Solar Dynamics Observatory (SDO) Extreme Ultraviolet Variability Experiment (EVE): Release notes for version 5 science data products

Level 2 Science Data Products

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Introduction

EVE level 2 data files were created at the Laboratory for Atmospheric and Space Physics in Boulder, Colorado for the NASA Solar Dynamics Observatory (SDO) Extreme Ultraviolet Variability Experiment (EVE). The Science Processing and Operations Center (SPOC) is responsible for creating and maintaining access to all EVE products.

This is a new release of EVE Level 2 data products. We have made every effort at verification and validation, but if you have any questions or encounter any problems with the data, please let us know about them.
For access and data product issues please contact Don.Woodraska@lasp.colorado.edu.
For science issues please contact Frank.Eparvier@lasp.colorado.edu.

Responsible Data Usage:

SDO Mission scientific and model results are open to all, however users should contact the PI or designated EVE team member early in an analysis project to discuss appropriate use of instrument data results. Appropriate acknowledgement to institutions, personnel, and funding agencies should be given. Version numbers should also be specified. Pre-prints of publications and conference abstracts should be widely distributed to interested parties within the mission.

Reference Publications

More information about the EVE instrument measurements, and calibrations can be found in these references:

Woods, T. N., F. G. Eparvier, R. Hock, A. R. Jones, D. Woodraska, D. Judge, L. Didkovsky, J. Lean, J. Mariska, H. Warren, D. McMullin, P. Chamberlin, G. Berthiaume, S. Bailey, T. Fuller-Rowell, J. Sojka, W. K. Tobiska, and R. Viereck, "Extreme Ultraviolet Variability Experiment (EVE) on the Solar Dynamics Observatory (SDO): Overview of Science Objectives, Instrument Design, Data Products, and Model Developments", *Solar Physics, 275*, 115-143, doi: 10.1007/s11207-009-9487-6, 2012. http://lasp.colorado.edu/home/eve/files/2011/06/EVE_Overview_SolarPhys.pdf

Hock, R. A., P. C. Chamberlin, T. N. Woods, D. Crotser, F. G. Eparvier, D. L. Woodraska, and E. C. Woods, "Extreme Ultraviolet Variability Experiment (EVE) Multiple EUV Grating Spectrographs (MEGS): Radiometric Calibrations and Results", *Solar Physics, 275*, 145-178, doi: 10.1007/s11207-010-9520-9, 2012.

http://lasp.colorado.edu/home/eve/files/2011/06/Final_Sol_Phy_Hock_1April_2010.pdf

Didkovsky, L., D. Judge, S. Wieman, T. Woods, and A. Jones, "EUV SpectroPhotometer (ESP) in Extreme Ultraviolet Variability Experiment (EVE): Algorithms and Calibrations", *Solar Physics, 275*, 179-205, doi: 10.1007/s11207-009-9485-8, 2012.

Level 2 Science Products

Two types of EVE level 2 products are routinely created: **Spectra** (EVS) and **Lines** (EVL). Level 2 spectra are the merged spectral measurements from the two spectrographs, MEGS A and B. The A detector is designed to measure from 6-17 nm, and 17-37 nm using two filters, while the B detector is designed to measure 37-106 nm. Level 2 processing stitches these pieces to form one spectrum. This version includes all of measured wavelengths spanning 5.8-106.2 nm. All level 2 irradiances are adjusted to 1 AU. Level 2 line files contain selected lines derived form the level 2 spectra, ESP diode values and bands that correspond to other SDO instruments and some derived proxies.

For an in-depth discussion of EVE instrumentation please visit http://lasp.colorado.edu/home/eve/science/instrument/.

Naming Convention

Level 2 products follow this naming convention
`EV?_L2_YYYYDDD_HH_vvv_rr.fit` where:
 `EV` designates this as an EVE product
 `?` is either S (spectrum) or L (lines/bands)
 `L2` designates this as a level 2 product
 `YYYY` is the year
 `DDD` is the day of year (001-366)
 `HH` is the UT hour of day (00-23)
 `vvv` is the version number (005)
 `rr` is the revision number (01-99)

The version number only increments after major software changes or after major calibration updates. These are expected to change after the incorporation of each suborbital rocket calibration flight. When referencing EVE data in scientific papers, users agree to mention this version number.

