GOES-16 and 17 SUVI Performance Analysis and Comparison with Other Instruments

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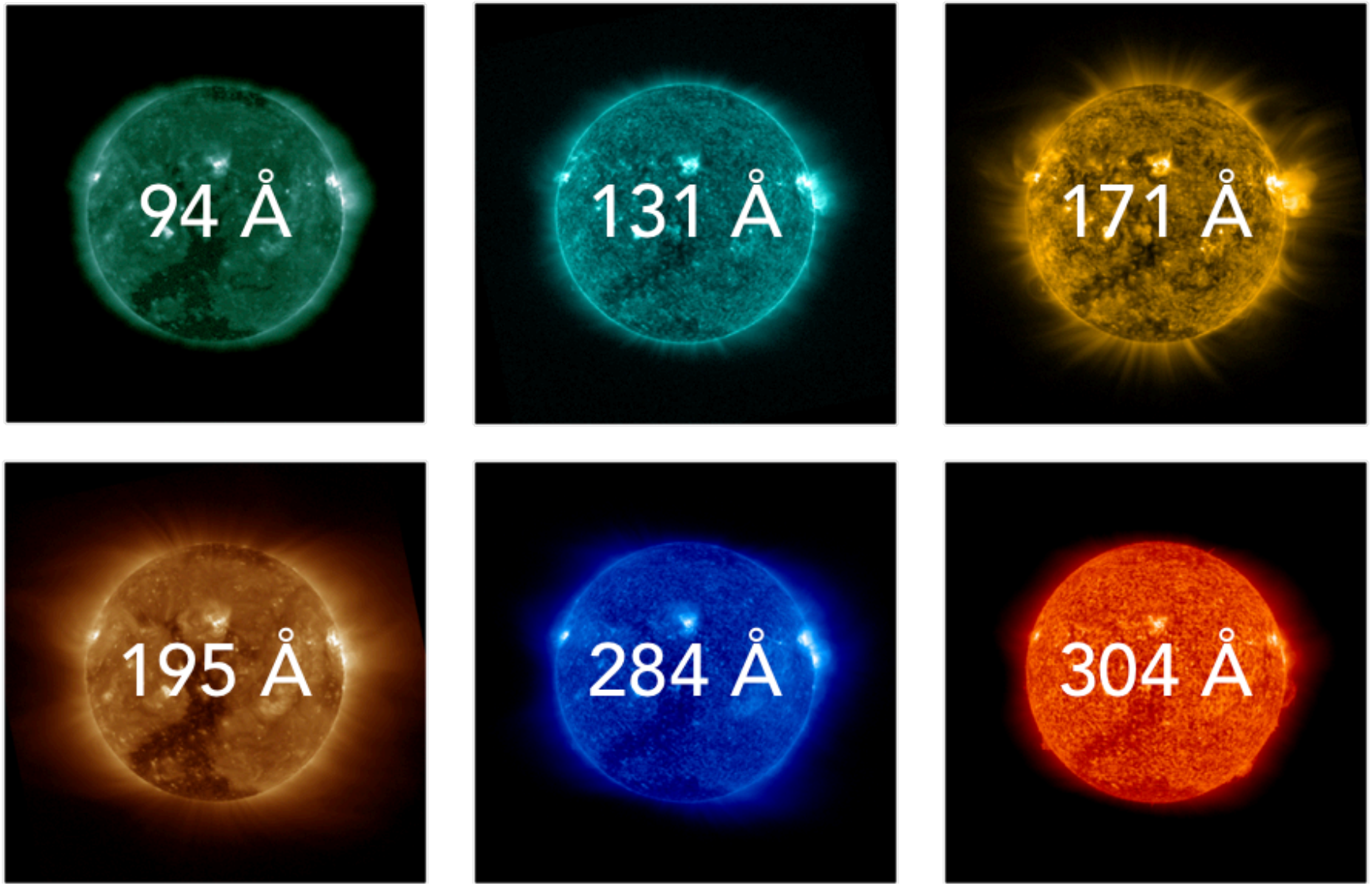
The Solar UltraViolet Imager (SUVI) is an EUV imager with 6 channels



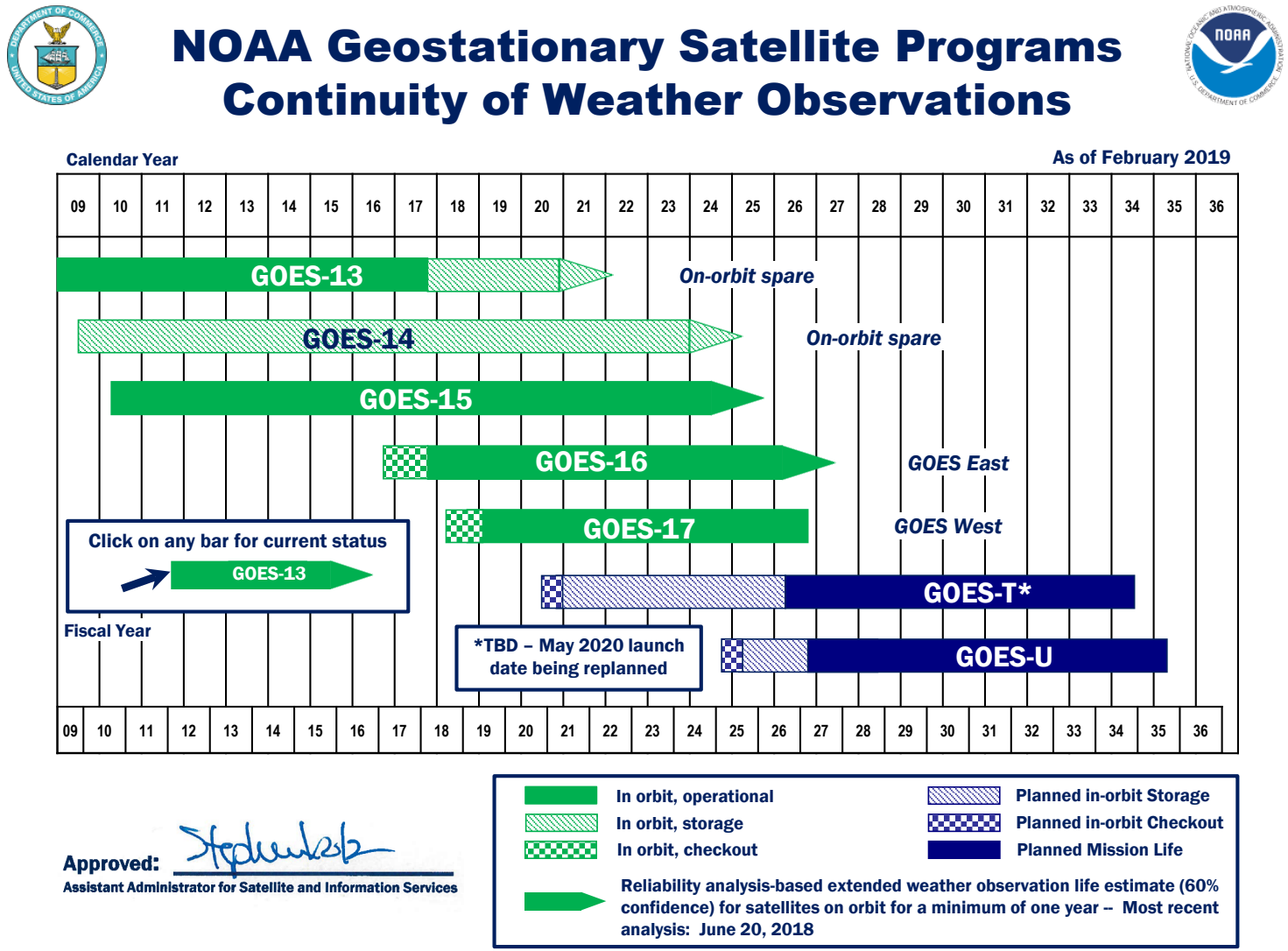
53 x 53 arcmin field-of-view

1280 x 1280 CCD

2.5 arcsec/pixel resolution

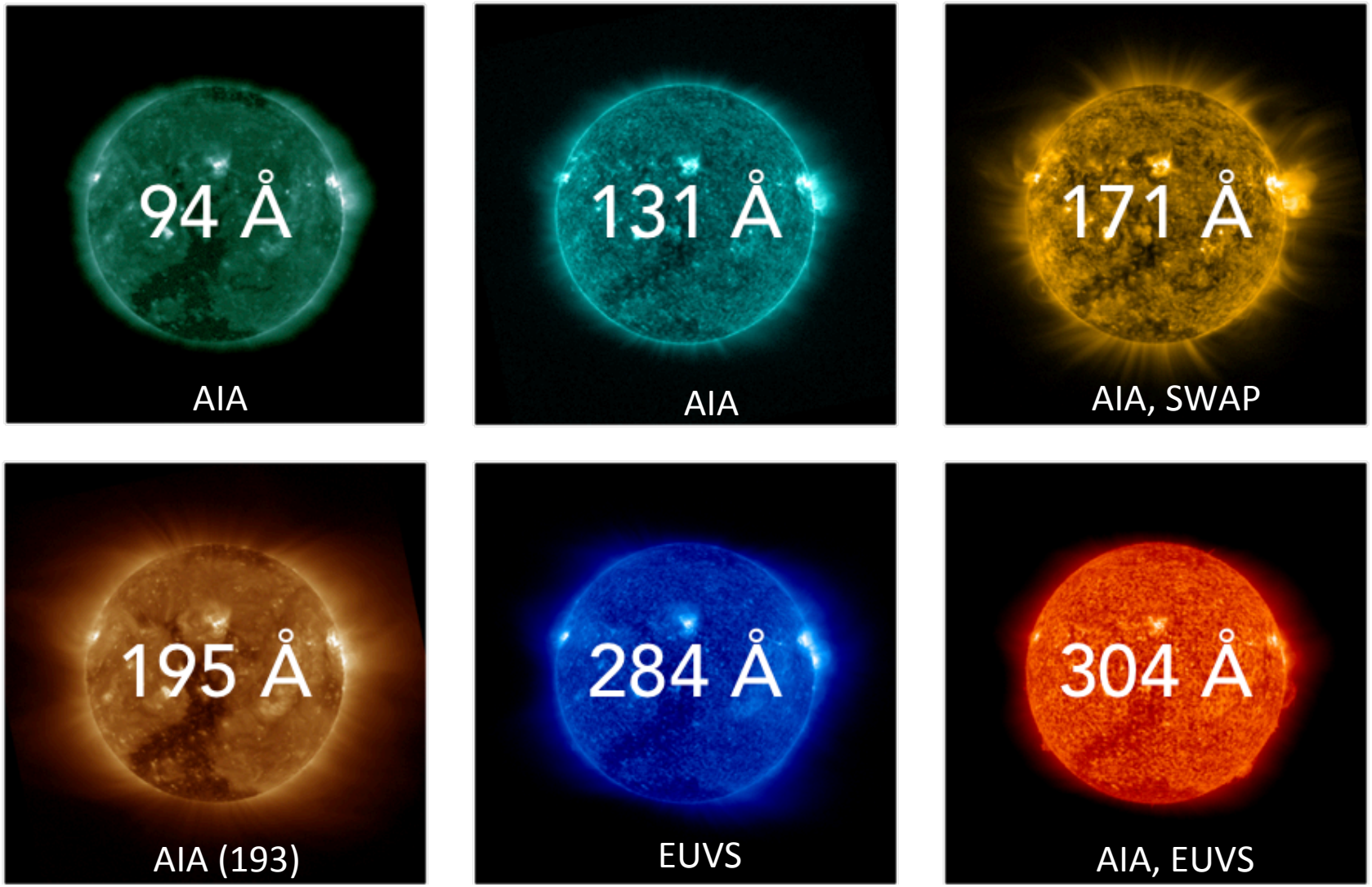
10 s operational cadence

Planned lifetime is almost 20 years between 4 (nearly) identical instruments

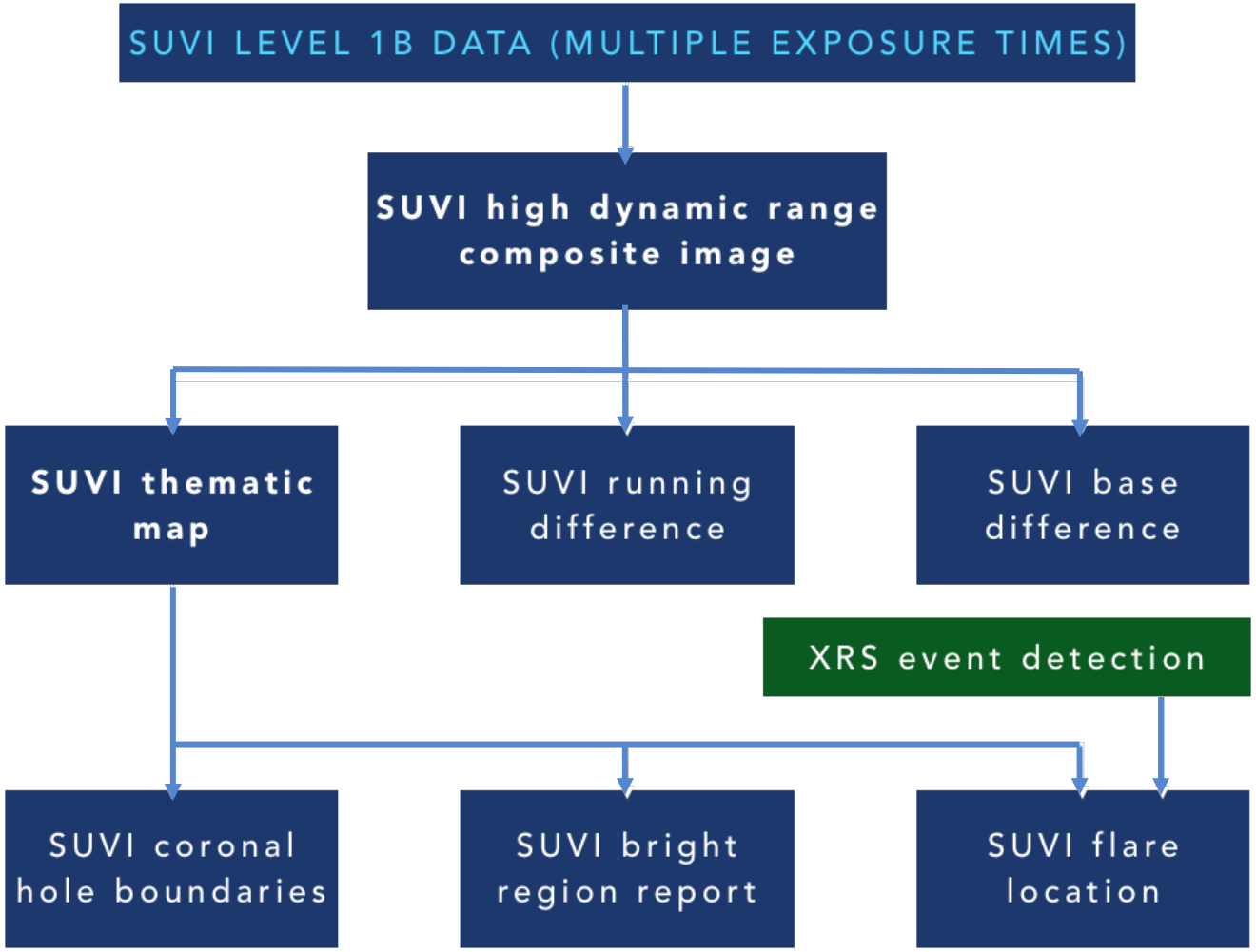


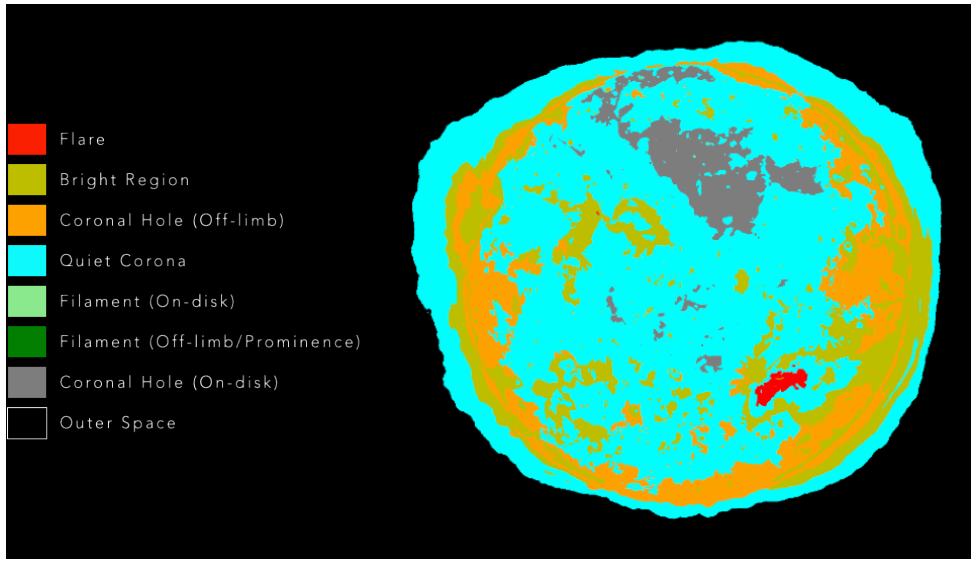
Data available at: https://data.ngdc.noaa.gov/platforms/solar-space-observing-satellites/goes

SUVI passbands closely match those of AIA and SWAP imagers, as well as two EUVS channels

