



JPSS-1 VIIRS Spectral Calibration and performance

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*Acknowledgement to the Raytheon instrument
measurement and spectral analysis teams*

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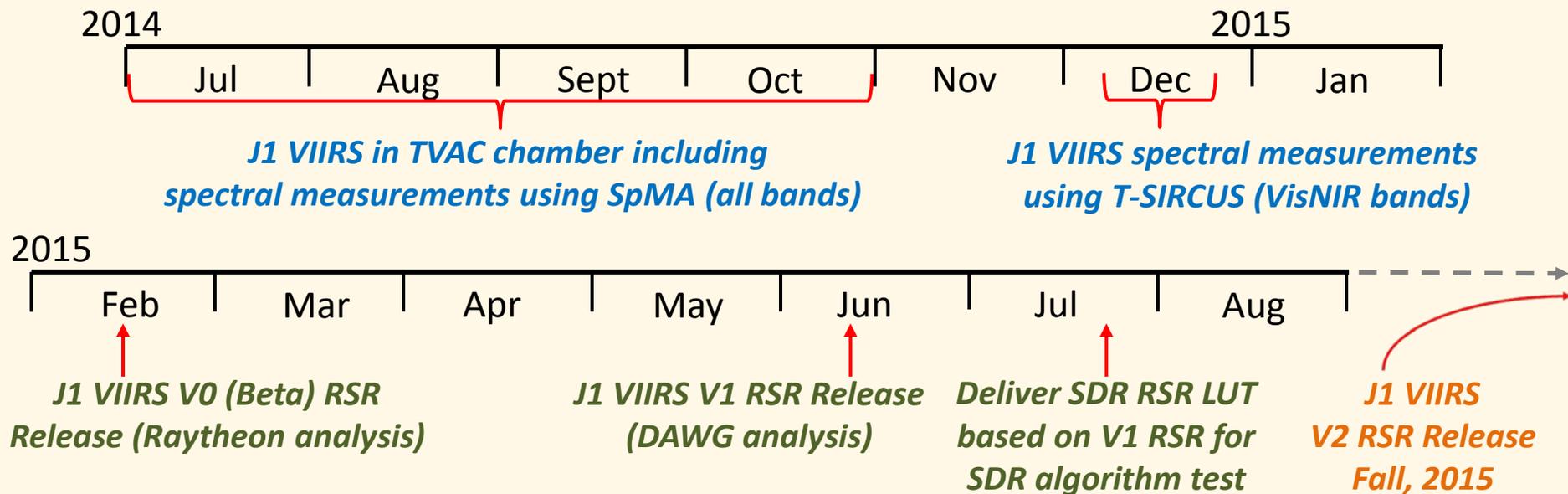
College Park, MD

Outline

- Overview of spectral test program and RSR releases
- DAWG Version 1 (V1) Release
- S-NPP/JPSS-1 RSR comparisons
- S-NPP/JPSS-1 spectral metrics
- Spectral impact on SDR (compared to S-NPP)
- Summary
- JPSS-1 RSR will not be modulated by WO2 contamination experienced on S-NPP

Overview and Timeline of VIIRS Spectral Measurements/Releases

- All bands, all detectors (DNBHGS surrogate: DNBMGS) measured using single band illumination (all bands) plus VisNIR full focal plane illumination
- Measurements predominantly contiguous at FWHM in spectral space
- First release (V0) within 4 months of completing spectral measurements
- V1 release replaced V0 release



Pedigree of the DAWG J1 VIIRS V1 Relative Spectral Response (RSR)

- Independent RSR analysis by the govt-sponsored VIIRS Data Analysis Working Group (DAWG).
 - DAWG chose which measurement collects to use
 - DAWG generated its own Relative Spectral Output correction.
 - DAWG performed its own in-band to out-of-band stitching
 - DAWG set its own SNR-based data quality filtering
 - DAWG created its own band average (over all detectors) RSR
- Analysis uses FP-15,-16 measurements collected at Raytheon El Segundo facility during the July-October 2014 sensor test program.
- T-SIRCUS based measurements of VisNIR band RSR in December 2014 are not included; however, preliminary T-SIRCUS based RSR were allowed to indirectly influence the DAWG RSR analysis for some bands.

The DAWG J1 VIIRS RSR V1 Release

- Consists of: RSR files (tar file), PDF showing RSR plots, README
- Stitched IB+OOB RSR with all RSR normalized at the peak to 1.0.
- Detector and band average RSR provided at the native spectral sampling of the test data. M9 RSR is water vapor corrected. M16A and M16B band average RSRs are averaged into an “M16” RSR.
- Detector numbering convention is “sensor order”, i.e. leading detector in along track direction is detector 1.
- Band average SNR metric used to separate high quality (i.e. light-driven) response from low quality (i.e. noise-driven). A quality flag (0=High; 1 = Low) is provided at each wavelength in the detector RSR, and supports data quality filtering for the band average RSR.
- Low quality response including negative response is retained in the detector RSR but is set to 1E-10 in the band average RSR.
- RSR are not corrected for a minor SpMA spectral smile influence.

The V1 Release* is available on the limited access NASA eRoom:

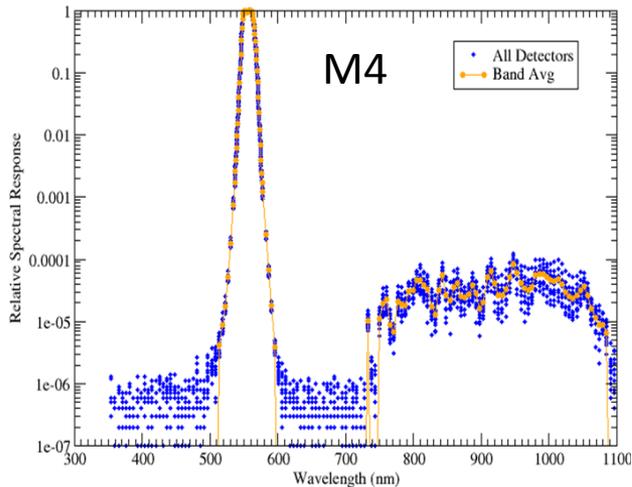
https://jpss-erooms.ndc.nasa.gov/eRoom/JPSSInstruments/VIIRSF2_JPSS1/0_fa80

*under EAR99 protection

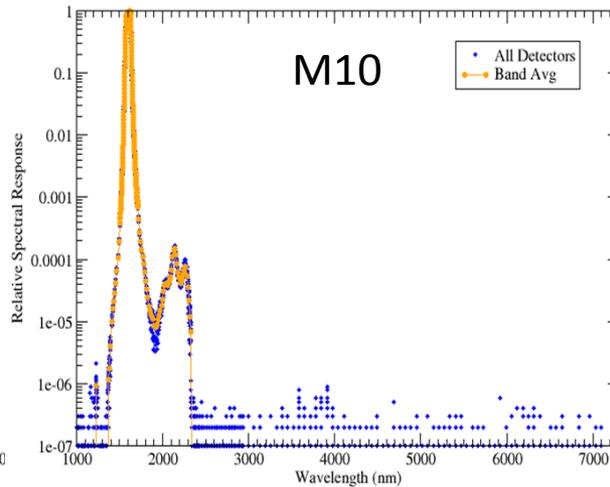
Version 1 RSR Data Quality

- Set data quality filter thresholds to distinguish high quality response (i.e. light-driven) from low quality response (i.e. noise-driven).
- Average the detector RSR into a band average RSR for each band, applying the data quality filter to screen out low quality response from the averaging process.

