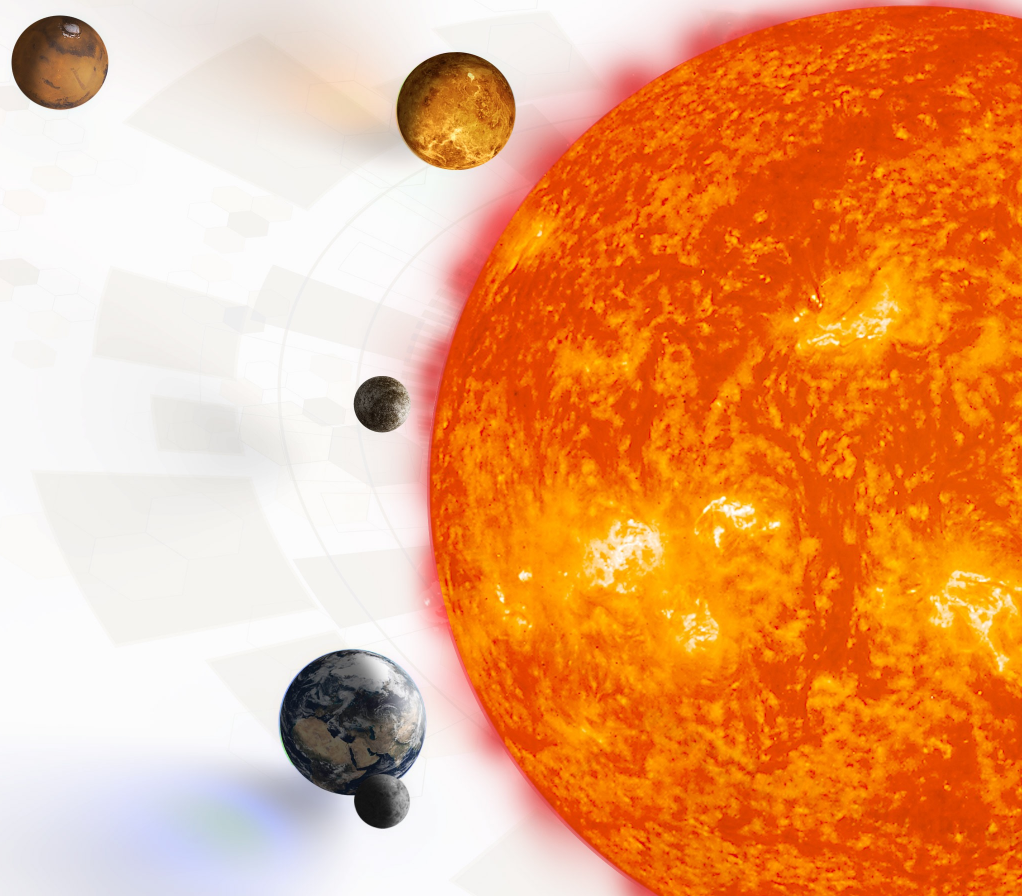
Laboratory for Atmospheric and Space Physics
University of Colorado **Boulder**