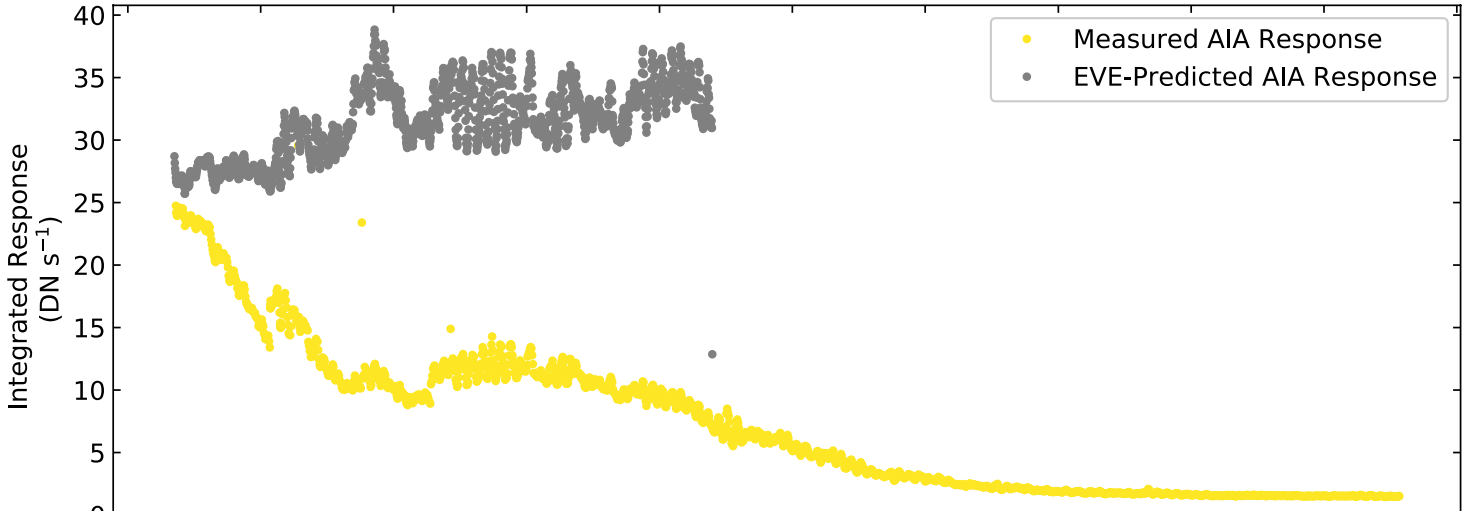


SUVI requires image degradation calibration to maintain accurate measurements for both science and operational products



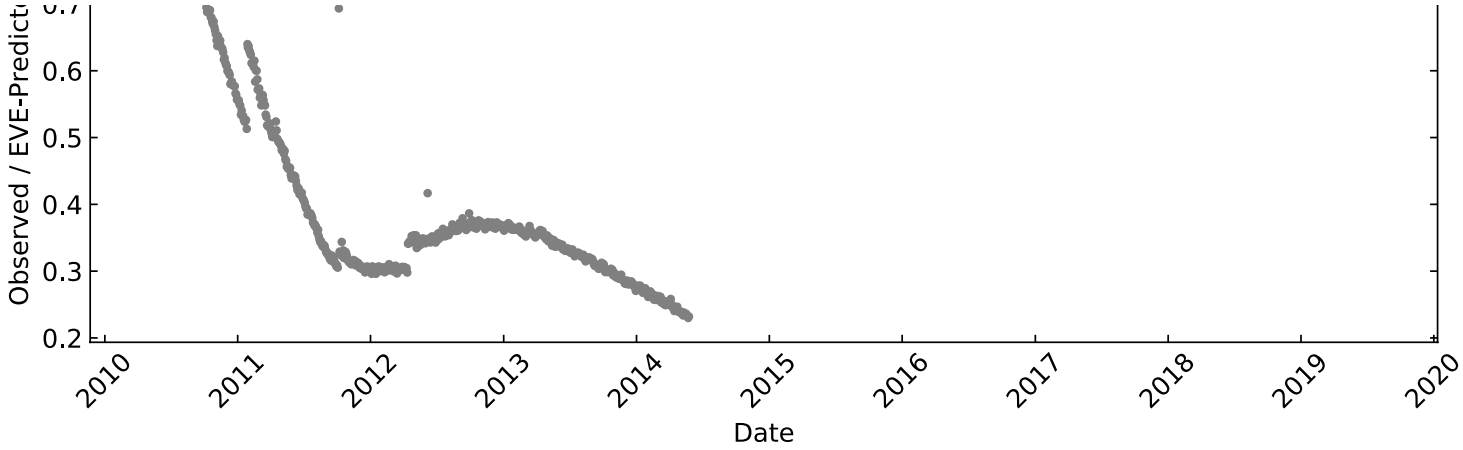


AIA degradation could be calibrated with EVE until MEGS-A failure in 2014

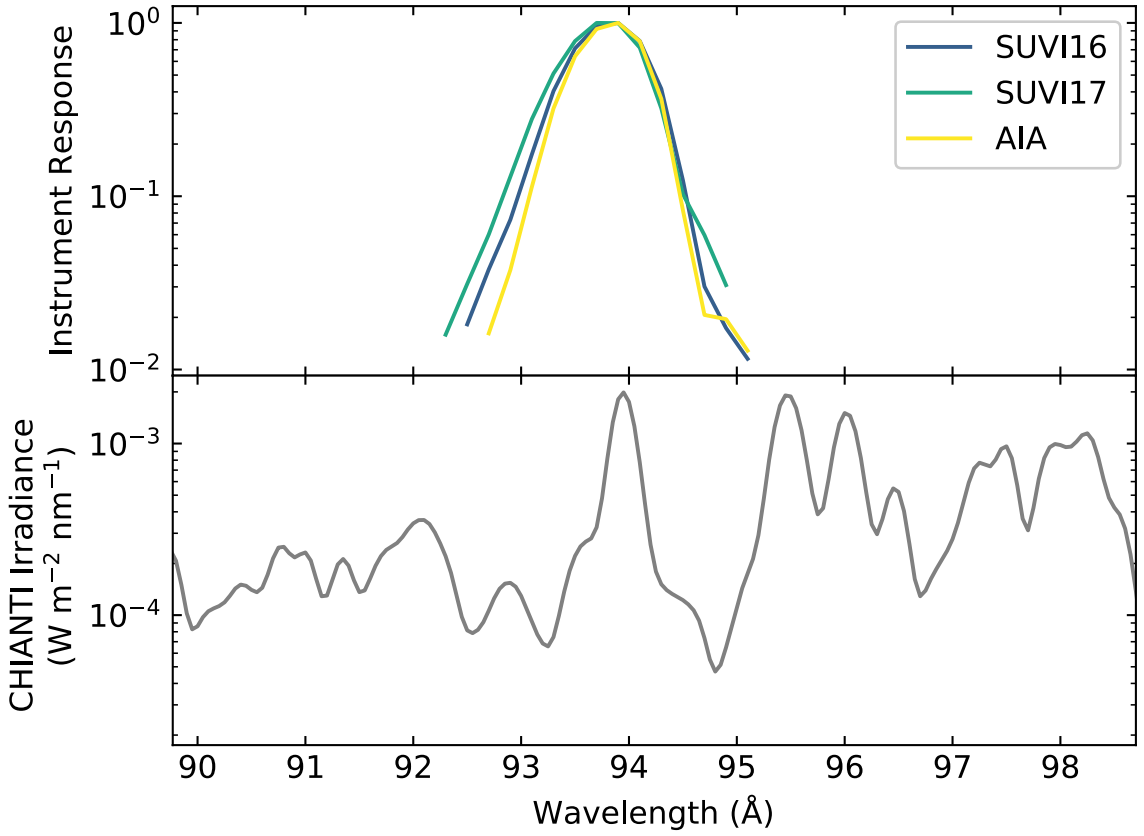


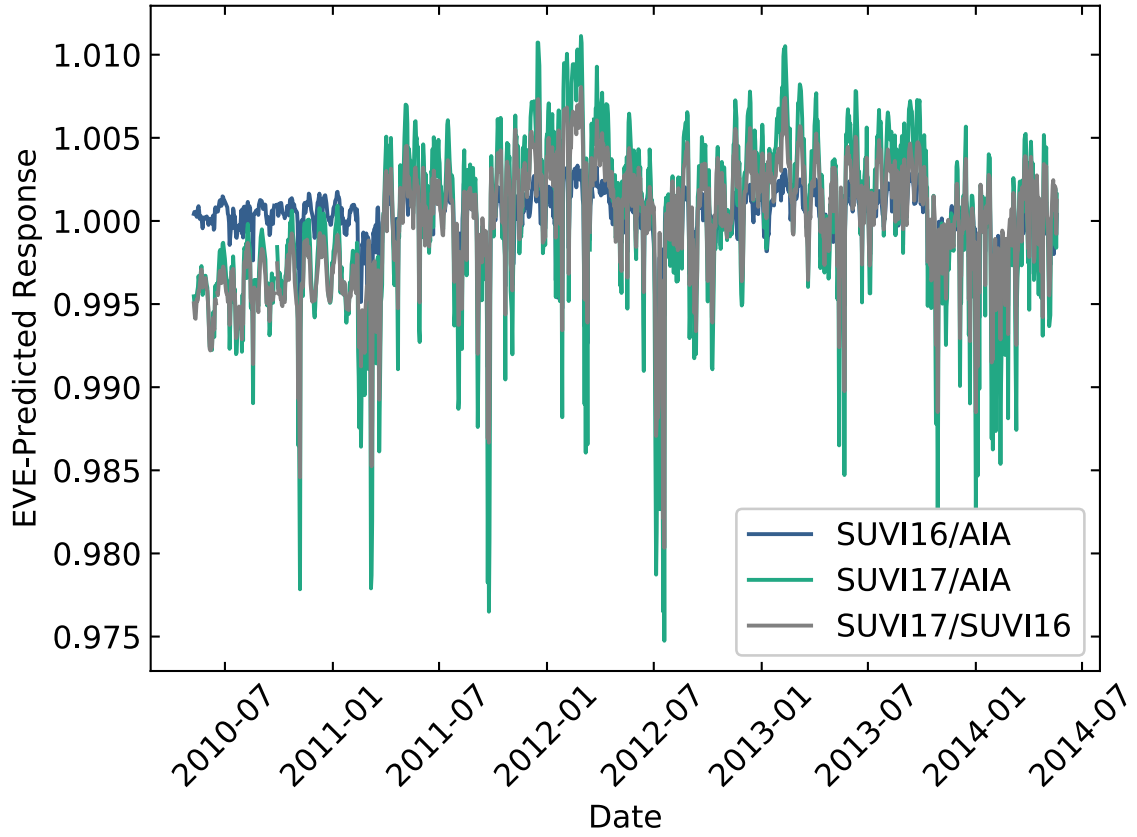
304 Å

Our goal is to leverage the multi-instrument aspect of SUVI with other EUV instruments to understand and correct image degradation

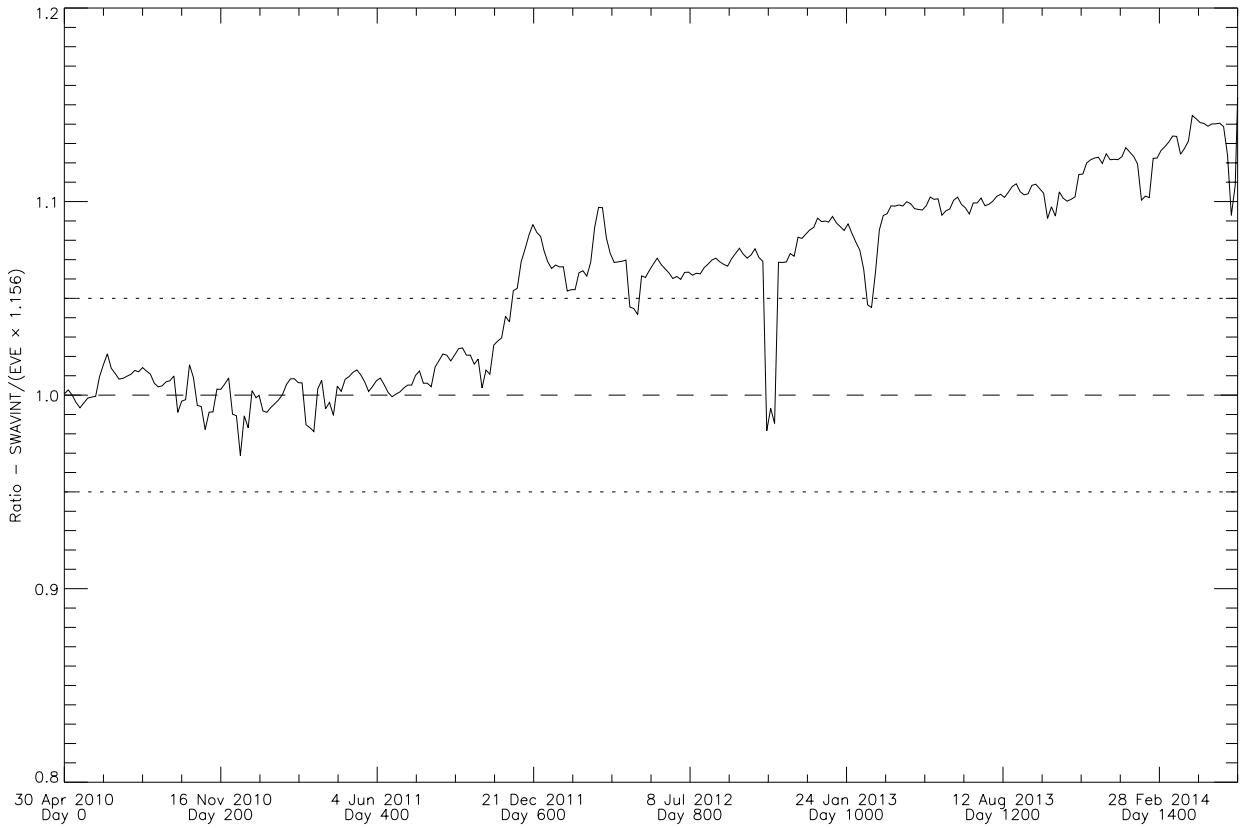


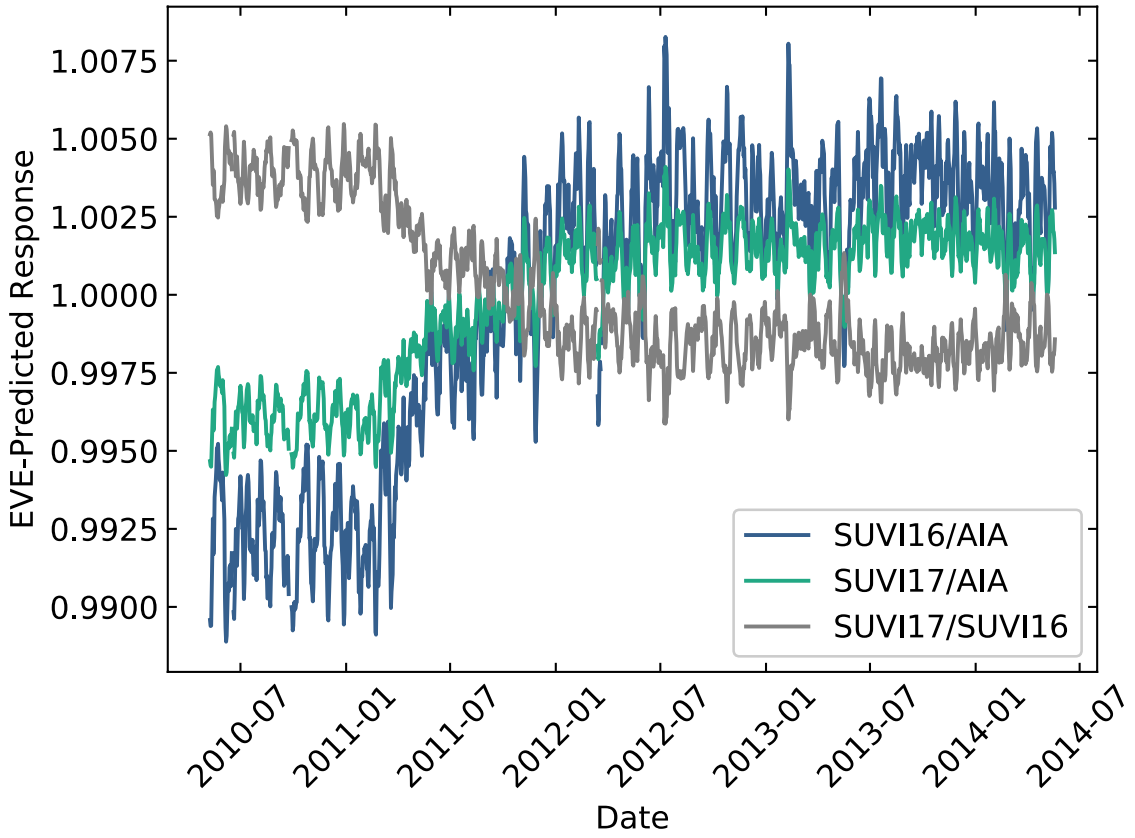
SUVI and AIA response function comparison 94 Å



