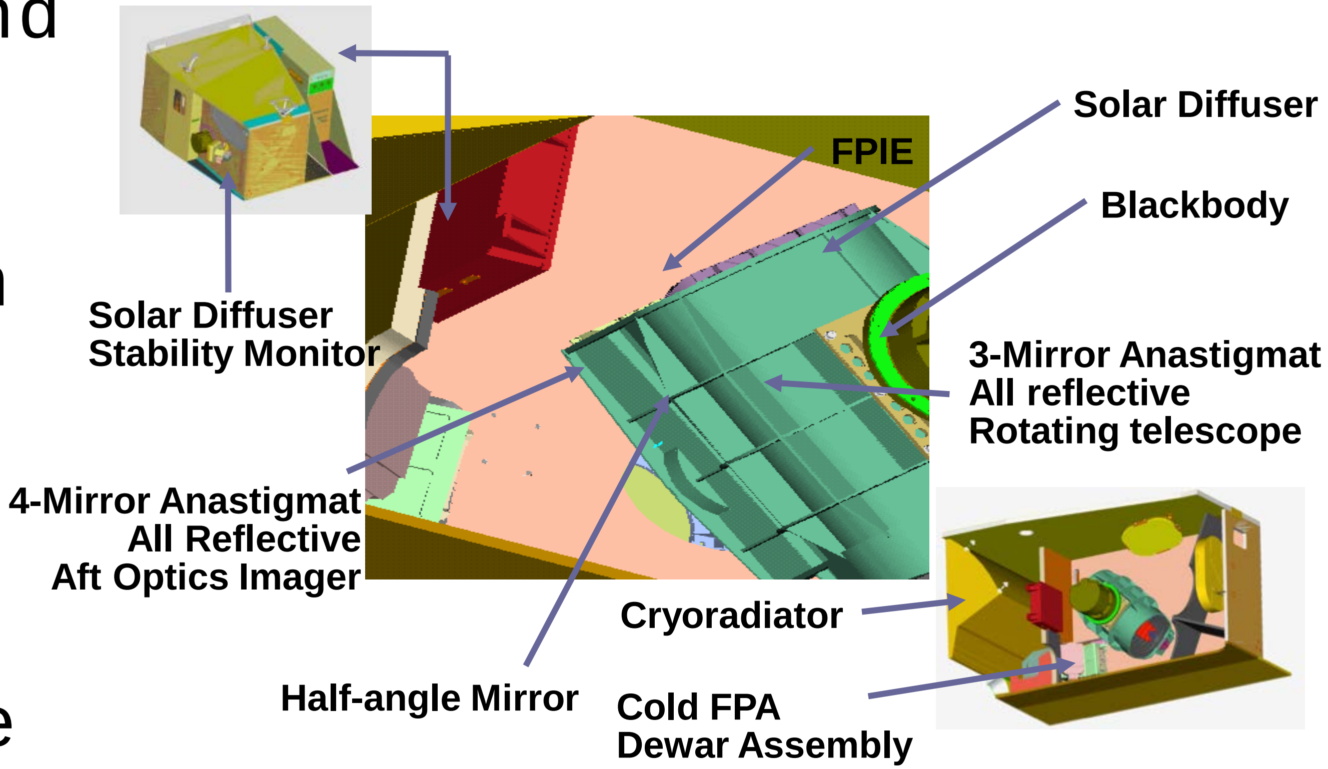
S-NPP VIIRS first light

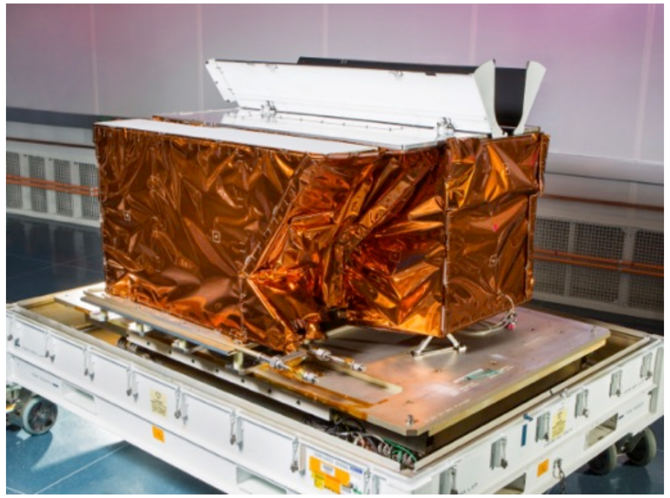
- S-NPP, J1, J2, J3, J4 have same basic design but will not be identical
- The more sensors we build, the more we learn about behavior of current systems and the future builds
- J1 VIIRS is well understood and should provide a worthy follow-on to S-NPP VIIRS
- J2 is on its way to being as well understood as J1
- J3 and J4 have already begun component-level hardware assembly

Overview of pre-launch testing objectives

Characterize overall performance and identify potential noncompliance issues

- Testing includes radiometric, geometric, and spectral performance
- Component and Sub-system Level
- Sensor Level ambient, pre-thermal vacuum (TVAC), TVAC, and post-TVAC
- Observatory Level
- Ensure sensor performance meets design requirements
- Check that sensor data quality will achieve overall science objectives
- Allows key sensor performance parameters to be derived for on-orbit operation and calibration
- Support mitigation strategies to address noncompliance issues

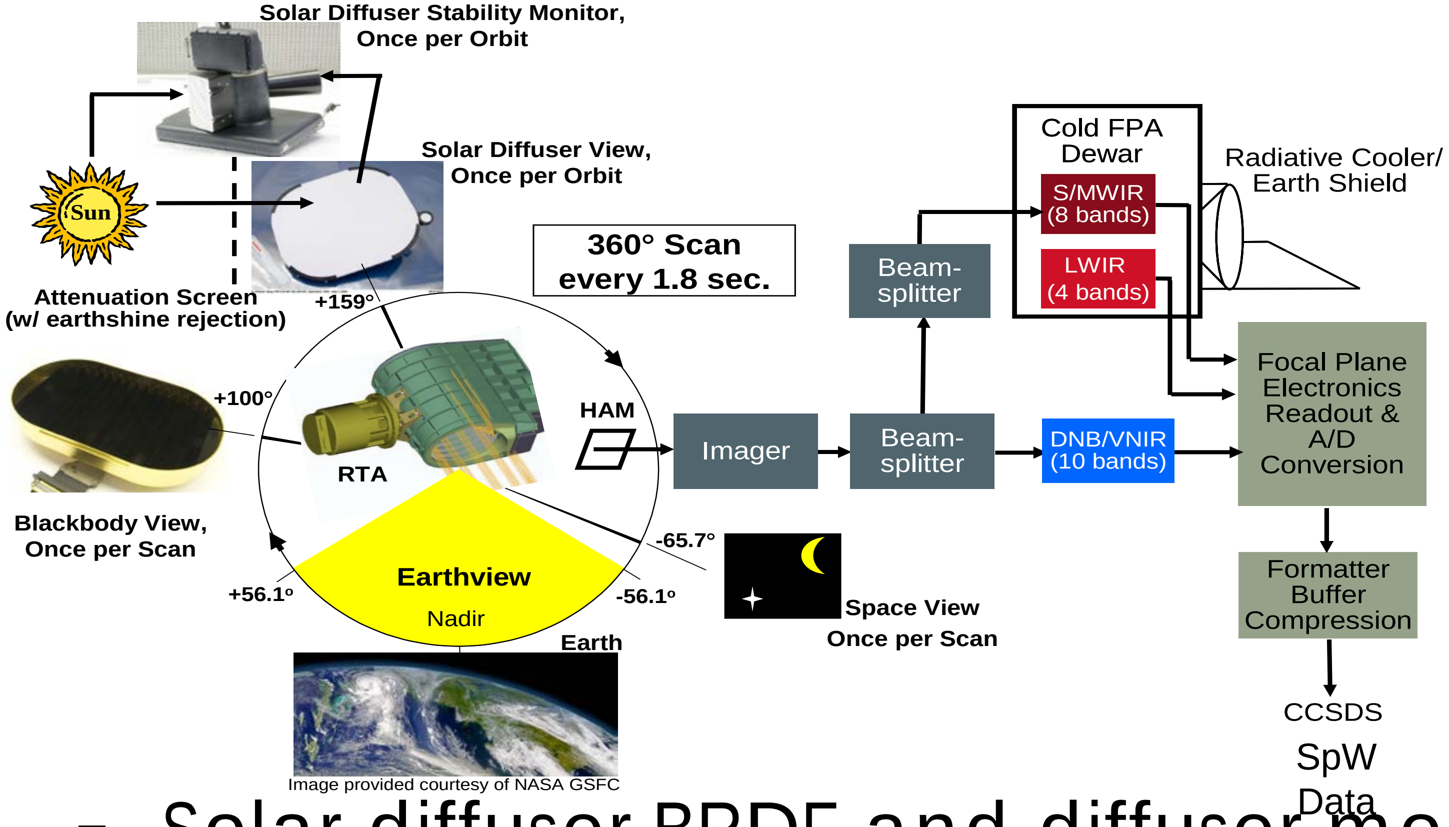




Pre-launch characterization/calibration

Tests also include evaluation of the full system including onboard calibrators

- Radiometric - SNR/NEdT, detector gains and dynamic range
- Spectral - In-band and out-of-band relative response
- Spatial and geometric including band-to-band registration, modulation transfer function, and pointing
- Thermal testing
- Electromagnetic interference
- Response versus scan-angle
- Vibration testing



- Solar diffuser BRDF and diffuser monitor screen transmission function
- Polarization sensitivity
- Blackbody emissivity
- Stray light

Test data evaluation is a team effort

Collaborative and independent assessments by sensor vendor (Raytheon SAS) and government teams

- Government Team includes Aerospace Corp., U. of Wisconsin, NASA, NOAA
- Periodic reviews
  - Data Review Boards to evaluate results presented by sensor team
  - Data Analysis Working Group to evaluate results primarily from government team
  - Special technical interchange meetings
  - Regular briefing at NOAA VIIRS SDR meetings

Raytheon/NASA Team – J1 Sensor Shipping from RTN

J1 VIIRS

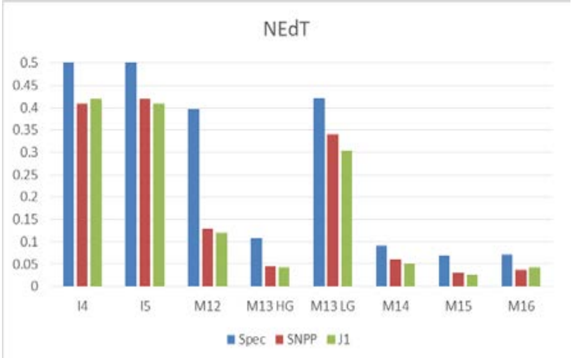
Initial J1 observatory-level thermal vacuum (TVAC-1) testing showed no issues for VIIRS

- TVAC-2 indicated cryoradiator thermal margin was lower than expected based on J1 Sensor TVAC test data
  - Led to added testing for other plateaus within the TVAC-2 testing
  - Radiometric performance is met at the 3 temperature setpoints but predicted M14 SNR margin at end of life does not meet requirement
- VIIRS is bagged and ready for shipment to Vandenburg

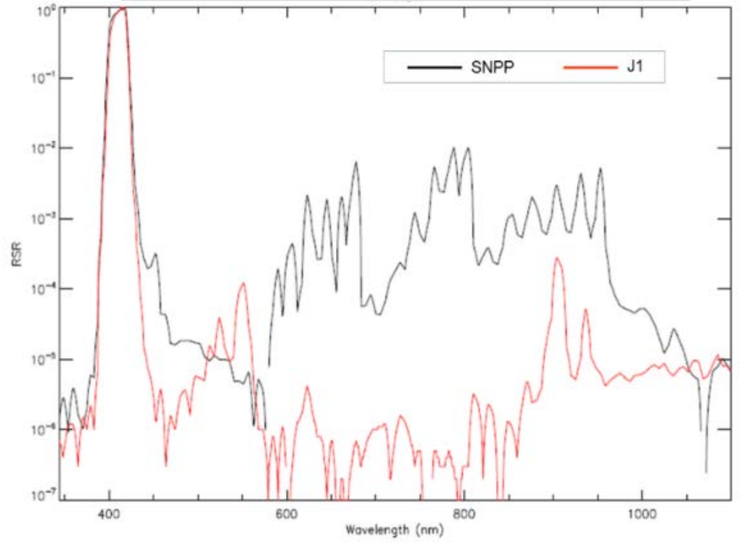
VIIRS J1 installation on the Spacecraft

Reminder – key changes to J1 relative to S-NPP

Lessons learned in the testing and evaluation of S-NPP VIIRS led to several modifications to J1 VIIRS including:



