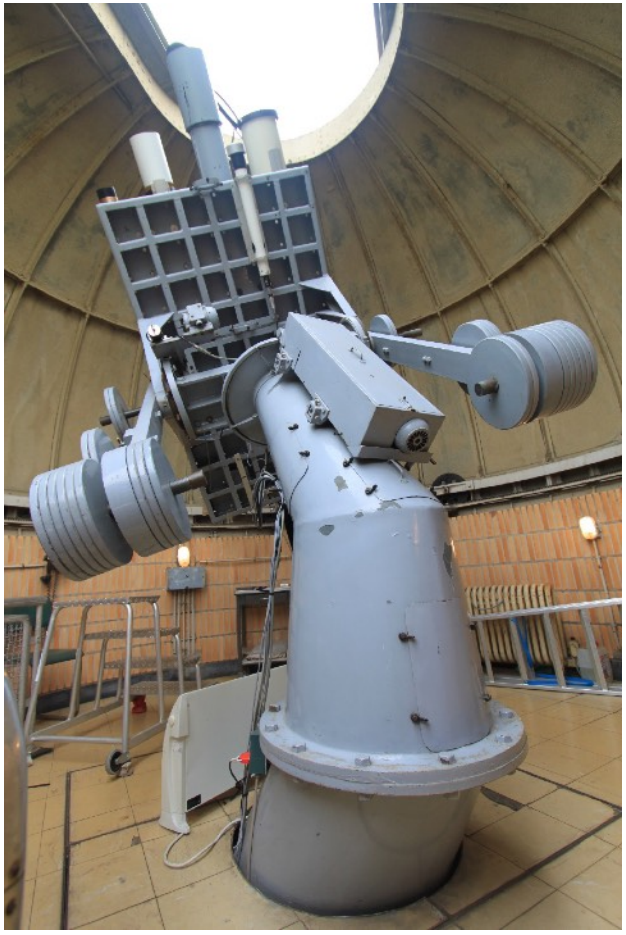
STCE instruments insights: Unveiling the source of the May 2024 severe geomagnetic storms

Bechet S., Berghmans D.,Dominique M., D'Huys E., Marqué C.

STCE annual meeting
27/06/2024

USET ground-based optical telescopes





Location:

- Uccle

Observations:

- White-light full-disk drawings and images
- H-α full-disk images
- CaII K full-disk images

