NOAA Satellite Programs
-Cal/Val Overview

Changyong Cao and Mitch Goldberg
NOAA/NESDIS

Joint Agency Commercial Imagery Evaluation
Louisville, KY, March 26-28, 2014
Outline

• Polar-orbiting Operational Environmental Satellite
  » Suomi-NPP/JPSS Program Update
  » Suomi-NPP VIIRS post-launch characterization and Cal/Val activities
  » VIIRS Products and Applications

• Geostationary Operational Environmental Satellite
  » GOES-R Program Update
  » GOES-R pre-launch and post-launch Cal/Val readiness activities
  » GOES-R Products and Applications
Continuity of NOAA’s Polar (Primary) Operational Weather Satellite Programs

Launch Dates based on U.S. PB 14

As of October 2013

<table>
<thead>
<tr>
<th>FY</th>
<th>09</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>17</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
<th>23</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
<th>28</th>
<th>29</th>
<th>30</th>
<th>31</th>
<th>32</th>
<th>33</th>
<th>34</th>
<th>35</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Approved: Mary E. Fleming
Assistant Administrator for Satellite and Information Services

*Program funding provided through FY2025. The follow-on program will provide funding for operations post 2025.

DMSP: Defense Meteorological Satellite Program
JPSS: Joint Polar Satellite Program
Suomi NPP: Suomi National Polar Partnership

Post Launch Test
- Operational
- Secondary
- Operational beyond FY 2036
- Predicted Extended Mission Life
Overview of VIIRS Data Products

National Polar-orbiting Partnership satellite

Bridge mission between NASA’s EOS (Earth Observing System) & the next-generation NOAA’s JPSS (Joint Polar Satellite System)

- **SDRs (Sensor Data Records) = Level 1b**
  - Calibrated and geo-located: radiance, reflectance, and brightness temperature

- **VIIRS SDR team** consists of experts from NOAA, NASA, The Aerospace Corp., University of Wisconsin, MIT/Lincoln Lab, NGAS & Raytheon

- Providing life cycle/end-to-end calibration support to S-NPP/JPSS VIIRS (pre-launch, post-launch, & long-term monitoring)

- VIIRS SDR product is used to produce 20+ Environmental Data Records (EDRs)

Suomi NPP VIIRS
Launched: October 28, 2011

16 Moderate resolution bands
M-Bands (0.75 km):
- 11 Reflective Solar Bands (RSB)
- 5 Thermal Emissive Bands (TEB)

5 Imaging resolution bands
I-Bands (0.375 km):
- 3 RSB
- 2 TEB

1 Day Night Band (DNB) broadband
DNB (0.75 km)

Cao et al. TGARS, 2014
### Table 1. VIIRS Environmental Data Records

<table>
<thead>
<tr>
<th>Category</th>
<th>Data Records</th>
</tr>
</thead>
</table>
| **Land**       | Active Fires, Land Surface Albedo, Land Surface Temperature, Ice Surface Temperature, Snow Ice Characterization, Snow Cover, Vegetation Indices, Vegetation Health Index, Green Vegetation Fraction (Priority 2*
|                | Surface Type, Net Heat Flux                                                   |
| **Ocean**      | Sea Surface Temperature (Priority 2*), Ocean Color/Chlorophyll (Priority 2*)  |
| **Imagery and Clouds** | Imagery (Key Performance Parameters = Priority 1* for six selected bands: I1, I4, I5, M14, M15, and M16) |
|                | Cloud Optical Thickness, Cloud Effective Particle Size, Cloud Top Pressure, Cloud Top Height, Cloud Top Temperature, Cloud Base Height, Cloud Cover/Layers, Cloud Mask, Polar Winds (Priority 2*) |
| **Aerosols**   | Aerosol Optical Thickness, Aerosol Particle Size, Suspended Matter           |

*Priority 1 products include VIIRS SDR and Imagery for six selected bands (Source: JPSS L1RD V2.7, 30 January 2013).