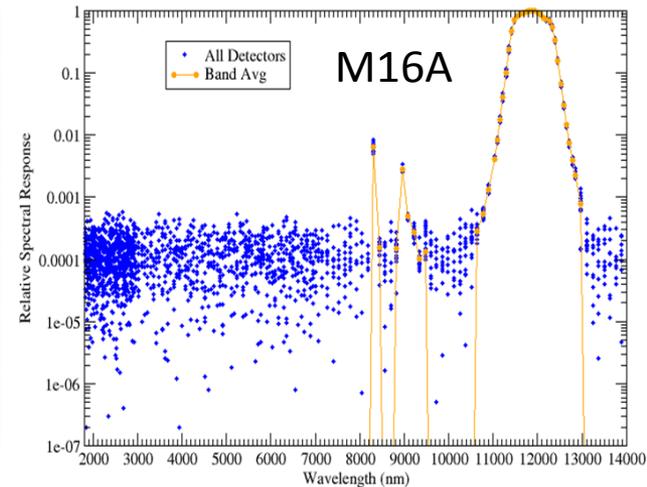
J1 VIIRS Detector RSR
V1 Release; PR1.4



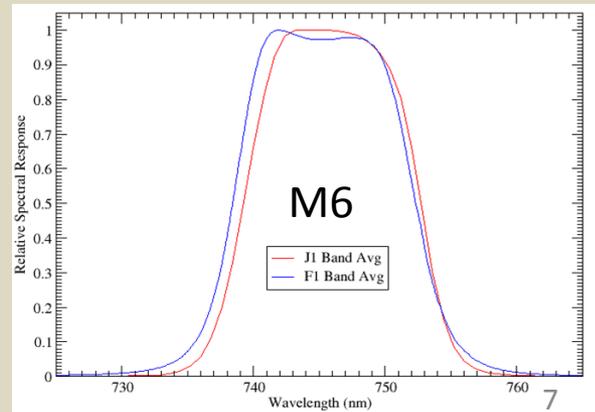
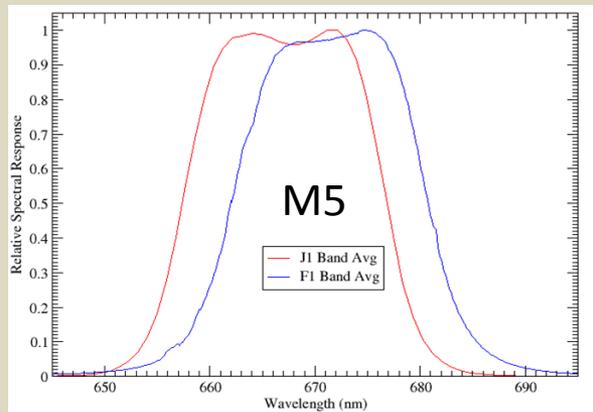
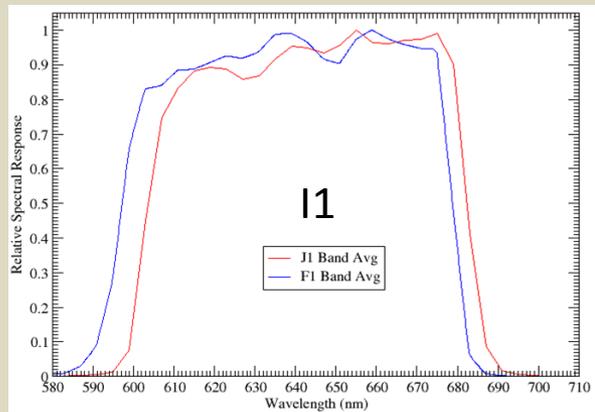
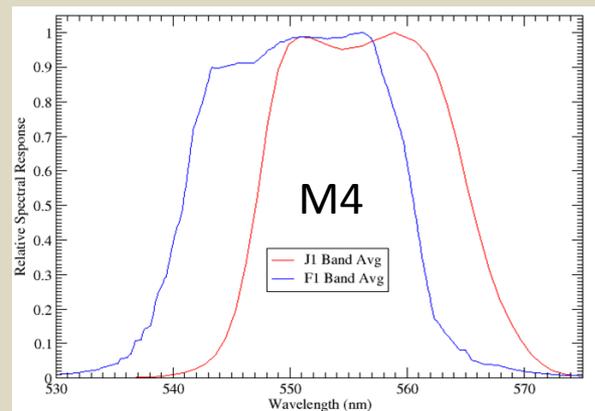
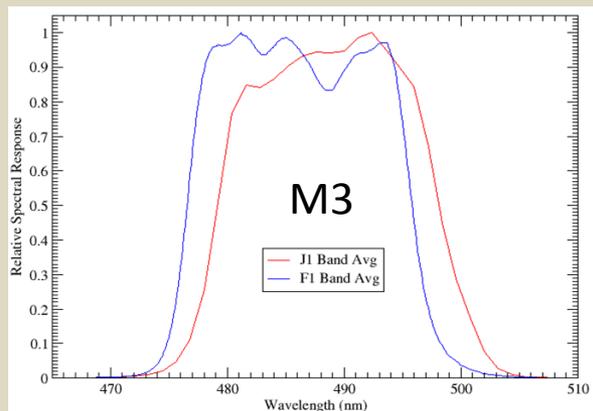
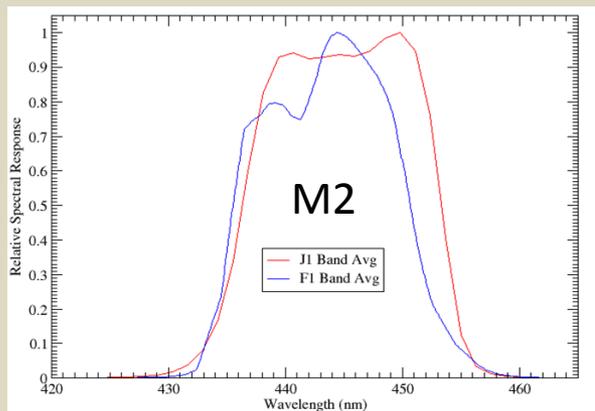
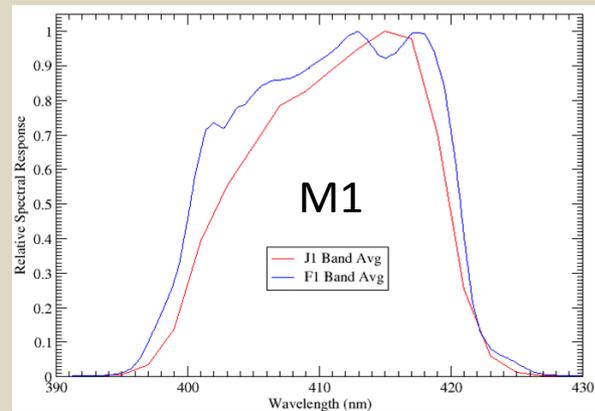
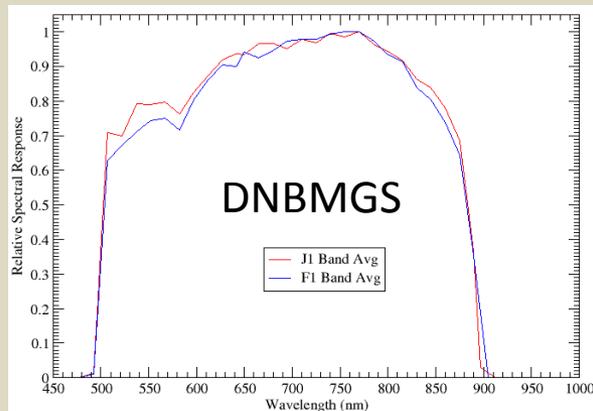
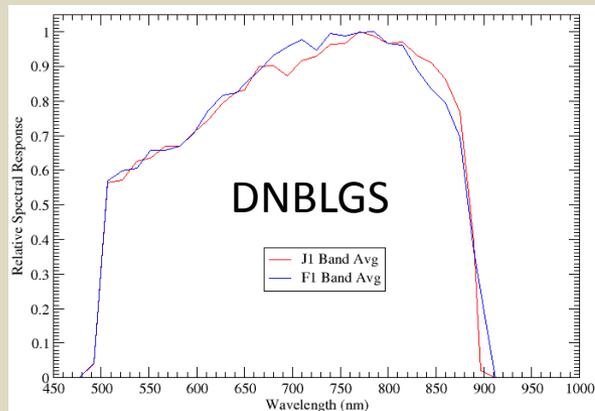
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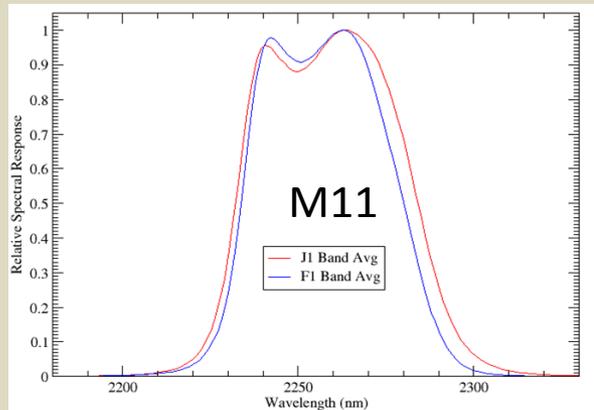
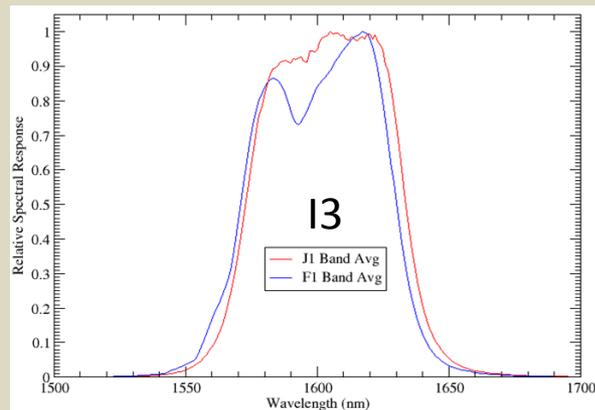
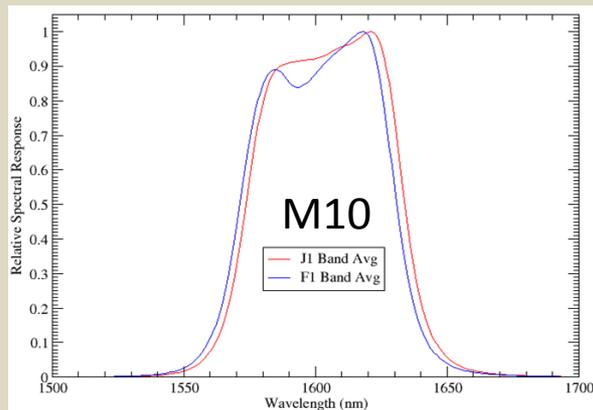
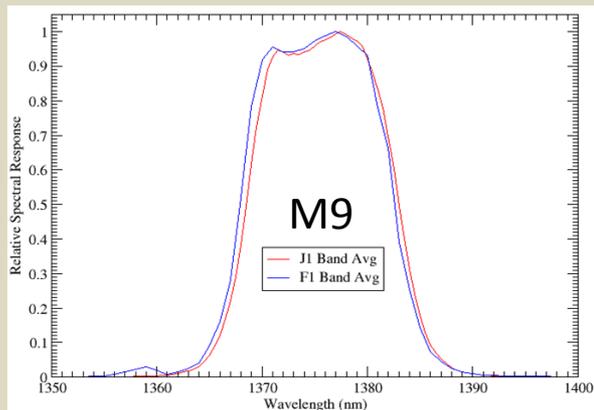
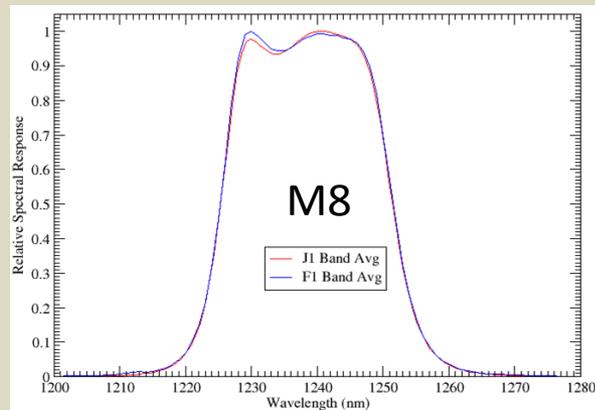
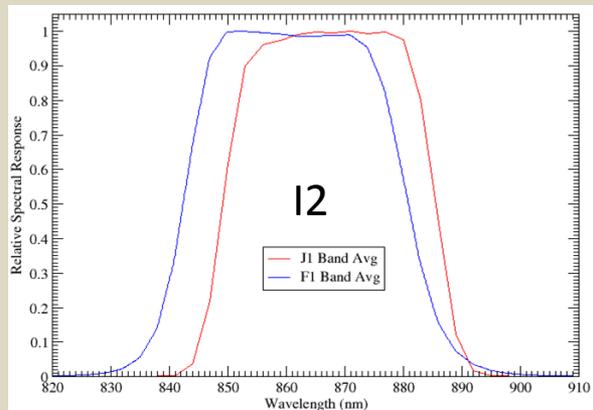
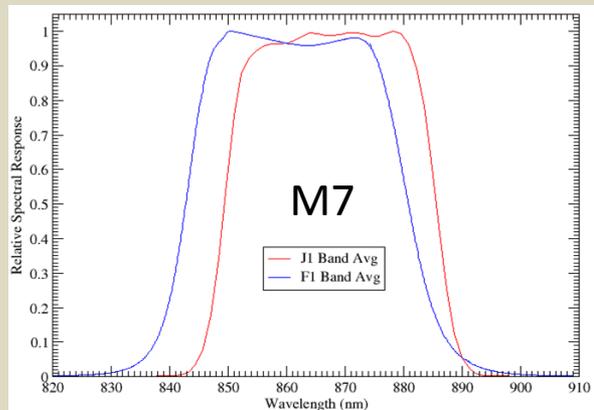
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V1 Release; PR1.4



