SDO EVE Science Data Processing Workshop

Space Weather Status

Chris Jeppesen
jeppesen@lasp.colorado.edu
(303)-492-2469

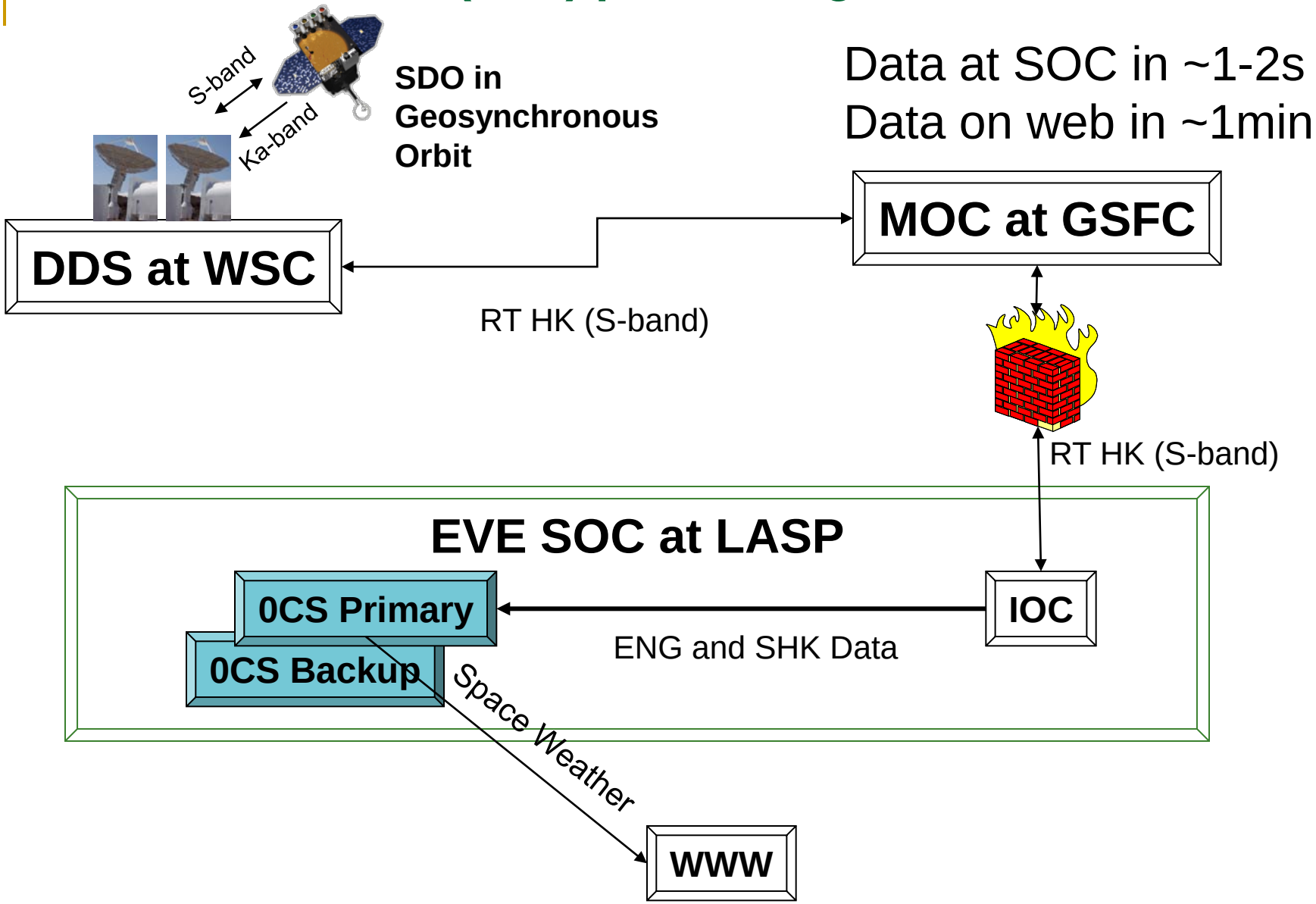
Processing Levels

Level	Description	Span	Type
0A (TLM)	Unprocessed VCDUs (packets) – files received from DDS	~1 min	binary
0B	Assembled/merged integrations separated by channel	~1 min	FITS
0C	Space weather (Ka-band) – all channels available in Latest and Daily files	15 min & 1 day	ASCII
0CS	Space weather (S-band) – lowest latency, only diodes and proxies	Same	ASCII
0D	Daily merged 0B data with duplicates removed	1 day	FITS
1	Irradiance for each channel **(no degradation applied to spectra)**	1 hour	FITS
~~1A~~	~~SAM only, event list~~	~~1 day~~	~~FITS~~
~~1B~~	~~SAM only, spectrum (cadence is TBD)~~	~~Same~~	~~FITS~~
2-EVS	Merged, degradation corrected MEGS-A and B level 1 spectra with MEGS-B sampling (.02 nm)	1 hour	FITS
2-EVL	Extracted lines and bands, averaged diodes to match spectrum timestamp, proxies (same as 0C)	Same	FITS
3	Daily average spectrum at 0.02 nm	1 day	FITS
3	Daily average 0.1 nm spectrum	1 year	FITS/SAV/ASCII?
3	Daily average 1 nm spectrum	Mission	

Space Weather Products

- L0CS Space Weather ASCII tables
- ESP and MEGS-P Plots
- SAM images and videos
- L0C(Ka) spectrum ~4min latency

Level 0C – S-Band (0CS) processing



Level 0CS products

- ESP and MEGS-P ASCII tables
  - ASCII table of quick-calibrated ESP and MEGS-P diode irradiances, quadrant fractions, XRS-A and B proxies, and quadrant heliocentric position (latitude and longitude)
  - Two files
    - One from 00:00UTC to current time
    - One of the past 15 minutes
  - Data arrives from spacecraft every 10 seconds, ~1-2 second latency
  - Averaged into 1-minute bins
  - Published once per minute as soon as a 1-minute bin is filled

Level 0CS Space Weather table

Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://lasp.colorado.edu/eve/data_access/quicklook/quicklook_data/L0CS/LATEST15m_EVE_L0CS_DIODES_1m.txt

Most Visited | [Eve for me] Issue Na... | http://www.cloudster... | http://lasp.colorado.e... | Astronomy Picture of ... | Introduction to the SS... | SDO - EVE Test Log | LASP STAFF PORTAL | AIM Ops | IDL

http://lasp.color...CS_DIODES_1m.txt

```
; DATA_list: LATEST15m_EVE_L0CS_DIODES_1m.txt
; Created: Tue Oct  5 14:55:23 2010 UTC
; Origin: SDO/EVE Science Processing and Operations Center, LASP/CU
; Units: W/m^2 for irradiance, dark is counts/(0.25s sample), quadrants are unitless, solar lat & lon are deg
