Energetics from Solar irradiance
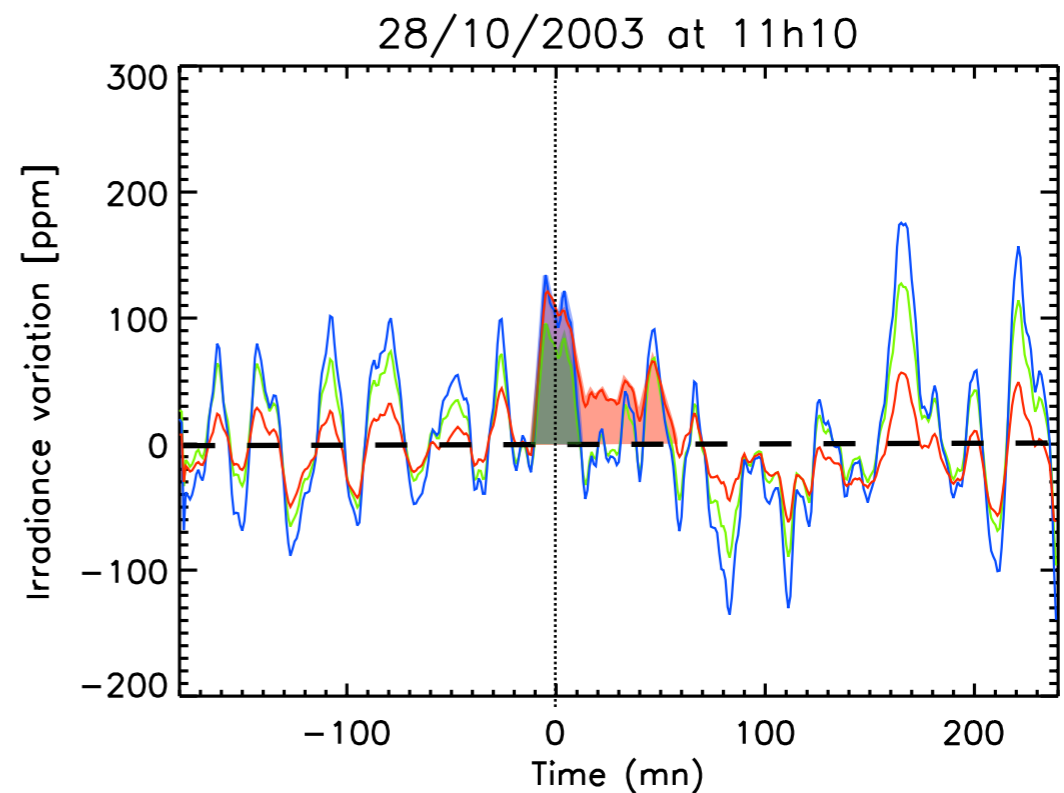
Matthieu Kretzschmar

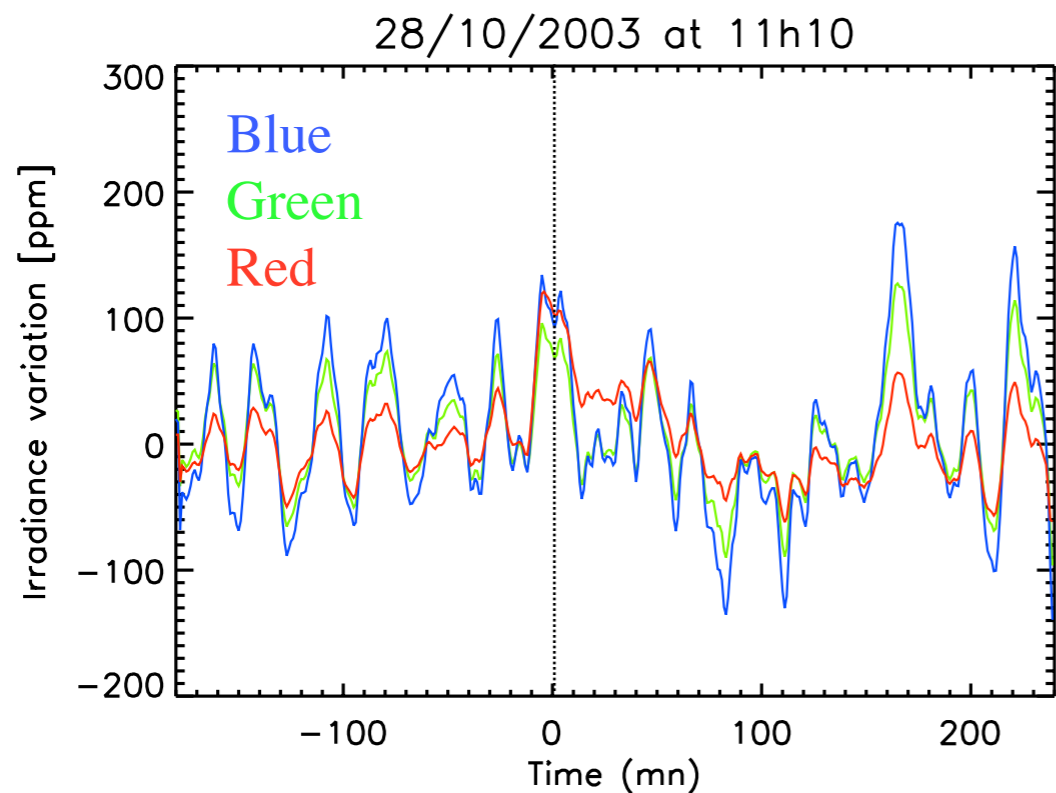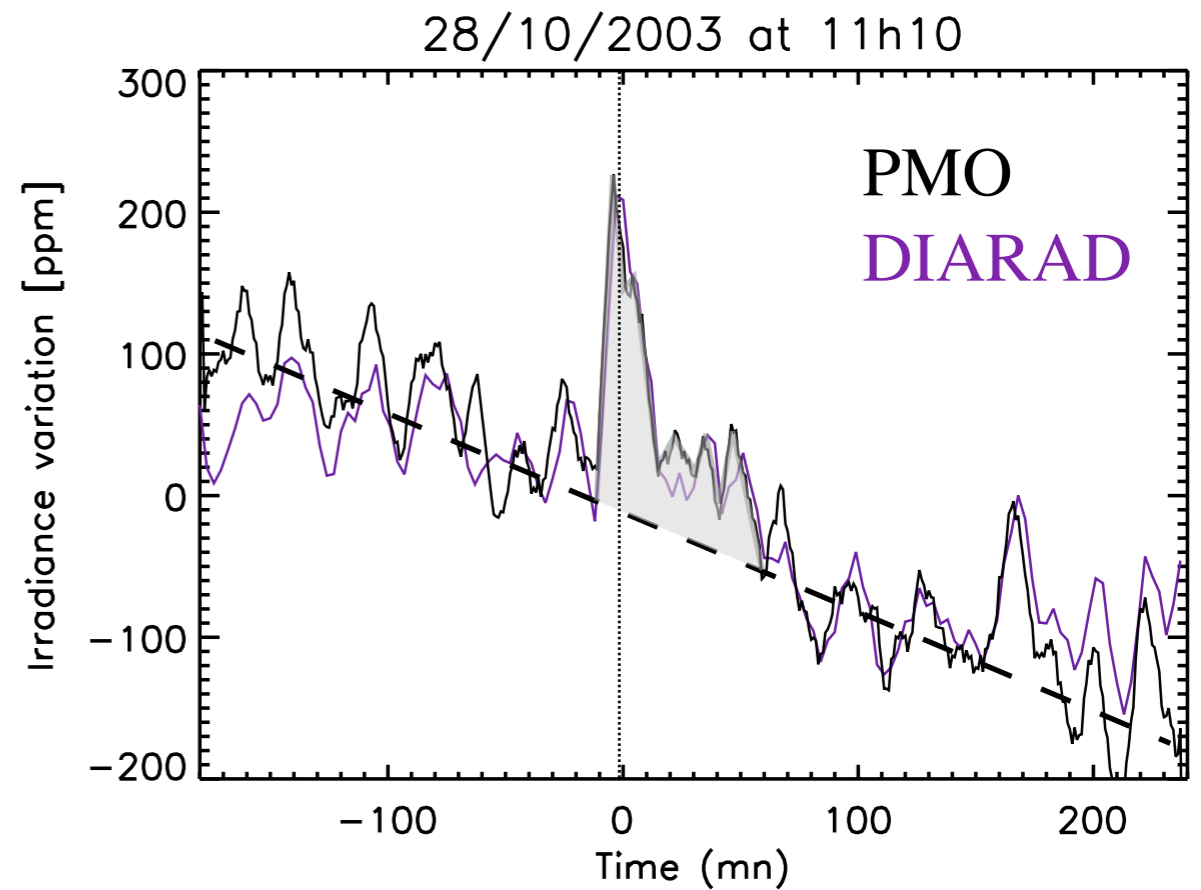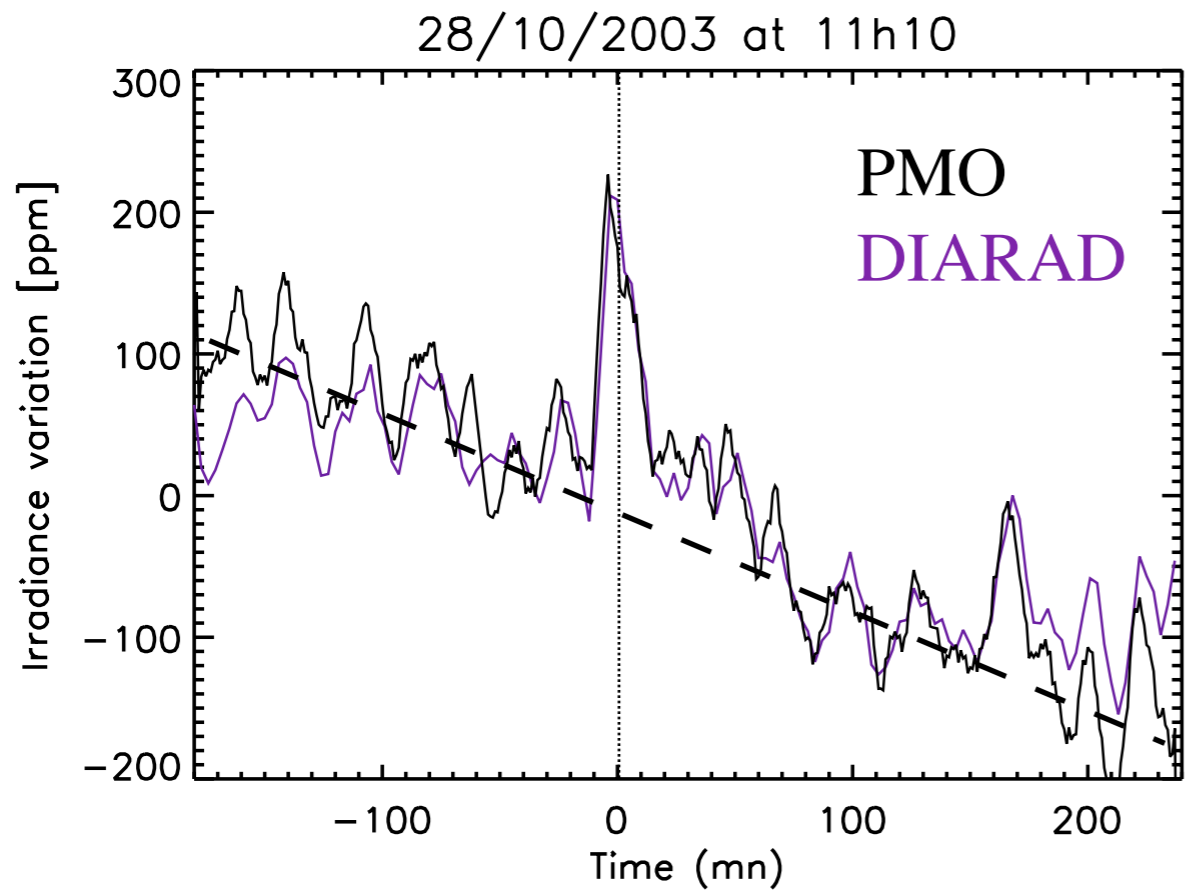*LPCE/CNRS, Orléans, france*

