2015 JPSS STAR Science Teams Annual Meeting Summary

Lihang Zhou

JPSS STAR (JSTAR) Program Manager

Image Credit: http://earthspacecircle.blogspot.com

Great Turnout:

- Over 300 attendees every day, from NOAA, NASA, Universities, and industries.
- 158 oral presentations plus 60 poster presentations.
- Missions/Visions briefed by NESDIS AA, STAR Acting Director, JPSS Director, JPSS Program Science, Program overviews from International partners and JPSS STAR Management
- SDR, EDR overviews followed by detailed science presentations and discussions, great interactions among SDR, EDR science team members
- Operational users presented on their status and plans regarding to uses of JPSS products
- Plans for Science Quality Data Processing and Enterprise Framework were presented by the science teams

Met All Meeting Objectives

- √ Review JPSS Program Level and NESDIS Level Priorities
- √ J-1 Instruments and Algorithm Readiness
- √ Review Science Teams Support for Suomi NPP
- √ Interaction/Communication among stake holders
- √ Feedback from user community

Presentations available at:
http://www.star.nesdis.noaa.gov/star/meeting_2015JPSSAnnual_agenda.php

Future Recommendations

- √ Enterprise algorithms and cost effective solutions for Science Mission Life-Cycle support
- √ Optimal and reliable data products and uses from a fusion of US (NOAA) and worldwide (non-NOAA) POES/GOES satellite constellation, Programs, and Systems across public and private domains
- √ Science Quality Data Processing (Reprocessing) is necessary for Cal Val and users. STAR, with the expertise on satellite algorithms and cal val, will coordinate with NCEI and other stakeholders on the R2O of the JPSS products reprocessing
- √ Globalization and unification of Cal/Val processes and Maturity Definition of products derived from a variety of satellite Platforms.

Summary Slides for Breakout Sessions

Session 5: Advanced Applications

Co-chairs: Mitch Goldberg, Paul DiGiacomo
Prepared by: Veronica Lance

- √ Focused on novel uses of JPSS data (along with additional sources) in generating informative products that form the knowledge base for actions by decision-makers in pursuit of NOAA's key missions

- √ 8 Presentations; Speakers from STAR, NCEI, NWS/NCEP/EMC, OAR/ARL, CIMSS

- √ Compelling Topics:
  Volcanoes; Gas Flare-offs; Nowcasting of events; Global phenology of vegetation; Global air quality from marine emissions; Coupled physical-biogeochemical models for global ocean predictions; Improved SDR Calibrations in support of Ocean Color; Non-NOAA data in support of NOAA missions

Session 6a VIIRS SDR Summary

Changyong Cao
VIIRS SDR Lead

VIIRS SDR Breakout Session 6a

- A successful and productive session;
- Presentations focused on J1 VIIRS readiness, waiver mitigation, instrument performance, and validation capability development;
- Presenters included STAR scientists, instrument vendor, NASA, and the Aerospace Corp. which facilitated excellent technical interchange.
- The team made significant progress toward J1 readiness:
  - STAR successfully delivered J1 VIIRS DNB geocode change as part of the waiver mitigation on schedule;
  - J1 VIIRS SDR LUT ver1.0 has been delivered;
  - Completed prelaunch data analysis and instrument characterization;
  - RSB autocal will be turned on in a week;
  - Validation capabilities have been expanded, including new tools for waiver validations;
  - Cal/Val plan has been developed, with additional field campaign preparation planned.

VIIRS SDR Breakout Session 6a- Actions

- A number of actions have been generated to address issues and challenges:
  1. Prepare and provide simulated images of I3 with noisy detector (d4), and DNB images with op21,op21/26 for the EDR teams;
  2. Investigate possible M5 biases relative to MODIS using spectrally flat targets;
  3. Determine the J1 VIIRS DNB extent of the extended earth view based on useful earth view scan angles;
  4. Prepare and provide the official parameters for the J1 VIIRS polarization for EDR teams to use in their algorithms;
  5. Re-assess the need for quarterly WUCD; deep dive analysis on BB calibration to mitigate impacts on SST spikes;
  6. Prepare reprocessing by researching the best approaches leveraging similar activities for the RSB; perform feasibility study of a SDR L1.5 product working closely with the SST team;
  7. Further verify the effect of NOVAS library updates (initially estimated to be up to 400m near the poles).

Session 6b OMPS SDR Team Breakout

Chunhui Pan and Fuzhong
OMPS SDR Leads

August 28, 2015

Major Events

OMPS SDR Team Overview to Session 6b on Wednesday

- One-day dedicated Session 6b for the SDR and EDR teams. 35+ participants, including four of the five group leads attended in person. Several dialed in.
- Team meeting during the session lunch break.
- Two side meetings on a general cooperation and technical issue for J1 algorithm LUTs
- Many attended Ozone EDR activities (Session on Ozone EDR and Users' Breakout Sessions)

Overview

The Team Overview reviewed:

- Team member and primary roles
- Products and Users
- Instrument system design
- Instrument prelaunch test results
- J1 Requirements and performance
- Potential improvement in SCDBs: BPS and Radiance, irradiance calibration coefficients
- Accomplishments
- Future Plans for SNPP and J1

OMPS SDR Session 6b

9 presentations for SDRs:

1	*Characterization of SNPP OMPS Cross-Track Uncertainty*	Chunhui Pan	UMD/ESSIC (STAR)
2	*J1 OMPS Calibration and Test Status*	Glen Jaross	NASA
3	*Overview of OMPS Instrument*	Sarah Lipscy	Ball
4	*J1 OMPS Operations Plan*	Tom Kelly	NASA
5	*J1 Algorithm Readiness*	Trevor Beck	STAR
6	*OMPS Nadir Radiometric Calibration*	Colin Seftor	NASA
7	*OMPS Wavelength Calibration*	Mark Kowitt	NASA
8	*ICVS Preparation for J1*	Ding Liang	ERT (STAR)
9	*SNPP OMPS Limb Performance and Level 1 Product*	Glen Jaross	NASA