; 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
; 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 value
;  XRS-A proxy: a model of the expected XRS-A value
;  SEM proxy: a model of the expected SEM 26-34 nm value
;  0.1-7ESPquad: the total irradiance over the ESP quadrant diode 0.1-7 nm
;  171ESP: ESP irradiance measurement near 17.1 nm
;  257ESP: ESP irradiance measurement near 25.7 nm
;  304ESP: ESP irradiance measurement near 30.4 nm
;  366ESP: ESP irradiance measurement near 36.6 nm
;  darkESP: ESP dark diode count rates (background)
;  1216MEGS-P: MEGS-P irradiance measurement at H I Lyman-alpha 121.6 nm
;  darkMEGS-P: MEGS-P dark diode count rates (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
; Format:
;  YYYY DOY MO DD
;  HHMM XRS-B    XRS-A     SEM      0.1-7     171       257       304       366       dark      1216      dark      q0        q1        q2        q3
;       proxy    proxy     proxy    ESPquad   ESP       ESP       ESP       ESP       ESP       MEGS-P    MEGS-P    ESP       ESP       ESP       ESP
;-----------------------------------------------------------------------------------------------------------------------------------------------------
;END_OF_HEADER
2010 278 10 05
1440  7.97e-08  1.67e-09 -1.00e+00  3.93e-05  5.71e-04  2.79e-04  5.05e-04  1.59e-04  4.91e+01 -1.00e+00  3.30e+01  2.67e-01  2.48e-01  2.47e-01  2.38
1441  7.83e-08  1.63e-09 -1.00e+00  3.89e-05  5.71e-04  2.78e-04  5.04e-04  1.43e-04  4.90e+01 -1.00e+00  3.30e+01  2.68e-01  2.46e-01  2.48e-01  2.39
1442  8.02e-08  1.68e-09 -1.00e+00  3.94e-05  5.71e-04  2.78e-04  5.03e-04  1.57e-04  4.90e+01 -1.00e+00  2.63e+01  2.69e-01  2.48e-01  2.49e-01  2.35
1443  7.83e-08  1.63e-09 -1.00e+00  3.89e-05  5.72e-04  2.78e-04  5.03e-04  1.51e-04  4.90e+01 -1.00e+00  3.93e+01  2.67e-01  2.49e-01  2.47e-01  2.36
1444  7.97e-08  1.67e-09 -1.00e+00  3.93e-05  5.71e-04  2.78e-04  5.03e-04  1.61e-04  4.90e+01 -1.00e+00  4.00e+01  2.73e-01  2.45e-01  2.47e-01  2.35
1445  7.97e-08  1.67e-09 -1.00e+00  3.90e-05  5.71e-04  2.79e-04  5.05e-04  1.62e-04  4.87e+01 -1.00e+00  4.00e+01  2.68e-01  2.46e-01  2.48e-01  2.38
1446  8.52e-08  1.80e-09 -1.00e+00  3.94e-05  5.71e-04  2.79e-04  5.04e-04  1.66e-04  4.83e+01 -1.00e+00  3.98e+01  2.69e-01  2.50e-01  2.46e-01  2.36
1447  8.11e-08  1.70e-09 -1.00e+00  3.89e-05  5.71e-04  2.78e-04  5.04e-04  1.41e-04  4.84e+01 -1.00e+00  3.98e+01  2.67e-01  2.49e-01  2.48e-01  2.36
```