SDO-EVE Data Products

Current, Version 8, and Beyond

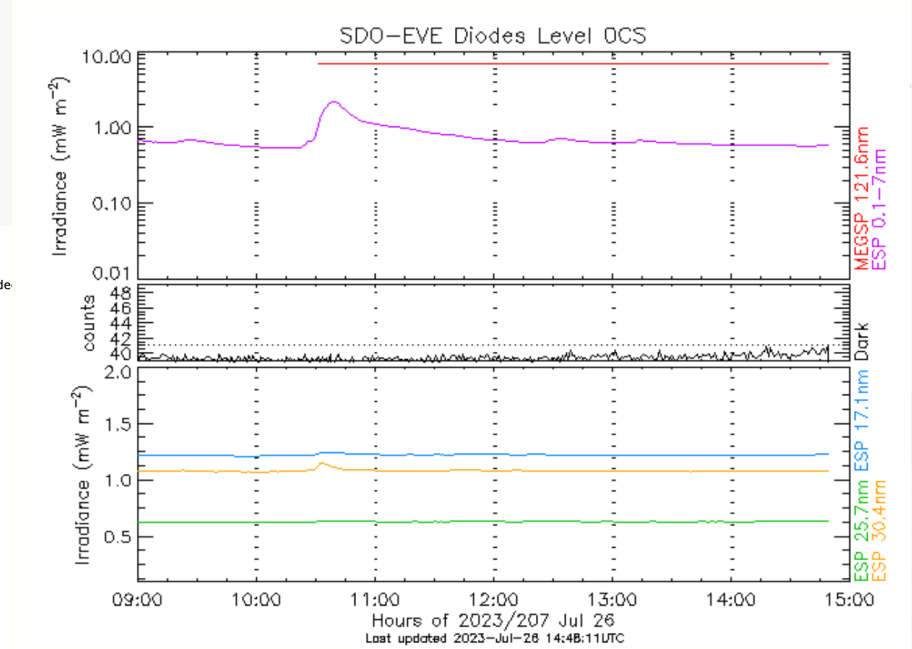
Rita Borelli



SDO-EVE Data Product Review

Level	Description	Components	Wavelength Coverage	Wavelength Sampling	Temporal Sampling	Time Span of Data File	Daily size (GB)	Latency of Availability
L0CS	**Fastest Space Weather Product**: Crudely calibrated irradiances* with least latency (from S-Band)	ESP bands + quad (flare location)	0.1-7, 18.2, 25.6, 30.4, 36.6 nm	broadband ~4-nm	1-min	Latest 15-min and current 1-day (growing file)	0.005	**< 1 min**
		MEGS-P	121-122 nm	1-nm				
		XRS & SEM proxies	Proxies	Varies by band				
L1-P	**Photometer Data:** fully calibrated and corrected photometer irradiances	ESP	0.1-7, 18.2, 25.6, 30.4, 36.6 nm	~4-nm	1/4-sec	1-hour	0.03	1 Day
		SAM	0.1-7 nm	7-nm	1- & 5-min		varies	
		MEGS-P	121-122 nm	~1-nm	1/4-sec		0.006	
L2-S	**Spectra**: fully calibrated spectral irradiances at instrument resolution	MEGS-A, B	6-106 nm	0.02 nm	10-sec & 60-sec	1-hour	1.2	1-2 Day
L2-L	**Lines & Broadband irradiances:** fully calibrated photometer irradiances and extracted spectral features	MEGS-A, B, P, ESP	select lines & bands	Varies by band	10-sec & 60-sec	1-hour	0.01	1-2 Day
L3	**Merged Spectra:** fully calibrated, corrected, and merged spectral irradiances	ESP, SAM, MEGS-A, MEGS-B, MEGS-P	0.1-106 nm	0.02, 0.1 & 1 nm	1-day	1-day	<0.001	1-2 Day
L4	**Model Spectra**	ESP QD Proxy	0.1-106 nm	0.02 nm	60-sec	1-day	1.2	1-2 Day

Level 0CS Space Weather



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; D/ VE_L0CS_DIODES_1m.txt
; C 5:07:16 2023 UTC
; Origin: SDO/EVE Science Processing and Operations Center, LASP/CU
; Units: W/m^2 for irradiance, dark is Counts/Second, quadrants are unitless, solar lat & lon are de
; Source: SDO-EVE ESP and MEGS-P instruments, http://lasp.colorado.edu/eve
; Product: Level 0CS, 1-minute averaged SDO-EVE Solar Indices from broadband photometers
; Version: 5.0, code updated 2022-Nov-22
; Missing data: -1.00e+00
; Column descriptions:
; HHMM: hour and minute in UT
; XRS-B proxy: a model of the expected XRS-B 0.1-0.8 nm, calculated using two-component method
; XRS-A proxy: a model of the expected XRS-A
; SEM proxy: a model of the expected SEM 26-34 nm
; 0.1-7ESPquad: the total irradiance over the ESP quadrant diode 0.1-7 nm
; 17.1ESP: ESP irradiance measurement near 17.1 nm
; 25.7ESP: ESP irradiance measurement near 25.7 nm
; 30.4ESP: ESP irradiance measurement near 30.4 nm
; 36.6ESP: ESP irradiance measurement near 36.6 nm
; darkESP: ESP dark diode count rate (counts/second) background
; 121.6MEGS-P: MEGS-P irradiance measurement at H I Lyman-alpha 121.6 nm
; darkMEGS-P: MEGS-P dark diode count rate (counts/second) background
; q0ESP: ESP quadrant 0 fraction (q0ESP to q3ESP add up to 1.0)
; q1ESP: ESP quadrant 1 fraction
; q2ESP: ESP quadrant 2 fraction
; q3ESP: ESP quadrant 3 fraction
; CMLat: Latitude centroid of ESP quad diode irradiance at the sun in degrees
; CMLon: Longitude centroid of ESP quad diode irradiance at the sun in degrees
; x_cool proxy: Cool component for calculating XRS-B proxy
; oldXRSB proxy: XRS-B calculated using the version 2 method
; Format:
; YYYY DOY MO DD
; HHMM XRS-B XRS-A SEM 0.1-7 17.1 25.7 30.4 36.6 dark 121.6 dark q0 q1 q2 q3 CM CM x_cool oldXRSB
; proxy proxy proxy ESPquad ESP ESP ESP ESP ESP MEGS-P MEGS-P ESP ESP ESP ESP Lat Lon proxy proxy