Team Meetings

- Vision of team interaction: STAR expects to Perform cal/val and adapt for IDPS
- Collaborate with NASA broadly and indefinitely
- Work with Raytheon as has been
- Lessons Learned from S-NPP: Inflexible code, wavelength calibration, radiometric calibration in cross-track direction as well as consistency between NM and NP.
- Lessons Learned from J1 prelaunch data
  - Improved bandpass with weighted band center algorithm and add dichroic effect.
  - Modify radiometric and irradiance calibration coefficients to improve a consistency between NM and NP.
- Need algorithm LUTs readily for high, medium and low resolution data
- Need an integrated test for algorithm LUTs with input data covers J1 spectral and spatial domain
- Need to access BATC documents
- Need to access NASA delivered documents from GRAVITE
- There are potential issues associated with the use of 417nm channel in the wavelength and the SL due to the code processes only 260 wavelength channels. Current plan is to use a sparse spectrum for the wavelength to build outputs of 35x5x196 for the wavelengths and SL.

Tables to be Ready for Block 2.0 Test

SDR algorithm LUTs will be delivered as:

1. 6 full frame tables and a mounting matrixes for each of NP and NM: Darks, LED, Calconst, SRG, BP and OSOL and the mounting matrix (CC). A DR and associated CCR will be submitted for the delivery. It is expected that the tables (total = 14) will be ready in 5 weeks. The proxy data test will start as soon as the Block 2.0 is available for offline test.
2. Non-fullframe tables for different resolution data

   NP: 6 tables for 5x5 data: SL, CFearth, TP, ST, Macro and Wavelength

   - NASA/SOC will provide 3 of these tables (ST, TP and Macro)
   - STAR will deliver the other 3 (SL, CFearth and Wavelength)

   TC: For 3 of these tables TP, ST and Macro: TC uses the aggregator to reduce the higher resolution input tables to a 35x5 output that can be ingested by the SDR. There are 3 types of potential inputs: HR (145x30), MR (104x15) and LR (36x5), resulting in a total of 9 dual tables

   - The other 3 tables (SL, CFearth, and Wavelength) are single tables and will be generated by STAR.
   - NASA/SOC will provide the set of 12 TC tables. The SOC delivery is expected by the end of October 2015
3. Version table

   A current example of this table was delivered for S-NPP. A new table will be delivered for J1 by NASA/SOC. This table is the same for the NP and the TC and is required to synchronize the paired tables (ST, macro and TP). This delivery from the SOC will occur with # 2.
4. Spectral coverage - PEATE will formally define the wavelengths coverage to help STAR generate the Wavelength tables in the next few weeks.

Summary

- Most comprehensive collection to document the progress. This was the major goal and has been accomplished, thanks to the team members.
- Team meetings to discuss the changing roles, lessons learned, new challenges. Defined SDR algorithm LUTs needed for high, medium and low resolution data for integrated test. Delivery timeline is scheduled.
- Precious opportunity to learn about the (indirect) users' perspective.
- TIM to focus on technical issue.
- Very productive overall.

Ozone EDR Summary
Larry Flynn

- The product session for ozone provided coverage of a busy and productive year for operations, applications and research.

- There was good progress as we delivered both the V8Pro and V8TOz as enterprise heritage algorithms and have high performing research versions of algorithms to generate SO2 and NO2 products.

- OMPS ozone products (total column, nadir profile and limb profile) are stable and precise and fulfill their role as the satellite component of NOAA's ozone monitoring system.

- Projects are underway that show the added value of ozone and other OMPS products for air quality, hazard identification and aerosols applications.