- Part I: Total solar irradiance and visible irradiance
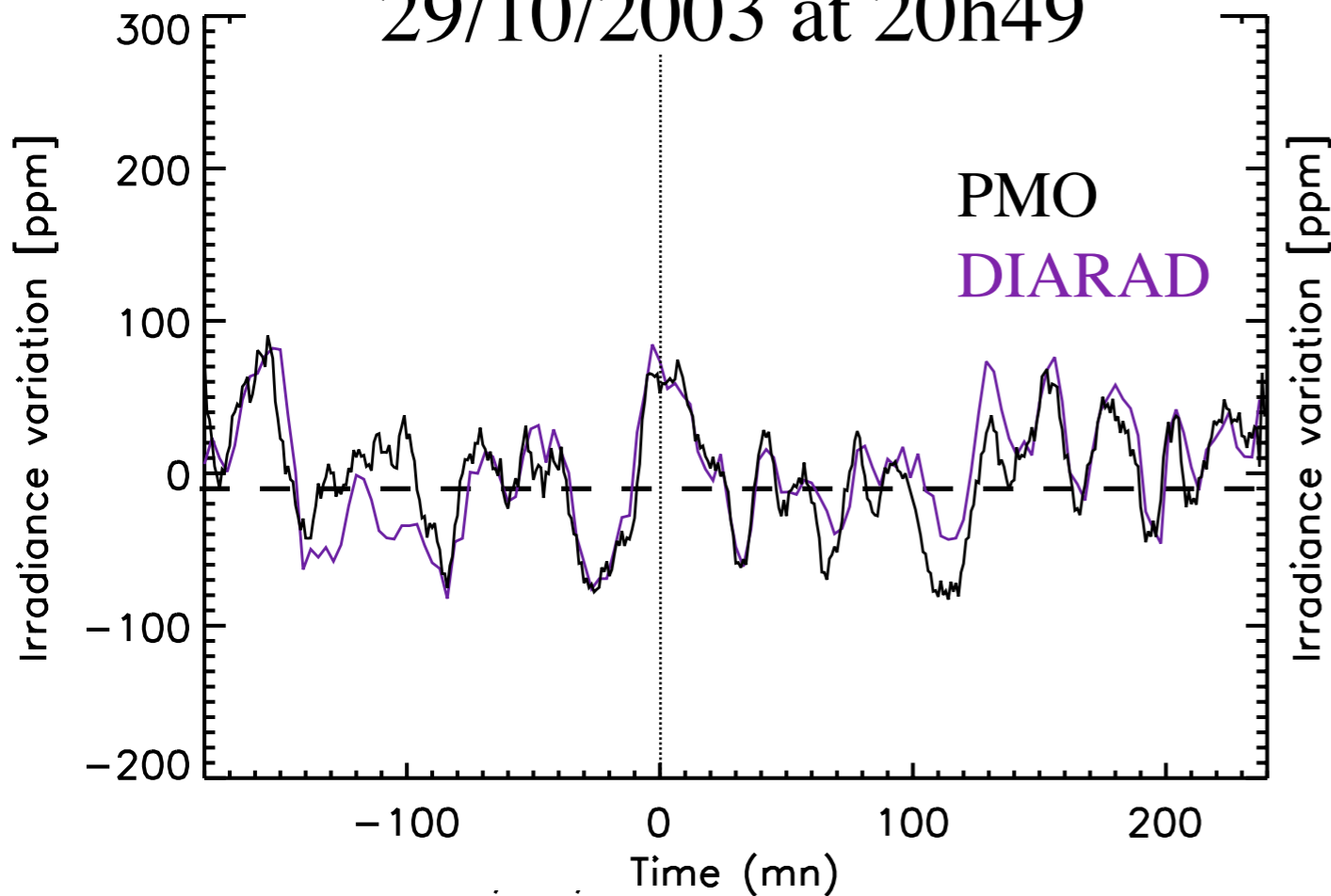
Data&Method

- I use the high temporal resolution irradiance data from the VIRGO experiment onboard SoHO. Two sensors measure the TSI (PMO and DIARAD), and SPM measures the visible irradiance in three channels of about 5nm centered around 402nm (blue), 500nm(green), and 862 (red)

- dt=1mn for PMO and SPM, 3mn for DIARAD.

