# Solar Dynamics Observatory (SDO) Extreme Ultraviolet Variability Experiment (EVE): Release notes for version 7 science data products

**Level 2B Science Data Products 8/6/18**

## Table of Contents



Introduction

EVE level 2B 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 version change includes updated long-term degradation corrections for MEGS-B and ESP. A small dark adjustment was applied to MEGS-A and MEGS-B that lowers the irradiance by a quarter of a standard deviation, so it is most noticeable in the very dim regions. The MEGS-P (Lyman-alpha) diode measurements have been updated to replace the Kalman filter with a Fourier transform filter, and the calibration has been updated to match SORCE SOLSTICE version 15.

This is a new release of EVE Level 2B 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.

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.

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 2B Science Products
Two types of EVE level 2B products are routinely created: **Spectra** (EVS) and **Lines** (EVL). Level 2B spectra are from the MEGS B spectrograph. The B detector is designed to measure 37-106 nm. This version includes all of the measured wavelengths spanning 3.01-106.59 nm. All level 2B irradiances are adjusted to 1 AU. Level 2B line files contain selected lines derived from the level 2B 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 .

**WARNINGS**: The MEGS-A detector experienced a capacitor short on May 26, 2014 (day 146) that prevents the detector from working. No solar spectra are measured for wavelengths shorter than 33 nm after that anomaly. MEGS-B has been extended to its shortest possible wavelength of 33.0 nm. EUV spectra are only available when MEGS-B is exposed, usually for 3 hours per day.

## Naming Convention

Level 2B products follow this naming convention `EV?_L2B_YYYYDDD_vvv_rr.fit` where:

- `EV` designates this as an EVE product
- `?` is either `S` (spectrum) or `L` (lines/bands)
- `L2B` designates this as a level 2B product
- `YYYY` is the year
- `DDD` is the day of year (001-366)
- `vvv` is the version number (007)
- `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 2B Lines/Bands Products

The EVE level 2B line files contain 6 header data units, containing data and corresponding information pertaining to 30 extracted solar emission lines. Each file contains one day's worth of observations with each observation being reported at a nominal integration time of 60 seconds. The LinesMeta data unit contains information about lines derived from the EVE level 2B spectrum. It contains wavelength 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 | Strint | Line name example (Fe) |
| 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 of the band example |
|---|---|---|
| Name | String | (AIA_304) |
| Type | String | SDO instrument example (AIA) |
| Low_Wavelenght_nm | Float | 23.2650 |
| High_Wavelength_nm | Float | 37.4450 |

The DiodeMeta data unit contains information about spectral bands derived from EVE level 2B 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 60-second spectrum cadence from the 4 Hz measurements. The DiodeMeta data unit is described in the following table.

**DiodeMeta:**

Column Name Type Description

| | | |
|---|---|---|
| Name | String | Name of band example (171) |
| Type | String | SDO instrument example (ESP) |

The ESP central quad diode contains information about the center of brightness for the 0.17 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 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 | Double | Seconds // International Atomic Time seconds since Jan 1, 1958 at center of integration |
| YYYYDOY | Long | NA // 4-digit year and 3-digit day of year designation with Jan 1=001 |
| SOD | Long | Seconds // seconds of the UT day at the center of the integration |
| FLAGS | INT | NA // 0=good, other values indicate data may be suspect |
| SC_FLAGS | INT | NA // 0=good, other value indicate spacecraft events like eclipses, lunar transits, etc |