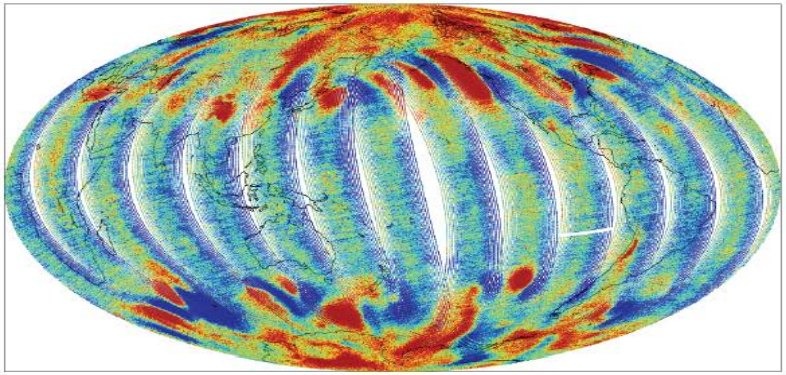
Session 6c ATMS SDR Summary

Ninghai Sun
ATMS SDR Technical Lead

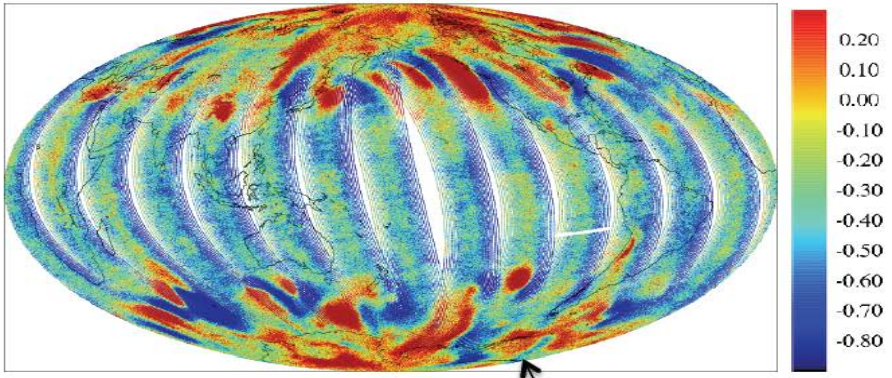
S-NPP ATMS Striping Mitigation

Global O-B Distributions of ATMS Channel 8

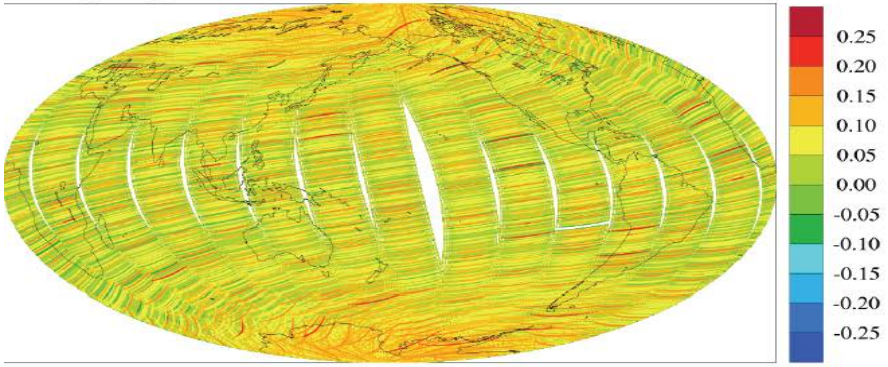
Before de-striping



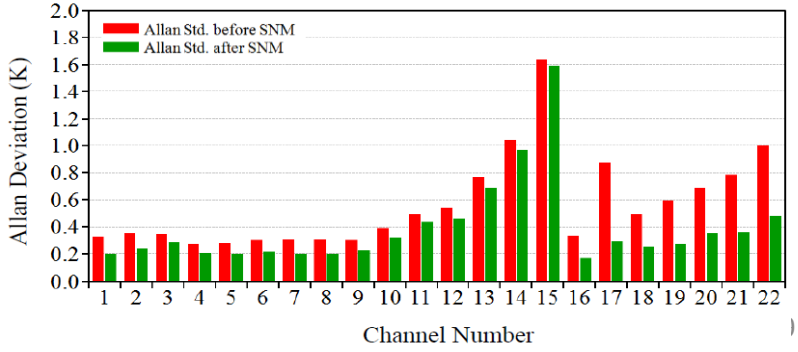
After de-striping



Striping noise filtered



Striping noise is not visibly seen anymore in the global O-B field after de-striping using the PCA/ SymFilter algorithm.



Channel noise is reduced after de-striping →

Xiaolei Zou, *et. al.* (UMD/ESSIC)

JPSS-1 ATMS Readiness

Summary of ATMS Status

- S-NPP flight unit status
  - Post-launch validation activities have confirmed S-NPP ATMS is meeting or exceeding its performance specifications (see papers in S-NPP special issue of JGR)
  - On-orbit testing of scan drive mitigation (reversals) is in progress

- J1 flight unit status
  - just completed 1 year of re-work, and begun environmental re-testing
  - If environmentals are problem-free, J1 unit installs on s/c in Nov
  - J1 observatory-level tests partly done using EDU as stand-in
  - J1 observatory-level TVAC probably in early CY2016
  - If those tests stay on schedule, then launch date is looking good

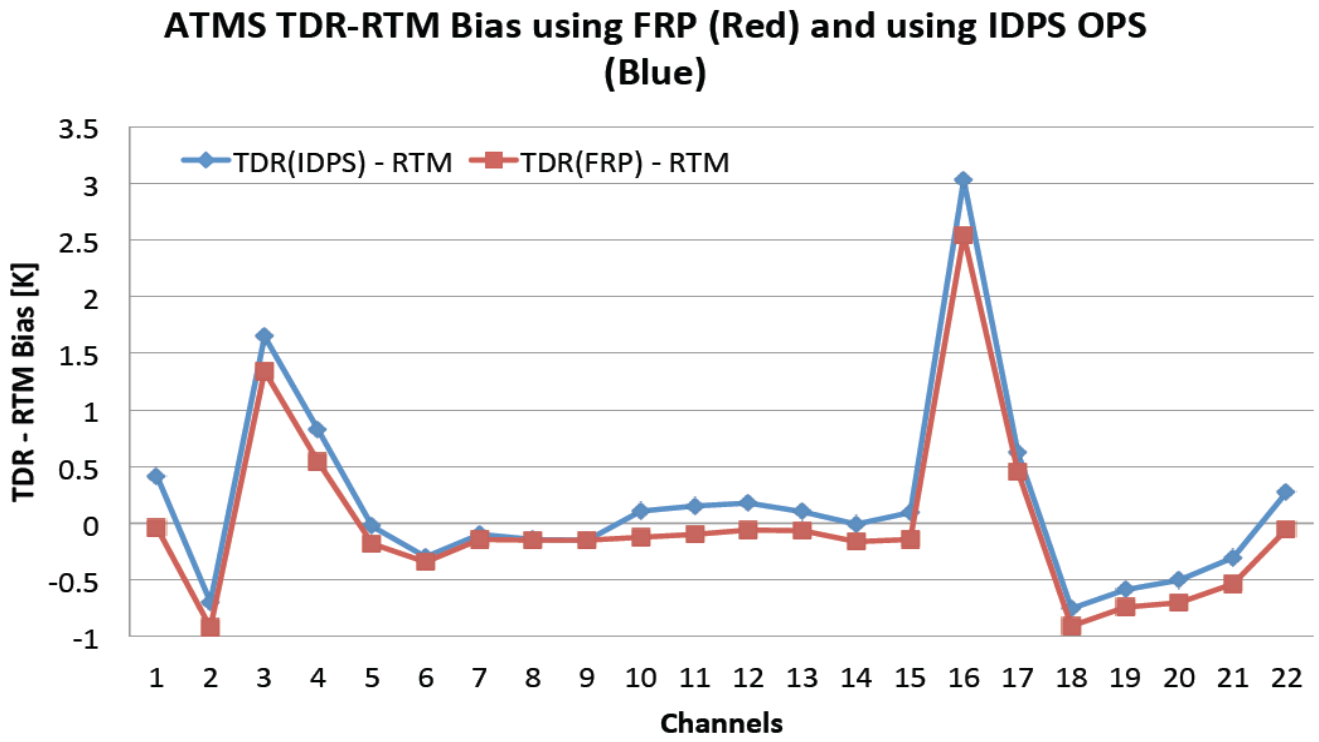
- J2 flight unit status
  - procurements have begun

