ADVANCES IN STAR INTEGRATED CAL/VAL SYSTEM (ICVS)

Fuzhong Weng, Ninghai Sun (presenter), Xin Jin, Ding Liang, Xingming Liang, Lori Brown

NOAA/NESDIS/STAR

Ninghai.Sun@noaa.gov

STAR ICVS Team

Outline

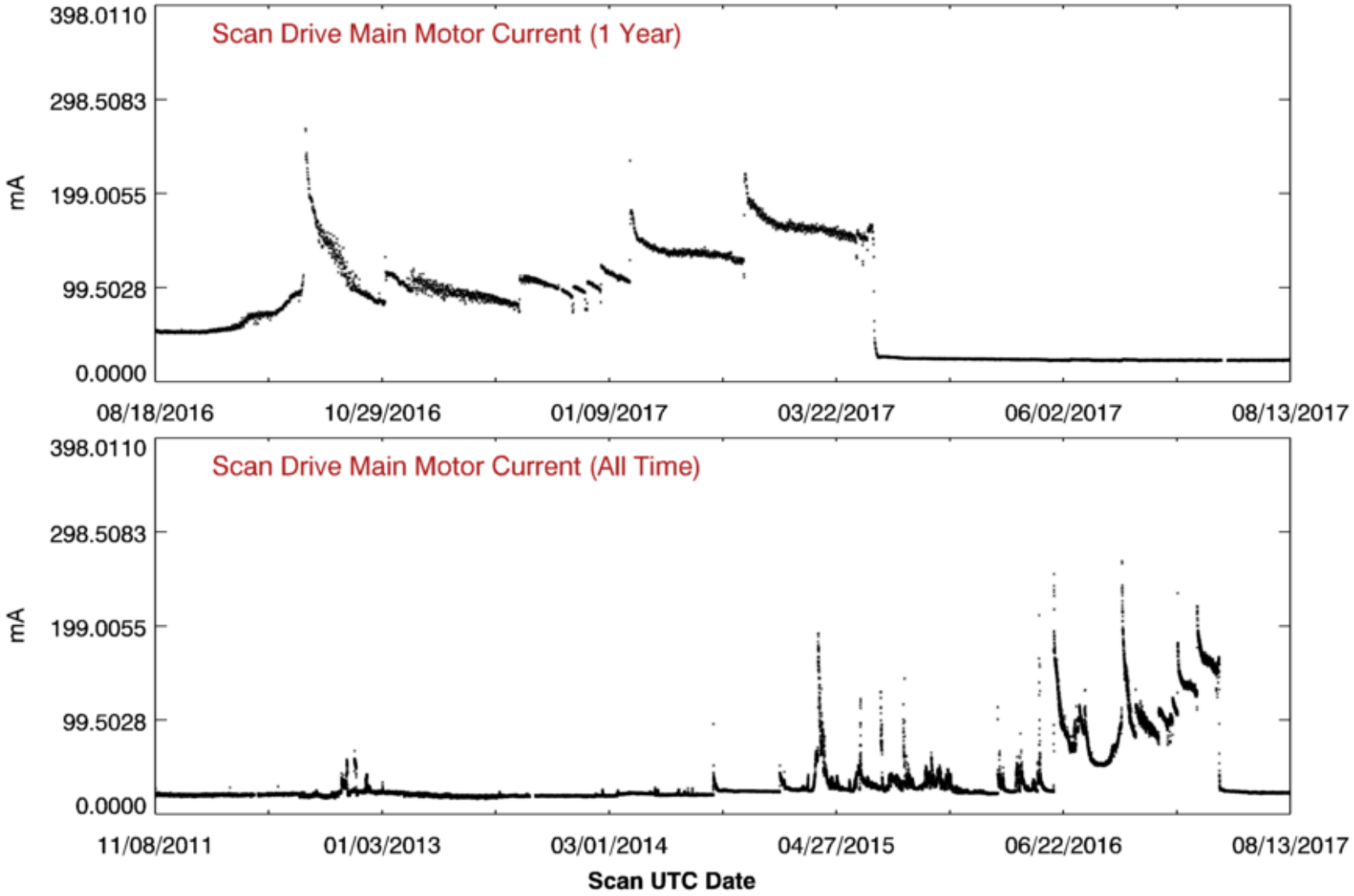
- ICVS Team Members
- S-NPP Major instrument/SDR data events in the last year
- Advances in current system
- JPSS-1 Readiness
- Future Improvements
- Summary and Path Forward

ICVS Team Members

Team Member	Organization	Roles and Responsibilities
Fuzhong Weng (PI)	NOAA/STAR	Project sci. and tech. lead
Ninghai Sun	NOAA/STAR/ERT, Inc.	Tech. lead, system designer, microwave instrument trending sub-system developer
Xin Jin	NOAA/STAR/ERT, Inc.	CrIS trending sub-system developer
Xingming Liang	NOAA/STAR/ERT, Inc.	VIIRS trending sub-system developer
Ding Liang	NOAA/STAR/ERT, Inc.	OMPS trending sub-system developer
Stanislav Kireeve	NOAA/STAR/ERT, Inc.	VIIRS image/AVHRR/HIRS sub-system developer
Lori Brown	NOAA/STAR/IMSG, Inc.	ICVS web site master
Shubha Barriga	NOAA/STAR/ERT, Inc.	ICVS outreach

Major Instrument Events

ATMS Scan Drive Main Motor Current



Major SDR Data Events (Cont'd)

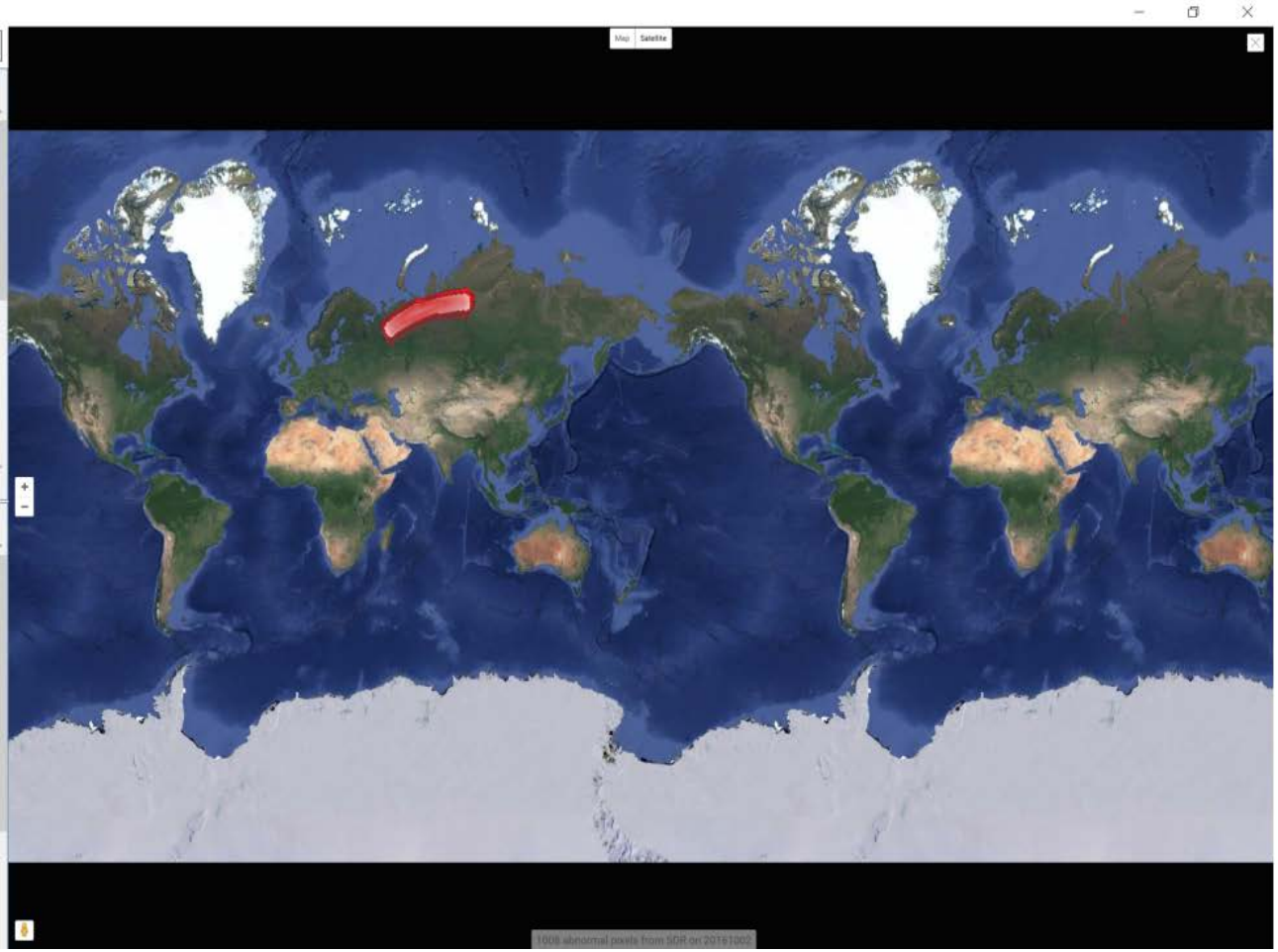
CrIS LW imaginary radiance anomaly detected 10/04/2016