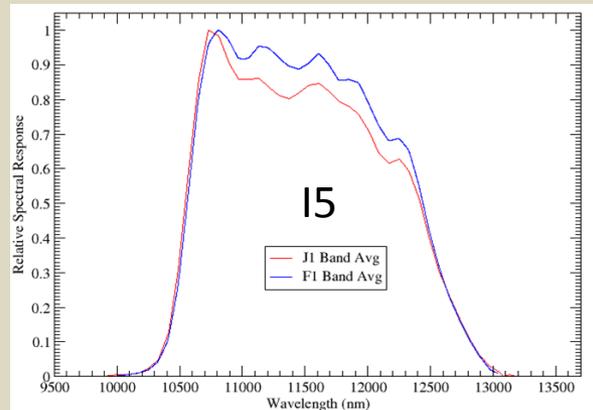
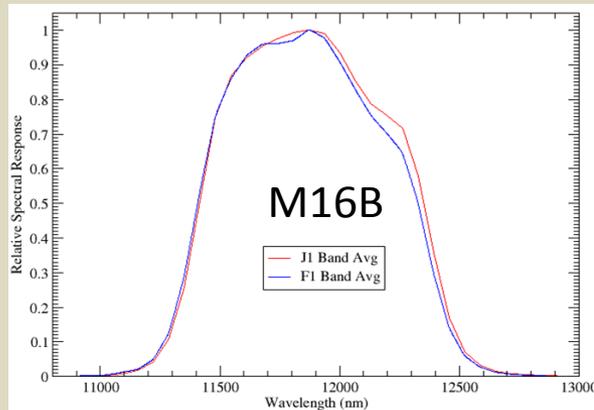
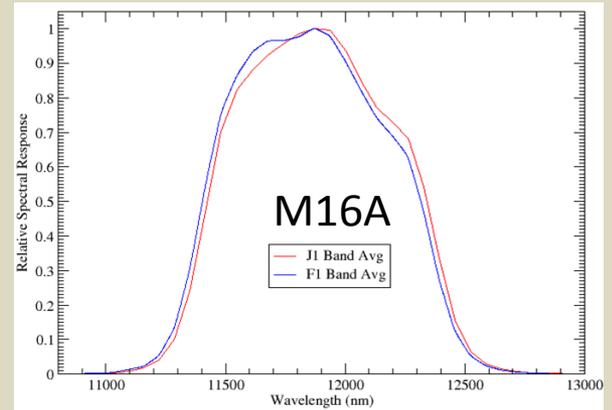
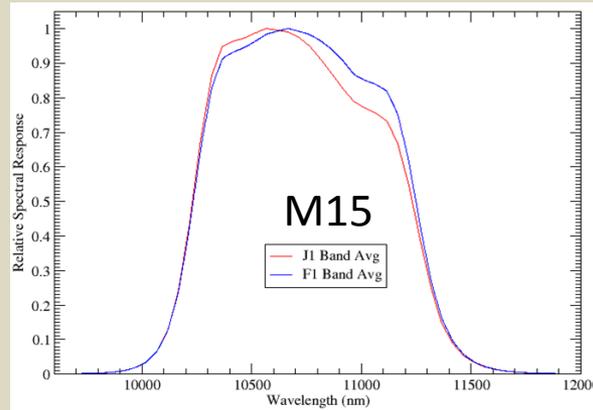
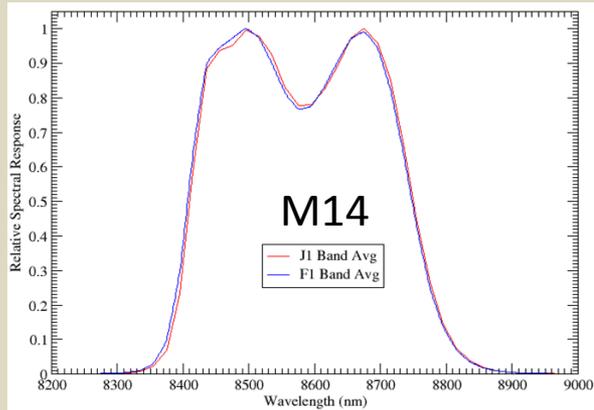
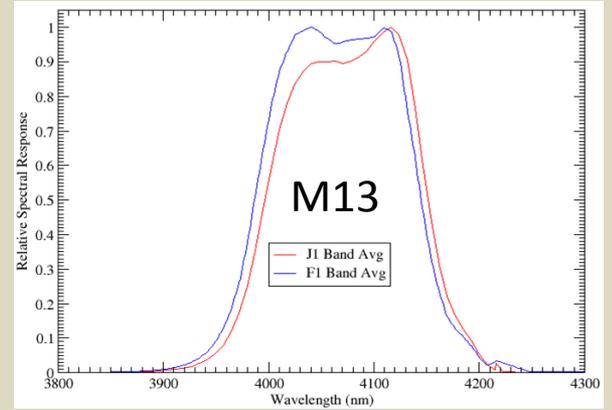
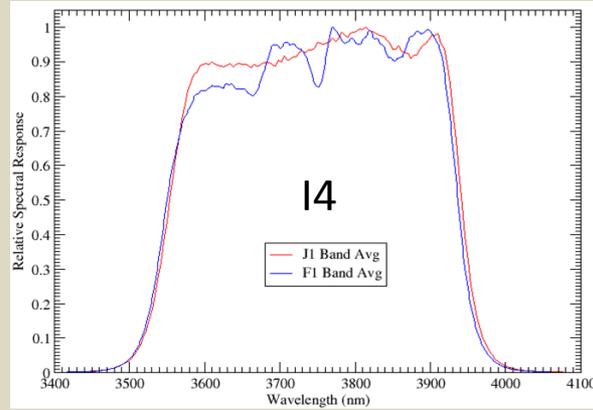
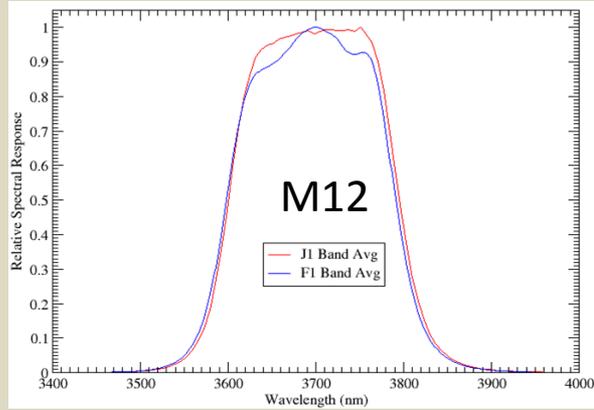
J1 VIIRS V1 Band Average RSR: RSB (1 of 2)



