Rocket EVE Calibration Spectra

This provides a summary of the improved rocket EUV spectra by using a common SURF calibration set.

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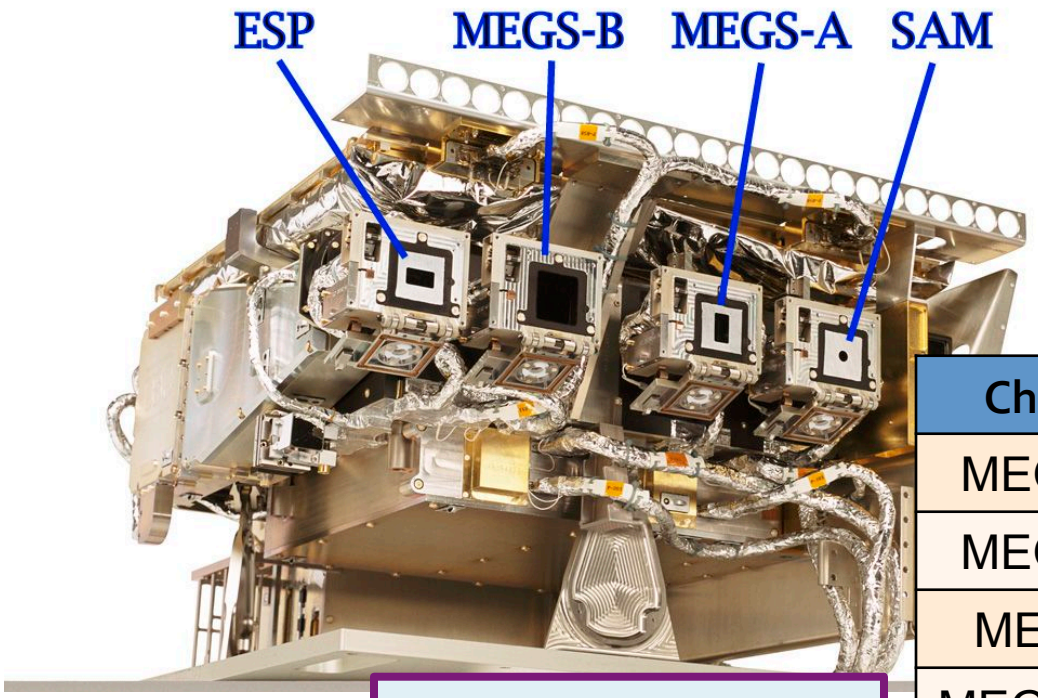
February 2015

These rocket EVE calibration measurements are made primarily for tracking any long-term drifts of the SDO EVE flight instrument. They can also benefit calibrations for SDO AIA, SOHO SEM, STEREO EUVI, Hinode EIS, TIMED SEE, SORCE XPS, GOES XRS, GOES EUVS, and GOES SXI/EUVI.

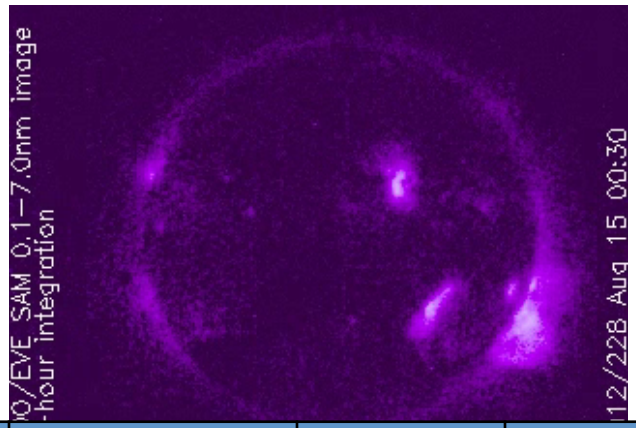
***FILES**: megs_rocket_ref_flux.dat, .sav is at native MEGS resolution*
megs_rocket_ref_flux_1nm.dat, .sav is in 1-nm bins

SDO EVE measures solar EUV irradiance

SDO EVE has significant improvements in spectral resolution (0.1 nm) and time coverage (24/7, 0.25 s -10 s cadence)



SAM is X-ray Imager



Channel	λ Range	Δλ	Δt
MEGS-A1	6-18 nm	0.1 nm	10 sec
MEGS-A2	18-37 nm	0.1 nm	10 sec
MEGS-B	37-106 nm	0.1 nm	10 sec
MEGS-SAM	0.1-7 nm	(1 nm)	10 sec
MEGS-P	121.6 nm	1 nm	0.25 s
ESP	0.1-38 nm	4 nm	0.25 s

EVE calibrations include daily and weekly on-board calibrations of the redundant filters. Long-term degradation is tracked using ~annual rocket underflights with prototype EVE.

