JPSS Products and Capabilities

Lihang Zhou
NOAA/NESDIS/STAR
JPSS STAR (JSTAR) Program Manager

with contribution from
JSTAR Algorithm and Data Products Algorithm Team Leads/Members
<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ATMS</strong> - Advanced Technology Microwave Sounder</td>
<td>ATMS and CrIS together provide high vertical resolution <strong>temperature</strong> and <strong>water vapor</strong> information needed to maintain and improve forecast skill out to 5 to 7 days in advance for extreme weather events, including hurricanes and severe weather outbreaks</td>
</tr>
<tr>
<td><strong>CrIS</strong> - Cross-track Infrared Sounder</td>
<td>VIIRS provides many <strong>critical imagery products</strong> including snow/ice cover, clouds, fog, aerosols, fire, smoke plumes, vegetation health, phytoplankton abundance/chlorophyll</td>
</tr>
<tr>
<td><strong>VIIRS</strong> – Visible Infrared Imaging Radiometer Suite</td>
<td>Ozone spectrometers for <strong>monitoring ozone</strong> hole and recovery of stratospheric ozone and for UV index forecasts</td>
</tr>
<tr>
<td><strong>OMPS</strong> - Ozone Mapping and Profiler Suite</td>
<td>Scanning radiometer which supports studies of Earth Radiation Budget</td>
</tr>
<tr>
<td><strong>CERES</strong> - Clouds and the Earth’s Radiant Energy System</td>
<td></td>
</tr>
</tbody>
</table>
JPSS Program Data Products

VIIRS (26 EDRs)  
RDR & SDR (for each of 22 bands)
- Active Fires
- Albedo (Surface)
- Aerosol Optical Thickness
- Aerosol Particle Size Parameter
- Cloud Base Height
- Cloud Cover/Layers
- Cloud Effective Particle Size
- Cloud Optical Thickness
- Cloud Top Height
- Cloud Top Pressure
- Cloud Top Temperature
- Cloud Mask
- Ice Surface Temperature
- Imagery

EDRs:
- Land Surface Temperature
- Ocean Color/Chlorophyll
- Quarterly Surface Type
- Sea Ice Characterization
- Snow Cover
- Surface Type
- Suspended Matter
- Vegetation Indices
- Green Vegetation Fraction
- Polar Winds
- Sea Surface Temperature
- Vegetation Health Index Suite

CERES
RDR
- Carbon Dioxide
- Carbon Monoxides
- Infrared Ozone Profile
- Methane
- Outgoing Longwave Radiation

AMS/R2 (11 EDRs)
RDR, SDR, TDR
- Cloud Liquid Water
- Imagery
- Precipitation Type/Rate
- Precipitable Water
- Sea Ice Characterization
- Sea Surface Temperature
- Snow Cover/Depth
- Snow Water Equivalent
- Soil Moisture
- Surface Type

CrIS (5 EDRs)  
RDR, SDR
- Atm Vertical Temperature Profile
- Atm Vertical Moisture Profile
- Cloud Liquid Water
- Imagery
- Snow Cover

CrIS/ATMS (2 EDRs)
- Sea Ice Concentration
- Temperature Profile
- Total Precipitable Water
- Annual Average Rainfall Rate
- Snow Water Equivalent

OMPS-Nadir  
(2 EDRs)
OMPS-N RDR & SDR
- O3 Total Column
- O3 Nadir Profile

OMPS-Limb
OMPS-L RDR
- Land Surface Emissivity
- Land Surface Temperature
- Moisture Profile
- Rainfall Rate
- Snow Cover
- Snow Water Equivalent

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
Suomi NPP Sensor Products Maturity