Ed Kim, *et. al.* (NASA/GFSC)

ATMS SDR Full Radiance Process (FRP)

Global Mean TDR-RTM Bias

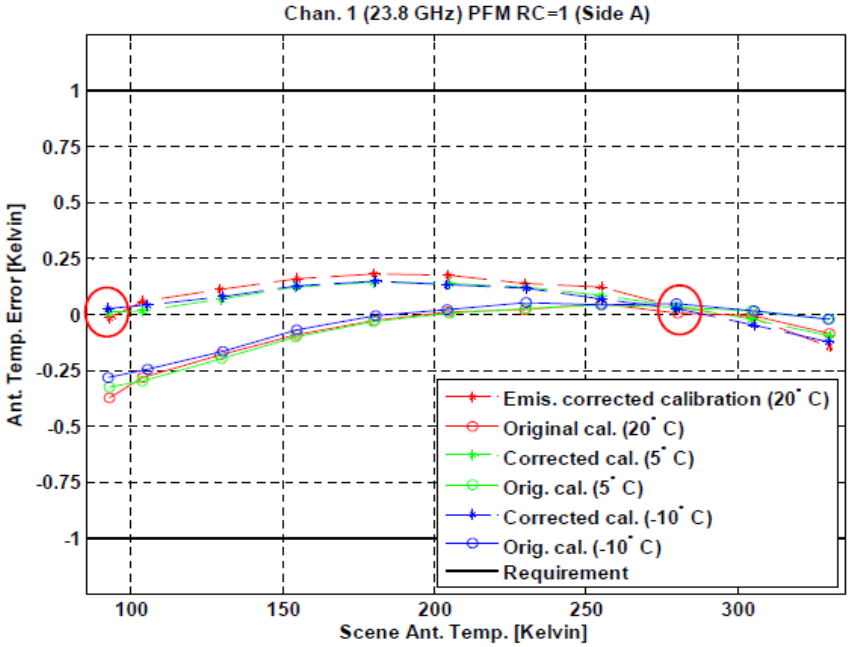
- Calibrated scene temperature from ADL-Full radiance are consistently lower than IDPS at all ATMS channels
- Major cause of the difference is due to the incorrect application of nonlinearity correction in IDPS

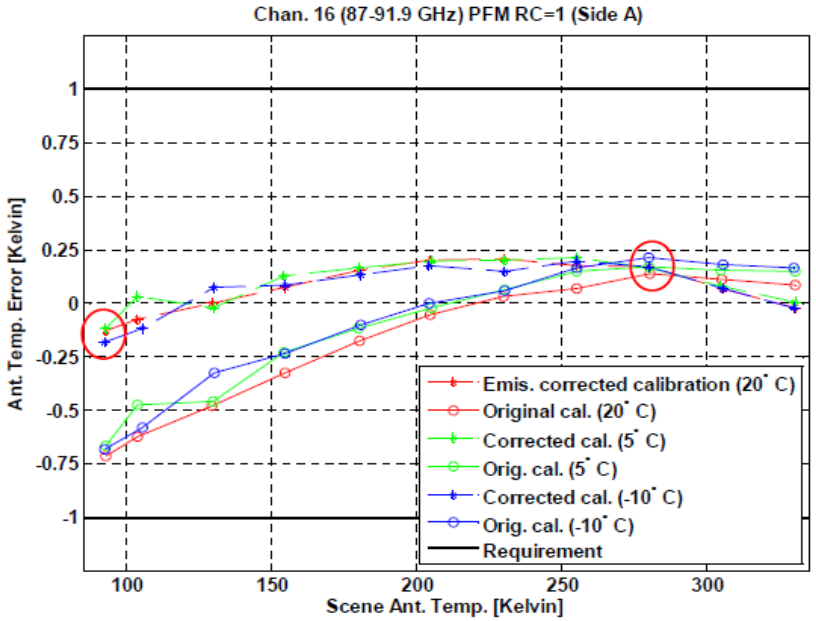


Hu (Tiger) Yang, *et. al.* (UMD/ESSIC)