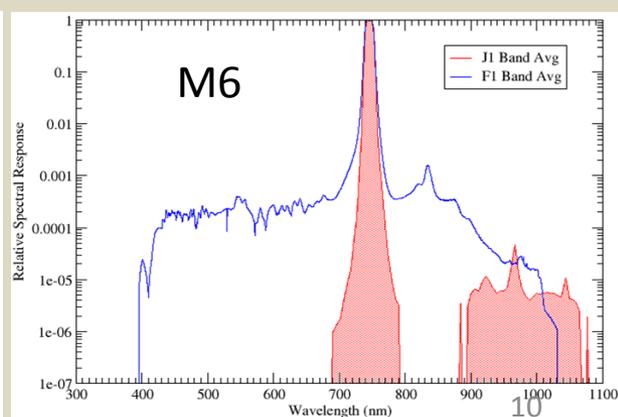
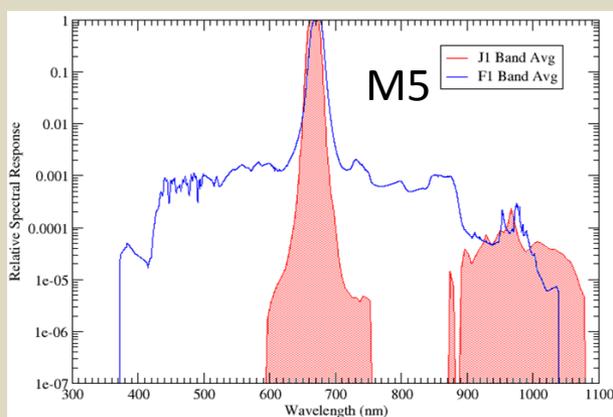
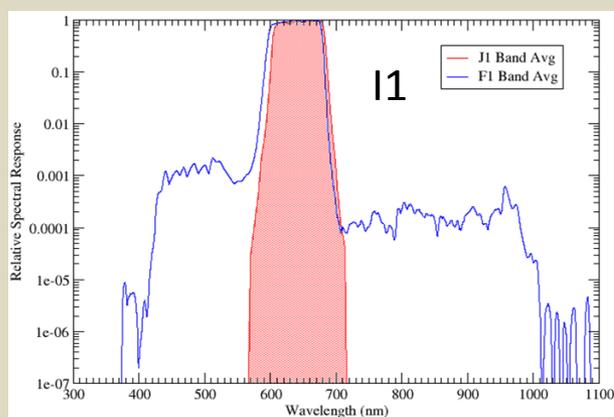
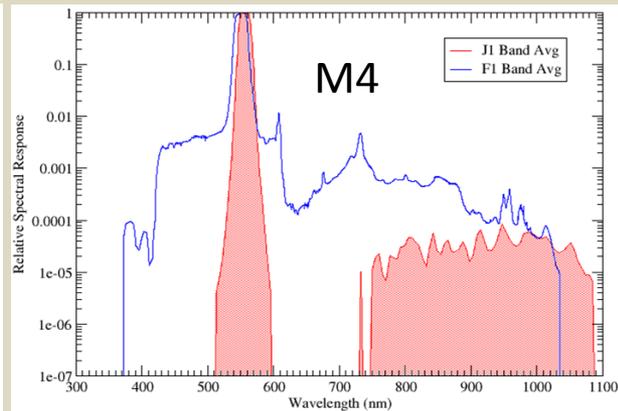
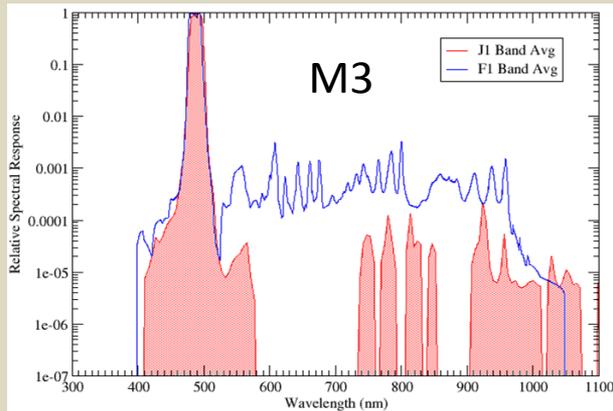
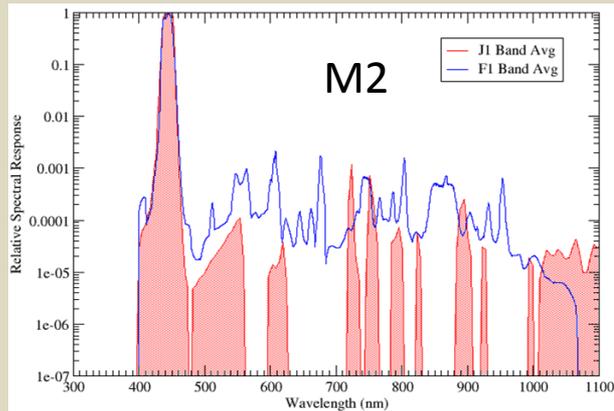
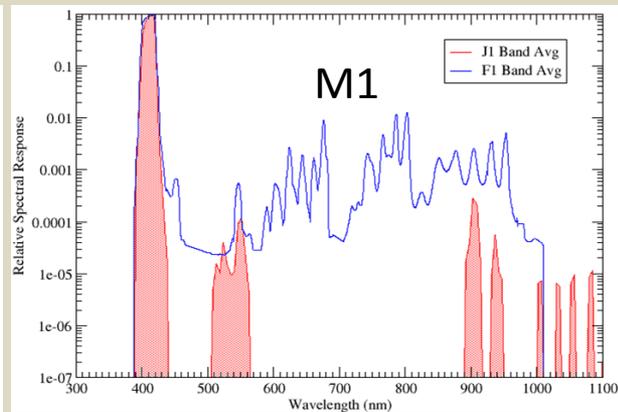
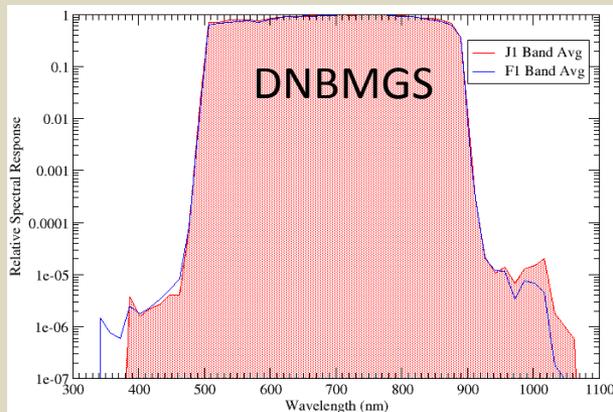
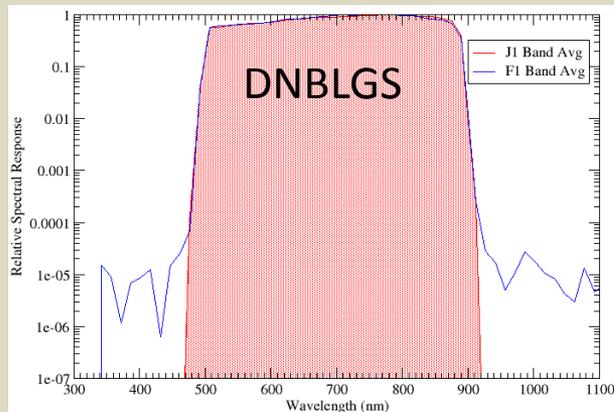
J1 VIIRS V1 Band Average RSR: RSB (2 of 2)