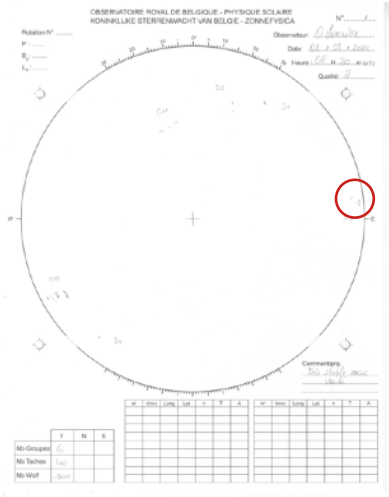
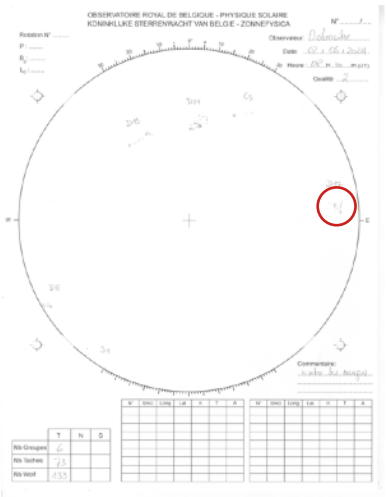
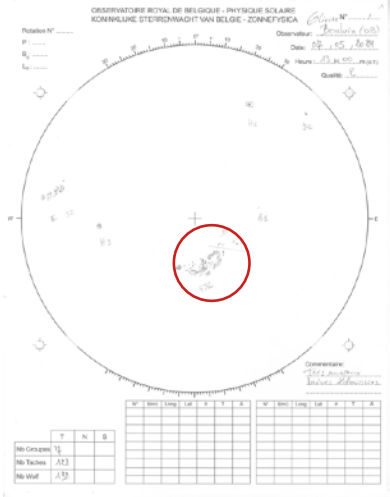
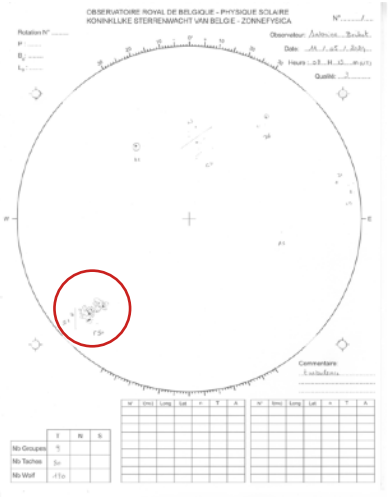
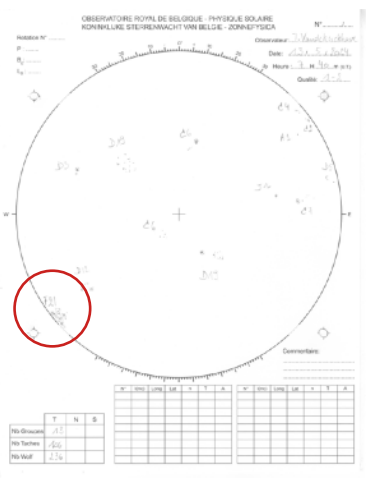
Observation period and cadence:

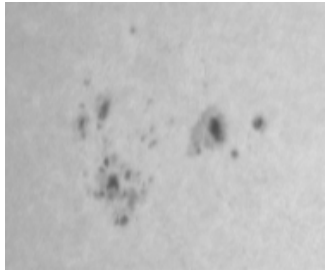
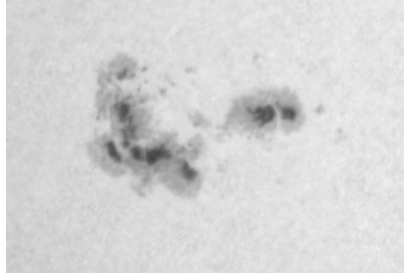
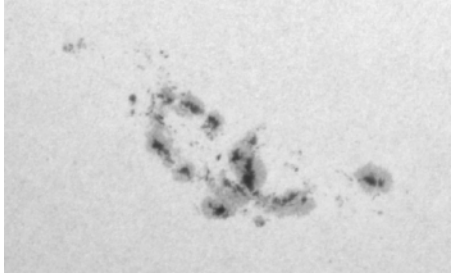
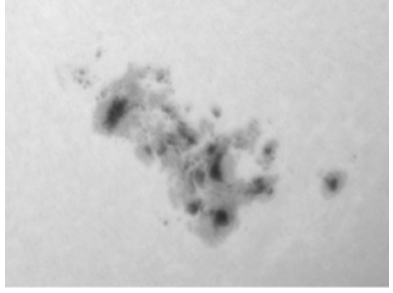
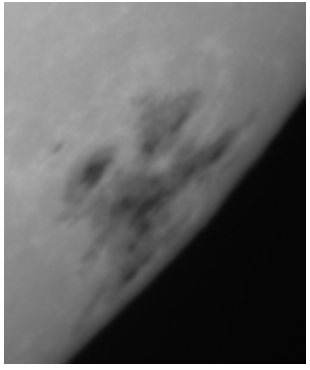
- Morning to evening, 7/7d when weather permits
- Synoptic: 15 min
- High cadence: up to 4 images/s

Instrument lifetime:

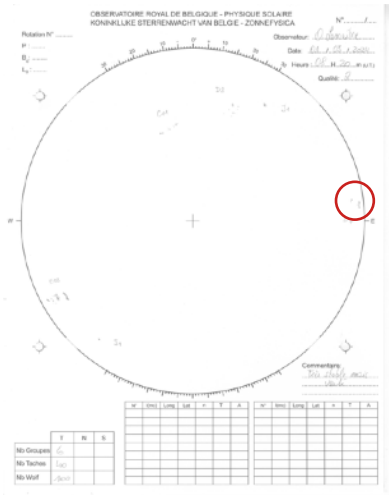
- Drawings: 1940 - now
- Numerical images: 2002- now

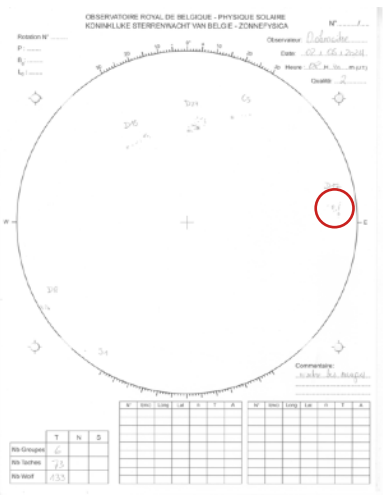
NOAA3664 sunspot group evolution

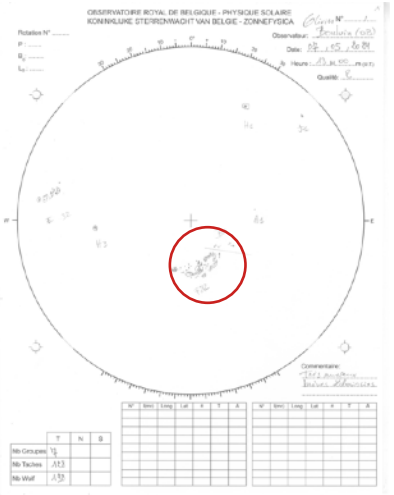






