SOLAR SOFT X-RAY IRRADIANCE WITH YOHKOH/SXT

NICOLE ALBANESE

AKI TAKEDA

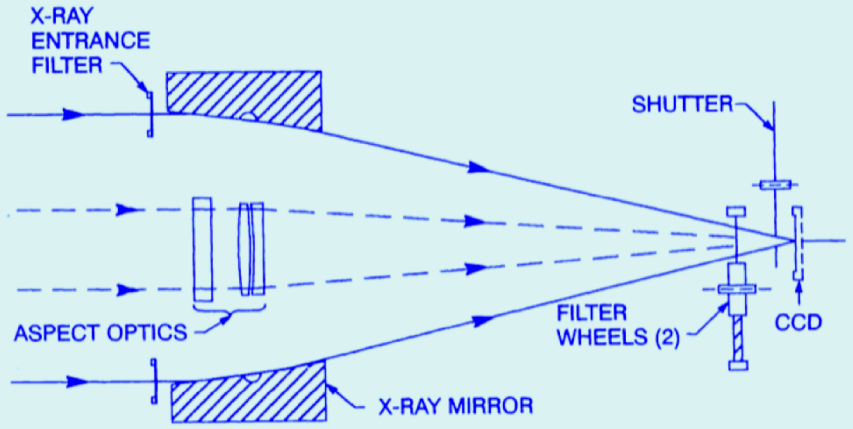

Fig. 1a. Schematic illustration of the optical concept and key elements of the SXT.

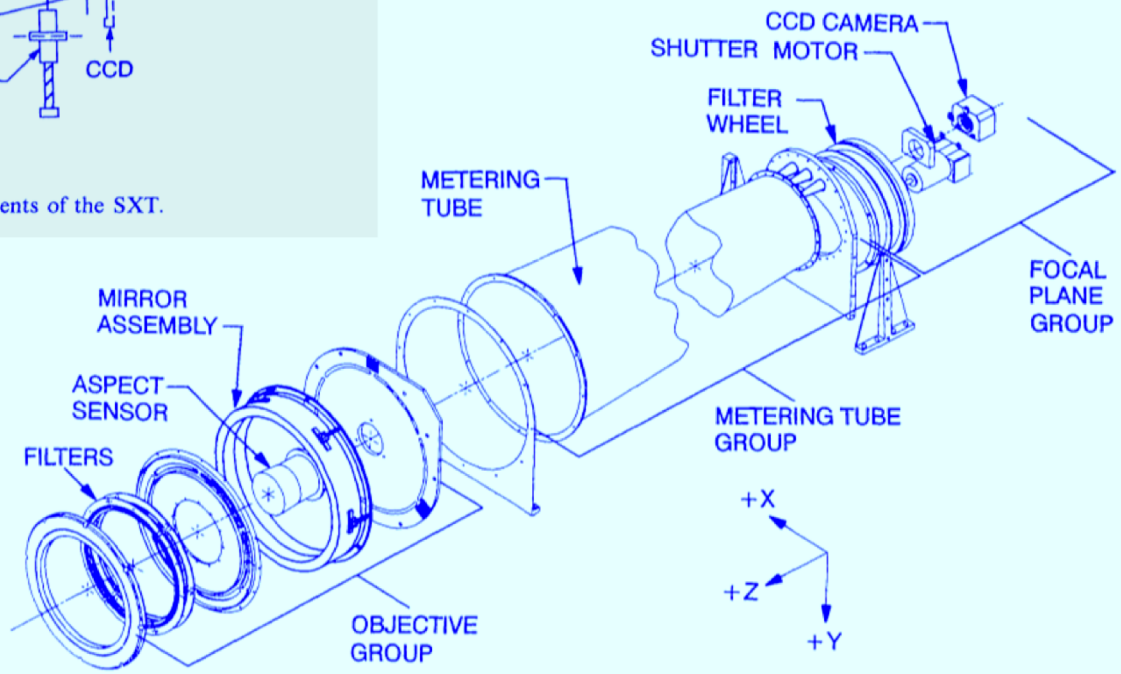

Fig. 1b. Exploded diagram of the SXT. Sub-assemblies mentioned in the text are identified.

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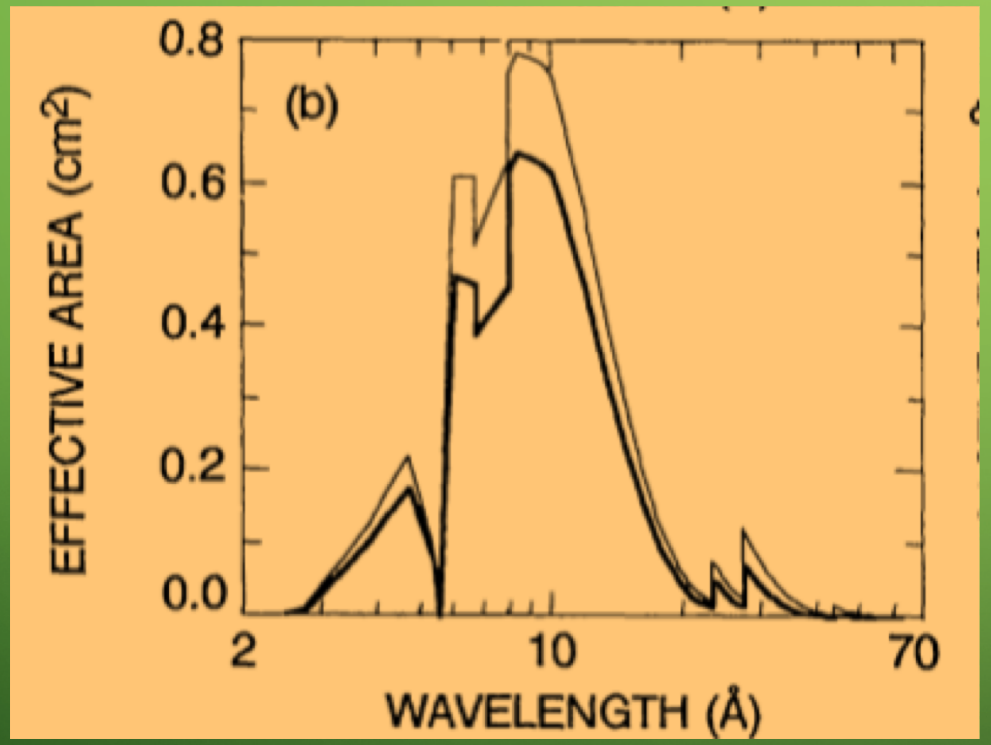
FILTERS