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Beta</th>
<th>Provisional</th>
<th>Validated</th>
</tr>
</thead>
<tbody>
<tr>
<td>CrIS</td>
<td>February 10, 2012</td>
<td>February 6, 2013</td>
<td>March 18, 2014</td>
</tr>
<tr>
<td>ATMS</td>
<td>May 2, 2012</td>
<td>February 12, 2013</td>
<td>March 18, 2014</td>
</tr>
<tr>
<td>VIIRS</td>
<td>May 2, 2012</td>
<td>March 13, 2013</td>
<td>April 16, 2014</td>
</tr>
</tbody>
</table>

**Beta**
- Early release product.
- Initial calibration applied
- Minimally validated and may still contain significant errors (rapid changes can be expected. Version changes will not be identified as errors are corrected as on-orbit baseline is not established)
- Available to allow users to gain familiarity with data formats and parameters
- Product is not appropriate as the basis for quantitative scientific publications studies and applications

**Provisional**
- Product quality may not be optimal
- Incremental product improvements are still occurring as calibration parameters are adjusted with sensor on-orbit characterization (versions will be tracked)
- General research community is encouraged to participate in the QA and validation of the product, but need to be aware that product validation and QA are ongoing
- Users are urged to consult the SDR product status document prior to use of the data in publications
- Ready for operational evaluation

**Validated**
- On-orbit sensor performance characterized and calibration parameters adjusted accordingly
- Ready for use in applications and scientific publications
- There may be later improved versions
- There will be strong versioning with documentation
ATMS SDR Reached Validated Maturity (Mar 2014)

- ATMS TDR/SDR data have reached a full validated maturity level
- All the ATMS channels have noises much lower than specification
- Both TDR and SDR products are used in NOAA operations
- Innovated sciences have been made for instrument calibration

ATMS Channel Weighting Functions

Fuzhong Weng, NOAA/NESDIS/STAR ATMS SDR Lead
CrIS SDR Reached Validated Maturity (Mar 2014)

CrIS SDR uncertainties (blue) vs. specifications (black)

<table>
<thead>
<tr>
<th>Band</th>
<th>NEdN</th>
<th>Radiometric Uncertainty</th>
<th>Frequency Uncertainty</th>
<th>Geolocation Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>@287K BB mW/m²/sr/cm⁻¹</td>
<td>@287K BB (%)</td>
<td>(ppm)</td>
<td>(km) *</td>
</tr>
<tr>
<td>LW</td>
<td>0.098 (0.14)</td>
<td>0.12 (0.45)</td>
<td>3 (10)</td>
<td>1.2 (1.5)</td>
</tr>
<tr>
<td>MW</td>
<td>0.036 (0.06)</td>
<td>0.15 (0.58)</td>
<td>3 (10)</td>
<td>1.2 (1.5)</td>
</tr>
<tr>
<td>SW</td>
<td>0.003 (0.007)</td>
<td>0.2 (0.77)</td>
<td>3 (10)</td>
<td>1.2 (1.5)</td>
</tr>
</tbody>
</table>

SNPP CrIS Full Spectral Resolution SDR
**NESDIS Unique CrIS-ATMS Product System (NUCAPS) Products**

- **Products**
  - Temperature profile (AVTP)
  - Water vapor profile (AVMP)
  - CrIS Ozone profile (O3)
  - Outgoing Longwave Radiation (OLR)
  - Trace Gas (CO, CO2, CH4, SO2, N2O, HNO3)
  - File format: NetCDF4

- **Cal/Val Maturity Status:** Temperature/Water Vapor Profile reached Validated 09/03/2014

- **J1 Updates/Improvements:**
  - Extend NUCAPS for CrIS full spectral data
  - Update trace gaseous and OLR products
  - Improve surface emissivity
  - Enhance microwave retrieval

- **Schedules/Timeline:**
  - CrIS full spectral channel selection for NWP and NUCAPS Oct-2015
  - CrIS Full Spectral Data in Sounding System Oct-2015
  - Trace Gas (CO, CO2, and CH4) Algorithm Tuning, Validation, and Verification June-2016
  - Enhancement of microwave retrieval in NUCAPS June-2016