1008 abnormal pixels from SDR on 20161002

2016/10/2 | SDR | Go | Reset | Setting

ID	Property Description	Value
1	Granule Timestamp	t0747049_e0747347_b2555
2	Latitude	65.5321
3	Longitude	73.7846
4	BT@900 WN	Filled value
5	BT@2500 WN	Filled value
6	BT@1030 WN	Filled value
7	BT@1500 WN	Filled value
8	Imgny Rad.@900 WN	-999.79999
9	Imgny Rad.@2500 WN	-999.79999
10	Field Of View	1
11	Field Of Regard	23
12	Scan ID Of The Day	3506
13	QF1 Missing Scan	1
14	QF1 Timing Sequence Error	1
15	QF1 Invalid Laser WL	0

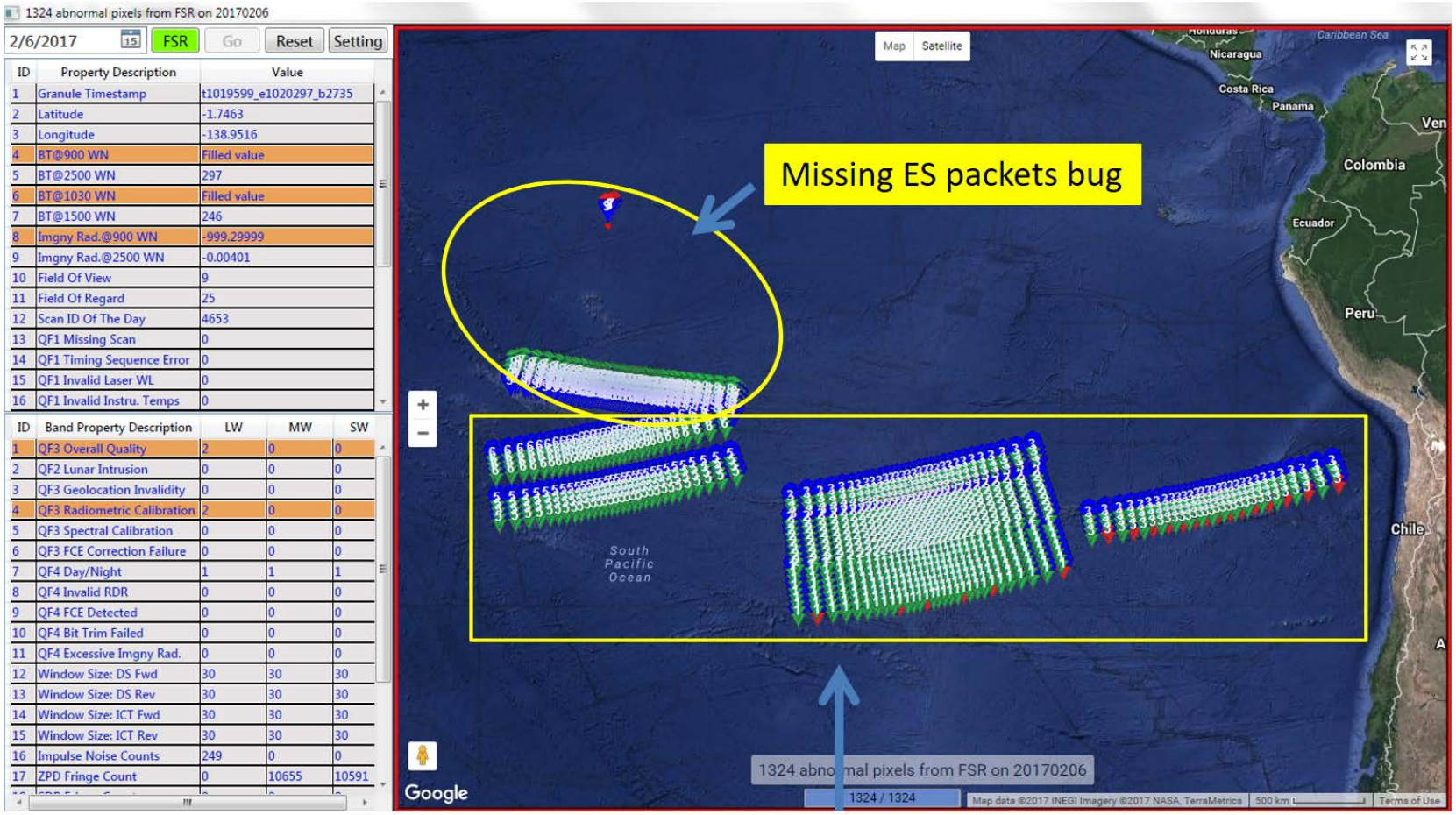
ID	Band Property Description	LW	MW	SW
1	QF3 Overall Quality	2	2	2
2	QF2 Lunar Intrusion	0	0	0
3	QF3 Geolocation Invalidity	0	0	0
4	QF3 Radiometric Calibration	2	2	2
5	QF3 Spectral Calibration	0	0	0
6	QF3 FCE Correction Failure	0	0	0
7	QF4 Day/Night	0	0	0
8	QF4 Invalid RDR	1	1	1
9	QF4 FCE Detected	0	0	0
10	QF4 Bit Trim Failed	0	0	0
11	QF4 Excessive Imgny Rad.	0	0	0
12	Window Size: DS Fwd	26	26	26
13	Window Size: DS Rev	26	26	26
14	Window Size: ICT Fwd	26	26	26
15	Window Size: ICT Rev	26	26	26
16	Impulse Noise Counts	254	254	254
17	ZPD Fringe Count	65534	65534	65534



Major SDR Data Events (Cont'd)

STAR CrIS Full Spectral Resolution (FSR) SDR Data Quality

1) missing ES packets in the first scan of a calibration window (Fixed in Block2.0)
2) Lunar intrusion in the first scan of calibration window



ID	Property Description	Value
1	Granule Timestamp	t1019599_e1020297_b2735
2	Latitude	-1.7463
3	Longitude	-138.9516
4	BT@900 WN	Filled value
5	BT@2500 WN	297
6	BT@1030 WN	Filled value
7	BT@1500 WN	246
8	Imgny Rad.@900 WN	-999.29999
9	Imgny Rad.@2500 WN	-0.00401
10	Field Of View	9
11	Field Of Regard	25
12	Scan ID Of The Day	4653
13	QF1 Missing Scan	0
14	QF1 Timing Sequence Error	0
15	QF1 Invalid Laser WL	0
16	QF1 Invalid Instru. Temps	0