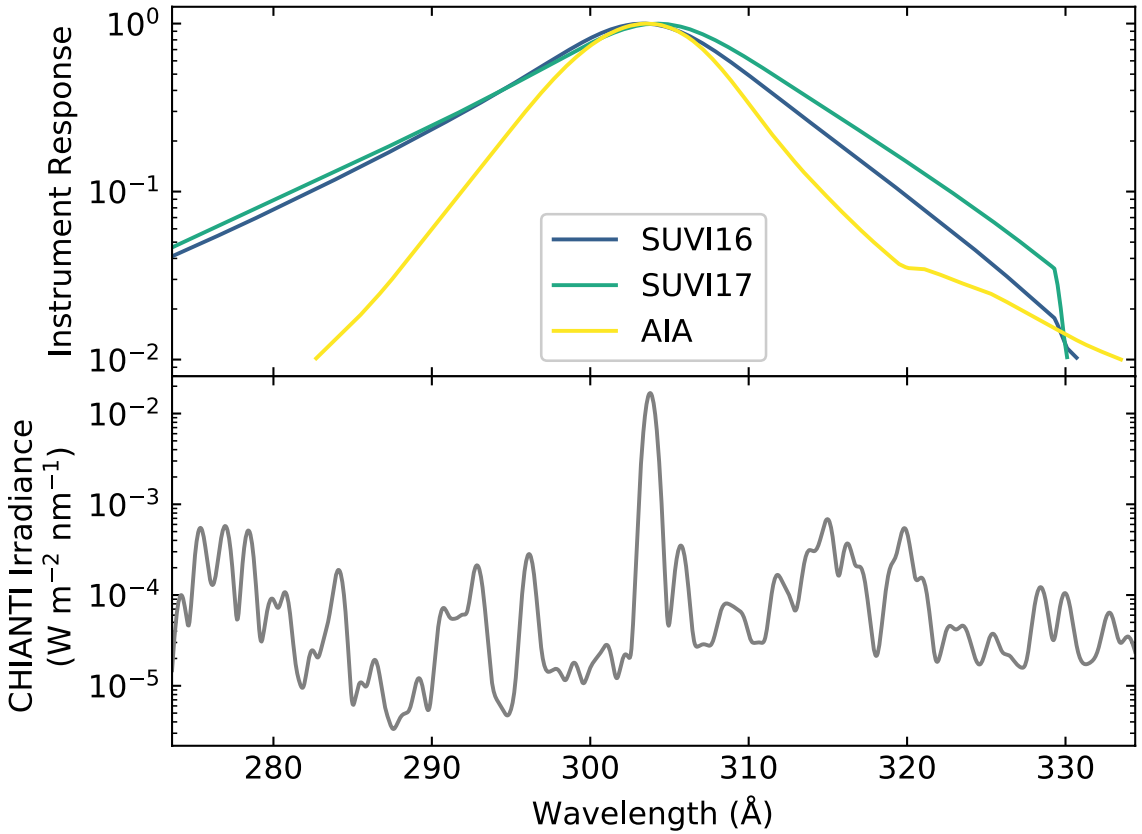


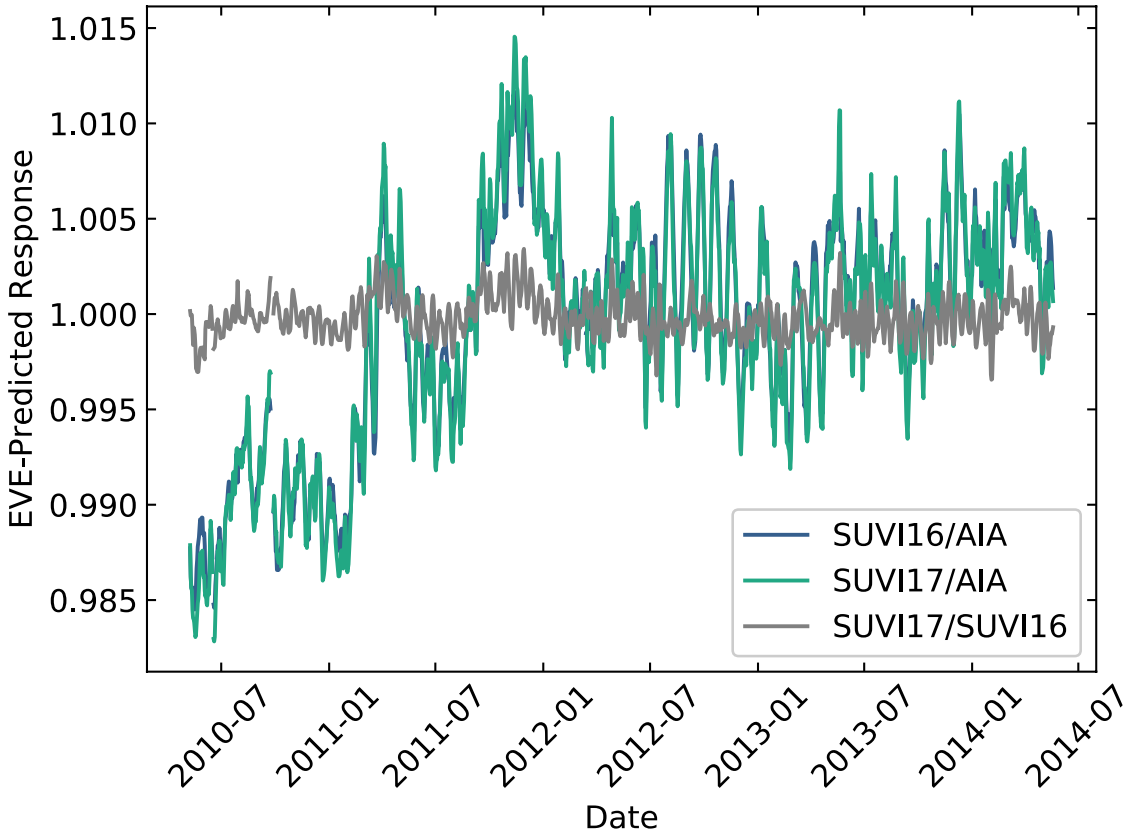
SUVI and AIA response function comparison 171 Å



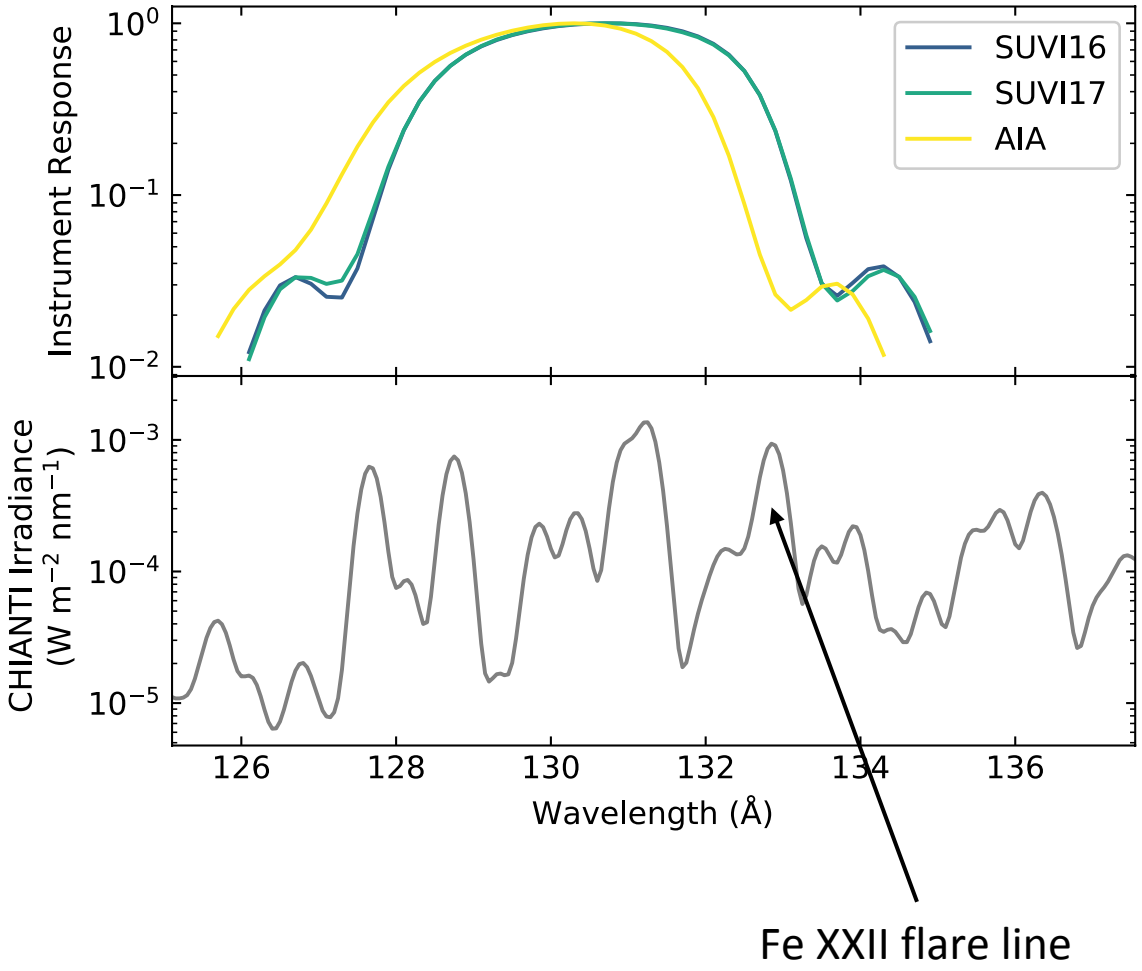


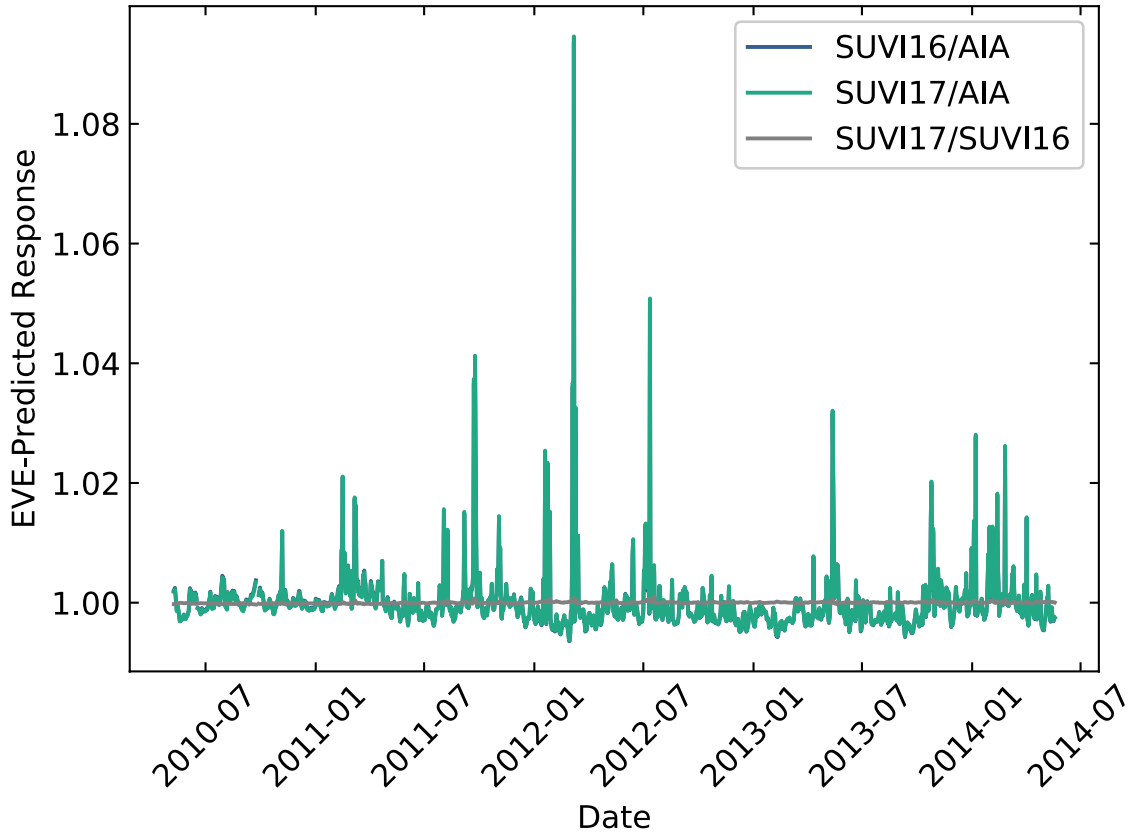
SUVI and AIA response function comparison 304 Å





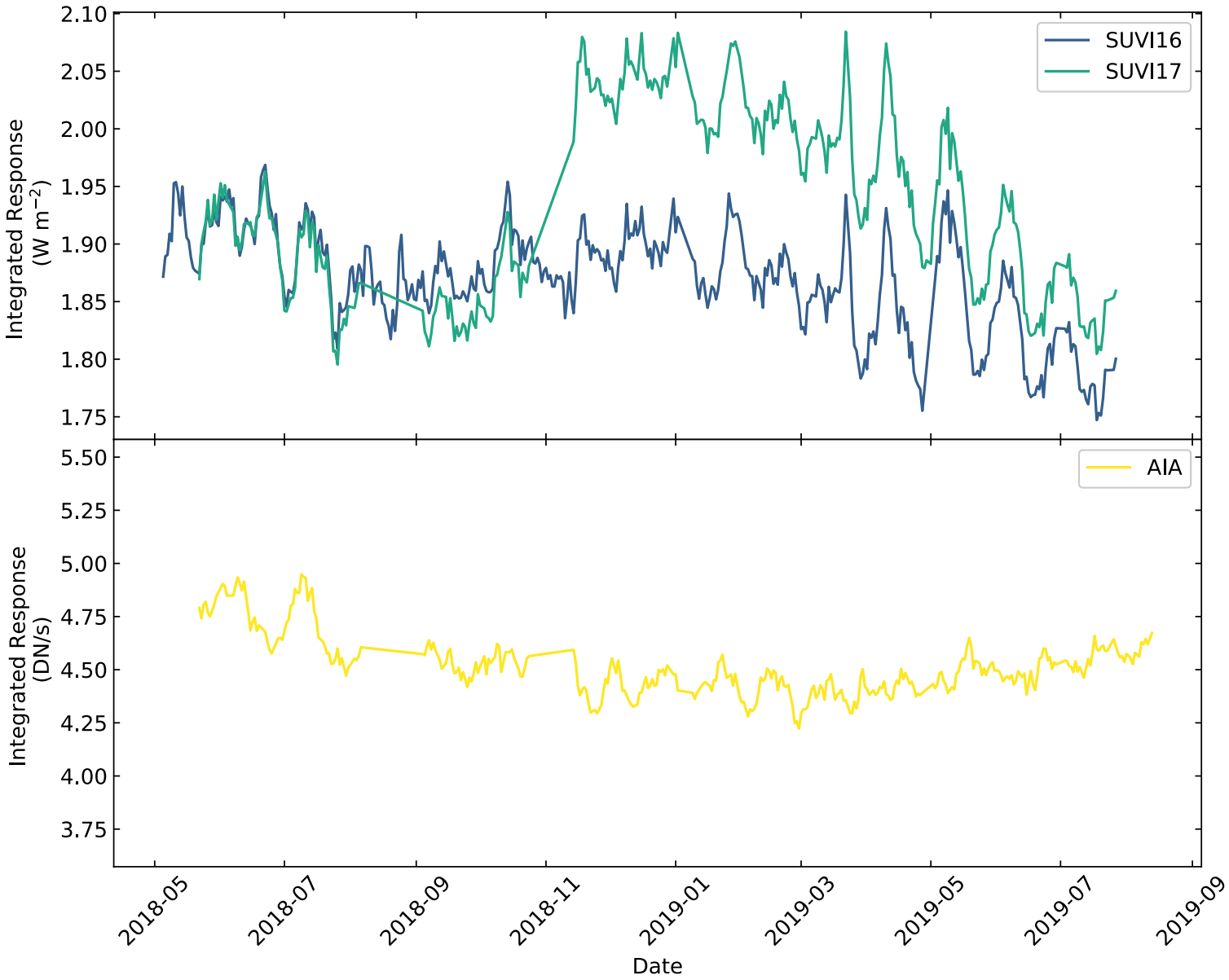
SUVI and AIA response function comparison 131 Å





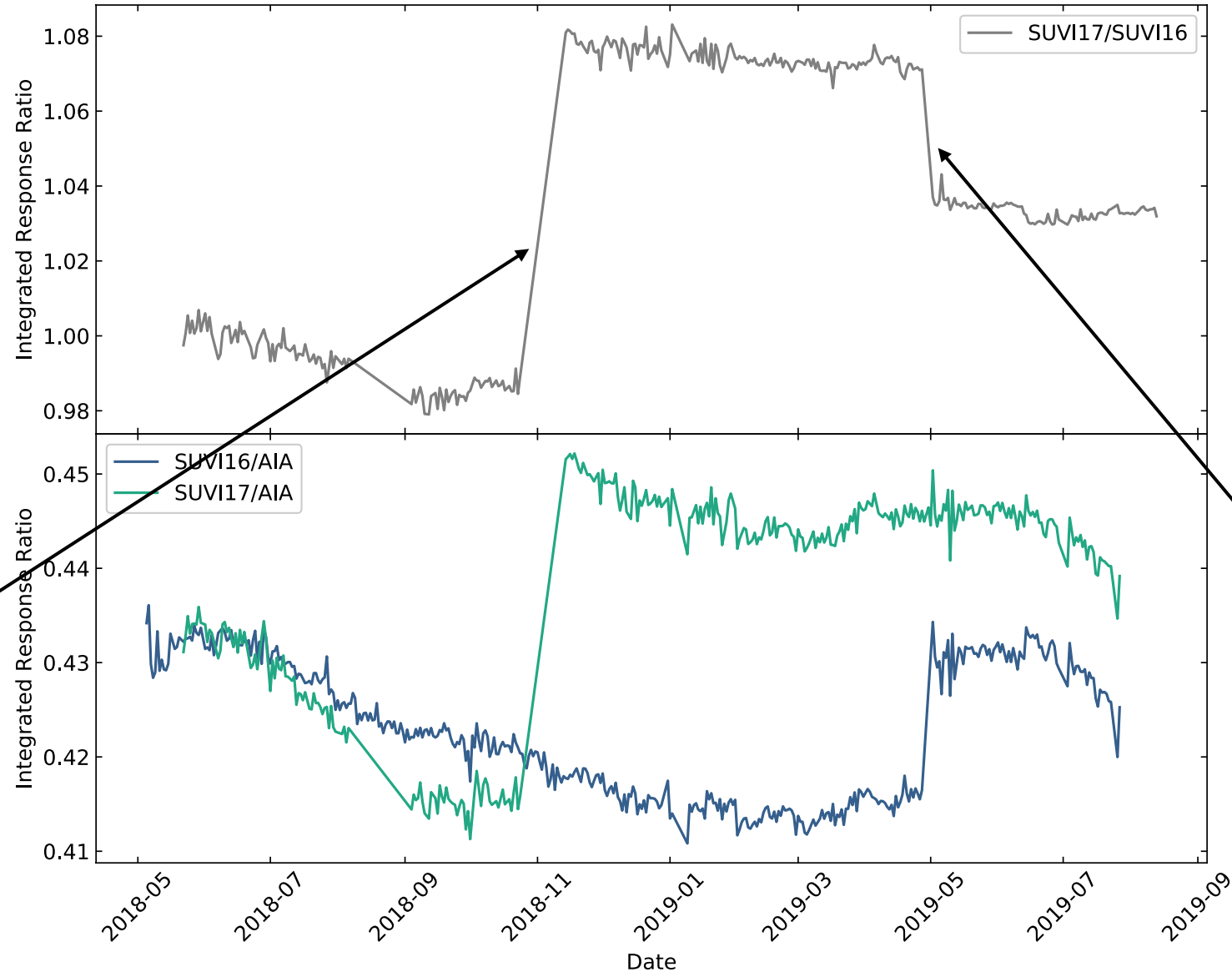
SUVI 16/17 and AIA passbands largely agree (with exception of 131 A)