The revision increments whenever updated information are available. Generally, revision 1 is considered "preliminary". After 30 days, products become "definitive" since no new telemetry can be delivered after this period of time due to finite storage capacity of the SDO ground station. For most days, revision 1 will be the final revision, but newer revisions take precedence over older ones if they exist.

Level 2 Lines/Bands Products

The EVE level 2 line files contain 6 header data units, containing data and corresponding information pertaining to 30 extracted solar emission lines. Each file contains one hours worth of observations with each observation being reported at the instruments nominal integration time of 10 seconds, except the 4 Hz ESP diode values that are averaged to 10 seconds to correspond with other EVE instrument observations.

The LinesMeta data unit contains information about lines derived from the EVE level 2 spectrum. It contains wave length information describing the line, line temperature, the line name, line type, and other lines included within the wavelength band of the line as described in the following table.

LinesMeta:

Column Name	Type	Description
wave_center	Float	Center wavelength of line
wave_min	Float	Minimum wavelength of line
wave_max	Float	Maximum wavelength of line

LogT	Float	Log (base 10) temperature of line (K)
Name	String	Line name example (Fe XVIII)
Type	String	Type of line example (F)
Blend	String	Other lines included in this line

The BandsMeta data unit describes the extracted bands from the EVE spectrum that correspond to the 7 AIA spectral bands, two GOES-14 bands, 4 extracted MEGS spectral bands corresponding to the ESP diodes, two very broadbands used for creating the Q_{EUV} proxy, two MEGS-A broadbands representing each slit, and 3 MEGS-B bands. The BandsMeta data unit is described in the following table.

BandsMeta:

Column Name	Type	Description
Name	String	Name of the band example (AIA_304)
Type	String	SDO instrument example (AIA)

The DiodeMeta data unit contains information about spectral bands derived from EVE level 2 spectra that corresponds to measurements made by EVE diodes from ESP and MEGS P. The diode measurements (ESP and MEGS-P) are averaged down to the 10-second spectrum cadence from the 4 Hz measurements to create a more convenient way to compare the data to other measurements. The DiodeMeta data unit is described in the following table.

DiodeMeta:

Column Name	Type	Description
Name	String	Name of the band example (171)
Type	String	SDO instrument example (ESP)

The ESP central quad diode contains information about the center of brightness for the 0.1-7 nm bandpass. These are normalized to provide a relative measure of the distribution of irradiance. During flare periods, the difference of flare and pre-flare measurements indicates the flare position.

QuadMeta:

Column Name	Type	Description
Name	String	Name of the band example (Q0)
Type	String	SDO instrument example (ESP)

The LinesDataUnits data unit contains unit information for corresponding entries in the LinesData data unit. The contents of the data unit are described in the table below.

LinesDataUnits:

Column Name	Type	Description
TAI	String	seconds // International Atomic Time seconds since Jan 1, 1958 at center of integration
YYYYDOY	String	NA // 4-digit year and 3-digit day of year designator with Jan 1=001
SOD	String	seconds // seconds of the UT day at the center of the integration
FLAGS	String	NA // 0=good, other values indicate data may be suspect
SC_FLAGS	String	NA // 0=good, other value indicate spacecraft events like eclipses, lunar transits, etc
Line_Irradiance	String	W m^-2 // Power per unit area at 1-AU over the integrated line with no background subtraction, MEGS-A provides the spectrum shorter than 37 nm and MEGS-B longer than 37 nm
Line_Precision	String	NA // relative precision
Line_Accuracy	String	NA // relative accuracy
Band_Irradiance	String	Mixed: W m^-2 or avg counts AIApixel^-1 second^-1 // Power per unit area at 1-AU over the integrated band with MEGS-A providing the spectrum shorter than 37 nm and MEGS-B longer than 37 nm, not
Band_Precision	String	NA // relative precision
Band_Accuracy	String	'NA // relative accuracy
Diode_Irradiance	String	W m^-2 // Power per unit area at 1-AU measured by the diode
Diode_Stdev	String	NA // relative one-sigma spread of 4 hz integrations over the 10 second window
Diode_Precision	String	NA // relative precision
Diode_Accuracy	String	Relative accuracy of diode measurements
Quad_Fraction	String	NA // fraction of the 0.1-7 nm irradiance in each of the quadrant diodes with the sum=1., useful for finding location of center of irradiance
Quad_Stdev	String	NA // relative one-sigma spread of 4 Hz integrations over the 10 second window
Quad_Precision	String	Relative precision of quadrant diode measurements
Quad_Accuracy	String	Relative accuracy of quadrant diode measurements