- RTA Mirrors Changed from nickel coated to VQ
  - Improved spatial stability with temperature
- Dichroic 2 Coatings Redesigned
  - Improved spatial performance between SMWIR & LWIR
- Eliminated Throughput Degradation Due to Tungsten
  - Improved radiometric sensitivity
- Enhanced VisNIR Integrated Filter Coating Change
  - Improved crosstalk, out-of-band performance
  - But, led to higher polarization sensitivity for Bands M1 – M4
- Build variations between J1 and S-NPP led to several performance differences between the two including 15 performance waivers and their associated mitigation plans or impact evaluations

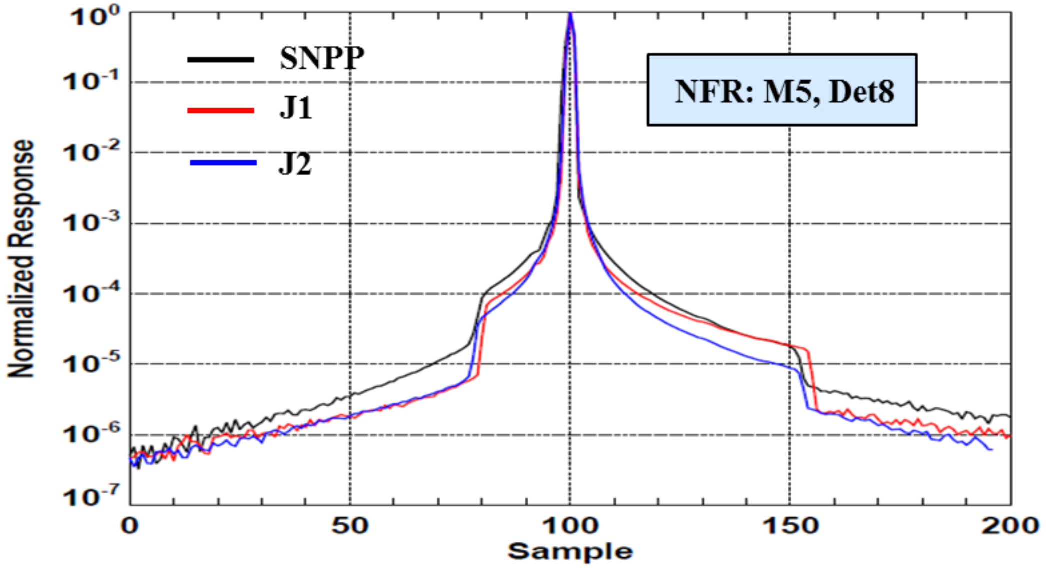


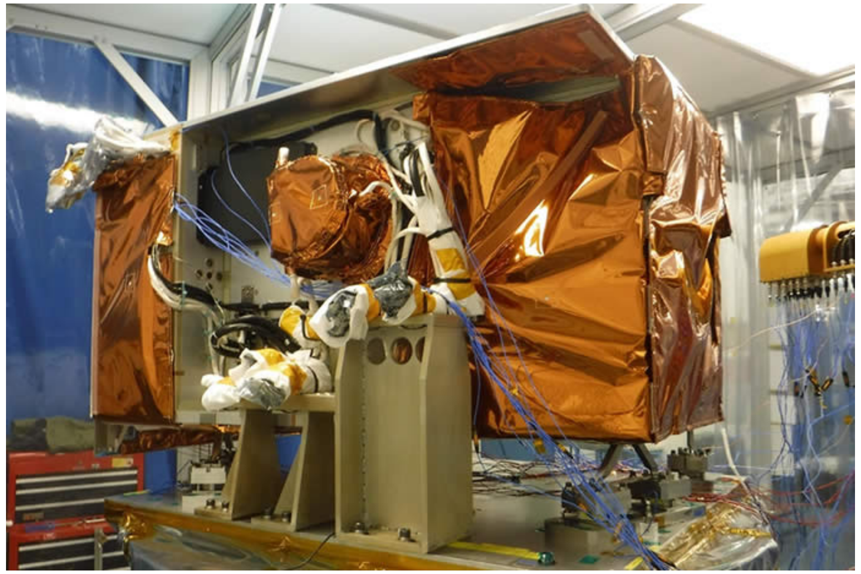
J2 VIIRS currently in TVAC testing

Performance testing and evaluation is following similar path as done for S-NPP and J1

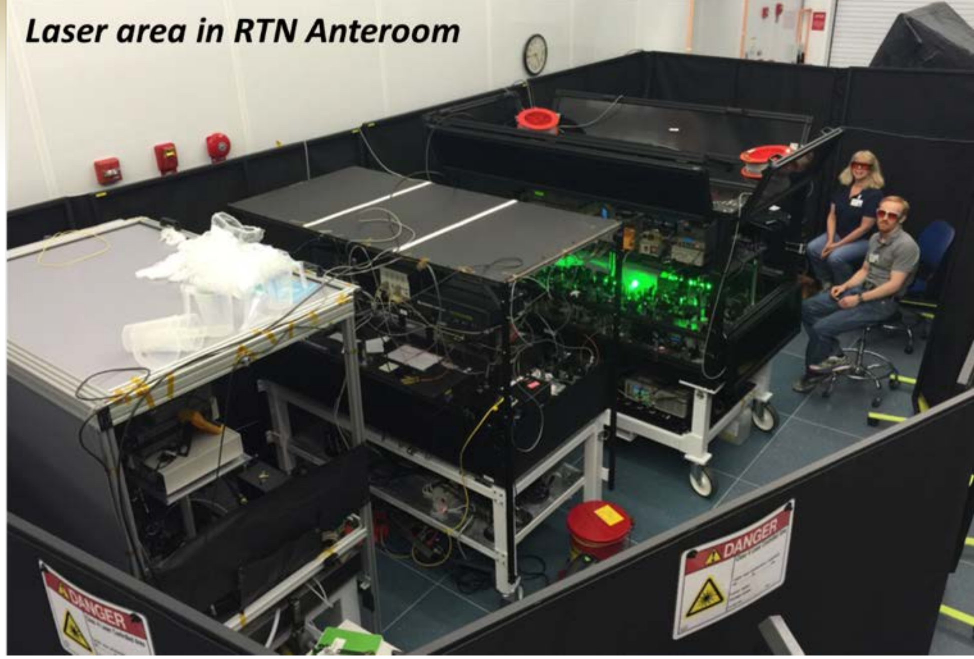
- Evaluating J2 relative to J1
- Pre-TVAC testing with GLAMR (GSFC Laser for Absolute Measurement of radiance tunable laser
- PER took place last fall followed by vibration, electromagnetic interference and compatibility (EMI/EMC), pre-TVAC
- TVAC testing began earlier this summer


Completed J2 VIIRS instrument



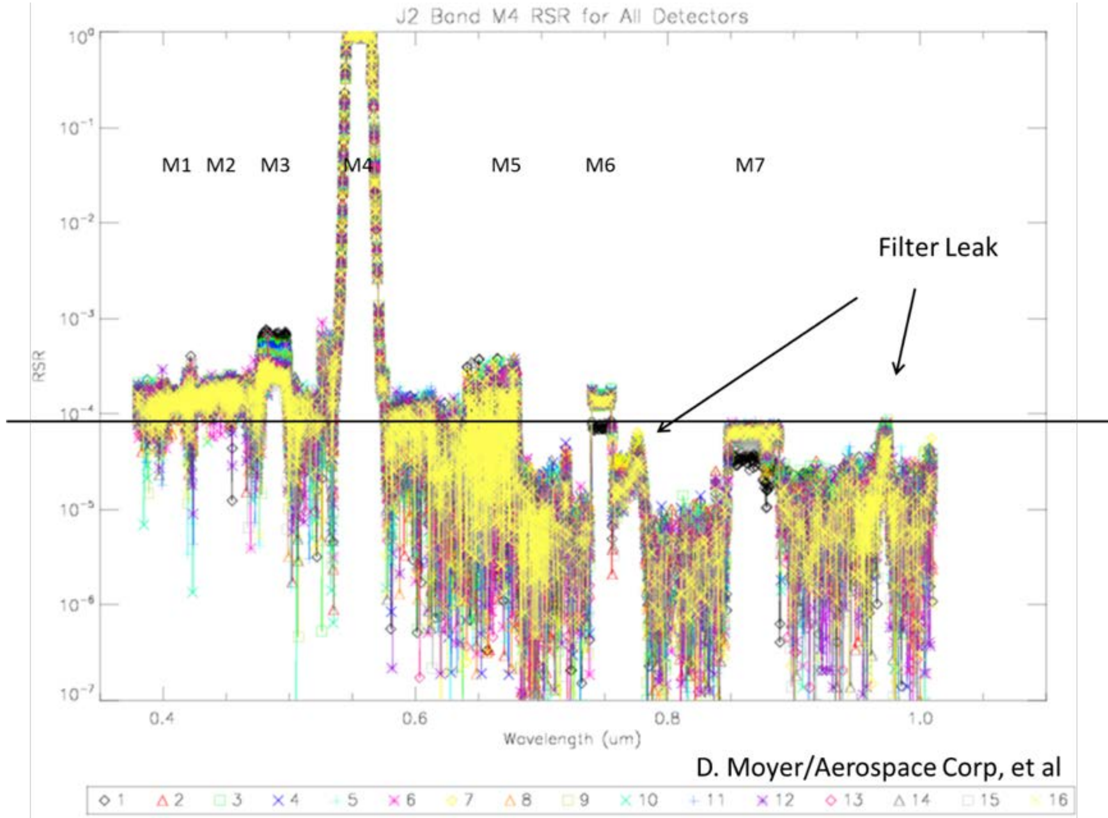

J2 VIIRS on vibe table

Reminder – key changes to J2 relative to J1



JPSS-2 VIIRS similar to predecessors, with multiple performance improvments including:

- Redesign of VisNIR integrated filter assembly (IFA) filter to reduce polarization sensitivity
- Changes to aft optics assembly (AOA) fold mirror #2
- Eliminated SWIR and DNB non-linearity issues seen in J1
- J2 test program includes lessons-learned:
  - Better efficiency
  - Cost reductions
  - Enhanced stray light testing
  - Shorter crosstalk testing
- Early results indicate no major issues with J2 VIIRS



D. Moyer/Aerospace Corp, et al

J2 VIIRS is performing well

But, as with all sensors, there are features that will affect the quality of the data

- Studies of the optical results from J2 VIIRS indicated a scan underlap
  - Present in J1 VIIRS
  - Build variations in optics means that S-NPP VIIRS data minimally affected
  - Modifications to J2 VIIRS optical system and sampling approach has mitigated this issue
  - Effect on science should be limited
- Testing of the onboard blackbody uniformity returned a value that exceeds the subsystem uniformity requirement
  - Still in the early stages of determining possible cause
  - Unclear at this point whether it will impact J2 VIIRS performance

Other J2 features

- J2 testing has included added thermal tests to gain better understanding of the cryoradiator model
- Polarization characterization has a requirement that uncertainty is to be less than 0.5% (1 sigma) for scan angles less than 55.84 degrees
  - VIIRS instrument level polarization test uses a lamp-based, spherical integrating source (SIS)
  - On orbit VIIRS sees top of atmosphere (TOA) radiance based on solar illumination
  - Polarization model now has a better model for SIS – TOA uncertainty
  - Band M1 is most sensitive to SIS- TOA uncertainty
  - Issue found while attempting to determine the best optical elements to use for the J3 instrument
  - Possible additional testing after TVAC is being weighed that would better simulate the expected on-orbit solar spectrum