### SUMMARY ON NUCAPS Retrieval Validation vs JPSS L1RD REQUIREMENTS

<table>
<thead>
<tr>
<th>MW+IR TEMPERATURE</th>
<th>RESULTS</th>
<th>JPSS L1RD</th>
<th>MW+IR WATER VAPOOR</th>
<th>RESULTS</th>
<th>JPSS L1RD</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 – 300mb</td>
<td>1.35K</td>
<td>1.5K</td>
<td>100 - 600mb</td>
<td>28.2%</td>
<td>35%</td>
</tr>
<tr>
<td>300mb - SURF</td>
<td>1.25K</td>
<td>1.6K</td>
<td>600mb -SURF</td>
<td>21.8%</td>
<td>20%</td>
</tr>
</tbody>
</table>

JSTAR NUCAPS Lead: Mark Liu / NPROVS lead: Tony Reale
JPSS VIIRS provides significant improvements.

The Visible Infrared Imaging Radiometer Suite offers more spectral bands, higher resolution, wider swath and greater accuracy, resulting in a large number of products.

- VIIRS SDR Reached Validated Maturity
- Excellent noise performance for all VIIRS bands
- Noise values stable since launch

Changyong Cao JSTAR VIIRS Lead
VIIRS Imagery EDR

- **Products**
  - 6 of 16 M-band visible/IR bands
  - 5 of 5 (all) I-band visible/IR bands
  - NCC (EDR) derived from DNB (SDR)
  - DNB
    - File Format: HDF5/NetCDF4
- **Maturity Status:**
  - Validated 04/23/2014
- **Summary of Instruments/Product Quality:**
  - Met all the requirement;
  - Exceptional product quality!
  - High reputation among end users!
- **Users:**
  - NWS (thru AWIPS-I and II)
  - NRL (NexSat online imagery)
  - NGDC
  - National Ice Center
  - Alaska (primary users of DB VIIRS)
  - ICVS uses of Imagery for display

- **J1 Updates/Improvements:**
  - Reduce striping in DNB
  - Possible Additional bands
  - Improved Data latency

VIIRS Sees Calbuco Volcanic Eruption

VIIRS 11.45 µm IR and 0.70 µm DNB image, 23 April 2015 (William Straka, SSEC)

Imagery EDR I5 Band – Marco Vargas
VIIRS Sea Surface Temperature (SST)

- **Products**
  - Produced at NDE by the NOAA heritage Advanced Clear-Sky Processor for Oceans (ACSPO) system
  - File Format: NetCDF4
- **Cal/Val Maturity Status:**
  - **Validated** 09/03/2014 Science Review
- **Products are monitored online in near-real time**
  - iQUAM: in situ SST quality monitor
    http://www.star.nesdis.noaa.gov/sod/sst/iquam
  - SQUAM: SST Quality Monitor
    http://www.star.nesdis.noaa.gov/sod/sst/squam

Annual Validation statistics against drifters (Jun 2013- May 2014)
*JPSS Spec: Bias 0.2K; Accuracy: 0.6K*

<table>
<thead>
<tr>
<th>Processor</th>
<th>Mean / Std (Day)</th>
<th>Mean/Std (Night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IDPS</td>
<td>-0.13 / 0.78</td>
<td>-0.08 / 0.43</td>
</tr>
<tr>
<td>ACSPO</td>
<td>+0.06 / 0.48</td>
<td>+0.01 / 0.36</td>
</tr>
<tr>
<td>NAVO</td>
<td>+0.02 / 0.43</td>
<td>+0.05 / 0.31</td>
</tr>
</tbody>
</table>

**J1 Updates/Improvements:**
- Fix overly conservative cloud mask in coastal areas and dynamic parts of the ocean
- Improve performance in the high latitudes
- Explore additional VIIRS bands M13, M14 potentially useful for SST
- Improve error characterization
- Implement de-striping operationally
- Generate new Level 3 ACSPO SST product
VIIRS Ocean Color EDR

Products:
• Normalized Water-leaving Radiance
• Chlorophyll-a
• Water Diffuse Attenuation Coefficient at 490 nm Kd (490)
• Total Suspended Sediment, water Turbidity

Cal Val Maturity:
On March 27, STAR JPSS held a validation review the Multi- Sensor Level 1-2 (MSL12) Ocean Color EDR algorithm with VIIR) data for Validated Maturity.