- As the flare signal is at the fluctuation level, I estimate the flare energy in a very simple way, just by integrating what is above a mean level (shaded area in the following figures).

- In respect with using the flare profile in GOES/SXR to integrate the TSI time series, this avoids to make assumptions on the flare profile in spectrally integrated light, and thus on the relative spectral contribution to the total flare signal.
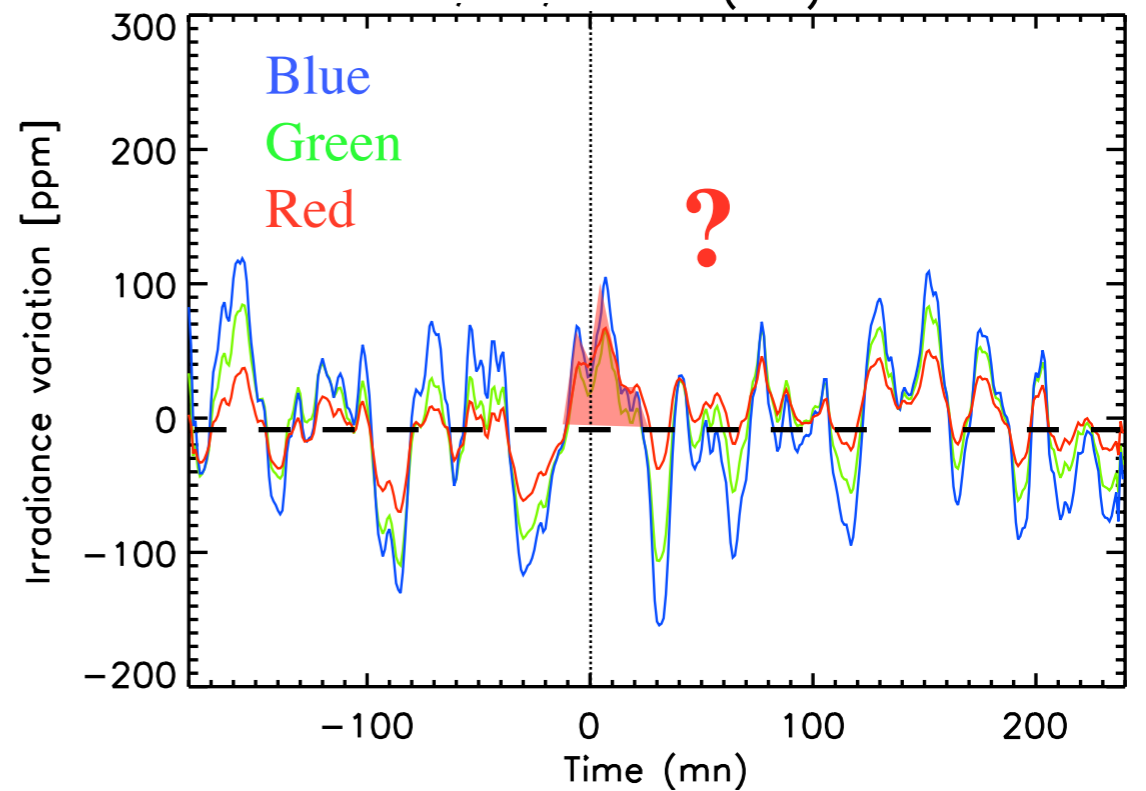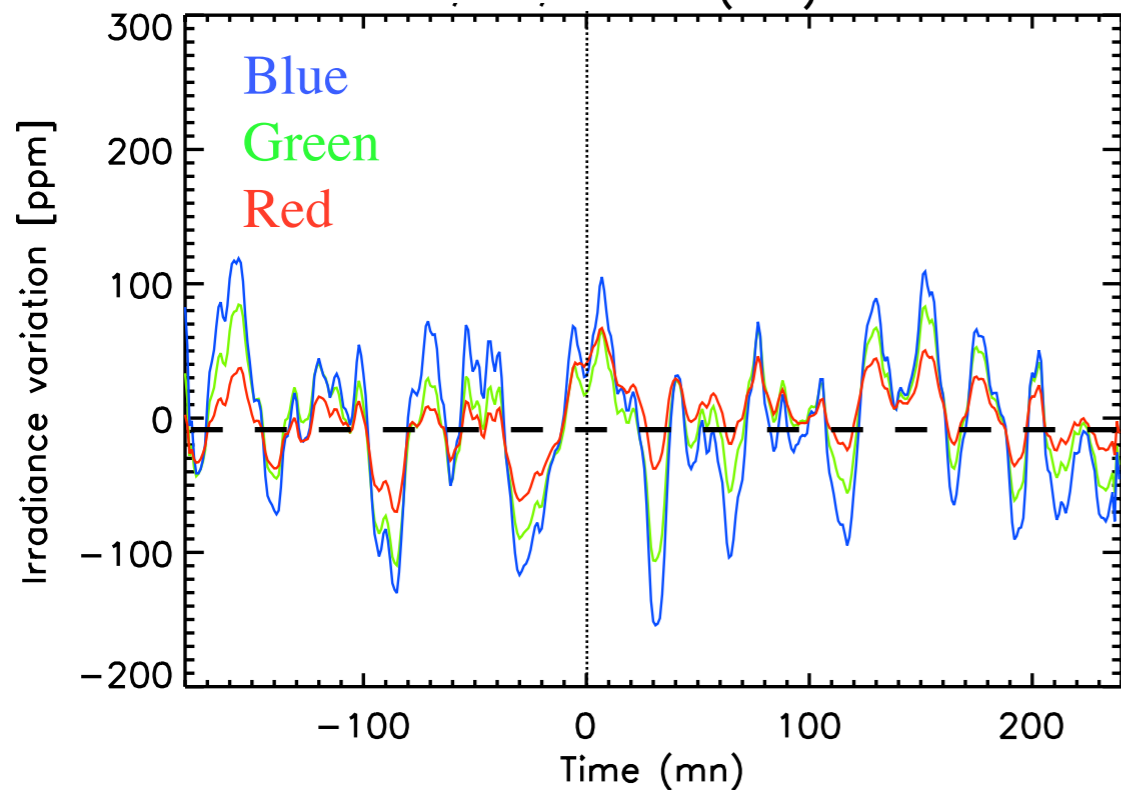
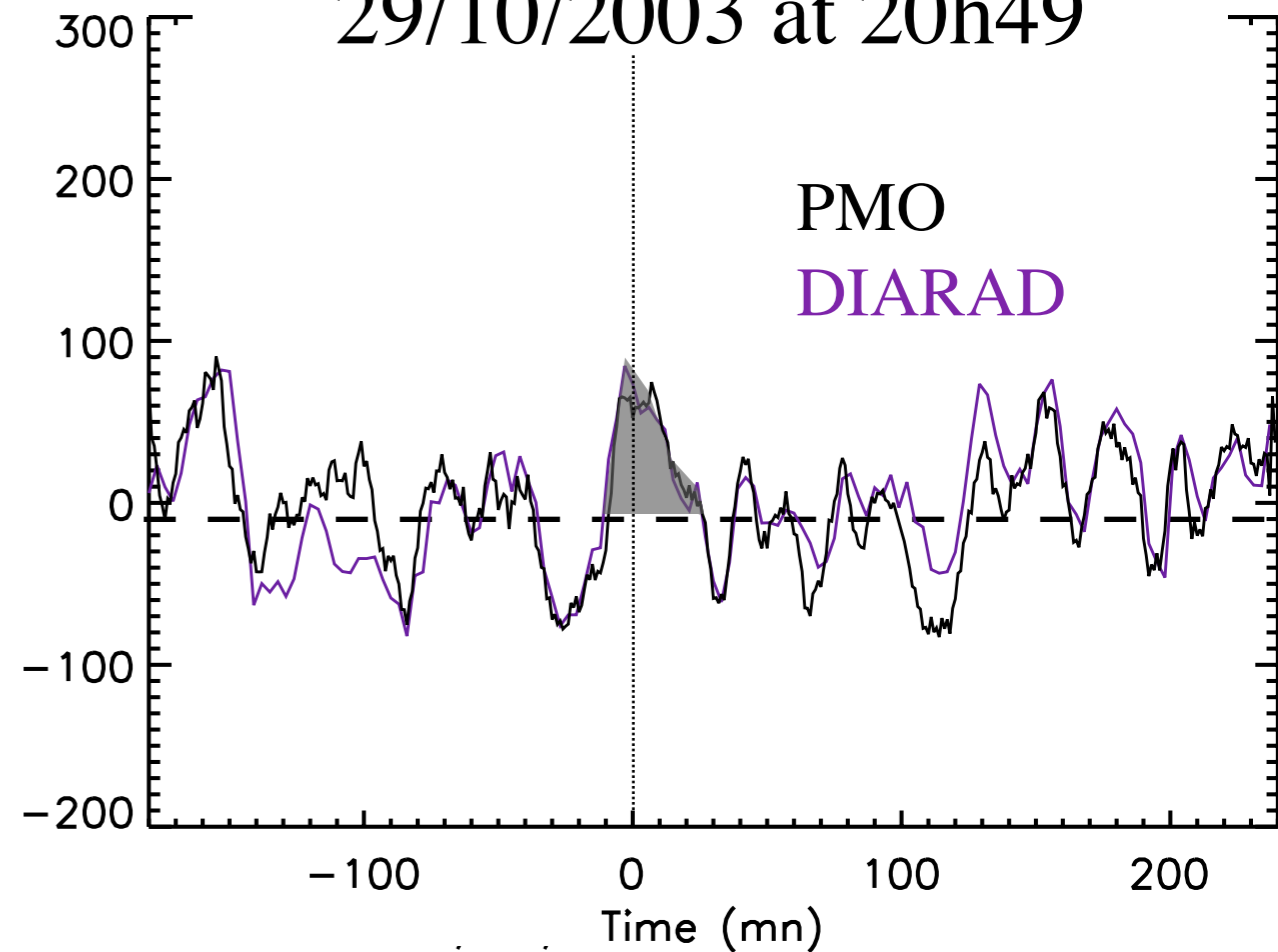# 28 Oct 2003