J3/J4 lessons learned

Instrument Heritage Review took place last year to determine possible modifications for J3/J4 relative to J2

- Decreased polarization sensitivity of M1 through appropriate selection and characterization of dichroic beamsplitters
- Eliminating near-IR out-of-band leak in solar diffuser stability monitor (SDSM) filters
- Satisfy end-user/science need to minimize scan-to-scan underlap
- Identifying methods to ensure system performance for J3/J4 after an expected 10+ years on the shelf
- J1+ Test & Verification Lessons Learned under evaluation for J3+

J3/J4

J3/J4 VIIRS is already beginning assembly

- Electronics Module circuit card assemblies (CCAs) in build+test, focal plane arrays (FPAs) in work (J2 Spares), opto-mechanical module procurements
- J3 DNB/FPIE Testing
- Raytheon exploring options for dichroic beamsplitter (DBSP-1) to reduce band M1 polarization
- Raytheon determined method to select solar diffuser panels with reduced susceptibility to on-orbit UV degradation
- Near-term future efforts
  - OMM lower level assembly builds
  - Continue EM and OMM electronic CCA builds
  - Start FPIE/DNB TVAC Test
- Work on the final integration of the J4 Spare DNB build

Getting ready for J1 launch - Post-launch tests - PLTs

J1 VIIRS has a clearer idea of how the sensor will be tested and evaluated during commissioning

- Thanks to the efforts from the JPSS flight team at GSFC, members of STAR at NOAA, and Raytheon
- PLTs based on the lessons learned during S-NPP testing
- Tailored toward the lessons learned during pre-launch tests
- Balance of
  - Vendor has to verify requirements for sell off
  - Early data points for instrument trending
  - One-off collections for sensor understanding
  - Early characterizations that can only be done shortly after launch

Example Post Launch Tests (PLTs)
Pitch Offset (Backflip) for Instrument Calibration
Spacecraft Jitter Characterization Post Launch
Consolidated SEU Trending
VIIRS Compressed Emissive Band Calibration
VIIRS Solar Diffuser Characterization Maneuver
VIIRS Lunar Roll Calibration and Sector Rotation
CERES Solar Calibration/ Interference/ Glint Evaluation, & OMPS Solar Diffuser Goniometric Calibration Maneuver
VIIRS Activation
VIIRS Dynamic Range and Linearity Verification
VIIRS Solar Diffuser Calibration

Conclusions

A five sensor development program for operational measurements is a challenge

- Lessons learned from S-NPP to J1 to TVAC testing of J2 have led to improvements along the way
  - Sensors will always have build-to-build variations
  - Collaboration between all groups involved has improved and led to better understanding of each subsequent sensor
- J1 VIIRS is bagged and ready for its post-launch testing
- J2 has been baked, shaked, irradiated, and is now in a cold, dark, airless place
- J3 and J4 are progressing through subsystem builds
- J1 and J2 both show differences from S-NPP but all indications are the data from both will be readily incorporated into the operational processing as well as fit within the longer history of previous sensors

VIIRS Radiometric Performance Improvements for Operations

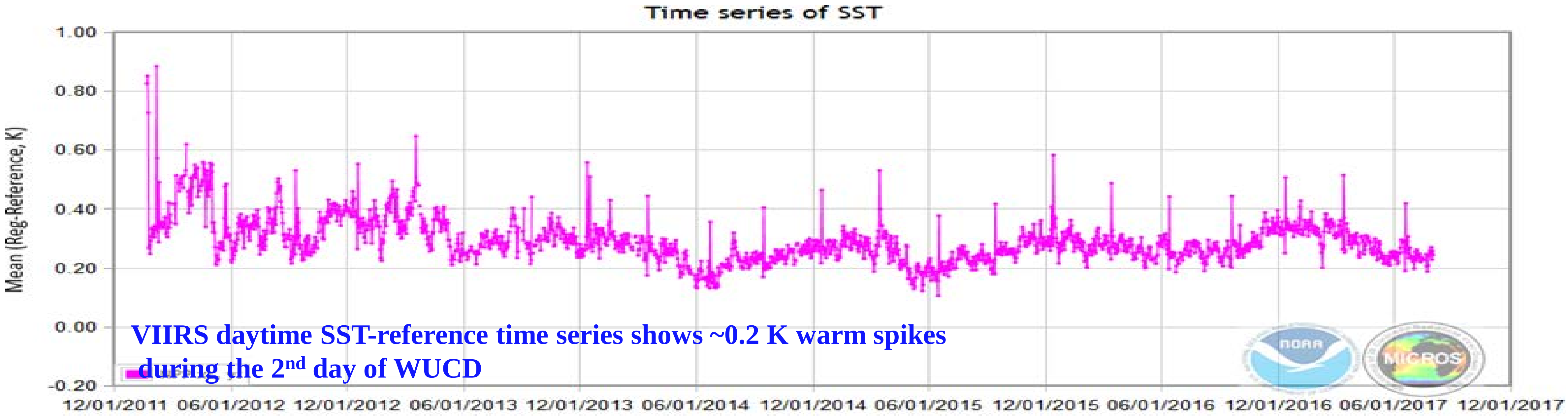
1) Thermal Emissive Band (TEB) improvements- WUCD correction (W. Wang)

2) Kalman Filter-based Predictive Model to Support Near Realtime VIIRS RSB SDR Product (X. Shao)

STAR JPSS Annual Science Meeting, 14-18 August, 2017

Progress in TEB Calibration & Anomaly Resolution

- S-NPP VIIRS TEB calibration performs well during nominal operations:
  - Achieved validated maturity on March 19, 2014
  - Quarterly onboard blackbody warm-up-cool-down (WUCD) are used to characterize calibration offset and nonlinearity changes
- VIIRS SST product is consistent with reference, except for long standing anomalies during WUCD.

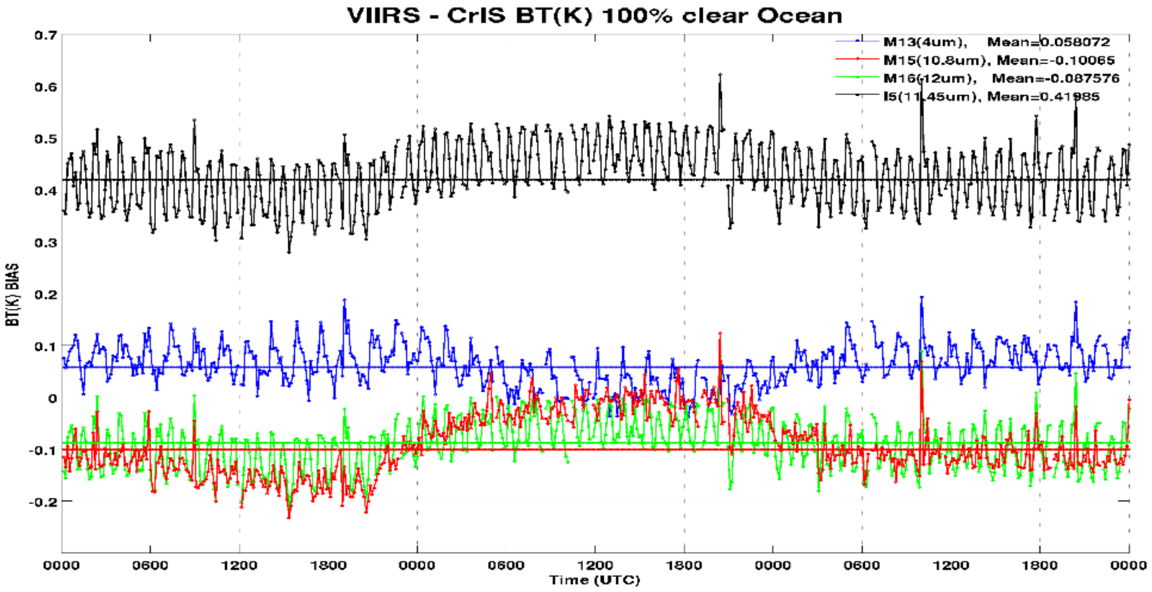


TEB Calibration Bias during WUCD

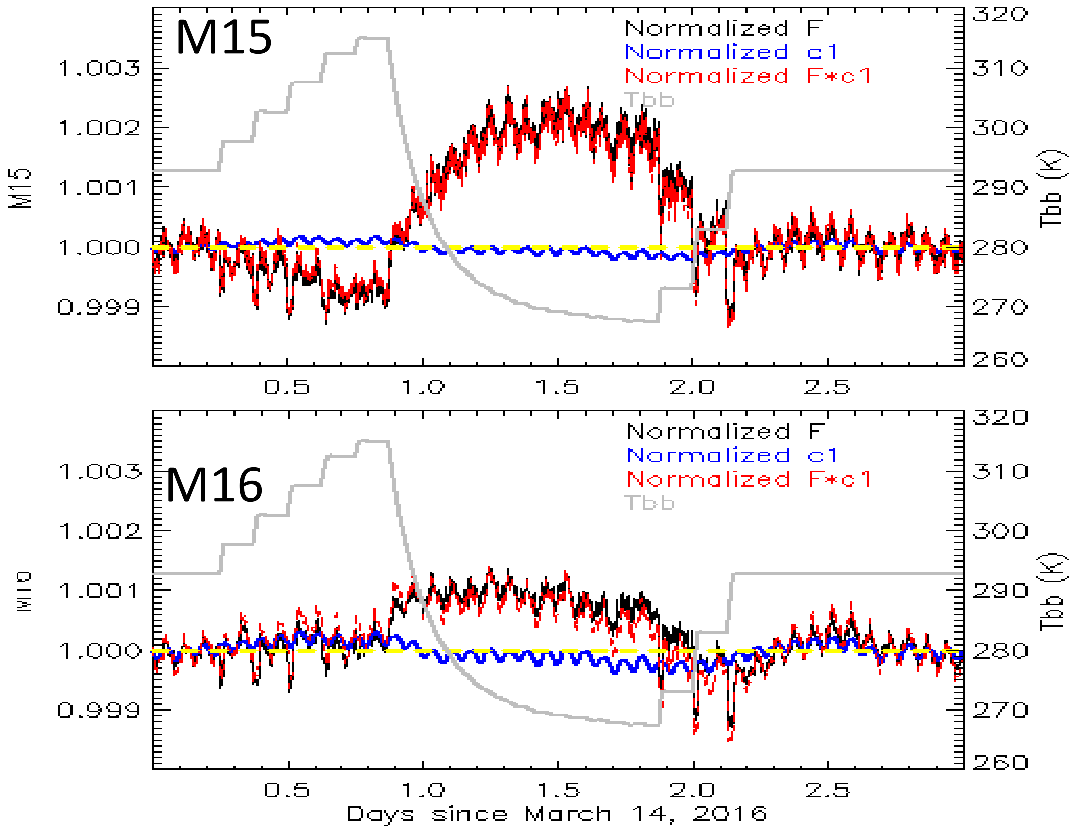
- SST WUCD anomaly is mainly caused by calibration biases in M15/M16 and further amplified by the SST algorithm (Cao et al. 2017)

M15 WUCD bias: 0.1 K
M16 WUCD bias: 0.05 K

WUCD biases were also observed in other TEB bands, with different magnitude/patterns



Courtesy of Dr. Jun Li (University of Wisconsin Team)