The LinesData data unit contains the actual science measurements for the observation period for lines, bands and diodes. The diode measurements are averaged to 10 seconds to provide measurements at the same cadence as the line and band measurements.

LinesData:

Column Name	Type	Description
TAI	Double	International Atomic Time of center of observation
YYYYDOY	Long	Year and day of year of observation

SOD	Double	Seconds of day of the center of observation
FLAGS	Byte	EVE specific flags †
SC_FLAGS	Byte	SDO specific flags †
Line_Irradiance	Float	An array of irradiance values. One value per line. ‡
Line_Precision	Float	An array of precision values. One value per line.
Line_Accuracy	Float	An array of accuracy values. One value per line.
Band_Irradiance	Float	An array of irradiance values. One value per band.
Band_Precision	Float	An array of precision values. One value per band.
Band_Accuracy	Float	An array of accuracy values. One value per band.
Diode_Irradiance	Float	An array of irradiance values. One value per diode. ‡
Diode_Stdev	Float	An array of standard deviation values. One value per diode.
Diode_Precision	Float	An array of precision values. One value per diode.
Diode_Accuracy	Float	An array of accuracy values. One value per diode.
Quad_Fraction	Float	The fractional amount of the diode per total of all quad diodes
Quad_Stdev	Float	The standard deviation of the observations for the diode
Quad_Precision	Float	The precision of the observations for the diode
Quad_Accuracy	Float	The accuracy of the observations for the diode

†
There are two sets of flags included. One is EVE-specific flags, and the other is Spacecraft flags. Generally, any flags being set mean some data are missing or possibly suspect. The following tables describe the values for each bit in the flag.

Values in the FLAGS field are the bitwise OR of these values.

Bit 0 (value 1)	MEGS-A data is missing
Bit 1 (value 2)	MEGS-B data is missing
Bit 2 (value 3)	ESP data is missing
Bit 3 (value 4)	MEGS-P data is missing
Bit 4 (value 5)	Possible clock adjust in MEGS-A
Bit 5 (value 6)	Possible clock adjust in MEGS-B
Bit 6 (value 7)	Possible clock adjust in ESP
Bit 7 (value 8)	Possible clock adjust in MEGS-P

Values in the SC_FLAGS field are the bitwise OR of these values.

Bit 0 (value 1)	4-bit obstruction indicator (0 is no obstruction)
Bit 1 (value 2)	4-bit obstruction indicator (0 is no obstruction)
Bit 2 (value 4)	4-bit obstruction indicator (0 is no obstruction)
Bit 3 (value 8)	4-bit obstruction indicator (0 is no obstruction)
Bit 4 (value 16)	Observatory is off-pointed by more than 1 arc minute

If more than one obstruction is taking place, only the highest-numbered one will be indicated.
Obstruction flag values:

Value 0	No obstruction
Value 1	Warmup from Earth eclipse
Value 2	Atmosphere penumbra
Value 3	Atmosphere umbra
Value 4	Penumbra of Mercury
Value 5	Umbra of Mercury
Value 6	Penumbra of Venus
Value 7	Umbra of Venus
Value 8	Penumbra of Moon
Value 9	Umbra of Moon
Value 10	Penumbra of solid Earth
Value 11	Umbra of solid Earth

‡
Lines are integrated from low to high bounds, and the 4 Hz photometer data are averaged down to the same time-scale as the spectrum, nominally 10 seconds. No continuum is subtracted from the line irradiances.

