NOAA Integrated Calibration and Validation System (ICVS) Alerts, Events, and Monitoring

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NOAA/NESDIS/STAR

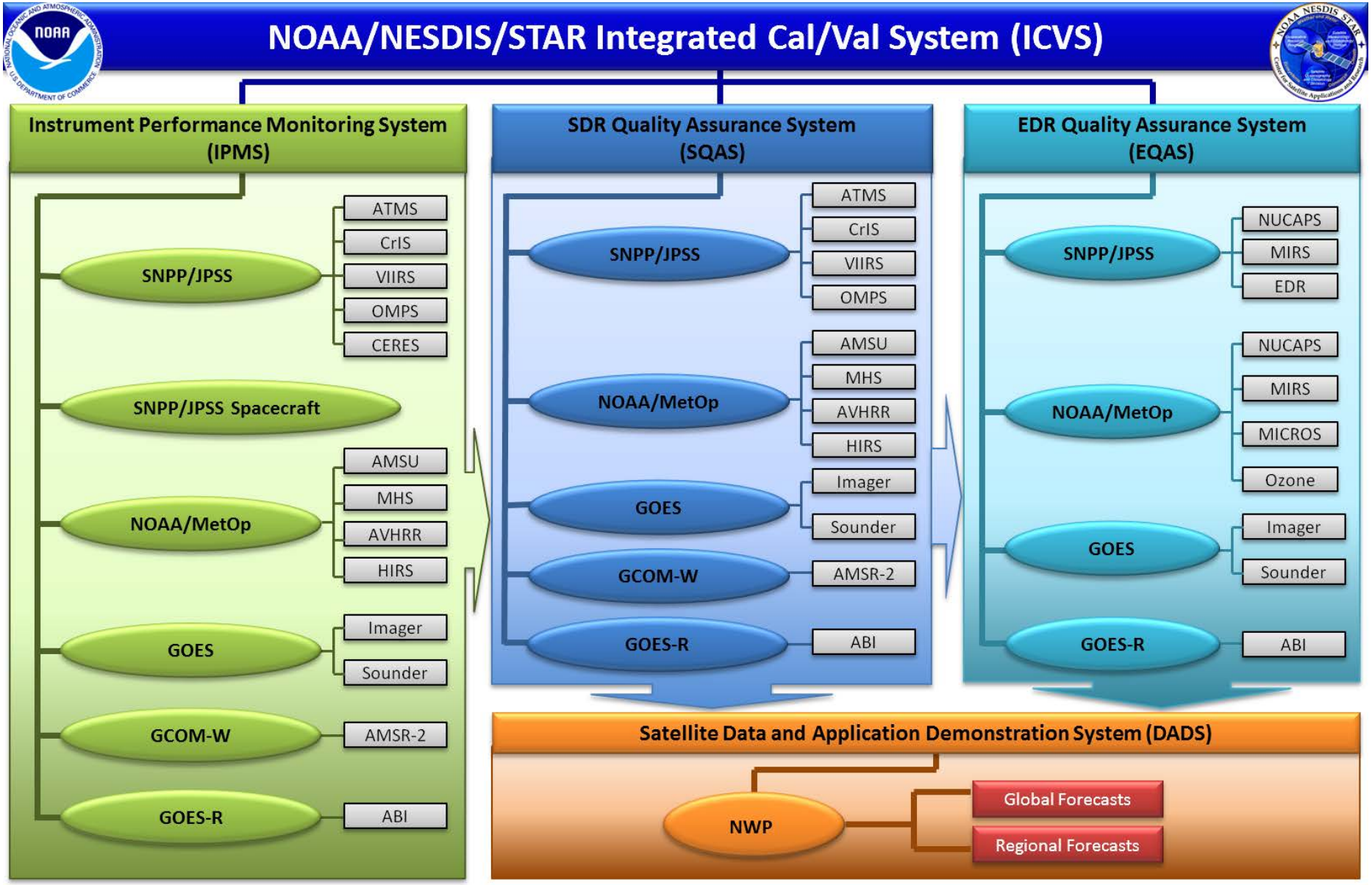
Outline

- **Introduction to STAR ICVS**
  - Objectives
  - Services
  - IT Infrastructure
  - Processing Flowchart
- **Major Accomplishments**
  - New Trending Products
  - Improvements of Existing Products
  - Useful Near Real Time Anomaly Alert
- **Summary & Future Plans**
  - ICVS improvement and implementation plan
  - JPSS Readiness

Benefits of STAR ICVS System

- Provide near real time and long term spacecraft and instrument health status and performance monitoring
- Provide near real time and long term SDR/EDR data product quality monitoring
- Provide real time support for sensor calibration activities and instrument anomaly troubleshooting
- Provide quick and preliminary estimate of satellite data impact in NWP applications
- Ensure the integrity of the climate data records from broader satellite instruments

STAR ICVS Structure



Services

- NOAA ICVS provides the following services
  - Monitors over 400 parameters for 28 instruments onboard NOAA/METOP/SNPP satellites
  - Monitors and trends the SNPP spacecraft parameters , supporting NASA flight team
  - Monitors the instrument performance through trending the instrument house-keeping and telemetry parameters
  - Detects the anomaly events and automatically sends the warning messages to NOAA satellite operators, NASA instrument scientists, and senior program managers
  - Characterizes the sounder SDR data quality with respect to the numerical weather prediction model (NWP) simulations
  - Provides NWP users and remote sensing communities on the instrument noises for their real-time applications (e.g. error covariance in data assimilation)
  - Generates high resolution geostationary/polar-orbiting satellite images
  - 4246 all instrument status and data quality trending figures generated in near real time
  - Supports Suomi NPP life cycle reprocessing by operating SDR processing packages

STAR ICVS IT Infrastructure

Parts	Total
Servers	12
CPU Cores	876
Memory (GB)	5156
HDD (TB)	815

STAR Internal Servers

- STAR integrated calibration/validation system (ICVS)
- Global Space-based Inter-Calibration System (GSICS)
- Daily JPSS SDR calibration/validation activities

STAR-S1
80 Cores
256 GB
135 TB

STAR-S2
80 Cores
512 GB
230 TB

STAR-S3
80 Cores
512 GB
200 TB

STAR-S4
16 Cores
256 GB
12 TB

STAR-S5
16 Cores
256 GB
12 TB

STAR-S6
8 Cores
16 GB
8 TB

STAR-S7
4 Cores
4 GB
2 TB

STAR-S8
16 Cores
768 GB
20 TB

STAR-S9
16 Cores
768 GB
20 TB

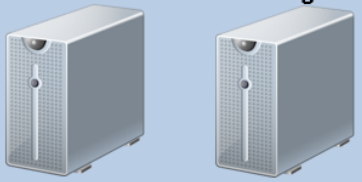
STAR CICS Cluster

- Computation intensive jobs
- NWP pre-operational testing
- Mission lifecycle data reprocess

