

# Suomi NPP VIIRS Calibration/ Validation Progress Update

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February 4, 2014

#### Outlines

► Issues in the VIIRS SDR Calibration

≻VIIRS image

≻RTA degradation

► VIIRS Signal-to-noise-ratio assessment and projection

≻VIIRS geolocation

≻VIIRS, MODIS, CrIS, and AVHRR cross comparisons

➢VIIRS image striping

≻VIIRS performance and milestones

#### ➤Summary

#### VIIRS SDR Calibration/Validation

Instrument parameters(ICVS) Scan Sync loss (the *synchronization* of RTA and HAM) BB thermistor #3, #6 ~30 mK variation VIIRS 1394 anomaly Software, BB thermistor LUT corrections RTA degradation due to contamination by tungsten oxide RTA stowed, rotated

Lunar roll maneuver Sector rotation Geolocation, BBR (lunar data), M13 LG Blackbody warm-up and cool-down Dynamic range and linearity A/B-side electronic configuration testing

Degradation model -> AutoCal Sensor response change due spectrally dependent degradation Users' guide, ATBD, Conference presentations/Publications SNO VIIRS/MODIS/CrIS/AVHRR cross comparisons SDSM screen transmission M13 LG issues DNB stray light

Striping Quality flags Dual-gain mismatch VIIRS Global True Color Image

VIIRS Global True Color Image VIIRS Single Band Image VIIRS Overall SDR Quality VIIRS F or H Factor VIIRS Health and Status VIIRS Solar Diffuser Count by Band VIIRS Solar Diffuser Count by Detector VIIRS Solar Diffuser Stability Monitor Trend VIIRS Solar Diffuser Count NEAN VIIRS Blackbody Count VIIRS Blackbody Count NEAN VIIRS Space View Count VIIRS Space View Count NEAN VIIRS Instrument Temperature VIIRS Focal Plane Temperature VIIRS Circuit Card Assembly Temperature VIIRS Scan Cavity Baffle Temperature

# VIIRS Global Quick View

A VIIRS RGB composite image is generated from M3, M4, and M5 bands. This VIIRS global quickview image serves as a fast check of the VIIRS data quality. Users can also use the image to select their interested scenario: a granule for ocean, land, clear sky, and clouds.



Significance: STAR is closely monitoring the VIIRS performance and serves users.

# VIIRS observed tropic cyclones without gap

Using the wide swath and the high spatial resolution of the VIIRS, STAR team found the landing of the typhoons Saola and Damrey, and the development of the typhoon Haikui.



Significance: VIIRS SDRs has wide a swath and high spatial resolution, uniquely for monitoring global tropic cyclones without gap.

#### NOAA/STAR ICVS



# SD Monitoring in RSBAutoCal

Prototype RSBAutoCal

0.95

0.9

- Conducted long-term testing of the calibration coefficients generated by the prototype RSBAutoCal implemented in ADL
- Observed good agreement between SD monitoring in RSBAutoCal and in the current, off-line procedure
- Preliminary H factors derived by the operational RSBAutoCal in IDPS closely match those from the prototype code



#### **SNR** Assessment and Projection

Specified SNR @ Ltyp Pre-Launch SNR SNR on 13 Nov. 2013 SNR at EOL (7 yrs) 4 13 Off Scale SNR/Spec > 20 3.5 3 SNR/Specified\_SNR 2.5 2 1.5 1 0.5 0 MSH WIT WE WO W10 WII M2H MSit Mo Mai 12 MTH WIT With WI With Wit way ঔ ✨ **VIIRS Bands** 

Courtesy Frank J. De Luccia @ Aerospace Corporation

# **VIIRS** Geolocation Verification with MODIS

Using the SNO prediction to investigate the geolocation consistency between the VIIRS and MODIS. The differencing animation image shows cloud movement, but also geolocation discrepancy for land features.

After the VIIRS new geolocation LUT was implemented, the "land movement" issue was resolved (see lower-right image).