Done

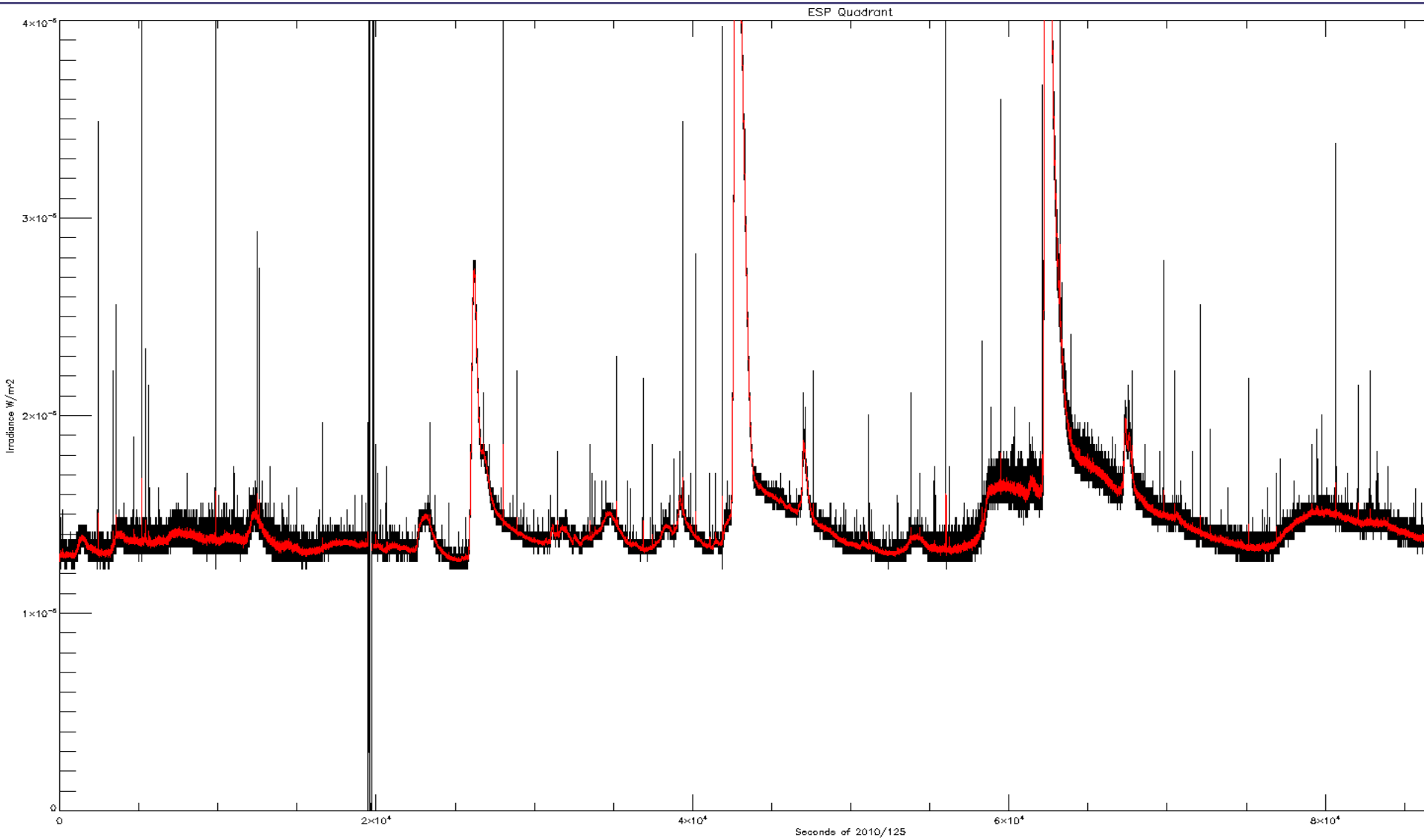
Level 0CS quick calibration

- Calibration of both ESP and MEGS-P is based on S-band data and coefficients from Level 1 from the previous day

$$E = \frac{DN\text{-}Dark}{k}$$

- Dark is from temperature polynomial (ESP) or actual dark diode reading (MEGS-P)
- Coefficient *k* is from Level 1 ESP or MEGS-P product and converts DN to physical units
- Ten-second data is then Kalman-filtered for despiking and removal of DN quantization