S-NPP ATMS Reflector Emissivity Correction

Applying Correction to Calibration Testing

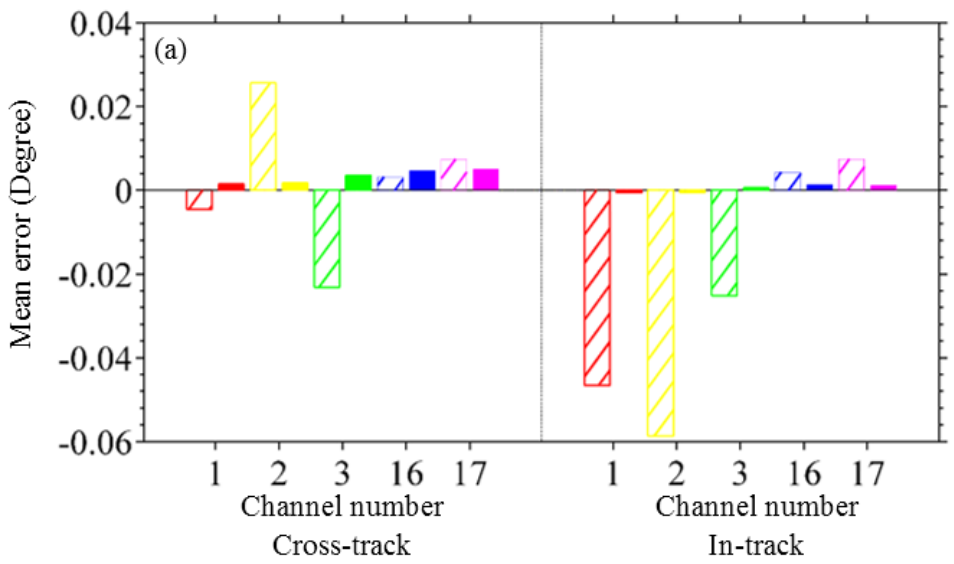


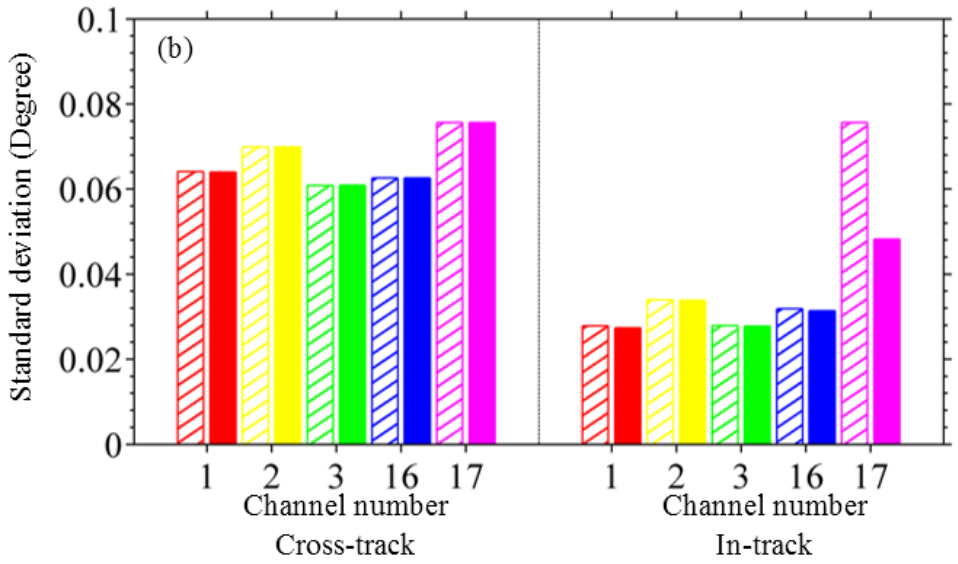


- The error of quasi-V channels moved close to zero at the two calibration points
- V-band quasi-H channels also moved closer to zero

Vince Leslie *et. al.* (MIT/LL)

S-NPP ATMS Geolocation Validation





	K	Ka	V	W	G
Roll	-0.0525	0.1645	-0.1967	-0.0103	0.0186
Pitch	0.3538	0.4388	0.1992	-0.0219	-0.0132
Yaw	-0.0938	-0.0594	-0.0524	0.0682	-0.0954

- S-NPP ATMS in-track and cross-track geolocation errors meet the requirement
- A rotation correction matrix is derived based on the analysis to improve the geolocation accuracy

Ninghai Sun, *et. al.* (STAR/ERT)

ATMS SDR Path Forward

- JPSS-1 ATMS Readiness
  - Prepare for JPSS-1 ATMS TVAC regression testing
  - Derive JPSS-1 ATMS PCT using full radiance process algorithm using TVAC regression testing datasets
  - Test reflector emissivity correction algorithm
  - Evaluate striping noise for JPSS-1 ATMS
  - Validate JPSS-1 ATMS mounting matrix
- Prepare for ATMS SDR FRP operational implementation
- Develop ATMS reflector emissivity correction operational code for IDPS implementation
- Develop ATMS geolocation accuracy trending package for ICVS
- Keep supporting S-NPP ATMS scan reversal activities

Session 6c (CrIS SDR) Summary

Yong Han (CrIS SDR Lead)
Dave Johnson (NASA CrIS Instrument Scientist)

CrIS Breakout Session (6c)

- 8 Presentations cover various areas critical for both S-NPP and J1 mission with a focus on J1 readiness
- Preliminary J1 SDR algorithm and calibration LUTs have been delivered and algorithm updates are progressing towards an on schedule delivery. The cal/val team continues to make good progress in optimizing the performance of the SDR algorithm.
- CrIS radiometric performance for SNPP and J1 is approaching levels sufficient for climate trending.
- J1 and SNPP CrIS spectral calibration accuracy is on the order of 2 ppm.
- The J1 CrIS bit trim and impulse noise masks are ready for launch, and based on SNPP data techniques show promise for correcting the remaining few radiation spikes that slip through the current impulse mask.
- Good progress is being made on further improvements to geolocation accuracy at the ends of the CrIS cross track scan.
- A 2-hour CrIS SDR team face-to-face meeting was held on Thursday afternoon to discuss ongoing and future work

Session 7a Imagery EDR Summary

Don Hillger
Imagery EDR Lead

Imagery Team Breakout Summary

- Presentations
  - **Jeremy Solbrig** talked about DoD uses of VIIRS.
  - **Curtis Seaman** talked about DNB and NCC display enhancements.
  - **William Straka III** presented disaster-related examples of VIIRS Imagery.
  - In a separate session, **Chris Elvidge** talked about operational use of DNB by NCEI-Boulder for global and regional applications.
- Conclusions
  - **VIIRS imagery is excellent** and has a wide range of uses and users.
  - **DNB and NCC are the new and innovative products** from VIIRS, meeting needs that were not necessarily foreseen before launch.
  - **The engagement of imagery users is primary to VIIRS validation**, being that VIIRS Imagery is a **Priority 1 product** and many of the VIIRS bands are either already **Key Performance Parameters (KPPs)** or are scheduled to become KPPs in the near future.
  - The Imagery Team is willing to **assist users with Imagery display and interpretation issues**.
  - **JPSS-1 DNB edge-of-scan issues** will be addressed with respect to the impact on the Imagery Team's NCC Imagery product.