Differencing image shows geolocation discrepancy at 30:55 Dec 20, 2011

Residuals	Error (Nadir)	Spec (Nadir)	Error (EOS)	Spec (EOS)	
Track mean	-9 m		-20 m		
Scan mean	-7 m		-46 m		
Track RMSE	73 m	133 m	161 m	500 m	
Scan RMSE	61 m	133 m	398 m	500 m	
Courtesy, Wolfe et al., Dec. 19, 2013					



Animation image at 18:05 Feb 25, 2012

# SNO Comparisons for Imaging Bands

- For the VIIRS VisNIR Imaging bands (I1 and I2) and the corresponding MODIS bands 1 and 2 (used in NDVI calculations):
  - There is no bias when comparing NPP VIIRS band 11 with MODIS band 1 on both Aqua and Terra
  - There are only small biases between VIIRS band I2 and MODIS band 2 on Aqua (~2%) and Terra (~1%)
- Improvements to VIIRS radiometric calibration have generated more consistent SNO comparisons since mid-November 2012
- I2 is one of the bands most affected by the VIIRS telescope throughput degradation (due to tungsten oxide contamination), but weekly updates of the calibration coefficients have provided stability for the radiometric products



# MODIS Collection 5 vs. Collection 6

- Aqua MODIS radiometric calibration has been recently improved in production of Collection 6 datasets
- The largest change has occurred for bands 8 and 9 that are comparable with VIIRS bands M1 and M2, respectively
- When, instead of Collection 5 data, Aqua MODIS Collection 6 data are used in SNO comparisons with VIIRS :
  - M1 bias is reduced from +4% to -1%
  - ➤ M2 bias is reduced from 1% to near zero
- Observed temporal variation of the M1 bias may be due to VIIRS polarization sensitivity (will investigate)
- 6Sv radiative transfer modeling conducted for VIIRS band M1 (including out-of-band response) and for MODIS band 8 (using a snow surface reflectance and a range of atmospheric conditions) agrees better with the Collection 6 data



# **VIIRS Reflectance Trends for Libya-4**

Using SDRs reprocessed with calibration coefficients improved by the NASA VIIRS Calibration Support Team



Normalized to MODIS reflectance (BRDF)

#### **VIIRS TEB Comparisons**



#### SDR Comparison with AVHRR

VIIRS and AVHRR TEBs agree (~ 0.3 K). VIIRS and AVHRR RSB agree with the slope. Large bias in RSB needs to be further investigated.



# VIIRS M15 Image Striping

Solar diffuser view helped in identifying the M15 detectors with less stable gains which appears to be the major root cause for SST striping.

D1, D2, and D8 for M15 gains are not as stable as the other detectors which is identified as the root cause for the striping.

Striping is at noise level which has little impact on meeting the requirement, nevertheless SST amplifies the striping by ~4x.





#### VIIRS and CRTM Modeling for M12 Striping Investigation



The STAR team applied the CRTM to simulate the VIIRS SDR data. It is found that the M12 striping reported by the SST EDR team is caused by the difference in VIIRS azimuth angles among detectors.