Comparison of SUVI 16 and 17 and AIA integrated response



304 Å

Comparison of SUVI 16 and 17 and AIA integrated response

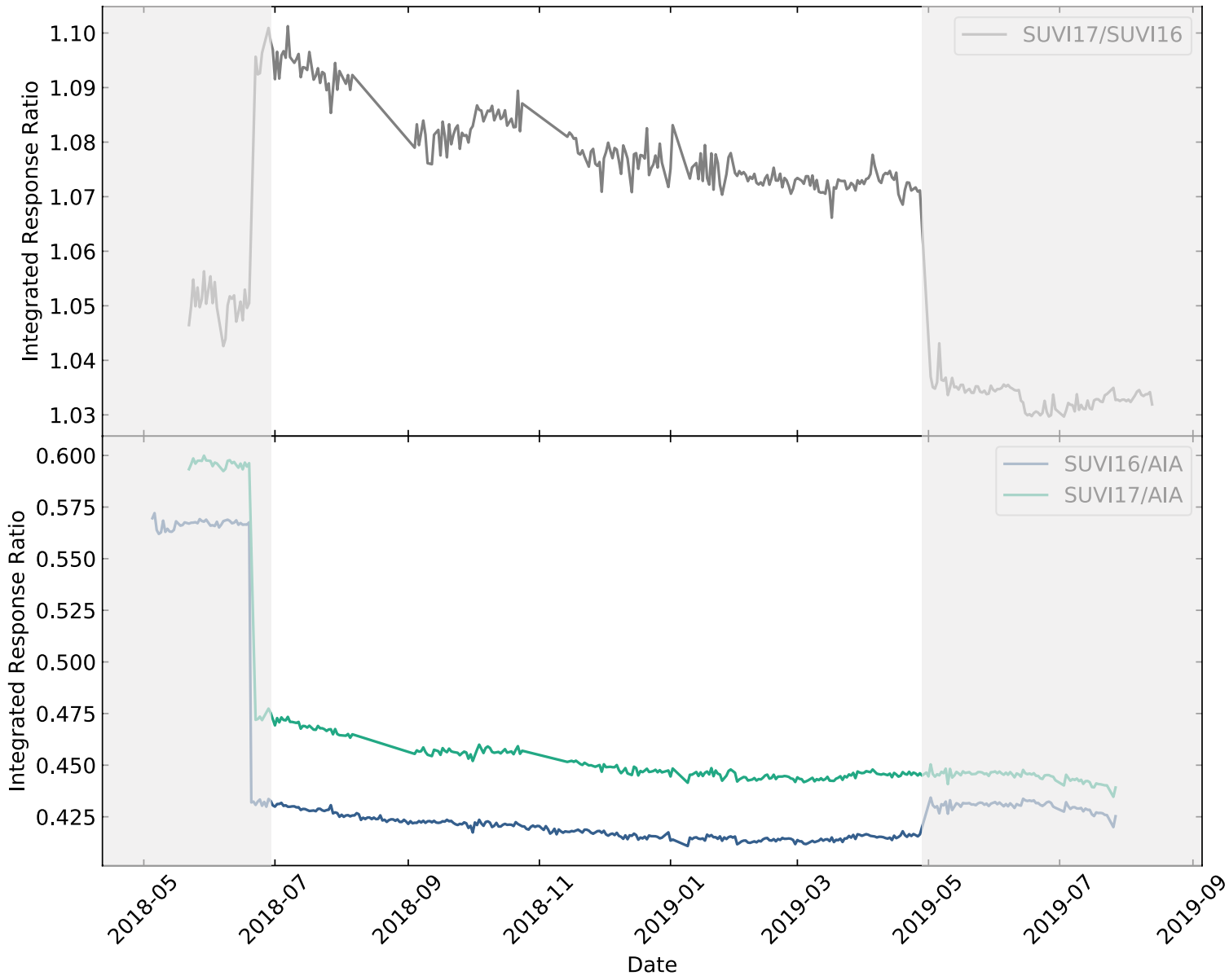


304 Å

Calibration change

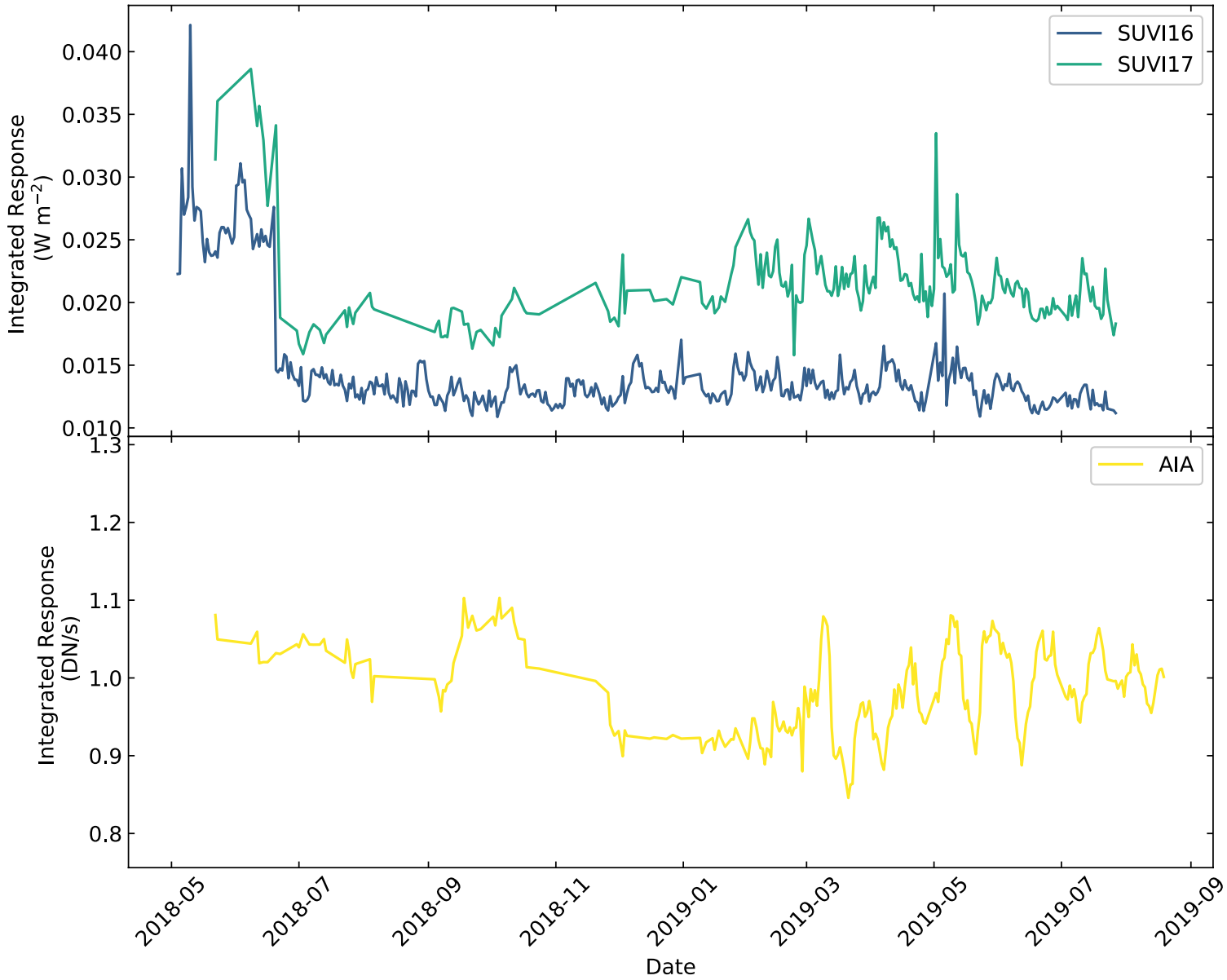
Unknown change

Comparison of SUVI 16 and 17 and AIA integrated response



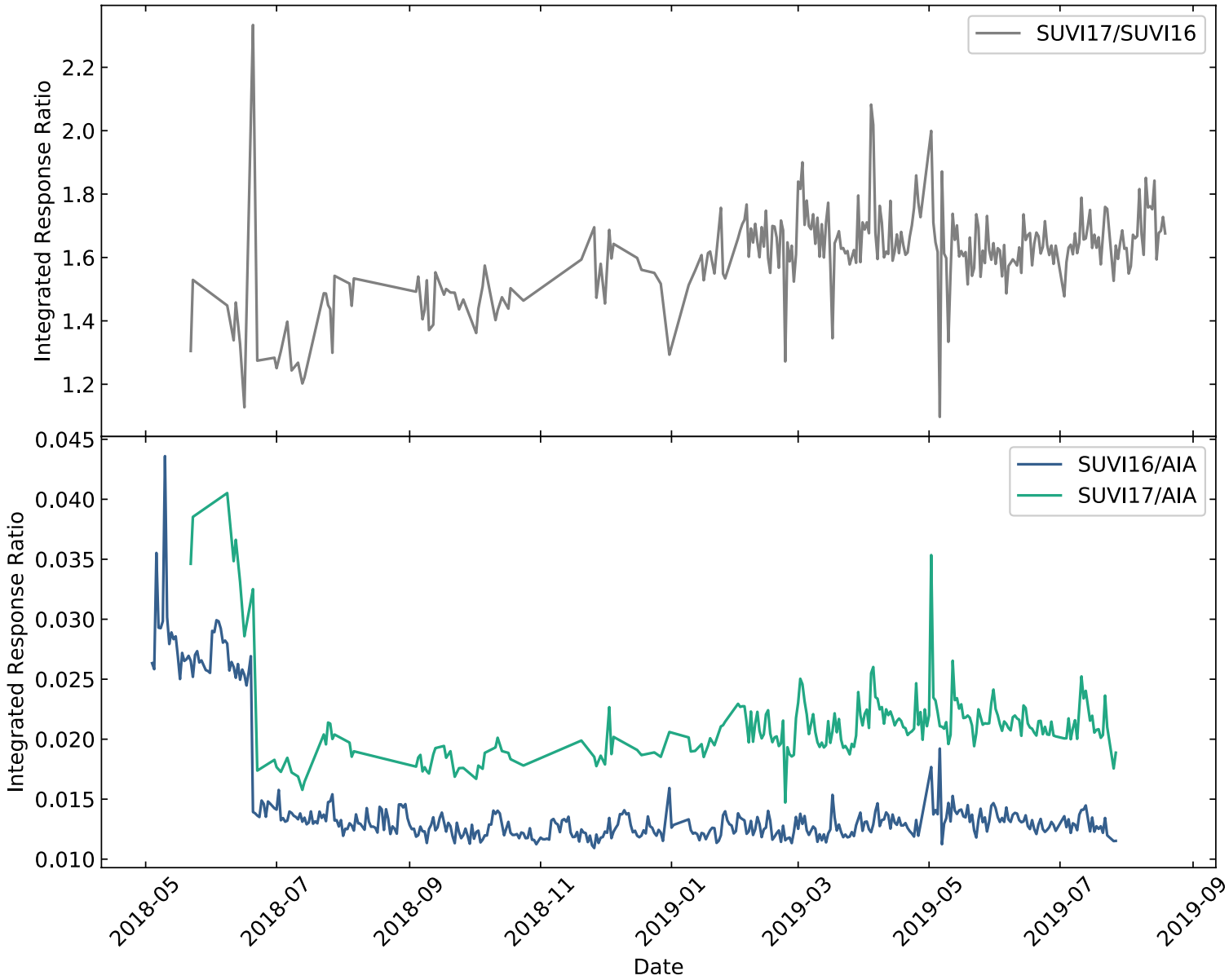
304 Å

Comparison of SUVI 16 and 17 and AIA integrated response



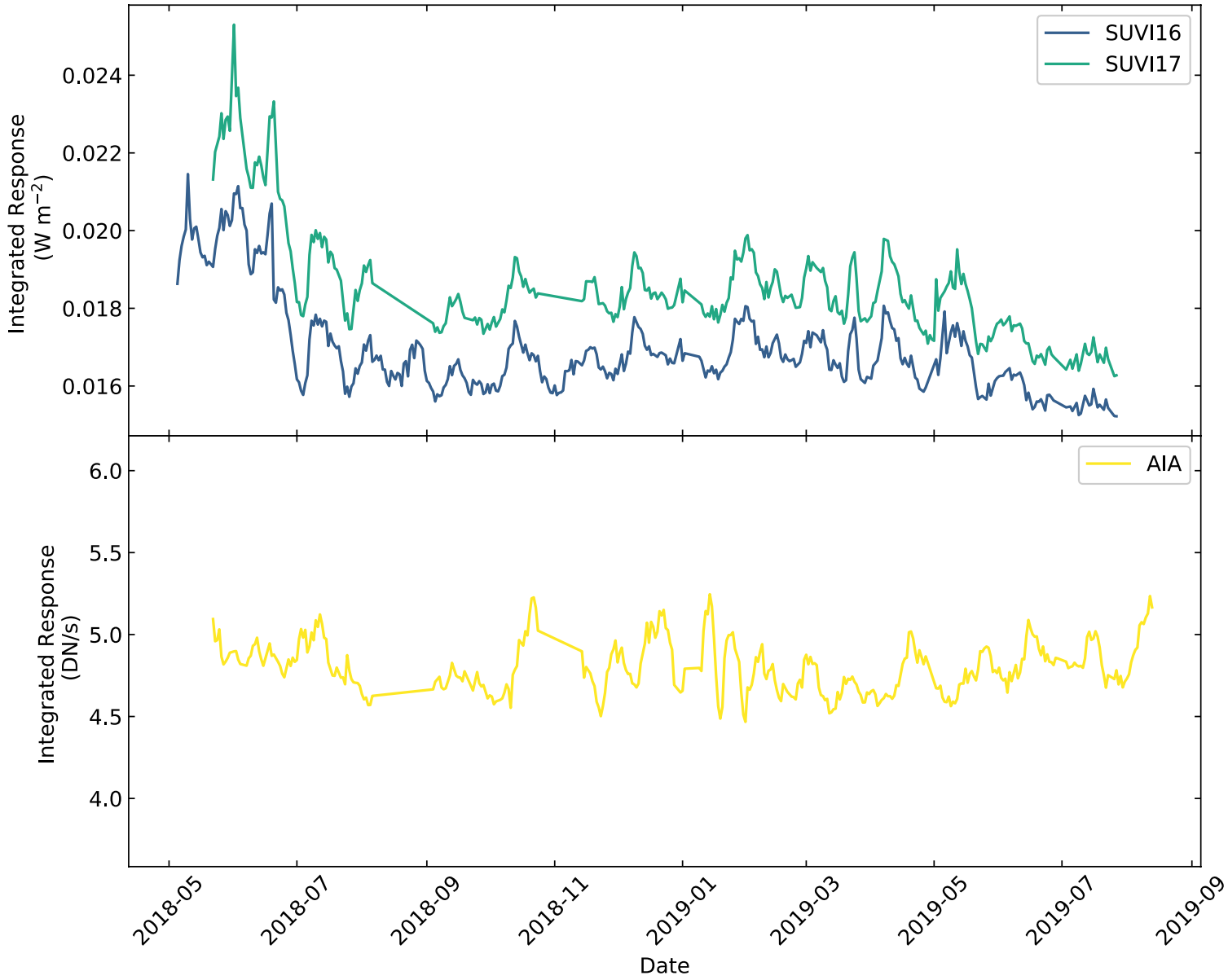
94 Å

Comparison of SUVI 16 and 17 and AIA integrated response



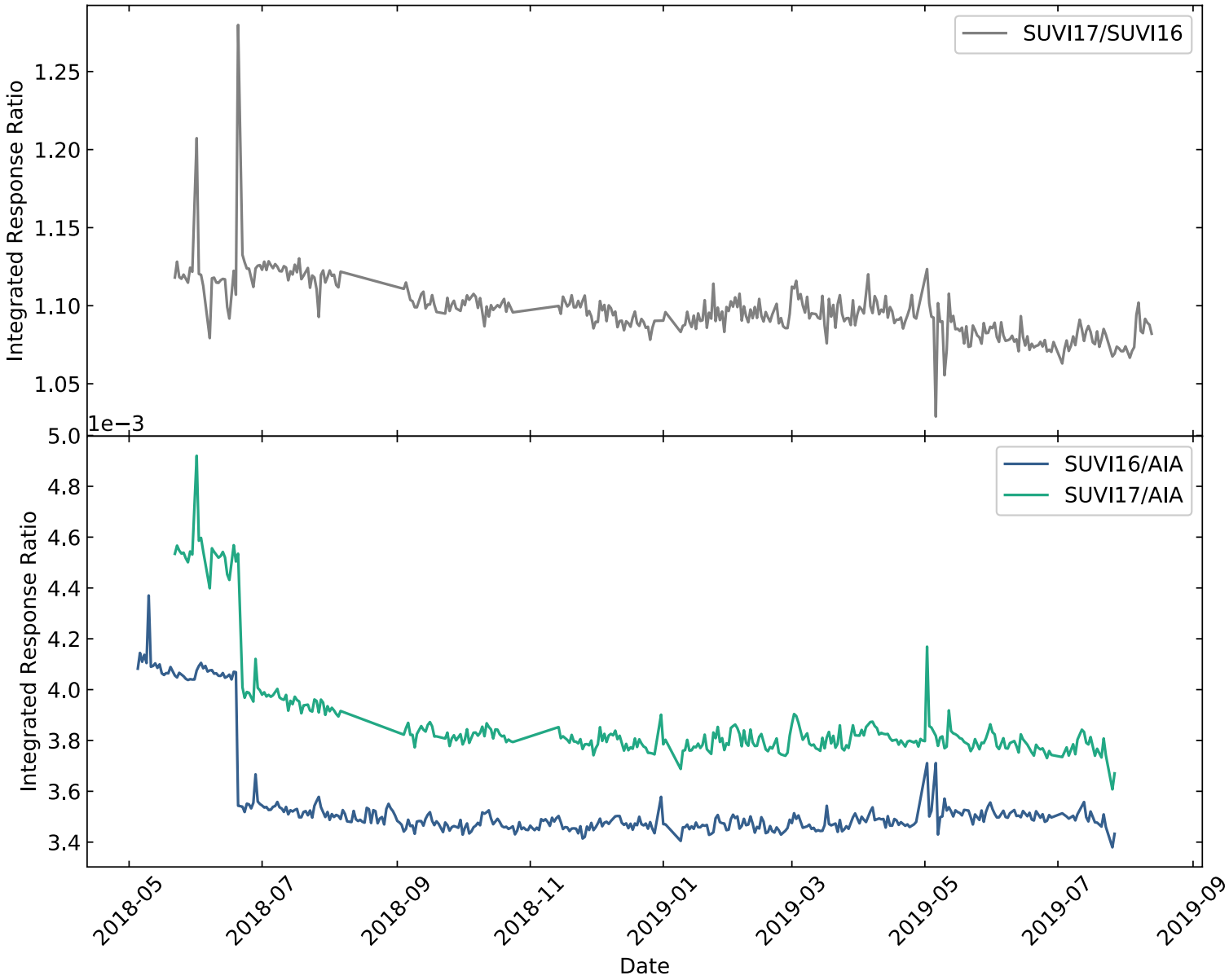
94 Å

Comparison of SUVI 16 and 17 and AIA integrated response



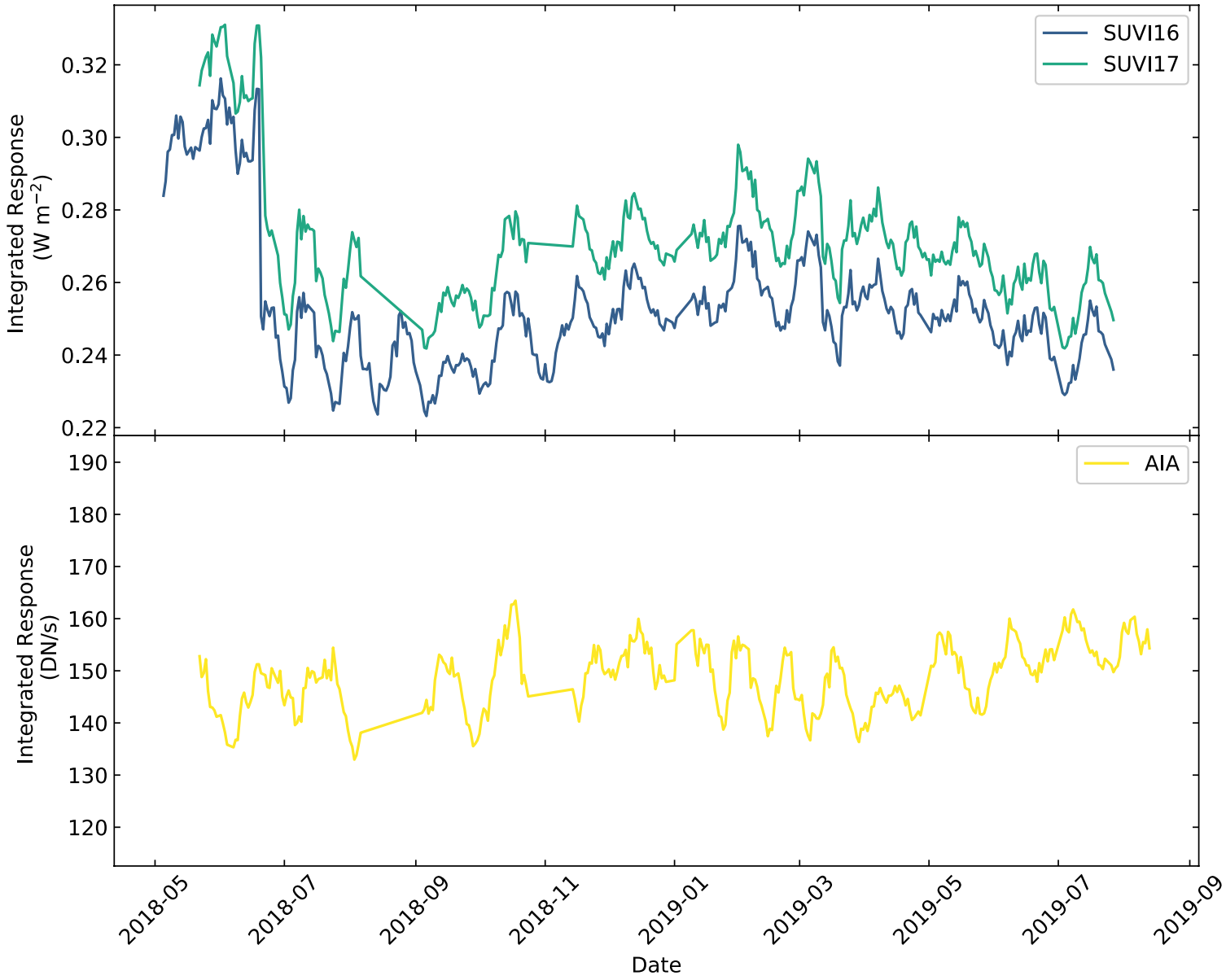
131 Å

Comparison of SUVI 16 and 17 and AIA integrated response