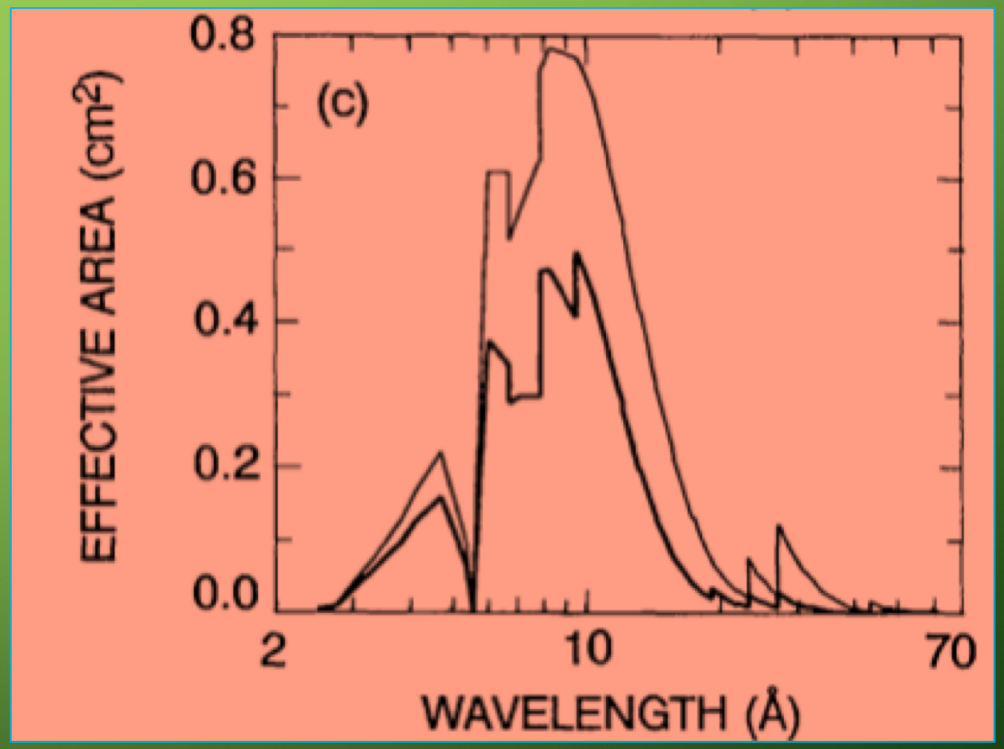
Thin Al Filter

1265 Å Al filter



Dagwood Filter

2930 Å Al, 2070 Å Mg, 562 Å Mn, and 190 Å C.



$$R_{ij} \equiv \frac{DN_i/\delta t_i}{DN_j/\delta t_j} = \frac{F_i(T)}{F_j(T)}.$$

$$DN_i = N_i \delta t_i / 100$$

$$N_i = E_i / 3.65 k_e$$

$$E_i = \frac{1}{4\pi D^2} F_i(T) \varepsilon$$

$$E_i = \frac{1}{4\pi D^2} \int_0^\infty \int_\lambda N_e^2(l) P[\lambda, T(l)] \eta_i(\lambda) d\lambda dl \cdot d\sigma$$

$$\varepsilon = \int_0^\infty N_e^2(l) dl \cdot d\sigma$$

$$F_i = \int_\lambda P(\lambda, T) \eta_i(\lambda) d\lambda$$

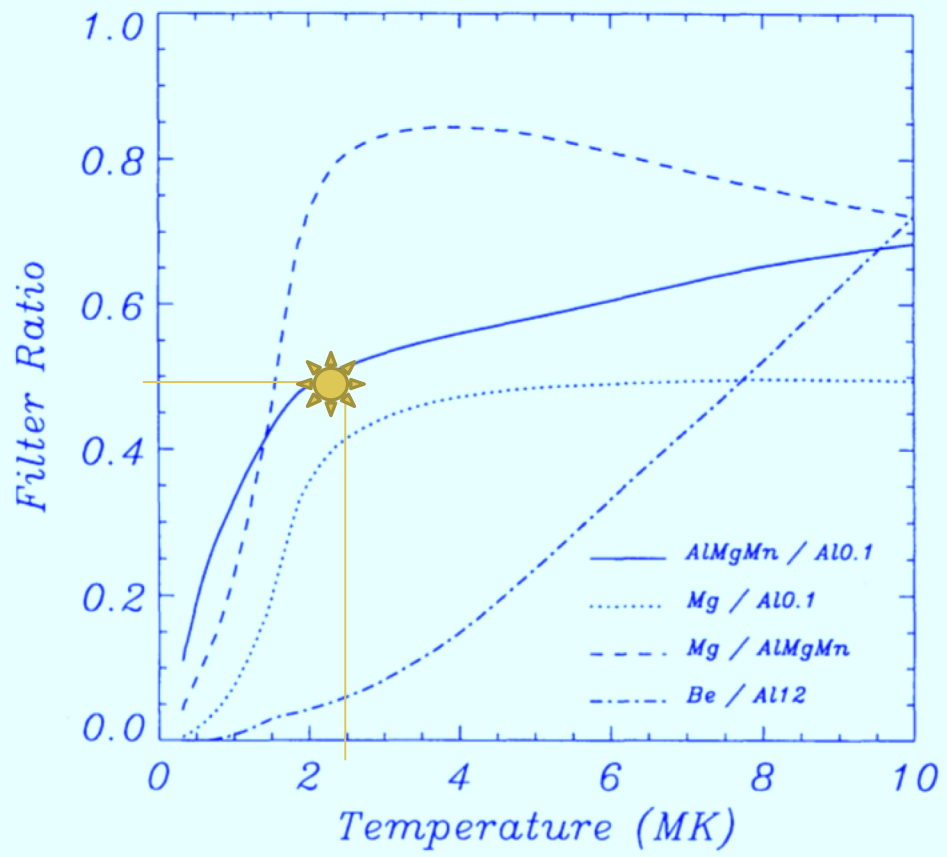
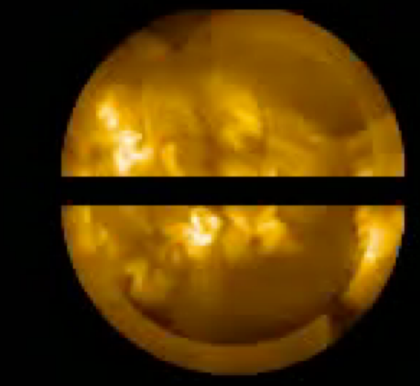


Fig. 1. SXT signal ratios for the representative filter pairs.