;END_OF_HEADER
2023 207 07 26

0000	5.34e-06	3.59e-07	2.49e-04	6.369e-04	1.196e-03	6.171e-04	1.089e-03	-1.000e+00	1.94e+02	6.8028e-03	1.56e+02	2.336e-01	2.243e-01	2.766e-01	2.655e-01	5.1	15.9	2.90e+03	2.87e-07
0001	5.18e-06	3.47e-07	2.49e-04	6.281e-04	1.195e-03	6.172e-04	1.089e-03	-1.000e+00	1.94e+02	6.8028e-03	1.58e+02	2.343e-01	2.240e-01	2.764e-01	2.653e-01	5.0	15.7	2.90e+03	2.79e-07
0002	5.09e-06	3.40e-07	2.49e-04	6.208e-04	1.195e-03	6.173e-04	1.089e-03	-1.000e+00	1.94e+02	6.8028e-03	1.57e+02	2.349e-01	2.235e-01	2.765e-01	2.650e-01	4.9	15.6	2.90e+03	2.74e-07
0003	5.06e-06	3.38e-07	2.49e-04	6.189e-04	1.195e-03	6.173e-04	1.088e-03	-1.000e+00	1.94e+02	6.8028e-03	1.59e+02	2.347e-01	2.231e-01	2.772e-01	2.650e-01	4.9	16.0	2.90e+03	2.72e-07
0004	5.06e-06	3.38e-07	2.49e-04	6.202e-04	1.195e-03	6.172e-04	1.088e-03	-1.000e+00	1.94e+02	6.8028e-03	1.57e+02	2.350e-01	2.229e-01	2.771e-01	2.650e-01	4.8	15.9	2.90e+03	2.72e-07
0005	5.01e-06	3.35e-07	2.49e-04	6.201e-04	1.194e-03	6.172e-04	1.089e-03	-1.000e+00	1.94e+02	6.8035e-03	1.57e+02	2.346e-01	2.235e-01	2.765e-01	2.654e-01	5.0	15.8	2.90e+03	2.70e-07
0006	4.91e-06	3.27e-07	2.49e-04	6.153e-04	1.194e-03	6.172e-04	1.088e-03	-1.000e+00	1.94e+02	6.8032e-03	1.57e+02	2.344e-01	2.225e-01	2.774e-01	2.658e-01	4.9	16.5	2.90e+03	2.64e-07
0007	4.77e-06	3.17e-07	2.48e-04	6.076e-04	1.194e-03	6.171e-04	1.087e-03	-1.000e+00	1.94e+02	6.8032e-03	1.57e+02	2.340e-01	2.245e-01	2.773e-01	2.642e-01	4.9	15.6	2.90e+03	2.57e-07
0008	4.57e-06	3.02e-07	2.48e-04	5.975e-04	1.194e-03	6.172e-04	1.086e-03	-1.000e+00	1.94e+02	6.8028e-03	1.61e+02	2.343e-01	2.222e-01	2.780e-01	2.655e-01	4.8	16.7	2.90e+03	2.47e-07

Version 8 Updates

- ESP updates: fixed quad diode fractional irradiance
- New Level 4 Lines data product in the works
- Updates to emission lines added in Level 2/2B and Level 3
- Improvements to the 17.1 nm region of the Level 2/2B & Level 3 spectra
- MEGS-B: particle filtering & dark corrections
- MEGS-B long term degradation

Lines reported from each channel

- Additional lines added to the Level 2/2b and Level 3 data products
- Where there is crossover, lines will be reported from each channel; e.g. the 17.1 nm line is measured by both MEGS-A1 and MEGS-A2 and will be reported for each
- Backwards compatible data structures include everything from version 7 data products

```
PRIMARY                    LONG      0
PRIMARY_HEAD               STRING    Array[5]
LINESMETA                  STRUCT -> <Anonymous> Array[39]
LINESMETA_HEADER           STRING    Array[46]
BANDSMETA                  STRUCT -> <Anonymous> Array[20]
BANDSMETA_HEADER           STRING    Array[32]
DIODEMETA                  STRUCT -> <Anonymous> Array[6]
DIODEMETA_HEADER           STRING    Array[29]
QUADMETA                   STRUCT -> <Anonymous> Array[4]
QUADMETA_HEADER            STRING    Array[27]
CHANNELLINESMETA           STRUCT -> <Anonymous> Array[44]
CHANNELLINESMETA_HEADER    STRING    Array[48]
LINESDATA                  STRUCT -> <Anonymous> Array[1440]
LINESDATA_HEADER           STRING    Array[109]
LINESDATAUNITS             STRUCT -> <Anonymous> Array[1]
LINESDATAUNITS_HEADER      STRING    Array[77]
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* blue indicates NEW in version 8
```