M. Kretzschmar, Solar activity during the onset of Solar Cycle 24, Global event energetics workgroup.

29 Oct 2003

M. Kretzschmar, Solar activity during the onset of Solar Cycle 24, Global event energetics workgroup.

6 Dec 2006

14 Jul 2000

M. Kretzschmar, Solar activity during the onset of Solar Cycle 24, Global event energetics workgroup.
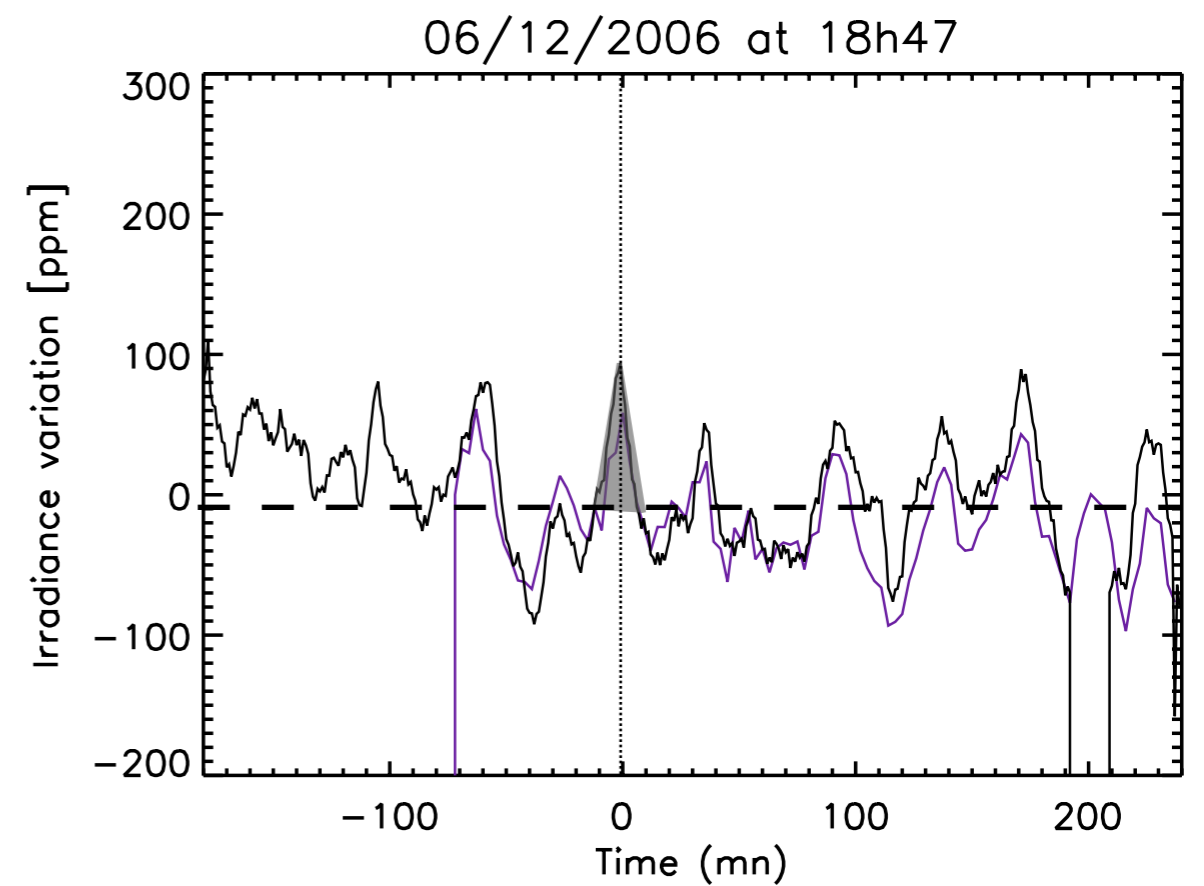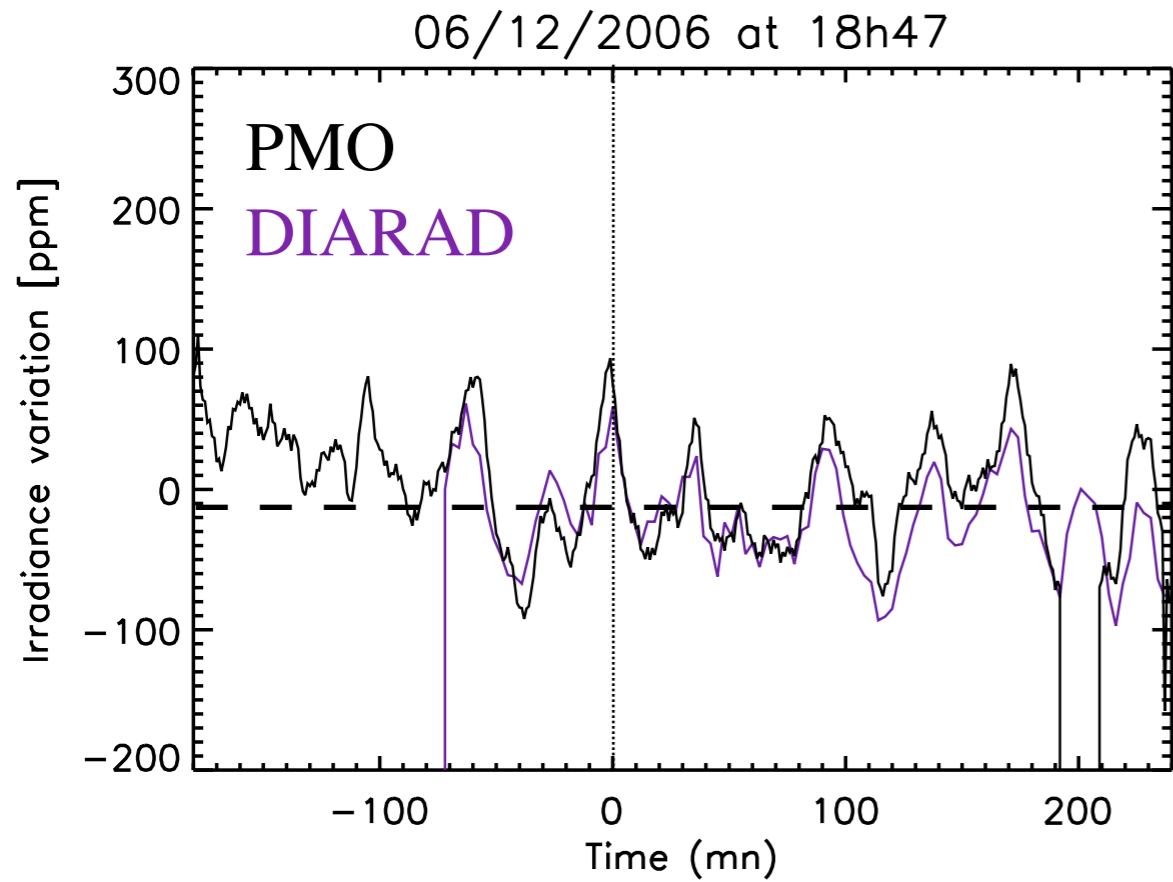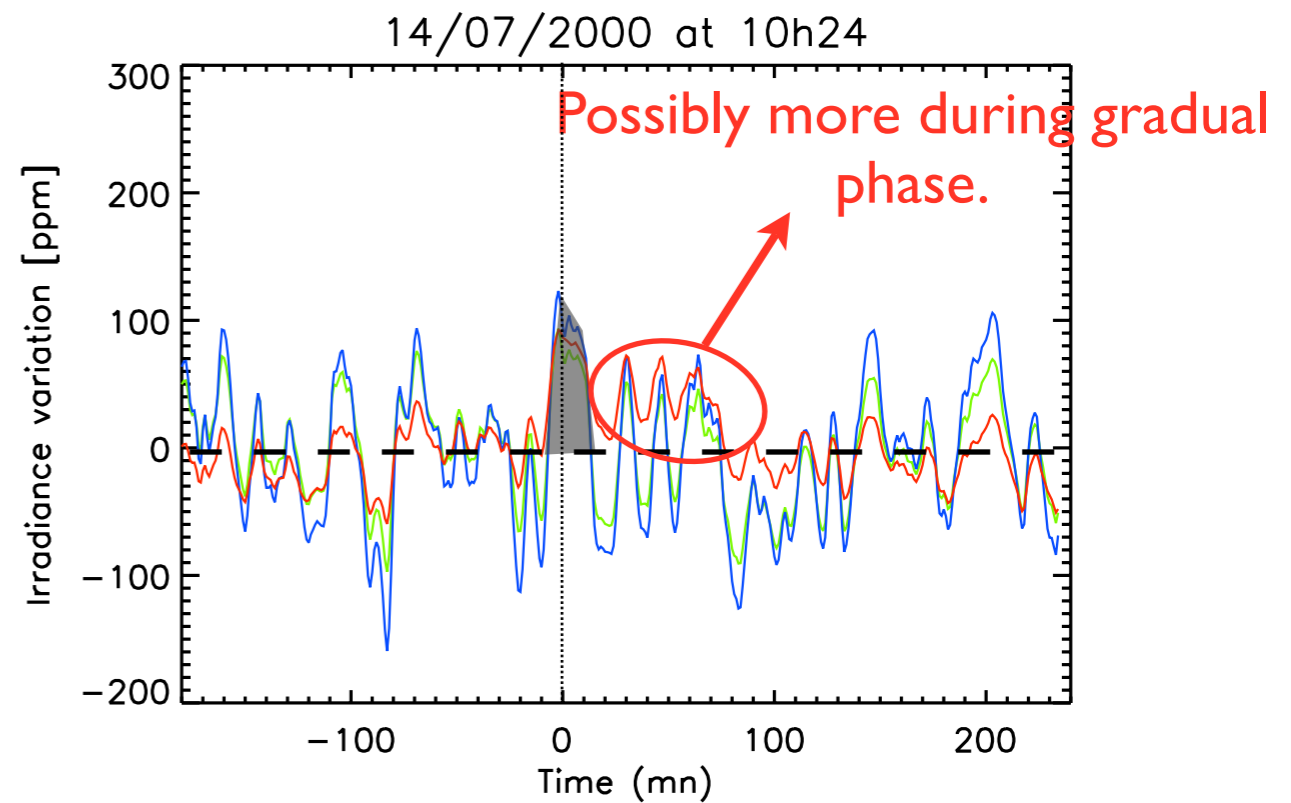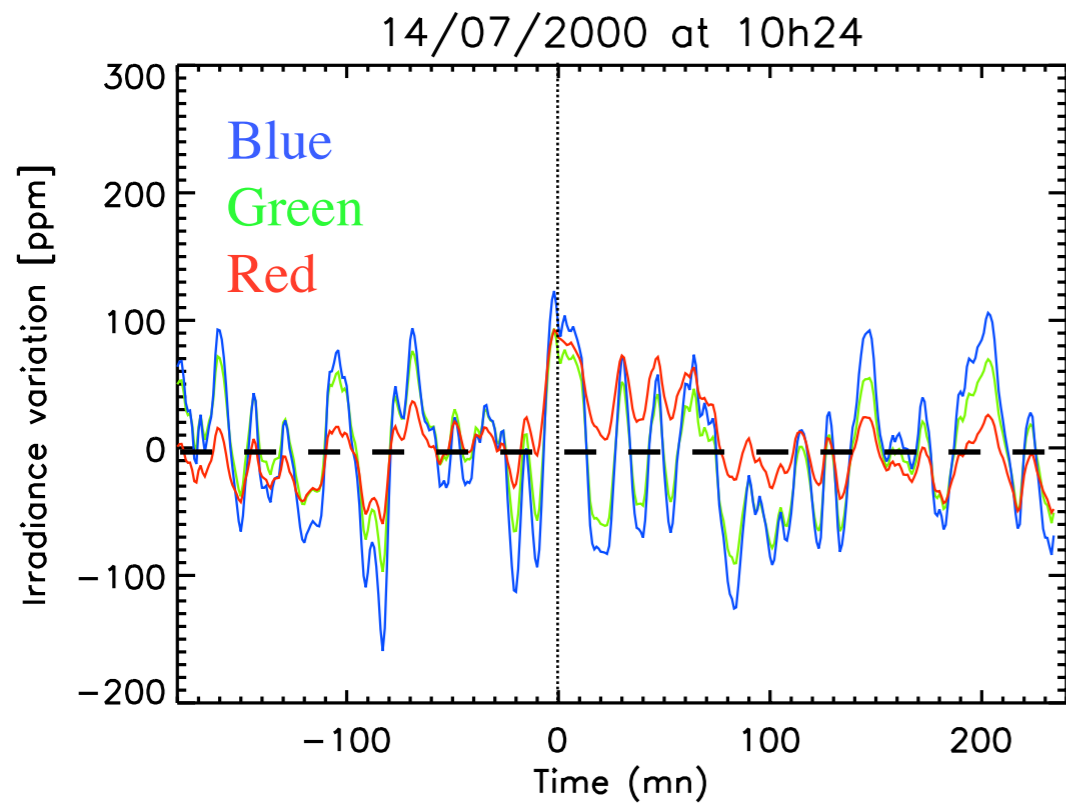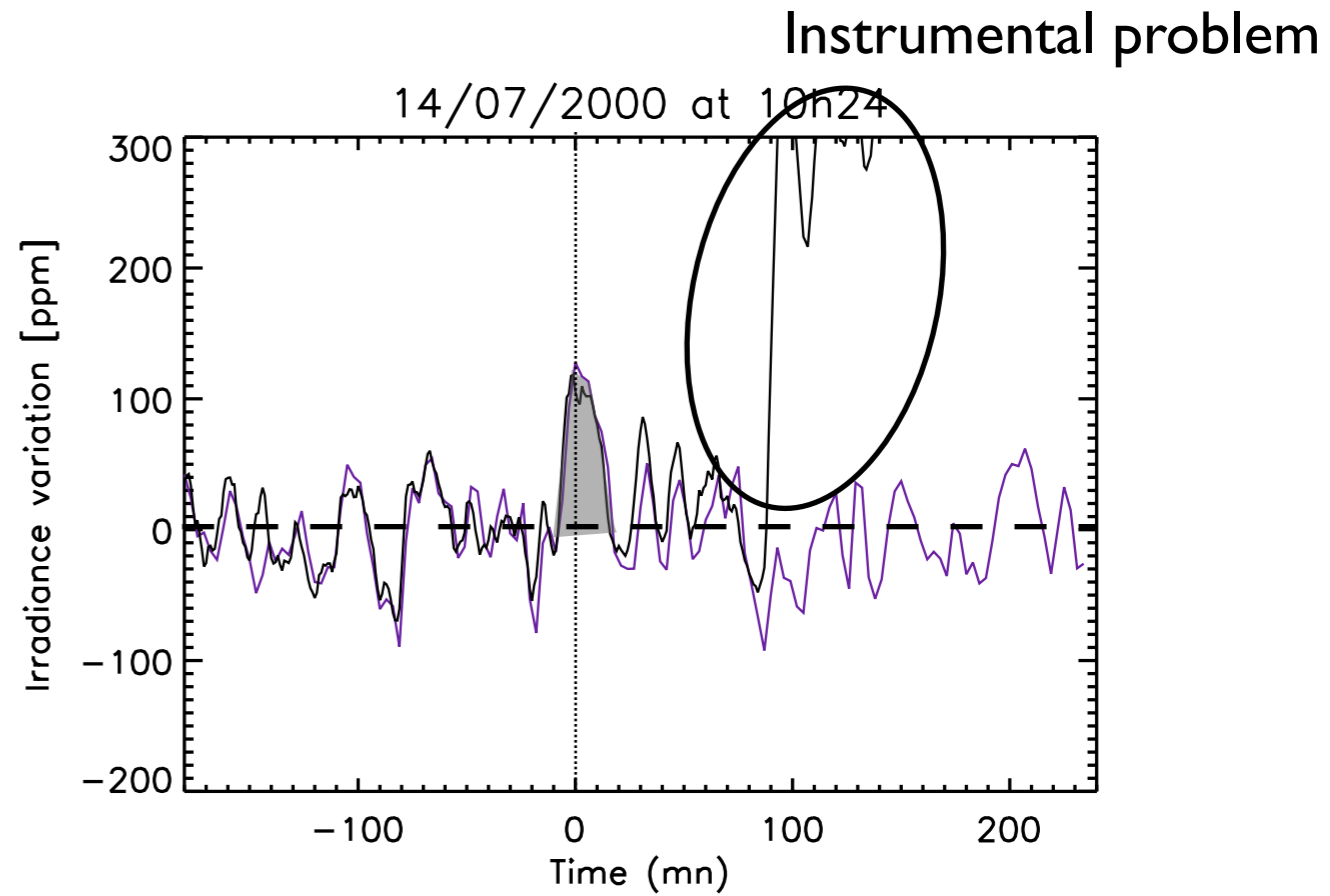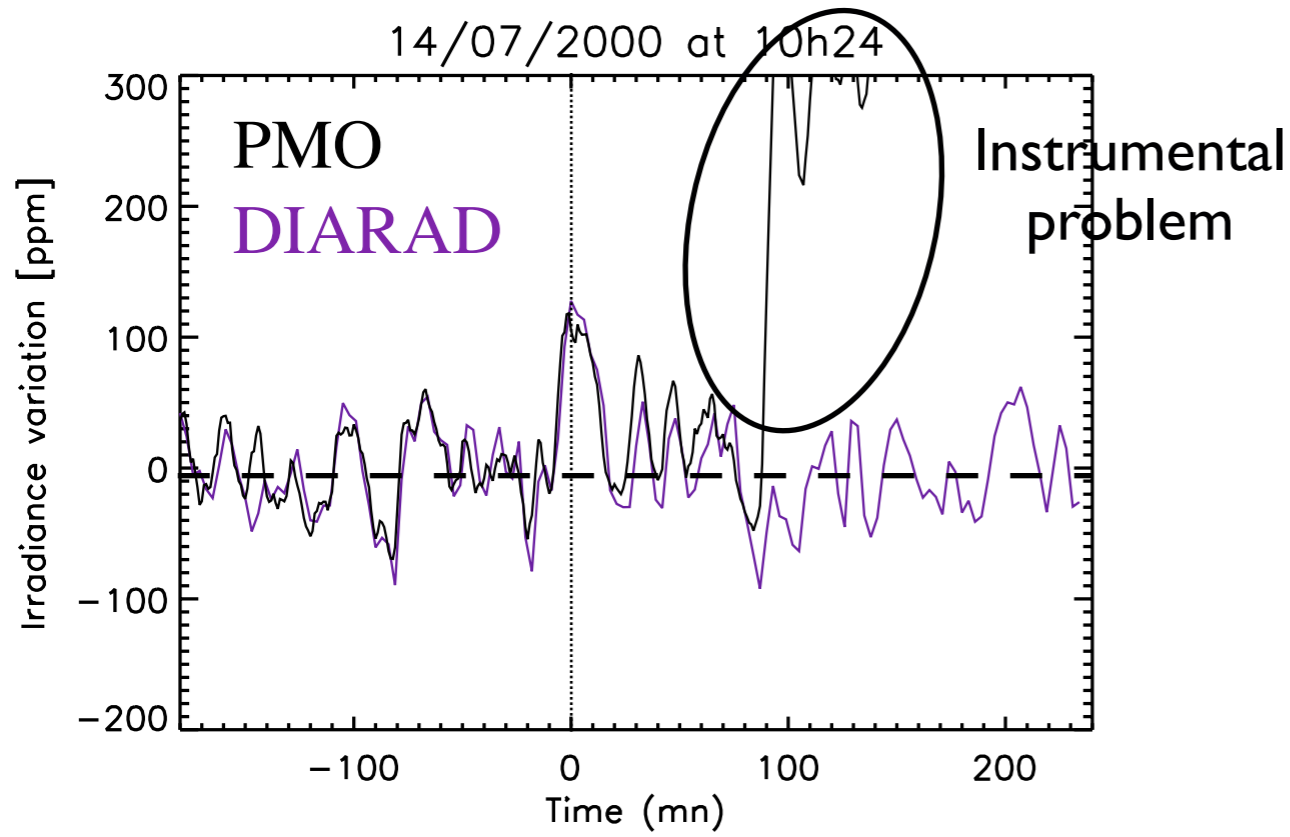
Remarks