| | | |
|---|---|---|
| Line_Irradiance | Float | Wm^-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 | Float | NA // relative precision |
| Line_Accuracy | Float | NA // relative accuracy |
| Band_Irradiance | Float | 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 |
| Band_Precision | Float | NA // relative precision |
| Band_Accuracy | Float | NA // relative accuracy |
| Diode_Irradiance | Float | Wm^-2 // power per unit area at 1-AU measured by the diode |
| Diode_Stdev | Float | NA // relative one-sigma spread of 4 hz integrations over the 1 minute window |
| Diode_Precision | Float | NA // relative precision |
| Diode_Accuracy | Float | Relative accuracy of diode measurements |
| Quad_Fraction | Float | 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 | Float | NA // relative one-sigma spread of 4 Hz integrations over the 60 second window |
| Quad_Precision | Float | Relative precision of quadrant diode measurements<br>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 60 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 | Long | Seconds of day at center of observation |
| FLAGS | Byte | EVE specific flags |
| SC_FLAGS | Byte | SDO specific flags |
| Line_irradiane | 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 line |
| Band_precision | Float | An array of precision values. One value per line |
| Band_accuracy | Float | An array of accuracy values. One value per line |
| Diode_irradiance | Float | An array of irradiance values. One value per line |
| Diode_stdev | Float | An array of standard deviation values. One value per line |

| | | |
|---|---|---|
| Diode_preecision | Float | An array of precision values. One value per line |
| Diode_accurace | Float | An array of accuracy values. One value per line |
| Quad_stdev | Float | An array of standard deviation values. One value per line |
| Quad_precision | Float | An array of precision values. One value per line |
| Quad_accuracy | Float | An array of accuracy values. One value per line |

†

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 4) | ESP data is missing |
| Bit 3 (value 8) | MEGS-P data is missing |
| Bit 4 (value 16) | Possible clock adjust in MEGS-A |
| Bit 5 (value 32) | Possible clock adjust in MEGS-B |
| Bit 6 (value 64) | Possible clock adjust in ESP |
| Bit 7 (value 128) | 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 60 seconds. No continuum is subtracted from the line irradiances.

Level 2B Spectra Products

The level 2B spectrum files contain 3 header data units, SpectrumMeta, SpectrumUnits and Spectrum. These data units contain the fully calibrated 60-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 | Center wavelength for each bin |
| Accuracy | Float | 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 | Double | International Atomic Time of center of observation |
| YYYYDOY | Long | Year and day of year of observation |
| SOD | Long | Seconds of day at center of observation |
| Flags | Byte | EVE specific flags |
| SC_Flags | Byte | SDO specific flags |
| Int_Time | Byte | Seconds - Duration of the exposure |
| Irradiance | Float | Wm^-2 nm^-1 // Sepctral power per unit area per nanometer at 1-AU |
| Count_Rate | Float | Counts per second - dark corrected count rate per pixel per second |
| Precision | Float | NA // relative precision, 0=perfect measurement, 1=signal equals noise, multiply by the irradiance to get units (absolute) |
| Bin_Flags | Byte | 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 2B products described in this document are all publicly available at the EVE website. We caution users to carefully consider their data needs. The level 2B products are free for responsible public use; however, downloading the entire dataset is not a good solution for most users. The 2018 dataset comprises approximately 1 GB spread over about 730 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.

FITS Binary Table reference: , Cotton, W. D., Tody, D. B., and Pence, W. D., Astronomy & Astrophysics Supplement Series, 113, 159-166, 1995.

Additional detailed documentation is available on-line.

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.

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.

For IDL, you may also use mrdfits.pro available at:

Explanation and Examples in IDL

Level 2B data products are stored in FITS format and may be read by a variety of software, see the documentation section at 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.

We will use the function in the following examples.

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

```
IDL> data = eve_read_whole_fits( "EVS_L2B_2018200_006_02.fit.gz" )
```