Cao et al., JGR, 2013

Images Courtesy: https://cs.star.nesdis.noaa.gov/NCC/GalleryPage04
Suomi NPP VIIRS SDR Validated Maturity

- **Milestone:** Successfully completed the VIIRS SDR Validated Maturity Workshop

- **Accomplishments**
  - STAR held a three-day Suomi NPP SDR Science and Validated Product Maturity Review (December 18-20, 2013) at the NOAA NCWCP to assess the readiness of the VIIRS SDR data product maturity
  - The VIIRS SDR team members and EDR users reported on the progress made since the Provisional Maturity Review demonstrating the VIIRS SDR maturity level
  - Concluding the Workshop the review panel members reached consensus that overall the VIIRS SDR product has reached the validated status and therefore is recommended to be approved by the Algorithm Executive Review Board (AERB)

- **Significance:** VIIRS SDR data has been recommended for operational use; supports NOAA’s weather ready nation and advanced system cal/val goals
Major Achievements

Major Achievements Since Provisional

• VIIRS on-orbit performance is well characterized & meets specifications
• RSBAutoCal being tested and independently validated by NOAA
• VIIRS DNB Straylight Correction implemented (Aug. 2013); tool kit has been evaluated by NOAA
• Geo-location uncertainties for I-/M-bands are ~ 70 m at nadir, meeting specifications at nadir and edge-of-scan (DNB terrain corrected geo-location product is expected in Mx8.3 in March 2014)
Suomi-NPP VIIRS Long-Term Monitoring

VIIRS Mirror Degradation Status

Solar Diffuser Degradation

NOAA/NESDIS/STAR Satellite Integrated Calibration / Validation System (ICVS)
http://www.star.nesdis.noaa.gov/icvs/NPP/ipm_telemetry_npp_viirs.php

- RTA degradation leveling-off while H-factor degradation continues
VIIRS and MODIS Inter-comparison

Through the second year of the Suomi NPP on orbit operations, the biases between VIIRS and MODIS SNO measurements in the reflective solar bands have remained small and mostly within the combined 2% uncertainty requirements for VIIRS and MODIS.

Suomi NPP VIIRS Example Product - Aerosol

- VIIRS aerosol products are provided to science and operational users

Courtesy of S. Kondragunta
Suomi NPP VIIRS Example Product - Aerosol

VIIRS Climatology Chlorophyll-a Image
(Feb. 2012 to Sep. 2013)

Generated from VIIRS IDPS Ocean Color EDR

- VIIRS Ocean Color (OC) products are provided to science and operational users
- Working closely with OC EDR teams to ensure data quality

J1 Pre-Launch Support:

- Developing Radiative Transfer Simulations to characterize polarization phenomenology to better understand the impacts to products
- Developing capability to measure polarization by coupling ASD with polarizing lenses

Courtesy of M. Wang
Land Surface Temperature

- JPSS VIIRS LST EDR development and evaluation
  - Beta version in operation since Dec. 2012
  - Provisional version in operation since Oct. 2013
  - Validated version 1 operation is scheduled in Dec. 2014

- GOES LST Level 2 development and evaluation
  - GOES-R LST ATBD and software package was delivered to vendor (AER/Harris Corp.) in 2011, tested through 2012.
  - validation tool has been developed in 2013
  - GOES-14, -15 operational LST production

- Expertise on LST cross-satellite and in-situ validation
  - Multiple satellite LST comparisons: EOS/MODIS, NPP/VIIRS, GOES/Imager, MSG/SEVIRI, etc.
  - In-situ data collections and comparisons: SURFRAD, CRN, LSASaf stations, etc.