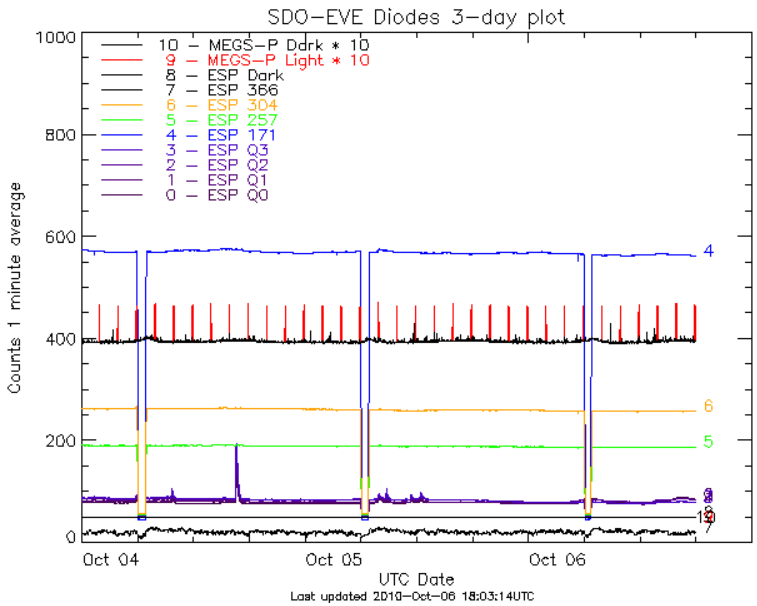
Level 0CS Kalman Filtering

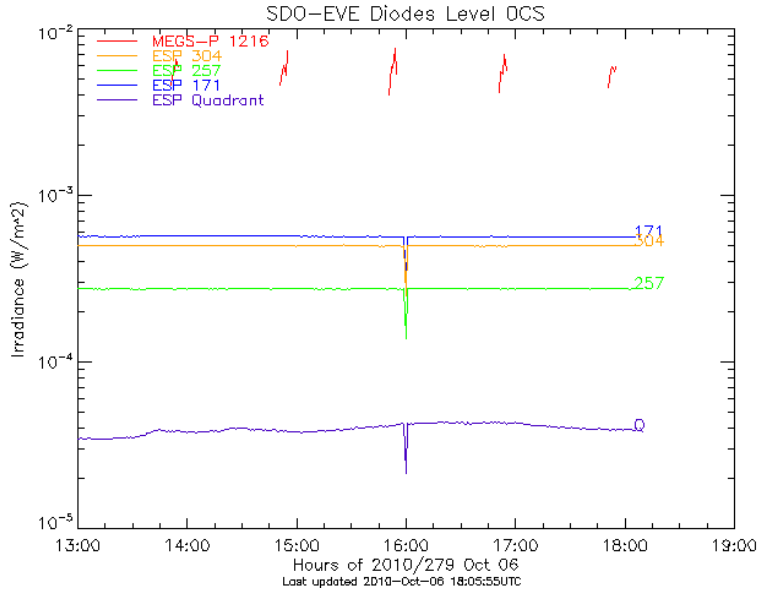


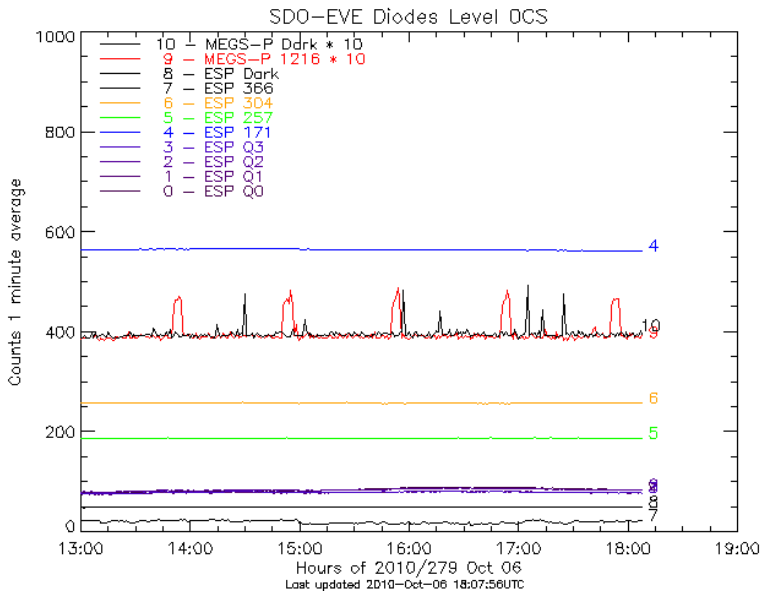
Level 0CS plots

- ESP and MEGS-P plots
  - Plots of the last 5+ hours is published on the web site once per minute
    - Quick-calibrated and raw data available
  - Plots of the last 2+ days is published on the web site once every 10 minutes
    - Raw data only, quick-calibration coming soon