STAR-CICS1
432 Cores
1296 GB
136 TB

UMD/AOSC Servers

- Data dissemination
- Academia research testing



STAR-UMD1
64 Cores
256 GB
20 TB

STAR-UMD2
64 Cores
256 GB
20 TB

Direct Link

Direct Link

Internet

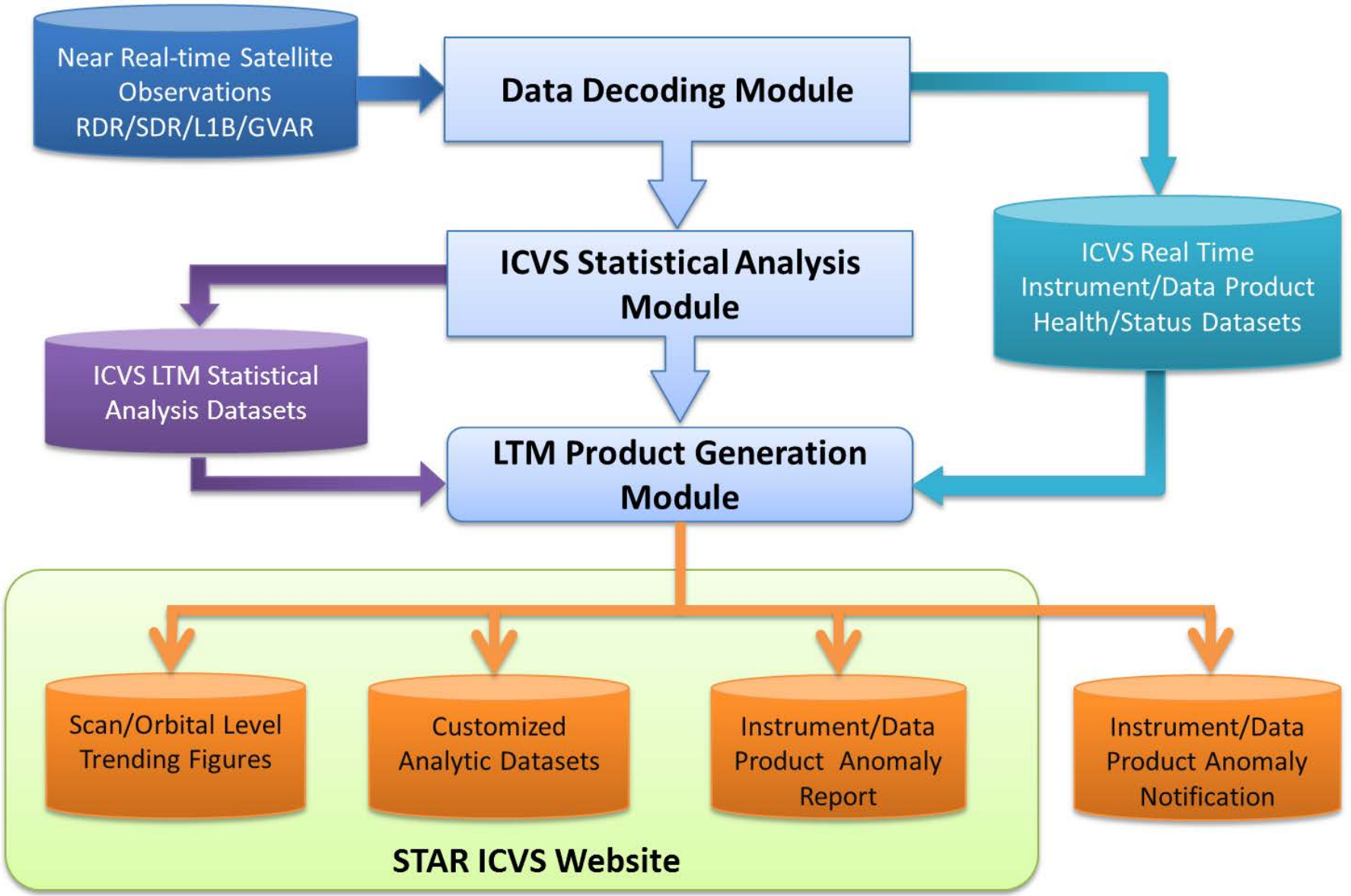
GRAVITE
Real time S-NPP/JPSS data

CLASS
Lifetime S-NPP/JPSS data

NWP Centers
NWP forecast data

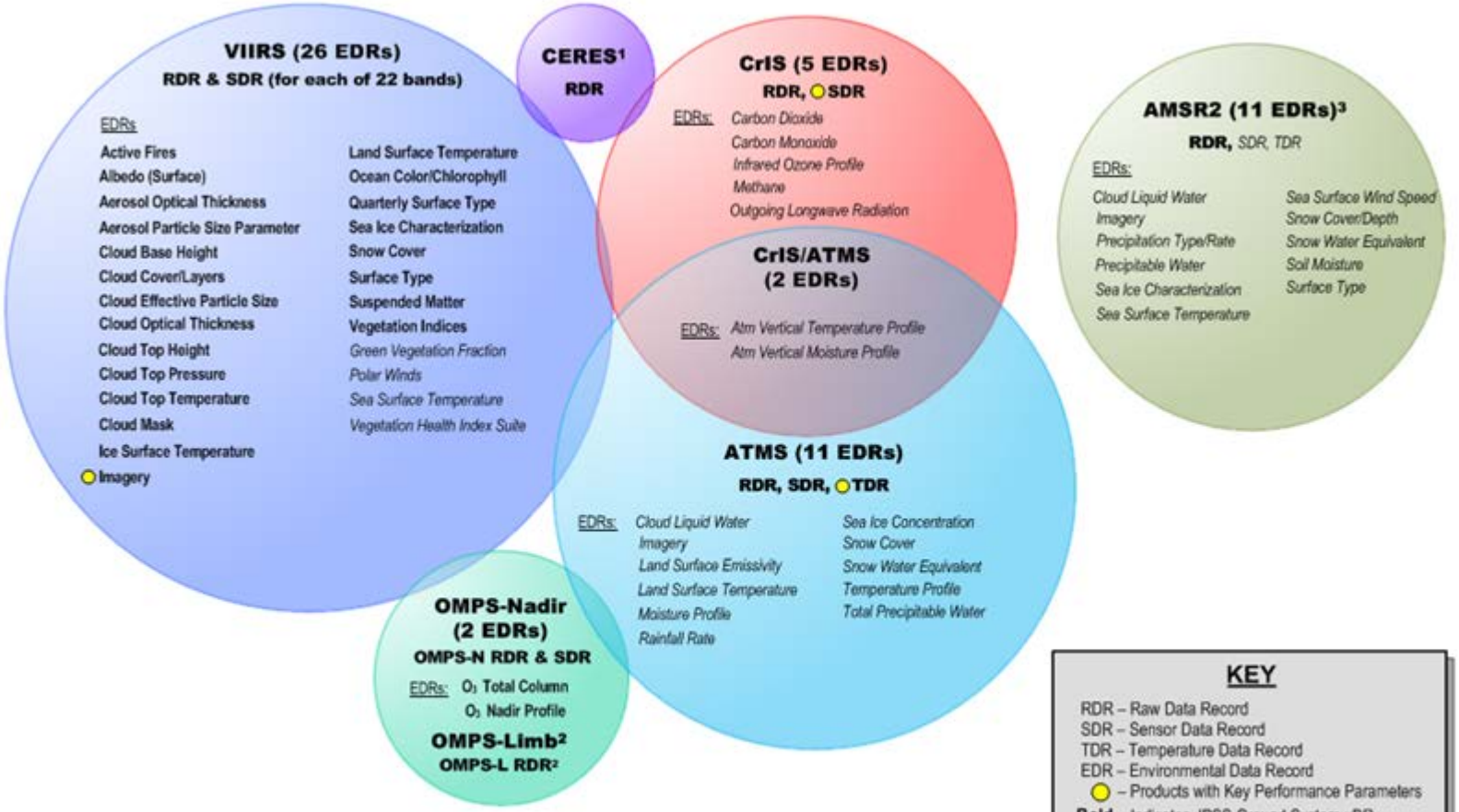
Other Data Center
Cosmic, MLS, et. al.

STAR ICVS Data Processing Flowchart



JPSS Data Products

JPSS Program Data Products



KEY

RDR – Raw Data Record
SDR – Sensor Data Record
TDR – Temperature Data Record
EDR – Environmental Data Record
○ – Products with Key Performance Parameters
Bold – Indicates JPSS Ground System xDR
Italics – Indicates NOAA Polar Legacy (ESPC) xDR

Notes:
[1]RDRs for the JPSS-2 Mission are contingent on NASA manifest of the Radiation Budget Instrument (RBI)
[2]Not applicable to JPSS-1; contingent on NASA manifest of OMPS-Limb on the JPSS-2 Mission
[3]Dependent on the Global Change Observation Mission (GCOM) provided by the Japan Aerospace Exploration Agency

The JPSS Program includes Ground System Support for the Metop, DMSP, and GCOM missions

December 18, 2014
This chart is controlled by JPSS Program Systems Engineering

JPSS-P Rev C

STAR ICVS Event Log

STAR ICVS Integrated Calibration / Validation System Long-Term Monitoring

Monitoring and characterizing satellite instrument performance for weather, climate and environmental applications

ICVS Home > ICVS Anomaly History

ICVS Instrument Anomalies

Cumulative Zip file of all MX Releases, (ZIP, 1.57 MB, New: 6/30/2016)

Click column headings to sort; Type in the "Search" box to query table contents.

Updated: 8/8/2016

Show 30 entries Search:

Event	Date	Time (UTC)	End (UTC)	Instrument (s)	Retrieved from:	CCR	Notes
VIIRS DNB Calibration	08/02/16	1:52	17:06	V	C/V Leads Archive	---	---
ATMS Table and RAM Dumps	08/02/16	16:59	17:02	A	ESPC Ops Report	---	During SVL Contact 24691 SNPP engineers placed the ATMs instrument in safe mode to perform required ATMS table dumps. While in safe mode no scince data was generated resulting in a 2 minute, 40 second ATMS outage.