- LST development tools
  - LST simulation tool with a comprehensive simulation database
  - Emissivity library
  - LST validation and monitoring tool

- Comparison with MODIS LST

Courtesy of Bob Yu (STAR)
Provisional Readiness For VIIRS Land Surface Albedo EDR

- Land surface albedo (LSA) is one of land surface products developed for the JPSS mission.
- Current LSA version (beta) is based on a bright pixel surface albedo (BPSA) algorithm.
- A significant improvement is made on the LSA BPSA algorithm from applying BRDF information in its look-up table (LUT) generation, and a temporal filter.
- Intensive evaluation has been performed through cross-satellite (i.e. MODIS-LSA) comparisons and through in-situ LSA estimates.
- A scientific review process is scheduled in April 2014 for approval of provisional version release.

Significance: Provisional version release is a significant milestone to users.

Courtesy of Bob Yu (STAR)

Sponsored by JPSS program
Land Surface Temperature for LandSat8

- Technical readiness
  - Split-window design of Thermal Infrared Sensor (TIRS) of Landsat 8 is perfect for LST measurement
  - Algorithms are available for testing
  - NOAA has expertise, experience, and tools (simulation tool, database, validation tool, etc.) on satellite LST development

- Collaboration with USGS for possible Landsat8 LST development
  - Dialog with USGS project scientist
  - Proposal submitted (July, 2013)
  - Pending improved calibration
  - Simulation database improved for Landsat8 LST

- NOAA POC: Dr. Bob Yu, NOAA/NESDIS/STAR

Graphic Courtesy NASA

Courtesy of Bob Yu (STAR)
High radiance resolution, large amplitude range. Able to detect light outage and recovery trend.

Complementing the statistics from power companies

Cao et al., IEEE GRSL, 2013
VIIRS DNB Applications at NWS Alaska

Images Courtesy of Eric Stevens Univ. of Alaska
VIIRS DNB Applications at NWS Alaska

Images Courtesy of Eric Stevens Univ. of Alaska
Global Event Monitoring

• VIIRS provides timely global coverage which can be very useful for global event monitoring

• VIIRS observed over Malaysia ~40 minutes after MH370 lost contact

• Contrail and atmospheric profile analysis might be useful

• Image shows brightness temperature difference between I4 and I5 in longwave IR bands
VIIRS DNB Applications with Landsat

DNB imagery of Tampa, FL

Landsat RGB imagery of Tampa, FL
ABI is the next generation GOES Imager

GOES-R is scheduled to launch in late 2015

<table>
<thead>
<tr>
<th></th>
<th>Current</th>
<th>ABI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral Coverage</td>
<td>5 Bands</td>
<td>16 Bands</td>
</tr>
<tr>
<td>Spatial Resolution</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.64 µm visible</td>
<td>1.0 km</td>
<td>0.5 km</td>
</tr>
<tr>
<td>Other visible/near-IR</td>
<td>N/A</td>
<td>1.0 km</td>
</tr>
<tr>
<td>1.38 µm</td>
<td>N/A</td>
<td>2 km</td>
</tr>
<tr>
<td>Bands &gt; 2µm</td>
<td>4 km</td>
<td>2 km</td>
</tr>
<tr>
<td>Spatial Coverage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full disk</td>
<td>Scheduled (3 hrs)</td>
<td>4 per hour</td>
</tr>
<tr>
<td>Visible (Reflective)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-orbit calibration</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

- Increase in spectral coverage facilitates more quantitative products
- Increased emphasis on calibration

http://cimss.ssec.wisc.edu/goes/abi/
GOES-R ABI Cal/Val Update

Instrument Status:

» Calibration Working Group (CWG) pre-launch assessment of GOES-R ABI complete:
  - Successful GOES-R ABI Pre-Shipment Review held September 24-26 in Fort Wayne, IN
  - ABI FM1 instrument can proceed towards shipment

• Version 2 of GOES-R ABI SRFs released:
  » Update reflects results from pre-launch testing and analysis
    - [https://cs.star.nesdis.noaa.gov/GOESRCWG/ABISRF](https://cs.star.nesdis.noaa.gov/GOESRCWG/ABISRF)

Post-Launch Readiness:

• CWG is well positioned to provide post-launch support and ensure ABI's performance throughout the lifetime of the instrument
  » Ramping up support for GOES-R post-launch efforts:
    » Post-Lauch Test (PLT), Science Tests, and Long-Term Monitoring
    » Leveraging the VIIRS Post Launch Activities (57 tasks), current GOES PLT, and others

• Collaborating with Japan Meteorological Agency (JMA) to enhance GOES-R Readiness
  » Himawari-8 Advanced Himawari Image (AHI), planned to launch in the Fall of 2014, a sister instrument to the future GOES-R ABI
  » NOAA Memorandum Of Understanding (MOU) between NESDIS and JMA:
    » Use Suomi-NPP VIIRS as a transfer radiometer to perform inter-comparisons between AHI and ABI, presented at the 2014 American Meteorological Society Annual meeting
GOES-R Products

Baseline Products

- Aerosol Detection (Including Smoke and Dust)
- Aerosol Optical Depth (AOD)
- Clear Sky Masks
- Cloud and Moisture Imagery
- Cloud Optical Depth
- Cloud Particle Size Distribution
- Cloud Top Height
- Cloud Top Phase
- Cloud Top Pressure
- Cloud Top Temperature
- Derived Motion Winds
- Derived Stability Indices
- Downward Shortwave Radiation: Surface
- Fire/Hot Spot Characterization
- Hurricane Intensity
- Land Surface Temperature (Skin)
- Legacy Vertical Moisture Profile
- Legacy Vertical Temperature Profile
- Radiiances
- Rainfall Rate / QPF
- Reflected Shortwave Radiation: TOA
- Sea Surface Temperature (Skin)
- Snow Cover
- Total Precipitable Water
- Volcanic Ash: Detection and Height

Future Capability Products

- Absorbed Shortwave Radiation: Surface
- Aerosol Particle Size
- Aircraft Icing Threat
- Cloud Ice Water Path
- Cloud Layers/Heights
- Cloud Liquid Water
- Cloud Type
- Convective Initiation
- Currents
- Currents: Offshore
- Downward Longwave Radiation: Surface
- Enhanced “V” / Overshooting Top Detection
- Flood/Standing Water
- Ice Cover
- Low Cloud and Fog
- Ozone Total
- Probability of Rainfall
- Rainfall Potential
- Sea and Lake Ice: Age
- Sea and Lake Ice: Concentration
- Sea and Lake Ice: Motion
- Snow Depth (Over Plains)
- SO₂ Detection
- Surface Albedo
- Surface Emissivity
- Tropopause Folding Turbulence Prediction
- Upward Longwave Radiation: Surface
- Upward Longwave Radiation: TOA
- Vegetation Fraction: Green
- Vegetation Index
- Visibility

NOAA: GOES-R ABI

16 Band Imager

<table>
<thead>
<tr>
<th>Spectral Region</th>
<th>Spatial Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 VNIR/SWIR</td>
<td>0.5, 1 &amp; 2 km</td>
</tr>
<tr>
<td>10 Infrared</td>
<td>2 km</td>
</tr>
</tbody>
</table>
GOES-R Temporal Resolution: Scan Mode 3

Full Disk Image: Every 15 min
CONUS Image: Every 5 min
Mesoscale Image: 1 Every 30 sec or 2 Every 1 min

GOES images adopted from Tim Schmitt
Preparations for Post-Launch Support

- Developing in-house implementations of the L1b Ground Processing Algorithms
- Resampler algorithm applied to proxy ABI data generated by UW to assess impact of and mitigation strategies for detector outages

Simulations

0.64 μm L1β image (courtesy of UW)  
0.64 μm L1β image with detector outages  
0.64 μm L1b image depicting striping
Preparations for Post-Launch Support

- Developing in-house implementations of the L1b Ground Processing Algorithms
- Resampler algorithm applied to proxy ABI data generated by UW to assess impact of and mitigation strategies for detector outages

Simulations

0.64 μm L1β image
(courtesy of UW)

0.64 μm L1β image with detector outages

0.64 μm L1b image with mitigated striping

WRF output from UW as proxy L1β image

Model detector outages

Resample to Fixed Grid Format using CWG Science Algorithm

Assessment of L1b Impacts
NCC Calibration Knowledge Base Updated

Visible Infrared Imaging Radiometer Suite (VIIRS)

The Visible Infrared Imaging Radiometer Suite (VIIRS) is one of the key instruments opened on November 21, 2011, which enables a new generation of operational, environmental monitoring and numerical weather forecasting, with 22 infrared records including clouds, sea surface temperature, ocean color, polar wind, vegetation, and other parameters. Calibration and validation have shown that VIIRS is performing very well.