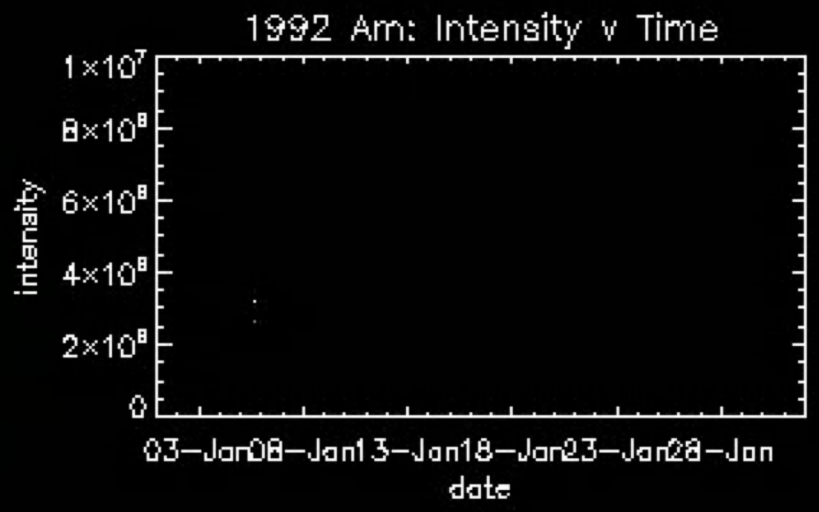
Temperature is the only variable left.

STEPS

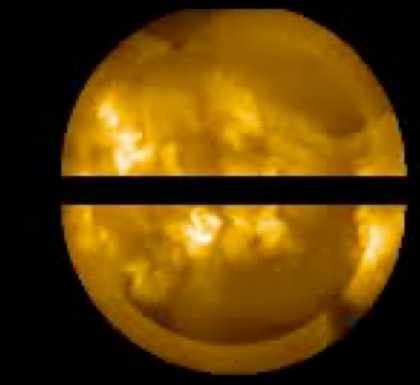
- STEP 1: Prepare images
- STEP 2: Mask images
- STEP 3: Collect intensity (Al v AlMg)
- STEP 4: Convert intensity to Te & Em (FRM)
- STEP 5: Convert Te & Em to Irradiance (Chianti)
- STEP 6: Break into North v South, specific areas