Users:
• NMFS (Surveys, Modeling)
• NWS (Ecosystem Forecasting, Modeling)
• NOS (HAB, Sanctuaries)
• OAR (Isoprene emissions, Ocean Acidification)

J1 Updates/Improvements: Algorithms improvements for coastal turbid and inland water are being developed

Example of destriping technique (Mikelsons et al. 2014) applied to water leaving radiances.

JSTAR Ocean Color Lead: Menghua Weng
VIIRS Vegetation Index

Products
- Normalized Difference Vegetation Index (NDVI) from top-of-atmosphere (TOA) reflectances
- Enhanced Vegetation Index (EVI) from top of canopy (TOC) reflectances
- Normalized Difference Vegetation Index (NDVI) from top of canopy (TOC) reflectances (New Product for JPSS-1)
- File format: HDF5

Cal/Val Maturity Status:
Validated 04/01/2015 AERB Approved

J1 Updates/Improvements:
- Addition of a new dataset (TOC NDVI)
- Addition of a new Quality Flag byte (QF4)
- Improved definition of high quality of the product
- Implementation of an EVI alternate (EVI2) algorithm
- Generation of Level 3 products (spatial and temporal composites)

JSTAR NDVI Lead: Marco Vargas; JSTAR GVF Cal Val Lead: Marco Vargas
VIIRS Active Fire

Products

- Contextual-thresholding detection algorithm based on MODIS Collection 4 algorithm
- List of detections over cloud-free land
- File format: HDF5

Cal/Val Maturity Status:

- Validated 09/04/2014 Science Review; S-NPP Active Fire ARP was declared Operational by SPSRB in Aug-2014

J1 Updates/Improvements:

- Include additional output: Fire Radiative Power (FRP)
- Provide global coverage (include water)

Schedules/Timeline:

- The S-NPP replacement algorithm is planned to be implemented in NOAA’s NDE system by late Summer 2015
VIIRS Land Surface Temperature (LST)

- **Products**
  - Land Surface Temperature
  - File format: HDF5

- **Cal/Val Maturity Status:**
  - Validated 03/25/2015 AERB Approved

- **J1 Updates/Improvements:**
  - Water Vapor correction
  - Angular correction
  - Emissivity explicit algorithm

<table>
<thead>
<tr>
<th>Attribute</th>
<th>L1RD Threshold</th>
<th>Validation Result</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-situ Validation</td>
<td>1.4K (2.5K)</td>
<td>-0.37 (2.35)</td>
<td>Results are based on the VIIRS data over SURFRAD sites for over 2.5 years. The error budget estimation is limited by ground data quality control, cloud filtering procedure and upstream data error.</td>
</tr>
<tr>
<td>R-based Validation</td>
<td>1.4K (2.5K)</td>
<td>0.47(1.12)</td>
<td>A forward radiative transfer model is used, over 9 regions in globe, representing all 17-IGBP types over the seasons. The error budget estimation is limited by profile quality, cloud screening procedure and sampling procedure.</td>
</tr>
<tr>
<td>Cross satellite Comparison</td>
<td>0.59(1.93): daytime 0.99(2.02): nighttime</td>
<td></td>
<td>The results are based on comparisons to MODIS LST, over 100 scenes, over low latitude, polar area and CONUSThe error budget estimation is limited by the spatial and temporal difference, sensor difference, angle difference etc.</td>
</tr>
</tbody>
</table>
VIIRS Surface Albedo

- **Products**
  - Land Surface Albedo (LSA)
  - Ocean Surface Albedo (OSA)
  - Sea-Ice Surface Albedo (SSA)
  - Only LSA and SSA are validated and maintained in the current VIIRS Albedo release
  - File format: HDF5