#### **VIIRS** Milestones

Band         Driving EDR(s)         Wavelength (µm)         Width (µm)         End of Samo (µm)         End of Samo (µm)         "The samo gain         "The samo (µm)         "The samo (µm) </th <th></th> <th></th> <th>Center</th> <th>Fouriv.</th> <th colspan="2">Horizontal Sample Interval (km)</th> <th></th> <th>I typ or</th> <th>1 min</th> <th>Imax</th> <th>Spec</th> <th>On Orbit</th> <th>MODIS</th>			Center	Fouriv.	Horizontal Sample Interval (km)			I typ or	1 min	Imax	Spec	On Orbit	MODIS
Mi         Ocean Color Aerosol         0.411         0.0198         0.75-0.75         1.60x1.58         H         44.9         30         135         352         588         B8           M2         Ocean Color Aerosol         0.444         0.0143         0.75-0.75         1.60x1.58         L         1155         615         316         1045         B9           M3         Ocean Color Aerosol         0.444         0.0143         0.75-0.75         1.60x1.58         L         1146         687         409         1010         B9           M3         Ocean Color Aerosol         0.486         0.0190         0.75-0.75         1.60x1.58         L         123         702         414         988         B10           M4         Ocean Color Aerosol         0.551         0.0209         0.75-0.75         1.60x1.58         L         100         959         242         336         B4/B12           11         Imagery EDR         0.639         0.0775         0.375x0.375         0.80x0.79         S         22         5         718         119         214         B1           M5         Ocean Color Aerosol         0.672         0.02         0.75-0.75         1.60x1.58         L         68 <td>Band</td> <td>Driving EDR(s)</td> <td>Wavelength (µm)</td> <td>Width (µm)</td> <td>Nadir</td> <td>End of Scan</td> <td>Gain</td> <td>Ttyp (Spec)</td> <td>or Tmin</td> <td>or Tmax</td> <td>SNR or NEdT (K)</td> <td>SNR or NEdT (K)</td> <td>equiv. band</td>	Band	Driving EDR(s)	Wavelength (µm)	Width (µm)	Nadir	End of Scan	Gain	Ttyp (Spec)	or Tmin	or Tmax	SNR or NEdT (K)	SNR or NEdT (K)	equiv. band
M1         Ocean Color Aerosol         0.411         0.0198         0.75-0.75         1.60x158         H         44.9         30         135         552         588         B8           M2         Ocean Color Aerosol         0.444         0.0143         0.75-0.75         1.60x158         H         40         26         127         380         572         B9           M3         Ocean Color Aerosol         0.486         0.0190         0.75-0.75         1.60x158         H         40         26         127         380         572         B9           M4         Ocean Color Aerosol         0.486         0.0190         0.75-0.75         1.60x158         H         40         26         12         702         414         988         B4/B12           M4         Ocean Color Aerosol         0.551         0.0209         0.75-0.75         1.60x158         K         L         10         9         59         42         36         B4/B12           M5         Ocean Color Aerosol         0.672         0.02         0.75-0.75         1.60x158         S         9.6         5.3         411         199         368         B13/B1           M6         Atmosph. Correct.         0.745						VisNIR							
Mile         Ocean Color Aerosol         0.444         0.0143         0.75-0.75         1.60x1.56         L         155         615         316         1045         Description           M2         Ocean Color Aerosol         0.444         0.0143         0.75-0.75         1.60x1.56         H         40         22         107         414         988         B10           M3         Ocean Color Aerosol         0.551         0.0209         0.75-0.75         1.60x1.58         H         22         107         414         988           M4         Ocean Color Aerosol         0.551         0.0209         0.75-0.75         1.60x1.58         H         21         12         782         362         534           M4         Ocean Color Aerosol         0.672         0.02         0.75-0.75         1.60x1.58         S         22         5         718         119         214         B1           M5         Ocean Color Aerosol         0.672         0.02         0.75-0.75         1.60x1.58         S         9.6         5.3         41         199         368         B15           12         NDV         0.862         0.037         0.75-0.75         1.60x1.58         S         9.6         <	M1	Ososa Colar Asraal	0.411	0.0109	0.75-0.75	1 60-1 59	Н	44.9	30	135	352	588	B8
M2         Ocean Color Aerosol         0.444         0.0143         0.75~0.75         1.60x1.58         H         4.0         2.6         1.27         3.80         572         89           M3         Ocean Color Aerosol         0.466         0.0190         0.75~0.75         1.60x1.58         H         3.2         2.2         107         416         6.23         409         1010           M4         Ocean Color Aerosol         0.551         0.0209         0.75~0.75         1.60x1.58         H         2.1         1.2         7.8         362         534         84/812           11         Imagery EDR         0.639         0.075         0.375×0.375         0.80x0.79         S         2.2         5         7.18         119         2.14         B1           M5         Ocean Color Aerosol         0.672         0.02         0.75~0.75         1.60x1.58         S         9.6         5.3         411         199         368         B13/B1           M6         Atmosph. Correct.         0.745         0.0146         0.75~0.75         1.60x1.58         S         9.6         5.3         411         199         368         B15           12         NDV1         0.862         0.039 <td></td> <td>Occall Olior Acrosof</td> <td>0.411</td> <td>0.0150</td> <td>0.75×0.75</td> <td>1.00X1.00</td> <td>L</td> <td>155</td> <td></td> <td>615</td> <td>316</td> <td>1045</td>		Occall Olior Acrosof	0.411	0.0150	0.75×0.75	1.00X1.00	L	155		615	316	1045	