Rocket EVE Spectra with Common Cal

- Each rocket flight has pre-flight and post-flight SURF calibrations. Each flight solar spectrum uses those SURF calibration results. As there are noise and possibly some systematic errors in the SURF data, transferring the rocket EVE calibration spectra to the flight EVE will inherit any SURF related systematic errors.
- The following slides show the rocket EVE spectra if only a single SURF calibration result is used for all rocket flights. This initial analysis assumes that the rocket MEGS have no degradation and that the solar pointing is at instrument center for every flight.
- These common rocket EVE calibration spectra are derived by:

$$F_{year} = F_{2010} \bullet \frac{C_{year}}{C_{2010}} \bullet \left(\frac{D_{year}}{D_{2010}} \right)^2$$

F = solar irradiance
C = dark-corrected count rate
D = Sun-Earth distance
36.258 (May 3, 2010) is the reference spectrum

Summary of Rocket EVE Flights

Rocket #	Date	Launch Time (UT)	Sun-Earth Dist. (AU)	ESP X Center (arc-min) Note 1	ESP Y Center (arc-min) Note 1	SAM X Center (arc-min)	SAM Y Center (arc-min)
36.240	04-14-2008 DOY 105	16:58:00	1.00301	-0.04	-1.73	? (too dim)	? (too dim)
36.258 reference	05-03-2010 DOY 123	18:32:02	1.00797	-6.5	-3.9	+0.83	+5.07
36.275	03-23-2011 DOY 082	17:50:00	0.99651	-1.48	+2.96	+1.76	-0.64
36.286	06-23-2012 DOY 175	19:30:01	1.01638	-1.22	-6.89	? (too dim)	? (too dim)
36.290	10-21-2013 DOY 294	18:00:00	0.99554	-2.17	-0.75	+2.64	+1.42
36.300	May 2015	TBD	TBD	TBD	TBD	TBD	TBD

Note 1. The ESP X-Y axes are rotated 90° from SAM X-Y axes.

Summary of Rocket EVE Flights Dark

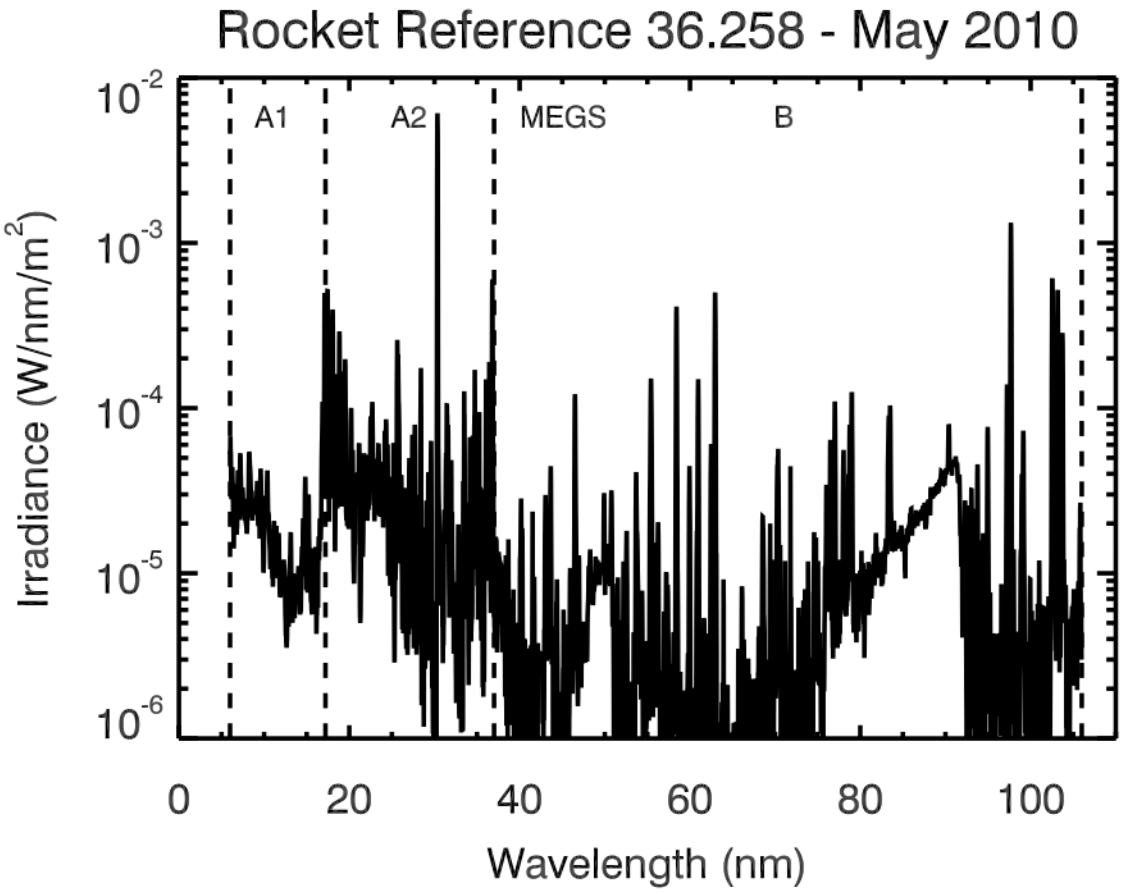
Rocket #	Date	A CCD Temp (C)	A Top Dark	A Bottom Dark	B CCD Temp (C)	B Top Dark	B Bottom Dark
36.240	04-14-2008 DOY 105		1341.13	1395.96		1364.78	1329.02
36.258 reference	05-03-2010 DOY 123		1336.65	1391.17		1361.29	1323.55
36.275	03-23-2011 DOY 082		1338.37	1392.57		1362.84	1325.33
36.286	06-23-2012 DOY 175		1336.02	1388.17		1360.29	1321.31
36.290	10-21-2013 DOY 294		1341.17	1394.07		1365.21	1327.40
36.300	May 2015	TBD	TBD	TBD	TBD	TBD	TBD

Assumptions

- Analysis assumes that there is no degradation of the rocket MEGS over 4 years
- There is no additional gain correction with temperature, besides the one made for the 2010 flight.
- There is no FOV correction for the solar center point changing slightly from the 2010 flight.