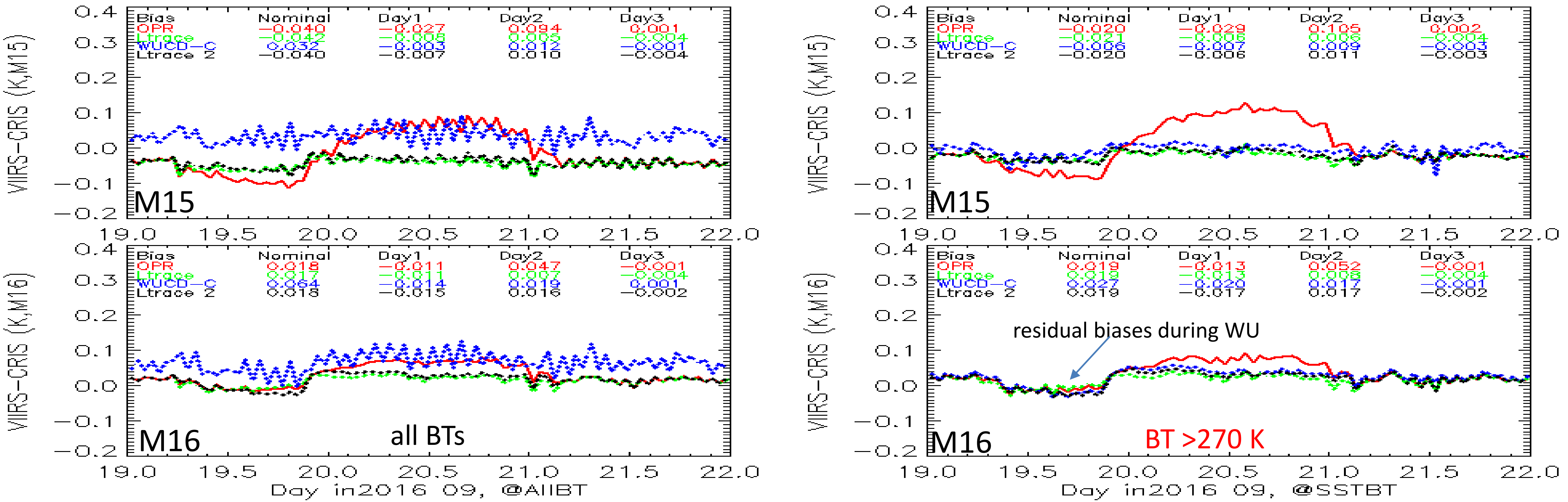
F-Factor anomalies during WUCD

NOAA STAR Algorithm (Cao et al. 2017)
for TEB WUCD calibration bias correction

- **VIIRS TEB WUCD biases are due to a flawed theoretical assumption in the TEB calibration equation**
  - The assumption is not working well during the WUCD event when the blackbody is unstable
- **Three correction methods were developed, implemented, and validated:**
  - **The Ltrace Method (empirical)**
    - Introduces an additive correction term (Ltrace) to the TEB F-factor equation to reconcile calibration curve changes during WUCD;
    - Localized correction, applying during non-nominal Tbb only.
  - **The WUCD-C Method**
    - Uses WUCD-derived C coefficients for TEB calibration, global correction method
  - **The Ltrace v2 Method (analytical)**
    - Introduces scaling factors to the operational TEB F-factors;
    - Scaling factors are derived from prelaunch and on-orbit WUCD derived C coefficients under nominal and actual BB temperatures;
    - Localized correction, implementation similar to the Ltrace method.
  - All methods are easy to implement operationally.

WUCD Bias Correction Method Validations

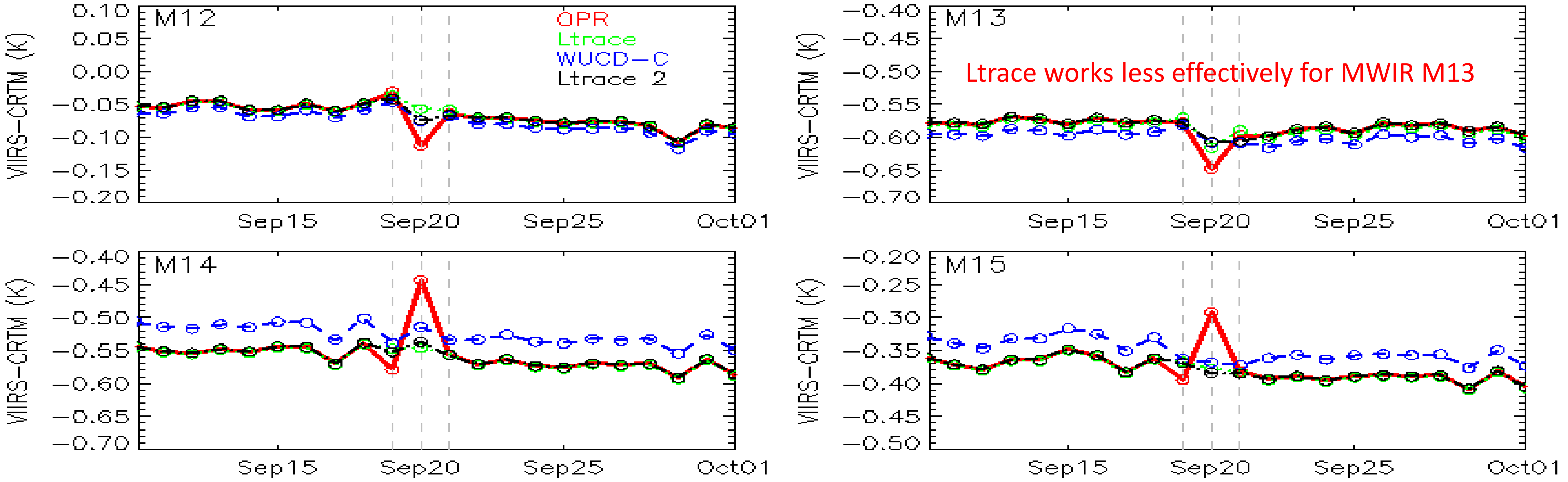
- Using co-located CrIS observations

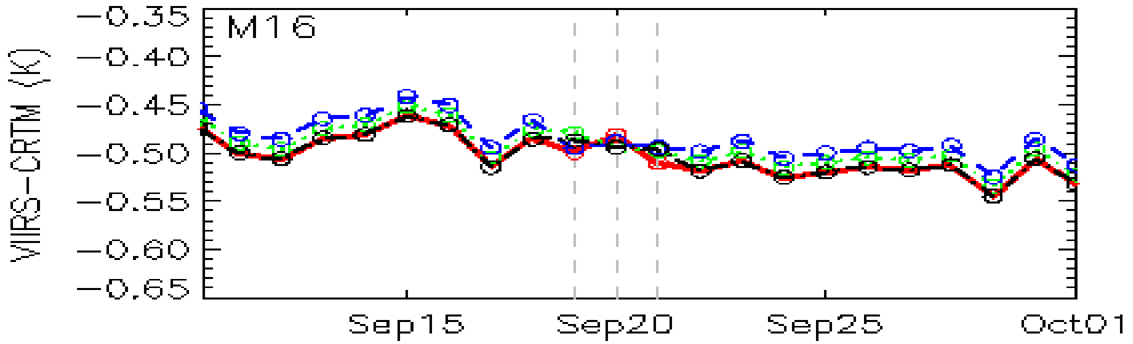


- **The three methods perform well for WUCD bias correction**
  - residual WUCD biases: 0.01 to 0.02 K;
  - **The Ltrace method perform the best, residual bias 0.01 K;**
  - Small under-corrections during the warm-up phase for all methods, require further study;
  - WUCD-C: larger polar to tropical variations observed, require further study.

In collaboration with Dr. Jun Li (University of Wisconsin Team)

WUCD Bias Correction Method Validation
- Using CRTM simulated clear-sky ocean radiances (nighttime)



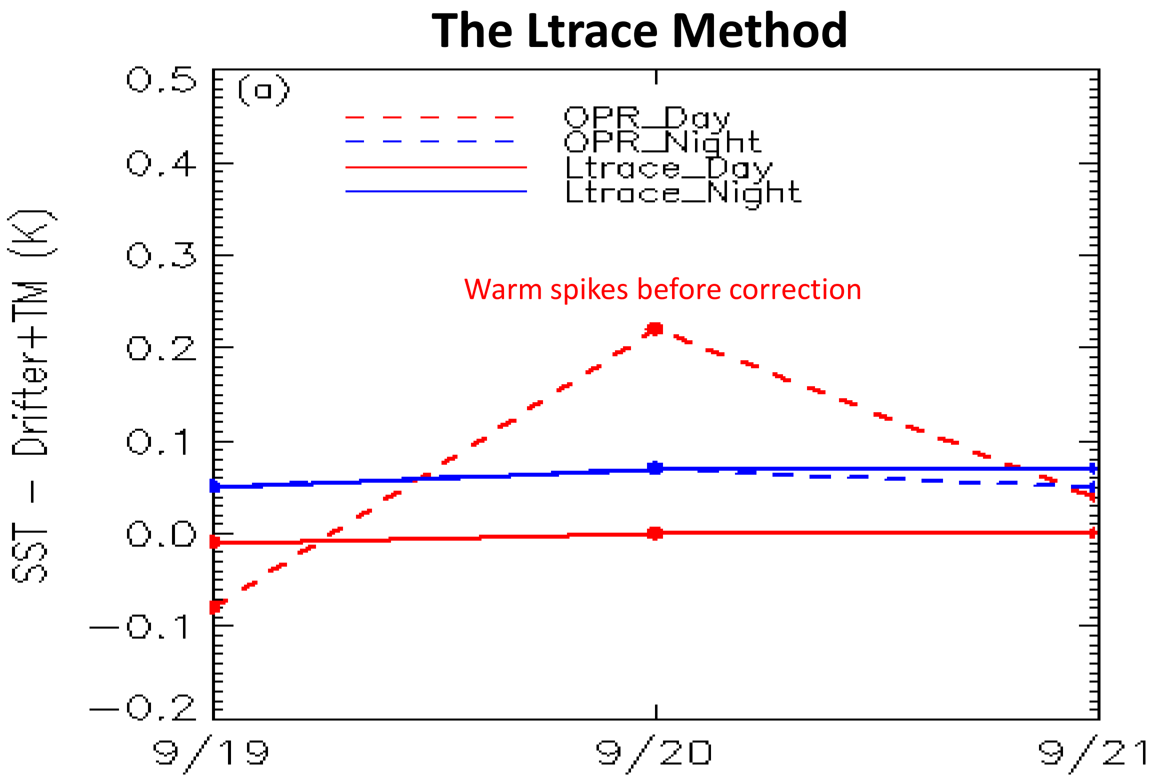


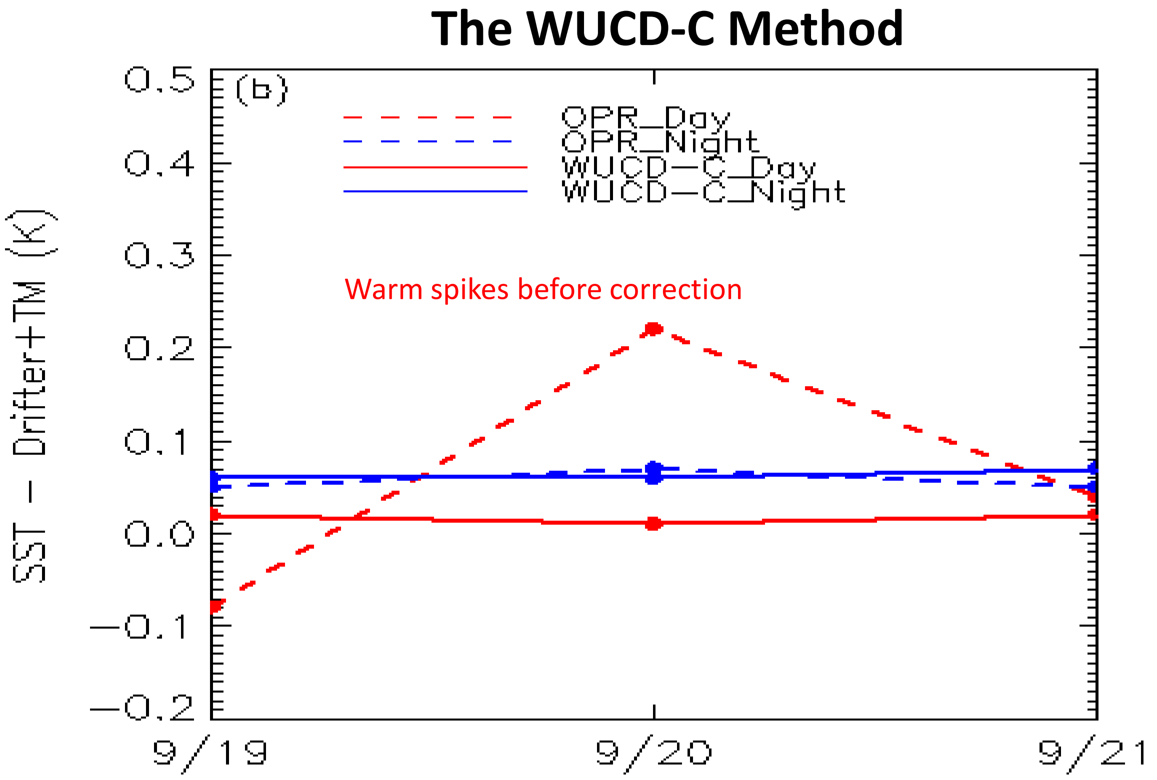
- All three methods perform well to correct WUCD calibration biases for TEB M-bands:

  Ltrace works less effectively for M13
- Consistent with the VIIRS-CrIS results.