Level 2 Spectra Products

The level 2 spectrum files contain 3 header data units, SpectrumMeta, SpectrumUnits and Spectrum. These data units contain the fully calibrated 10-second spectral irradiance values along with supplemental information.

The SpectrumMeta data unit contains two arrays, one being the center wavelengths of each spectral bin. The other array contains the estimate of accuracy of the irradiance on a per bin basis. Note, the accuracy array will be moved to the Spectrum data unit in future versions.

SpectrumMeta:

Column Name	Type	Description
Wavelengths	Float (array)	Center wavelength for each bin
Accuracy	Float (array)	Estimate of accuracy of the irradiance on a per bin basis

The SpectrumUnits data unit provides information on the units for each element in the Spectrum data unit. The table below describes each entry.

SpectrumUnits:

Column Name	Type	Description
TAI	String	seconds // International Atomic Time seconds since Jan 1, 1958 at center of integration
YYYYDOY	String	NA // 4-digit year and 3-digit day of year designator with Jan 1=001
SOD	String	seconds // seconds of the UT day at the center of the integration
FLAGS	String	NA // 0=good, other values indicate data may be suspect
SC_FLAGS	String	NA // 0=good, other value indicate spacecraft events like eclipses, lunar transits, etc
Int_Time	String	seconds // the duration of the exposure
Irradiance	String	W m^-2 nm^-1 // Spectral power per unit area per nanometer at 1-AU with MEGS-A providing the spectrum shorter than 37 nm and MEGS-B longer than 37 nm
Count_Rate	String	counts s^-1 // Dark corrected count rate per pixel per second

Precision	String	NA // relative precision, 0=perfect measurement, 1=signal equals noise, multiply by the irradiance to get units (absolute)
Bin_Flags	String	NA // flag for each spectral bin, 0=good, 255=missing

The Spectrum data unit contains the actual data for the observation period. It holds the irradiance spectrum as well as other values as described in the following table.

Spectrum:

Column Name	Type	Description
TAI	Double	International Atomic Time in seconds at the center of the observation
YYYYDOY	Long	4-digit year and 3-digit day of year of the observation
SOD	Double	Seconds of day for the middle of the observation period
FLAGS	Byte	EVE instrument flags
SC_FLAGS	Byte	Space craft flags
Int_Time	Double	The duration of the exposure
Irradiance	Float	5200 element array containing the irradiance for each bin
Count_Rate	Float	5200 element array containing the count rate on a per bin basis
Precision	Float	5200 element array containing Precision information for each bin
Bin_Flags	Byte	5200 element array containing quality information for each bin

Data Processing

All data products are generated at LASP, and the Level 2 products described in this document are all publicly available at the EVE website. We caution users to carefully consider their data needs. The level 2 products are free for responsible public use; however, downloading the entire dataset is not a good solution for most users. The 2010 dataset comprises approximately 50 GB spread over about 11,000 files, so the speed of an individuals Internet connection should be considered.

FITS Definition and Software

The EVE Level 2 products are stored in the scientific format called FITS as binary tables. FITS was first introduced in 1979. As one of the oldest scientific data formats, it continues to be widely used and expanded.

FITS reference: FITS: A Flexible Image Transport System, Wells, D. C., Greisen, E. W., and Harten, R. H., Astronomy & Astrophysics Supplement Series, 44, 363-370, 1981.
http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=1981A%26AS...44..363W&db_key=AST&high=3db47576cf05627

FITS Binary Table reference: Binary Table Extension to FITS, Cotton, W. D., Tody, D. B., and Pence, W. D., Astronomy & Astrophysics Supplement Series, 113, 159-166, 1995.
http://adsabs.harvard.edu/cgi-bin/nph-bib_query?bibcode=1995A%26AS..113..159C&db_key=AST&high=3db47576cf06210