Level 0CS plots

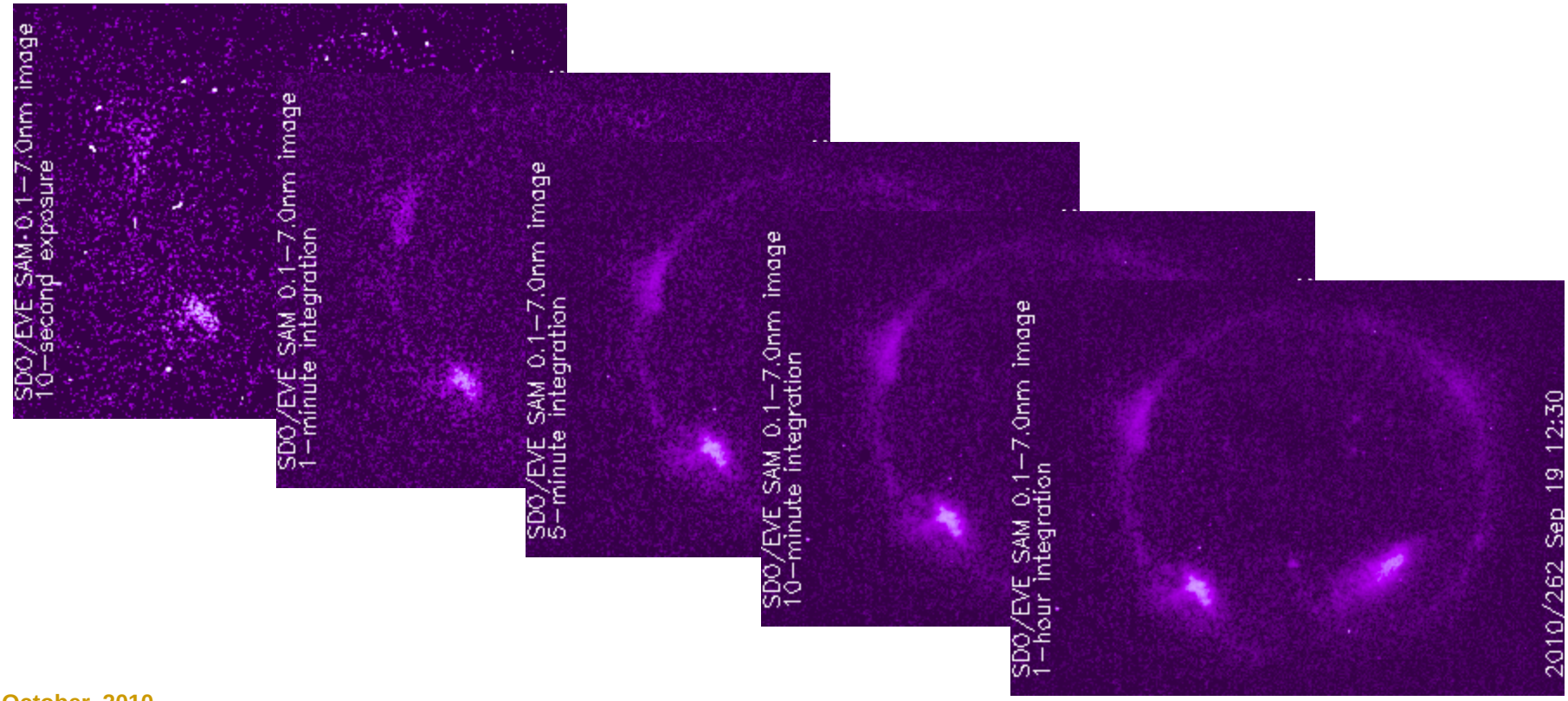






Level 0C SAM images

- Images are cropped from MEGS-A Level 0B, dark-corrected and despiked, and MEGS spectral lines subtracted
- Images are then averaged together in 1-minute, 5-minute, 10-minute, and 1-hour bins
  - Binning improves signal-to-noise ratio at the expense of time resolution