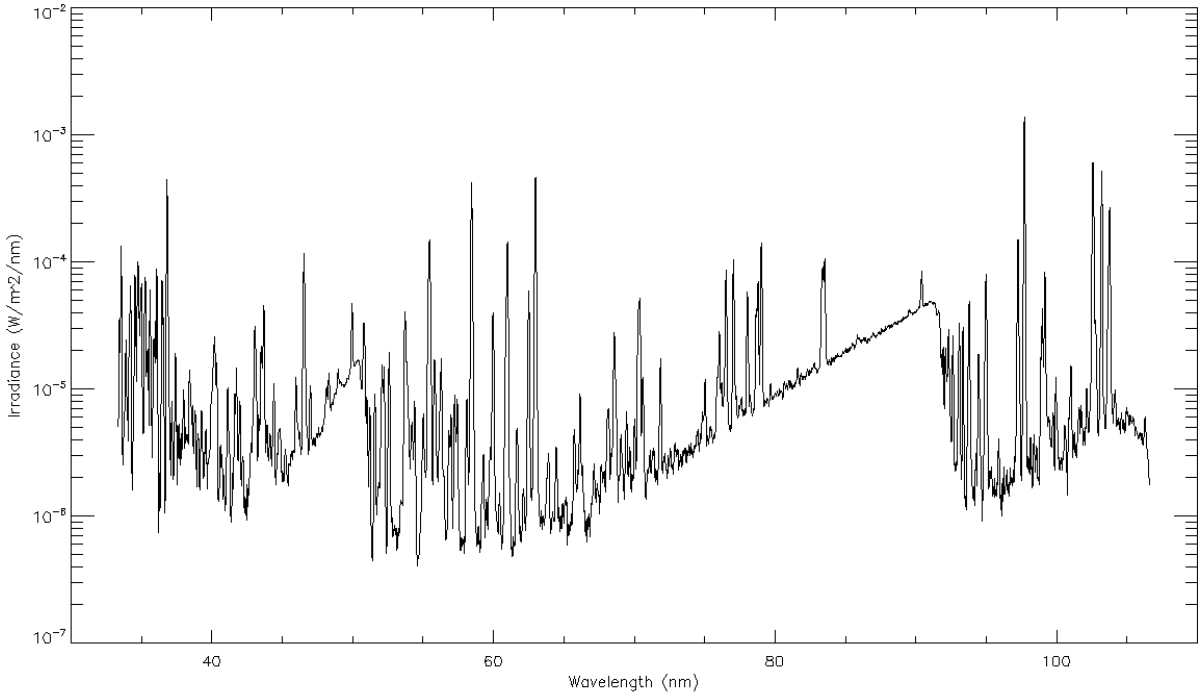
To see a list of the structure tag names, run the following command:

```
IDL> help, data, /structure
** Structure <92792458>, 8 tags, length=97445688, data length=97431284, refs=1:
   PRIMARY         LONG                 0
   PRIMARY_HEAD    STRING    Array[5]
   SPECTRUMMETA    STRUCT    -> <Anonymous> Array[5200]
   SPECTRUMMETA_HEADER
                   STRING    Array[30]
   SPECTRUMUNITS   STRUCT    -> <Anonymous> Array[1]
   SPECTRUMUNITS_HEADER
                   STRING    Array[41]
   SPECTRUM        STRUCT    -> <Anonymous> Array[1440]
   SPECTRUM_HEADER STRING    Array[69]
```