1992-01-05T16:28:05.141



white=total, brown=north hem, gold=south hem



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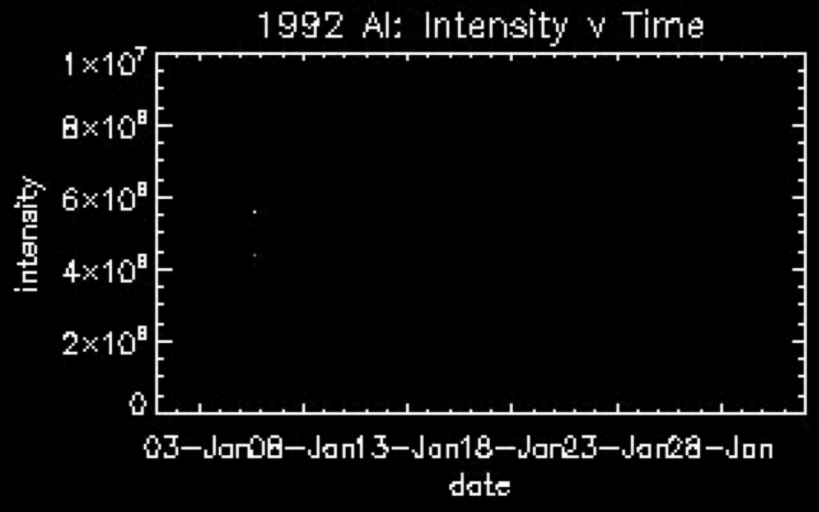
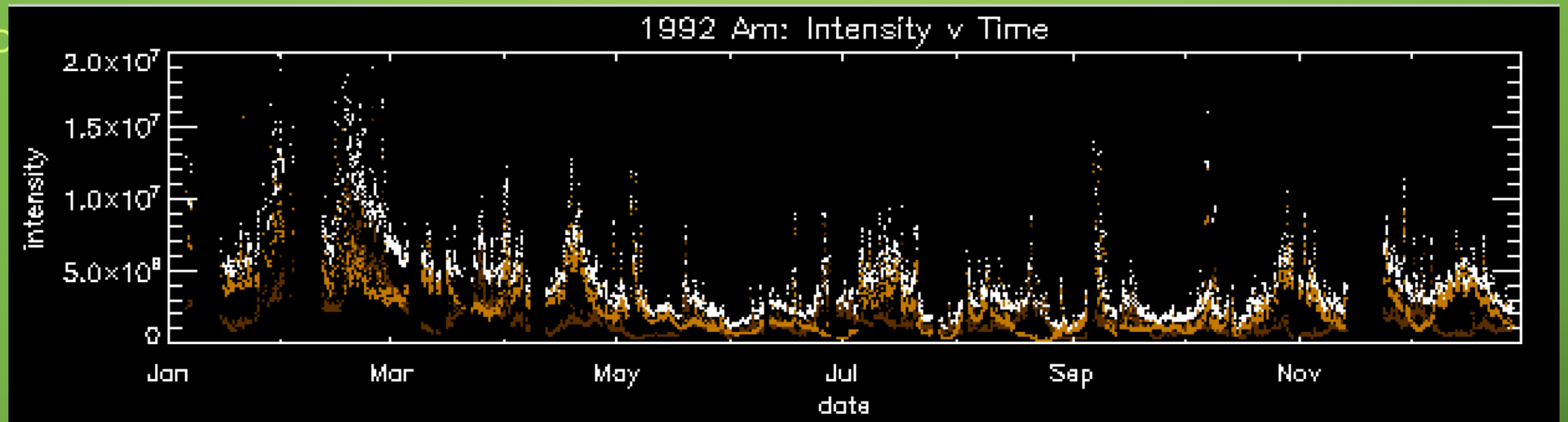
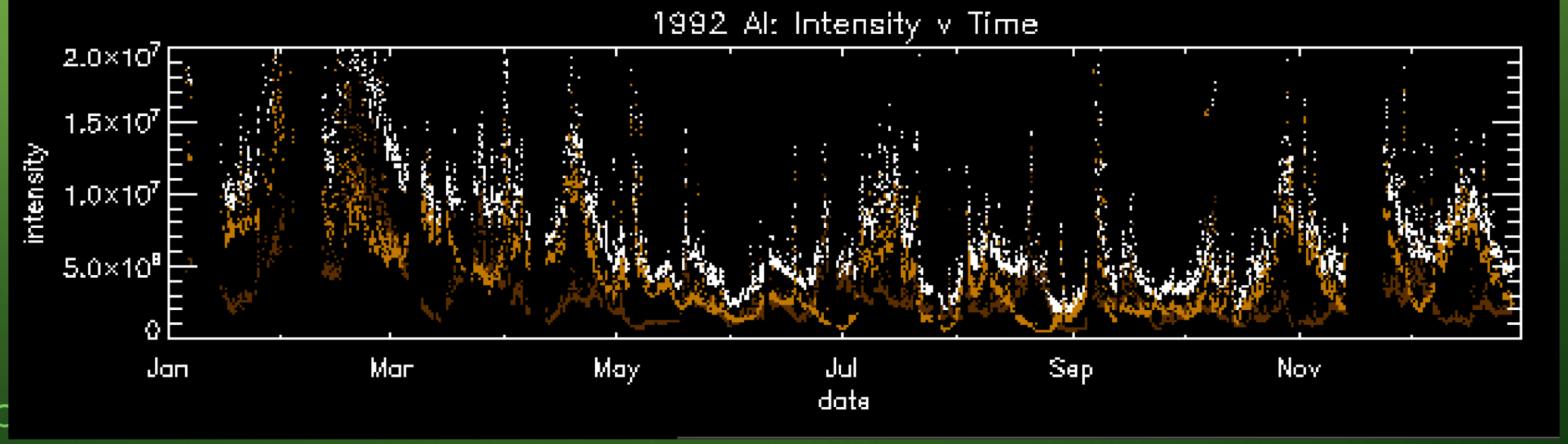
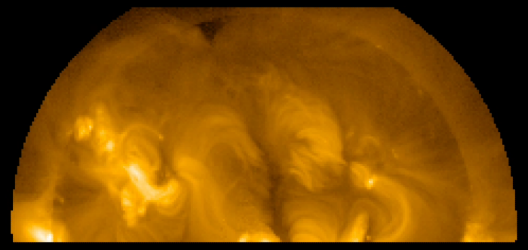
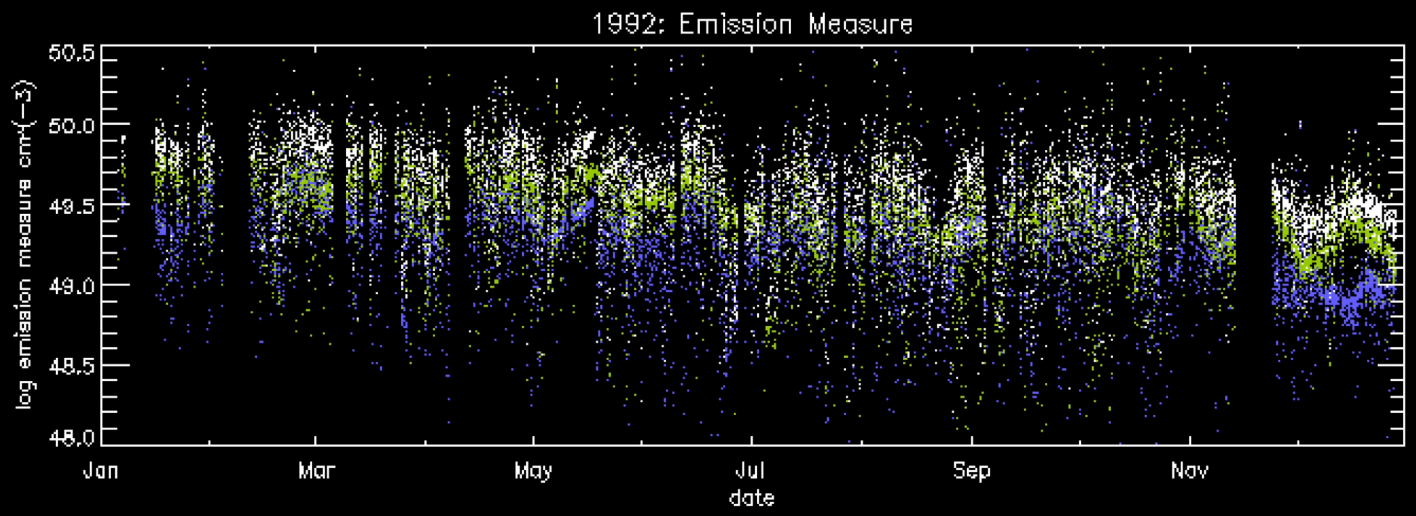