Session 7b Sounding EDR Summary

Mark Liu, Tony Reale
Sounding Leads

Sounding

- 16 presentations
- *NWS forecasters support use of NUCAPS sounding products as a valuable tool via AWIPS-2*
- Presentations focused on scientific performance, utility and visions for NOAA sounding EDR on a global scale.
- NOAA/CPC uses OLR for precipitation diagnostic and verification
- Trace gas products are evolving with applications for air quality monitoring
- NASA OCO-2 very successful and good for CrIS CO2 validation
- Hyperspectral sounder on GEO (MTG) in 2019/2020 to provide new high resolution sounding and associated validation challenges
- CALWATER and other field campaigns provided hydrometeor and ozone testbeds
- International working group including NOAA/STAR coordinating on radiative transfer model comparisons and retrieval algorithms.

Land / Cryosphere session (7c)

- The all-day session was co-chaired by Ivan Csiszar and Jeff Key and included participation by all product teams and key stakeholders
- The session included 22 presentations or discussion topics. The major overarching themes were:

1. Operational algorithm and product status

product maturity, alternative algorithms and NASA ST collaboration
long-term monitoring and needs for reprocessing for key applications

2. Product validation

JPSS-1 cal/val plans and readiness
coordination of approaches across multiple products / production systems and CEOS validation protocols

3. NOAA Enterprise System development and the use of non-NOAA satellite assets

product-specific approaches towards enterprise algorithms
development towards full suite of level-3 products
major focus on Sentinel-3 sensors for VIIRS-class products

4. Key user feedback

NCEP EMC Land Team for data assimilation
National Ice Center for critical operational applications

Session 7d.1: Ocean Color

Co-chairs: Menghua Wang, Paul DiGiacomo

√ Three major themes:

- MSL12 processing system for JPSS ocean color EDR products
- Cal/Val team updates on validation activities
- Applications of ocean color data by Users

√ Full Day of Presentations; Speakers and participants from

- -NOAA: *STAR, NCEI, NMFS, OAR*
- -Other US Agencies: *NASA, NIST, NRL*
- -Universities: *USM, CCNY, OSU, USC, LDEO/Columbia, UNH, U. Miami, UM-B*
- -International: *EC Joint Research Centre*
- -Commerical

√ 21 Ocean Color posters; Side meetings for Cal/Val cruise planning; Time for productive interactions and discussions among EDR producers, validation team, users and management.

Session 7d.2: SST Summary

Sasha Ignatov
SST Lead

Session 7d.2: SST Summary

Co-chairs: Sasha Ignatov, Paul DiGiacomo

√ Major themes
- ACSPO processing system for JPSS SST EDR products
- L2/L3 products, Improved (Current and Developing)
- Results from Users: Assimilation into L4 Analyses

Top meteorology offices around the world have incorporated or are incorporating ACSPO into their L4 analyses

√ Speakers and participants:
- Development: *STAR, CCNY, U. Miami, NAVO, USM*
- Users: *NOAA (STAR, NCEP, NCEI); NASA/JPL*
- *International Users: UK Met office, Canadian Met Centre, BoM of Australia, Japanese Met Agency*

✓ Excellent face-to-face discussions between data developers & users about current ACSPO product and future work

✓ Ongoing work: Improved SST Imagery; Pattern recognition improvements to cloud mask in dynamic, coastal, hi-lat ocean

Session 1: SST Producers

- Status of operational ACSPO product – Ignatov
- Status of ACSPO Reprocessing – Stroup
- ACSPO next year Work – Gladkova
- U. Miami Update – Kilpatrick
- NAVO Update – Willis
- USM Update – Arnone

- ✓ **ACSPO is the NOAA official SST system**
- ✓ **Improved Level 2, newly launched Level 3 product**
- ✓ **Fully archived with PO.DAAC/NCEI from May 2014 – on**
- ✓ **Reprocessing w/UW underway: Full, uniform, high quality record**
- ✓ **Productive collaboration between STAR & CICS, U Miami, NAVO, USM**
- ✓ **Future work: Improved SST Imagery and Improved cloud mask in dynamic, coastal, high-latitude areas**

Session 2: SST Users

- JPL/MUR Update – Chin (presented by Gladkova)
- Consistency of MUR/ACSPO – Gladkova
- Canadian Met Center Update – Surcel Colan (presented by Ignatov)
- NOAA Geo-Polar Update – Harris
- Met Office OSTIA Update – Fiedler (presented by Ignatov)
- NCEP Update – Lozano
- Australian Bureau of Meteorology Update – Beggs (presented by Ignatov)
- Japanese Met Agency Update – Sakurai (presented by Ignatov)
- NOAA NCEI ACSPO Archive Update – Baker-Yeboah

✓ **Top Met Centers around the world use VIIRS SST (Canadian Met Centre, NOAA Geo-Polar blended) or working to incorporate (UK Met Office, Australian Bureau of Meteorology, NOAA NCEP, and Japanese Met Agency) into Level 4 analyses**