In collaboration with Dr. Xingming Liang (STAR ICVS Team)

Impacts on SST Retrieval





- Both the Ltrace and WUCD-C method can effectively remove WUCD anomalies in the SST time series;
- The Ltrace 2 method is also expected to work well.

In collaboration with Dr. Alex Ignatov (NOAA STAR SST team)

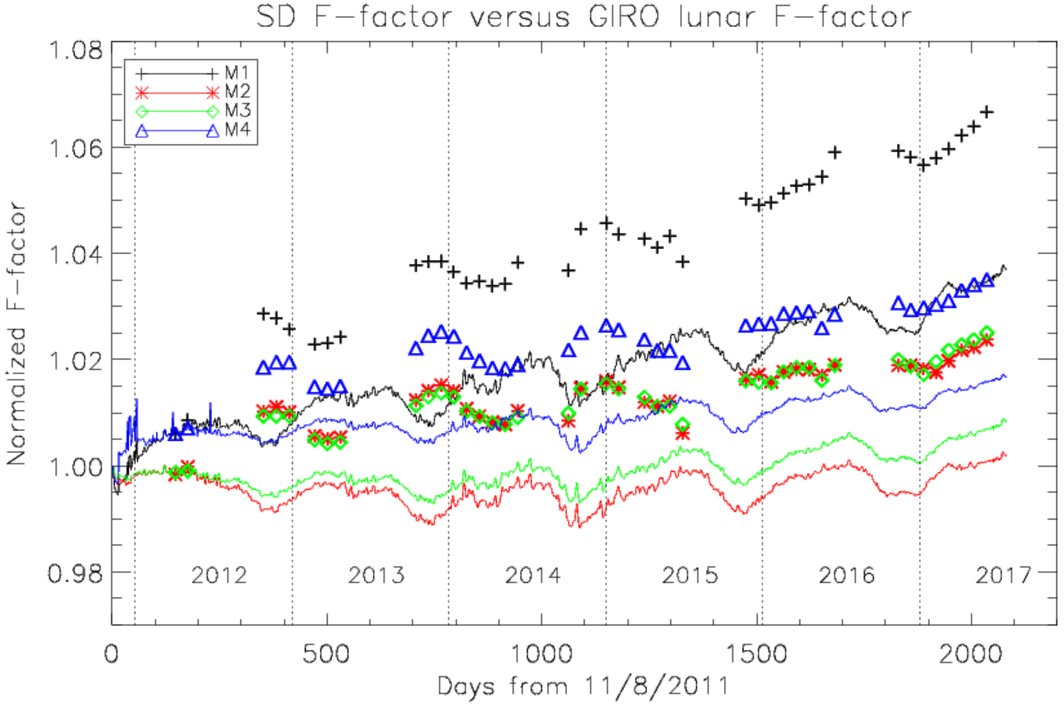
Summary

- Three VIIRS TEB WUCD bias correction methods were developed, implemented, and evaluated:
  - (1) Ltrace; (2)WUCD-C; (3) Ltrace v2.
  - All methods work well in terms of WUCD bias correction;
  - The Ltrace method performs the best for LWIR bands and is the easiest to implement operationally;
  - Further validation and analysis will be conducted for the Ltrace 2 method, especially for MWIR bands WUCD bias correction.

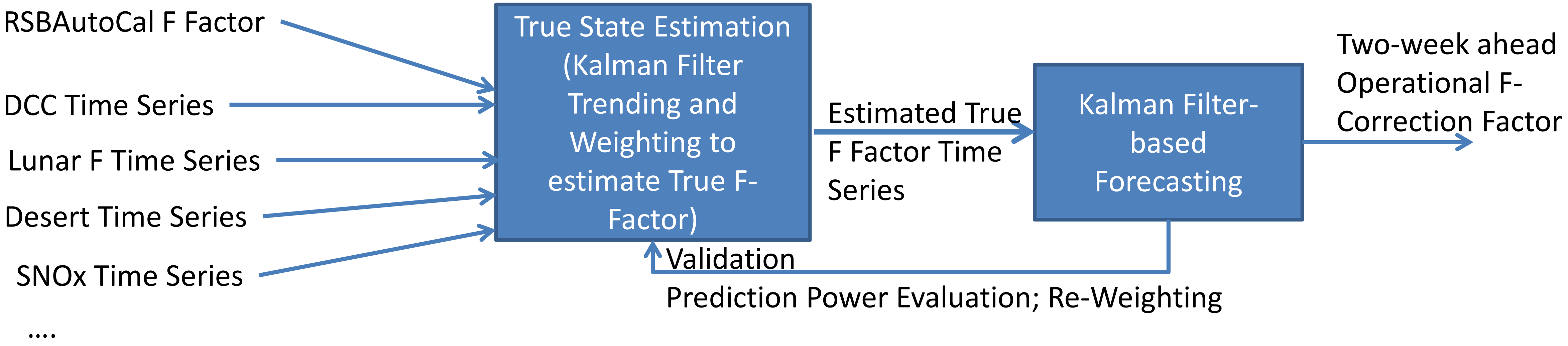
Contributors to this study: Changyong Cao, Bin Zhang, Jun Li, Zhenglong Li

VIIRS Solar Band Calibration Issue: Residual degradation in solar calibration

- M1 to M4 show underestimation of degradation in solar cal. (based on lunar cal. studies)
  - Both in IDPS and RSBAutoCal
  - DCC, desert monitoring, and SNOx with MODIS show trend in IDPS RSB SDR product
- Annual oscillation in solar-F factor
- ~2% bias of M5 and M7 radiance



Kalman Filter Model for F-Factor Correction Forecasting



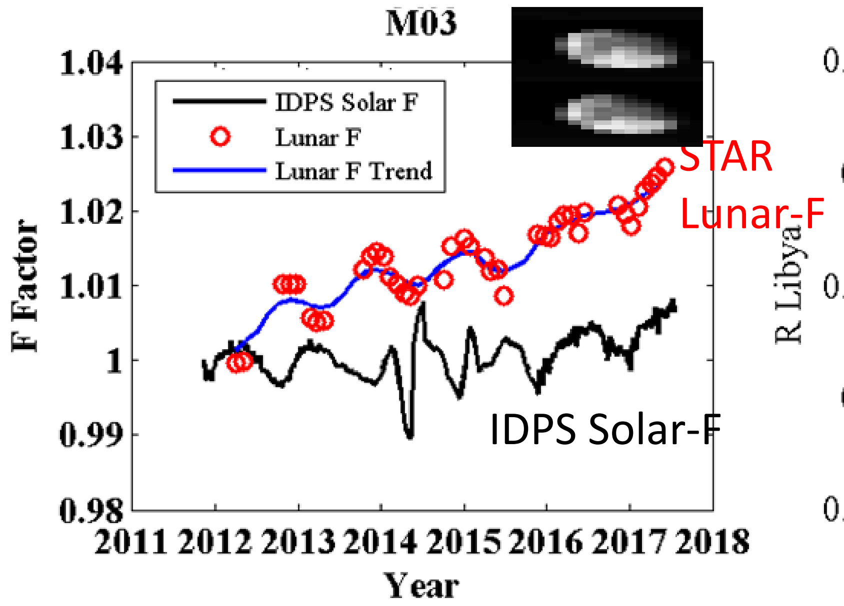
- Different time resolution (some at irregular interval)
- Different observations to characterize performance of the same detector (subject to measurement uncertainty and noise)
- Key steps
    - Kalman Filter trending
    - True State Estimation and Weighting Determination
    - Correction factor Prediction (Kalman filter prediction)

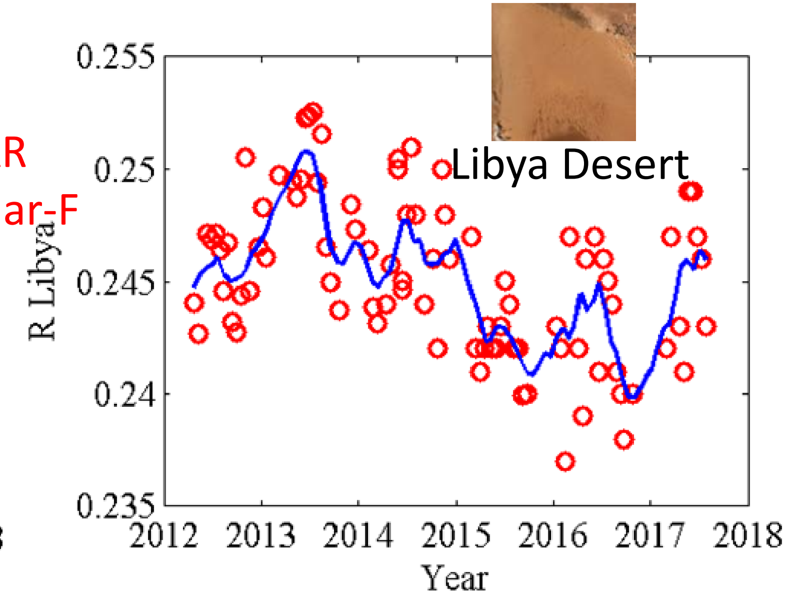
Data Sources

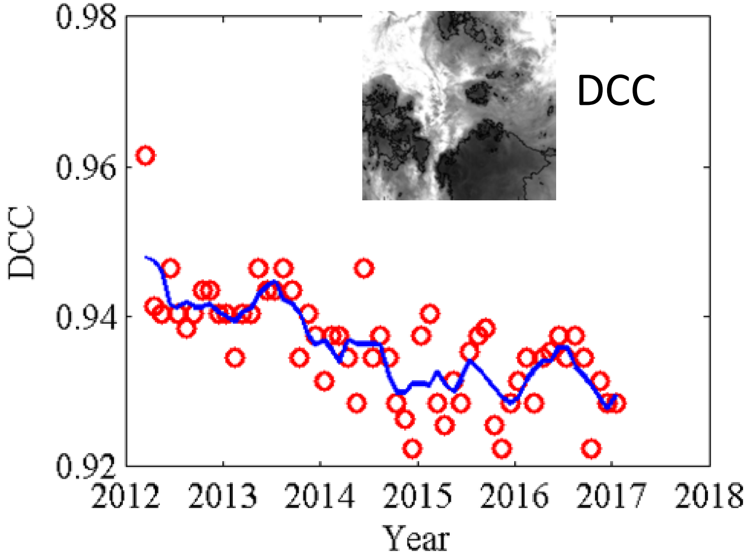
Monitoring Traget	Frequency	Interval	Note
IDPS Solar F	Daily	Launch to now	Derived from IDPS LUT
DCC Time Series	Monthly	Monthly (2012-01 to 2016-12)	Relative to IDPS data
Desert Time Series	Varies (~16 days)	2012 to 2017-04	Relative to IDPS data
SNO Time Series	Varies (~8 days)	2012 to 2017-04	Relative to IDPS data
Lunar-F	Monthly with 3-4 month gap each year	2012-04 to 2017-06	Derived from raw moon data normalized by GIRO model at NOAA/STAR
RSBAutoCal F	Orbit	Launch to now	

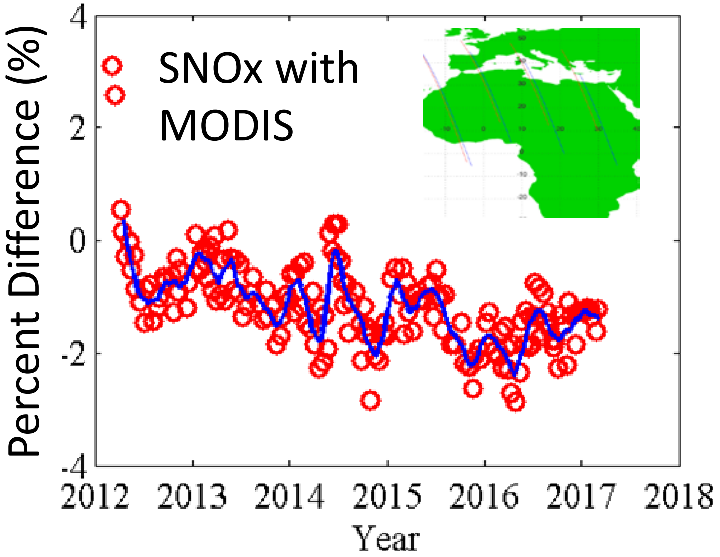
- In the following analysis, trend monitoring time series based on IDPS data are used.