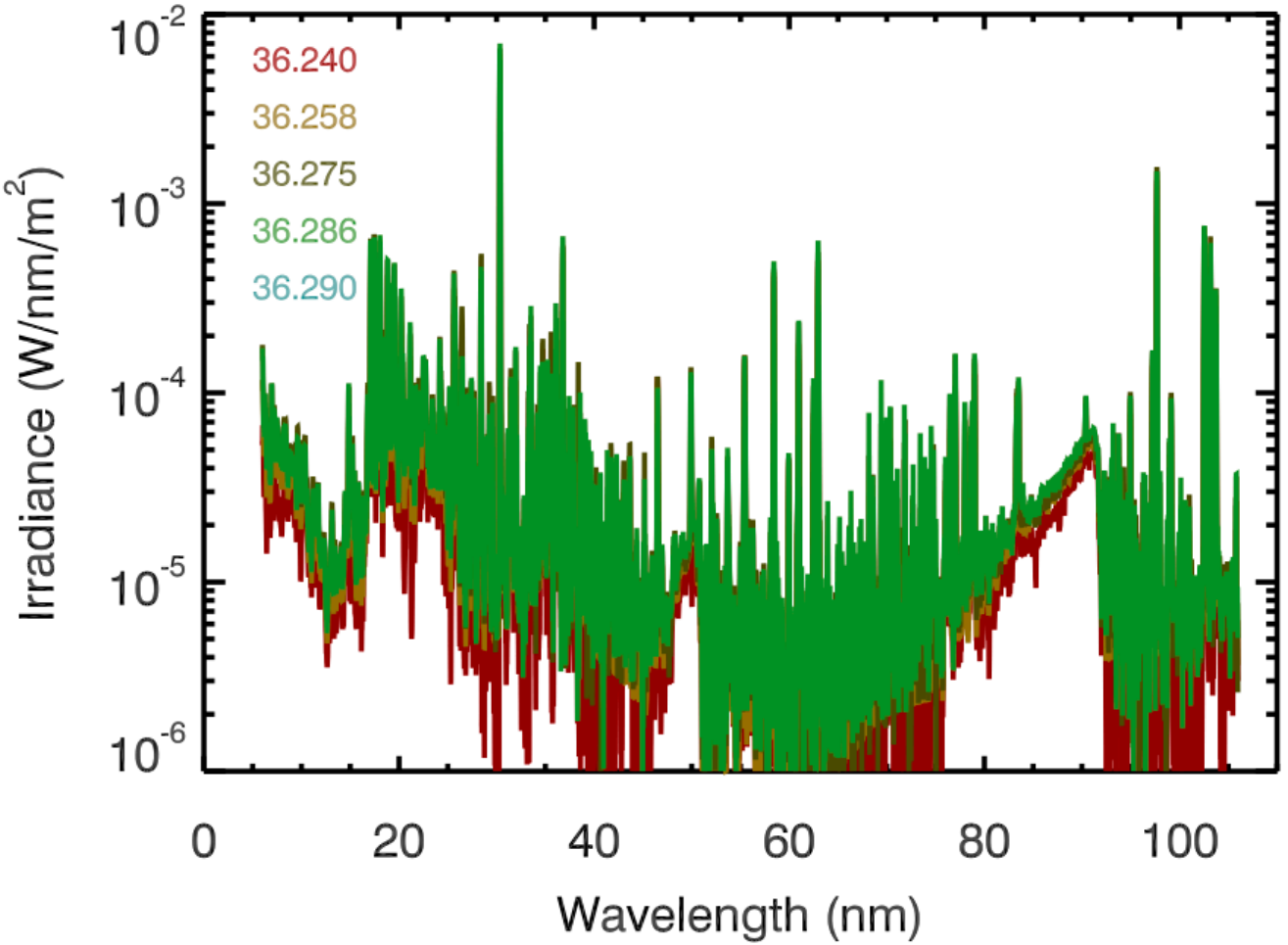
2010 Rocket Reference Spectrum

- MEGS-A1: 6.0 - 17.2 nm, every 0.01 nm
- MEGS-A2: 17.2 – 37.0 nm, every 0.01 nm
- MEGS-B: 37.0 – 106.0 nm, every 0.02 nm