- As seen in figures, uncertainties are large.

- There is sometimes a good correlation between the flare profile in SXR and in TSI, but this might as well be casual since there are TSI fluctuations of the same level without any X-ray flare.

X28 flare on Nov. 4, 2003 at 19h50

PMO
DIARAD
Blue
Green
Red
Goes 1-8nm (scaled)

Irradiance variation [ppm]

Time (mn)

- There are several cases (like for ex. the Nov. 4, 2003 flare) for which there is a real ambiguity about the signature of the flare. However, even if we can argue that there *is* a signature, we can not quantify it because it is superposed on fluctuations whose the level is at least of the same order.
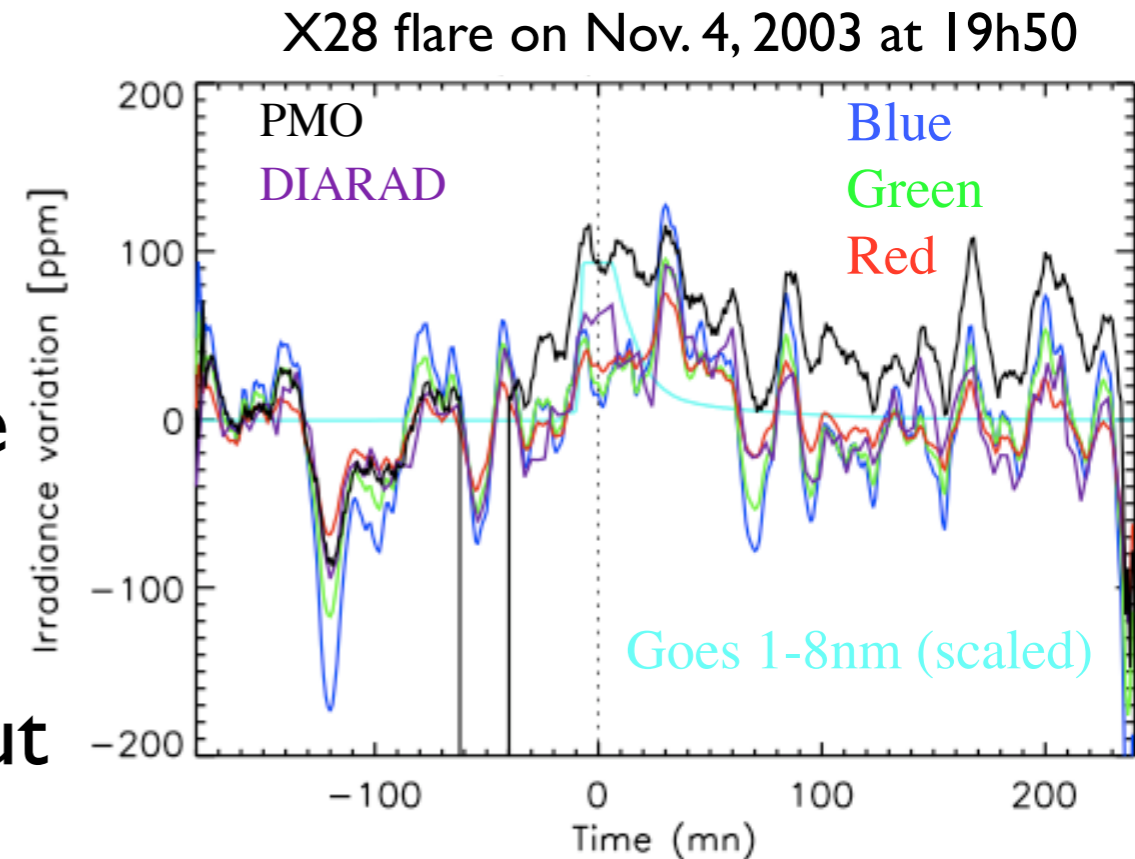
Energetics from Solar irradiance