Additional detailed documentation is available on-line.
http://fits.gsfc.nasa.gov/fits_documentation.html

Standard reader software is available from GSFC for many different languages. A graphical program called "fv" is useful for browsing the contents without writing any programs.
http://heasarc.gsfc.nasa.gov/docs/software/ftools/fv/

LASP provides an IDL function called eve_read_whole_fits.pro which allows easy reading of any EVE data product that is in FITS format. read_whole_fits.pro may be downloaded here
http://lasp.colorado.edu/eve/data_access/software/eve_read_whole_fits.pro.

For IDL, you may also use mrdfits.pro available at:
http://idlastro.gsfc.nasa.gov/mrdfits.html
http://idlastro.gsfc.nasa.gov/fitsio.html

Explanation and Examples in IDL

Level 2 data products are stored in FITS format and may be read by a variety of software, see the documentation section at http://lasp.colorado.edu/home/eve/data/data-access/ for more details. LASP provides an IDL function called eve_read_whole_fits.pro which allows easy reading of any EVE data product that is in FITS format. The software eve_read_whole_fits.pro may be downloaded here http://lasp.colorado.edu/eve/data_access/software/eve_read_whole_fits.pro.

We will use the function in the following examples.

To read in a level 2 data product, simply provide the function with the desired filename.

```
IDL> data = eve_read_whole_fits( 'EVS_L2_2013300_00_005_01.fit.gz' )
```

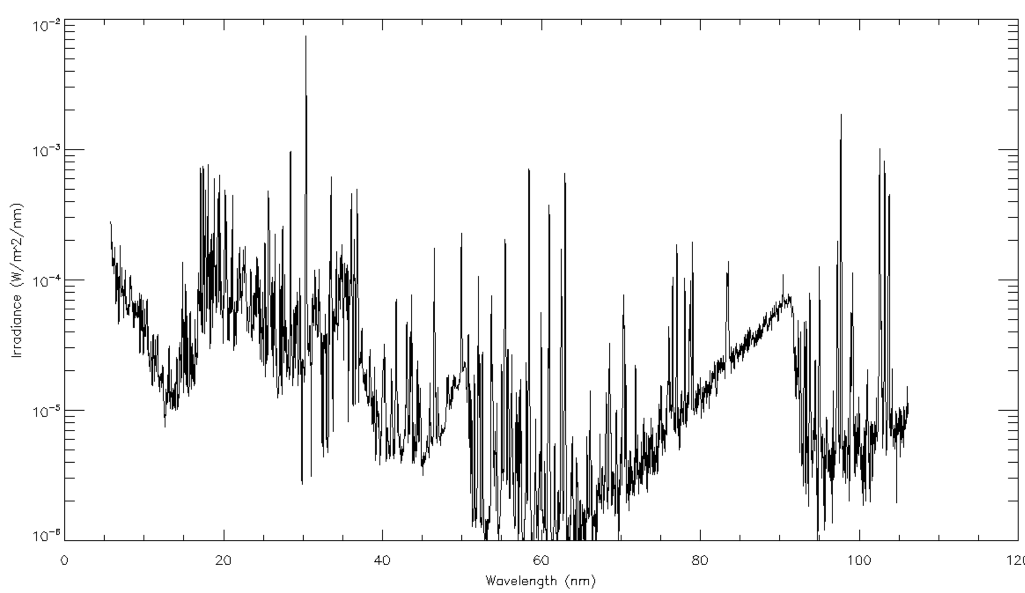
To see a listing of what is in the retrieved structure, perform the following command:

```
IDL> help, data, /structure
** Structure <d4bdb568>, 8 tags, length=24394824, data length=24391220, refs=1:
   PRIMARY          LONG                 0
   PRIMARY_HEAD     STRING    Array[5]
   SPECTRUMMETA     STRUCT    -> <Anonymous> Array[5200]
   SPECTRUMMETA_HEADER      STRING    Array[27]
   SPECTRUMUNITS    STRUCT    -> <Anonymous> Array[1]
   SPECTRUMUNITS_HEADER     STRING    Array[41]
   SPECTRUM              STRUCT    -> <Anonymous> Array[360]
   SPECTRUM_HEADER STRING    Array[93]
```

