



Initial Results of the FLARE Vicarious Calibration Method

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Outline

- **FLARE** = **F**ield **L**ine of sight **A**utomated **R**adiance **E**xposure
- FLARE Mission
- FLARE Introduction Video
- FLARE Services Summary
- Spatial LOOK-S Initial Results
- Spatial EVAL-S Initial Results
- Radiometric LOOK-R Initial Results
- Radiometric EVAL-R Initial Results
- Future Work



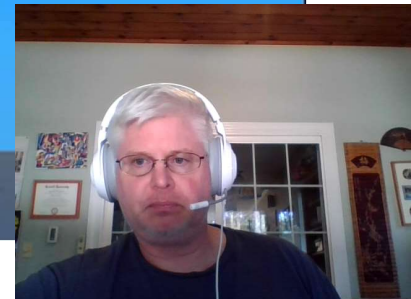
FLARE'S MISSION

Interoperable calibration for in-flight EO sensors, every mission, every day.

We will change calibration fidelity, frequency and value



FLARE Introduction Video @ www.flare-network.com



FLARE Portal: Subscription-based Cloud User Interface

The screenshot displays the FLARE Labsphere portal interface. The top navigation bar includes the FLARE logo and a menu icon. The main content area is titled "Schedule" and features a calendar view for August 2020. The calendar shows various satellite look events, each with a color-coded status: Booked (blue), Locked (black), Processing (grey), and Completed (orange). A sidebar on the left contains navigation links for Crafts, View, Add, LOOKS, Schedule, List, Add, EVALS, Add, Organization, View, Support, FAQ, Help & Tips, Terms & Conditions, and Contact Us. A modal window titled "Completed (Private) SENTINEL 2B" is overlaid on the calendar, showing details for a completed look event on Friday, July 31, 2020.

Calibration-as-a-Service (CaaS)

The screenshot displays the "Schedule LOOK" modal window in the FLARE portal. The modal is titled "LOOK Details" and contains the following information:

- Site Name:** Alpha Site
- Craft Name:** LANDSAT 8
- Signal Level:** 32.000
- TLE line 1:** 1 39084U 13008A 2023.16690511 .0000031 00000-0 17068-4 0 9994
- TLE line 2:** 2 39084 98.2232 292.1944 0001619 91.7551 268.3844 14.57109281398528
- Choose a date range:** 08-10-2020 - 08-19-2020
- Duration (seconds):** 60.00
- Craft angle:** (dropdown menu)
- Sun angle:** (dropdown menu)
- CALCULATE** button
- Product:** LOOK-R
- Duration (minutes):** \$1,000.00
- Highest Angle:** 01:00
- Highest Time:** 86.717045254
- 08-16-2020 17:11:26**


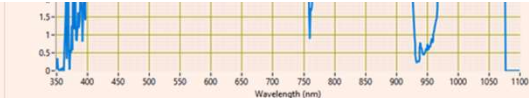


FLARE Services Summary

	S (Spatial)	R (Radiometric)
AL	  <p>Sensor Characterization</p>	  <p>Sensor Absolute Calibration</p>

Data Type	LOOK-S	LOOK-R	EVAL-S	EVAL-R
Node Data	X	X	X	X
Mirror Configuration	X	X	X	X
Look Quality	X	X	X	X
Look Radiometric Data	-	X	-	-
Look Derived Data	-	X	-	-
Sensor Point Spread Function	-	-	X	-
Sensor Spatial Criteria	-	-	X	-
Radiance Calibration Coefficient (CW)	-	-	-	-



	Sun Angle (Elevation deg)	65.4200
	# Mirrors	6
	Mirror RoC (m)	5.26
	Sky Quality Check	Pass
FLARE Execution Data		
 <p>FLARE Signal At-Sensor Spectral Intensity</p>		