- **Cal/Val Maturity Status:**
  - **Validated** 03/25/2015 AERB Approved

- **J1 Updates/Improvements:**
  - Update LUT of regression coefficients for estimating sea ice Albedo
  - Develop a separate LUT for snow pixels and other major land surface types
  - Implement a temporal filtering to improve both quality and continuity
  - Work with NWP users to develop a framework to generate gridded data set of LSA that fit users’ needs

JSTAR LSA Lead: Bob Yu
VIIRS Surface Type

**Products**
- VIIRS Surface Type (granule level)
- VIIRS Quality Surface Type IP (QST IP, Global Gridded Surface Type Map)
- File format: HDF5

**Cal/Val Maturity Status:**
- **Validated** 04/01/2015 AERB Approved

**Users:**
- Modeling studies
  - Land surface parameterization for GCMs (e.g. NCEP Noah LSM)
  - Biogeochemical cycles
  - Hydrological processes
- Carbon and ecosystem studies
  - Carbon stock, fluxes
  - Biodiversity
- Downstream products
  - Land surface temperature, cloud mask, aerosol products, other products require global land/water location information

**J1 Updates/Improvements:**
- Support vector machines (SVM) may replace the decision tree (DT) algorithm for higher reliability/stability
- Multiple year classification metrics are expected to produce more stable Surface Type map

**Schedules/Timeline:**
- SVM product evaluated Dec-2015
- New global surface type IP (QST IP) delivered to IDPS Dec-2015

JSTAR Surface Type Lead: Jerry Zhan
VIIRS Snow and Ice

- **Products & Cal/Val Maturity Status:**
  - **Snow Cover: Binary Map**
    - Validated 01/08/2014
  - **Snow Cover: Fractional Snow Cover**
    - Provisional 12/20/2013
  - **Ice Surface Temperature**
    - Validated 01/08/2014
  - **Sea ice characterization**
    - Provisional 12/20/2013
  - File format: HDF5

**JPSS-1: VIIRS Snow Fraction Algorithm will be improved** from the current 2x2 aggregation algorithm (750 m) to pixel by pixel (375 m) algorithm.
VIIRS Clouds

- **Products and Cal/Val Maturity Status:**
  - Cloud Mask: Validated 03/05/2014
  - Cloud Top (CTH, CTT, CTP), Cloud Optical Depth (daytime), Cloud Effective Particle Size, Cloud Base Height: Validated 09/03/2014
  - COD (nighttime), &CCL Provisional 08/20/2014

- **NOAA Enterprise Cloud Algorithm:** The Cloud from AVHRR Extended (CLAVR-x) is heritage NESDIS operational cloud processing system runs for multiple sensors on different satellites.

VIIRS Cloud Top Pressure: Images show VIIRS DB data from UW/CIMSS processed through the NDE Cloud Algorithms in CSPP/CLAVR-x.; Image on the left is a false color image (R=M5, G=M7, B=M15(rev)). March 8, 2015. Orbit 17414.; Cloud Top Pressure (right) is important for Aviation and used in the VIIRS Winds Application.

JSTAR Clouds Lead: Andy Heidinger
VIIRS Aerosol

- **Products**
  - Aerosol Optical Thickness
  - Aerosol Particle Size Parameter (APSP)
  - Suspended Matter (SM)
  - File format: HDF5 (IDPS), NetCDF4 (NDE)

- **Cal/Val Maturity Status:**
  - **AOT, APSP:**
    - Validated 12/22/2014 AERB Approved
  - **SM:**
    - Beta 06/26/2013 AERB Approved

- **Users:**
  - NWS NCEP
  - NWS Alaska
  - NWS Western Region
  - NRL
  - OSPO/SAB
  - EPA