Level 0C SAM video

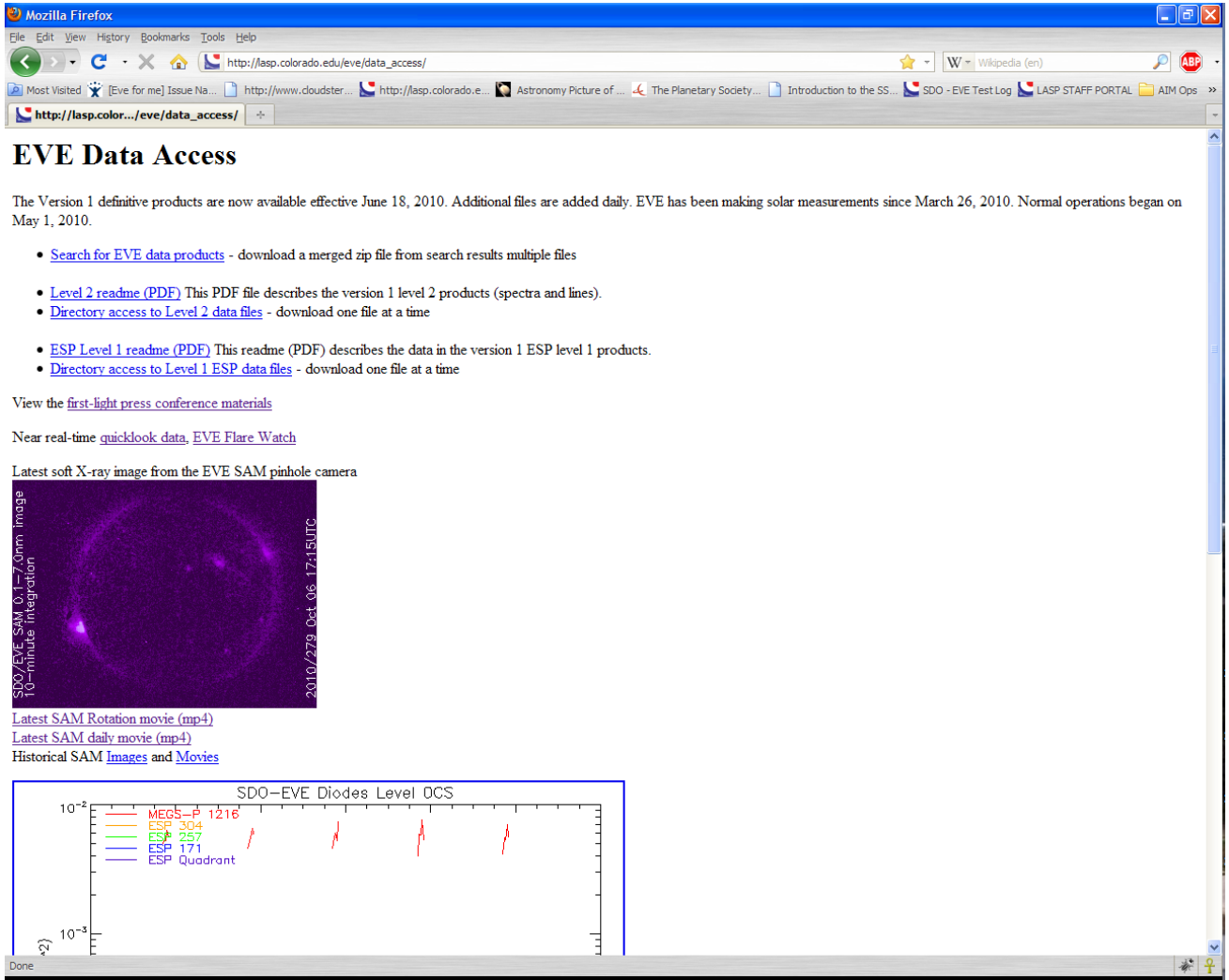
- Daily movie – 00:00UT yesterday to now, last 24+ hours
  - Published every 10 minutes
  - Based on 5-minute average data
- Carrington rotation movie – Beginning of last rotation to now, 27+ days
  - Published every 24 hours
  - Based on 1-hour average data