ATMS Once-per-Orbit Scan Reversals Implemented	07/25/16	-:--	-:--	A	Go-CAM Report, C/V Leads Archive	---	Svalbard Contact 24577, Ground commanded CBM-sequence until 08/04/16, then DAS-commanded at 70N, 75N, 80N, repeat. Expect 14 reversals/day.
ATMS TMon 131 and 132 Activated	07/18/16	-:--	-:--	A	C/V Leads Archive	---	---
ATMS TMon 131 and 132 Load	07/15/16	19:21	-:--	A	Go-CAM Report, C/V Leads Archive	---	On Friday, 15 July 2016, during contact 24437 at 19:21 UTC, OSPO loaded two new TMons (131 & 132) and one new ACBM sequence (100) to ATMS to monitor ATMS Main Motor temperature and DTU-measured ATMS Scan Drive Mechanism temperature. If either temperature exceeds 60C for 24 seconds or 10 seconds, respectively, ATMS will automatically be commanded to safe mode.
J2000 to TOD Update (Table 58)	07/14/16	-:--	-:--	ACOV	NPP ATR	---	---
VIIRS DNB Calibration	07/04/16	0:56	16:10	V	C/V Leads Archive	---	---
OMPS High Resolution Data Collection Discontinued	07/02/16	0:00	-:--	O	---	---	The measurement activities of the S-NPP/OMPS instruments will discontinue the High-Resolution Ozone observations that are solely collected by the NTC/NM instrument on Saturdays.◆ The High-Resolution Ozone observations will be replaced with routine EV data that are typically collected throughout the week.◆
Star Tracker Lunar Intrusion Test	06/17/16	0:00	19:58	---	Go-CAM Report, C/V Leads	---	---

Suomi NPP instrument event log is now available in STAR ICVS website provided by Cole Rossiter

STAR ICVS Event Log

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Updated: 8/8/2016

Show 30 entries Search: ATMS

Event	Date	Time (UTC)	End (UTC)	Instrument(s)	Retrieved from:	CCR	Notes
ATMS Table and RAM Dumps	08/02/16	16:59	17:02	A	ESPC Ops Report	---	During SVL Contact 24691 SNPP engineers placed the ATMs instrument in safe mode to perform required ATMS table dumps. While in safe mode no scince data was generated resulting in a 2 minute, 40 second ATMS outage.
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Major Performance Indicator

- **STAR ICVS-LTM system uses the following equation to calculation S-NPP ATMS channel sensitivity (NEΔT)**

$$Adev_{ch} = \left[\frac{1}{2(M-1)N} \sum_{i=1}^{M-1} \sum_{j=1}^{N} \left(\frac{C(i+1,j) - C(i,j)}{\overline{G_{ch}}(i)} \right)^2 \right]^{1/2}$$