ID	Band Property Description	LW	MW	SW
1	QF3 Overall Quality	2	0	0
2	QF2 Lunar Intrusion	0	0	0
3	QF3 Geolocation Invalidity	0	0	0
4	QF3 Radiometric Calibration	2	0	0
5	QF3 Spectral Calibration	0	0	0
6	QF3 FCE Correction Failure	0	0	0
7	QF4 Day/Night	1	1	1
8	QF4 Invalid RDR	0	0	0
9	QF4 FCE Detected	0	0	0
10	QF4 Bit Trim Failed	0	0	0
11	QF4 Excessive Imgny Rad.	0	0	0
12	Window Size: DS Fwd	30	30	30
13	Window Size: DS Rev	30	30	30
14	Window Size: ICT Fwd	30	30	30
15	Window Size: ICT Rev	30	30	30
16	Impulse Noise Counts	249	0	0
17	ZPD Fringe Count	0	10655	10591

Lunar intrusion in first scan of calibration window

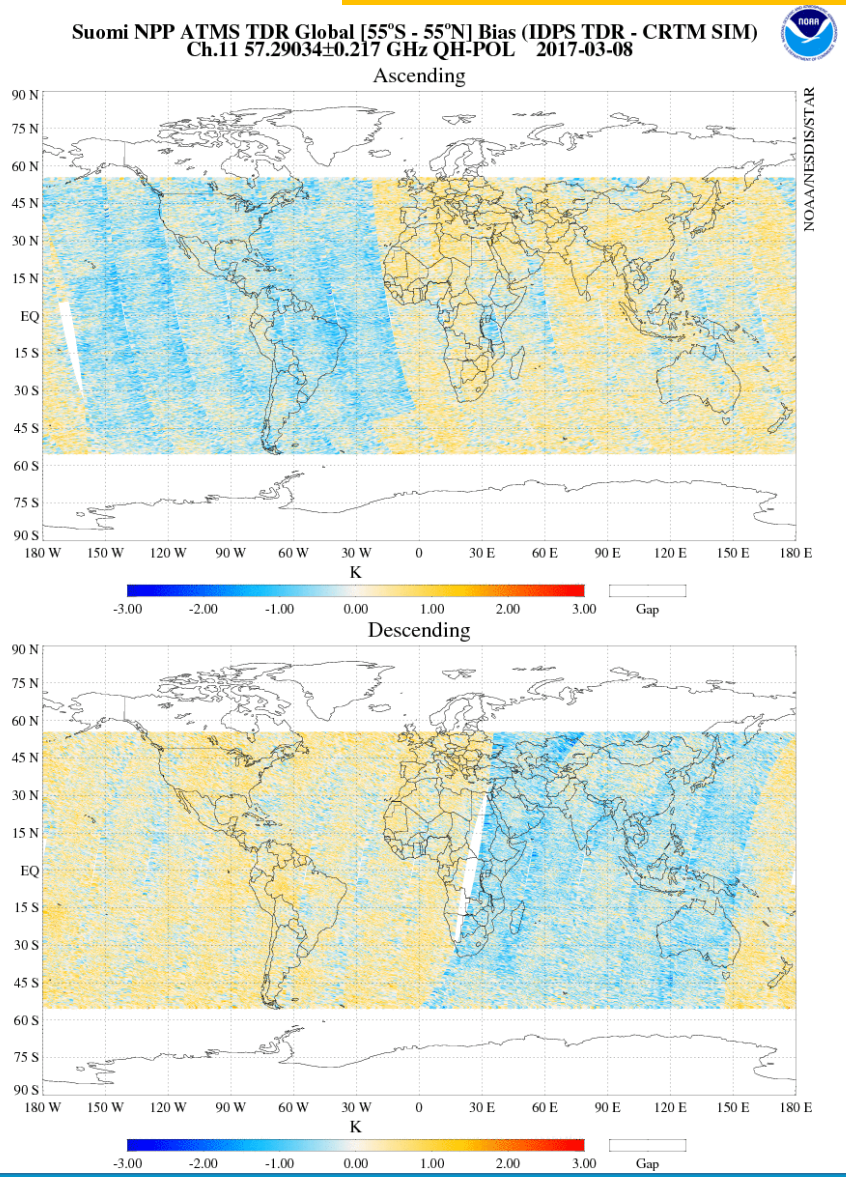
Major SDR Data Events (Cont'd)

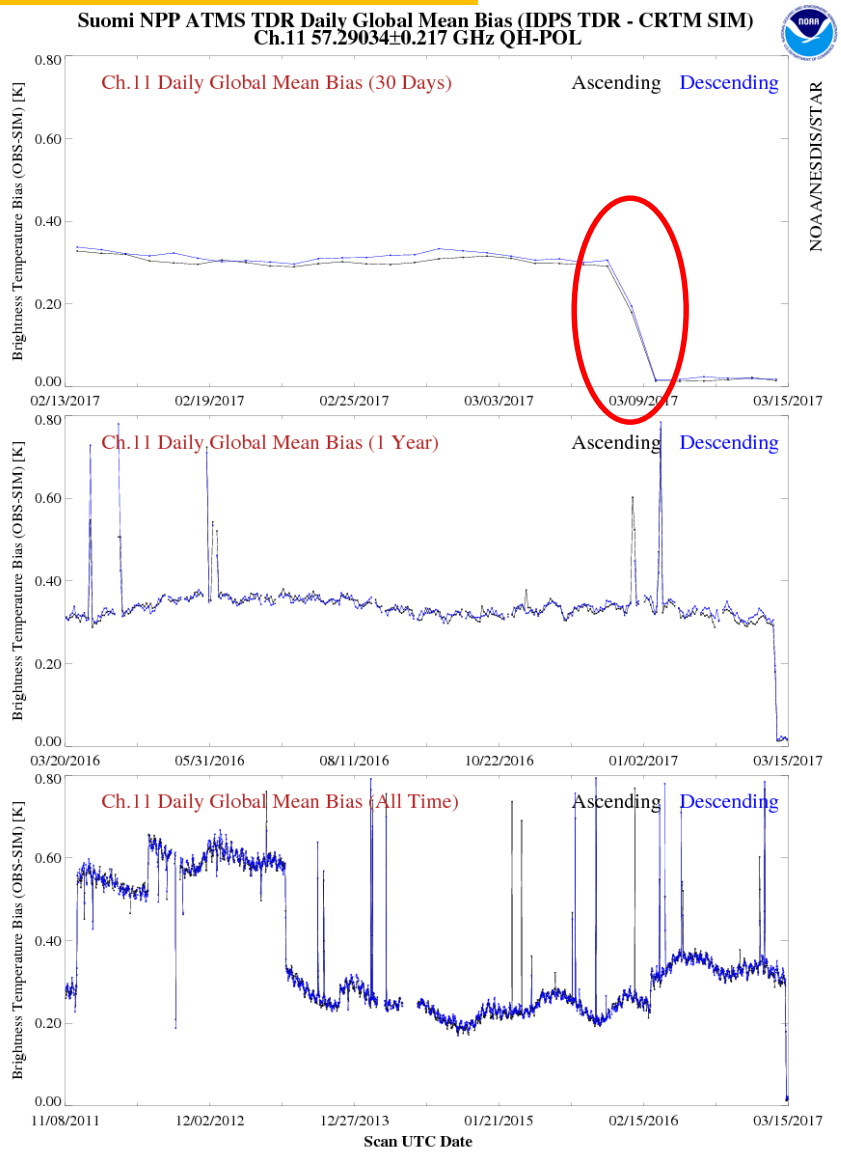
Sample S-NPP CrIS SDR data anomaly matrix

SNPP CrIS Biweekly Anomaly Summary (since 11/16/2016)								
Date	**Types**	**FOVs**	**Date**	**Types**	**FOVs**	**Date**	**Types**	**FOVs**
11/16	-	-	11/25	-	-	12/05	Filled Value	3
11/17	Filled Value	3	11/26	-	-	12/06	-	-
11/18	SW Rad. Imag.	1	11/27	-	-			
11/19	-	-	11/28	Filled Value	14			
11/20	SW Rad. Imag.	2	11/29	-	-			
11/21	Filled Value	3	11/30	-	-			
11/22	LW Rad. Imag. Filled Value FCE	49	12/01	Filled Value	1			
			12/02	-	-			
11/23	Filled Value	1	12/03	-	-			
11/24	-	-	12/04	-	-			

Major SDR Data Events (Cont'd)

S-NPP ATMS Block2 (MX0) TTO on March 8, 2017





Major SDR Data Events (Cont'd)

Missing packet situation is not correctly handled in Block2 data when SDR is manually processed

Too many bad pixels from FSR on 20170325. Number of Bad pixel: 3508. Only 10% will be plotted.