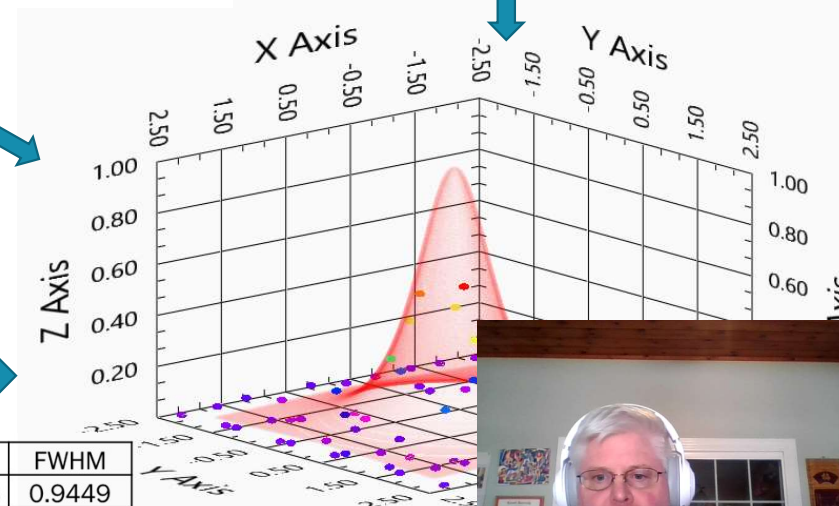
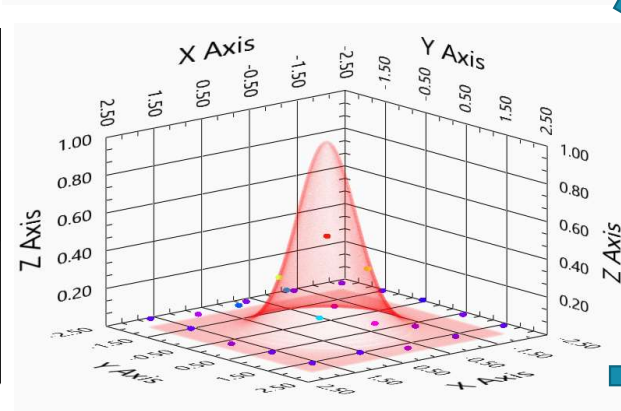
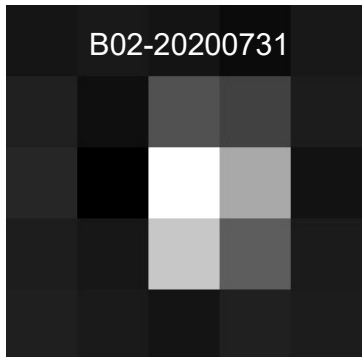
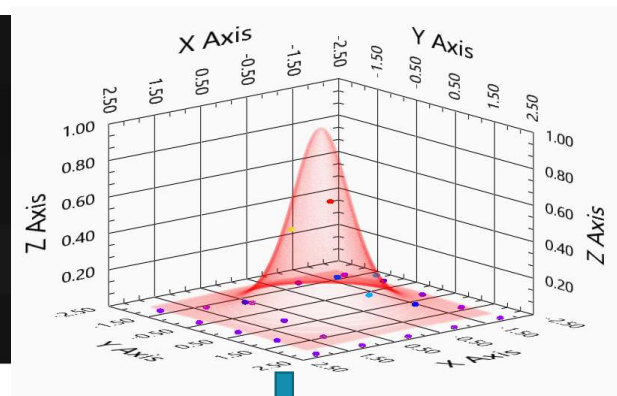
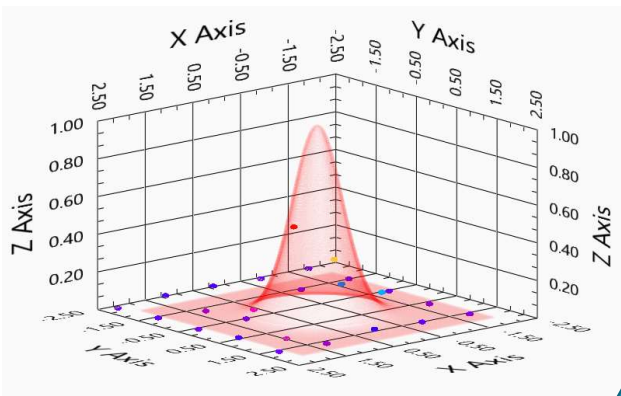
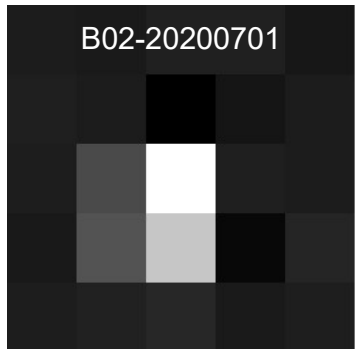
LOOK-S: Sentinel 2B, July 2020 – ALPHA System (SDSU)