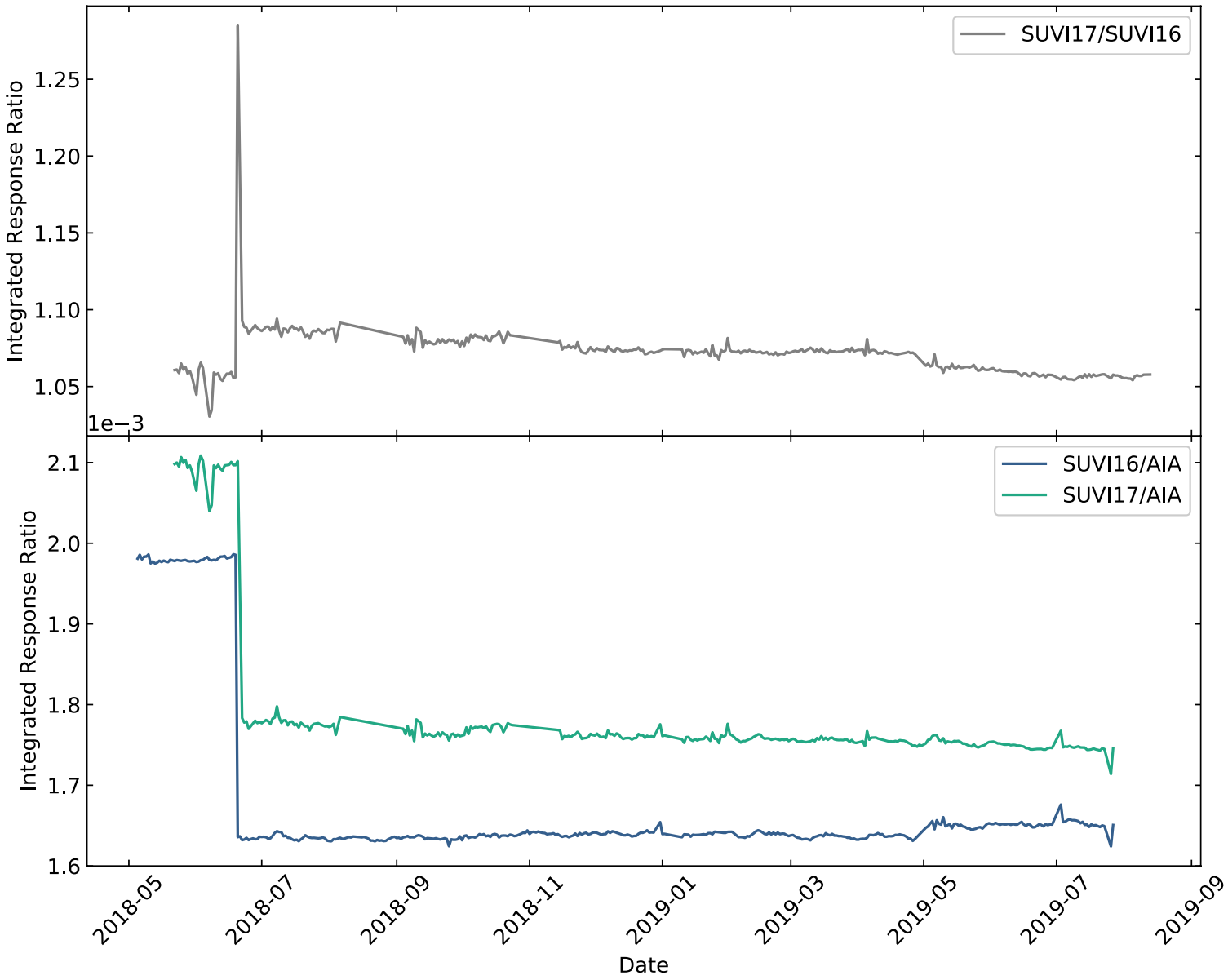
131 Å

Comparison of SUVI 16 and 17 and AIA integrated response



171 Å

Comparison of SUVI 16 and 17 and AIA integrated response



171 Å

Fitting degradation trend between SUVI and AIA
Can we back out the degradation coefficient?

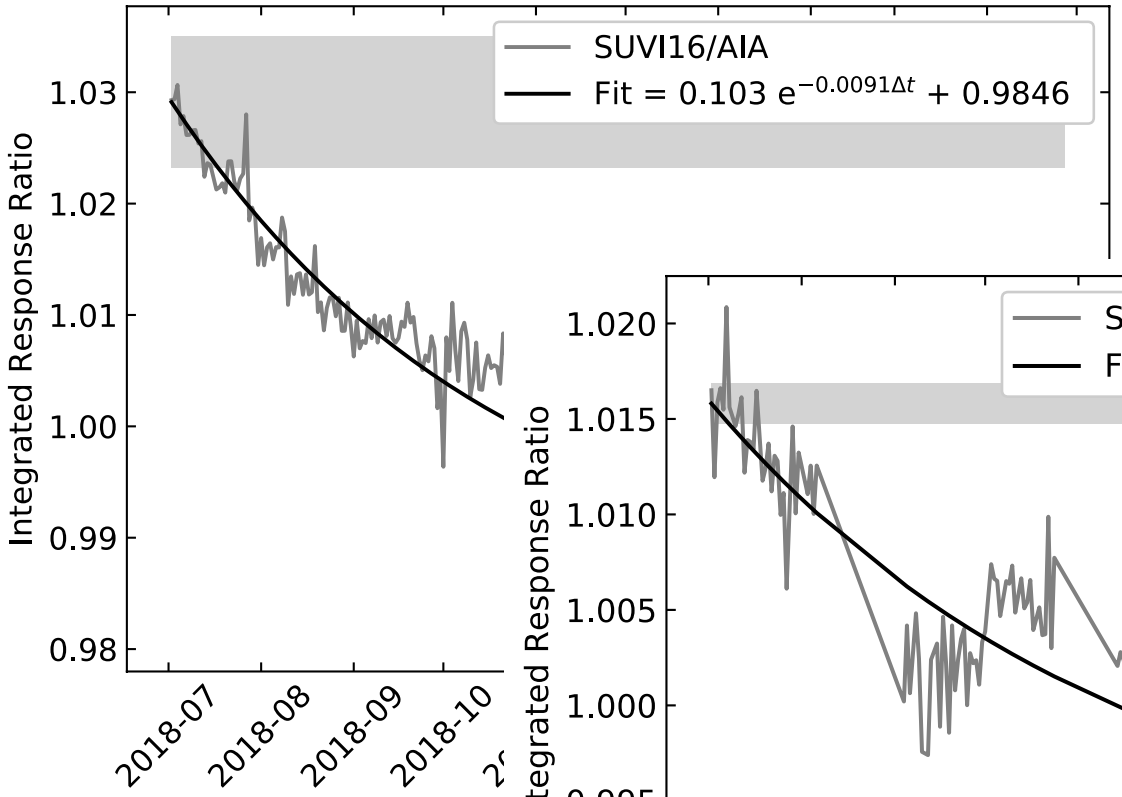
$$\frac{T_1}{T_2} = \frac{T_{i,1} e^{-\tau_1 (t - t_{i,1})}}{T_{i,2} e^{-\tau_2 (t - t_{i,2})}} \qquad \Delta t = t - t_{i,1}$$

$$= \frac{T_{i,1} e^{-\tau_1 (\Delta t)}}{T_{i,2} e^{-\tau_2 (\Delta t + t_{i,1} - t_{i,2})}}$$

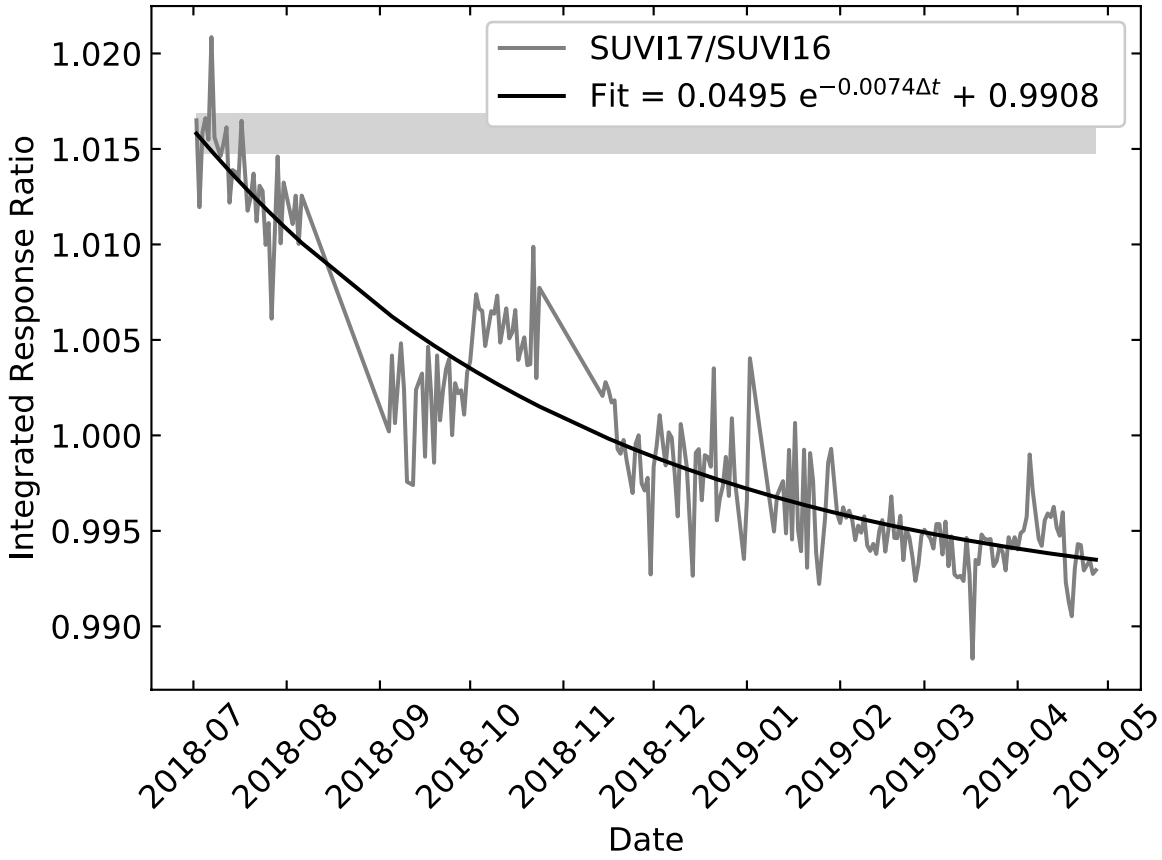
$$\frac{T_1}{T_2} = C e^{-(\tau_1 - \tau_2)\Delta t}$$

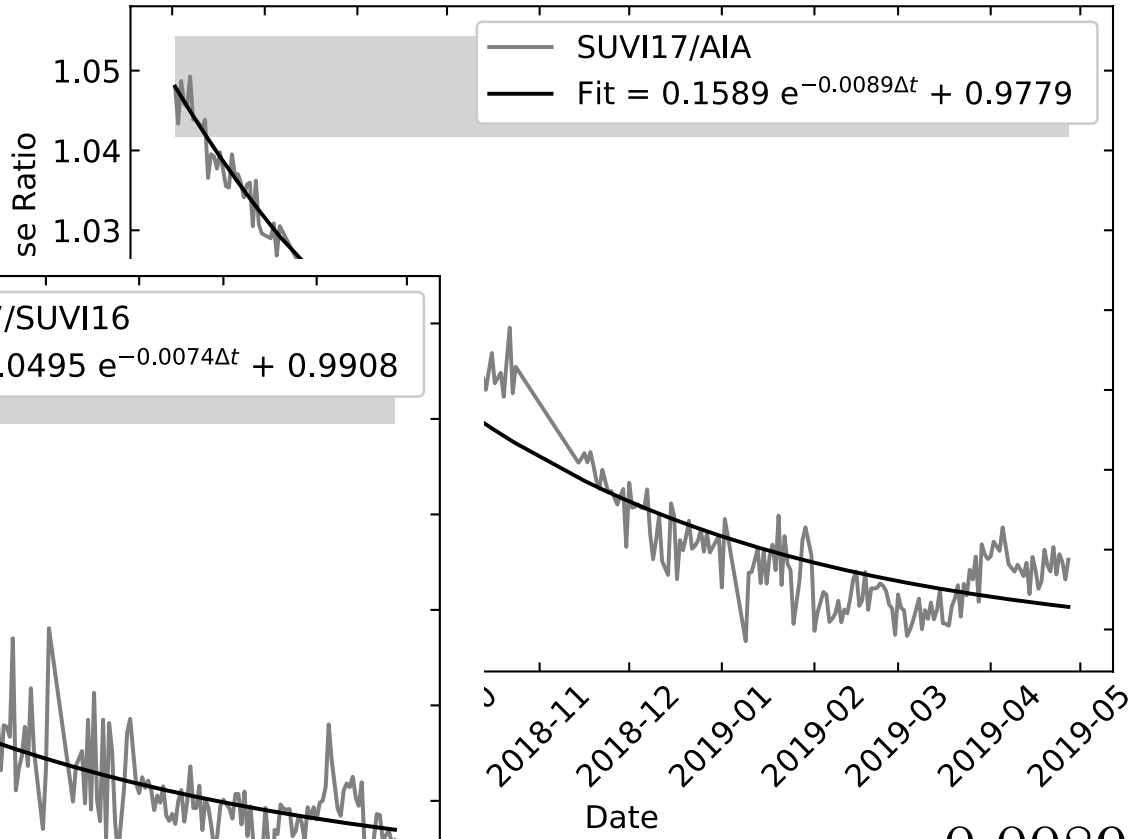
Fitting degradation trend to the data (SUVI 16 to AIA)
Can we back out the degradation coefficient?