M3         Ocean Color Aerosol         0.486         0.0190         0.75×0.75         1.60x1.58         H         32         22         107         416         628         410         988         B10           M4         Ocean Color Aerosol         0.551         0.0209         0.75×0.75         1.60x1.58         H         221         12         783         362         534         B4/B12           I1         Imagery EDR         0.639         0.0775         0.375×0.375         0.80x0.79         S         22         5         718         119         214         B1           M5         Ocean Color Aerosol         0.672         0.02         0.75×0.75         1.60x1.58         H         10         9         59         242         386         B13/B1           M6         Atmosph. Correct.         0.745         0.0146         0.75×0.75         1.60x1.58         S         9.6         5.3         411         199         368         B15           I2         NDVI         0.862         0.0387         0.75×0.75         1.60x1.58         S         9.6         5.3         411         199         368         B16/B2           M7         Ocean Color Aerosol         0.862	M2	Ocean Color Aerosol	0.444	0.0143	0.75×0.75	1.60x1.58	н	40	26	127	380	572	B9
M3         Ocean Color Aerosol         0.486         0.0190         0.75-0.75         1.60x1.58         III         122         107         4.16         0.228         B10           M4         Ocean Color Aerosol         0.551         0.029         0.75-0.75         1.60x1.58         H         21         12         78         362         534         B4/B12           I1         Imagery EDR         0.639         0.0775         0.375x0.375         0.80x0.79         S         22         5         7.18         119         214         B1           M5         Ocean Color Aerosol         0.672         0.02         0.75-0.75         1.60x1.58         L         68         651         360         631         B1/B1           M6         Atmosph. Correct.         0.755         0.0146         0.75-0.75         1.60x1.58         L         68         5.3         41         199         368         B15           I2         NDV         0.862         0.0397         0.75-0.75         1.60x1.58         L         33.4         349         340         631         B1/B2           M7         Ocean Color Aerosol         0.862         0.0397         0.75-0.75         1.60x1.58         L								146	- 22	687	409	1010	
M4         Ocean Color Aerosol         0.551         0.0209         0.75-0.75         1.60x1.58         H         21         12         78         382         534         Bd/B12           11         Imagery EDR         0.639         0.0775         0.375x0.375         0.80x0.79         S         22         5         718         119         214         B1           M5         Ocean Color Aerosol         0.672         0.02         0.75-0.75         1.60x1.58         H         10         9         59         242         336         B13/B1           M6         Atmosph. Correct         0.745         0.0146         0.75-0.75         1.60x1.58         S         9.6         5.3         411         199         368         B15           12         NDVI         0.862         0.039         0.375x0.375         0.80x0.79         S         25         10.3         349         150         264         B2           M7         Ocean Color Aerosol         0.862         0.0387         0.75-0.75         1.60x1.58         L         33.4         349         340         631         B16/B2           DNB         NCC Imagery         0.700         0.200         0.75-0.75         1.60x1.58	M3	Ocean Color Aerosol	0.486	0.0190	0.75×0.75	1.60x1.58		123		702	410	988	B10
M4         Ocean Color Aerosol         0.551         0.0209         0.75×0.75         1.60x1.58         1 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td rowspan="2">1.60x1.58 L</td> <td>21</td> <td>12</td> <td>78</td> <td>362</td> <td>534</td> <td><u>├───</u></td>						1.60x1.58 L	21	12	78	362	534	<u>├───</u>	
I1         Imagery EDR         0.639         0.0775         0.375x0.375         0.80x0.79         S         22         5         718         119         214         B1           M5         Ocean Color Aerosol         0.672         0.02         0.75x0.75         1.60x1.58         H         10         9         59         242         336         B13/B1           M6         Atmosph. Correct.         0.745         0.0146         0.75x0.75         1.60x1.58         S         9.6         5.3         411         199         368         B15           I2         NDVI         0.862         0.0394         0.375x0.375         0.80x0.79         S         25         10.3         349         150         264         B2           M7         Ocean Color Aerosol         0.862         0.0387         0.75x0.75         1.60x1.58         H         6.4         3.4         29         215         457         B16/B2           DNB         NCC Imagery         0.700         0.20         0.75x0.75         1.60x1.58         S         5.4         3.5         165         7.4         221         B5           M8         Cloud Particle Size         1.238         0.0271         0.75x0.75         <	M4	Ocean Color Aerosol	0.551	0.0209	0.75×0.75		L	90		667	315	856	B4/B12
M5         Ocean Color Aerosol         0.672         0.02         0.75×0.75         1.60x1.58         H         10         9         59         242         336         B13/B1           M6         Atmosph. Correct.         0.745         0.0146         0.75×0.75         1.60x1.58         S         9.6         5.3         41         199         368         B15           12         NDV1         0.862         0.0394         0.375x0.375         0.80x0.79         S         25         10.3         349         150         264         B2           M7         Ocean Color Aerosol         0.862         0.0387         0.75×0.75         1.60x1.58         H         6.4         3.4         29         215         457           DNB         NCC Imagery         0.700         0.20         0.75×0.75         1.60x1.58         L         33.4         349         340         631         B16/B2           DNB         NCC Imagery         0.700         0.075×0.75         1.60x1.58         S         5.4         3.5         165         74         221         B5           M9         Cirurs/Cloud Cover         1.375         0.0150         0.75×0.75         1.60x1.58         S         7.3	11	Imagery EDR	0.639	0.0775	0.375x0.375	0.80x0.79	s	22	5	718	119	214	B1