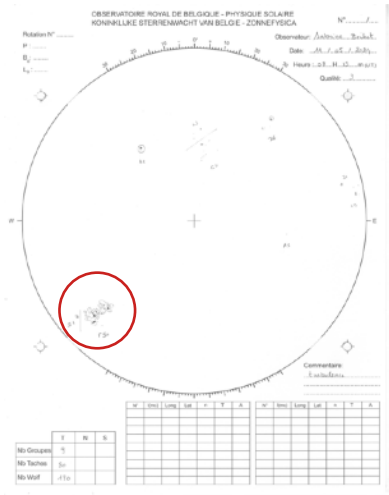






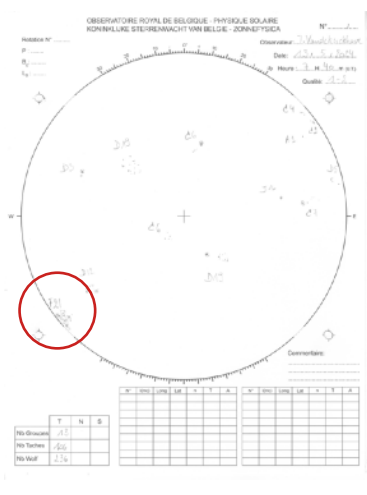
NOAA3664 sunspot group evolution

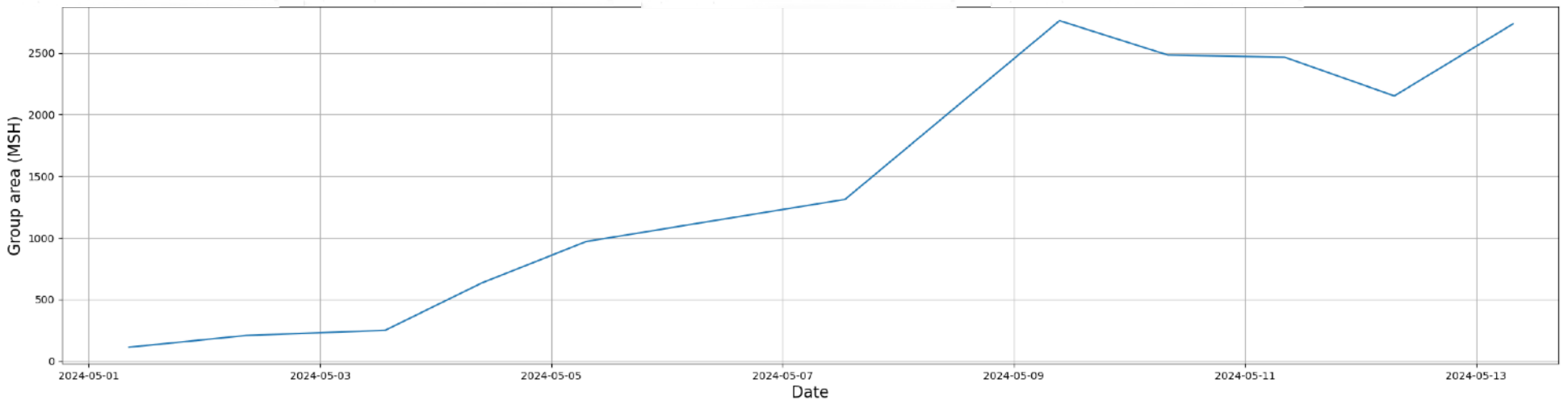




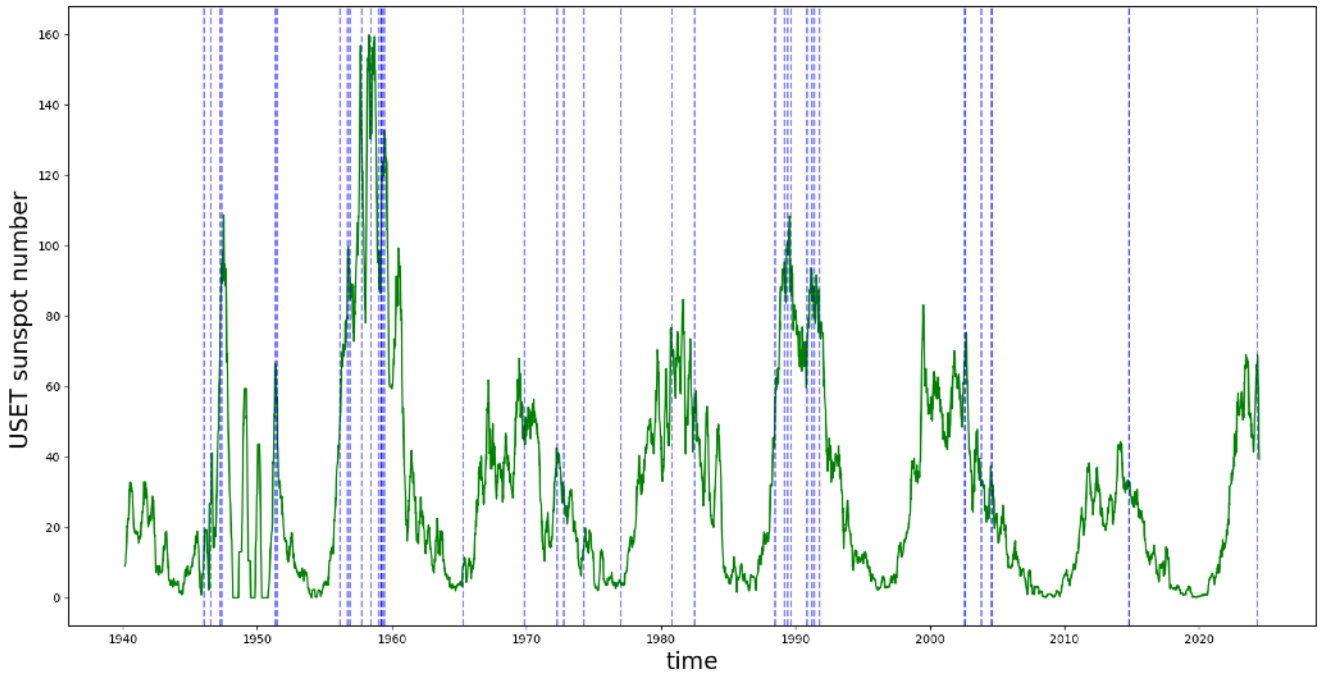




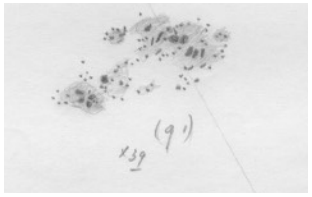