3/25/2017 | FSR | Go | Reset | Setting

ID	Property Description	Value
13	QF1 Missing Scan	0
14	QF1 Timing Sequence Error	0
15	QF1 Invalid Laser WL	0
16	QF1 Invalid Instru. Temps	1
17	QF1 Excessive Thermal Drift	1
18	QF1 Bad Neon Calibration	0
19	Valid PRT Count: Fwd	24
20	Valid PRT Count: Rev	24
21	ICT Temp Stab: Fwd	0.01312
22	ICT Temp Stab: Rev	0.01273
23	ICT Temp Consistency	-0.005309
24	Measured Laser WL	1546.2626
25	Monitored Laser WL	1546.2626
26	Resampling Laser WL	1546.2626
27	Spacecraft Maneuver	Normal Operations
28	Processing Version	A1M

ID	Band Property Description	LW	MW	SW
3	QF3 Geolocation Invalidity	0	0	0
4	QF3 Radiometric Calibration	1	1	1
5	QF3 Spectral Calibration	0	0	0
6	QF3 FCE Correction Failure	0	0	0
7	QF4 Day/Night	0	0	0
8	QF4 Invalid RDR	0	0	0
9	QF4 FCE Detected	0	0	0
10	QF4 Bit Trim Failed	0	0	0
11	QF4 Excessive Imgny Rad.	0	0	0
12	Window Size: DS Fwd	24	24	24
13	Window Size: DS Rev	24	24	24
14	Window Size: ICT Fwd	24	24	24
15	Window Size: ICT Rev	24	24	24
16	Impulse Noise Counts	0	0	0
17	ZPD Fringe Count	10647	10643	10630
18	SDR Fringe Count	0	0	0
19	ZPD Amplitude	368	768	-560

Three QFs are triggered in each pixel:
Scan-level 'Invalid Instrument Temperatures'
Scan-level 'Excessive Thermal Drift'
'degraded' Pixel-level 'Radiometric Calibration'

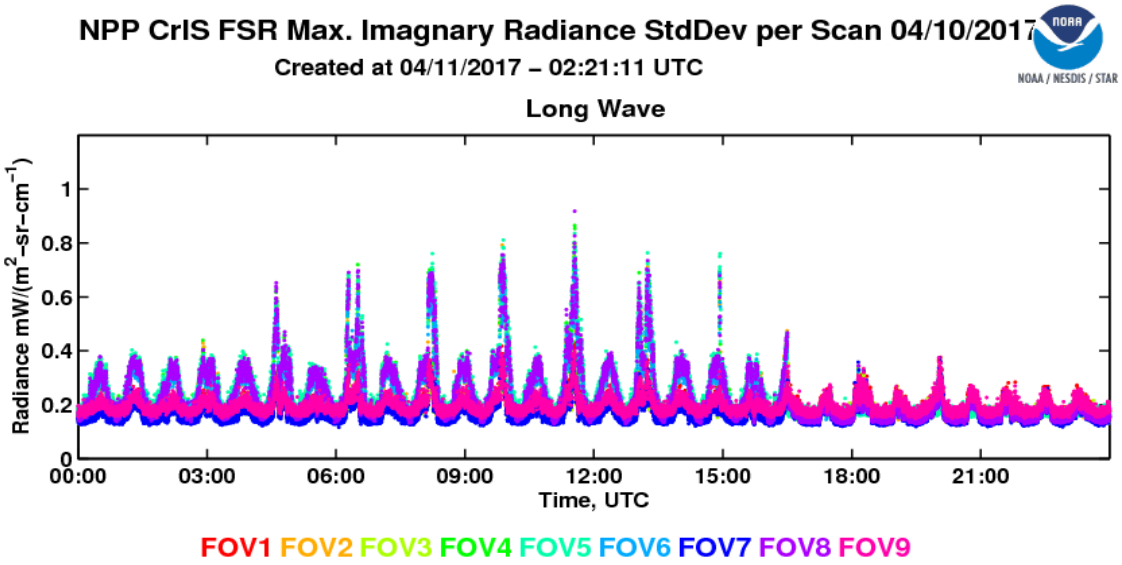
It seems some scans are missing

'Degraded' and 'Invalid' pixels have exactly the same QF results!
Strange time stamp: only two time stamp values indicating scan# 8355 and 8356 are available for all of them. But they are apparently located in many more different scans

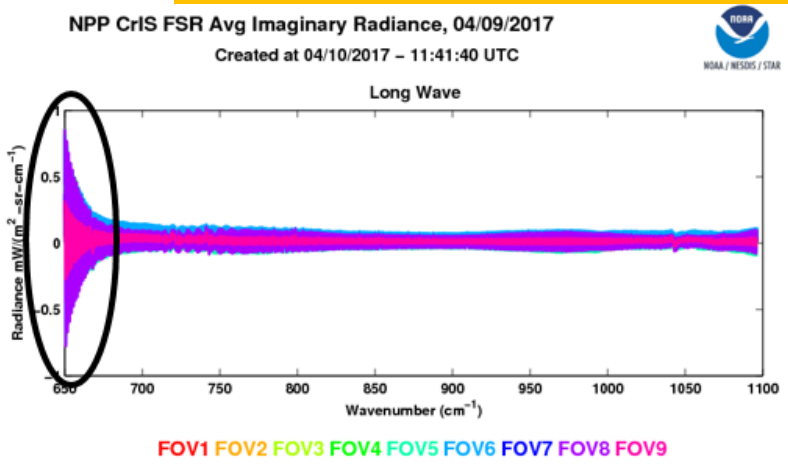
Google | 350 / 350 | Imagery ©2017 NASA, TerraMetrics | 1000 km | Terms of Use

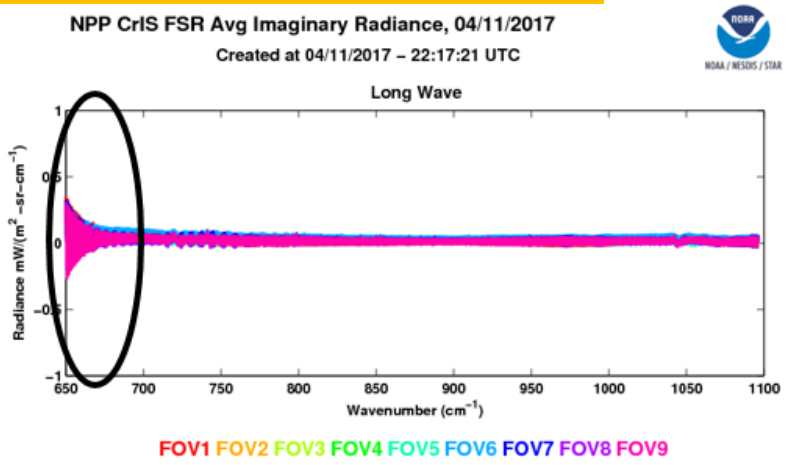
Major SDR Data Events (Cont'd)