Mis         Ocean Colut Activity         0.072         0.02         0.150.73         1.60X.136         L         68         651         360         631         D1311           M6         Atmosph. Correct.         0.745         0.0146         0.75×0.75         1.60X1.58         S         9.6         5.3         41         199         368         B15           12         NDVI         0.862         0.0394         0.375x0.375         0.80x0.79         S         25         10.3         349         150         264         B2           M7         Ocean Color Aerosol         0.862         0.037         0.75×0.75         1.60x1.58         H         6.4         3.4         29         215         457         B16/B2           DNB         NCC Imagery         0.700         0.200         0.75×0.75         1.60x1.58         S         5.4         3.5         165         7.4         221         B5           M8         Cloud Particle Size         1.238         0.0271         0.75×0.75         1.60x1.58         S         6         0.6         7.1         83         227         B56           M9         Cirrus/Cloud Cover         1.375         0.0572         0.375×0.75         1.60x1.58	ME	Ocean Color Aeronal	0.672	0.02	0.75-0.75	75 4 00-4 50 H	н	10	9	59	242	336	P12/P1
M6         Atmosph. Correct.         0.745         0.0146         0.75×0.75         1.60x1.58         S         9.6         5.3         41         199         368         B15           I2         NDVI         0.862         0.0394         0.375x0.375         0.80x0.79         S         25         10.3         349         150         264         B2           M7         Ocean Color Aerosol         0.862         0.0387         0.75×0.75         1.60x1.58         L         33.4         29         215         457         B16/B2           DNB         NCC Imagery         0.00         0.200         0.75×0.75         0.75×0.75         1.60x1.68         L         33.4         349         340         631         B16/B2           DNB         NCC Imagery         0.000         0.75×0.75         1.60x1.58         S         5.4         3.5         165         7.4         221         B5           M8         Cloud Particle Size         1.238         0.0271         0.75×0.75         1.60x1.58         S         6         0.6         7.11         83         227         B26           M9         Cirrus/Cloud Cover         1.375         0.057         0.75×0.75         1.60x1.58         S </td <td>NIS</td> <td>Ocean Color Aerosor</td> <td>0.072</td> <td>0.02</td> <td>0.75×0.75</td> <td>1.00X1.30</td> <td>L</td> <td>68</td> <td></td> <td>651</td> <td>360</td> <td>631</td> <td>D13/D1</td>	NIS	Ocean Color Aerosor	0.072	0.02	0.75×0.75	1.00X1.30	L	68		651	360	631	D13/D1
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	M6	Atmosph. Correct.	0.745	0.0146	0.75×0.75	1.60x1.58	s	9.6	5.3	41	199	368	B15
M7         Ocean Color Aerosol         0.862         0.0387         0.75×0.75         1.60x1.58         H         6.4         3.4         29         215         457         B16/B2           DNB         NCC Imagery         0.700         0.200         0.75×0.75         0.75×0.75         1.60x1.58         28.9         3.0         6         349         340         631         B16/B2           VERIANCE Imagery         0.700         0.200         0.75×0.75         0.75×0.75         1.60x1.58         28.9         3.0         6         39         -           M8         Cloud Particle Size         1.238         0.0271         0.75×0.75         1.60x1.58         S         6         0.6         77.1         83         227         B26           M9         Cirrus/Cloud Cover         1.375         0.0150         0.75×0.75         1.60x1.58         S         6         0.6         77.1         83         227         B26           M10         Snow Fraction         1.602         0.0587         0.75×0.75         1.60x1.58         S         7.3         1.2         71.2         342         586         B6           M11         Clouds         2.257         0.0467         0.75×0.75 <td>12</td> <td>NDVI</td> <td>0.862</td> <td>0.0394</td> <td>0.375x0.375</td> <td>0.80x0.79</td> <td>s</td> <td>25</td> <td>10.3</td> <td>349</td> <td>150</td> <td>264</td> <td>B2</td>	12	NDVI	0.862	0.0394	0.375x0.375	0.80x0.79	s	25	10.3	349	150	264	B2
Image of the constrained of the constrated of the constrained of the constrained of the constrained of t	M7	Ocean Color Aerosol	0.862	0.0387	0.75×0.75	1.60x1.58	н	6.4	3.4	29	215	457	B16/B2
DNB         NCC imagery         0.700         0.200         0.75x0.75         0.75x0.75         0.05x0.75         3E-9         3E-9         3E-9         0.02         6         >9         -           S/MWIR           M8         Cloud Particle Size         1.238         0.0271         0.75x0.75         1.60x1.58         S         5.4         3.5         165         74         221         B5           M9         Cirrus/Cloud Cover         1.375         0.0150         0.75x0.75         1.60x1.58         S         6         0.6         77.1         83         227         B26           13         Binary Snow Map         1.602         0.0572         0.375x0.375         0.80x0.79         S         7.3         1.2         71.2         342         586         B6           M10         Snow Fraction         1.602         0.0587         0.75x0.75         1.60x1.58         S         0.12         0.12         31.8         10         22         B7           I4         Imagery Clouds         3.753         0.360         0.375x0.375         0.80x0.79         S         270         210         353         2.5         0.4         B20           M12         SST			0.700	0.0001	0.75.0.75	0.75.0.75	L	33.4		349	340	631	