NOAA3664 : historical perspective

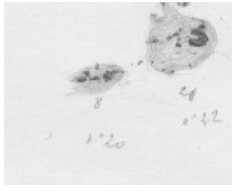


The 40th biggest sunspot recorded in the USET catalogue



7/4/1947 - 8600 msh





31/01/1946 - 5370 msh

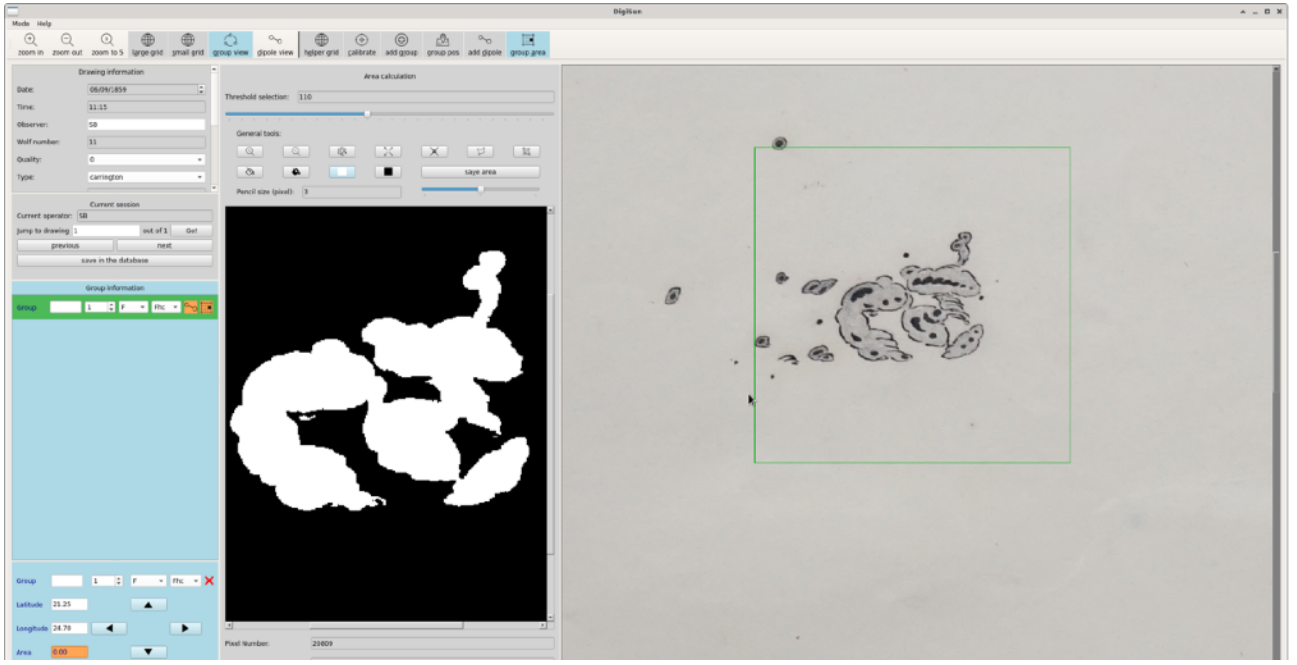


15/03/1989 - 4990 msh