304 Å



$\tau_{16} = 0.0091$

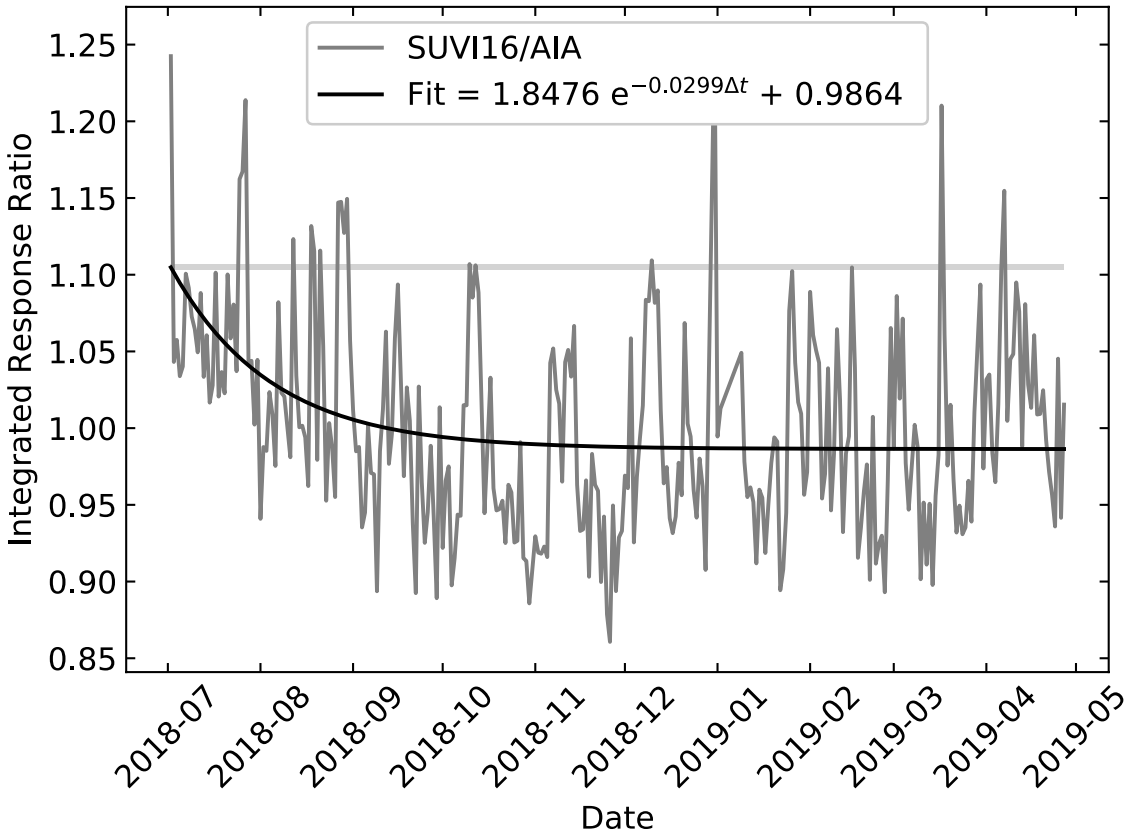




$\tau_{17} = 0.0089$

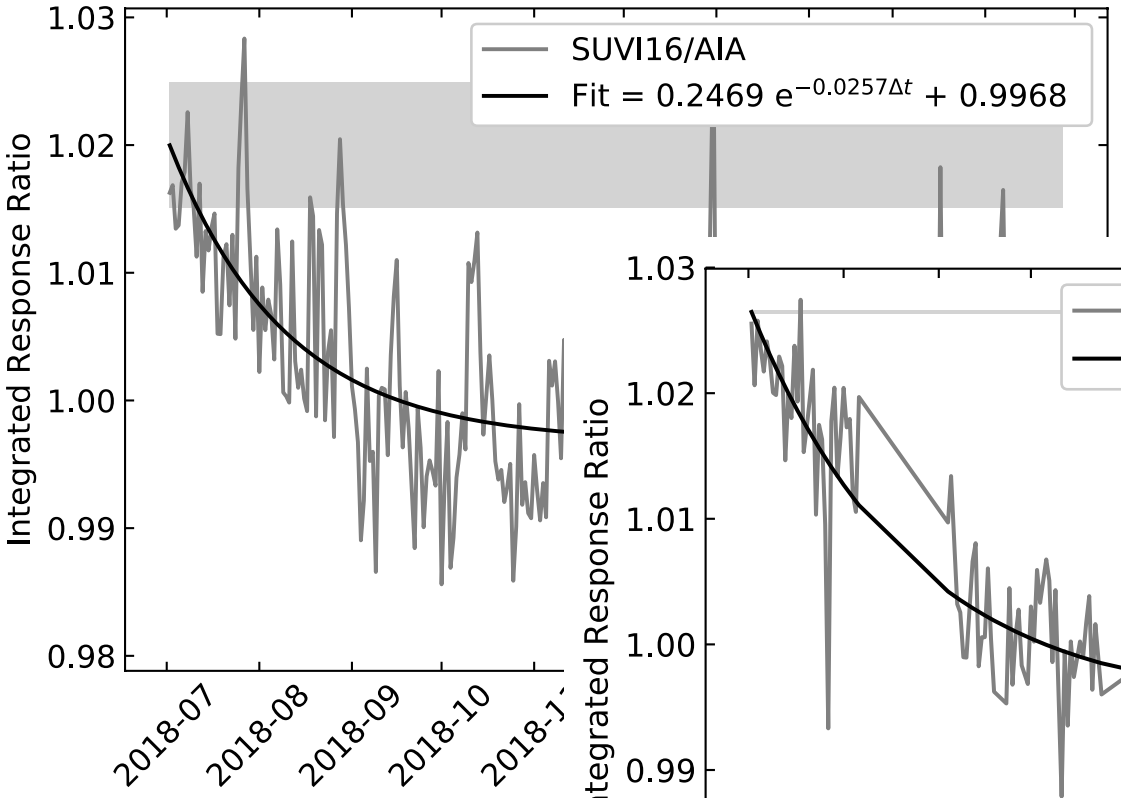
Fitting degradation trend to the data (SUVI 16 to AIA)
Can we back out the degradation coefficient?

94 Å

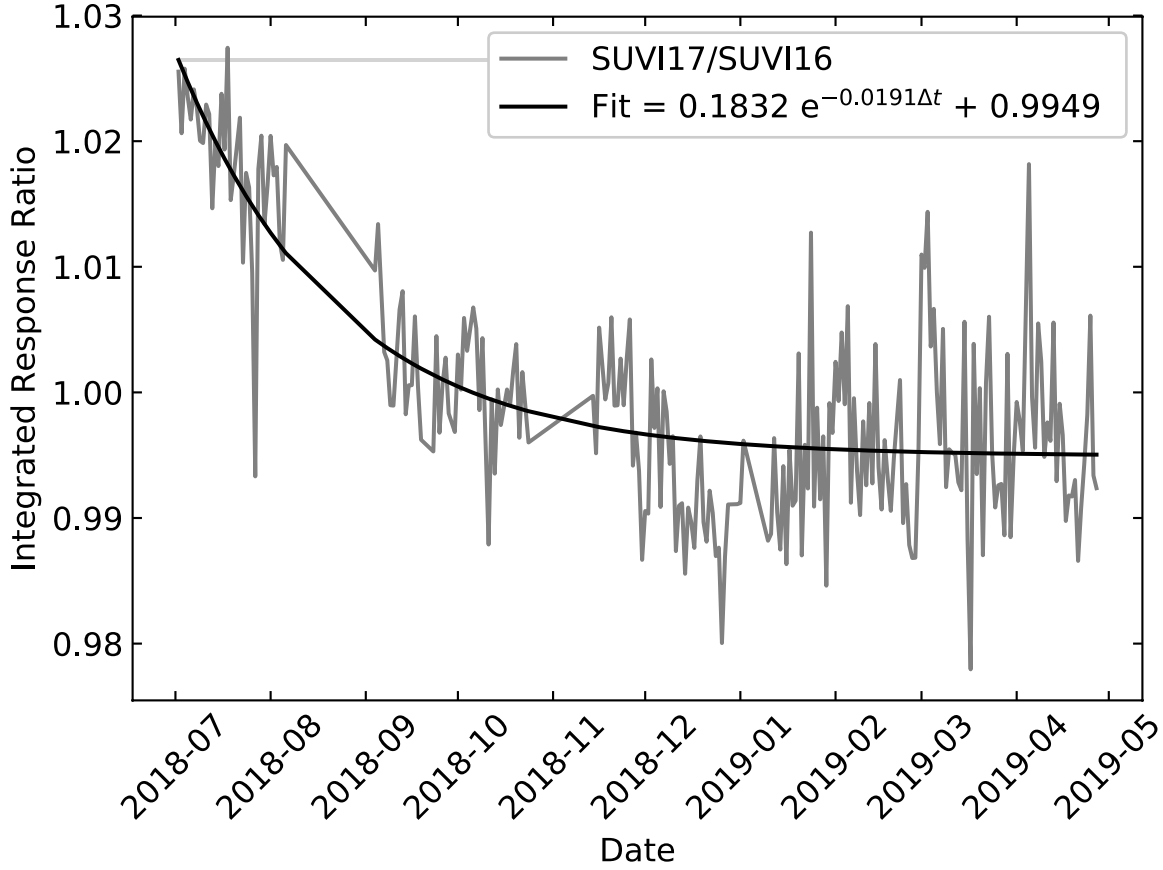


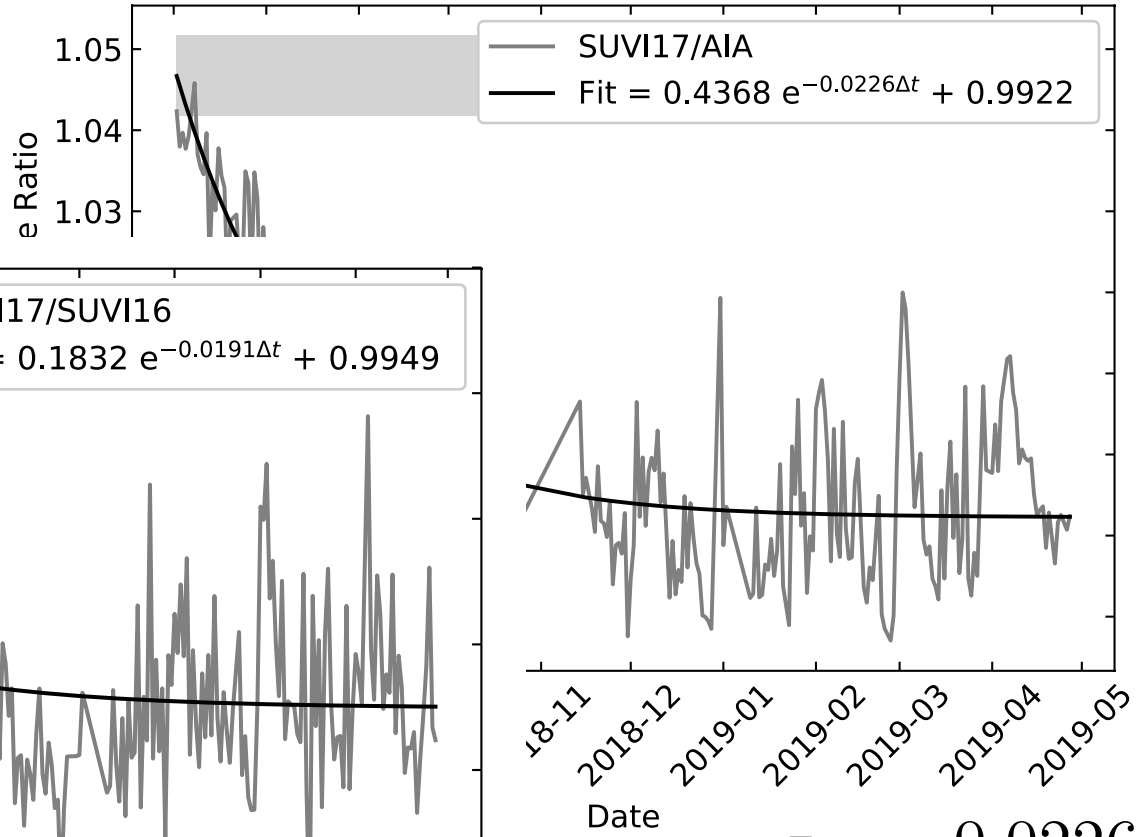
Fitting degradation trend to the data (SUVI 16 to AIA)
Can we back out the degradation coefficient?

131 Å



$\tau_{16} = 0.0257$

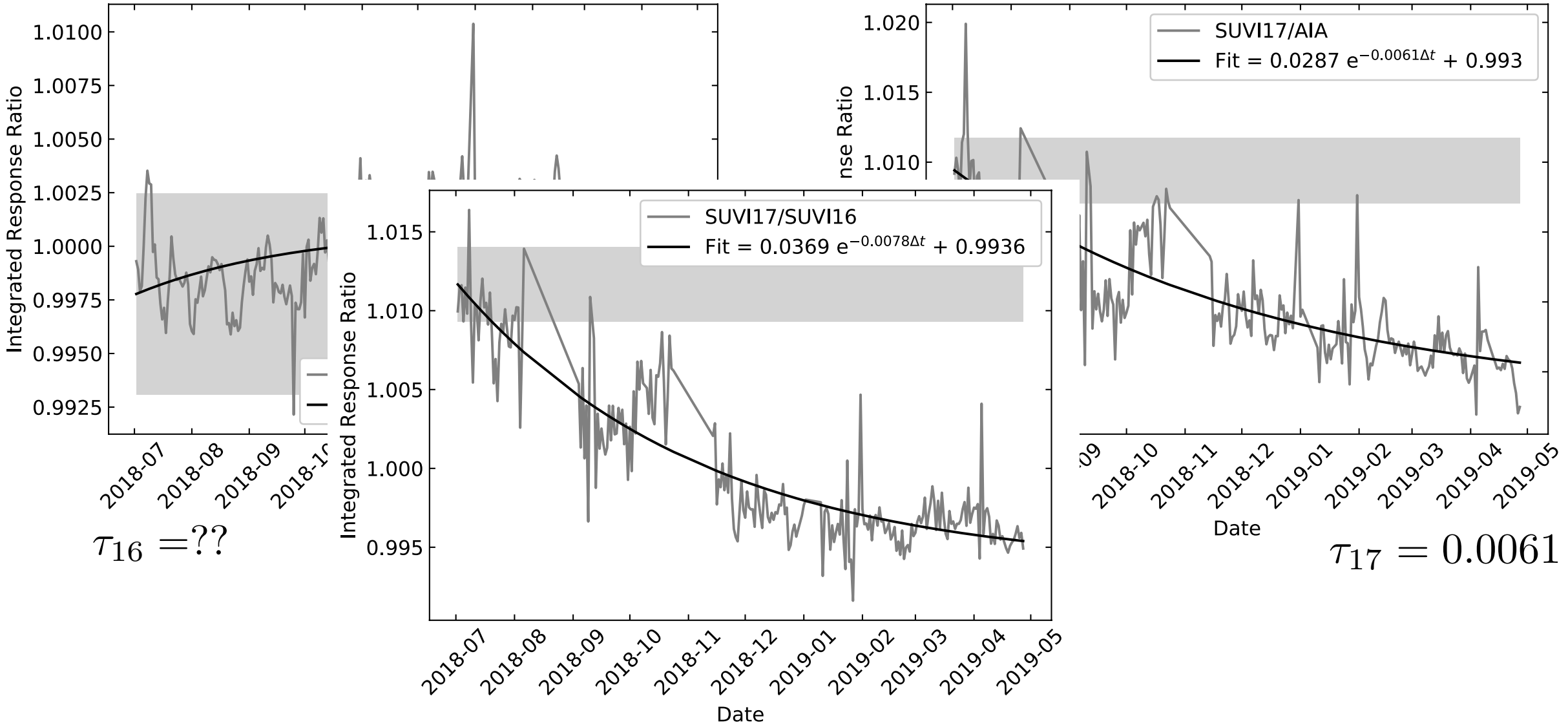




$\tau_{17} = 0.0226$

Fitting degradation trend to the data (SUVI 16 to AIA)
Can we back out the degradation coefficient?