FLARE



RESULTS - EVAL-S, Sentinel 2B Examples, July 2020

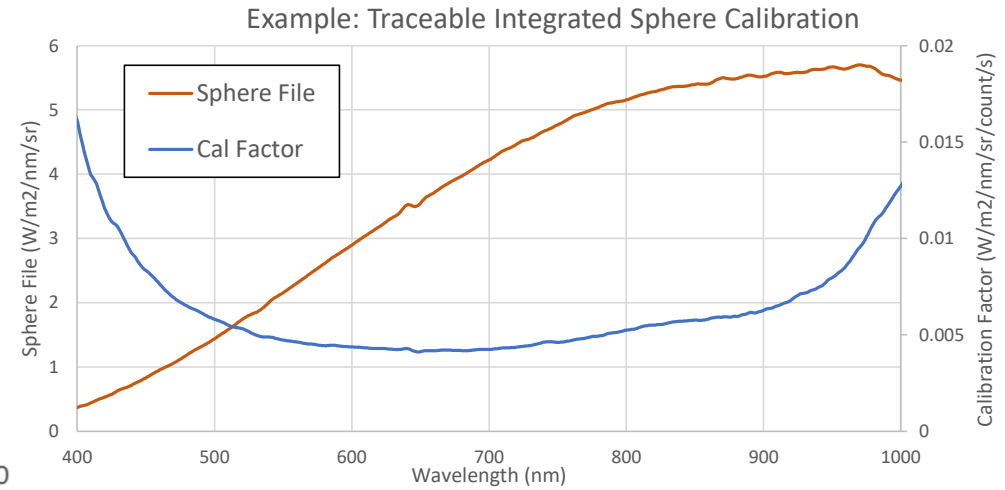
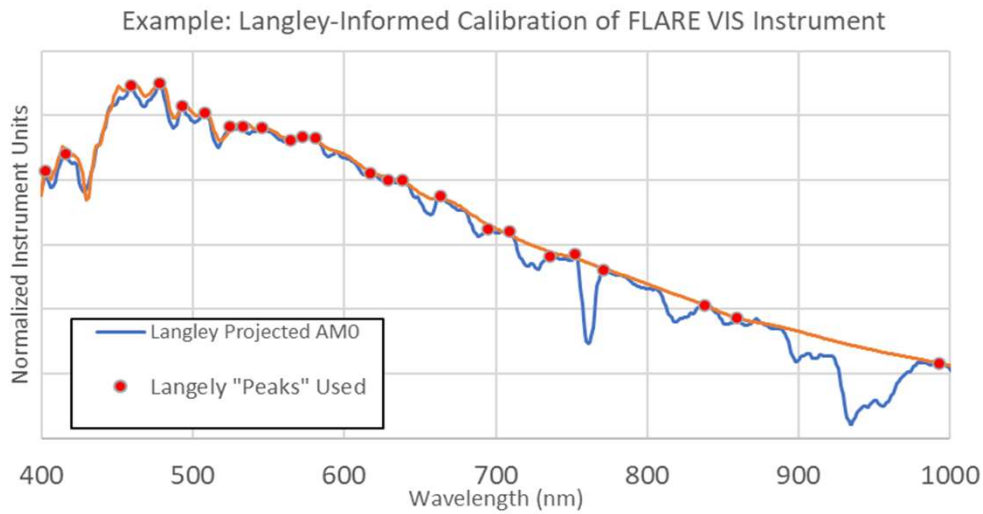