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TAI	DOUBLE	2.0511361e+09
YYYYDOY	LONG	2022365
SOD	DOUBLE	46.867446
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SC_FLAGS	BYTE	0
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MEGSA1_LINE_PRECISION	FLOAT	Array[44]
MEGSA1_LINE_ACCURACY	FLOAT	Array[44]
MEGSA2_LINE_IRRADIANCE	FLOAT	Array[44]
MEGSA2_LINE_PRECISION	FLOAT	Array[44]
MEGSA2_LINE_ACCURACY	FLOAT	Array[44]
MEGSB_LINE_IRRADIANCE	FLOAT	Array[44]
MEGSB_LINE_PRECISION	FLOAT	Array[44]
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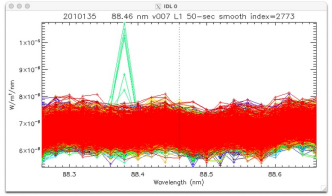
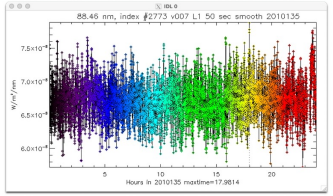
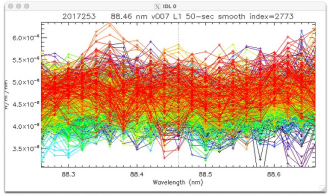
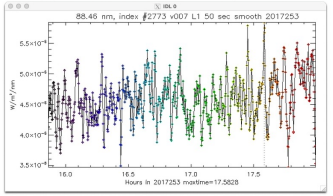
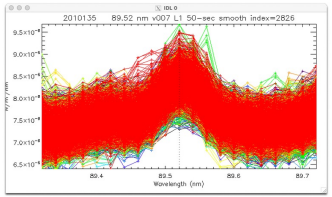
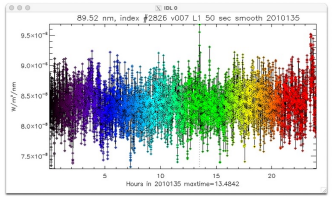
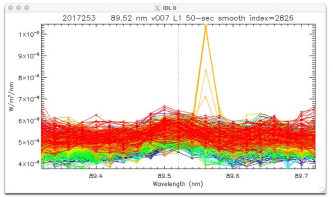
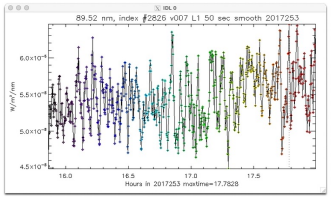
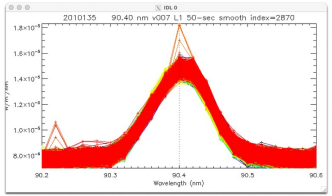
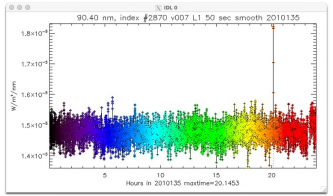
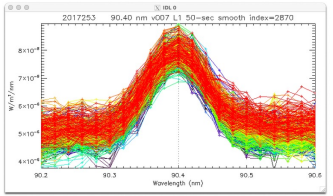
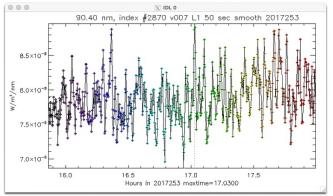
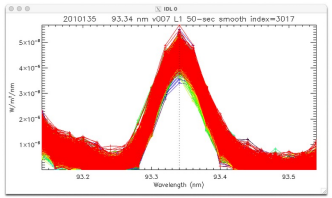
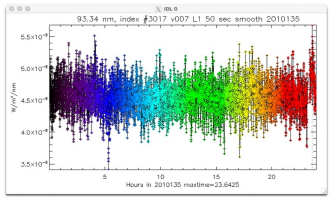
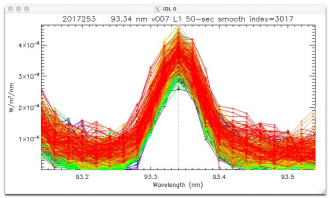
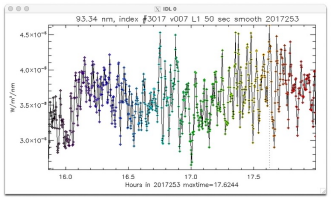
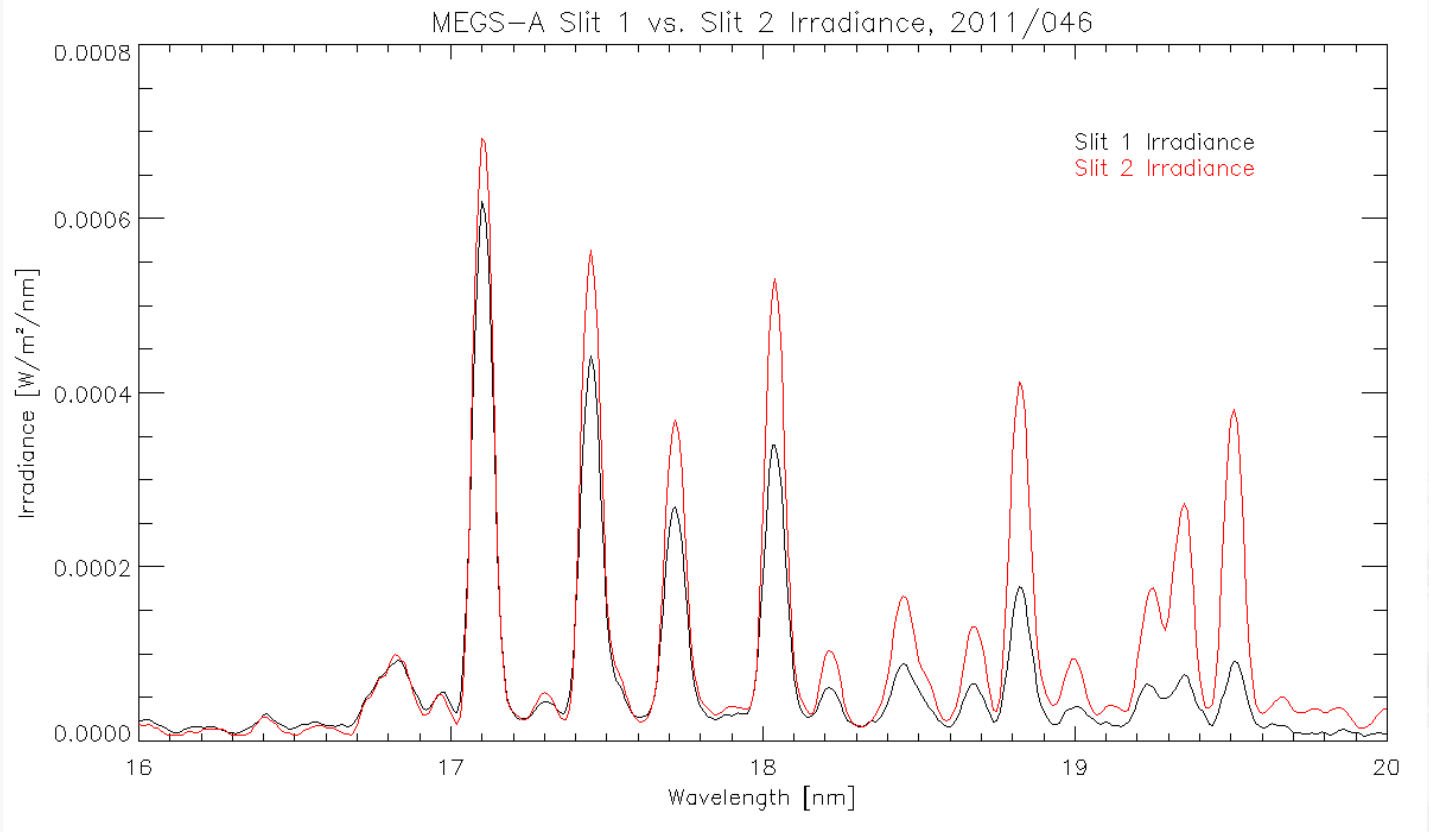
Evaluated 100+ candidate lines