Example of Trend Monitoring with Multiple Sources for VIIRS Band M3



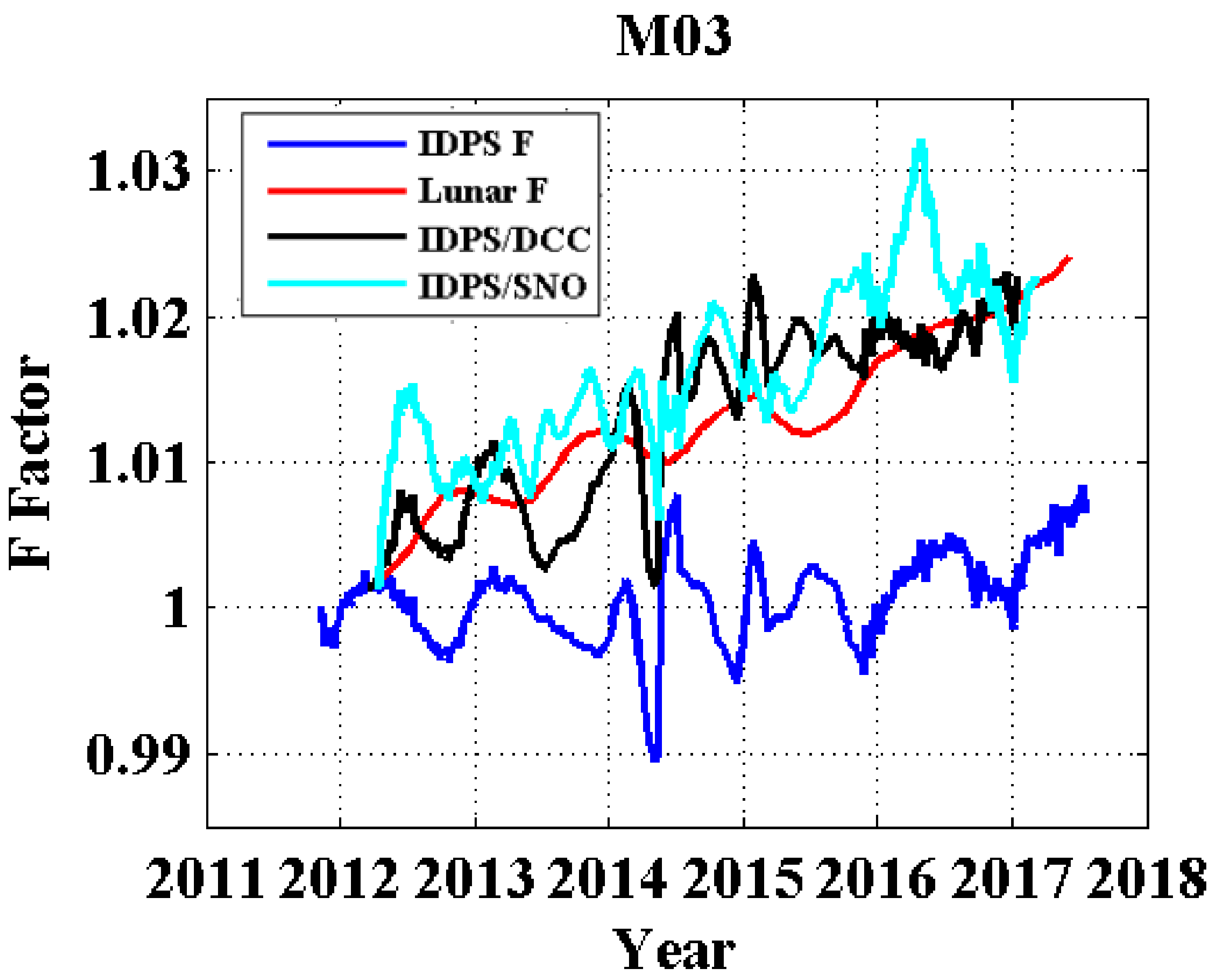






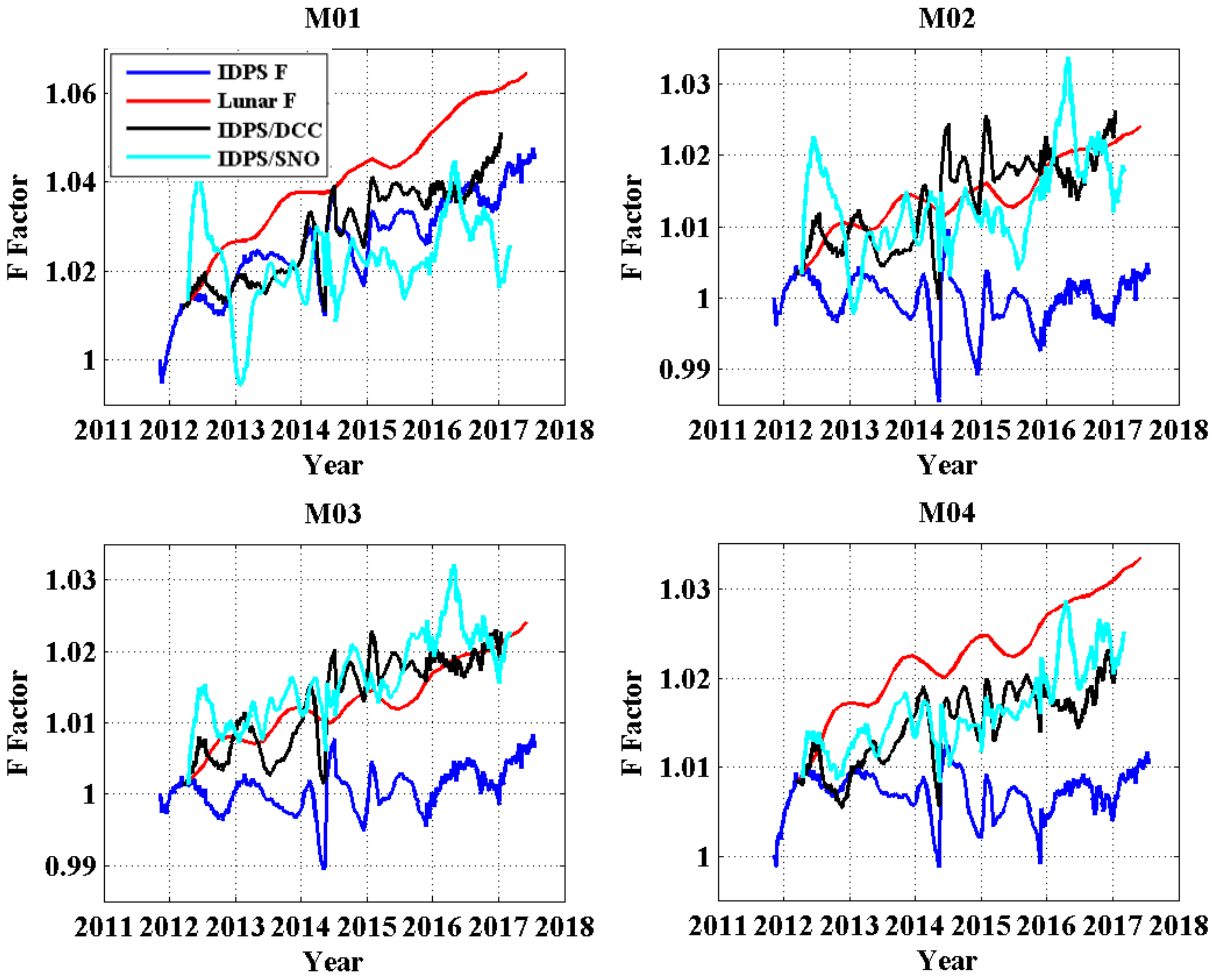
- Kalman Filter-based trend estimator
- NOAA/STAR Lunar-F clearly indicates underestimation of IDPS solar-F for M3 band.
- Consistent findings by NOAA-OC, NASA-VCST, NASA-OC, and NOAA-STAR
- DCC, Libya Desert and SNOx with MODIS
  - all are based on IDPS data
  - show similar downward trend
  - Point to same origin of underestimation by IDPS solar F factor
- Libya desert reflectance shows large oscillation due to BRDF. Need further processing.

Consistency Validation of Radiometric Trend Derived from Multiple Monitoring Sources (VIIRS M3)



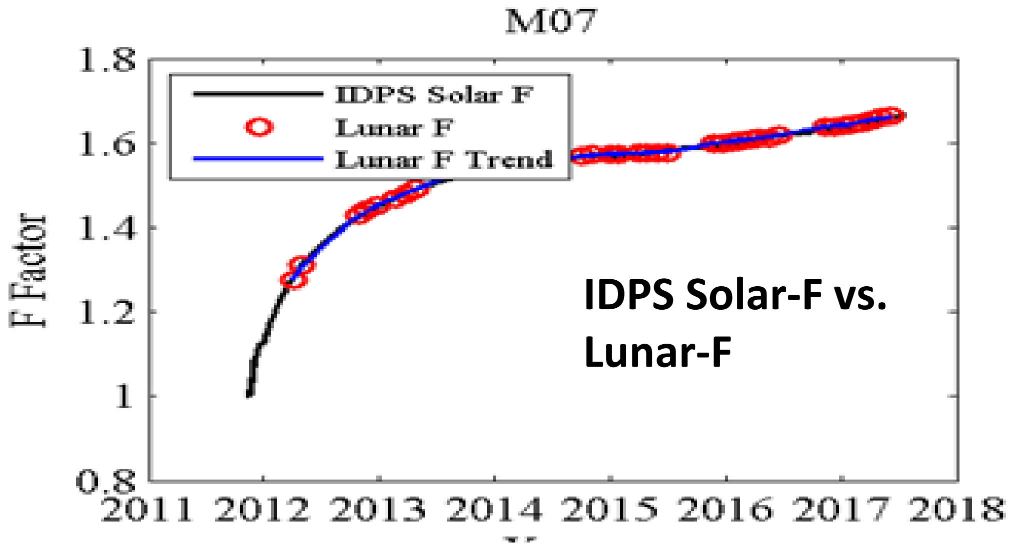
- IDPS Solar Diffuser F
- STAR Lunar-F
- DCC-Corrected F = IDPS F/(Normalized DCC Mode)
- SNO-Corrected F = IDPS F/(1+ SNO Difference%)
- VIIRS M3 Lunar observation, DCC and SNOx with MODIS all aligned with same trend;
- Consistent evidence of deviating from solar diffuser F factor.
- DCC and SNO data have larger fluctuation
- Possible Cause: Difference in RTA and SDSM view of SD BRDF