M8         Cloud Particle Size         1.238         0.0271         0.75×0.75         1.60x1.58         S         5.4         3.5         165         74         221         B5           M9         Cirrus/Cloud Cover         1.375         0.0150         0.75×0.75         1.60x1.58         S         6         0.6         77.1         83         227         B26           13         Binary Snow Map         1.602         0.0572         0.375x0.375         0.80x0.79         S         7.3         1.2         72.5         6         149         B6           M10         Snow Fraction         1.602         0.0587         0.75×0.75         1.60x1.58         S         0.12         0.12         31.8         100         22         B7           M11         Clouds         2.257         0.0467         0.75×0.75         1.60x1.58         S         0.12         0.12         31.8         10         22         B7           I4         Imagery Clouds         3.753         0.360         0.375x0.375         0.80x0.79         S         270         210         353         2.5         0.4         B20           M12         SST         3.697         0.192         0.75×0.75         1.60x	DNB	NCC Imagery	0.700	0.200	0.75×0.75	0.75×0.75	LG/MG/HG	3E-9	3E-9	0.02	6	>9	-
M8         Cloud Particle Size         1.238         0.02/1         0.75×0.75         1.60x1.58         S         5.4         3.5         165         7.4         221         B5           M9         Cirrus/Cloud Cover         1.375         0.0150         0.75×0.75         1.60x1.58         S         6         0.6         77.1         83         227         B26           13         Binary Snow Map         1.602         0.0572         0.375×0.375         0.80x0.79         S         7.3         1.2         72.5         6         149         B6           M10         Snow Fraction         1.602         0.0587         0.75×0.75         1.60x1.58         S         7.3         1.2         71.2         342         586         B6           M11         Clouds         2.257         0.0467         0.75×0.75         1.60x1.58         S         0.12         0.12         31.8         10         22         B7           14         Imagery Clouds         3.753         0.360         0.375×0.75         1.60x1.58         S         270         210         353         0.396         0.12         B20           M12         SST         3.697         0.192         0.75×0.75         1.6		Oland David a Olan	4.000	0.0074	0.75 0.75	5/WWWIK		5.4	2.5	405	74	224	
M9         Cirrus/Cloud Cover         1.375         0.0150         0.75×0.75         1.60x1.58         S         6         0.6         77.1         83         227         B26           I3         Binary Snow Map         1.602         0.0572         0.375x0.375         0.80x0.79         S         7.3         1.2         72.5         6         149         B6           M10         Snow Fraction         1.602         0.0587         0.75×0.75         1.60x1.58         S         7.3         1.2         71.2         342         586         B6           M11         Clouds         2.257         0.0467         0.75×0.75         1.60x1.58         S         0.12         0.12         31.8         100         22         B7           I4         Imagery Clouds         3.753         0.360         0.375×0.75         1.60x1.58         S         270         210         353         2.5         0.4         B20           M12         SST         3.697         0.192         0.75×0.75         1.60x1.58         S         270         230         353         0.396         0.12         B20           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58 </td <td>M8</td> <td>Cloud Particle Size</td> <td>1.238</td> <td>0.0271</td> <td>0.75×0.75</td> <td>1.60x1.58</td> <td>s</td> <td>5.4</td> <td>3.5</td> <td>165</td> <td>/4</td> <td>221</td> <td>85</td>	M8	Cloud Particle Size	1.238	0.0271	0.75×0.75	1.60x1.58	s	5.4	3.5	165	/4	221	85
I3         Binary Snow Map         1.602         0.0572         0.375x0.375         0.80x0.79         S         7.3         1.2         72.5         6         149         B6           M10         Snow Fraction         1.602         0.0587         0.75×0.75         1.60x1.58         S         7.3         1.2         71.2         342         586         B6           M11         Clouds         2.257         0.0467         0.75×0.75         1.60x1.58         S         0.12         0.12         31.8         10         22         B7           I4         Imagery Clouds         3.753         0.360         0.375×0.75         1.60x1.58         S         2.70         210         353         2.5         0.4         B20           M12         SST         3.697         0.192         0.75×0.75         1.60x1.58         S         270         230         353         0.396         0.12         B20           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         S         270         230         343         0.107         0.04           B23         0.75×0.75         1.60x1.58         S         270         100         336	M9	Cirrus/Cloud Cover	1.375	0.0150	0.75×0.75	1.60x1.58	s	6	0.6	77.1	83	227	B26
M10         Snow Fraction         1.602         0.0587         0.75×0.75         1.60x1.58         S         7.3         1.2         71.2         342         586         B6           M11         Clouds         2.257         0.0467         0.75×0.75         1.60x1.58         S         0.12         0.12         31.8         10         22         B7           I4         Imagery Clouds         3.753         0.360         0.375×0.375         0.80x0.79         S         270         210         353         2.5         0.4         B20           M12         SST         3.697         0.192         0.75×0.75         1.60x1.58         S         270         230         353         0.396         0.12         B20           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         S         270         230         343         0.107         0.04           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         S         270         230         343         0.107         0.04         B20           M14         Cloud Top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S	13	Binary Snow Map	1.602	0.0572	0.375x0.375	0.80x0.79	s	7.3	1.2	72.5	6	149	B6