1992 Am: Intensity v Time
2.0x10^7
1.5x10^7
1.0x10^7
5.0x10^6
0
intensity
Jan
Mar
May
Jul
Sep
Nov
date


1992 Al: Intensity v Time
2.0x10^7
1.5x10^7
1.0x10^7
5.0x10^6
0
intensity
Jan
Mar
May
Jul
Sep
Nov
date

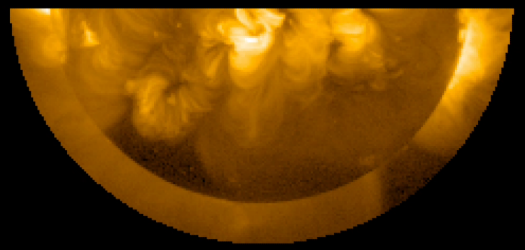
1992-01-06T11:57:09.003

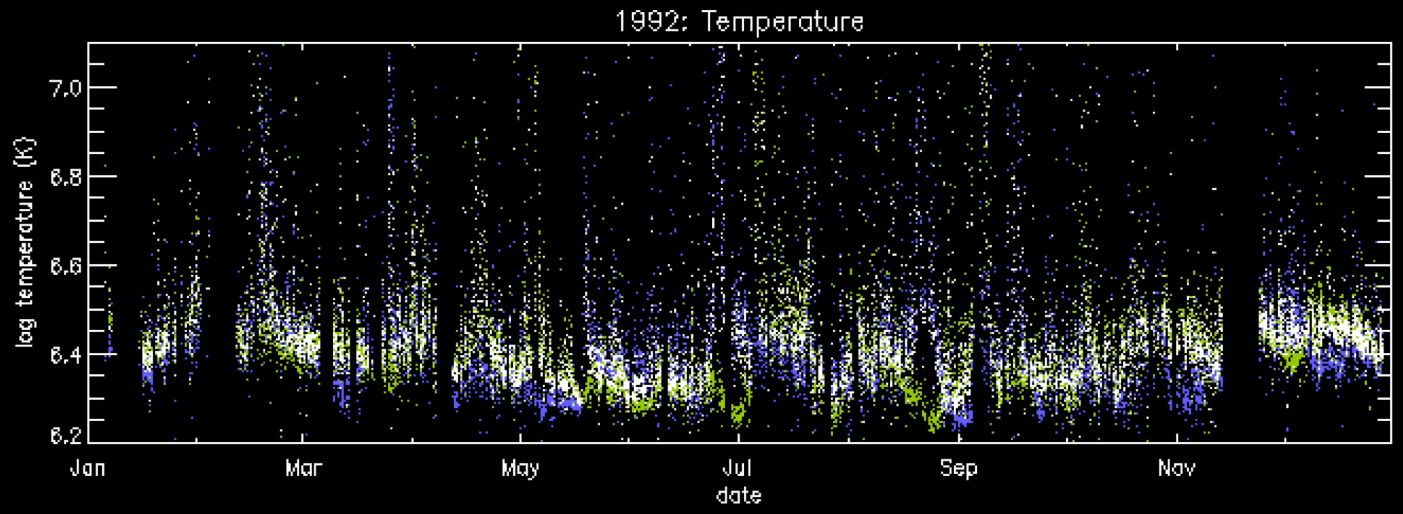


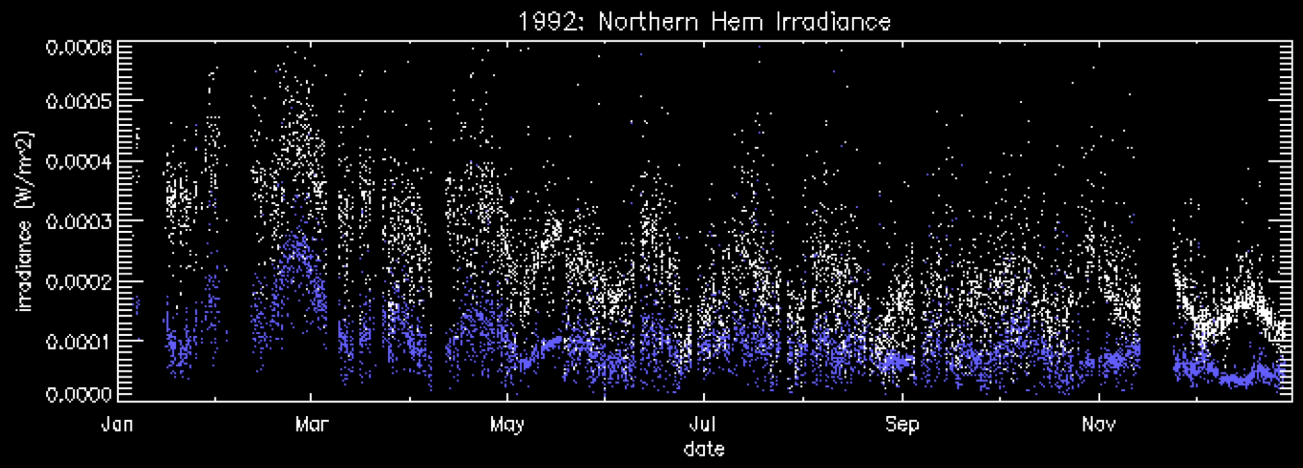


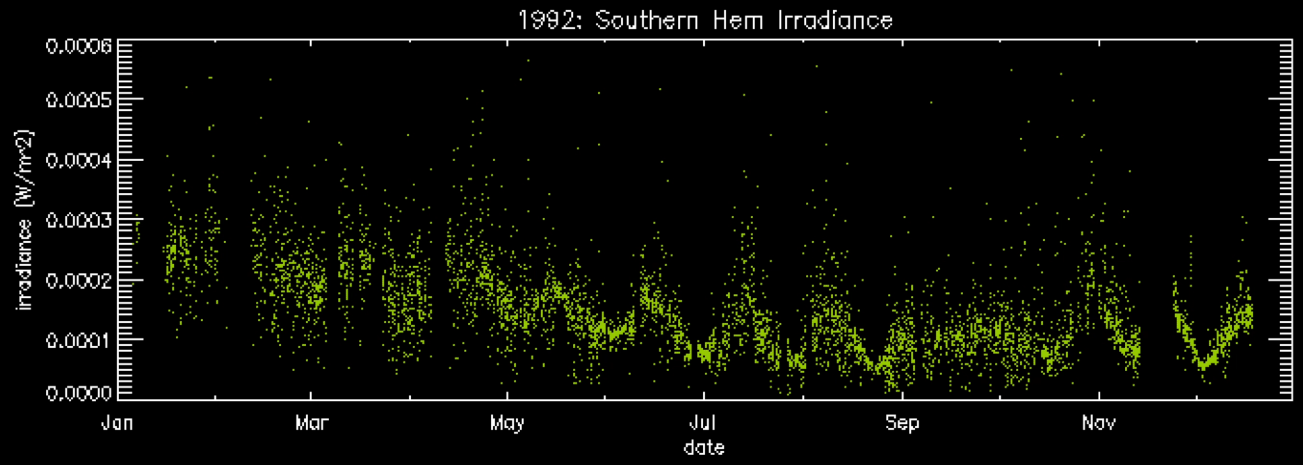
white=total, blue=northern hem, green=southern hem