- **J1 Updates/Improvements:**
  - **Aerosol Optical Thickness:**
    - Adding capability to retrieve AOT over bright surface
    - Improve data filtering
  - **Suspended Matter:**
    - Replace IDPS SM algorithm by JPSS Risk Reduction (RR) SM algorithm for dust and smoke detection
    - JPSS RR Volcanic Ash

Map of Monthly Gridded EDR

JSTAR Aerosol Leads: Shobha Kondragunta and Istvan Laszlo
OMPS Ozone

- **Products**
  - OMPS Nadir Mapper Total Ozone
    - Total Column Ozone
    - Total Column SO2
    - UV Absorbing Aerosol Index
    - Effective UV Reflectivity
    - NO2
  - OMPS Nadir Profiler Ozone Profile
  - OMPS Limb Profiler Ozone Profile

- **File format**: HDF5 (IDPS, TC & NP); NetCDF4 (Limb Profile)

- **J1 Updates/Improvements**
  - Higher spatial resolution

Antarctic Ozone Hole: September 22, 2012

Slide courtesy of Larry Flynn

JSTAR OMPS SDR and EDR | Lead: Larry Flynn
## SNPP Maturity Status

*(Will Include all NESDIS Unique Products for JPSS-1)*

<table>
<thead>
<tr>
<th>Products</th>
<th>Status Apr-14</th>
<th>Status Apr-15</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SDR</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATMS</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>CrIS</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>VIIRS</td>
<td>Green</td>
<td>Yellow</td>
</tr>
<tr>
<td>OMPS</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Imagery (non-NCC)</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Imagery NCC</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>VIIRS Cloud Mask</td>
<td>Green</td>
<td>Yellow</td>
</tr>
<tr>
<td>Cloud Properties (CLAVR-x)</td>
<td>Yellow</td>
<td>*</td>
</tr>
<tr>
<td>Aerosol Optical Thickness</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Aerosol Particle Size Parameter</td>
<td>Yellow</td>
<td>Green</td>
</tr>
<tr>
<td>Suspended Matter</td>
<td>Yellow</td>
<td>Red</td>
</tr>
<tr>
<td>Active Fires</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>Land Surface Temperature</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Surface Type</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>Surface Albedo</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Vegetation Indices</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Surface Reflectance IP</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Ocean Color / Chlorophyll</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Sea Surface Temperature (ACSPO)</td>
<td>Yellow</td>
<td>Green</td>
</tr>
<tr>
<td>Ice Surface Temperature</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Sea Ice Characterization</td>
<td>Green</td>
<td>Green</td>
</tr>
<tr>
<td>Snow Cover - Binary Mask</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>Snow Cover - Fraction</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>Sounding (NUCAPS)</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>OMPS Ozone EDR</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
</tbody>
</table>

| **EDR**                   |               |               |
| **Beta**                  | Yellow        | Yellow        |
| **Provisional**           | Yellow        | Yellow        |
| **Validated**             | Green         | Green         |

*Except CCL & Nighttime COT*
Most of the operational Suomi NPP products have reached Validated maturity level and met the product requirement.

SNPP Product evaluation and updates are continuing

- Long-term monitoring and reactive maintenance
- Replacement and upgrade algorithms with NOAA enterprise algorithms

Leveraging the SNPP cal val experience, and improved knowledge of the pre-launch characterization of the J1 instruments, the JSTAR teams are ready to accelerate the Cal/Val activities for JPSS-1 sensor and data products.

STAR JPSS Science Team Annual Meeting is scheduled for August 24-28, 2015, NCWCP, College Park, MD. SNPP lessons learned and plans for JPSS-1 Cal Val will be presented in details.
Thank You!
More information (open access)

- **NOAA/NESDIS/STAR JPSS website:**
  - Algorithm Theoretical Basis Documents (ATBDs)
  - Common Data Format Control Book
  - Code and proxy dataset information

- **NOAA/NESDIS JPSS website:**
  - [http://www.nesdis.noaa.gov/jpss/](http://www.nesdis.noaa.gov/jpss/)
  - JPSS program information