Band B02 Image	RMSE	FWHM
20200701	0.0208	0.9449
20200711	0.0363	1.1497
20200731	0.0348	1.1184
All	0.0304	1.0428

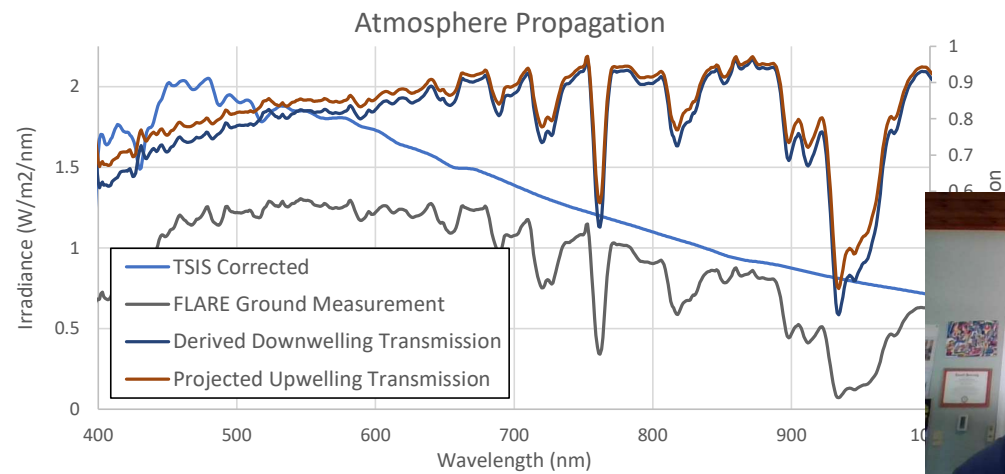
PSF SUMMARY



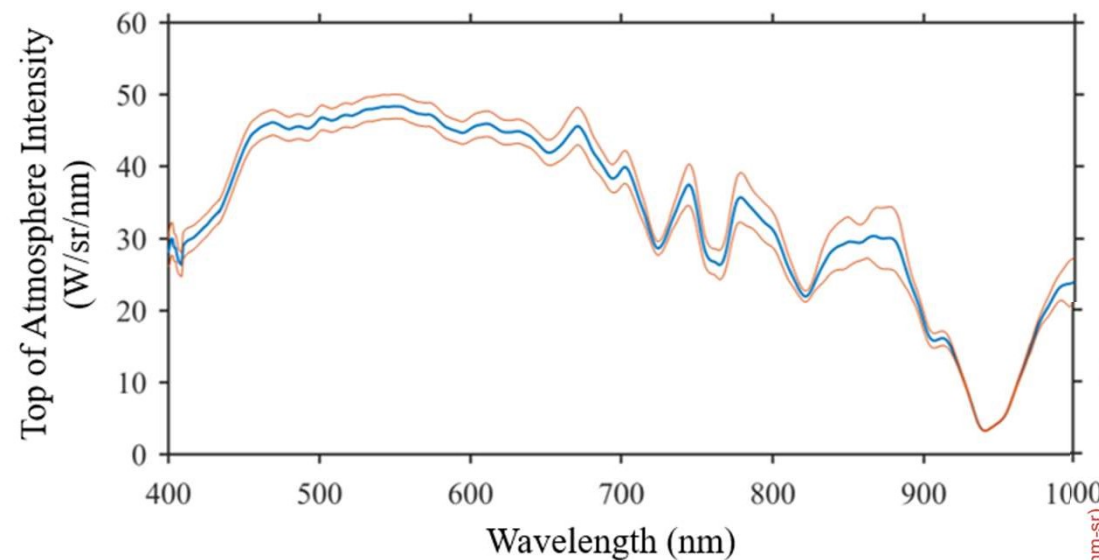
LOOK-R: Radiometric Validation and Atmospheric Extraction (2) methods