As described above, the wavelength information is stored in the data.spectrummeta structure. Knowing that MEGS B samples infrequently, we will use index 310 in this example to plot a full spectra. To plot the spectra, issue the following command:

```
IDL > plot, data.spectrummeta.wavelength, data.spectrum[310].irradiance,
YRANGE=[1.0e-6, 1.0e-2], /YLOG, charsize = 1.5, xtitle = "Wavelength (nm)",
ytitle = "Irradiance (W/m^2/nm)"
```

This command should produce a plot similar to:



Processing the lines, bands and diode file is similar to processing the spectrum files as show below. To read in the lines file issue the following commands:

```
IDL> data = eve_read_whole_fits( 'EVL_L2_2013300_00_005_01.fit.gz' )
```

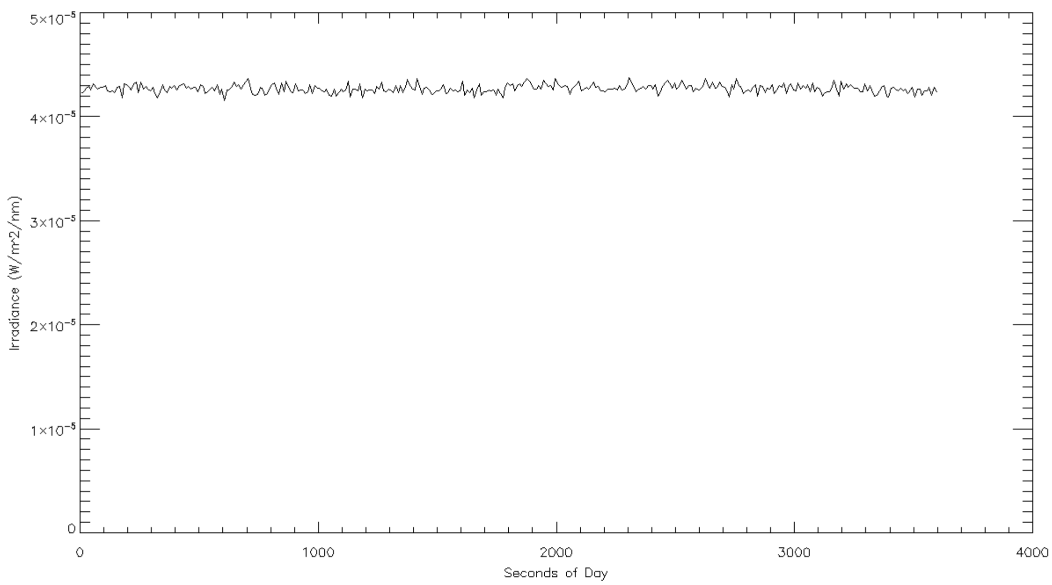
To see a listing of what is in the retrieved structure, perform the following command:

```
IDL> help, data, /structure
** Structure <29878a8>, 14 tags, length=331416, data length=329252, refs=1:
   PRIMARY          LONG                 0
   PRIMARY_HEAD     STRING    Array[5]
   LINESMETA        STRUCT    -> <Anonymous> Array[39]
   LINESMETA_HEADER
```

```
                    STRING    Array[48]
BANDSMETA           STRUCT    -> <Anonymous> Array[20]
BANDSMETA_HEADER
                    STRING    Array[28]
DIODEMETA           STRUCT    -> <Anonymous> Array[6]
DIODEMETA_HEADER
                    STRING    Array[27]
QUADMETA            STRUCT    -> <Anonymous> Array[4]
QUADMETA_HEADER     STRING    Array[27]
LINESDATA           STRUCT    -> <Anonymous> Array[360]
LINESDATA_HEADER
                    STRING    Array[124]
LINESDATAUNITS      STRUCT    -> <Anonymous> Array[1]
LINESDATAUNITS_HEADER
                    STRING    Array[59]
```

In this example we plot the He II line which is at index number 9 in the line_irradiance array.

```
IDL> plot, data.linesdata.sod, data.linesdata.line_irradiance[9],
xtitle = "Seconds of Day", ytitle = "Irradiance (W/m^2/nm)", charsize =
1.5
```



View http://lasp.colorado.edu/eve/data_access/software/Three Steps For EVE Data.pdf for a description on how to download and read EVE level 2 data.