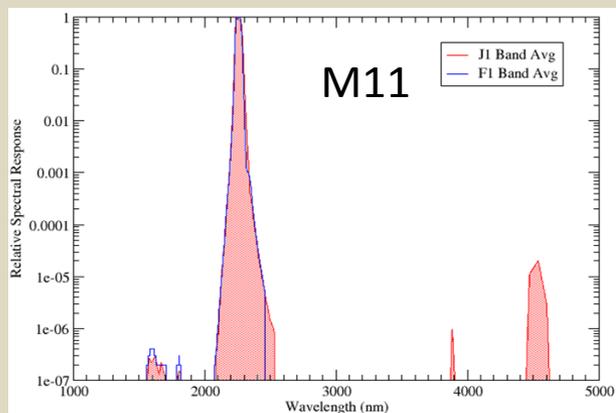
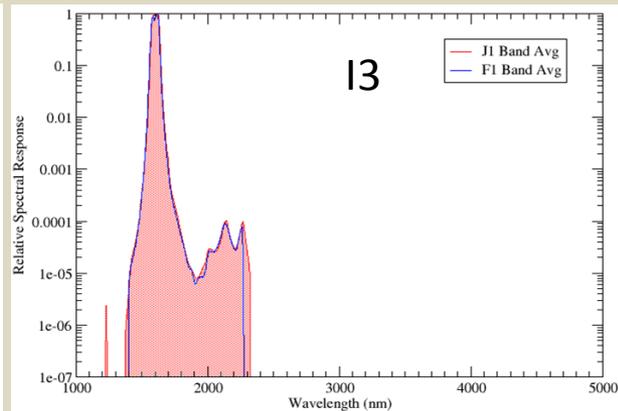
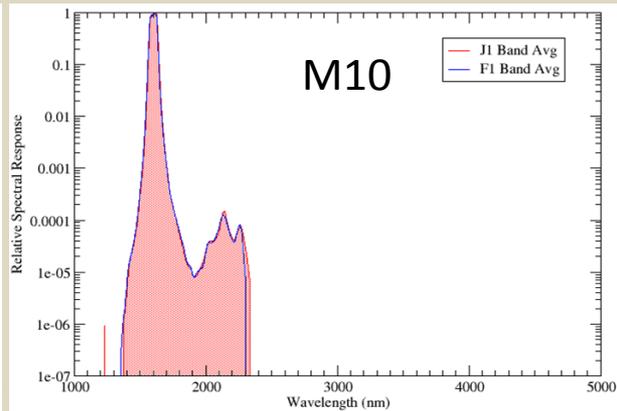
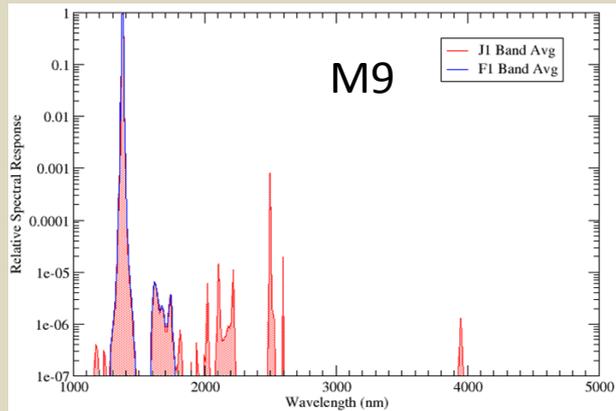
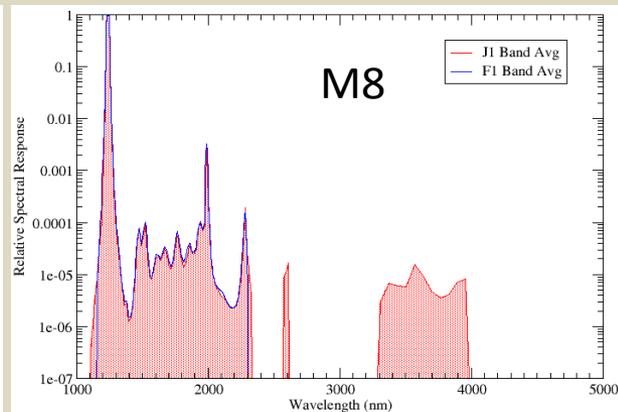
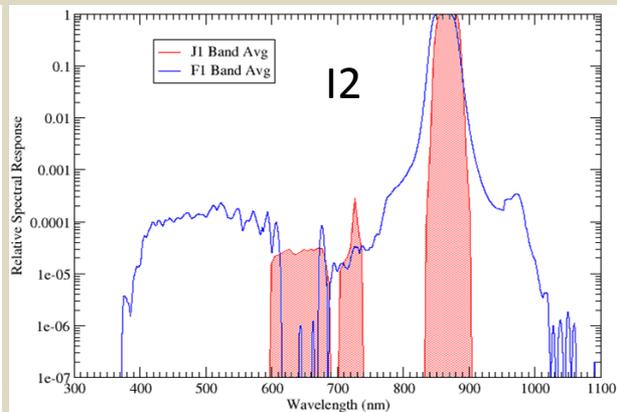
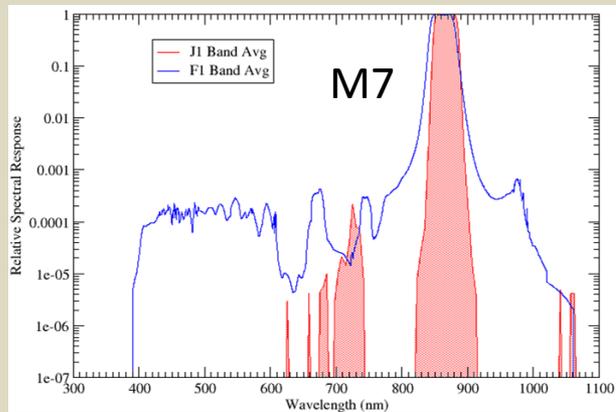
J1 VIIRS V1 Band Average RSR: TEB