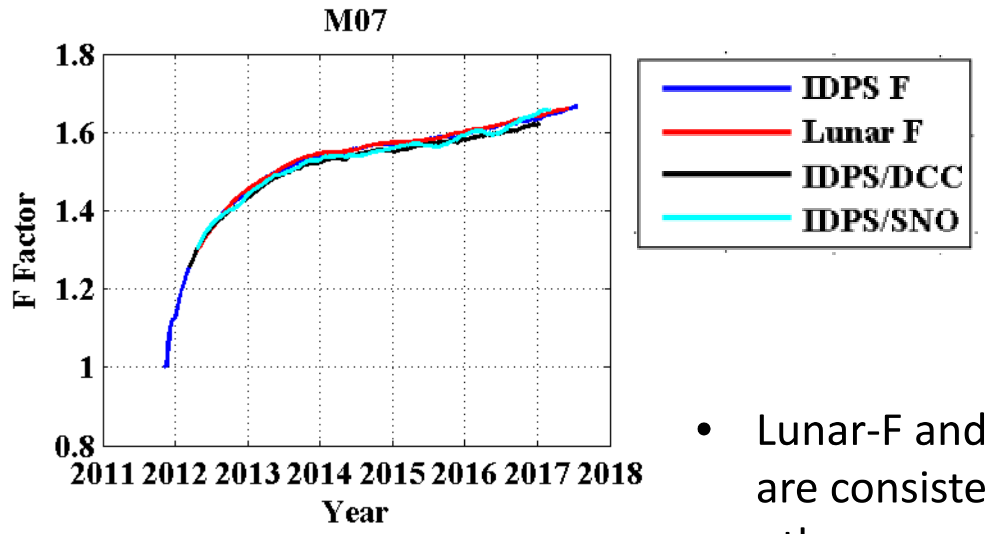
Consistency Validation of Radiometric Trend Derived from Multiple Monitoring Sources (VIIRS M1-M4)

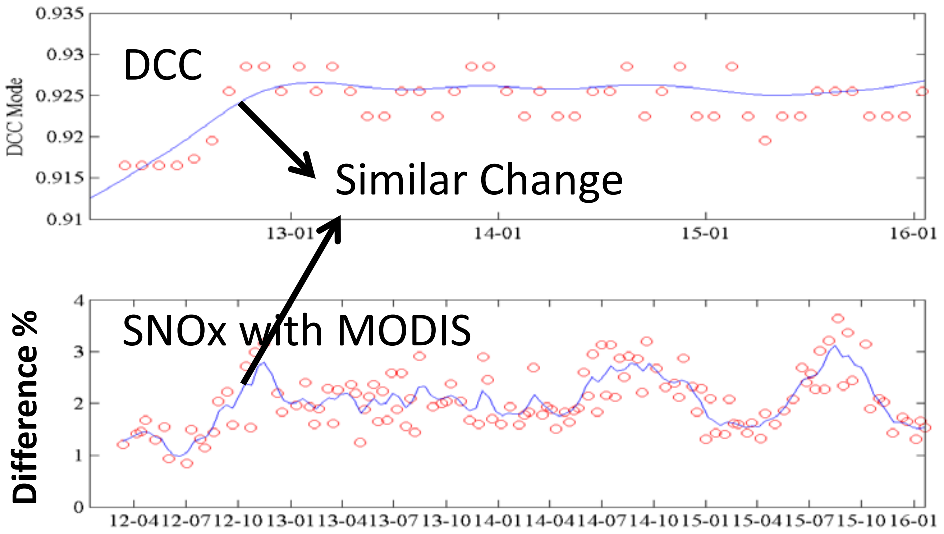


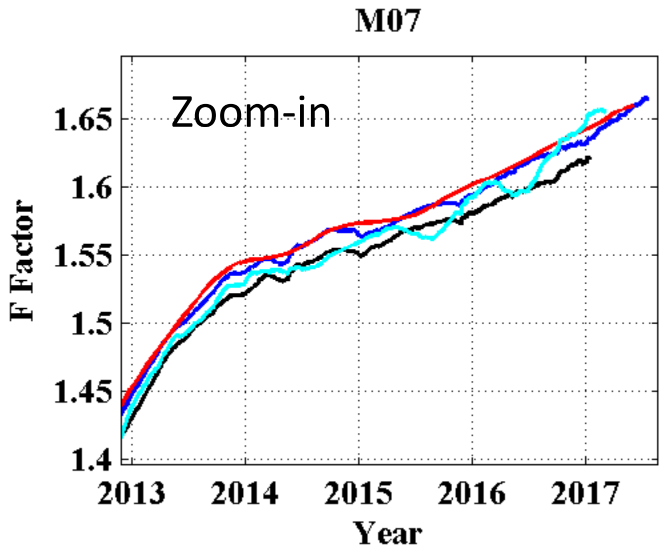
- IDPS Solar-F of M1-M4 all show underestimation of detector degradation
- VIIRS M2 and M3
  - Consistent trend among lunar-F, DCC-Corrected F and SNOx-Corrected F
- M1/M4: Lunar-F shows larger deviation.
- M4: DCC-Corrected F and SNOx-Corrected F are consistent
- M1/M2: SNOx-corrected F shows large fluctuation
- Strong evidence of consistency in trending from multiple sources

Radiometric Trend Monitoring for VIIRS M7









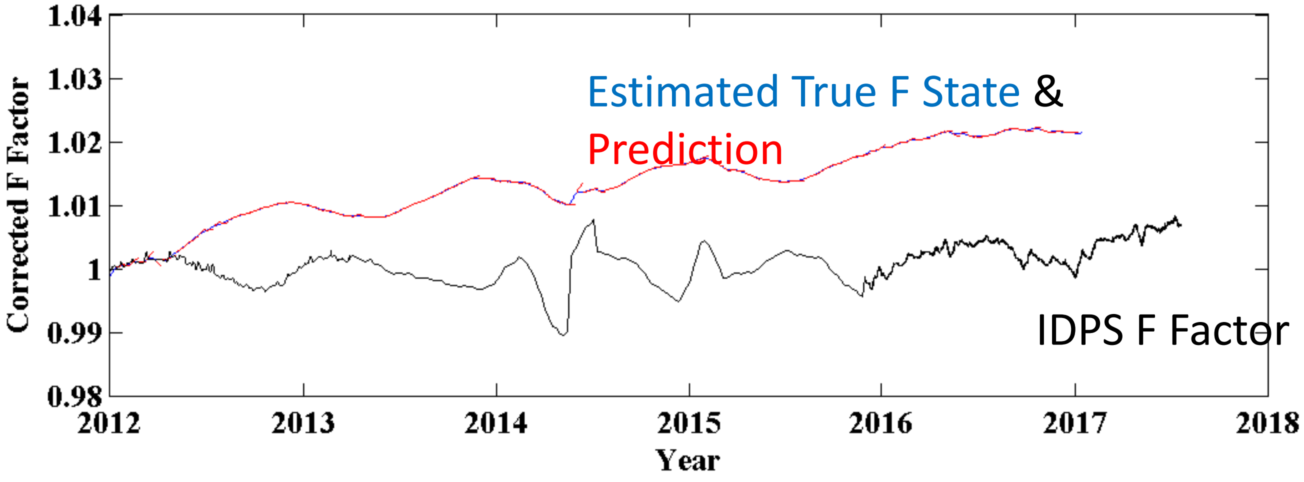
- Lunar-F and IDPS Solar-F are consistent with each other
- DCC and SNOx monitoring both show a change during middle of 2012.
- DCC-corrected and SNO-corrected F factor is lower in comparison to IDPS solar-F.

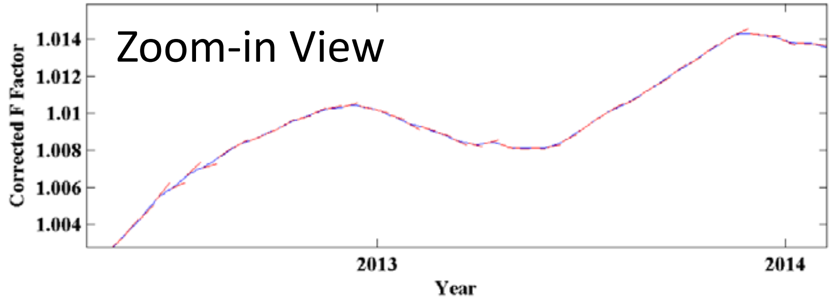
Development of Kalman Filter-based Predicative Model

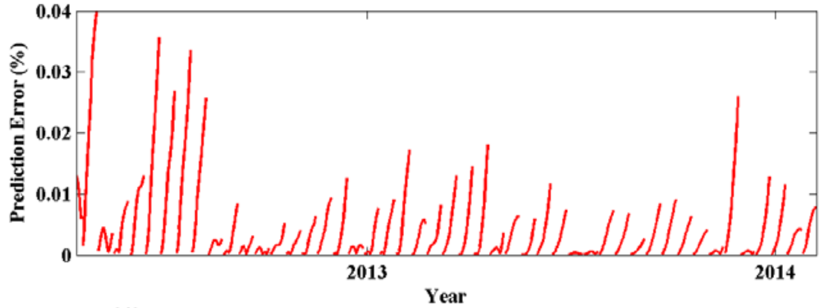
- In preparation for operational update of calibration scaling factor
- Need the bias correction two weeks in advance
  - Submission: two week ahead
  - Approval: One week
  - Operation: One week
- Combining inputs from multiple validation sources, estimate true-state F factor and perform 14-day prediction of scaling factor.
- Show preliminary results from the modeling efforts.
- Assessment of error or uncertainty sources.

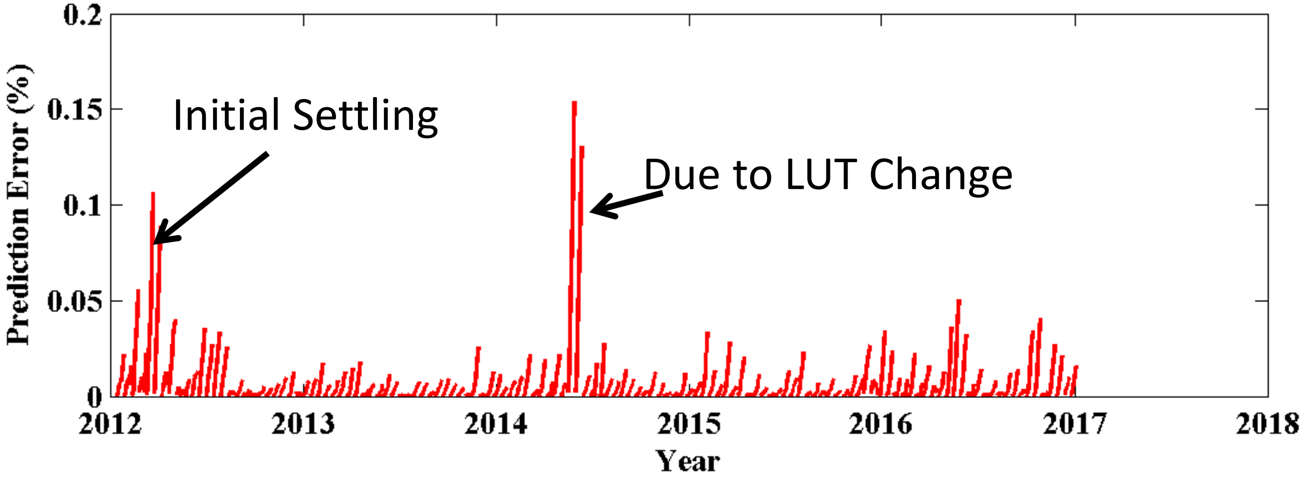
Kalman Filter-based Prediction Model (VIIRS M3)