1992-01-06T11:46:29.005





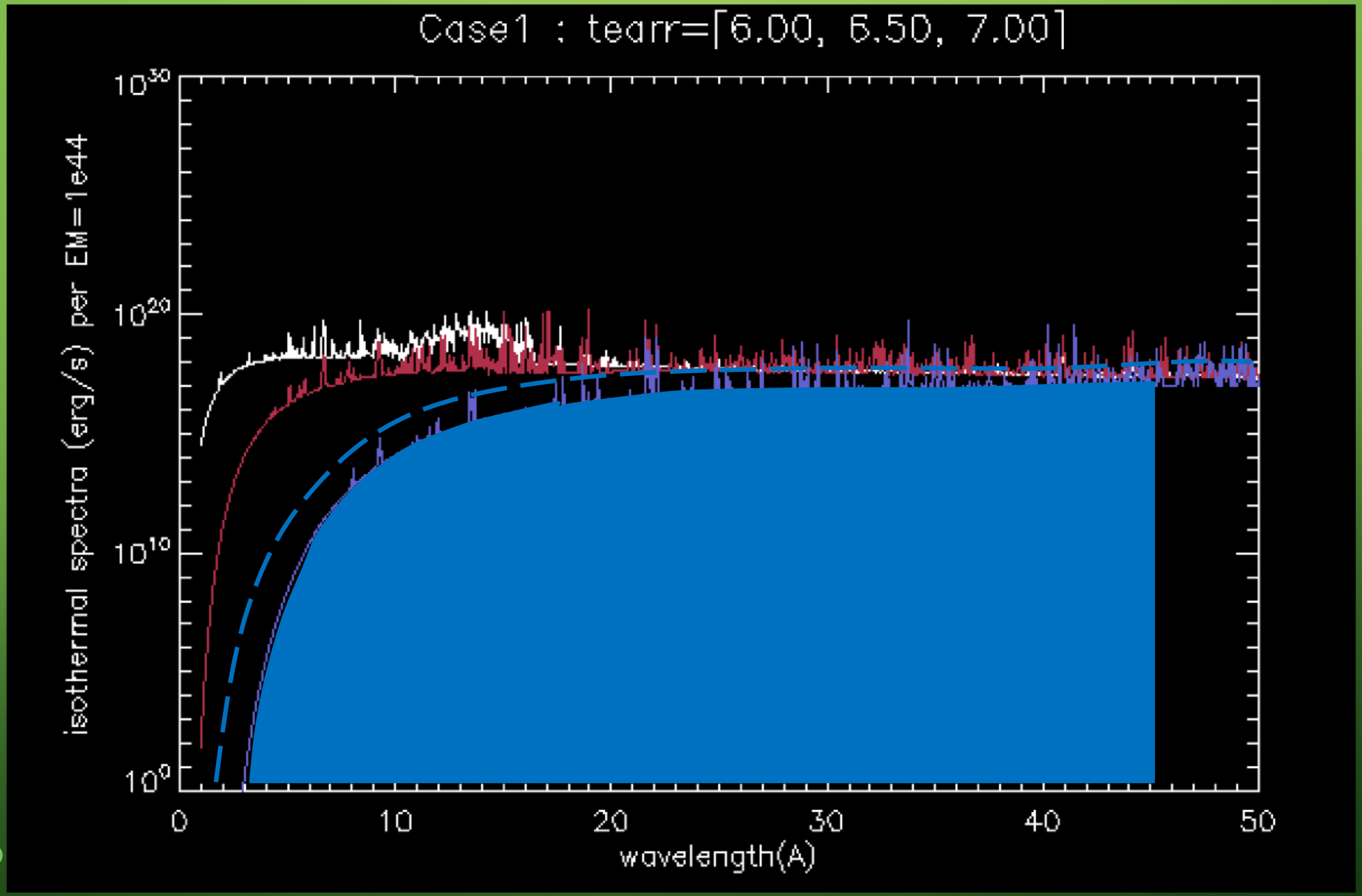

1992: Northern Hem Irradiance
irradiance [W/m^2]
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Mar
May
Jul
Sep
Nov
date

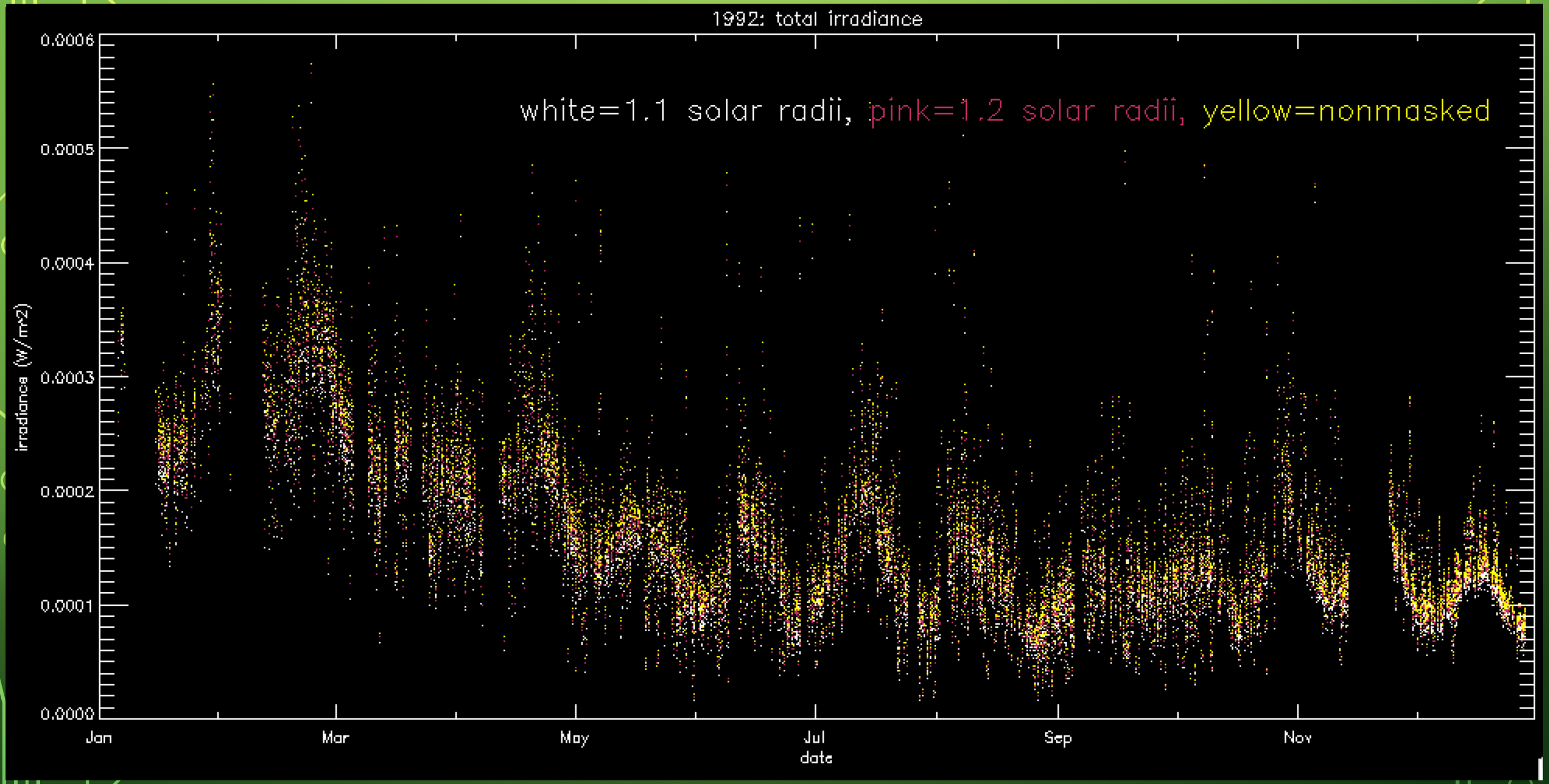

1992: Southern Hem Irradiance
irradiance [W/m^2]
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Mar
May
Jul
Sep
Nov
date