FSR Imaginary radiance much less variant after the TTO of MX1 on April 10, 2017



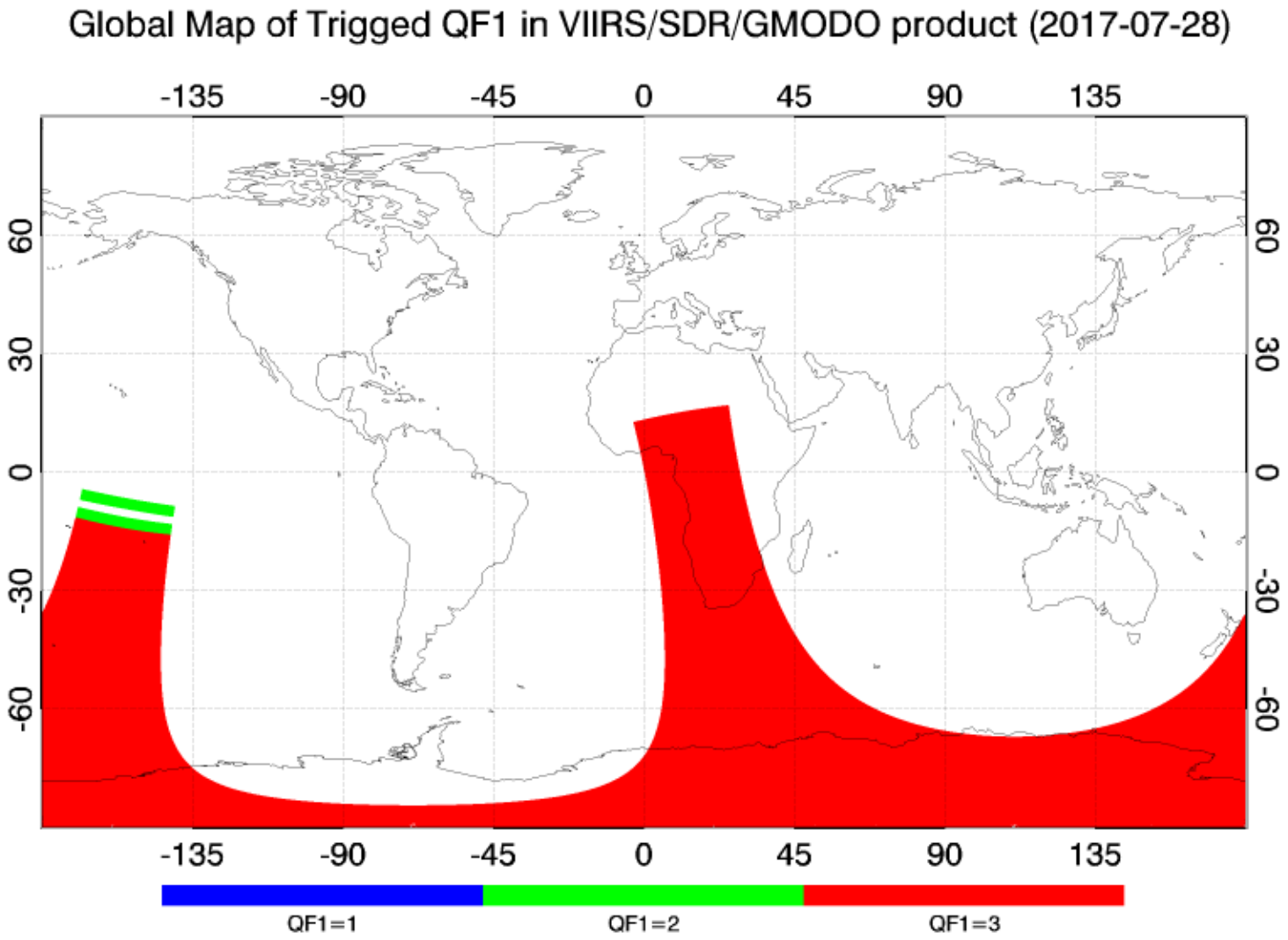
Average spectral imaginary radiance before and after MX1





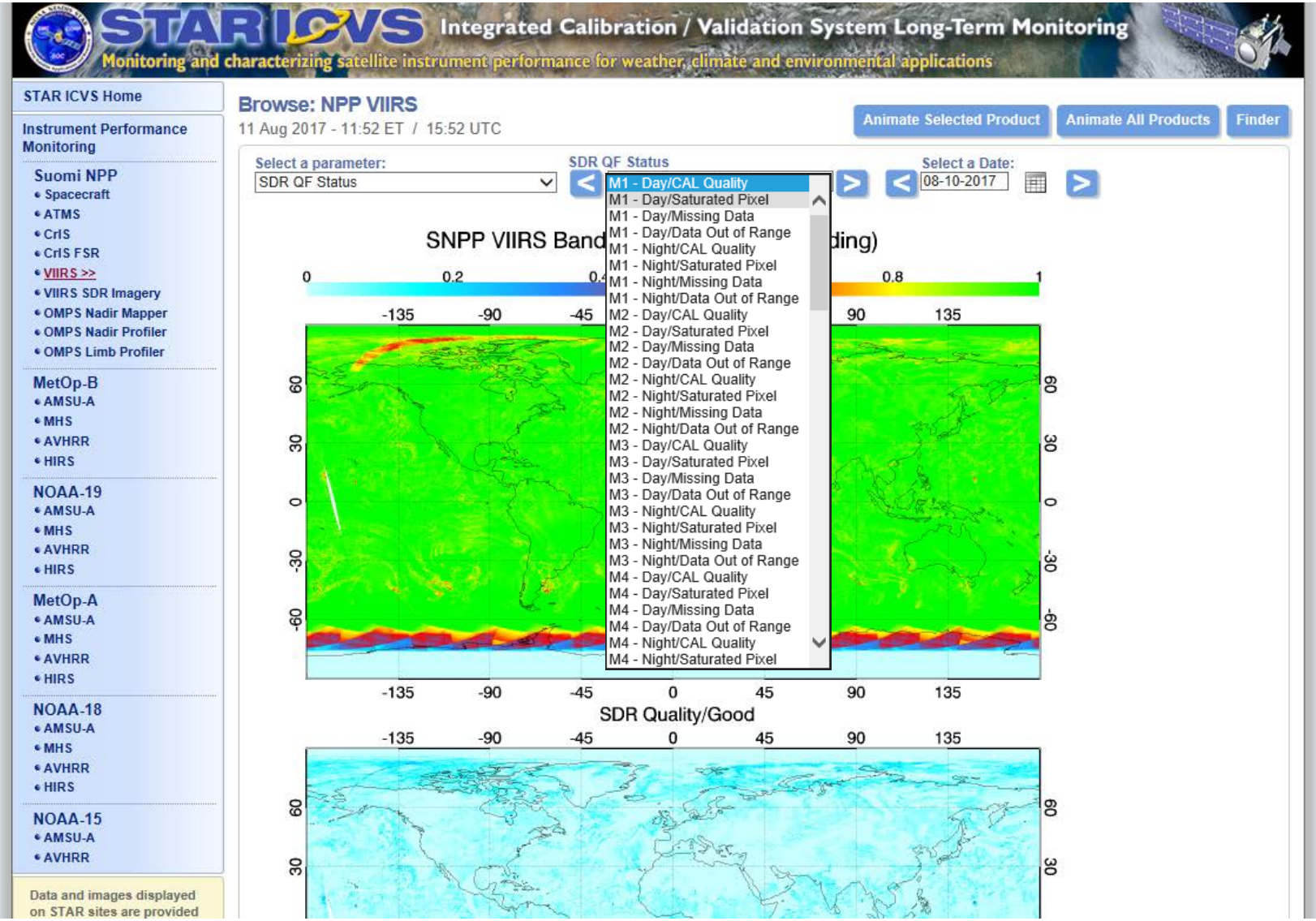
Major SDR Data Events (Cont'd)