Radiometric calibration provides measurements for atmospheric transmission calculations at time of overpass

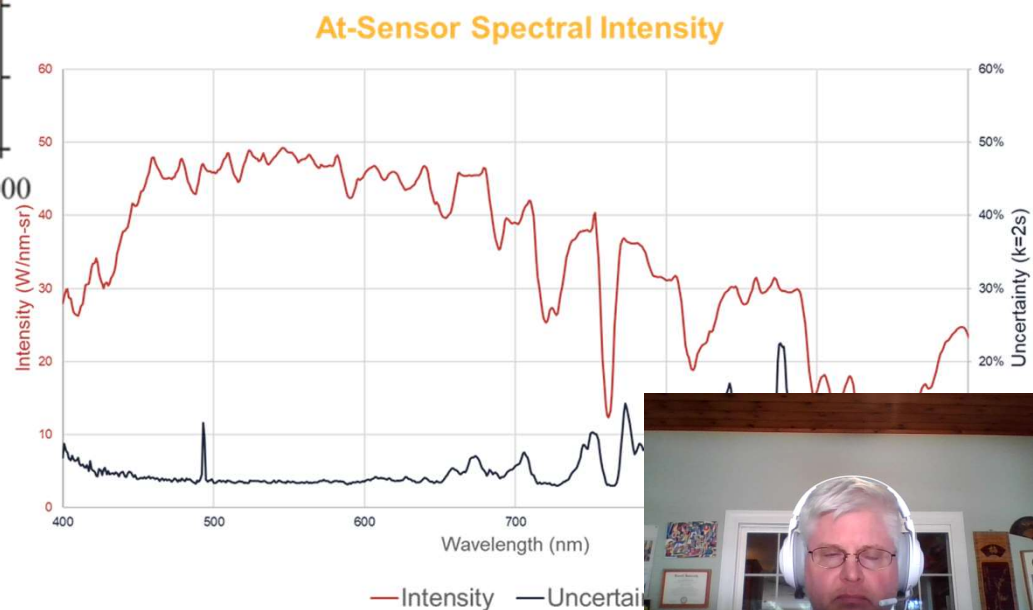


LOOK-R: Sentinel 2A Example, 16 July 2020



← Smoothed Standard Data with Uncertainty Bounds (2σ)

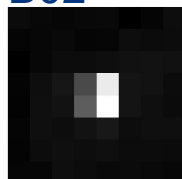
Full Spectral Resolution and Uncertainty (2σ)



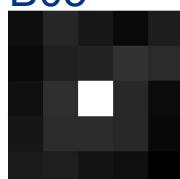
EVAL-R: S2A Example – 16 July 2020 Alpha