- News and Documents
- VIIRS Performance and Monitoring
- Data and Software

News
- VIIRS Long-term Monitoring
- VIIRS Performance Table
- Standardized Calibration Parameters
- VIIRS Spectral Response Functions
- VIIRS Event Log Database (experimental)
- VIIRS at Cal/Val Sites
- Lunar Calendar for DNB
- Validation Site Time Series

VIIRS Users Guide
- NPP/VISSR/OMPS
- NPP/JS/TOMPS
- Metadata
- Jason
- DISCOVR
- Space Weather
- Standards
- Lunar Calibration
- Calibration Sites
- Calibration Facilities
- Portable Instruments
- Tools

https://cs.star.nesdis.noaa.gov/NCC
S-NPP Field Validation Campaigns: NASA ER-2 Underflights

- VIIRS SDR accuracy evaluation
- SHIS (NIST-traceable blackbody source, 0.1 K)
- MASTER (50 m spatial resolution mapping)
- 3 underflights for S-NPP

**RSS Total Uncertainty Estimate**

~0.12 K (I4, I5, M12, M13, M15, M16)

0.21 K (M14)

Complete Spectral Coverage
STAR scientists demonstrated GOES-R field campaign readiness support in collaboration with NASA HYSPIRI mission collecting ground spectral reflectance and aerosol data with the GOES-R ASD field spectrometer and sun photometer.
JMA AHI Cal/Val Collaboration

- Collaborating with Japan Meteorological Agency (JMA)
  - MOU is in place with multiple successful exchanges
  - AHI is a sister instrument to the future GOES-R ABI
  - Plans to launch in late 2014, which is ahead of the GOES-R
  - Analysis of AHI data may provide potential risk mitigation opportunities that can be leveraged for ABI support
  - NOAA hosted JMA scientists

**JMA shares with NOAA early on-orbit calibration and instrument performance data (NOAA and JMA MOU)**

**NOAA scientists collaborate with JMA on instrument calibration/validation using AHI data (proposal funded by the program office for JMA visitors)**

- Predicted radiometric biases between ABI and VIIRS RSB channels for GOES-R

- Use S-NPP VIIRS as a transfer radiometer to perform inter-comparisons between AHI and AB
  - Presented at AMS 2014 Annual Meeting; F. Padula and C. Cao (2014)
Long-Term Monitoring: VIIRS Quality Flag Mapping (ICVS)

VIIRS SDR Quality Flag

- good
- poor
- no calibration
- missing data

ICVS VIIRS SDR quality flag map:

» Produced for each band daily for both ascending and descending orbits
» Demonstrated to be an important tool to investigate VIIRS global data quality and to identify events that impact data quality

Data flagged due to Moon in Space View

Missing VIIRS Earth View (EV) data due to lunar maneuver event
Summary

• Suomi-NPP VIIRS achieved Calibrated/Validated Maturity Status at the science level (to be announced April 2014)
  » VIIRS radiometric performance is very good

• NOAA scientists are leading post-launch SDR Cal/Val and long-term monitoring for all major NPP instruments
  » Continue pre-launch Cal/Val support and analysis of J1

• Successful GOES-R Pre-Shipment Review
  » ABI has been qualified with overall excellent radiometric performance per-launch
  » Continue pre-launch Cal/Val support and analysis of GOES-S
  » Preparations for GOES-R post-launch activities

• Continued development of the NOAA ICVS monitoring system