✓ **ACSPO Team has excellent collaboration with NCEI archive group**

Session 7e Cloud/Aerosol EDR Summary

Andrew Heidinger, Shobha Kondragunta and Istvan Laszlo (Clouds Lead, and Aerosol co-Leads)

Session 7e.1: Clouds

Co-chair: Andrew Heidinger

- √ Major themes:
  - Enterprise cloud mask provides new opportunities for optimization
  - The CIRA team has made progress on cloud base edr. Product will be demonstrated to NWS AWC soon.
  - Use of Lunar reflectance offering quantitative improvements in existing cloud products and offers a new lunar-based cloud optical depth and water path.
  - VCM continues to make progress and needs more feedback.
- √ Full Day of Presentations; Speakers and participants from NOAA/STAR, CSU/CIRA, Aerospace and UW/CIMSS
- √ During plenary session, Cloud Team (Heidinger) noted a systematic bias in cloud optical depths (COD) compared to those from MODIS and AVHRR. This due to VIIRS having a higher number of bright pixels. Cause under investigation.

JPSS Program Status

Suomi NPP is producing outstanding data

- The satellite is healthy and producing a high availability of data (~99.99%)
- Suomi NPP is the primary operational polar-orbiting satellite for NOAA

JPSS-1 is executing as planned

- Instruments and spacecraft are proceeding well
- Instruments are assembled and undergoing testing
- The spacecraft bus is built and undergoing testing
- Development and implementation of the new ground data processing system are underway

JPSS-2 development underway

- The instruments are progressing well
- Spacecraft has started

Highlights of JSTAR FY15 Accomplishments

✓ Milestones/Schedule: Critical JPSS Algorithms Improvements/Deliveries:

- ATMS full radiance calibration algorithm; CrIS Full Spectral Resolution; OMPS SDR extended spectral range/higher resolution; VIIRS GEO codes/LUT updates; VI; Active Fire; Clouds; Cryosphere; Aerosol; Ozone; Ocean Color; ICVS-Lite to GRAVITE

✓ Performance: Science Reviews/Workshops/User engagements:

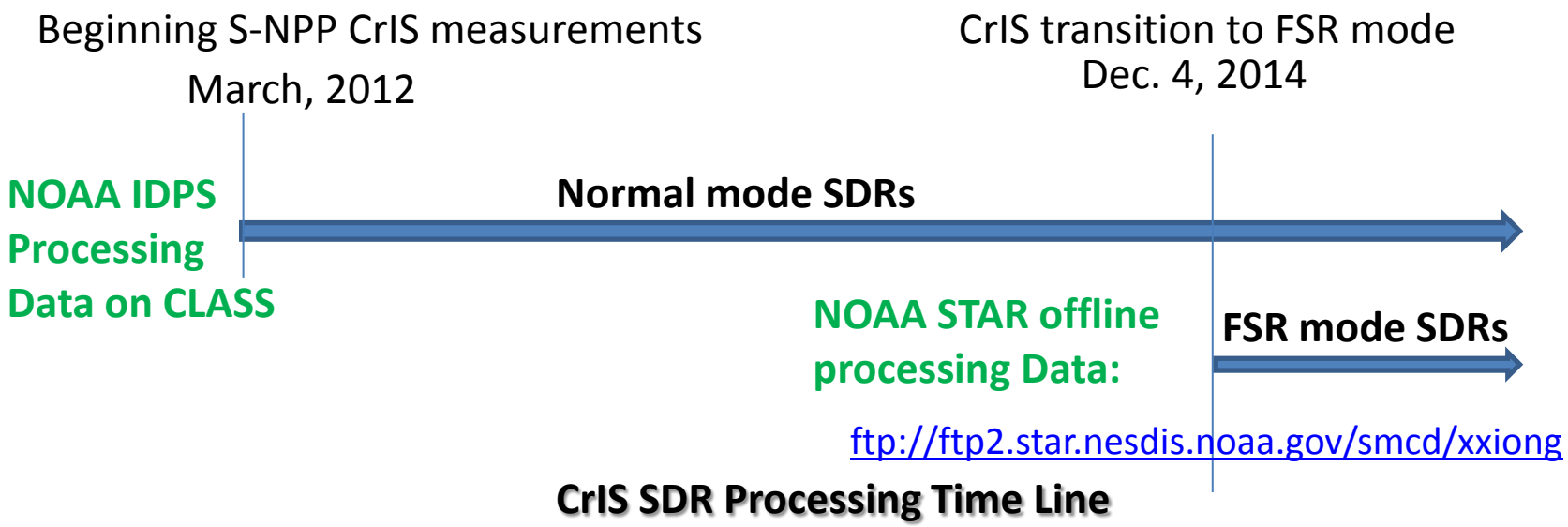
- 2015 Annual Meeting; Aerosol Workshop
- JPSS sensors waivers evaluation; Future instruments improvements
- Initial Enterprise Algorithms (JPSS Priority 3 and 4) Meetings
- Validation Maturity Reviews: LST; LSA; Surface Type; Ocean Color; OMPS SDR
- LTM Workshop: ICVS Instrument Annual Review; EDR LTM workshop
- CrIS Full Resolution Meeting with key NWP users

✓ Management: Documentations; Budget Plans/Execution:

- Completed ATBD transition to STAR system
- JPSS-1 Cal Val Plans draft delivered: SNPP lessons learned, objectives, tasks, timelines; challenges
- Completed NGAS and Aerospace Contracts Transition to be under NOAA contracts
- FY15 TTA budget/schedule/milestones fully accomplished; FY16 TTA submitted