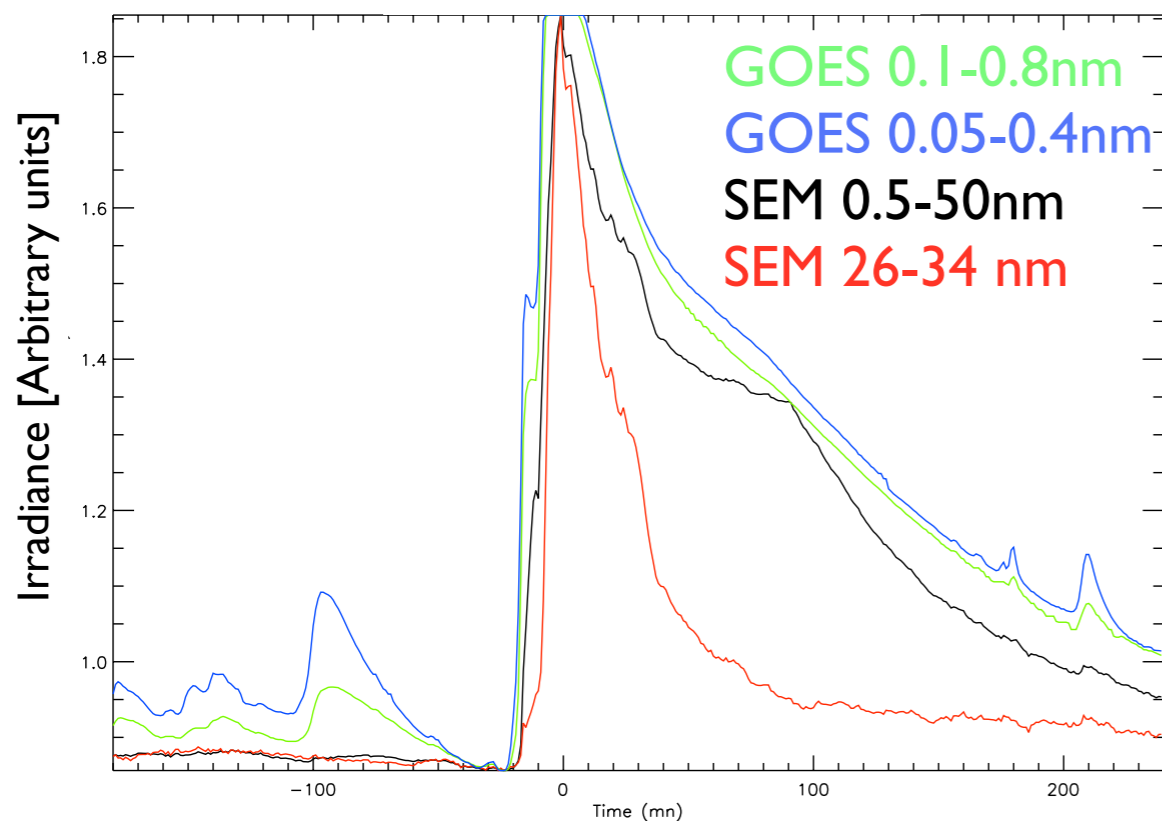- Part II: EUV irradiance.

Remarks

- To retrieve the radiated energy associated to each flare, I simply integrate the SEM signal in the two channels over the duration of the flare as indicated by GOES SXR data (so between start and end time), minus the minimum of the SEM signal over the same period: $\int_{t_{start}}^{t_{end}} I(t) - \min\left[I(t)\right]dt$

- The SEM data have not been corrected for saturation and particles effect. However, I have checked visually, by comparing with GOES curves, that the data were not strongly affected and that they were well correlated with the GOES SXR data. This explains why some value are missing ("damaged" data or badly correlated with SXR) and why the warning "Particles ?" appears in the comment column of the xls file.

- The end time as given in the GOES catalog is quiet early after the peak, so:

  1) Some energy in the gradual phase is missing

  2) The resulting energy values are quiet correct even if the SEM data has been corrupted by particles, which arrive after this end time.
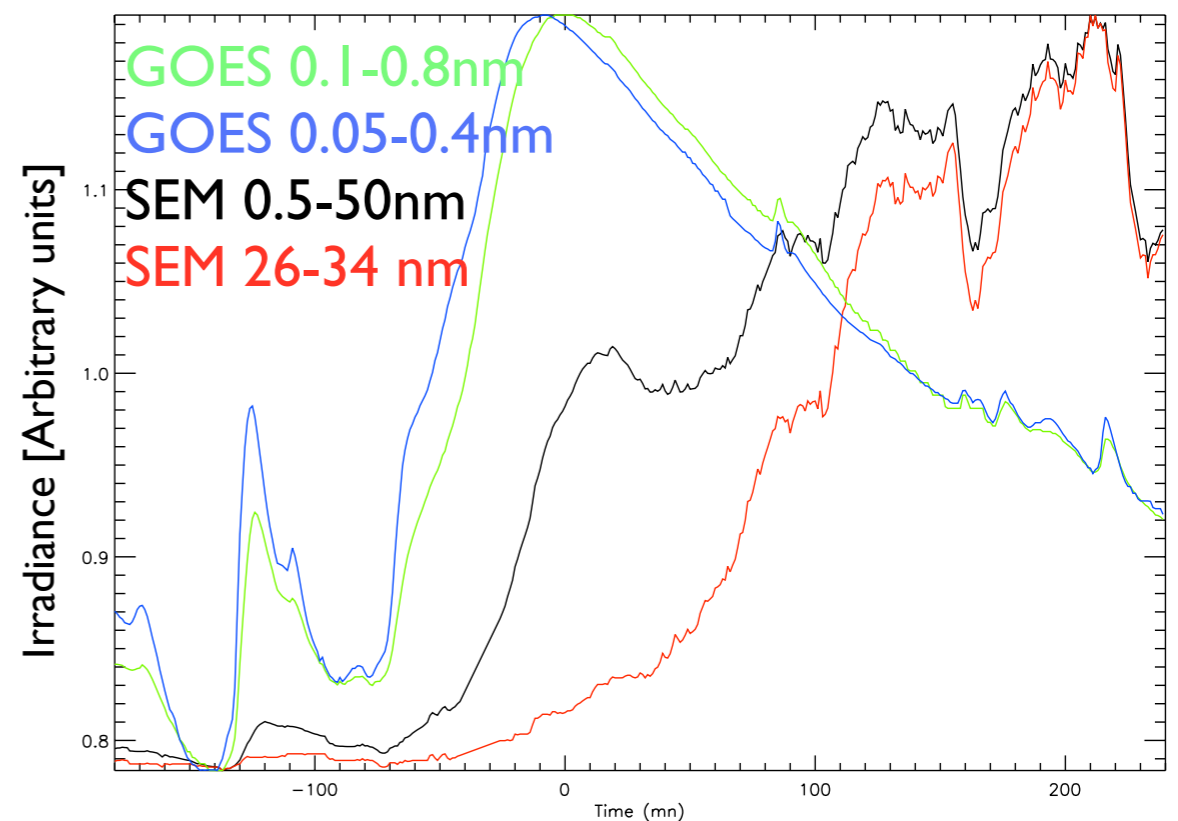
Examples