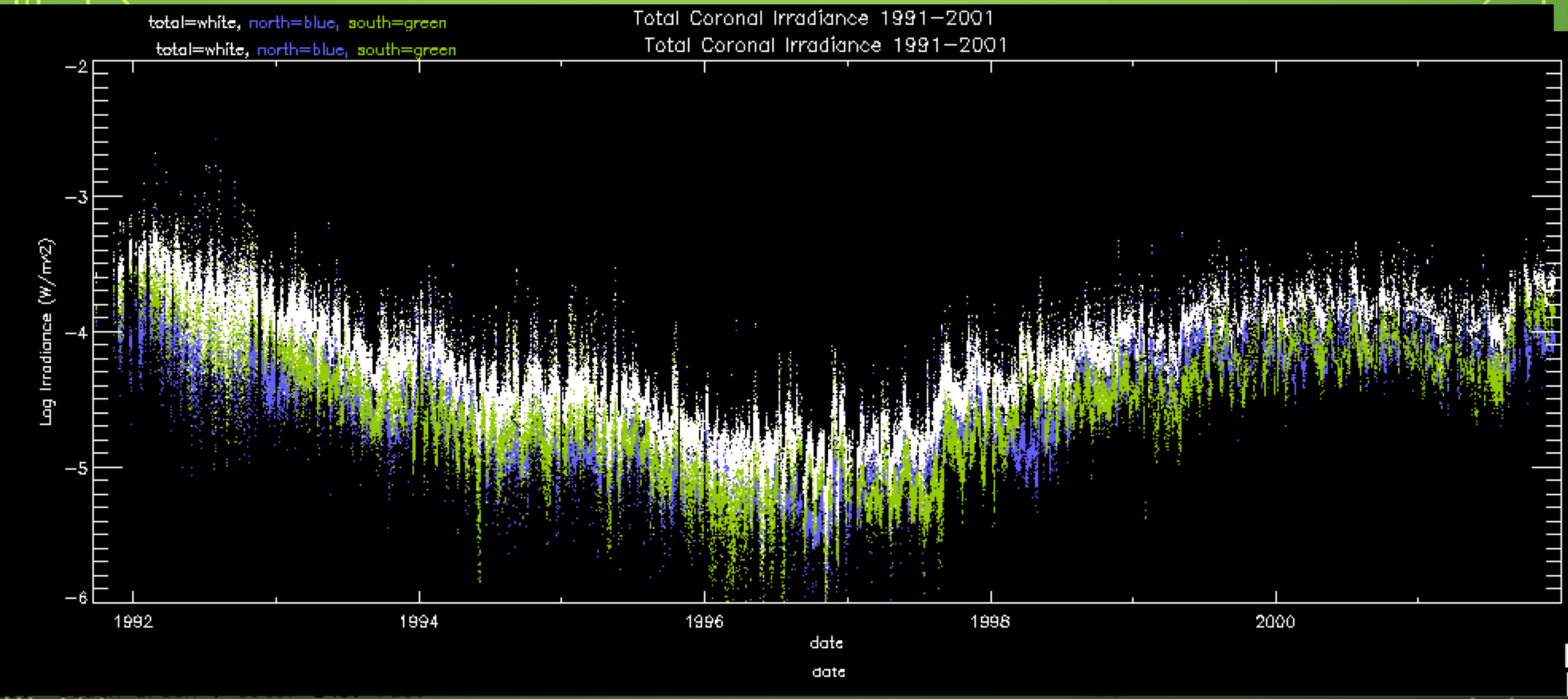
- CHIANTI = atomic database & IDL/Python programs, allows us to calculate the spectra from astrophysical plasmas

- Total Coronal Irradiance = $\int$ coronal isothermal spectra (integral over specified wavelength)

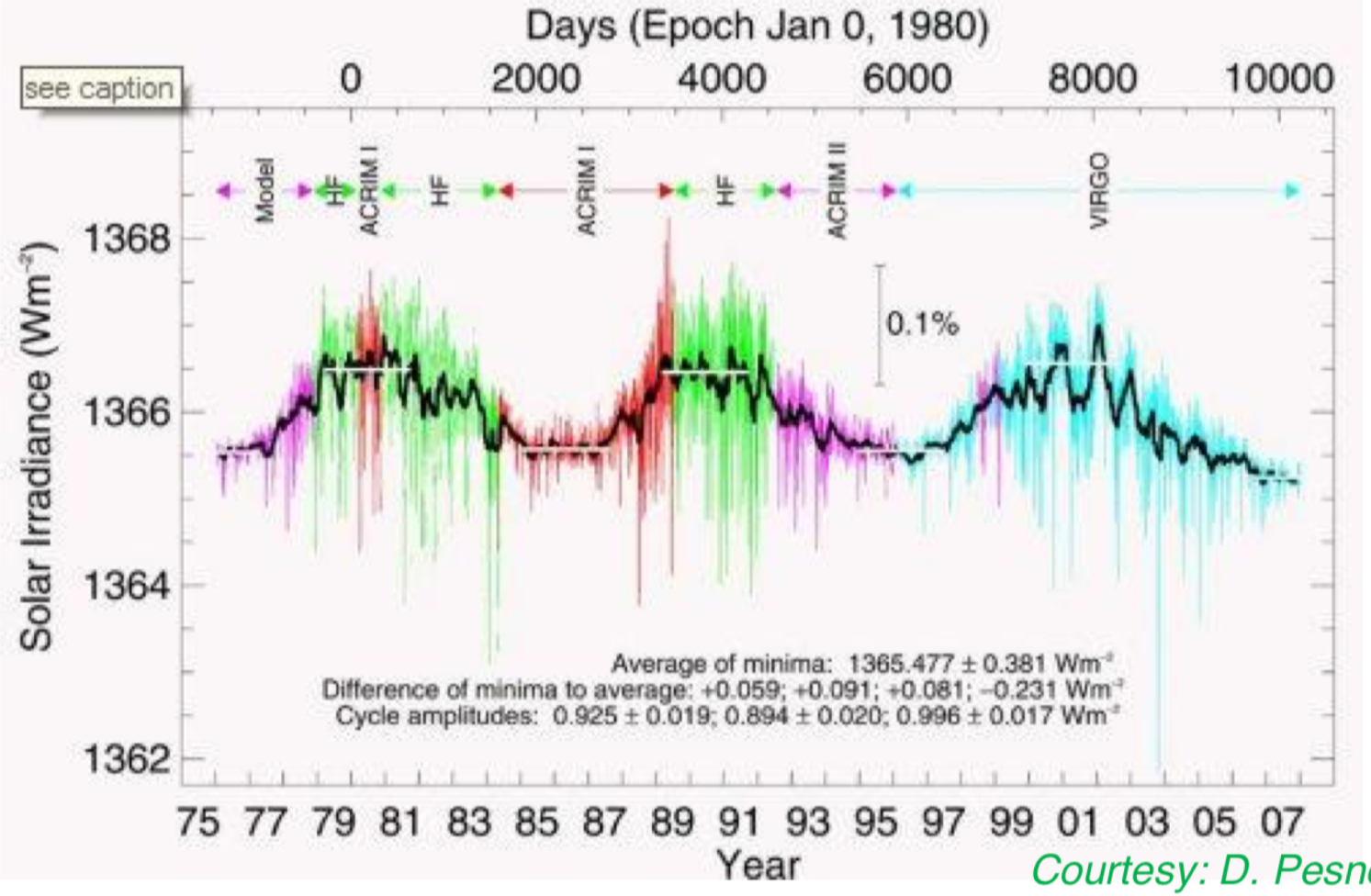
- isothermal.pro : Computes spectra from isothermal plasmas (including emission lines)