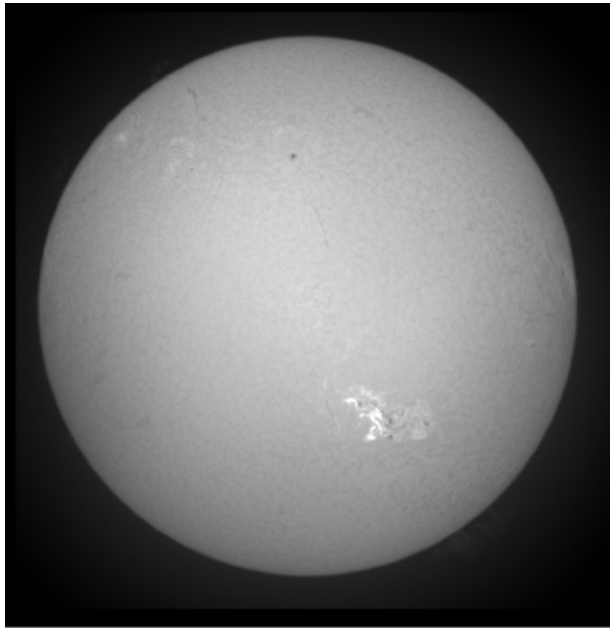
NOAA3664 : historical perspective

Area measurement with DigiSun:

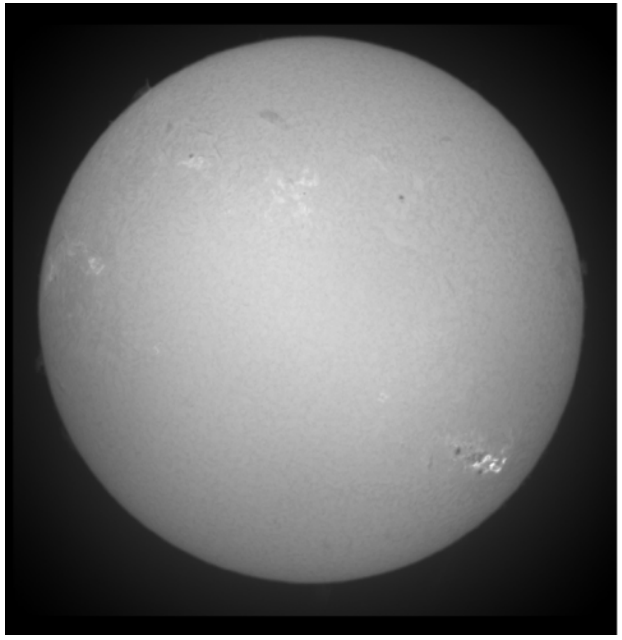
- Carrington (01/09/1859):
  - 2971 msh
- NOAA3664 (09/05/2024):
  - 2760 msh