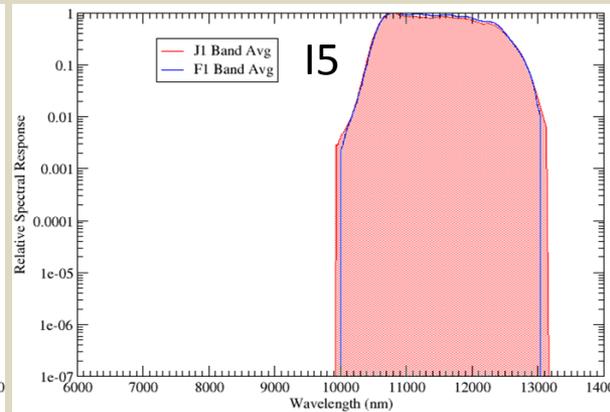
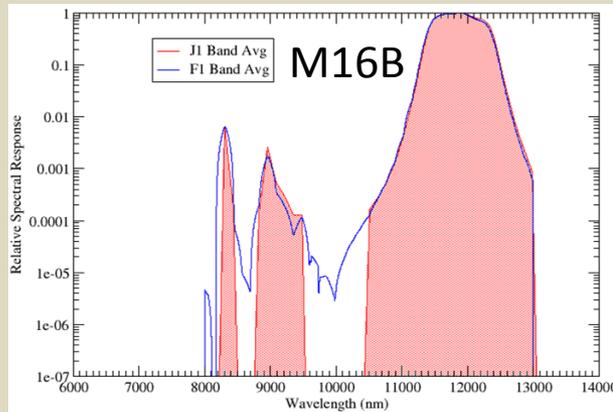
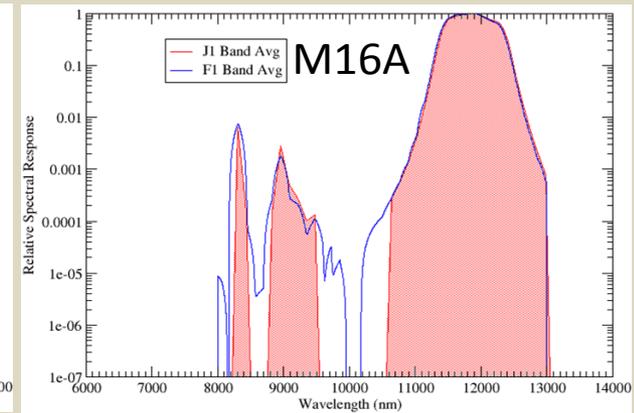
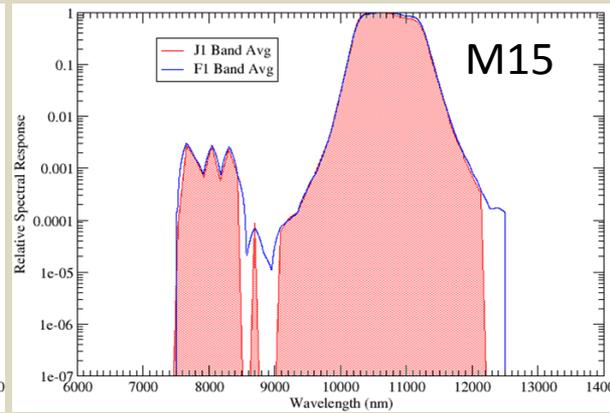
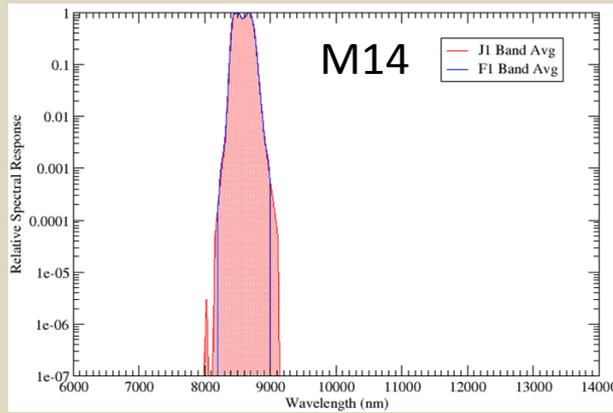
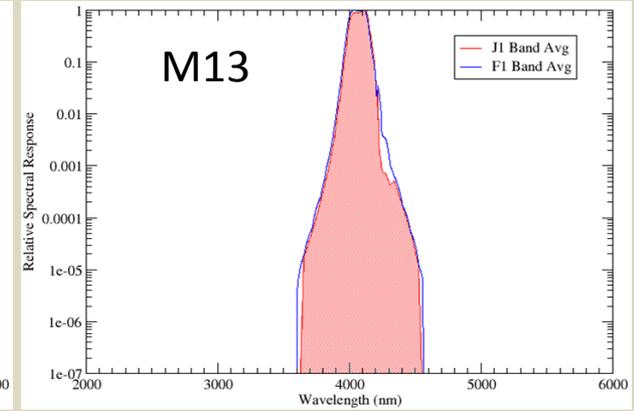
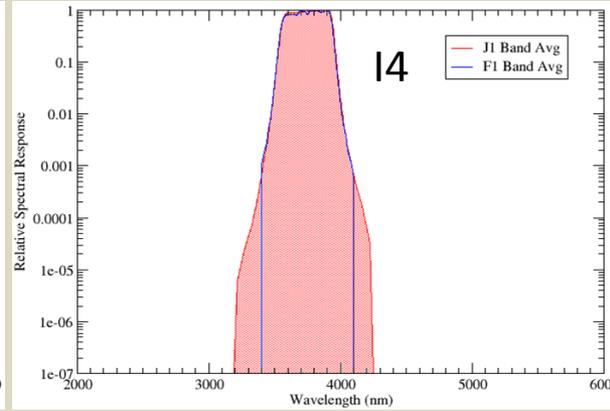
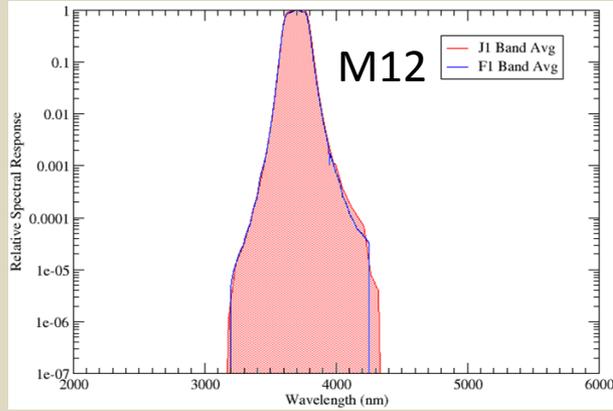
J1 VIIRS V1 Band Average RSR: RSB (1 of 2)