The energy in the SEM channels has been computed using start and end time of the flare given by the GOES catalog

No value were retrieved; this would request a more detailed analyze.
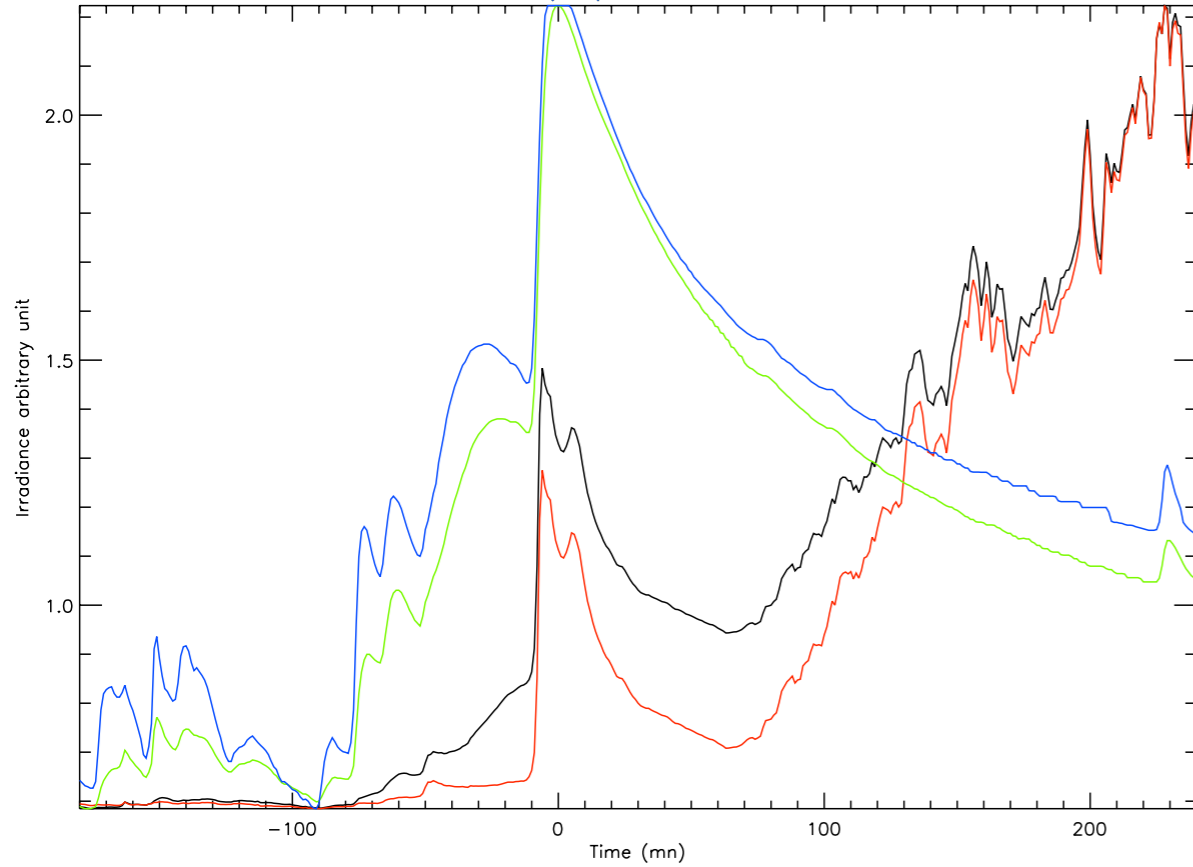

X28 Flare on Nov. 4, 2003

GOES 0.1-0.8nm
GOES 0.05-0.4nm
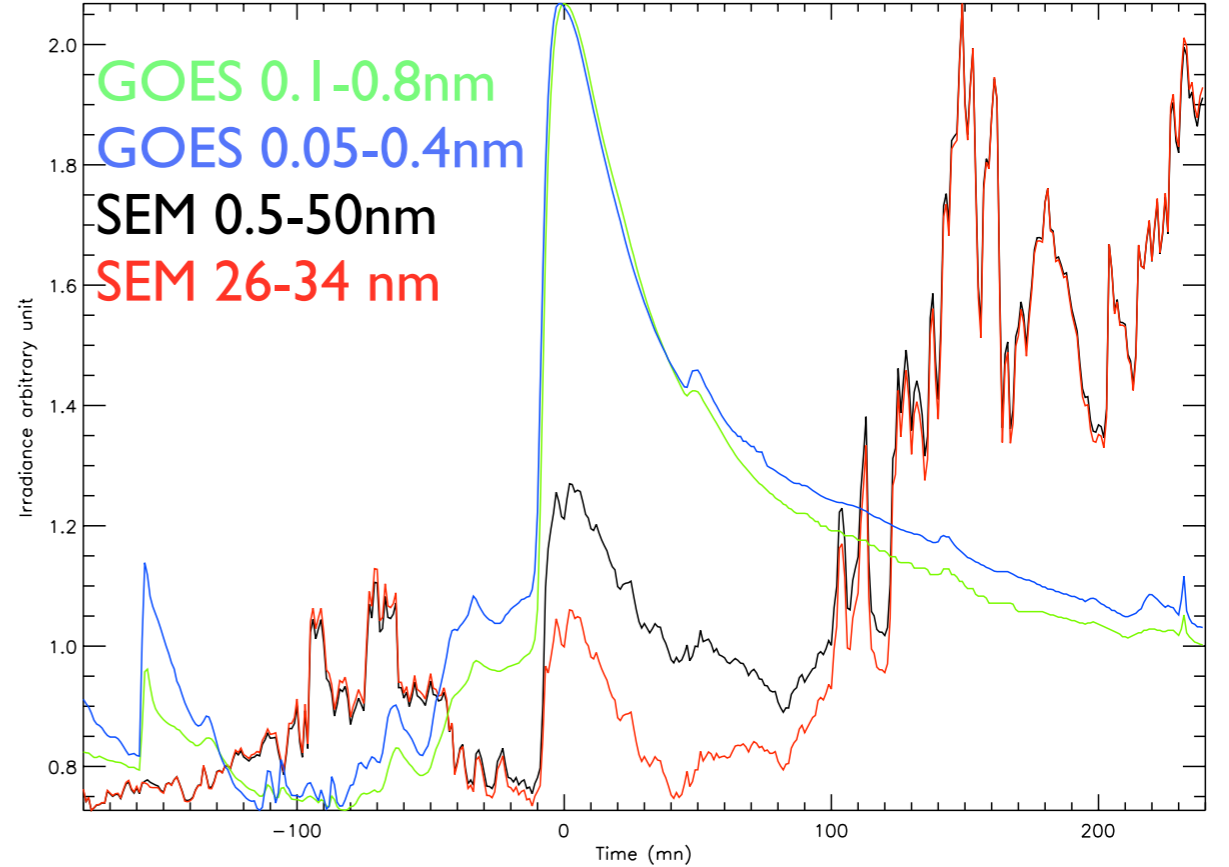SEM 0.5-50nm
SEM 26-34 nm

M7.1 Flare on Dec. 26, 2001

GOES 0.1-0.8nm
GOES 0.05-0.4nm
SEM 0.5-50nm
SEM 26-34 nm

Flare labeled "Particles?":

X17.2 flare on Oct. 28, 2003

X10 flare on Oct. 29, 2003

GOES 0.1-0.8nm
GOES 0.05-0.4nm
SEM 0.5-50nm
SEM 26-34 nm

X3.4 flare on Dec. 13, 2006

X5.7 flare on Jul. 14, 2000

M. Kretzschmar, Solar activity during the onset of Solar Cycle 24, Global event energetics workgroup.