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	M10	Snow Fraction	1.602	0.0587	0.75×0.75	1.60x1.58	s	7.3	1.2	71.2	342	586	B6
I4         Imagery Clouds         3.753         0.360         0.375x0.375         0.80x0.79         S         270         210         353         2.5         0.4         B20           M12         SST         3.697         0.192         0.75×0.75         1.60x1.58         S         270         230         353         0.396         0.12         B20           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         S         270         230         343         0.107         0.04         B20           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         H         300         230         343         0.107         0.04         B20           M14         Cloud Top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S         270         190         336         0.091         0.06         B29           M15         SST         10.729         0.900         0.75×0.75         1.60x1.58         S         300         190         343         0.07         0.03         B31           15         Cloud Imagery         11.469         1.75         0.375x0.375         0.80x	M11	Clouds	2.257	0.0467	0.75×0.75	1.60x1.58	s	0.12	0.12	31.8	10	22	B7
M12         SST         3.697         0.192         0.75×0.75         1.60x1.58         S         270         230         353         0.396         0.12         B20           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         S         270         230         353         0.396         0.12         B20           M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         H         300         230         343         0.107         0.04           L         380         634         0.423         L         B20           LWIR           M14         Cloud Top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S         270         190         336         0.091         0.06         B29           M15         SST         10.729         0.90         0.75×0.75         1.60x1.58         S         300         190         343         0.07         0.03         B31           15         Cloud Imagery         11.469         1.75         0.375×0.375         0.80×0.79         S         210         190         340         1.5         0.4 <t< td=""><td>14</td><td>Imagery Clouds</td><td>3.753</td><td>0.360</td><td>0.375x0.375</td><td>0.80x0.79</td><td>S</td><td>270</td><td>210</td><td>353</td><td>2.5</td><td>0.4</td><td>B20</td></t<>	14	Imagery Clouds	3.753	0.360	0.375x0.375	0.80x0.79	S	270	210	353	2.5	0.4	B20
M13         SST/Fires         4.067         0.165         0.75×0.75         1.60x1.58         H         300         230         343         0.107         0.04         B23           M14         Cloud Top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S         270         190         336         0.091         0.06         B29           M14         Cloud Top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S         270         190         336         0.091         0.06         B29           M15         SST         10.729         0.990         0.75×0.75         1.60x1.58         S         300         190         343         0.07         0.03         B31           I5         Cloud Imagery         11.469         1.75         0.375x0.375         0.80x0.79         S         210         190         340         1.5         0.4         B31	M12	SST	3.697	0.192	0.75×0.75	1.60x1.58	S	270	230	353	0.396	0.12	B20
M14         Cloud Top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S         270         190         336         0.091         0.06         B29           M15         SST         10.729         0.990         0.75×0.75         1.60x1.58         S         300         190         343         0.07         0.03         B31           I5         Cloud Imagery         11.469         1.75         0.375x0.375         0.80x0.79         S         210         190         340         1.5         0.4         B31	M13	SST/Fires	4.067	0.165	0.75×0.75	1.60x1.58	Н	300	230	343	0.107	0.04	B23
M14         Cloud Top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S         270         190         336         0.091         0.06         B29           M15         SST         10.729         0.990         0.75×0.75         1.60x1.58         S         300         190         343         0.07         0.03         B31           I5         Cloud Imagery         11.469         1.75         0.375x0.375         0.80x0.79         S         210         190         340         1.5         0.4         B31							<u> </u>	380		634	0.423		l
M14         Cloud top Properties         8.578         0.324         0.75×0.75         1.60x1.58         S         270         190         336         0.091         0.06         B29           M15         SST         10.729         0.990         0.75×0.75         1.60x1.58         S         300         190         343         0.07         0.03         B31           I5         Cloud Imagery         11.469         1.75         0.375x0.375         0.80x0.79         S         210         190         340         1.5         0.4         B31													
M15         SS1         10.729         0.990         0.75×0.75         1.60×1.58         S         300         190         343         0.07         0.03         B31           I5         Cloud Imagery         11.469         1.75         0.375×0.375         0.80×0.79         S         210         190         340         1.5         0.4         B31	M14	Cloud Top Properties	8.5/8	0.324	0.75×0.75	1.60x1.58	S	270	190	336	0.091	0.06	B29
1 15 Cloud imagery 11.469 1.75 U.3/5XU.3/5 U.8UXU.79 5 21U 19U 34U 1.5 U.4 B31	M15	SST Claud Images	10.729	0.990	0.75×0.75	1.60x1.58	S	300	190	343	0.07	0.03	B31
I M16 I SST I 11.845 I 0.866 I 0.75∞0.75 I 1.60∞1.58 I S I 300 I 190 I 340 I 0.072 I 0.03 I B32	15 M16		11.469	1.75	0.3/5X0.3/5	0.80x0.79	3	300	190	340	1.5	0.4	B31 B32