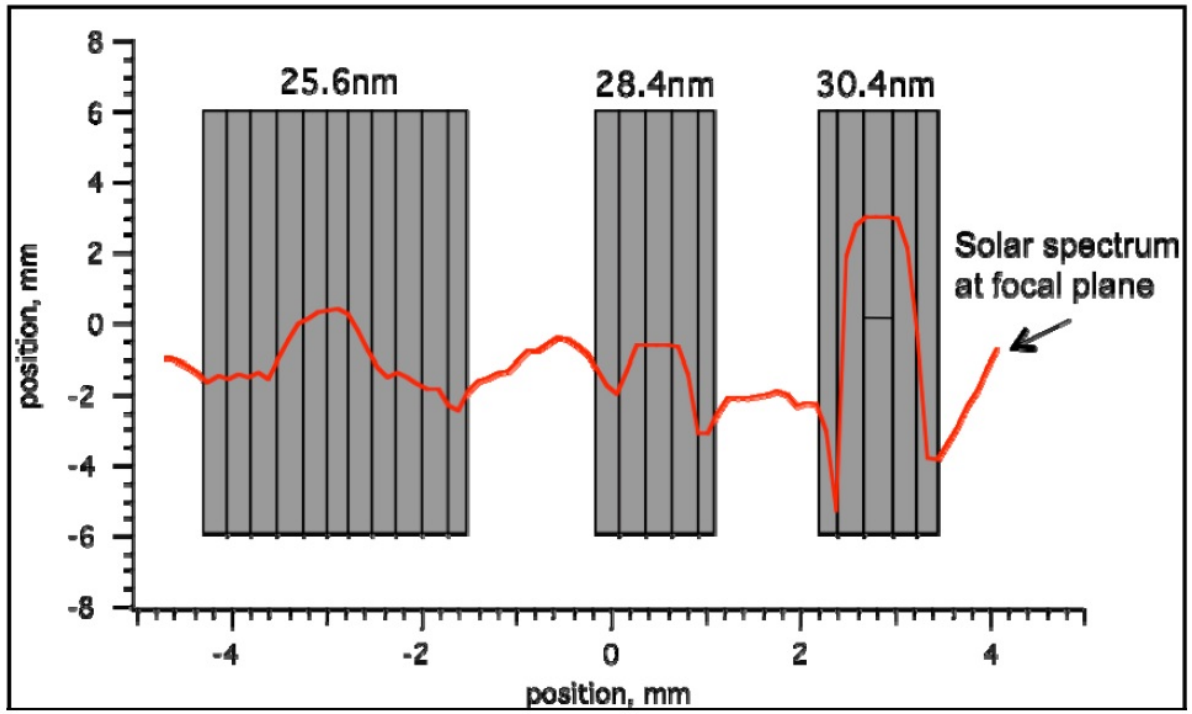
171 Å

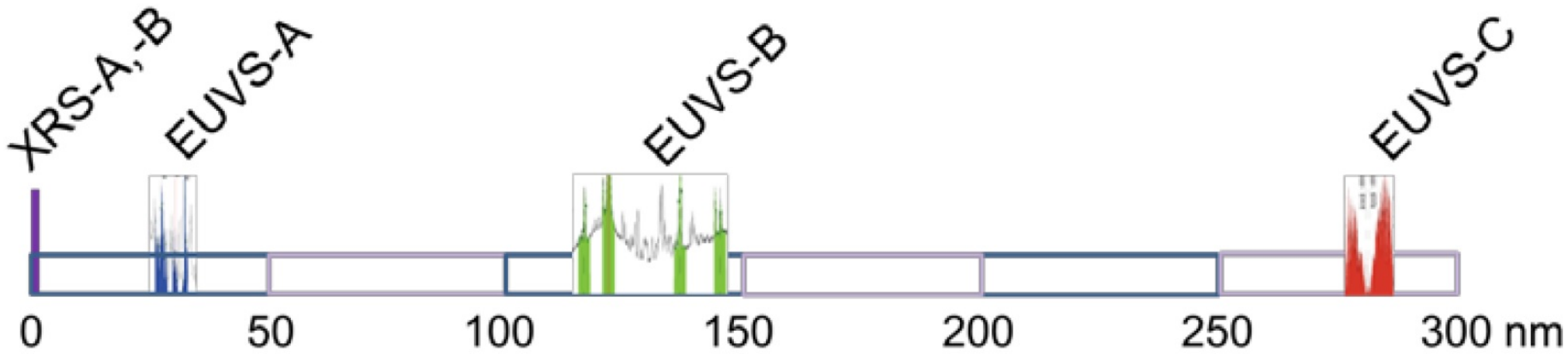


$\tau_{16} = ??$

$\tau_{17} = 0.0061$

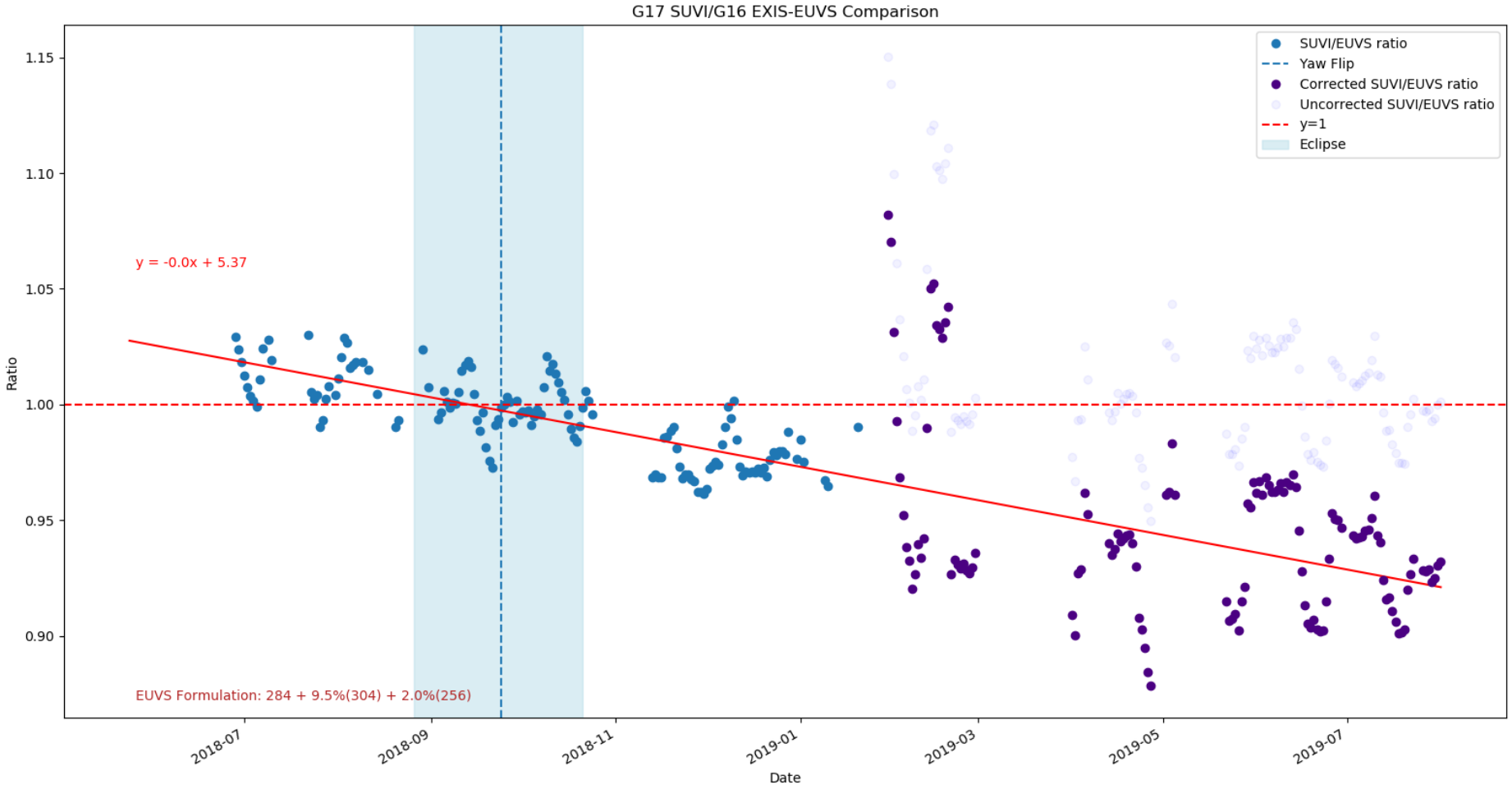
Comparison of SUVI 16 and 17 and EUVS





Comparison of SUVI 17 and EUVS

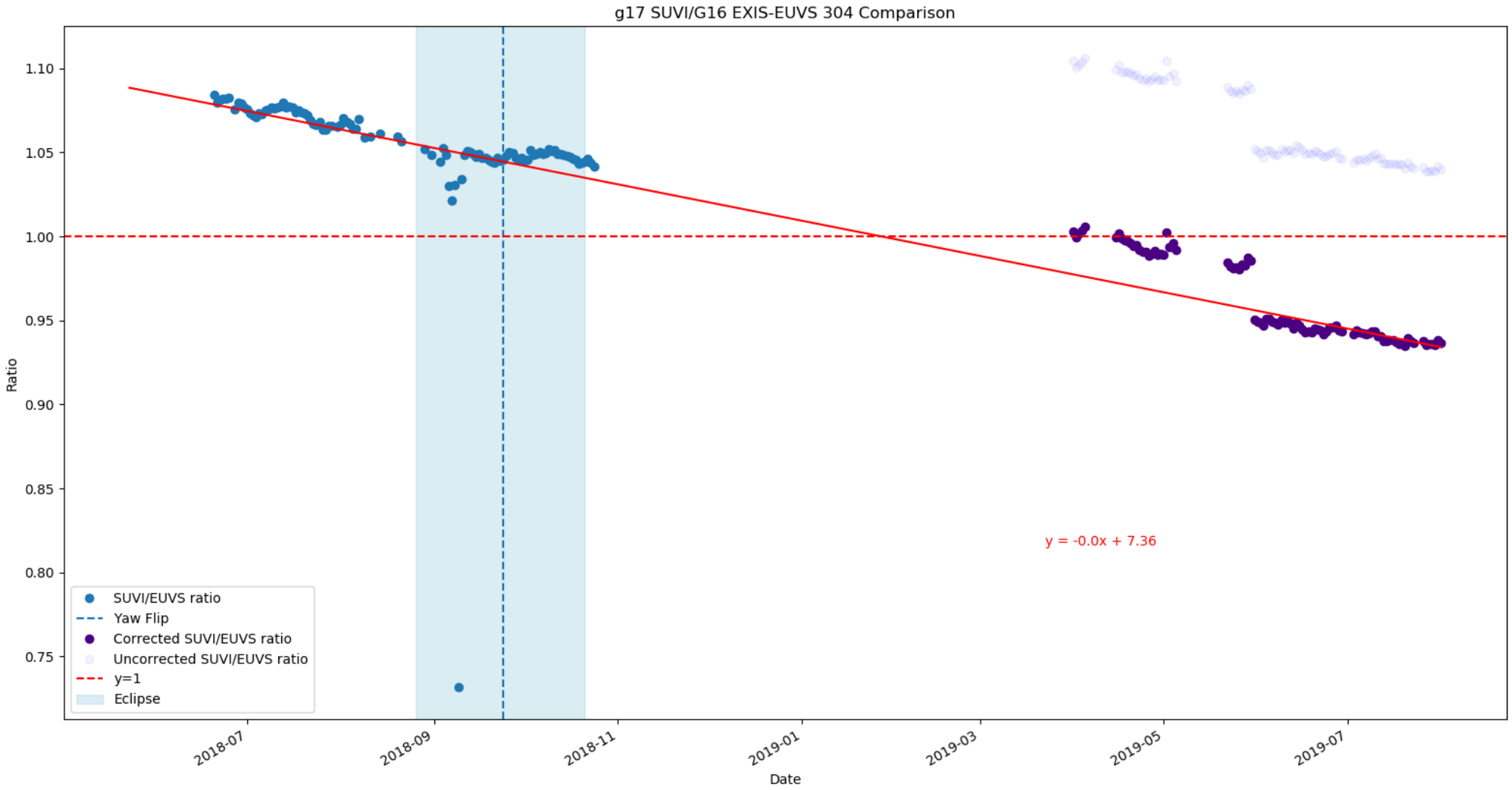
284 Å



Calibrated EUVS data courtesy of Don Woodraska

Comparison of SUVI 17 and EUVS

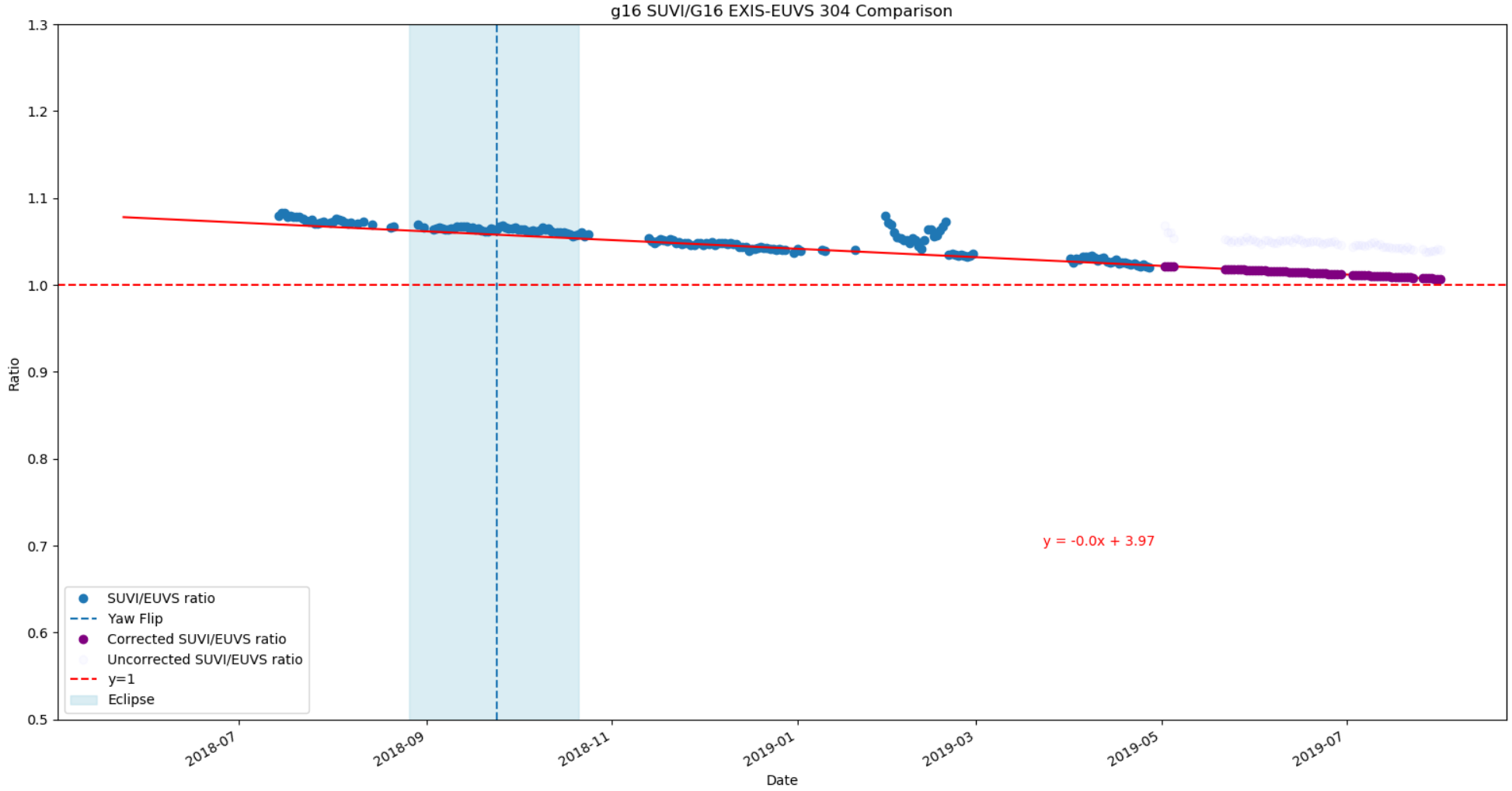
304 Å



Calibrated EUVS data courtesy of Don Woodraska

Comparison of SUVI 16 and EUVS

304 Å



Calibrated EUVS data courtesy of Don Woodraska

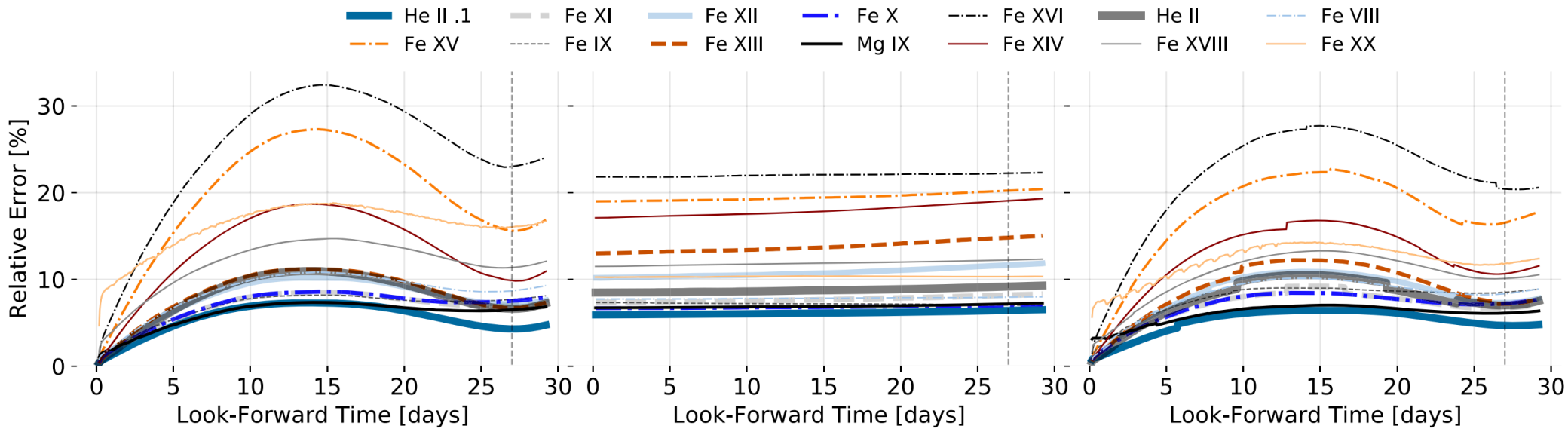
Comparison of SUVI 16 and 17 with EVE rocket underflights

June 17, 2018

	SUVI 16 L1b	Rocket conv SUVI 16	% Difference		SUVI 17 L1b	Rocket conv SUVI 17	% Difference
94 Å	1.80E+06	7.73E+05	132.86%		2.40E+06	5.91E+05	306.09%
131 Å	1.50E+07	1.44E+07	4.17%		1.57E+07	1.30E+07	20.77%
171 Å	2.80E+08	2.99E+08	-6.35%		2.80E+08	2.50E+08	12.00%
195 Å	1.51E+08	1.54E+08	-1.95%		1.77E+08	1.35E+08	31.11%
284 Å	3.40E+07	3.30E+07	3.03%		4.00E+07	3.60E+07	11.11%
304 Å	2.00E+08	1.61E+08	24.22%		2.00E+08	1.55E+08	29.03%

Future plans?