NOAA3664 : flares seen in the chromosphere



09/05/2024 08:57:57
X2.2



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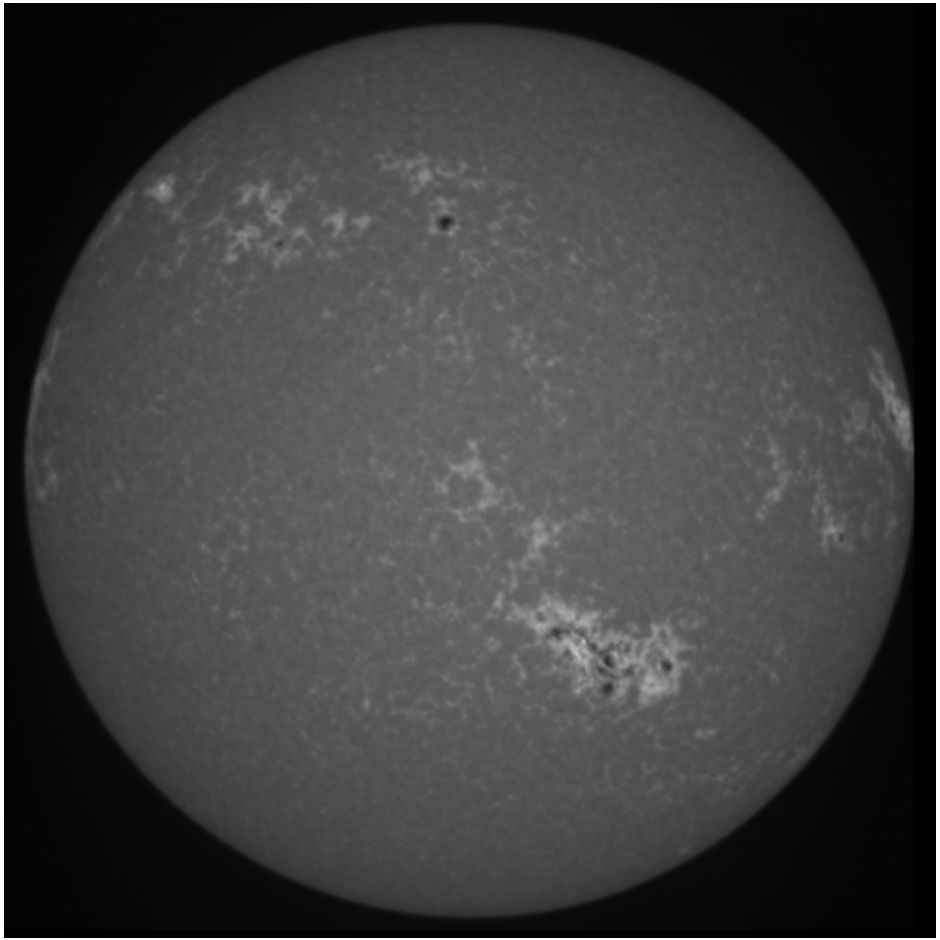
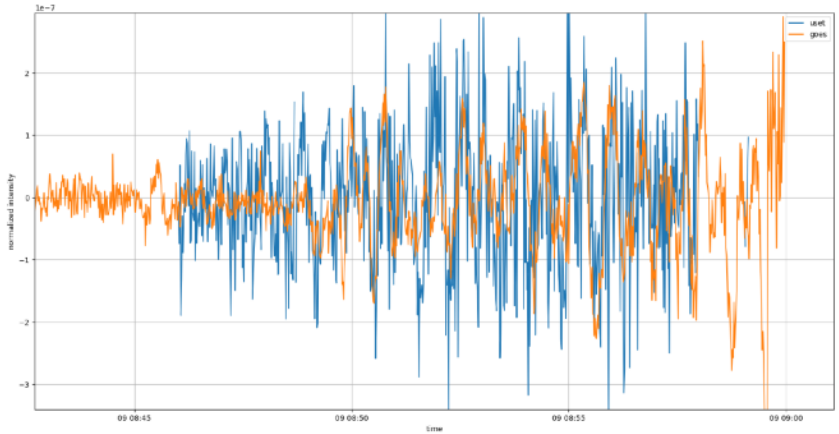
X1.5