Case1 : tearr=[6.00, 6.50, 7.00]
isothermal spectra (erg/s) per EM=1e44
10^{30}
10^{20}
10^{10}
10^{0}
0
10
20
30
40
50
wavelength(A)


1992: total irradiance
white=1.1 solar radii, pink=1.2 solar radii, yellow=nonmasked
irradiance (W/m^2)
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0.0000
Jan
Mar
May
Jul
Sep
Nov
date

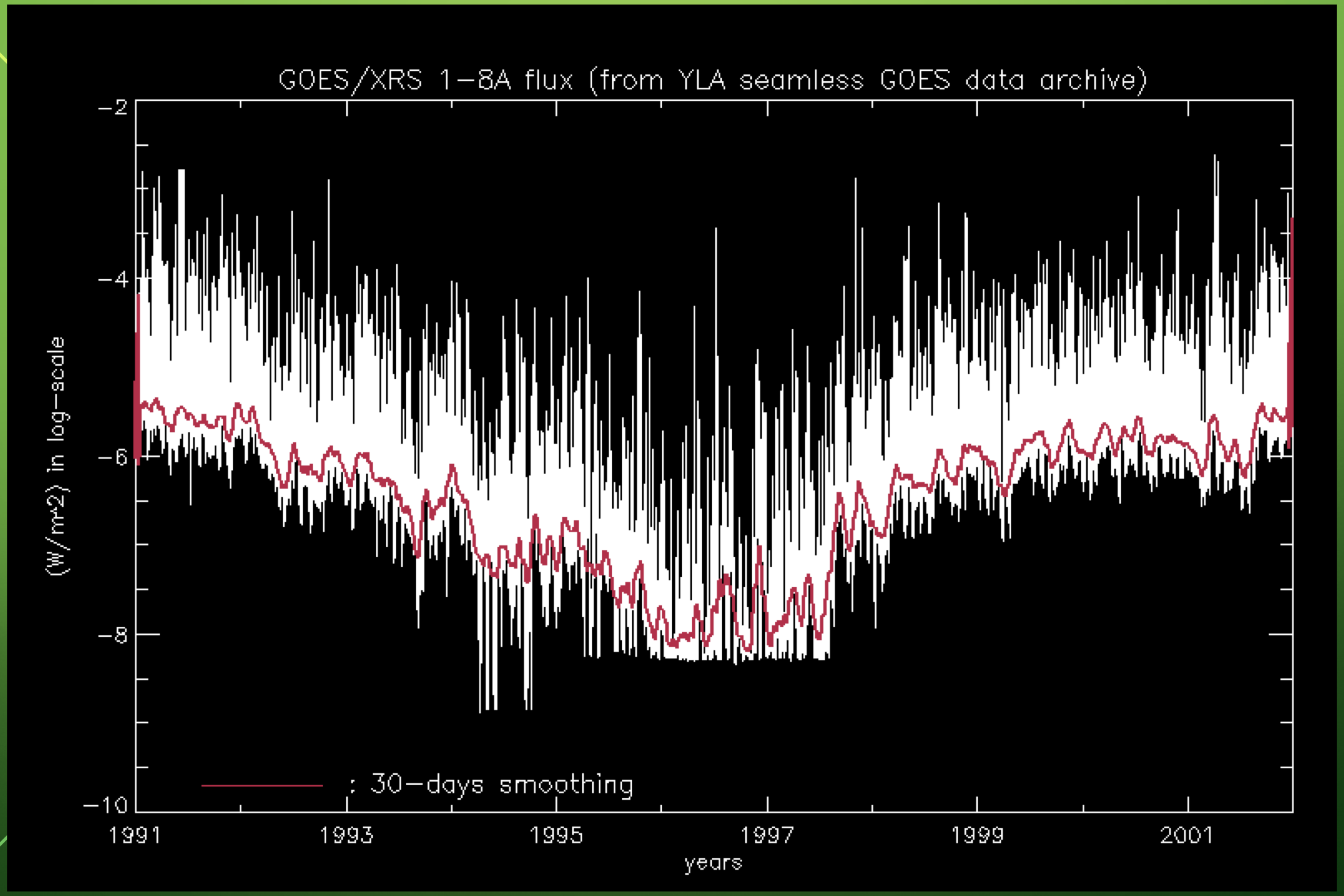

total=white, north=blue, south=green
Total Coronal Irradiance 1991–2001
total=white, north=blue, south=green
Total Coronal Irradiance 1991–2001
−2
−3
−4
−5
−6
Log Irradiance (W/m^2)
1992
1994
1996
1998
2000
date
date

Variability of Total Solar Irradiance (TSI)



Courtesy: D. Pesnell

Mean value **1361 W m^{-2}** (Kopp & Lean 2011) with 11-year cycle variations of ± 0.1%. Sunspots cause downward excursions of ~ 0.2%. Currently measurements of TSI made by the SORCE spacecraft: **http://lasp.colorado.edu/home/sorce/**


GOES/XRS 1-8A flux (from YLA seamless GOES data archive)
(W/m^2) in log-scale
-2
-4
-6
-8
-10
1991
1993
1995
1997
1999
2001
years
: 30-days smoothing

PROJECT SUMMARY

- YOHKOH SXT, FULL SUN IMAGE , LEVEL 2
- FRM (Summed intensity within 1.2 solar radii)
- CHIANTI (Integrated isothermal coronal spectra)
- SOLAR X-RAY IRRADIANCE FROM 1991-2001 (wbins: 3-45Å)
- INTERPRETING (SORCE, GOES)

CITATIONS

- "Data Description." *Yohkoh Legacy Data Archive*, Montana State University, 2 Nov. 2010, ylstone.physics.montana.edu/ylegacy/.
- Hara et. al (1992) PASJ, vol 44, L135-140
- K. P. Dere, E. Landi, H.E. Mason, B. C. Monsignori Fossi, P. R. Young (1997) Astronomy and Astrophysics Suppl. Ser., vol 125, pp. 149-173
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