The metadata regarding the line name, wavelength ranges, temperature, and other useful information are contained in the linesmeta. These can be accessed to generate a table as follows:

```
IDL> for i=0,n_elements(data.linesmeta)-1 do print,data.linesmeta[i].name,
data.linesmeta[i].wave_center, data.linesmeta[i].logt, i
Fe XVIII      9.39260      6.81000       0
Fe VIII       13.1240      5.57000       1
Fe XX         13.2850      6.97000       2
Fe IX         17.1070      5.81000       3
Fe X          17.7243      5.99000       4
Fe XI         18.0407      6.07000       5
Fe XII        19.5120      6.13000       6
Fe XIII       20.2044      6.19000       7
Fe XIV        21.1331      6.27000       8
He II         25.6317      4.75000       9
Fe XV         28.4150      6.30000      10
He II         30.3783      4.70000      11
Fe XVI        33.5410      6.43000      12
Fe XVI        36.0758      6.43000      13
Mg IX         36.8076      5.99000      14
S XIV         44.5700      6.44000      15
Ne VII        46.5221      5.71000      16
Si XII        49.9406      6.29000      17
Si XII        52.1000      6.28000      18
O III         52.5795      4.92000      19
He I          53.7000      3.84000      20
O IV          55.4370      5.19000      21
Fe XX         56.7870      6.96000      22
He I          58.4334      4.16000      23
Fe XIX        59.2240      6.89000      24
O III         59.9598      4.92000      25
Mg X          60.9800      6.10000      26
Mg X          62.4943      6.05000      27
O V           62.9730      5.37000      28
O II          71.8535      4.48000      29
Fe XX         72.1560      6.96000      30
Ne VIII       77.0409      5.81000      31
O IV          79.0199      5.19000      32
O II          83.5500      4.52000      33
H I           94.9700      3.84000      34
H I           97.2537      3.84000      35
C III         97.7030      4.84000      36
H I           102.572      3.84000      37
O VI          103.190      5.47000      38
```

Note that this line list differs from the version 4 line list. Nine new lines are shown in bold with blue color. These additional MEGS-B lines were added to replace the ones that were lost after the MEGS-A anomaly. Most of the new lines are coronal but there are a few cooler lines as well. The lines between 33.5410 nm and 36.8076 nm are now measured by MEGS-B after the MEGS-A anomaly. We believe there is uncorrected degradation in MEGS-A for at least the 36.8076 nm emission line and the time series shows a step.

During MEGS-B observations 27 lines are now extracted (33.541-103.190 nm).

SolarSoft

SolarSoft and IDL users may wish to download the EVE SolarSoft software package. It is available at our web site by browsing the Data Access page.
http://lasp.colorado.edu/home/eve/data/data-access/

Additional information about SolarSoft can be found through the LMSAL website, http://www.lmsal.com/solarsoft.
Note that the EVE SolarSoft package can be run in IDL without SolarSoft.

Data Availability and Data Gaps

Daily calibrations are performed that last a total of about 30 minutes; however, the channel calibrations are staggered so that one of the science channels is always observing the Sun during the daily calibration. These daily calibrations allow for EVE to directly measure dark signals on the detectors to track changes. For the CCDs, the flatfield LEDs are also used. On Sundays, a slightly longer calibration is performed to increase statistics.