NPP SDR-GEO QF triggered due to the delay of S/C diary



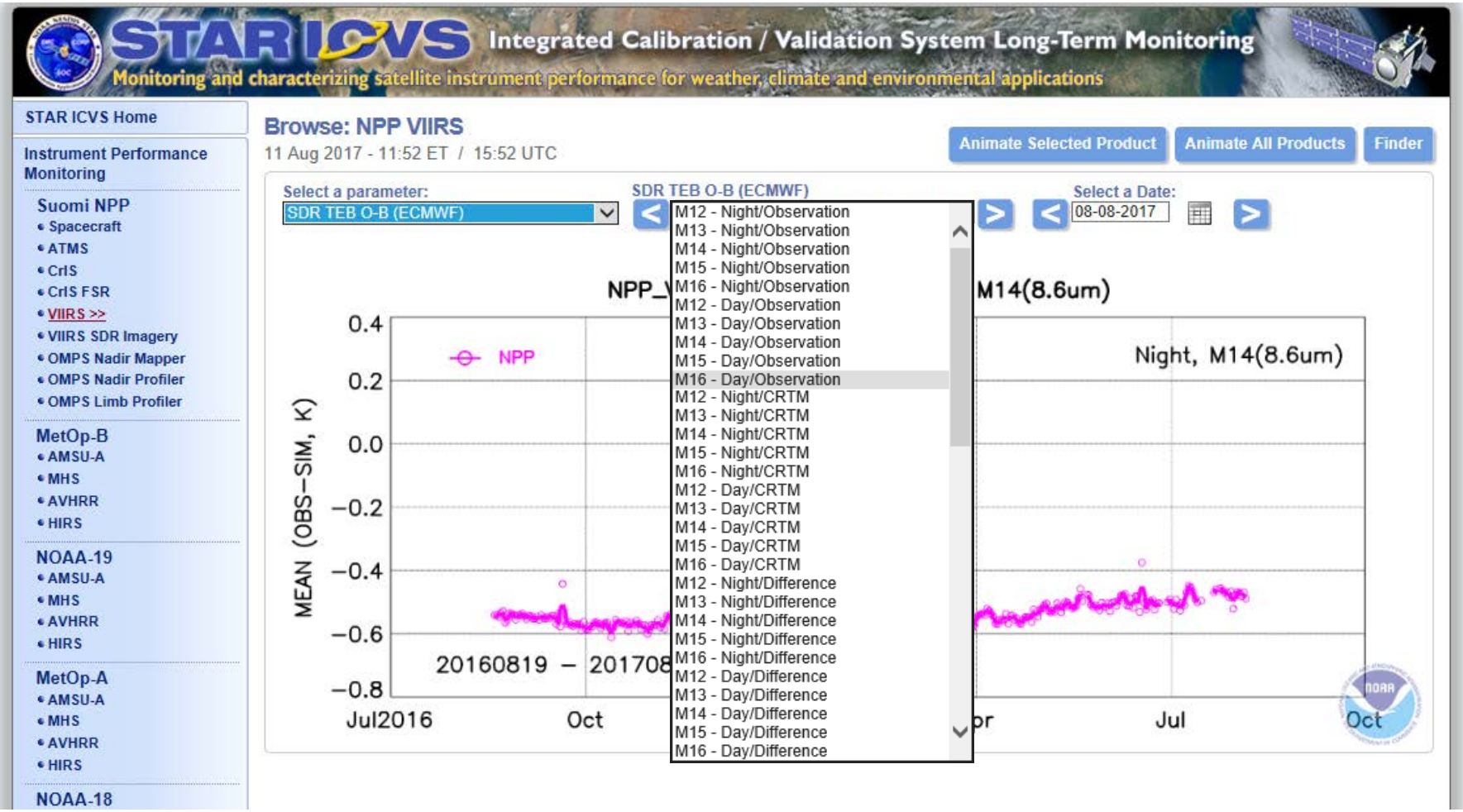
Advances in ICVS

Improved VIIRS quality flag monitoring



Advances in ICVS (Cont'd)

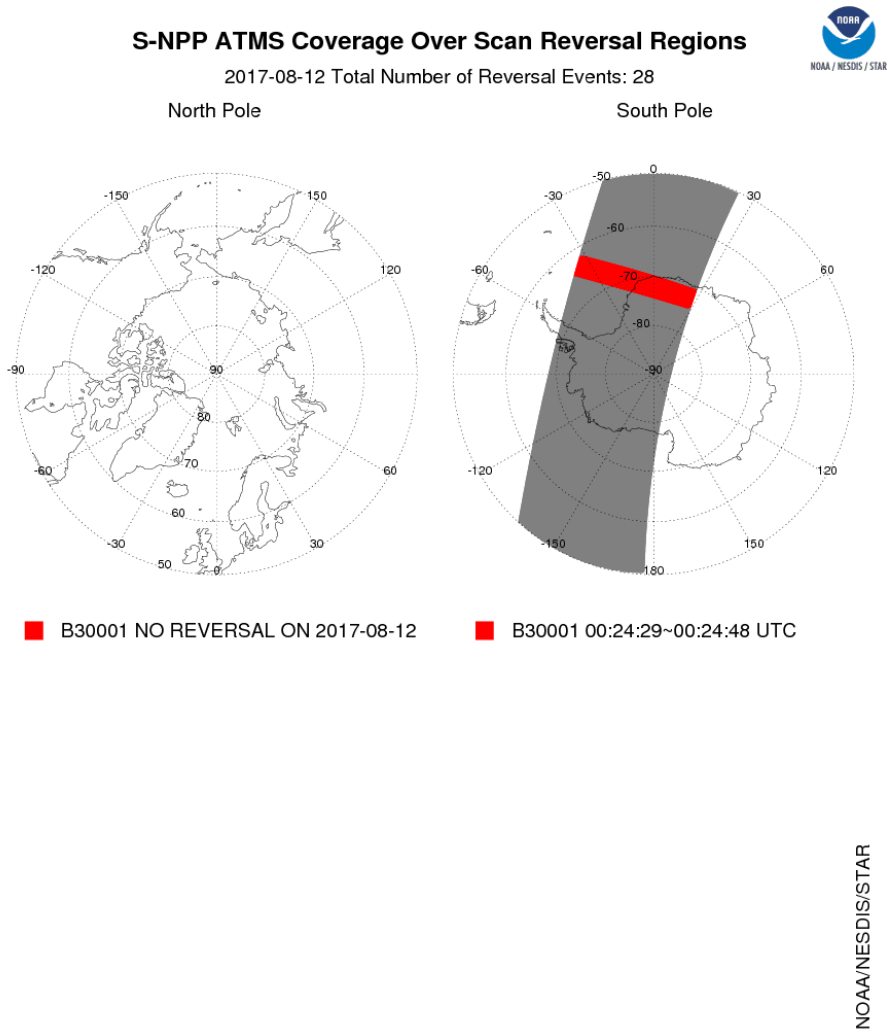
New VIIRS SDR Bias Characterization Capability



- ✓ TEB (M12-M16)
- ✓ Day/Night Separated
- ✓ Daily O-B Map
- ✓ Long term trending time series