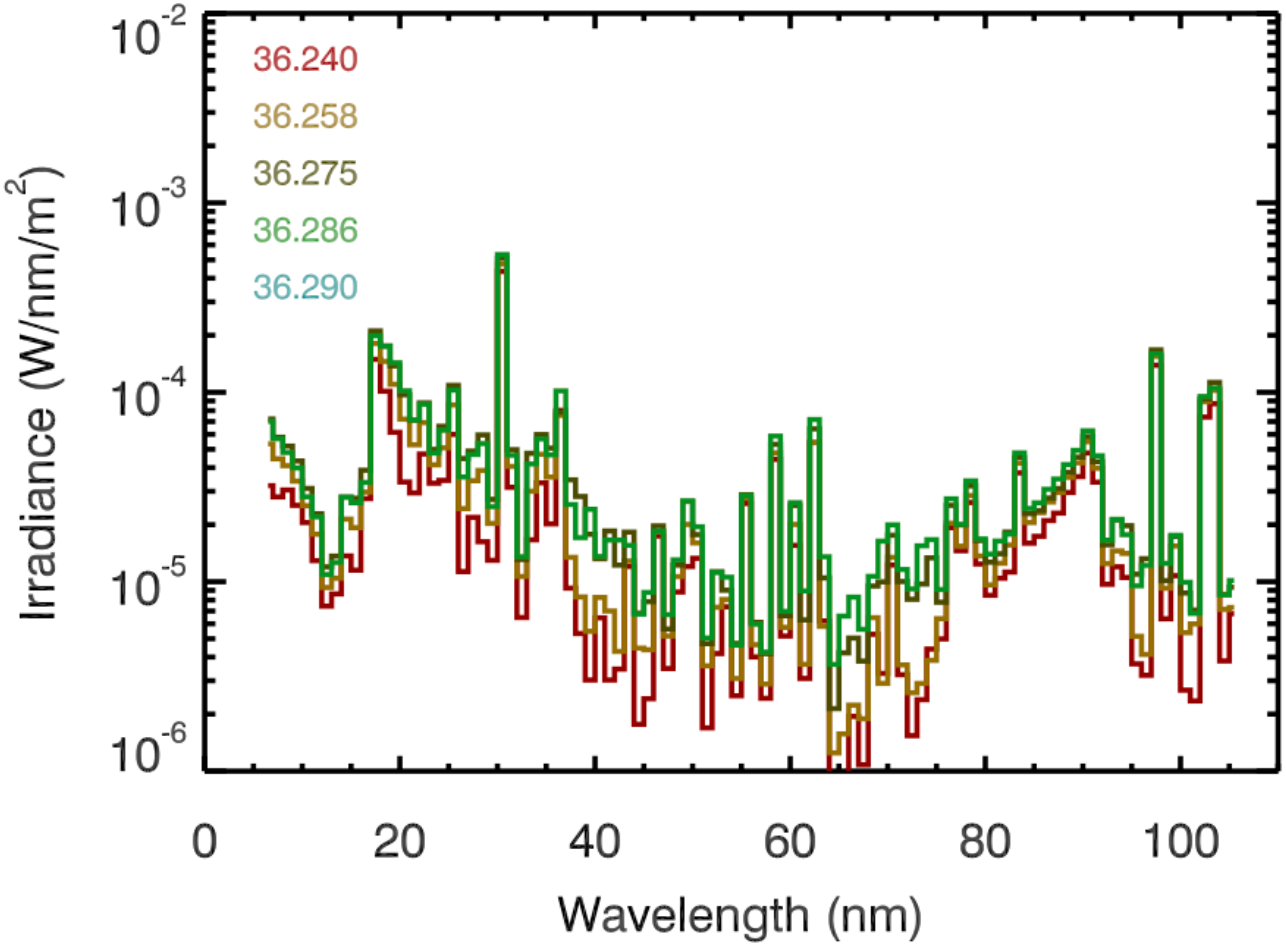
Rocket Spectra

- At instrument resolution



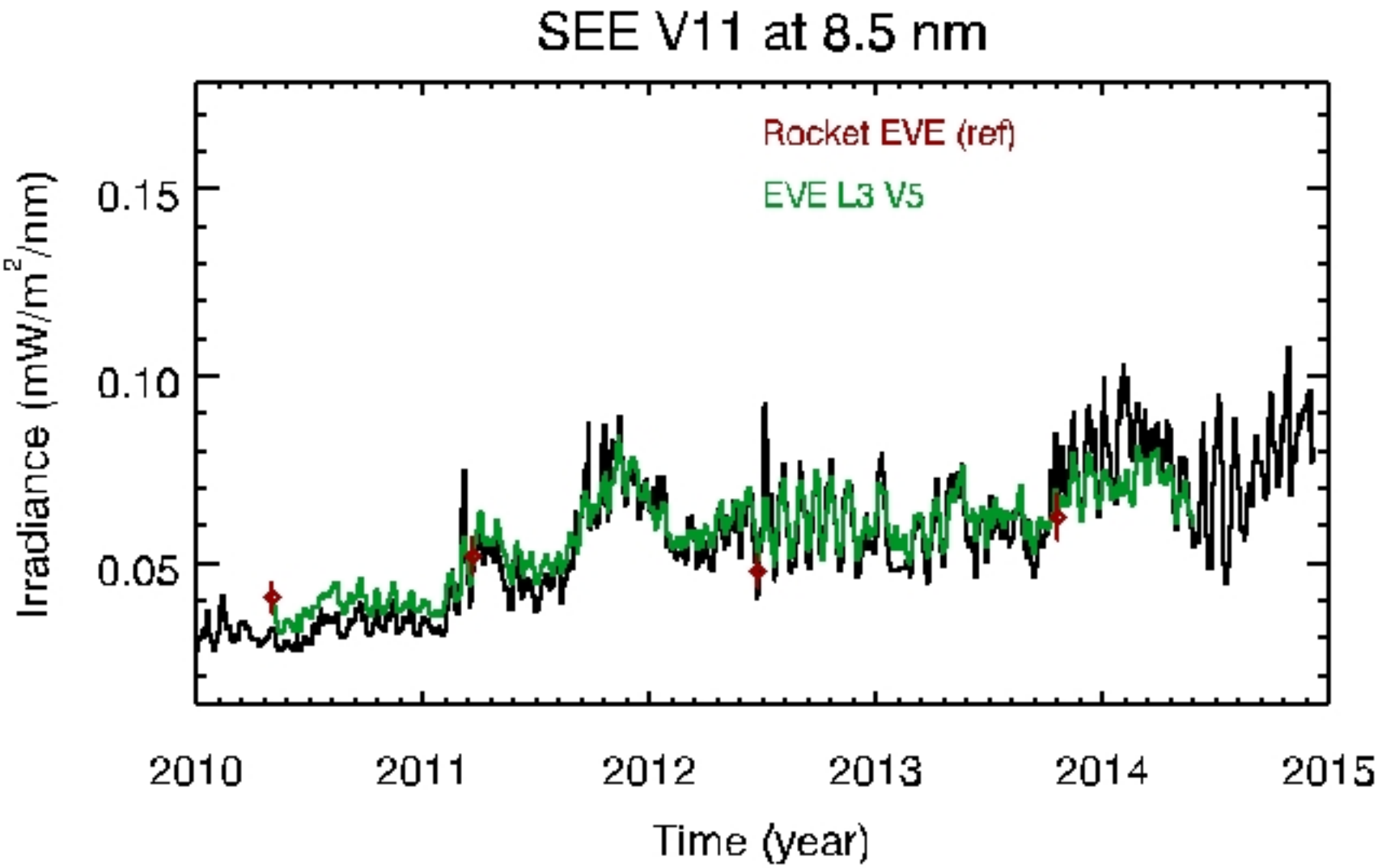
Rocket Spectra in 1-nm Bins