- **NASA NPP website:**
  - Algorithm Theoretical Basis Documents (ATBDs)
  - Common Data Format Control Book

- **CLASS:** [http://www.nsof.class.noaa.gov/saa/products/welcome](http://www.nsof.class.noaa.gov/saa/products/welcome)
  - Free download all the SNPP data products
ATMS SDR Reached Validated Maturity (Mar 2014)

ATMS on-orbit performance is significantly better than specification

RSDR – AMSU fov constructed from ATMS oversampled fovs. Averaging ATMS fovs into AMSU fov reduces original noise by about factor of 3.

Fuzhong Weng, NOAA/NESDIS/STAR ATMS SDR Lead
<table>
<thead>
<tr>
<th>VIIRS</th>
<th>Requirement (absolute uncertainty for uniform scenes)</th>
<th>Prelaunch and onboard calibration</th>
<th>Validation: Relative to MODIS/CrIS/IASI/other thru Inter-comparisons</th>
</tr>
</thead>
<tbody>
<tr>
<td>RSB</td>
<td>2% typical reflectance; 0.3% stability; 0.1% desirable for Ocean Color Applications</td>
<td>1.2% for M1-M7; 1.5% for M8&amp;9; 1.4% for M10; 1.3% for I1&amp;I2; 1.6% for I3</td>
<td>2% (±1%) for matching bands</td>
</tr>
<tr>
<td>TEB</td>
<td>M12/M13: 0.7%(0.13K) @270K M14: 0.6% (0.26K) @270K M15/M16: 0.4% (0.22K/0.24K) @270K I4: 5% (0.97K) @270K I5: 2.5% (1.5K) @270K</td>
<td>Better than 0.13K for all M bands except M13 (0.14); 0.47K for I4; 0.23K for I5</td>
<td>0.1K based on statistical comparison with MODIS and CrIS ER-2/SHIS Aircraft underflight shows excellent agreement M15 0.4 K bias relative to CrIS at 200K (in spec.)</td>
</tr>
<tr>
<td>DNB</td>
<td>• 5%, 10%, 30% L\text{\textsubscript{min}} (LGS,MGS,HGS)</td>
<td>3.5%, 7.8%, and 11% (LGS, MGS, HGS)</td>
<td>• 4%, 7.7%, 11.8% (LGS, MGS, HGS)</td>
</tr>
</tbody>
</table>

JPSS-1 Waiver Mitigation: DNB nonlinearity at high scan angles (Requires change in Aggregation Mode)
<table>
<thead>
<tr>
<th>Requirement</th>
<th>Specification/Prediction Value</th>
<th>On-Orbit Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-linearity</td>
<td>&lt; 2% full well</td>
<td>&lt; 0.46%</td>
</tr>
<tr>
<td>Non-linearity Knowledge</td>
<td>&lt; 0.5%</td>
<td>~0.1%</td>
</tr>
<tr>
<td>On-orbit Wavelength Calibration</td>
<td>&lt; 0.01 nm</td>
<td>&lt; 0.01 nm #</td>
</tr>
<tr>
<td>Stray Light NM</td>
<td>≤ 2%</td>
<td>average ~± 1%*</td>
</tr>
<tr>
<td>Out-of-Band + Out-of-Field Response</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra-Orbit Wavelength Stability</td>
<td>&lt; 0.02 nm</td>
<td>&lt; 0.01 nm</td>
</tr>
<tr>
<td>SNR</td>
<td>Channel Dependent</td>
<td>As good as SBUV/2 at Alg. Channels &amp;</td>
</tr>
<tr>
<td>Inter-Orbital Thermal Wavelength Shift</td>
<td>&lt; 0.02 nm</td>
<td>0.03-nm amplitude annual cycle^</td>
</tr>
<tr>
<td>^CCD Read Noise</td>
<td>&lt; 60 –e RMS</td>
<td>&lt; 25 –e RMS</td>
</tr>
<tr>
<td>Detector Gain</td>
<td>&gt; 43</td>
<td>~45</td>
</tr>
<tr>
<td>Absolute Irradiance Calibration Accuracy</td>
<td>&lt; 7%</td>
<td>1~10%, average: ~7%</td>
</tr>
<tr>
<td>Absolute Radiance Calibration Accuracy</td>
<td>&lt; 8%</td>
<td>&lt; 5%</td>
</tr>
</tbody>
</table>