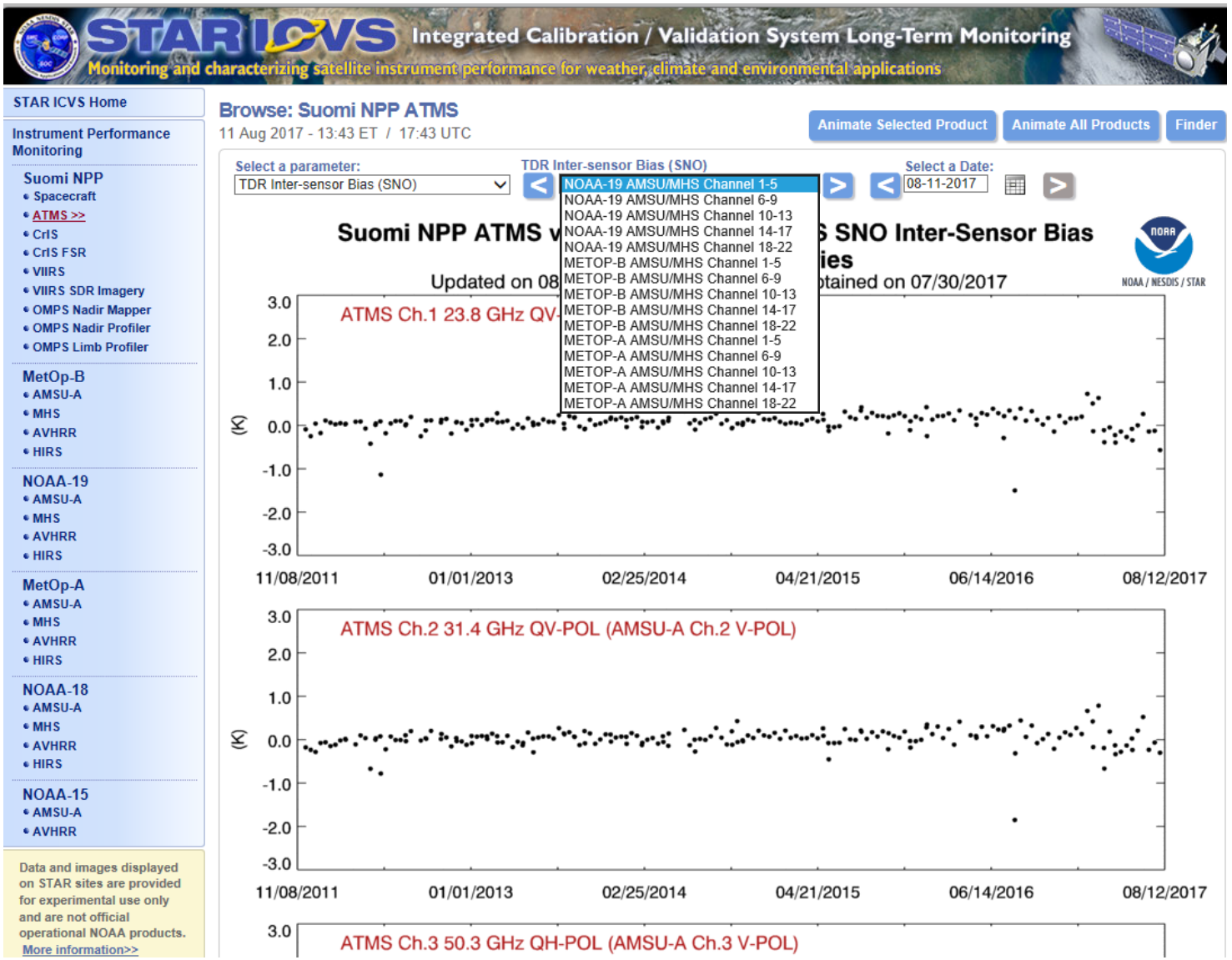
Advances in ICVS (Cont'd)

Updated ATMS Scan Reversal Data Gap Monitoring



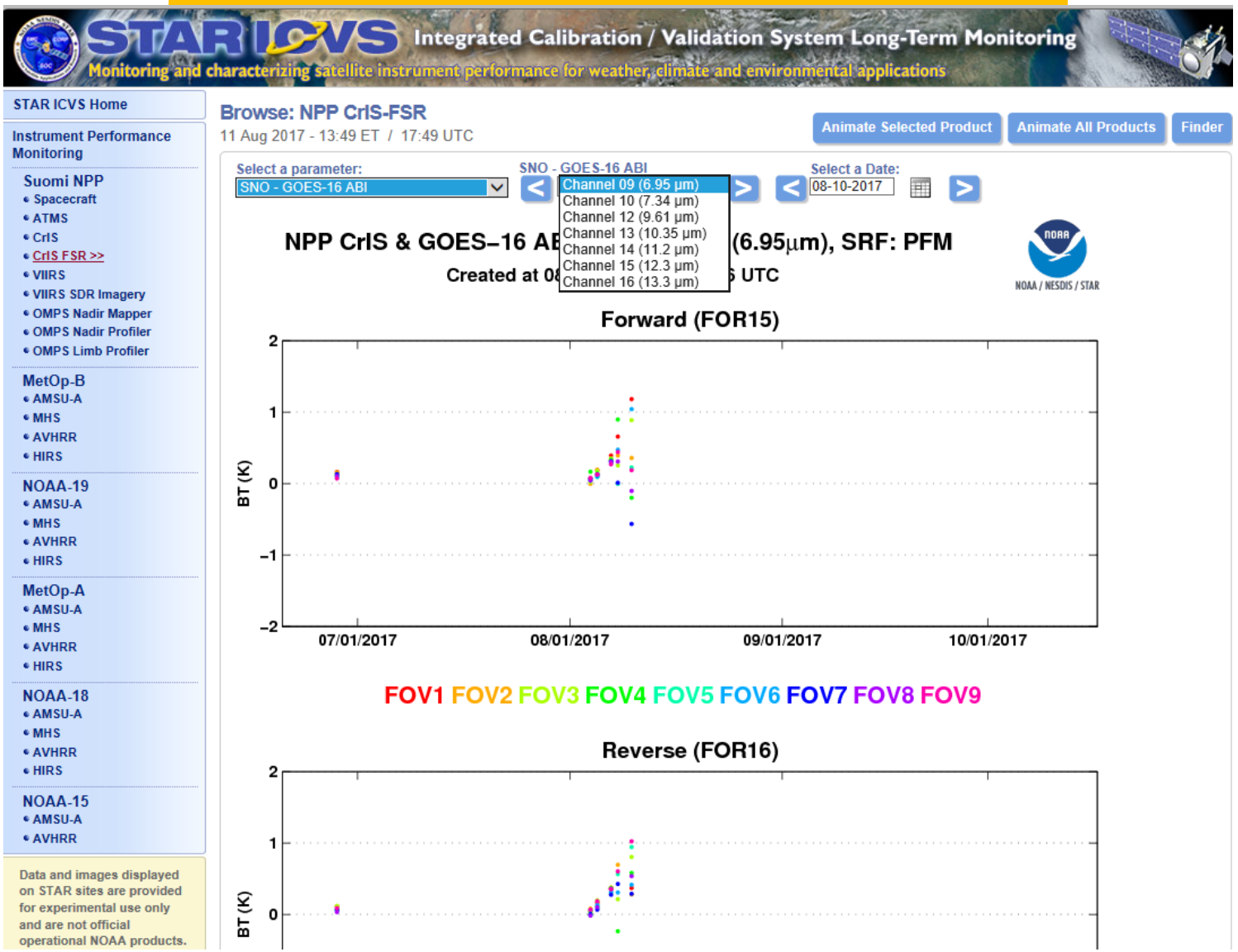
Advances in ICVS (Cont'd)

New ATMS/AMSU-A(MHS) Inter-Sensor Bias Monitoring Capability



Advances in ICVS (Cont'd)

New CrIS/ABI Inter-Sensor Bias Monitoring Capability



Advances in ICVS (Cont'd)

Improved Severe Weather Watch Capability

STAR ICVS Severe Weather Watch

Weather Event Imagery Developed in Support of the STAR Integrated Calibration / Validation System

- STAR ICVS Home
- VIIRS SDR Imagery
- GOES-R ABI Full Disk Animation (TBD)
- Himawari AHI Full Disk Animation (TBD)
- Severe Weather Watch Home
  - 2017
    - Tropical Storm Cindy >>
  - 2016
    - Hurricane Matthew
    - Hurricane Matthew - AT Animation