- In 1-nm bins for comparisons to SEE L3 and EVE L3 data products



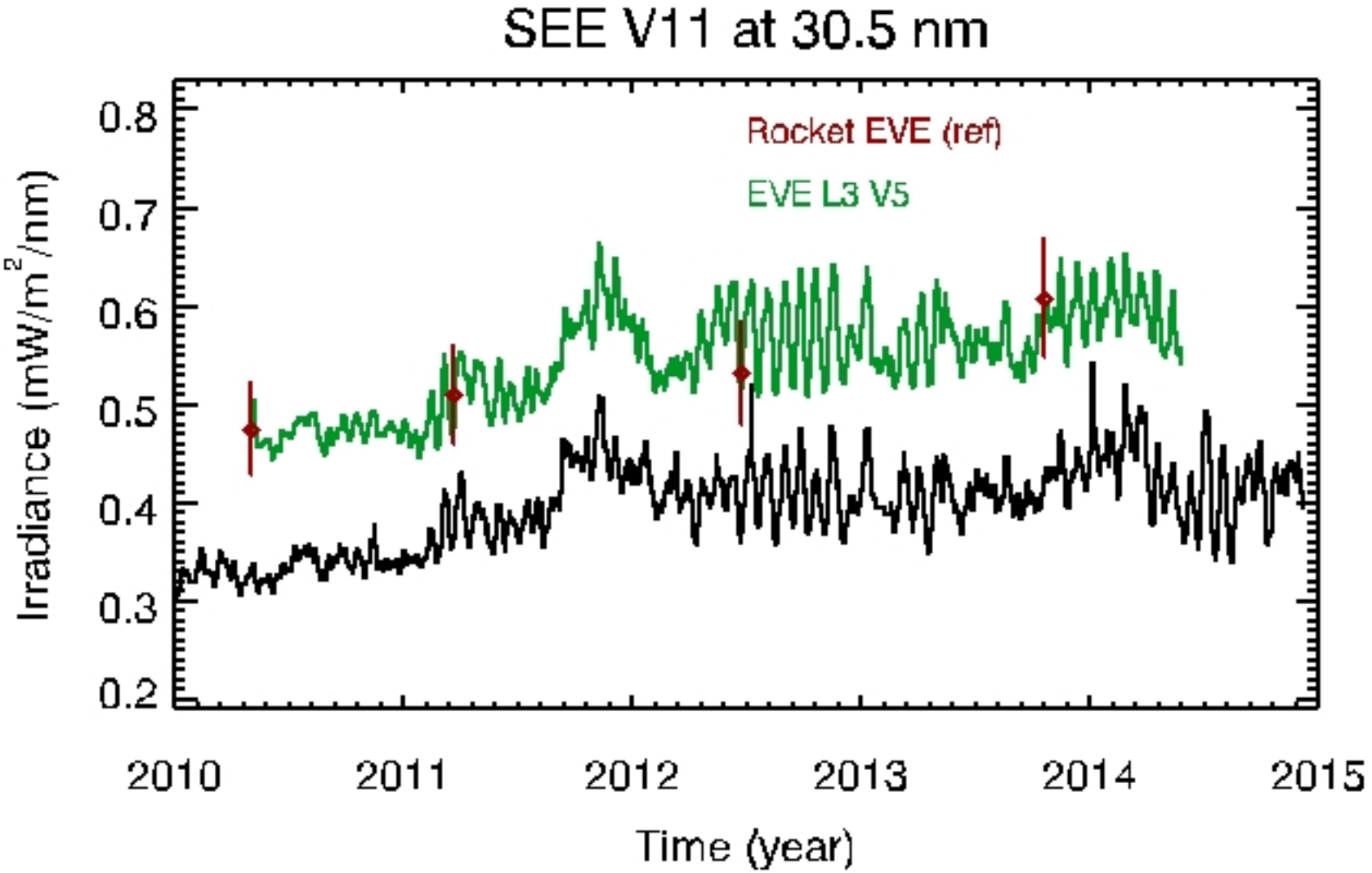
Comparison of EVE V5, SEE V11, Rocket

- SEE XPS L4 (model with