Where,

M is the number of scans for orbital NEΔT calculation

N is the number of warm count readings used in calculation

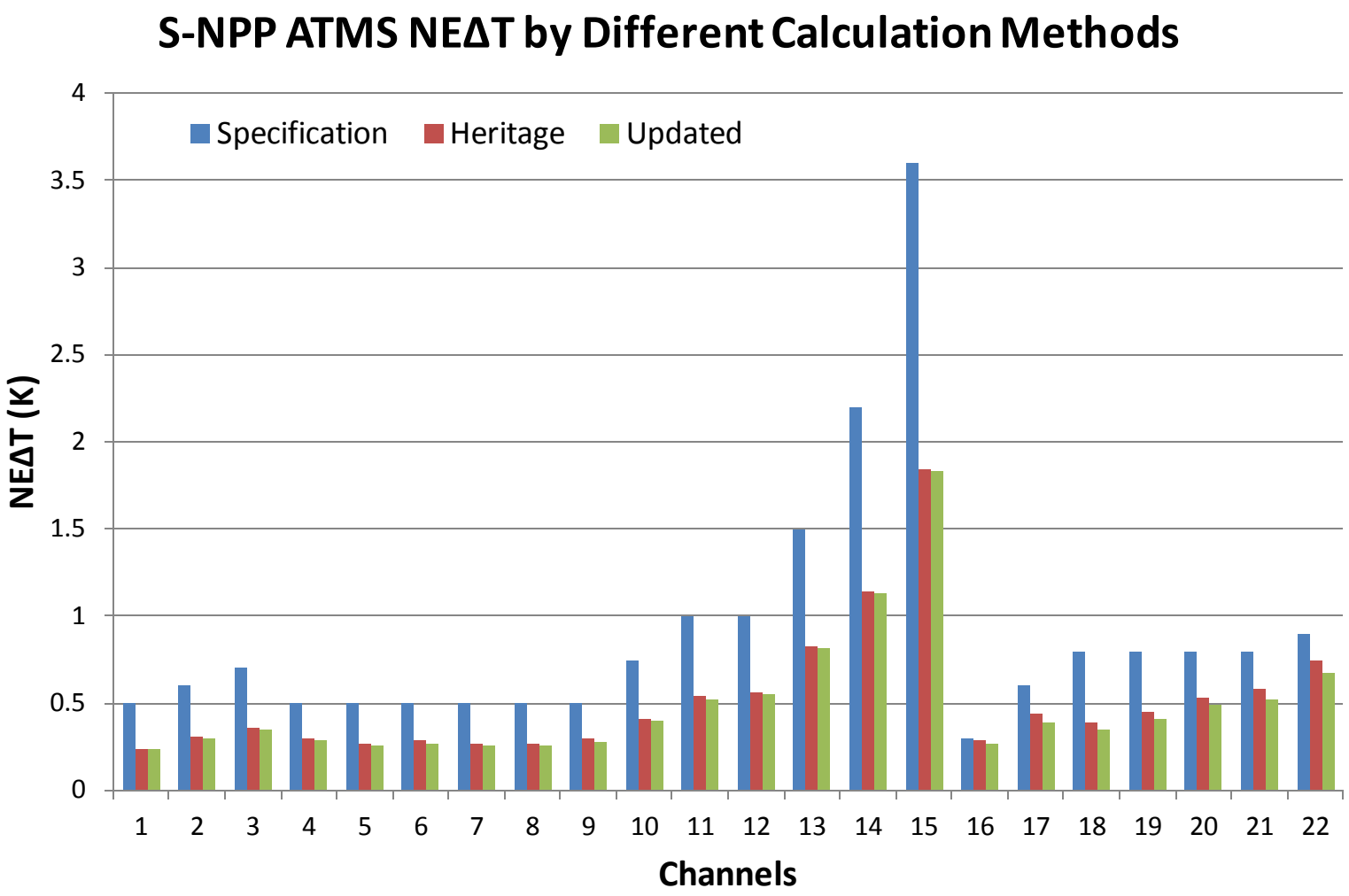
C is the warm count readings for each scan

G is the calibration gain of each scan

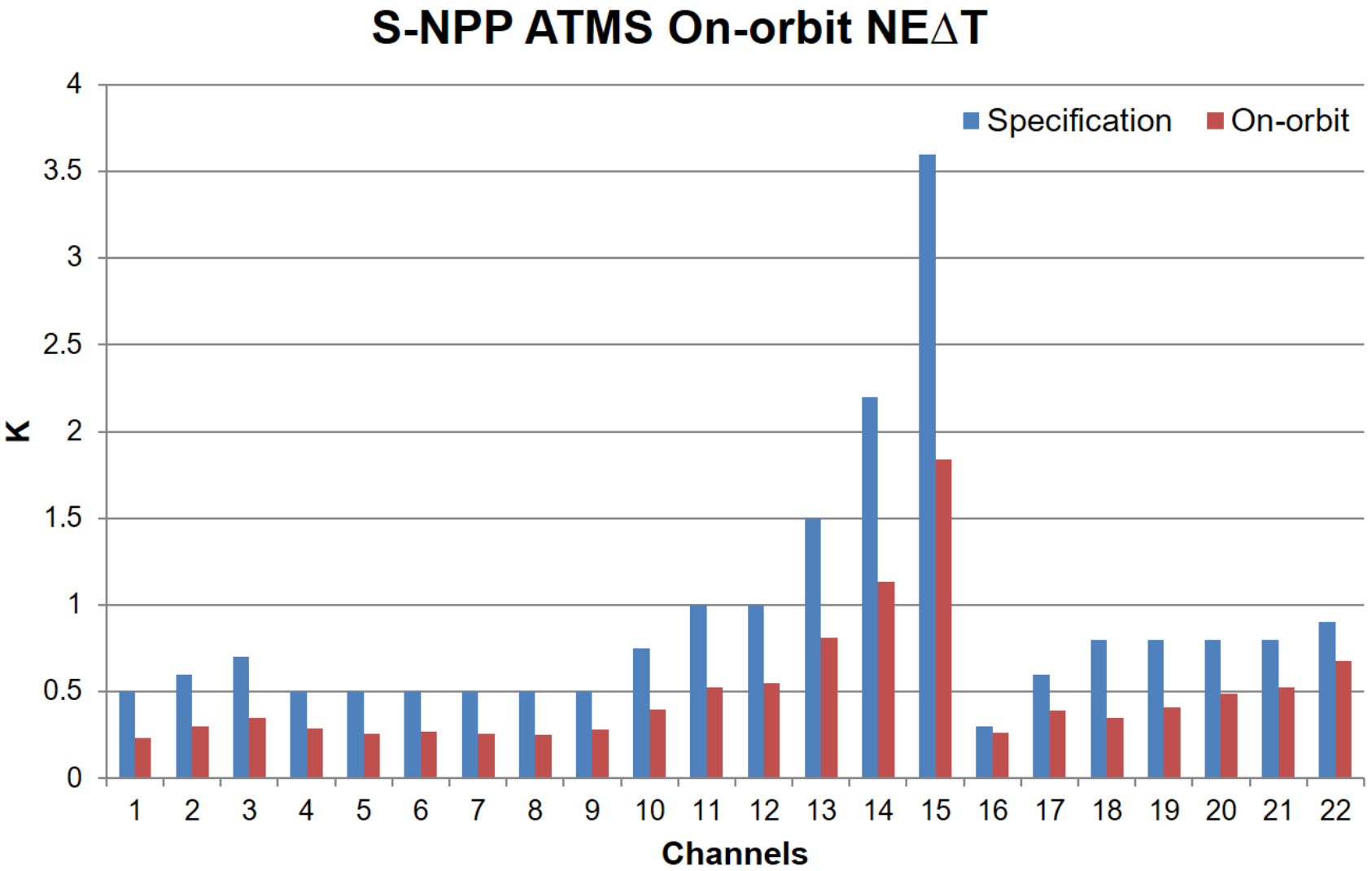
Tian, Miao, Xiaolei Zou, and Fuzhong Weng. "Use of Allan Deviation for Characterizing Satellite Microwave Sounder Noise Equivalent Differential Temperature (NEDT)." *Geoscience and Remote Sensing Letters, IEEE* 12.12 (2015): 2477-2480.