Two annual eclipse outage periods of about 3 weeks occur as the spacecraft orbit aligns with the Earth and Sun. These can last up to 72 minutes each day. After longer eclipses (10+ minutes), some thermal settling causes a wavelength shift on MEGS-A that is not yet corrected. Around the 2 eclipse seasons, additional off-pointing maneuvers are performed including EVE cruciform scans (9 hours), EVE FOV maps (~2 hours), plus maneuvers for the other instruments and the guide telescopes.

The spacecraft is also subject to being blocked by the moon, but this is infrequent. Other infrequent activities include momentum management, and station-keeping thruster firings.

CCD bakeouts have occurred as needed to maintain instrument sensitivity. The first bakeout started on June 16 (day 167), 2010 and continued through June 18 (day 169), 2010. The second CCD bakeout was much longer lasting from September 23 (day 266) through September 28 (day 271), 2010. After each bakeout, there is a period of several days where the detectors change rapidly, and this is not corrected in version 3. No future bakeouts will be scheduled.

To minimize the degradation on the MEGS B detector, MEGS B only observes the sun 2 to 3 hours per day and the timing of the observation has changed throughout the mission. When not observing the Sun, the MEGS B portion of the spectra is filled with -1.0 when MEGS-A data is available. After the MEGS-A anomaly when no MEGS-B data are available, the spectra file is no longer generated. The lines/bands file is generated because the ESP data remains continuously available.

Detailed daily information is provided in the Science Operations Mission Log and is available at this location:
http://lasp.colorado.edu/eve/data_access/evewebdata/EVE_sciopslog.html

Version Release Notes

The ESP 30.4nm diode data is now used to correct the trend for the MEGS-A 30.4 nm line, currently the only highly degraded line on the MEGS-A detector. Data from calibration rocket 36.258 is used to pin the calibration on 2010 day123.

We have applied the rocket calibration to MEGS-B in an attempt to recover some of the information that seems to be getting lost in the application of the pre-flight SURF responsivity. This process involved creating a modified responsivity that differs from the ground measurements for wavelengths shorter than 40 nm and longer than 60 nm. This compensates for unexpected sensitivity losses witnessed in early operations at long wavelengths prior to observing the sun for the first time. It also compensates for wavelength uncertainties and lower count rates during the calibration that affect the shorter wavelengths. Degradation trends in MEGS-B are estimated by comparing count rates measured to multiple linear regression proxy models using ESP, MEGS-P, and the 10.7 cm radio flux. The ratio provides a dimensionless degradation trend that is pinned to the first rocket.

In the version 5 EVE products MEGS-P was increased by a factor of 1.015 (1.5%) to agree with the SORCE SOLSTICE version 13 calibration.

The extracted bands used to produce an effective AIA count rate have not been updated to use newer AIA response functions that would spill over onto the MEGS-B wavelength region. Since MEGS-B is not available all day for most days, including the contribution would cause significant steps up and down in a time series (resulting from the availability of MEGS-B data.)

Other Notes

The spectra bins should not be used individually for analysis due to the possibility of small-scale wavelength shifts. Rather, users should integrate over the features of interest. MEGS-A (5-37 nm) is the most sensitive to these small wavelength shifts.

Since the MEGS-A 30.4 line has suffered detector burn-in and filter degradation, the line shape itself is being adjusted. This is likely to affect attempts to observe Doppler shifts. We recommend using the count rate spectrum to investigate the incredibly small line shifts.

The MEGS-P Lyman-alpha diode measurement is susceptible to low energy particles. Our initial attempt to remove the low energy particle noise using the dark diode needs refinement. Rather than exclude this measurement, we filter it based on those periods of increased particle noise. Therefore, the MEGS-P Lyman-alpha measurement is sometimes very complete, and sometimes only available from about 6-12 UT each day. The Lyman-alpha measurement uses the same filter mechanism as MEGS-B, so it is also operating with the same reduced-exposure scenario.

Also, due to random large particle hits, the Lyman-alpha measurement is filtered using a 10-second Kalman smoothing technique. Additional filtering was implemented for version 3 where data are pre-filtered using a median technique. Unfortunately, the Lyman-alpha measurement is very noisy, and therefore most useful after averaging to a daily value.