EVE spectra) matches EVE well



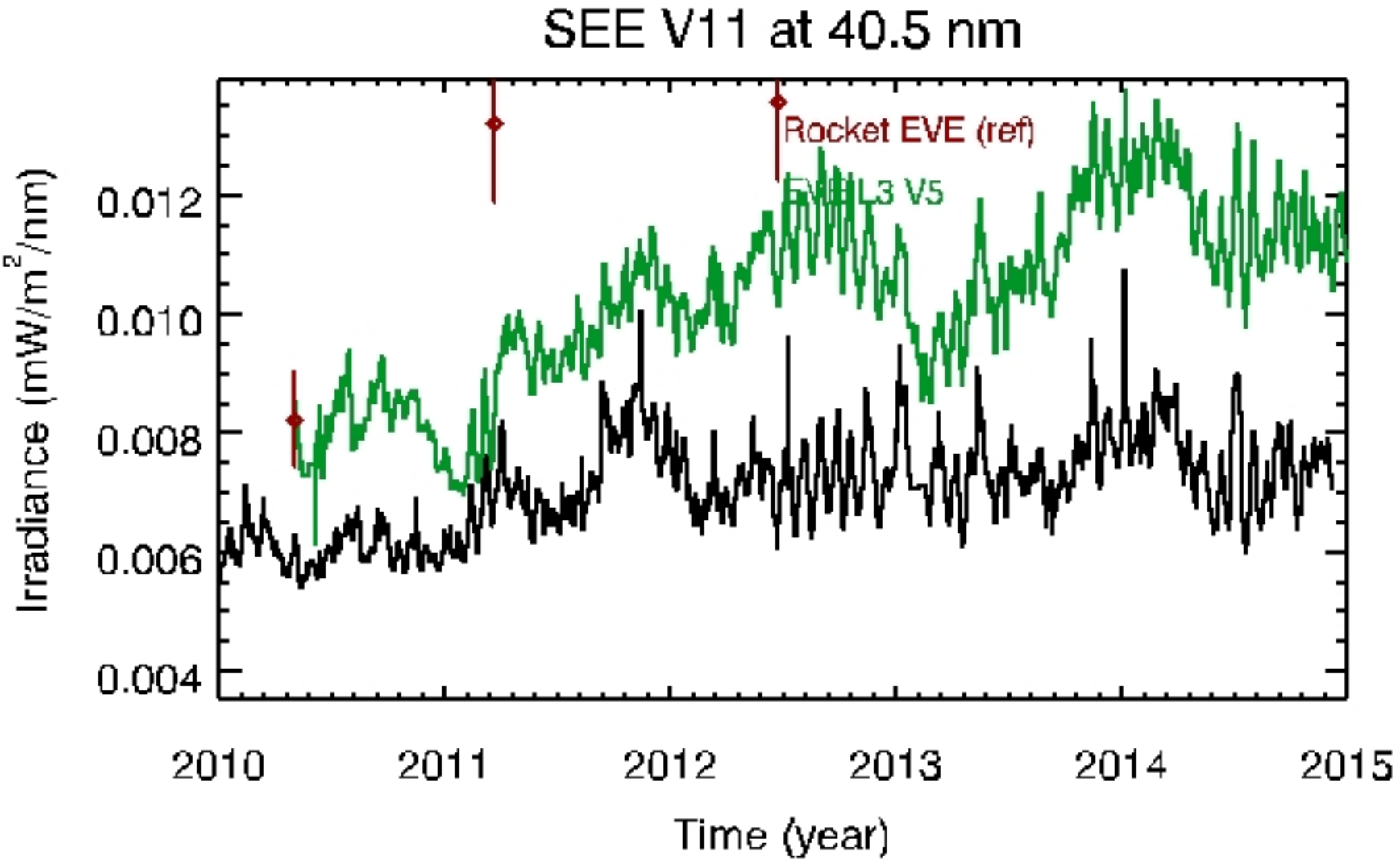
Comparison of EVE V5, SEE V11, Rocket

- SEE He II 304 is still low (but 26-34 nm agree)