#### **VIIRS** Performance



#### **VIIRS** Milestones

Milestone	Description	Date
1	NPP launch	10/28/2011
2	VIIRS turned on	11/08/2011
3	VIIRS door open (VIS)	11/21/2011
4	VIIRS Cryo-cooler door open (IR)	01/18/2012
5	NOAA CLASS SDR available	02/07/2012
6	Beta maturity	04/05/2012*
7	Provisional maturity	10/24/2012*
8	Validated maturity	12/19/2013*

\* SDR Review date IDPS RSB data products generally perform very well. TEB is excellent.

https://cs.star.nesdis.noaa.gov/NCC/VIIRS

#### Summary

- IDPS RSB data products generally perform very well.
- RSBAutoCal for generating calibration has been implemented.
- VIIRS Thermal Emissive Bands are stable and exceed the specification.
- D1, D2, and D8 for M15 gains are not as stable as the other detectors which is identified as the root cause for the striping.
- VIIRS M12 striping at daytime is mainly caused by the difference in VIIRS azimuth angles among detectors. CRTM can simulate the striping effect.
- VIIRS, MODIS, CrIS, and AVHRR agree well over the SNO scenes.
- VIIRS DNB Straylight Correction implemented (Aug. 2013); tool kit has been evaluated by STAR.
- Implementation of modulated RSR (April 2013).
- NASA lunar approach and the NOAA BB WUCD method potentially solved M13 LG calibration issue.
- Higher accuracy demanded by ocean color requirements.
- Bias between M15 and CrIS at low temperature.
- I2/M7 correlation analysis