Wavelength	Spectrum 2010-135	Time Series 2010-135	Spectrum 2017-253	Time Series 2017-253
88.452 nm C (98%)				
89.519 nm Ne (95%)				
90.409 nm C (100%)				
93.338 nm S (99%)				

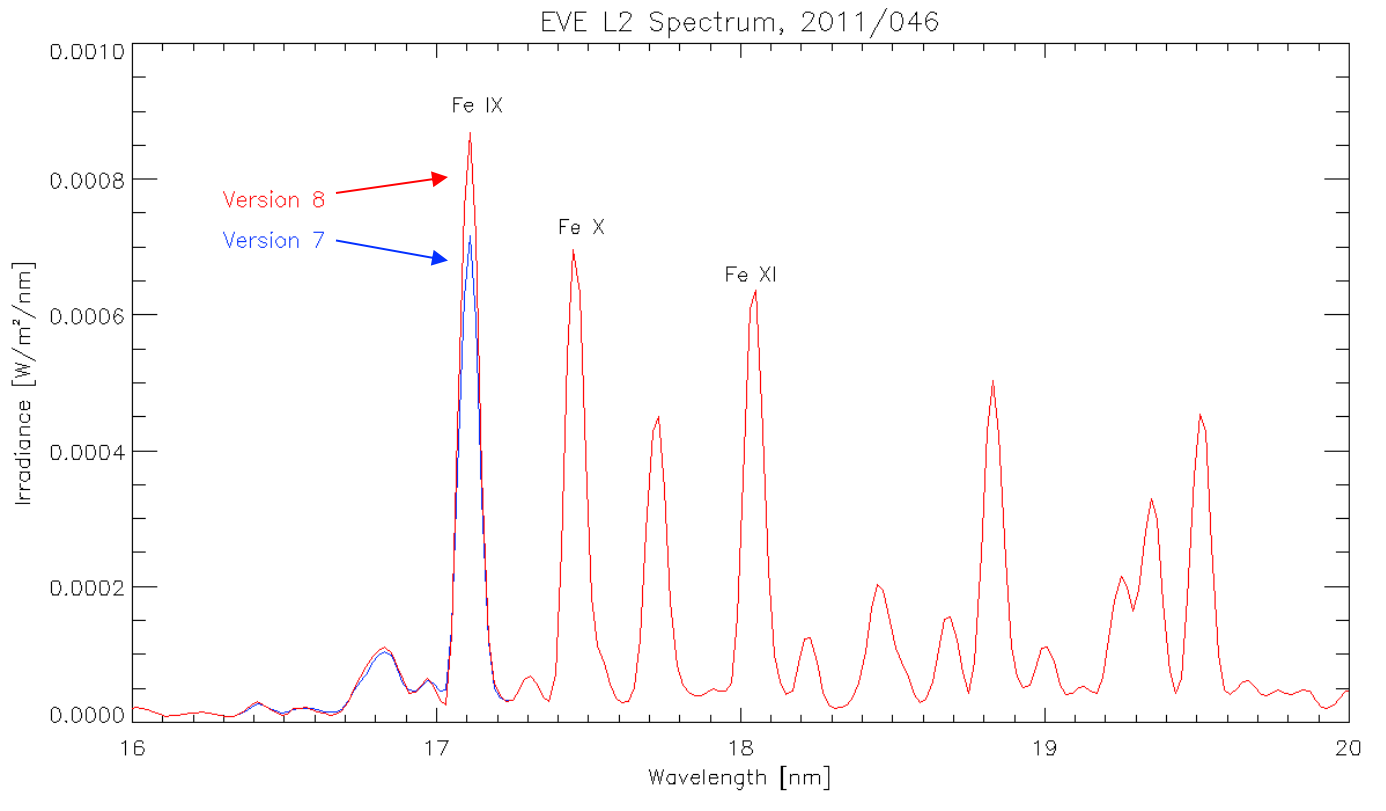
Spectra & time series: low solar activity (2010/135)

Spectra & time series: high solar activity (2017/253)

MEGS-A1 vs. MEGS-A2



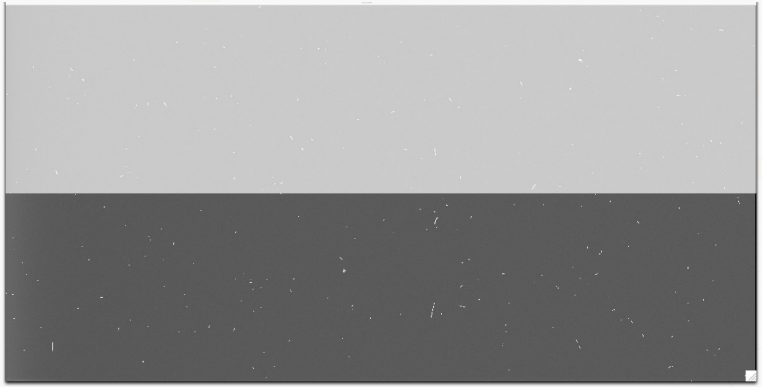
Improvements in 17.1 nm region of EVE spectrum