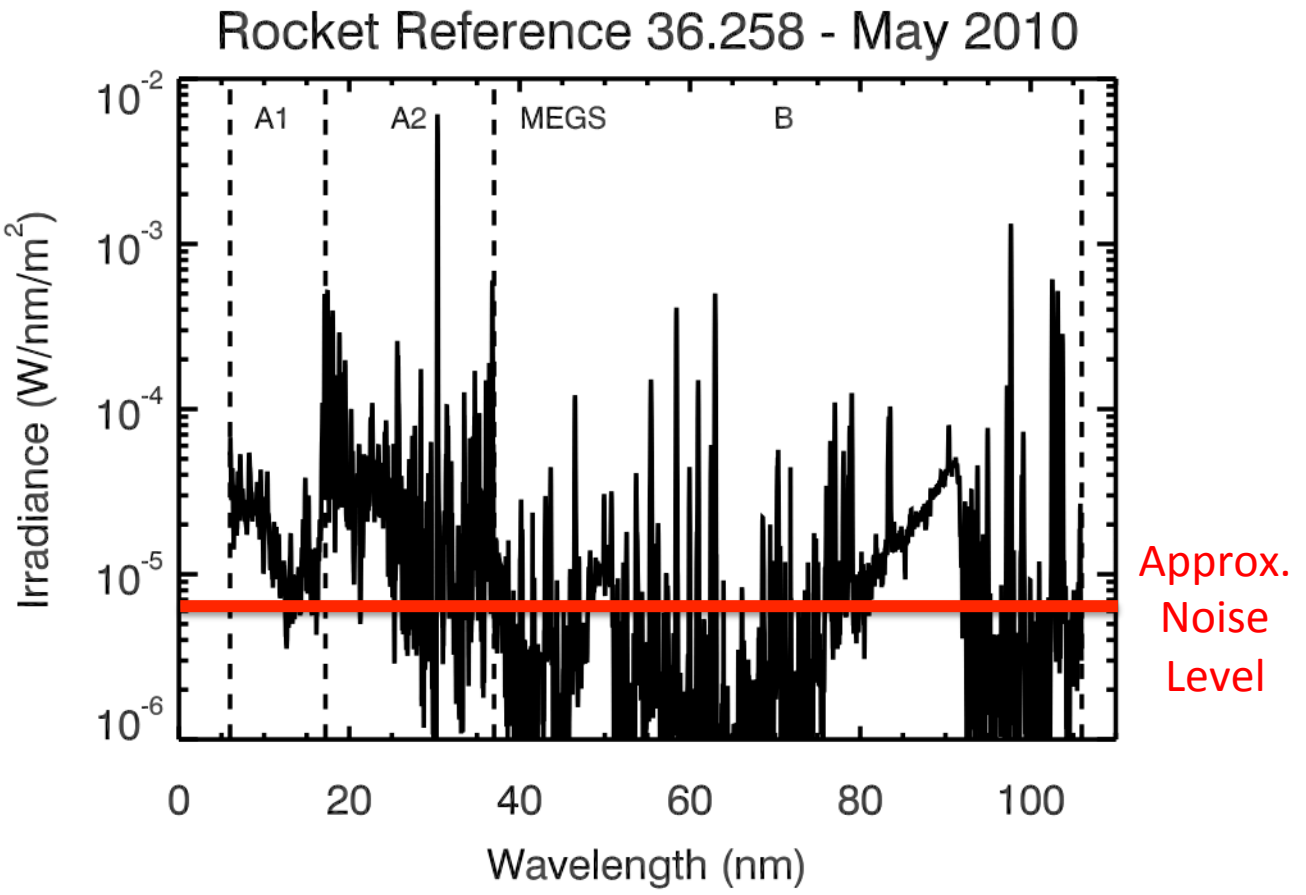
Comparison of EVE V5, SEE V11, Rocket

- MEGS-B (flight & rocket) drift more for low irradiances



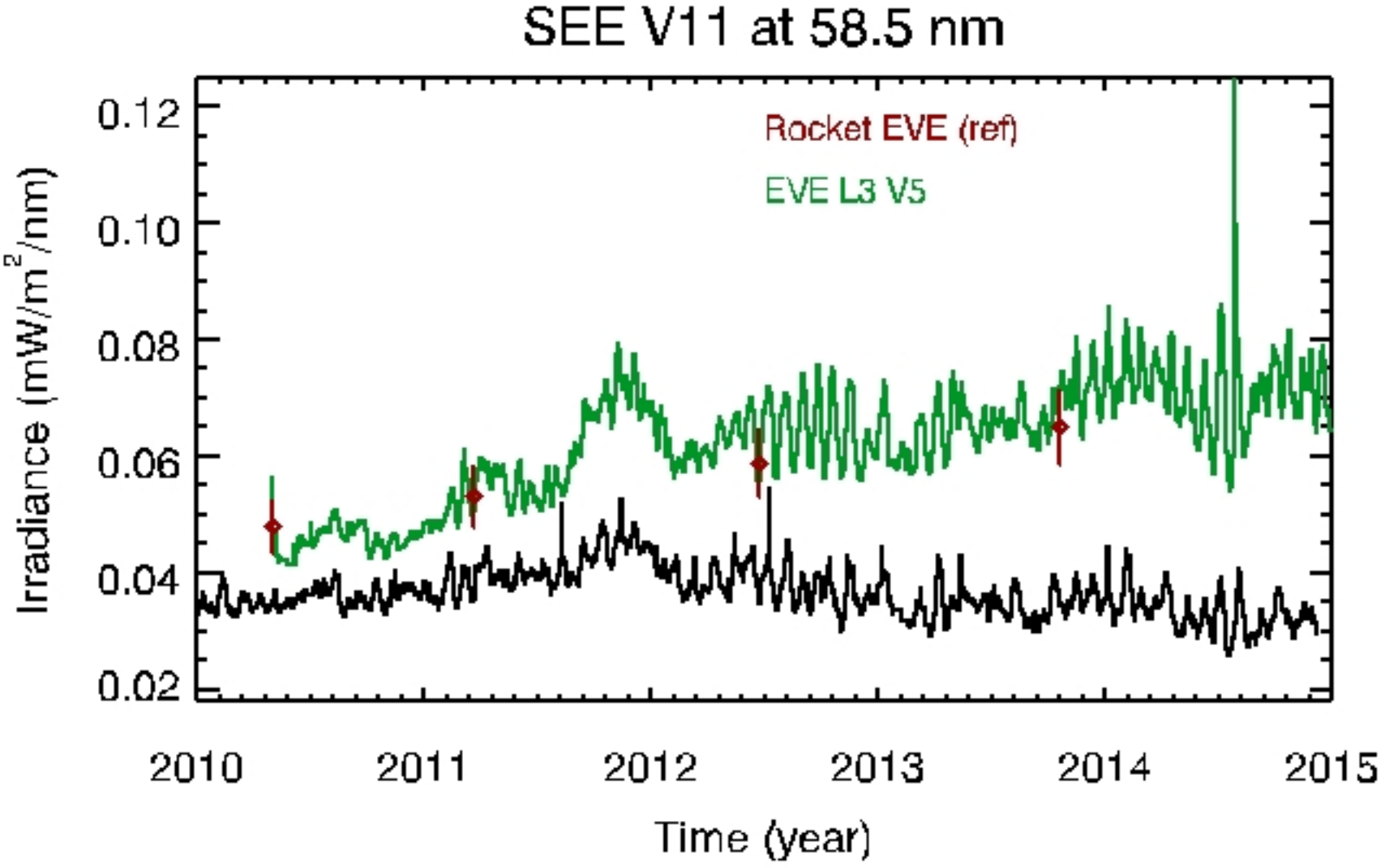
Rocket Reference Spectrum - Noise

- MEGS-A1: strong signal at all wavelengths
- MEGS-A2: some bins (29-36 nm) have weak signal
- MEGS-B: many bins have weak signal (more noise)