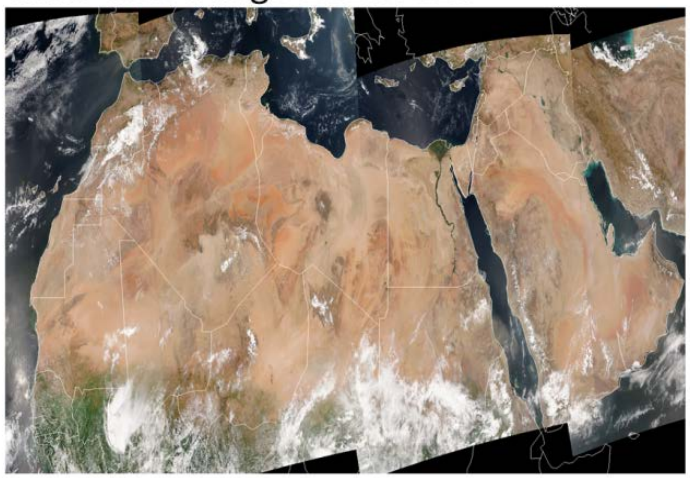
JSTAR FY15 Highlights Example (1):
Completed Development/Delivery J1 CrIS SDR software

- Excellent instrument performances since the beginning of the mission
- Successful transition normal spectral resolution (NSR) mode to full spectral resolution (FSR) mode on 12/4/2014
- Completed and delivered J1 CrIS SDR software with backward compatibility for S-NPP data processing
- Both NSR and FSR SDRs are routinely generated in offline system; made available to the users; and monitored with web-based ICVS

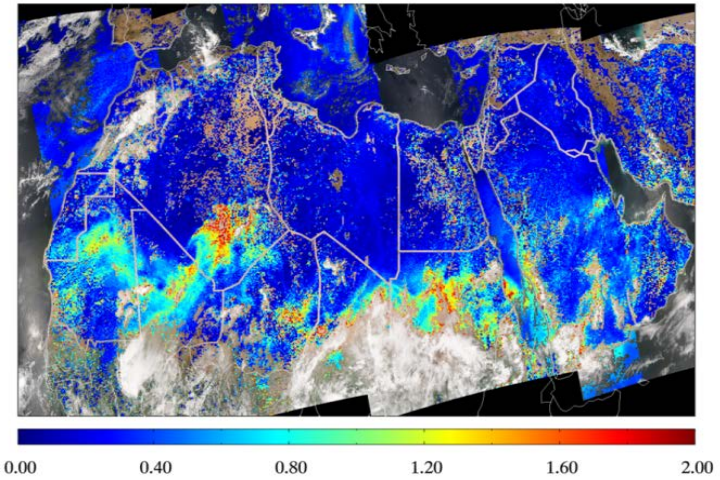


JSTAR FY15 Highlights Example (2):
The STAR Bright Surface (BS) AOT Algorithm

VIIRS RGB image 20130823

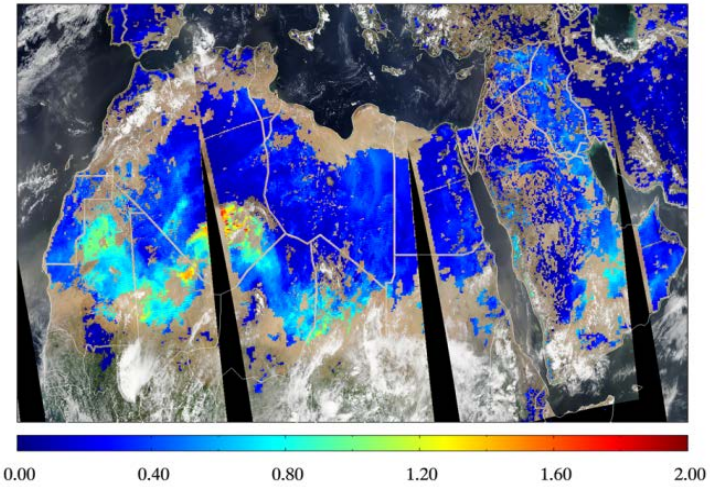


VIIRS AOT 20130823



- VIIRS AOT retrievals are <u>in agreement</u> with MODIS deep blue AOT retrievals in most areas:
- *Both show dust storm in the west*
- *Low AOT regions agree mostly*
- <u>Differences:</u>
- *Some high AOT regions in VIIRS are not seen in MODIS deep blue*
- *Less coverage in MODIS deep blue*

MODIS deep blue AOT 20130823



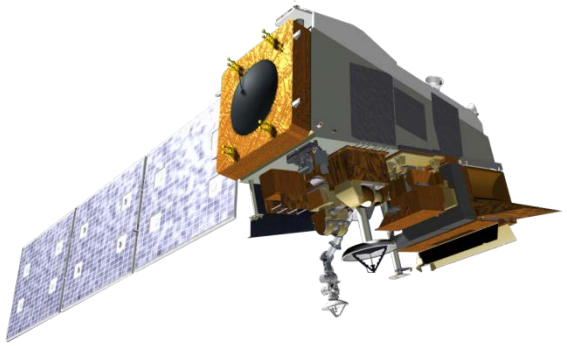
An example of AOT retrieval over north Africa and Arabian Peninsula

Moving Forward

- Launch JPSS-1 by March 2017
  - Delivery of final pre-launch sets of codes/coefficients for J1; Run algorithms through J1 test datasets
  - Develop and update the Cal/Val plans

- Ensure Key Performance Parameters (KPPs) operational readiness (CriS, ATMS and VIIRS Imagery)
  - 90 days after launch

- More efficient - use enterprise algorithms to reduce overall costs
  - Develop roadmap/timelines toward NOAA enterprise algorithms
  - Common algorithms / ground system implementation options to leverage resources and ensure best algorithm solutions
  - Common algorithm and Cal Val process applied to products generated across different ground systems



Thank You

http://www.star.nesdis.noaa.gov/jpss/