Chen, Yong, Fuzhong Weng, and Yong Han. "SI traceable algorithm for characterizing hyperspectral infrared sounder CrIS noise." *Applied optics* 54.26 (2015): 7889-7894.

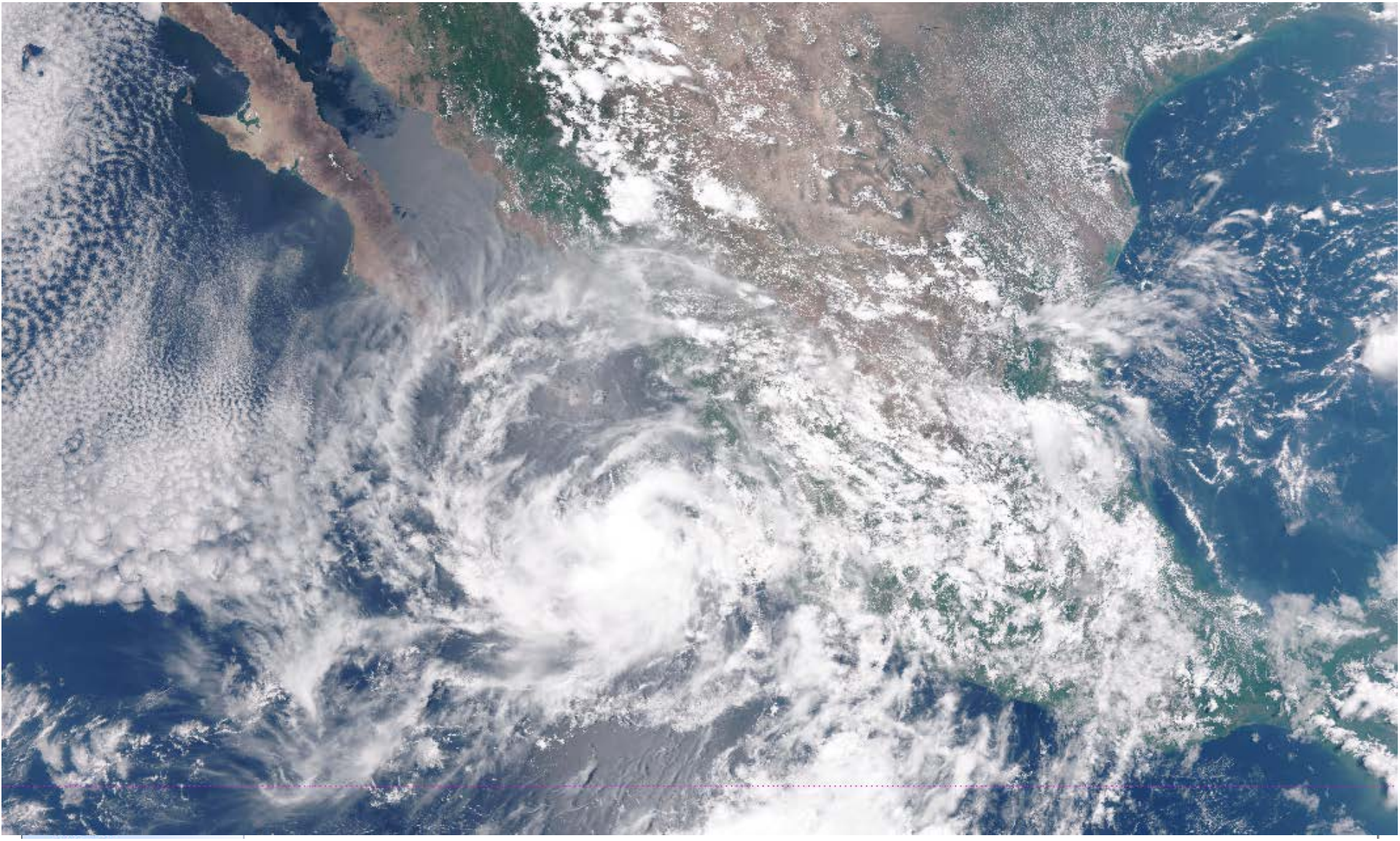
Major Performance Indicator



Major Performance Indicator

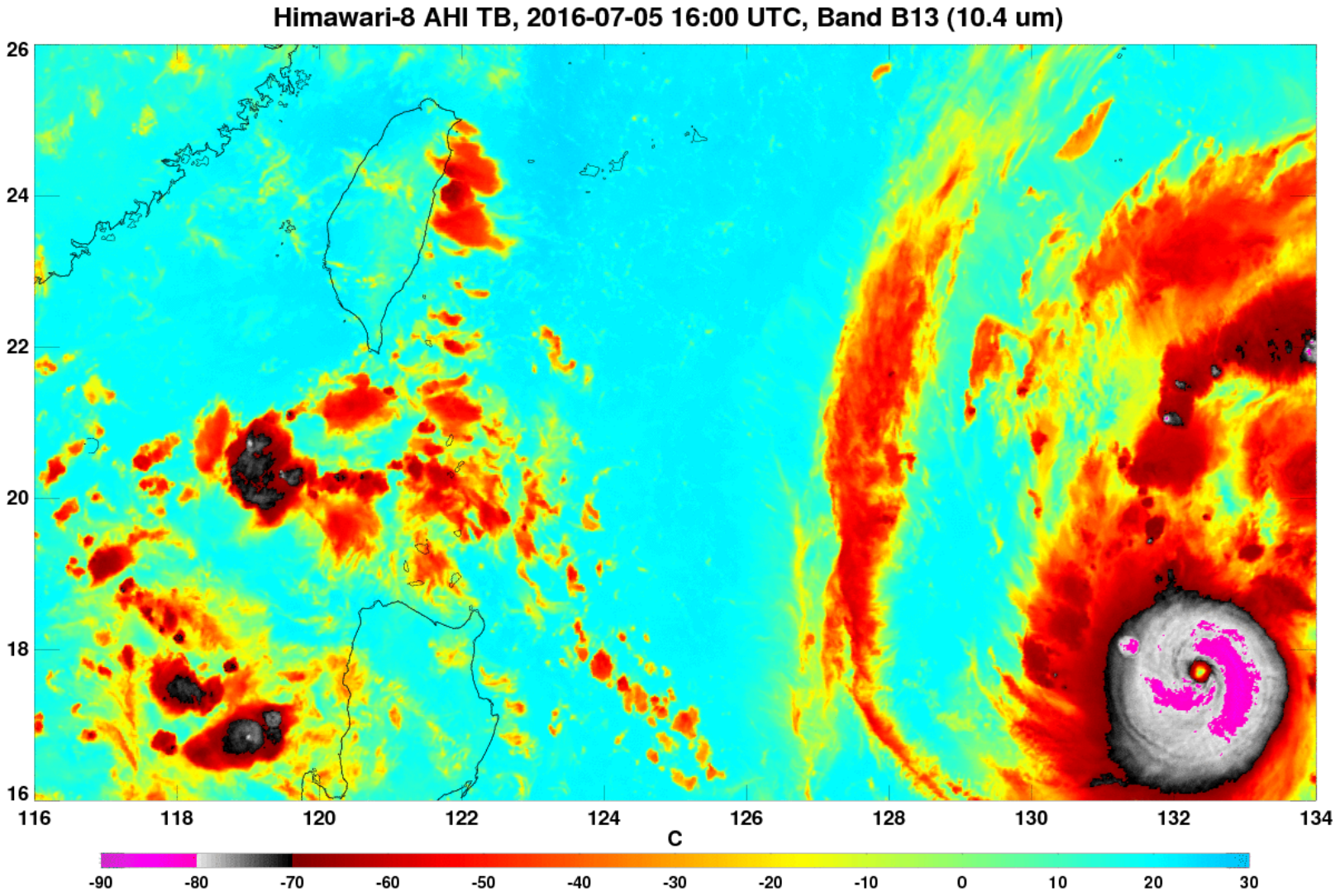


ICVS New Products

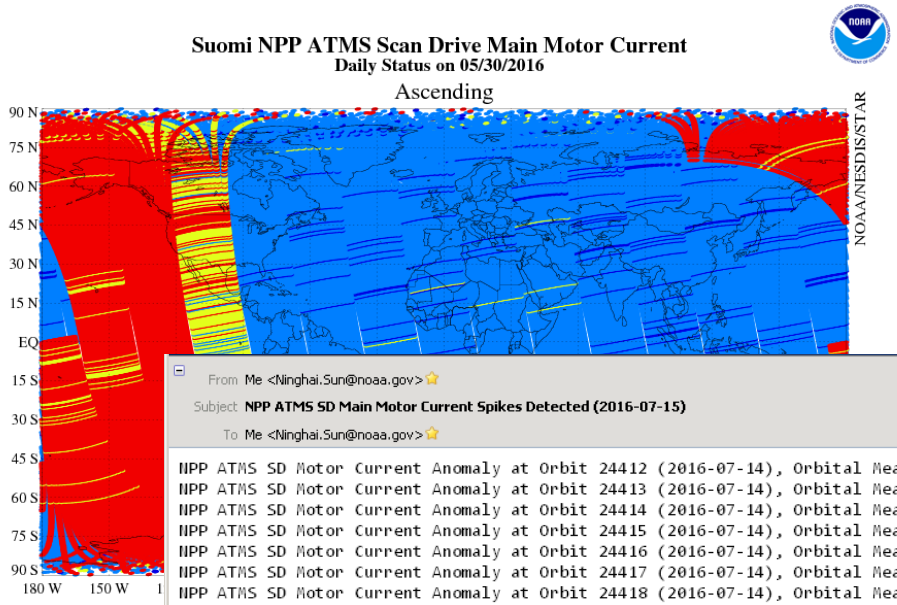


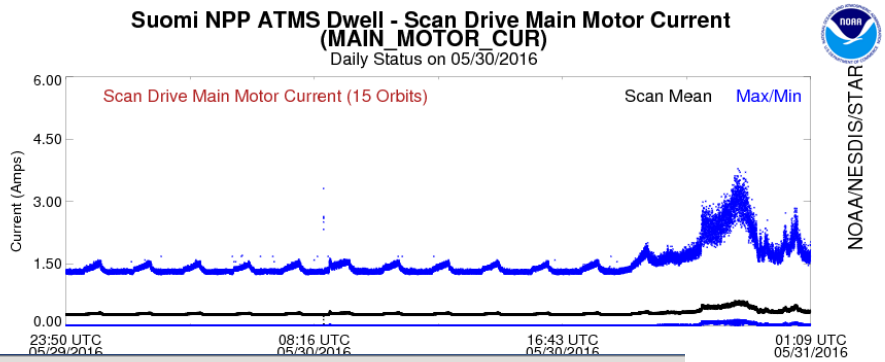
ICVS New Products

Super typhoon Nepartak from July 5 to 8, 2016 UTC



S-NPP Anomaly Alert





From Me <Ninghai.Sun@noaa.gov>

Subject **NPP ATMS SD Main Motor Current Spikes Detected (2016-07-15)**

To Me <Ninghai.Sun@noaa.gov>

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NPP ATMS SD Motor Current Anomaly at Orbit 24412 (2016-07-14), Orbital Mean =  89.41 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24413 (2016-07-14), Orbital Mean =  87.94 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24414 (2016-07-14), Orbital Mean =  87.60 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24415 (2016-07-14), Orbital Mean =  87.14 mA, Orbital Max = 133.85 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24416 (2016-07-14), Orbital Mean =  87.26 mA, Orbital Max = 133.85 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24417 (2016-07-14), Orbital Mean =  88.08 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24418 (2016-07-14), Orbital Mean =  88.13 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24419 (2016-07-14), Orbital Mean =  86.48 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24420 (2016-07-14), Orbital Mean =  88.17 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24421 (2016-07-14), Orbital Mean =  89.61 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24422 (2016-07-14), Orbital Mean =  87.74 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24423 (2016-07-14), Orbital Mean =  87.37 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24424 (2016-07-14), Orbital Mean =  89.69 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24425 (2016-07-14), Orbital Mean =  89.40 mA, Orbital Max = 155.62 mA
Please Check STAR ICVS-LTM Trending Figure at http://www.star.nesdis.noaa.gov/icvs/metrics/status/NPP/ATMS/2016/07/20160714_npp_atms_analog_22.png