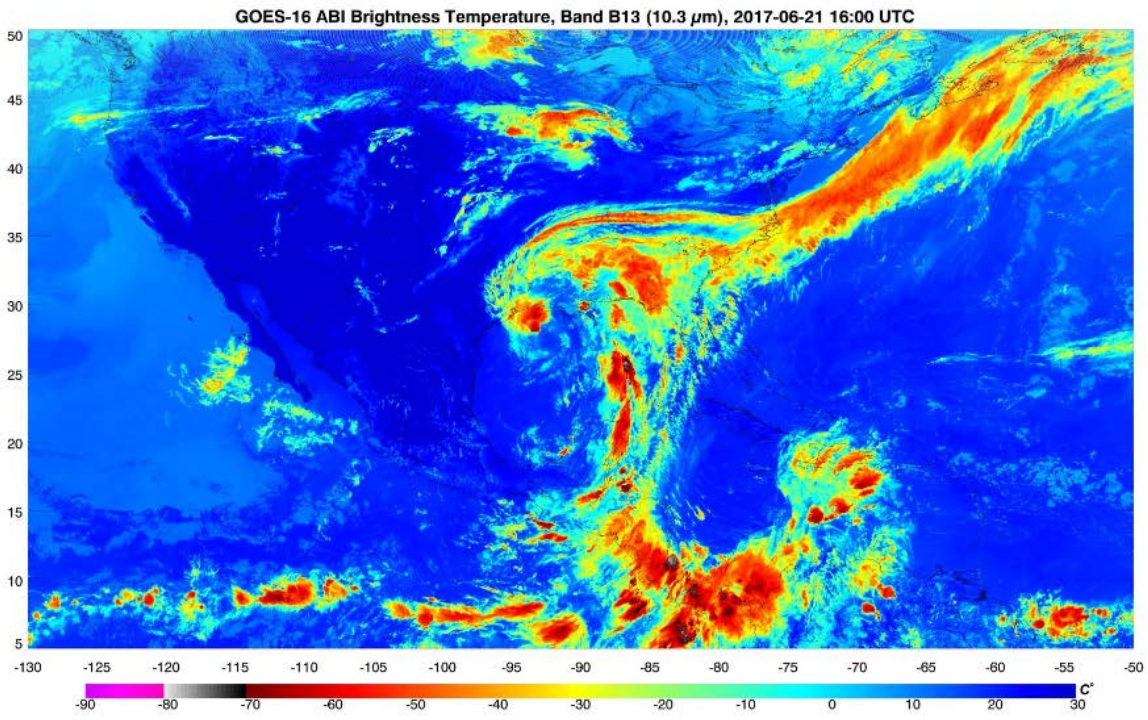
Data and images displayed on STAR sites are provided for experimental use only and are not official operational NOAA products. More information>>

ICVS Severe Weather Watch

Event:	Tropical Storm Cindy	Date:	June 2017
Region:	Gulf Coast	Satellite:	GOES-16 ABI

Animation of the most recent 72 product images

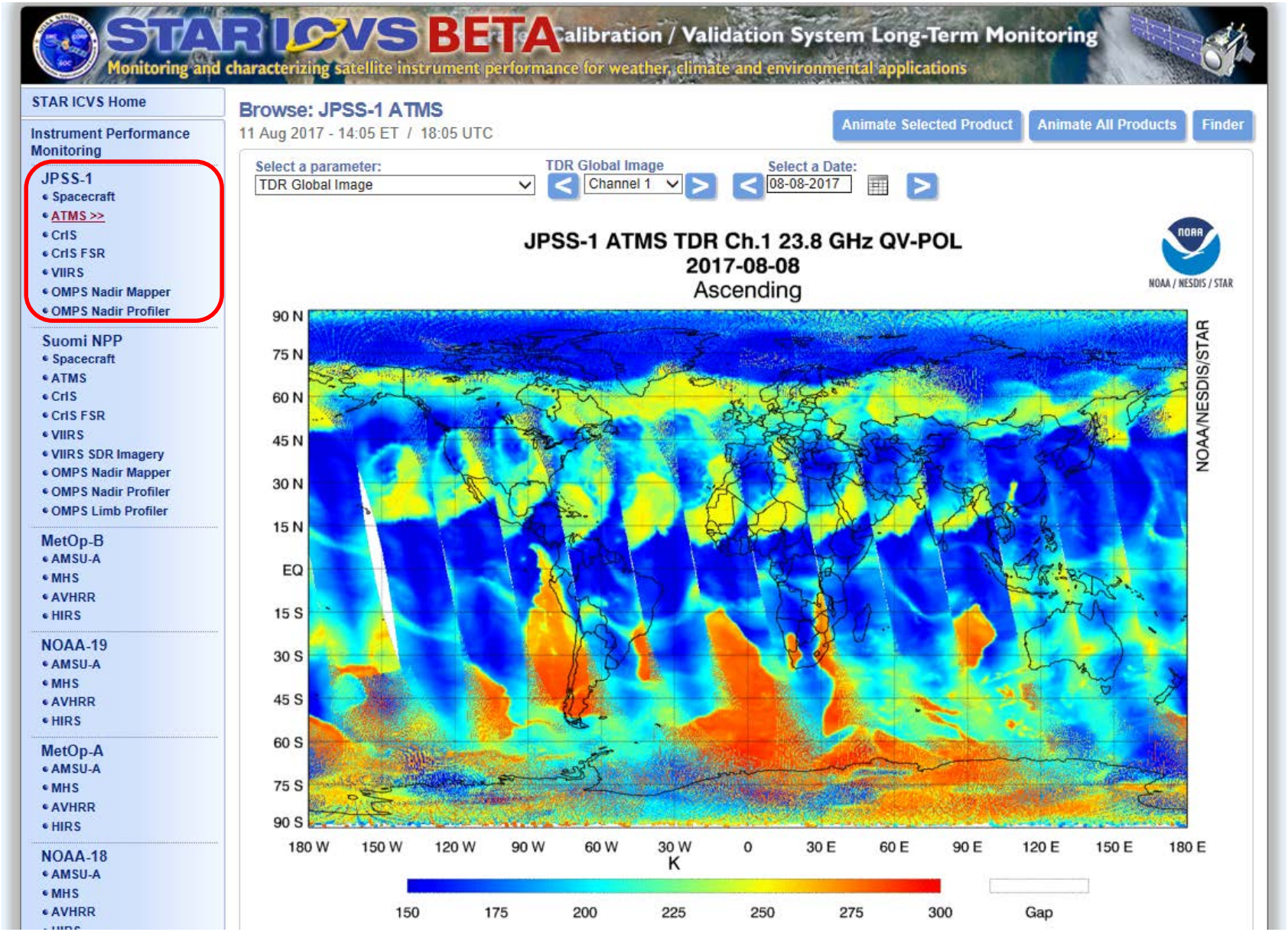
Infrared - Band 13 - 10.3µm - 06/21/2017 - 1600 GMT



Pause | Resume | Previous | Next

Speed: Slowest | Slower | Medium | Faster | Fastest

JPSS-1 Readiness



JPSS-1 Readiness

- Pre-launch Characterization
  - Performed multiple rounds of JPSS-1 proxy data testing
  - Published testing results images in ICVS-Beta web site

- Post-Launch Testing and Cal/Val Activity Plans
  - Start providing JPSS-1 spacecraft/instrument/data quality monitoring as soon as data are available
  - ICVS key parameters will support SDR teams to meet JPSS-1 Cal Val maturity timeline requirements

- Major Risks/Concerns/Issues/Challenges/ and Mitigation
  - Major format updates in multiple data sets
  - External auxiliary data sets not available for ICVS parameters in time

Future Improvements

- Improve software package execution efficiency
- Improve automatic user anomaly notification function
- Improve inter-sensor comparison capability
- Improve SDR-EDR connection in data quality monitoring

Summary & Path Forward

- Summary
  - ICVS generates 2896 S-NPP monitoring images every day
  - ICVS successfully provides SDR team critical support on Cal/Val activities
  - ICVS also provides NASA flight project support on instrument anomaly diagnosis
  - ICVS has been transitioned to GRAVITE for 24/7 operational run

- Path Forward
  - Explore the optimal CubeSat on-orbit monitoring plan
  - Explore the big data analysis technology in instrument anomaly troubleshooting and SDR/EDR data product applications