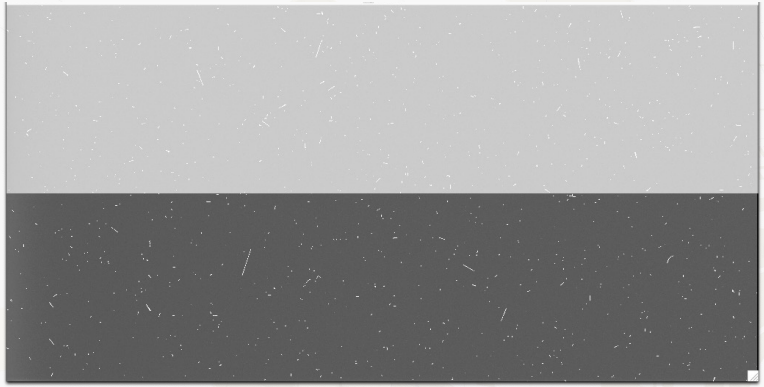
Version 8 better represents the 17.1 nm region.

MEGS-B: improved particle filtering

- MEGS-B integration time changed from 10-seconds to 60-seconds in 2018
- Leads to more particle strikes in images
- The process for filtering becomes more important to ensure we remove particle strikes



10-second dark image

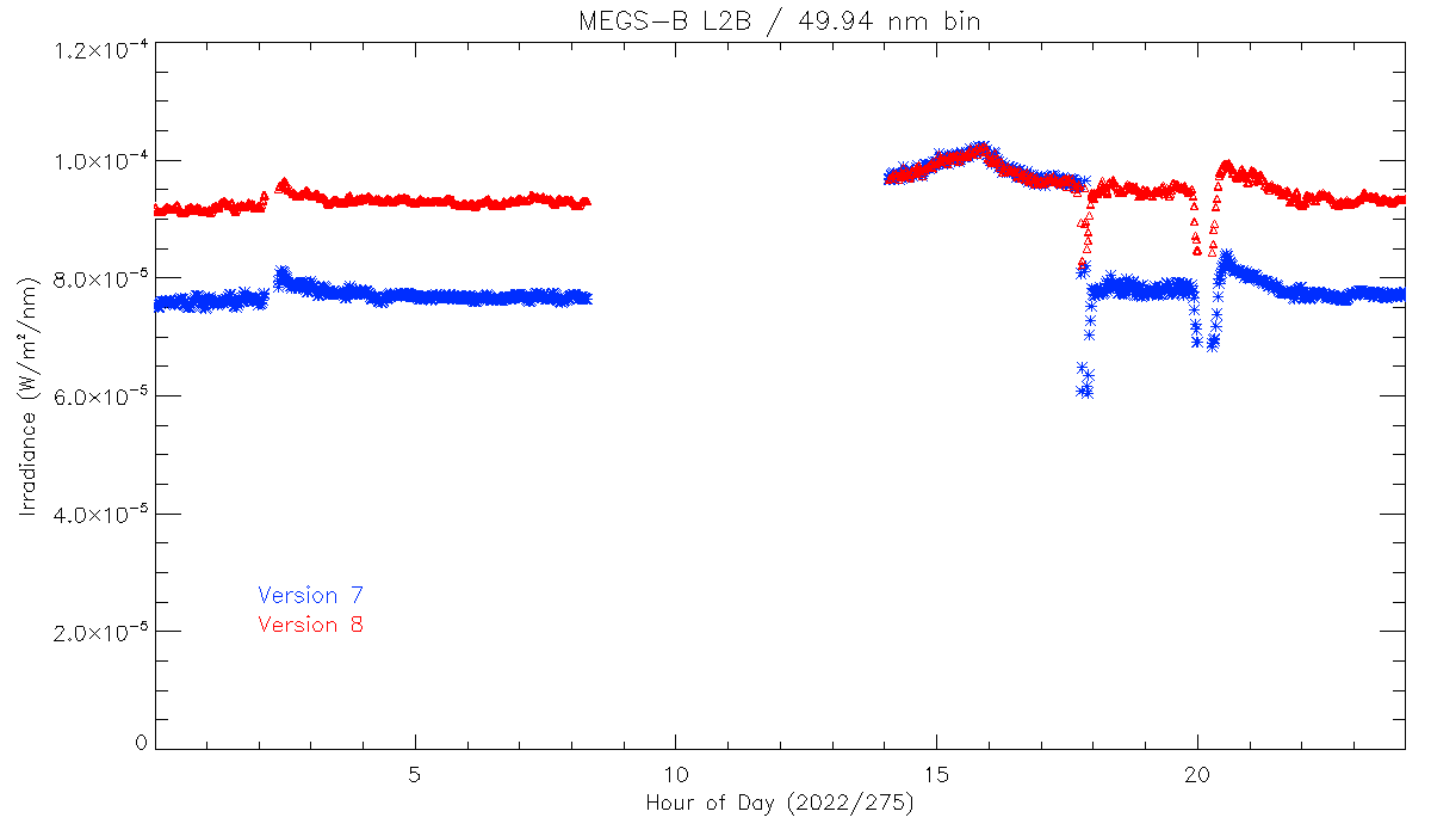


60-second dark image

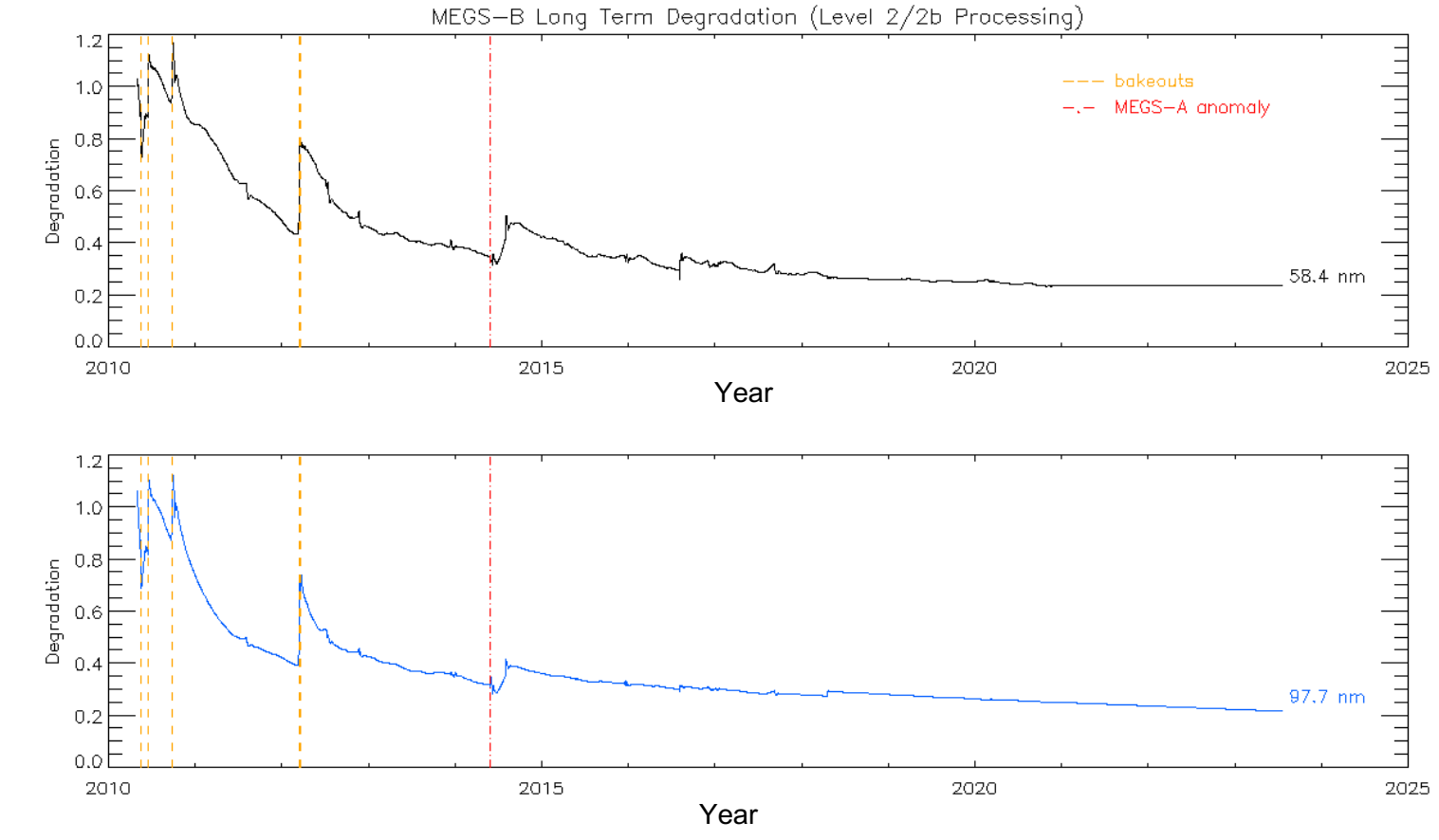
MEGS-B: improved particle filtering

MEGS-B difference image: raw image minus the filtered image

MEGS-B: improved particle filtering



MEGS-B long term degradation



Future updates…

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