NPP ATMS SD Motor Current Anomaly at Orbit 24426 (2016-07-15), Orbital Mean =  88.57 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24427 (2016-07-15), Orbital Mean =  86.85 mA, Orbital Max = 133.85 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24428 (2016-07-15), Orbital Mean =  86.06 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24429 (2016-07-15), Orbital Mean =  89.21 mA, Orbital Max = 155.62 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24430 (2016-07-15), Orbital Mean =  97.08 mA, Orbital Max = 199.18 mA
NPP ATMS SD Motor Current Anomaly at Orbit 24431 (2016-07-15), Orbital Mean =  93.76 mA, Orbital Max = 155.62 mA
Please Check STAR ICVS-LTM Trending Figure at http://www.star.nesdis.noaa.gov/icvs/metrics/status/NPP/ATMS/2016/07/20160715_npp_atms_analog_22.png
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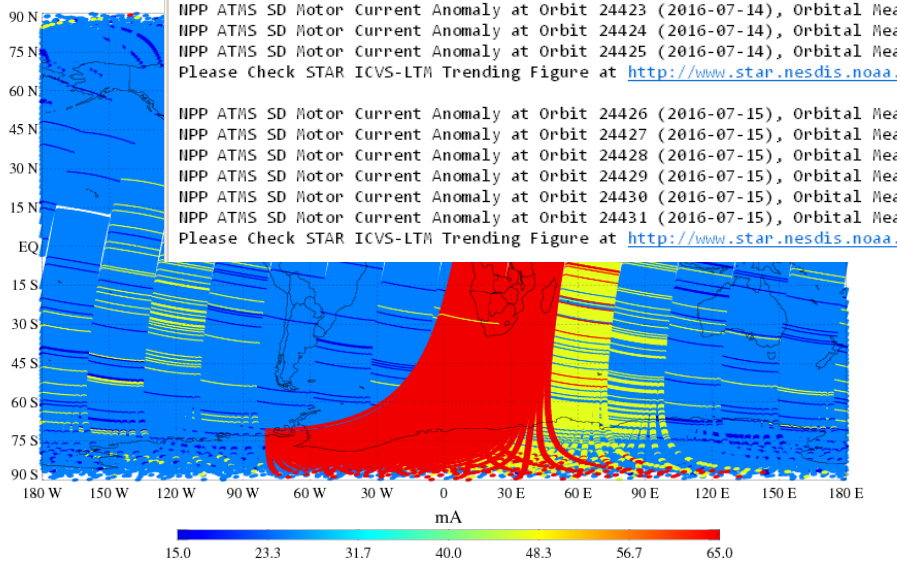