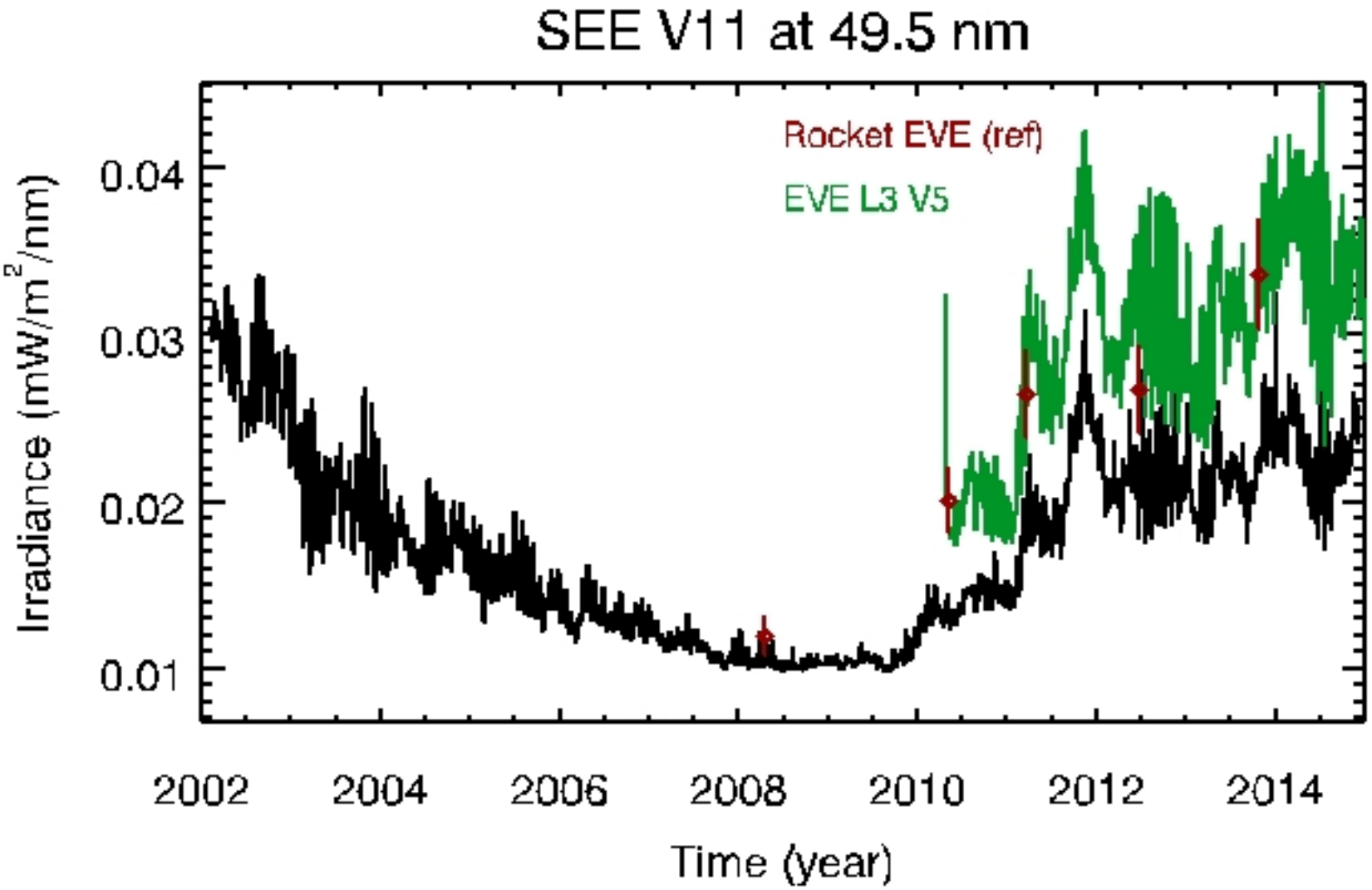
Comparison of EVE V5, SEE V11, Rocket

- SEE EGS trends downward after 2012 for > 55 nm
- SEE data processing will be updated in 2015 (to Version 12)



Comparison of EVE V5, SEE V11, Rocket

- Comparison over full range of SEE mission



Comparison Summary

- Rocket EVE measurements with common SURF cal (36.258, May 2010) agree well with SEE and EVE trends for brighter lines
  - For dim (low) irradiance, the MEGS background level drifts more than SEE
- EVE Version 5 looks great but improvements are needed for low irradiance region for MEGS-B for future EVE Version 6
- Several improvements needed for future SEE Version 12:
  - (absolute) calibration level for 26-34 nm and other bins
  - InstrumentdDegradation trend for > 2011