J1 VIIRS V1 Band Average RSR: RSB (2 of 2)



J1 VIIRS V1 Band Average RSR: TEB



J1 VIIRS V1 Spectral Compliance (Band Avg RSR)

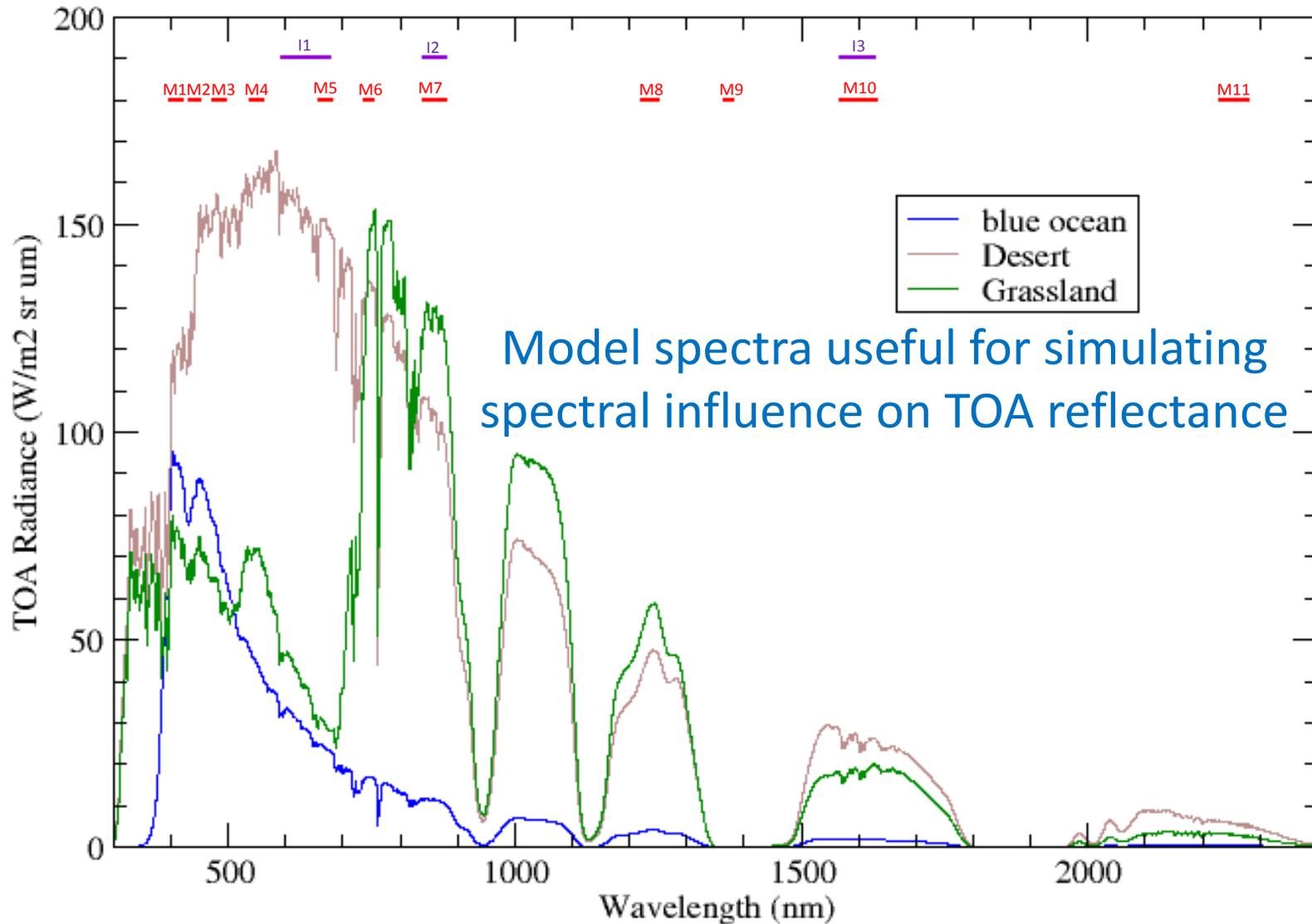
 → Non-compliant with specification

Focal Plane Legend:  - VisNIR;  - S/MWIR;  - LWIR

Band	S-NPP Measured Center (nm)	JPSS-1 Measured Center (nm)	S-NPP Specified Bandwidth (nm)	JPSS-1 Measured Bandwidth (nm)	S-NPP Specified Lower 1% Limit (nm)	JPSS-1 Measured Lower 1% Limit (nm)	S-NPP Specified Upper 1% Limit (nm)	JPSS-1 Measured Upper 1% Limit (nm)	J1 Measured IOOB (%)	S-NPP Measured IOOB (%)
I1	637.8	643.0	81.6	78.6	583.2	593.9	686.6	693.6	0.07	0.33
I2	861.6	867.3	38.3	36.4	828.7	841.5	897.9	893.6	0.09	0.48
I3	1601.2	1603.2	58.9	60.7	1543.1	1544.3	1664.1	1667.7	0.44	0.51
I4	3743.5	3747.6	385.6	387.5	3473.0	3474.1	4009.0	4015.2	0.16	0.24
I5	11507.9	11483.1	1881.7	1875.1	10191.0	10170.8	13081.3	13090.6	0.08	0.65
M1	410.5	411.1	20.2	17.6	394.6	395.3	426.8	425.4	0.17	2.40
M2	443.0	444.8	15.1	17.0	431.1	429.3	458.6	457.9	0.30	0.39
M3	486.0	488.6	19.4	19.0	472.1	473.0	502.8	504.4	0.27	0.76
M4	550.6	556.3	19.6	18.5	529.4	540.0	572.3	573.7	0.24	3.92
M5	671.4	667.1	18.8	19.5	649.5	649.6	693.9	684.9	0.25	2.99
M6	745.3	746.0	14.1	13.5	730.5	733.9	760.4	758.0	0.23	1.70
M7	861.8	867.5	38.0	36.3	829.6	842.8	897.8	892.5	0.10	0.46
M8	1238.4	1238.4	26.1	26.1	1213.5	1214.0	1265.2	1264.9	0.48	0.59
M9	1375.3	1375.8	13.9	14.5	1362.1	1362.0	1390.0	1390.0	0.41	0.42
M10	1601.2	1603.8	59.4	60.2	1542.6	1545.7	1664.8	1667.6	0.43	0.48
M11	2257.1	2258.2	46.4	52.0	2211.6	2209.4	2303.0	2314.4	0.35	0.42
M12	3694.6	3697.9	192.4	194.8	3516.2	3519.1	3890.0	3893.8	0.33	0.38
M13	4065.8	4074.0	158.0	155.0	3900.5	3911.7	4213.7	4214.1	0.35	0.88
M14	8577.8	8580.3	340.8	340.1	8333.5	8336.3	8875.9	8879.3	0.19	0.30
M15	10743.6	10730.9	1014.4	1001.7	9918.7	9916.9	11649.9	11638.7	0.35	0.42
M16A	11861.4	11882.8	919.1	914.6	11095.1	11104.1	12670.0	12692.5	0.39	0.56
M16B	11869.1	11883.0	922.8	934.5	11098.3	11101.5	12678.7	12698.5	0.38	0.54