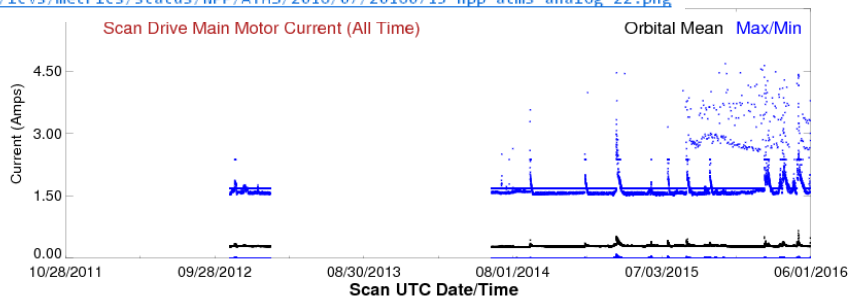
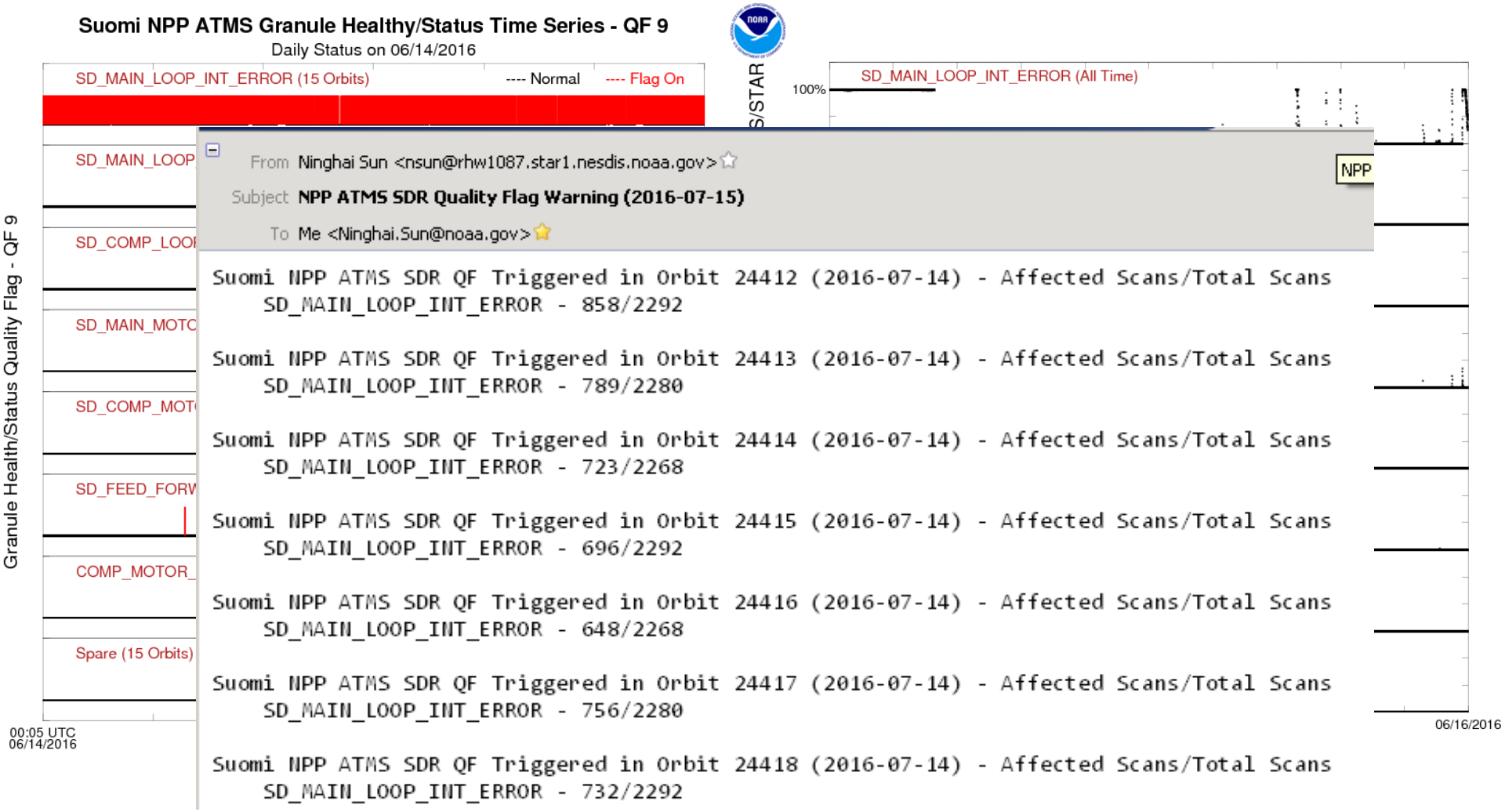
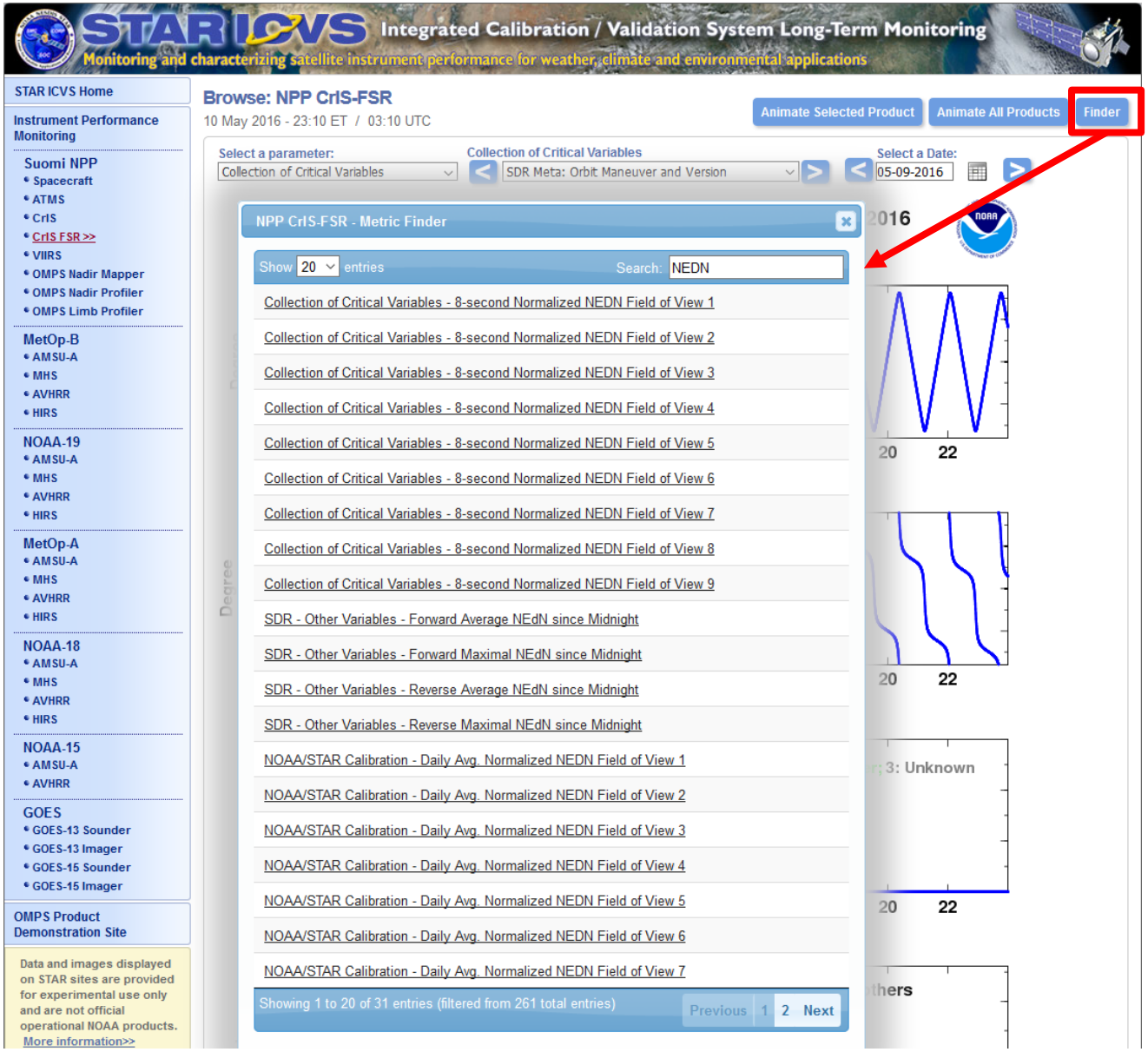




S-NPP ATMS Status



Improved Website



Summary & Future Plan

- STAR ICVS is not only just instrument status monitoring system but also a calibration testing and quality evaluation testbed
- STAR ICVS keeps providing near real time and long term trending of NOAA instrument and automatically sending warning messages when anomaly is detected
- STAR ICVS will keep supporting NESDIS 24/7 operational missions
- New functions and parameters are being added to ICVS to provide users better understanding of NOAA satellites/instruments operational status and support on calibration activities, as well as improving user experience by updating STAR ICVS website
- STAR ICVS has supported JPSS-1 pre-launch calibration activities and is ready for JPSS-1 post-launch instrument monitoring and calibration activities