Level 0C spectrum

- Made from MEGS A and B images
- Made from Ka-band data
  - ~4 minute latency
- In the form of an ASCII table
  - 1 row per minute, 1 column per spectrum bin, about 5200 bins per spectrum
- Not available yet -- Coming soon!

Data Availability

- L0CS data is available on the EVE web site: http://lasp.colorado.edu/eve/data_access/



L0CS web site structure

http://lasp.colorado.edu/eve/data_access/evewebdata/quicklook/L0CS

- LATEST_EVE_L0CS_DIODES_1m.txt – calibrated Space Weather ASCII table
- LATEST_EVE_L0CS_DIODES_1m_counts.txt – calibrated Space Weather ASCII table
- LATEST15m_EVE_L0CS_DIODES_1m.txt – Same as above but for the last 15 minutes
- LATEST15m_EVE_L0CS_DIODES_1m_counts.txt – Same as above but for the last 15 minutes
- latest_sam.png – Latest SAM image, 10-minute averaging
- SAM_latest_daily.mp4 – Latest SAM movie over last 24+ hours
- SAM_latest_rotation.mp4 – Latest SAM movie over last 27+ days
- SpWx – archived Space Weather tables
  - YYYY – Folder for each year
    - YYYYMMDD_EVE_L0CS_DIODES_1m.txt – Archived calibrated space weather table
    - YYYYMMDD_EVE_L0CS_DIODES_1m_counts.txt – Archived raw space weather table
- SAM
  - images
    - YYYY
      - DOY – Folder for each day of year
        - 01h – 1-hour averaging
          - SAM_YYYYDOY_HHMM_10m.png – Average of all good SAM images from the given time for 10 minutes
        - 10m – 10-minute averaging
          - SAM_YYYYDOY_HH00_01h.png – Average of all good SAM images from the given time for 1 hour
  - video
    - daily
      - YYYY
        - SAM_L2_YYYYDOY_YYYYDOY_VER_01.mp4 – 24+ hour movie from 00:00UT of first date to 24:00UT of last date (or to current time if this is the current movie)
    - carrington
      - SAM_L2_YYYYDOY_CRXXXX_VER_01.mp4 – 27+ day movie from 00:00UT on the day that Carrington rotation XXXX started

Versions of Level 0CS

- Mission start
  - Space weather products and plots were in raw DN
- 01 Sep 2010
  - Space weather ASCII tables in quick-calibrated irradiance. Both raw and calibrated plots are available.
- 02 Oct 2010
  - All irradiances Kalman filtered in both tables and calibrated plots