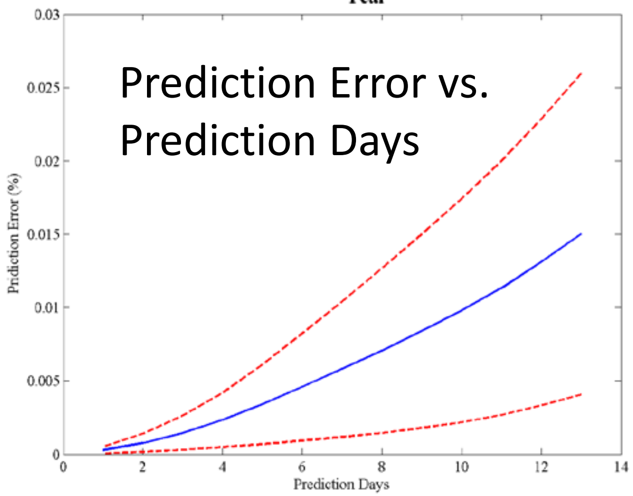
M03







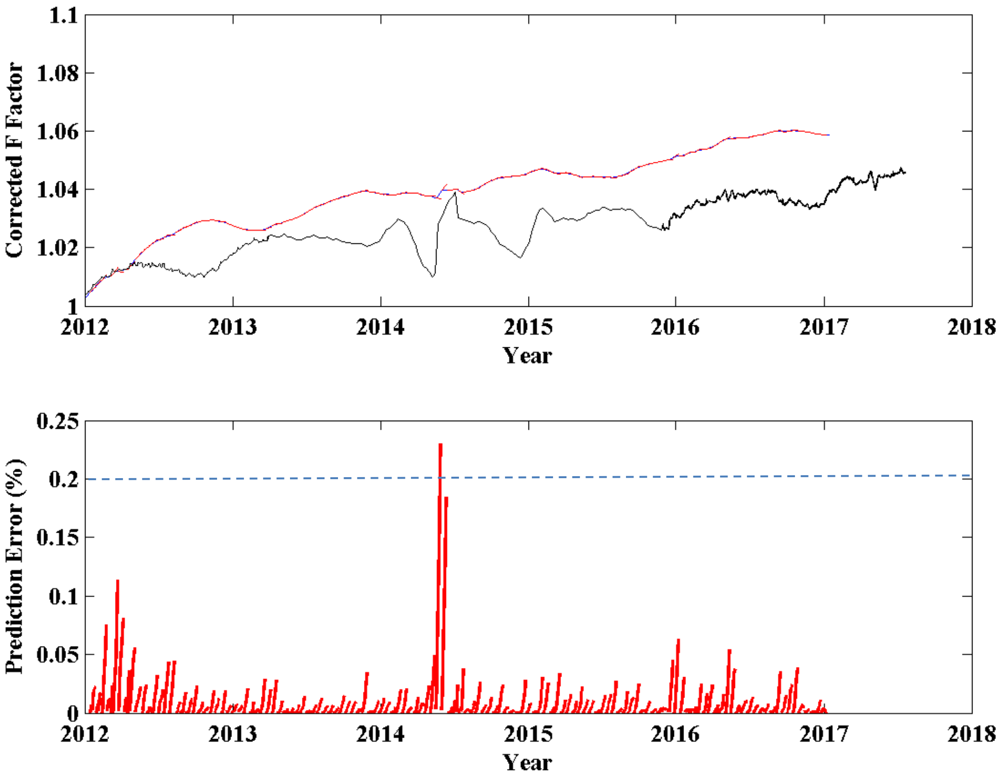




- Preliminary True F-Factor State estimation (80% Lunar, 10% DCC, 10% SNOx)
- 14-day forward daily prediction error within 0.2%

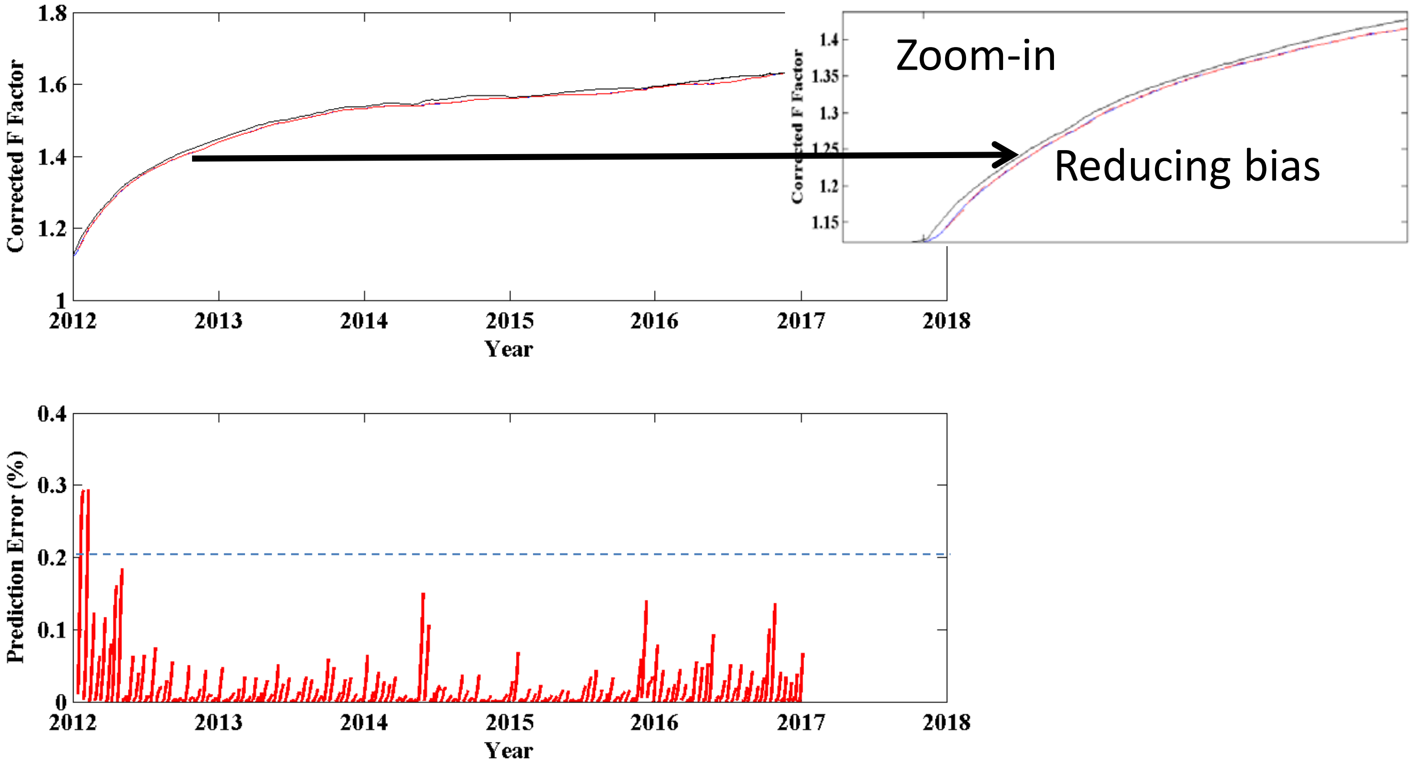
Kalman Filter-based Prediction Model (VIIRS M1-M4)

M1



- (80% Lunar, 10% DCC, 10% SNOx)

M7



- (1/3 Lunar, 1/3 DCC, 1/3 SNOx)

- Prediction model works for F factor with both gradual and rapid changes
- Large uncertainty at initial settling period and perturbation caused by manual updates
- Need further modeling on true F factor-state estimation for validation

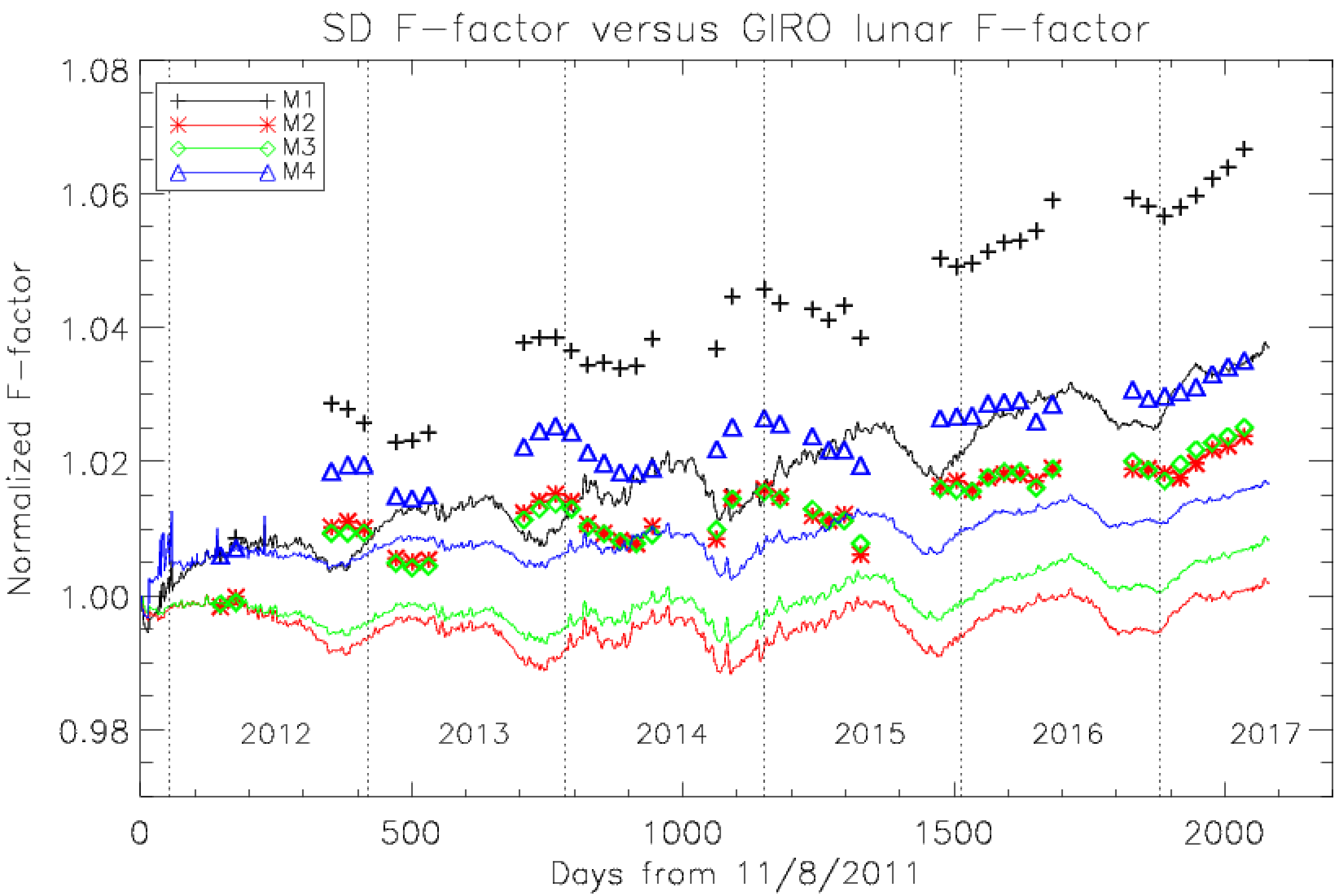
Summary and Path Forward

- Using IDPS solar F factor as an example, demonstrated consistency in VIIRS RSB calibration trend deviation from solar-F as monitored by Lunar-F, DCC, SNOx with MODIS and desert.
- On-going development of Kalman Filter-based predicative model to support near real time update of calibration coefficient.
- Path forward:
  - Uncertainty reduction in DCC , SNOx, ground target monitoring
  - Weekly DCC monitoring and fill the data gap with DCC-corrected F factor
  - Modeling and removal of annual oscillation in Solar-F and Lunar- F
  - True F Factor estimation and multi-source weight determination
  - Applications
    - Reprocessed VIIRS data with RSBAutoCal
    - Predictive Model to support near real time update of calibration coefficient for J1 VIIRS RSB

Contributors to this study:
Changyong Cao, Tom Liu, Wenhui Wang, Jason Choi, Sirish Uprety, Slawek Blonski, Bin Zhang

Back UP

VIIRS SDR Team Reprocessed Solar Cal.-F & Lunar-F



- IDPS Solar-F variations subject to LUT changes, and manual vs. auto updates etc.
- Reprocessed M1-M4 solar F factor still show deviation from lunar-F (Jason Choi's presentation on Tuesday (Aug. 15))
- To reconcile the difference in trending, DCC/desert/SNOx monitoring will be performed with reprocessed data.
- True F-factor state for reprocessed will be derived from multiple validation sources.
- Provided as a scaling factor for reprocessed data