# After new analysis of Day 1 Solar
* After measurement-based correction using prelaunch characterization
^ Regular annual cycle affects accuracy and stability & Information concentration possible by using near-by channels.
<table>
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<td>0.01 nm#</td>
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<tr>
<td>Stray Light NM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Out-of-Band + Out-of-Field Response</td>
<td>≤ 2</td>
<td>average ± 0.5%^</td>
</tr>
<tr>
<td>Intra-Orbit Wavelength Stability</td>
<td>&lt; 0.02 nm</td>
<td>&lt; 0.01 nm*</td>
</tr>
<tr>
<td>SNR</td>
<td>&gt; 1000</td>
<td>&gt; 1000 from SV and EV</td>
</tr>
<tr>
<td>Inter-Orbital Thermal Wavelength Shift</td>
<td>&lt; 0.02 nm</td>
<td>&lt; 0.01 nm</td>
</tr>
<tr>
<td>CCD Read Noise</td>
<td>&lt; 60 – e RMS</td>
<td>&lt; 25 – e RMS</td>
</tr>
<tr>
<td>Detector Gain</td>
<td>&gt; 46</td>
<td>~42</td>
</tr>
<tr>
<td>Absolute Irradiance Calibration Accuracy</td>
<td>&lt; 7%</td>
<td>5%</td>
</tr>
<tr>
<td>Absolute Radiance Calibration Accuracy</td>
<td>&lt; 8%</td>
<td>&lt; 5%</td>
</tr>
</tbody>
</table>

# After new analysis for Day 1 wavelength scale.
^ After ground-based correction for TOz algorithm channels.
* After intra-orbit adjustments.
NOAA Integrated CalVal System (ICVS) for Long Term Monitoring (LTM) of Operational Satellites

http://www.star.nesdis.noaa.gov/icvs
### JPSS/GOES-R Data Product Validation Maturity Stages – COMMON DEFINITIONS (Nominal Mission)

#### 1. Beta
- Product is minimally validated, and may still contain significant identified and unidentified errors.
- Information/data from validation efforts can be used to make initial qualitative or very limited quantitative assessments regarding product fitness-for-purpose.
- Documentation of product performance and identified product performance anomalies, including recommended remediation strategies, exists.

#### 2. Provisional
- Product performance has been demonstrated through analysis of a large, but still limited (i.e., not necessarily globally or seasonally representative) number of independent measurements obtained from selected locations, time periods, or field campaign efforts.
- Product analyses are sufficient for qualitative, and limited quantitative, determination of product fitness-for-purpose.
- Documentation of product performance, testing involving product fixes, identified product performance anomalies, including recommended remediation strategies, exists.
- Product is recommended for operational use (user decision) and in scientific publications.

#### 3. Validated
- Product performance has been demonstrated over a large and wide range of representative conditions (i.e., global, seasonal).
- Comprehensive documentation of product performance exists that includes all known product anomalies and their recommended remediation strategies for a full range of retrieval conditions and severity level.
- Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose.
- Product is ready for operational use based on documented validation findings and user feedback.
- Product validation, quality assurance, and algorithm stewardship continue through the lifetime of the instrument.

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May 2014, GOES-R, JPSS, and STAR Science Teams
JPSS-1 Key Performance Parameters (KPPs)
Nominal Cal/Val Timeline (Draft)

- Beginning of each color represents when product enters a given validation stage.
- Dependencies will be built into the schedule for each downstream EDR product.
- This is a draft timeline, detailed schedule will be available in summer 2015.