Machine learning



Galvez et al. 2019

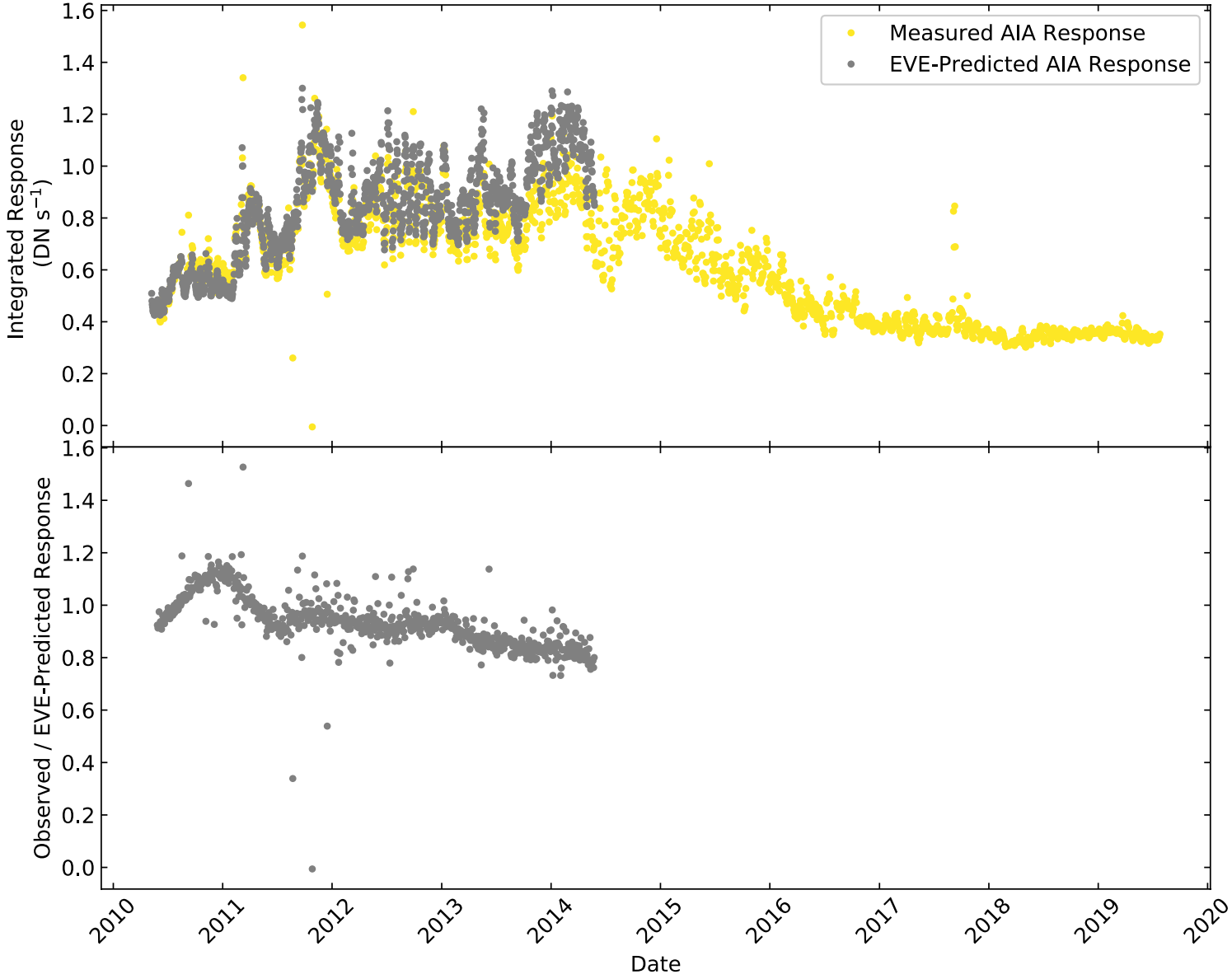
Comparison between unsigned B flux and 304 Å

Reprocessing SUVI and EUVS data for more reliable comparisons

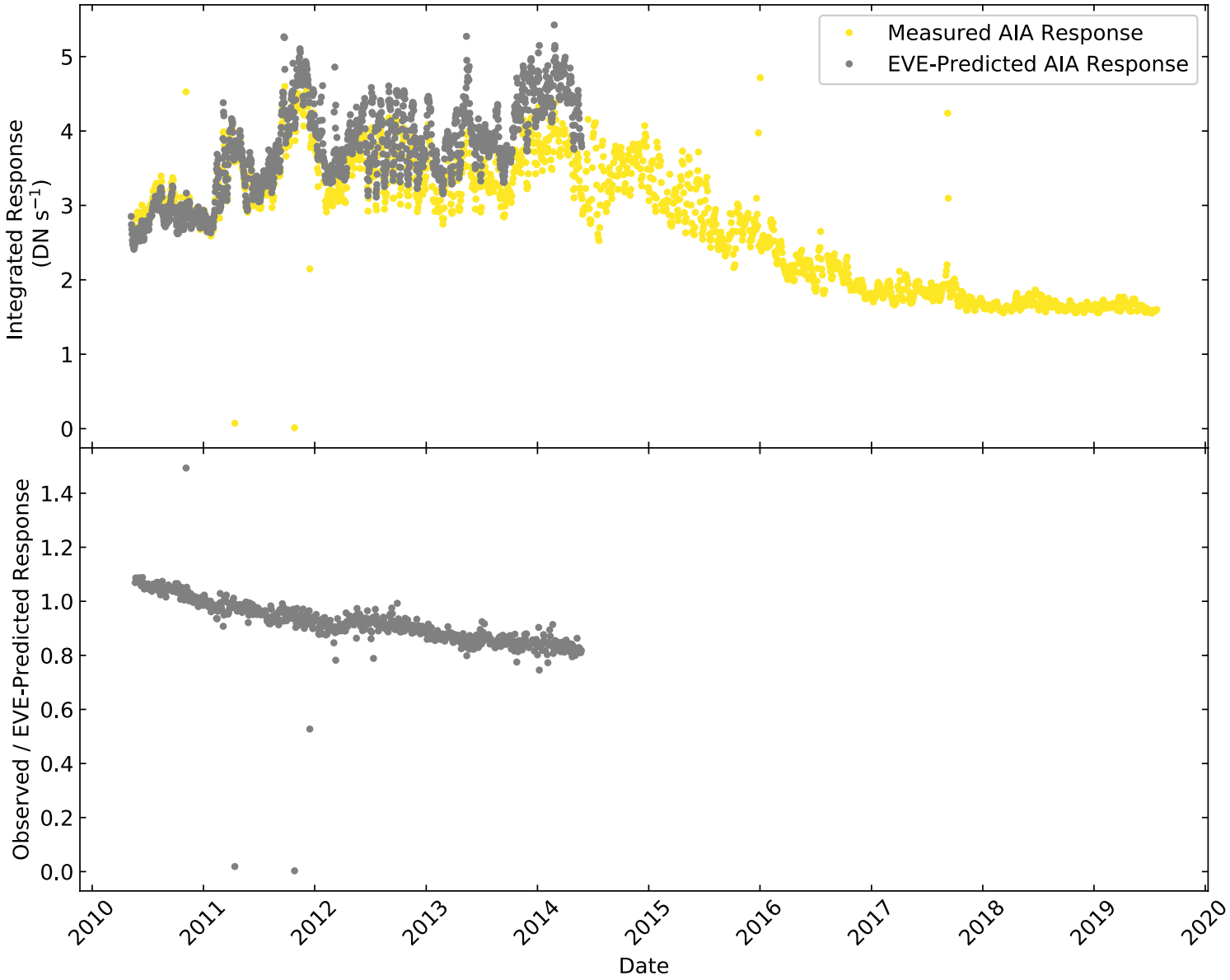
Extra Slides

AIA degradation and EVE integrated response comparison

94 Å



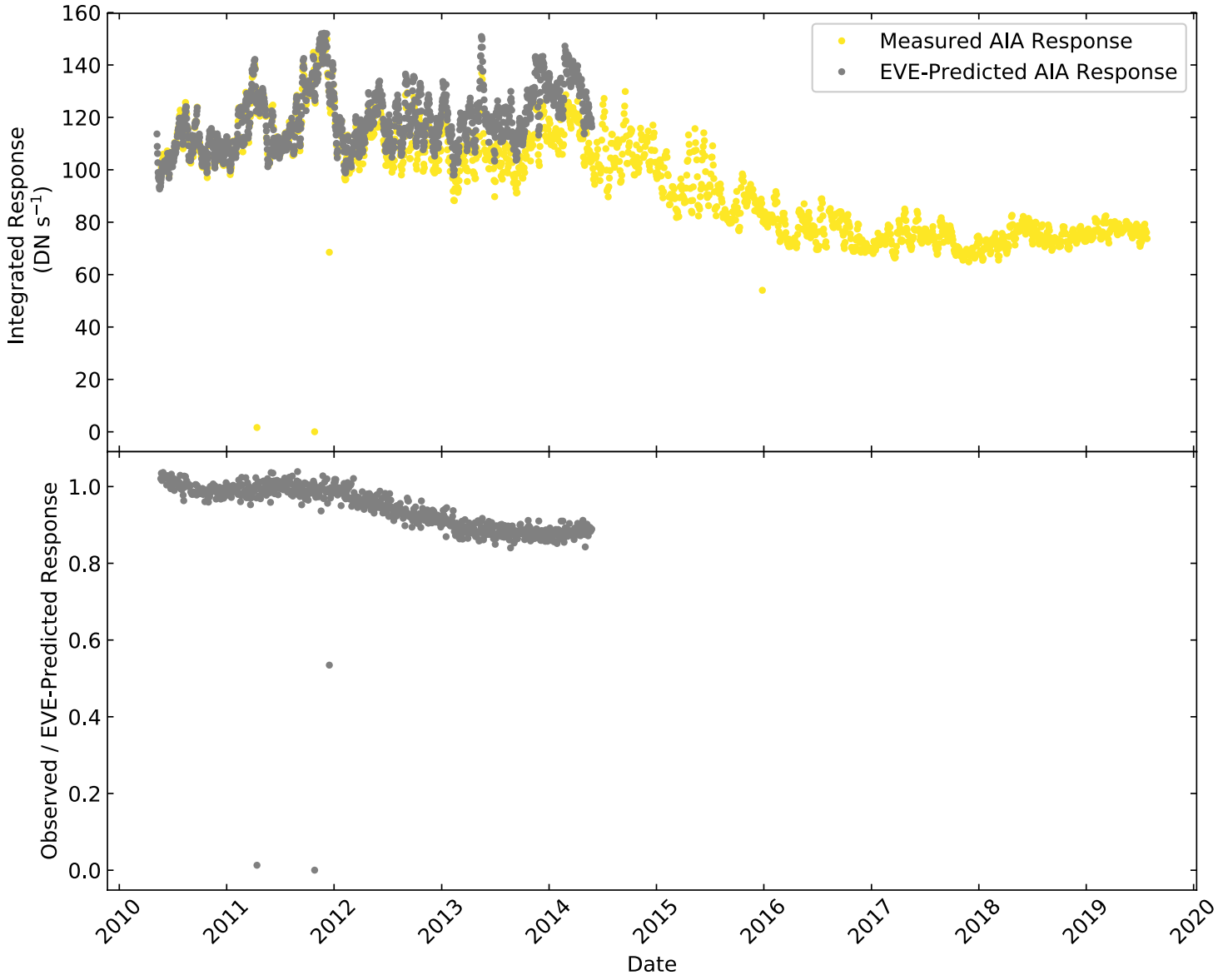
AIA degradation and EVE integrated response comparison



131 Å

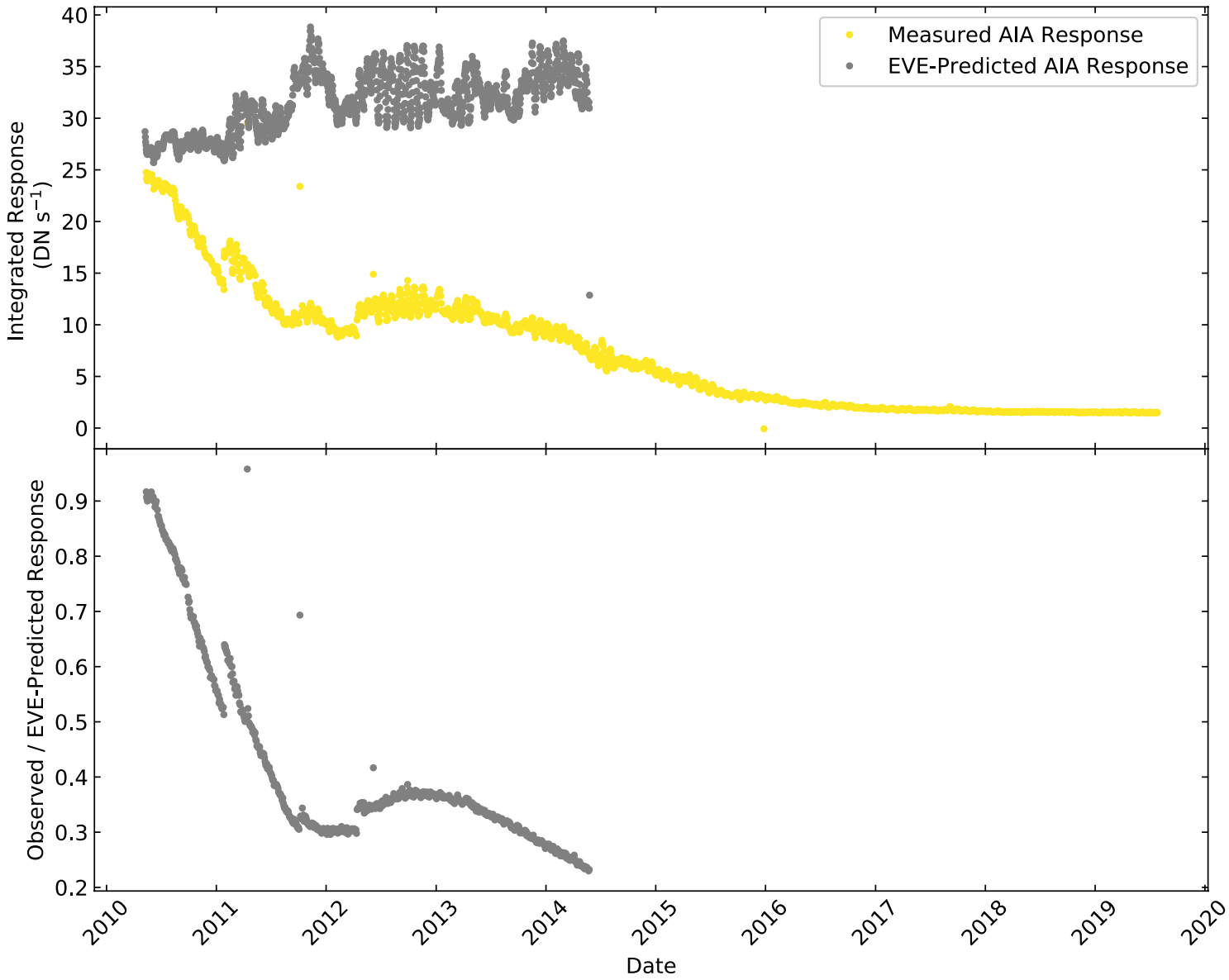
AIA degradation and EVE integrated response comparison

171 Å



AIA degradation and EVE integrated response comparison

304 Å



SUVI 16 and 17 effective area change