S2A Band Images

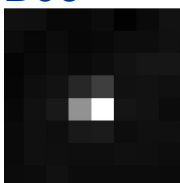
B02



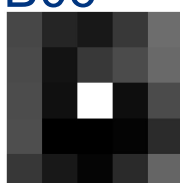
B05



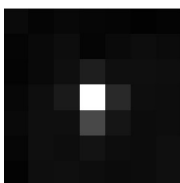
B03



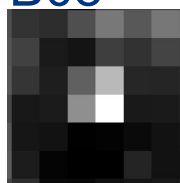
B06



B04

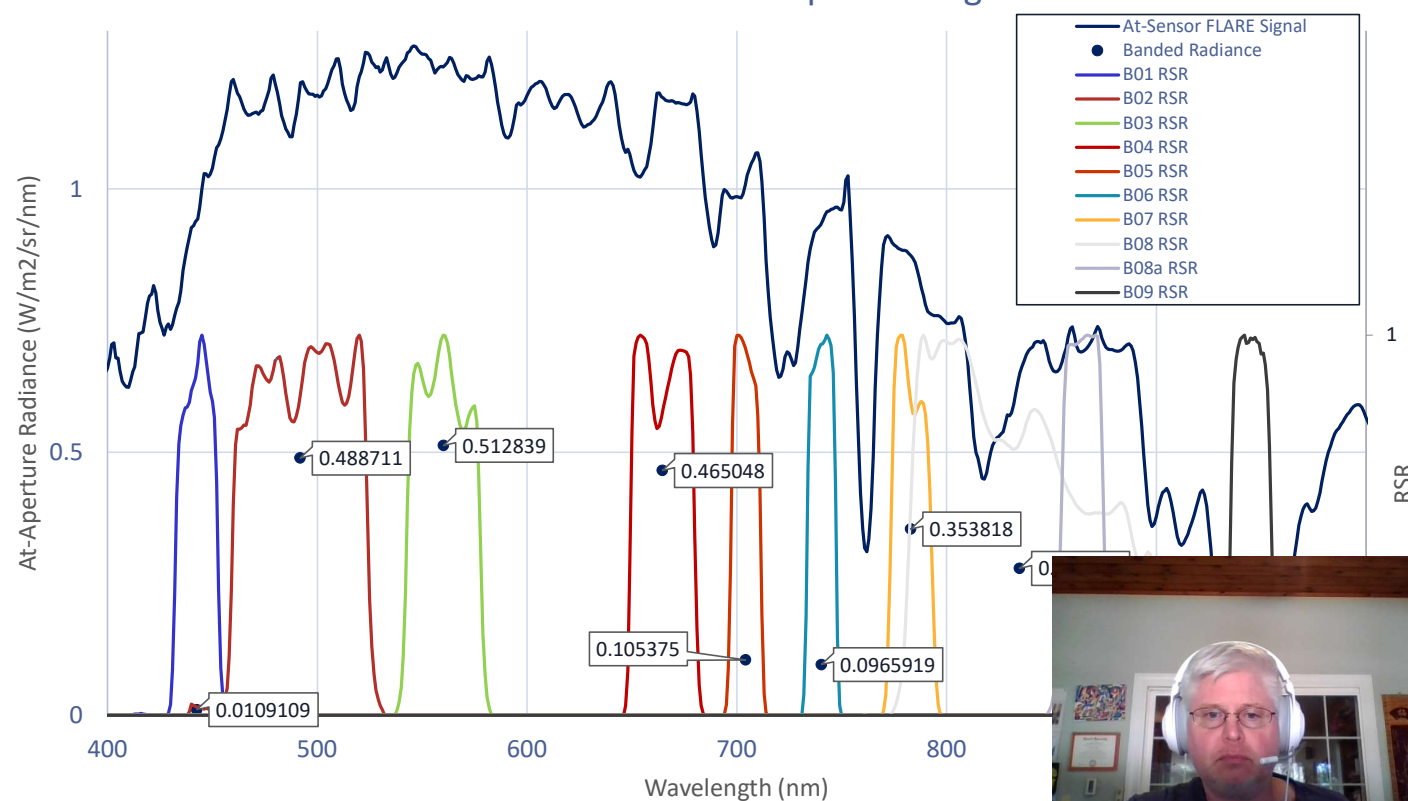


B08

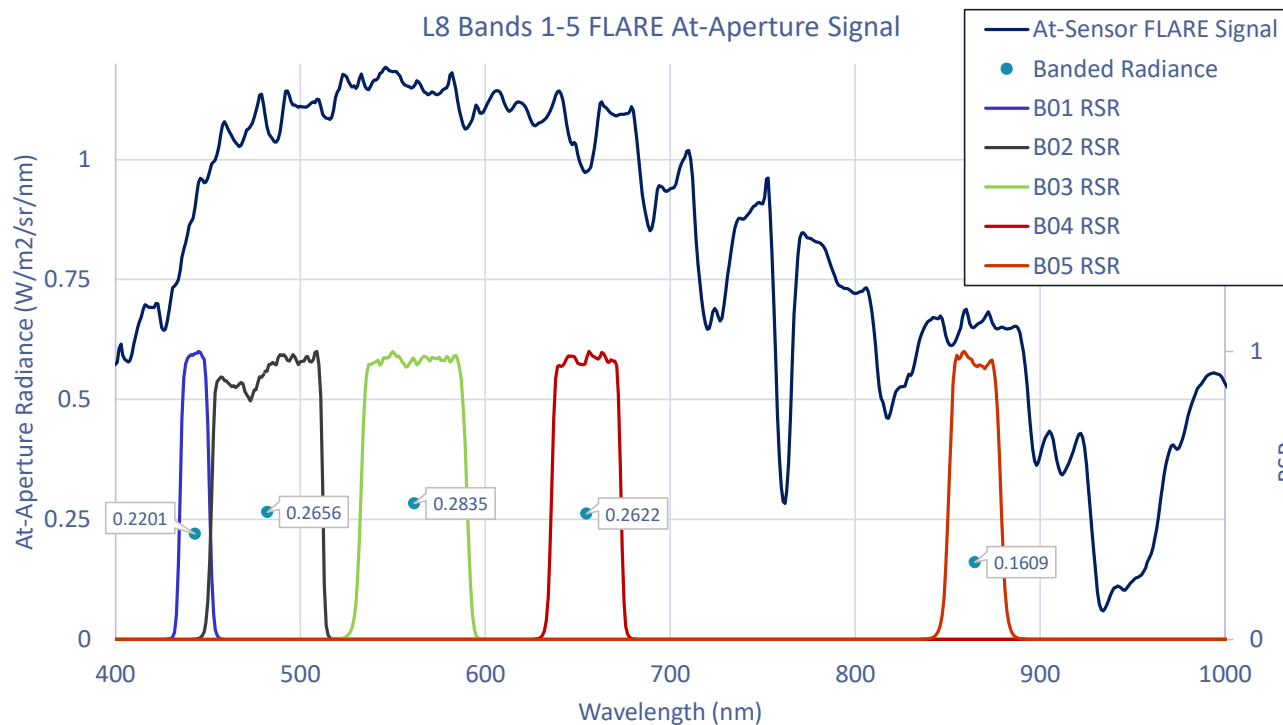


Spectral Calculations

S2A Bands 1-9 FLARE At-Aperture Signal



Preliminary EVAL-R: Landsat 8 – August 17th



BAND	FLARE	L8 Image	% from L8
B01	0.220076	0.20383	8.0%
B02	0.265555	0.25546	4.0%
B03	0.28349		
B04	0.26219		
B05	0.160887		



Continuing and Future Work

- Continue validation campaigns with Landsat 8 and Sentinel 2A/2B
- Comparison of PSF & LSF methods to Edge targets for geometric characterization
- Determine CoV on multiple Sentinel and Landsat validated FLARE events
- Develop independent absolute calibration verification train using embedded sphere in radiometry tower
- Expanded analysis to SWIR bands
- Continue campaigns with SDSU Team through 2021
- Extend calibrations to other constellations
- **Expand the Network!**
 - Railroad Valley
 - Mauna Loa – High Altitude
 - Selected for SLI-T
 - TBD





Questions?