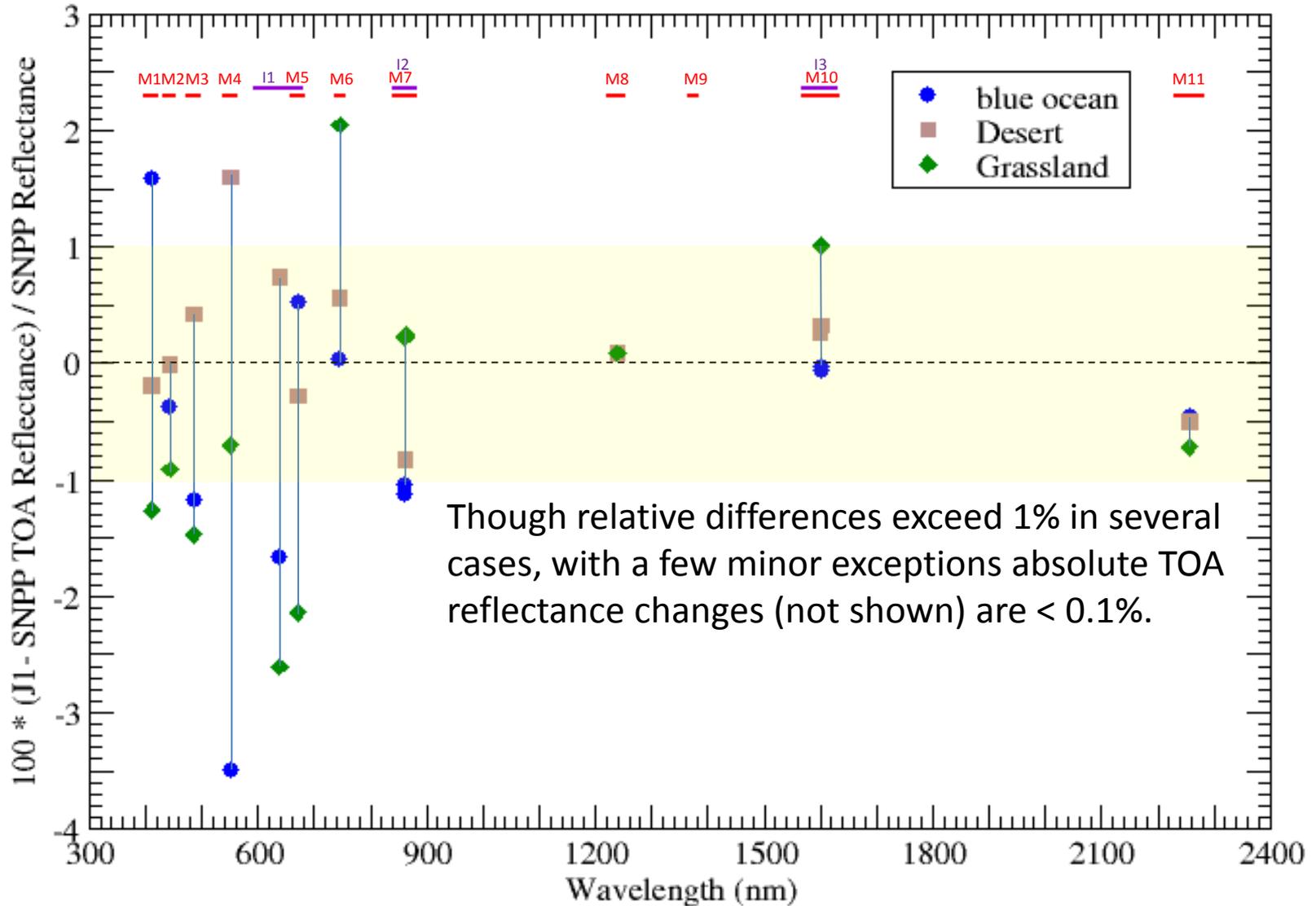
Modeled TOA Earth Spectra

(Spectra courtesy Bob Barnes, VOST)



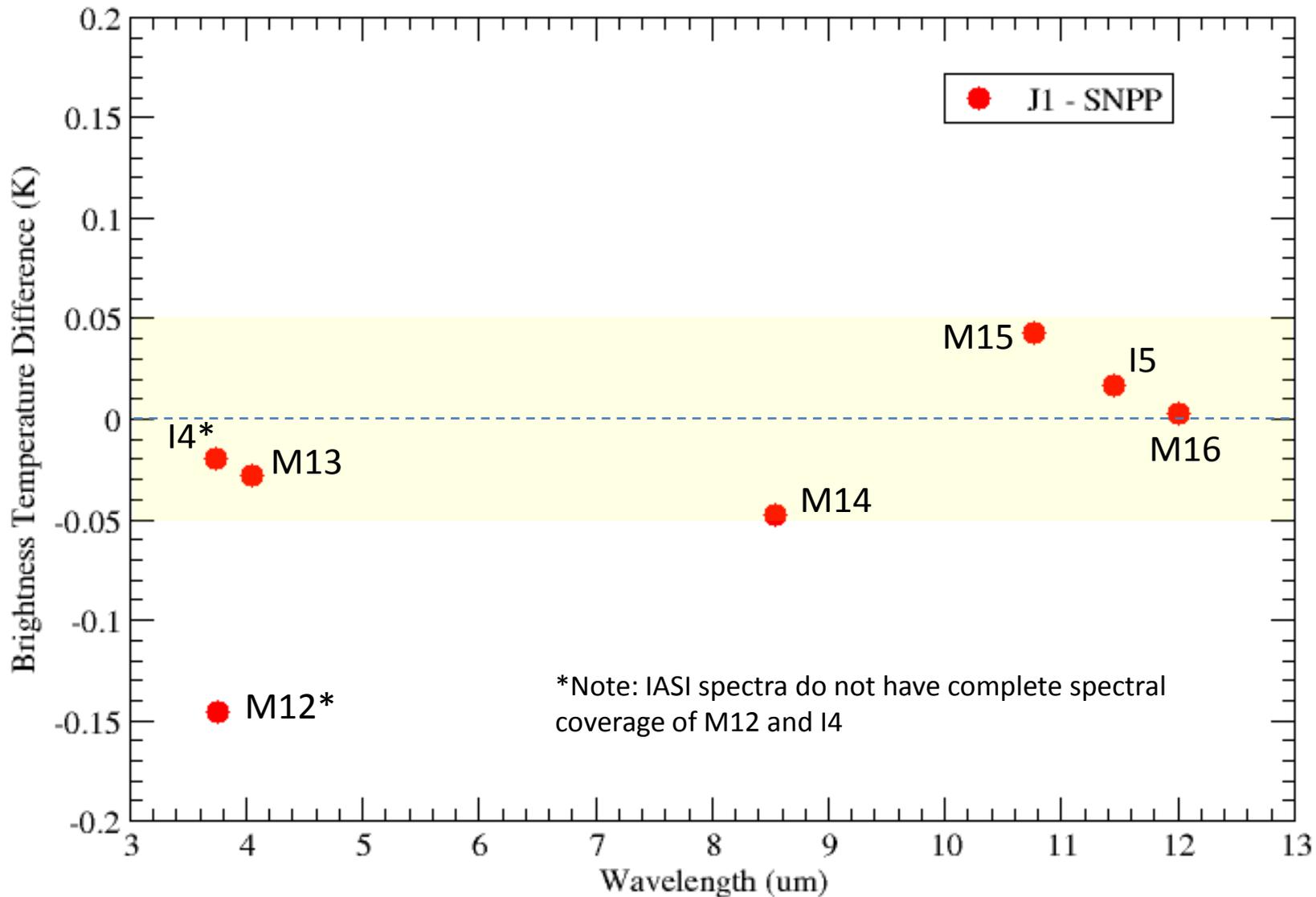
J1 vs SNPP VIIRS TOA Reflectance

Using forward model spectra with Oct 2011 (SNPP) and V1 (J1) RSR



J1 vs SNPP VIIRS TOA Brightness Temperature

Simulated using IASI Spectra with Oct 2011 (SNPP) and V1 (J1) RSR



Summary

- Govt-sponsored DAWG has performed an independent analysis of spectral test data leading to the V1 Release of J1 VIIRS RSR (under EAR99 protection). V1 replaces V0 Beta Release.
- Thanks to IFA redesign, J1 out-of-band response in VisNIR bands is compliant, a great improvement over F1. Performance similar to F1 performance on other spectral metrics.
- Spectral position and/or shape have changed noticeably for many bands compared to F1, but all are well characterized. Minor impact on SDR reflectances/brightness temperatures.
- V1 RSR are not an “at-launch” RSR product. A V2 Release is planned for later in 2015, adding NIST T-SIRCUS VisNIR measurements plus addressing CO2 influence in M13.