As described above, the wavelength information is stored in the data.spectrummeta structure. Knowing that MEGS B samples infrequently, we will use index 130 in this example to plot a full spectra. To plot the spectra, issue the following command:

```
IDL > plot, data.SPECTRUMMETA.WAVELENGTH, data.SPECTRUM[230].IRRADIANCE, YRANGE=[1.0e-
7, 1.0e-2], /YLOG, XRANGE=[30, 110], /XSTYLE, 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 for 2013 day 300 hour 17, issue the following command:

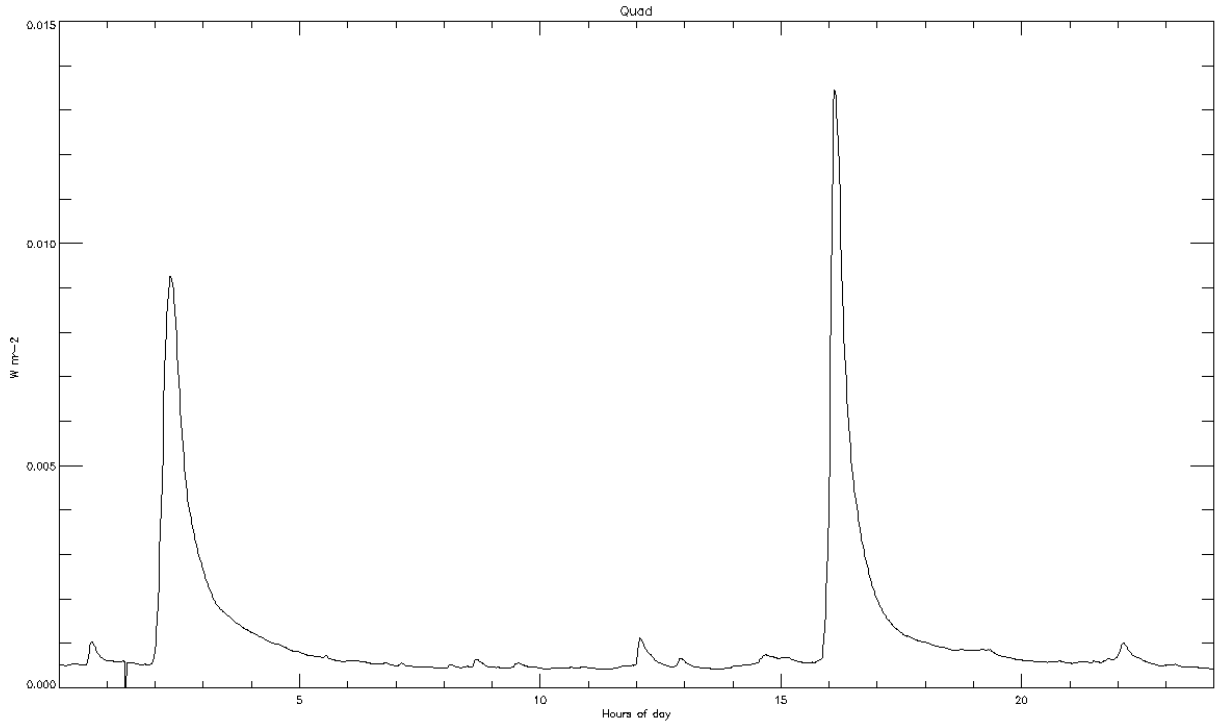
```
IDL> data = eve_read_whole_fits( 'EVL_L2B_2013300_007_01.fit.gz' )
```

To see a listing of tags in the structure, run the following command:

```
help, data, /structure
** Structure <c85be6a8>, 14 tags, length=1299048, data length=1290404, refs=1:
   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[27]
   QUADMETA        STRUCT    -> <Anonymous> Array[4]
   QUADMETA_HEADER STRING    Array[27]
   LINESDATA       STRUCT    -> <Anonymous> Array[1440]
   LINESDATA_HEADER        STRING    Array[109]
   LINESDATAUNITS  STRUCT    -> <Anonymous> Array[1]
   LINESDATAUNITS_HEADER   STRING    Array[59]
```

In this example we plot the quad diode line which is at index number 0 in the line_irradiance array.

**IDL>** plot, data.linesdata.sod / 3600.0, data.linesdata.diode_irradiance[0], xtitle='Hours of day',
ytitle=(strsplit(data.linesdataunits.diode_irradiance,'//',/extract))[0],
title=data.diodemeta[0].Name, yrange=[0.0,0.015], xmargin=[12,3], xstyle=1




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 |

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.

Additional information about SolarSoft can be found through the LMSAL website, . 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 earlier in the mission in attempts to recover instrument sensitivity for MEGS-B. 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 for 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 (missing MEGS-A and MEGS-B). 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:

Data availability can be assessed using the calendars on the EVE web site for the particular product and year of interest. This link is for level 2 and level 2B data for 2017. Green cells indicate data is available here.

Version Release Notes

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. The Lyman-alpha measurement uses the same filter mechanism as MEGS-B, so it is also operating with the same reduced-exposure scenario. The periods of high potential large contributions from particles is fixed to earth's magnetic field, so the UT time shifts about 3:56 each day.