NOAA3664 : flares seen in the photosphere

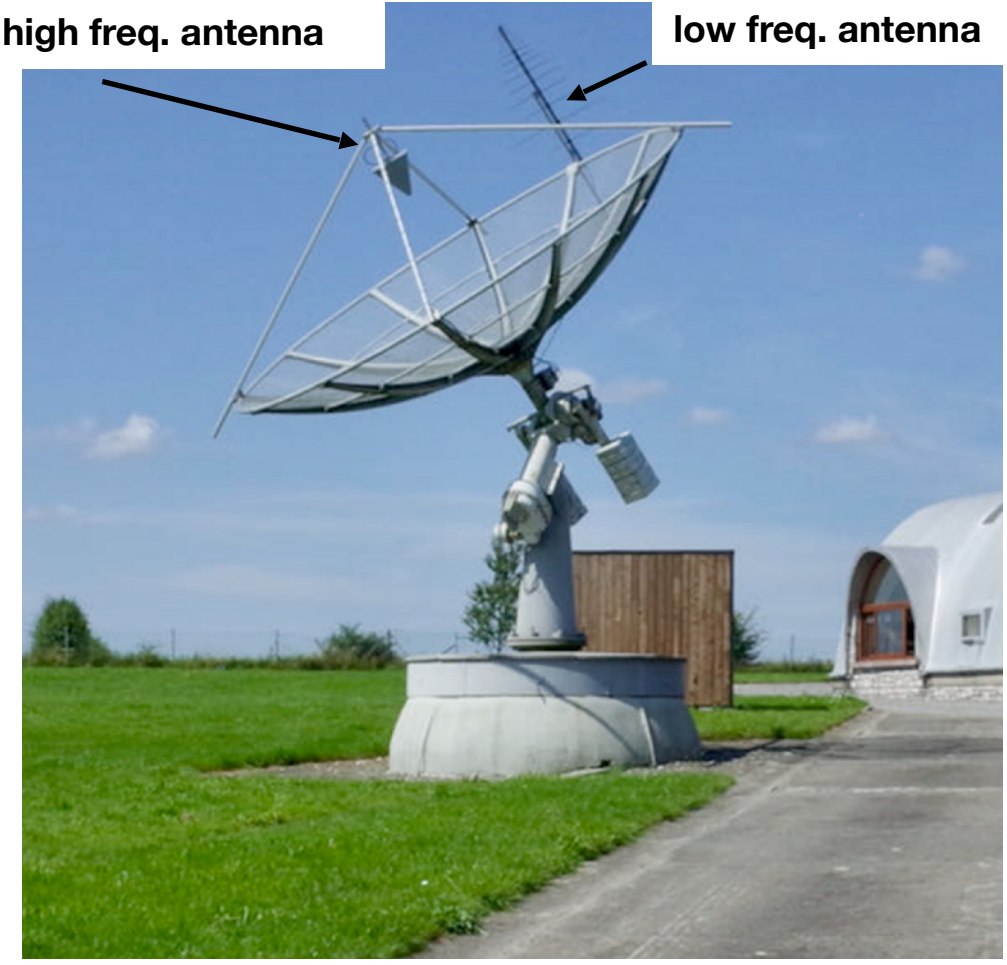


Images recorded at high cadence (4 images/s)

Oscillations in the intensity of the flare



Humain ground-based radio telescopes



Location:

- Humain

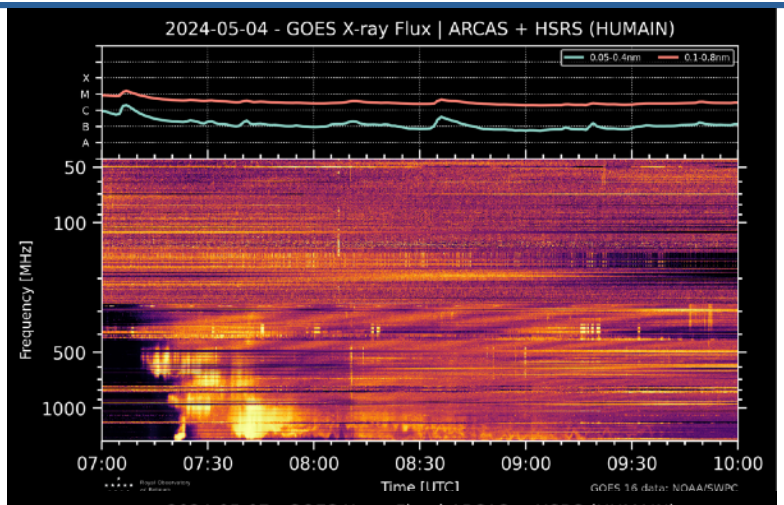
Observations:

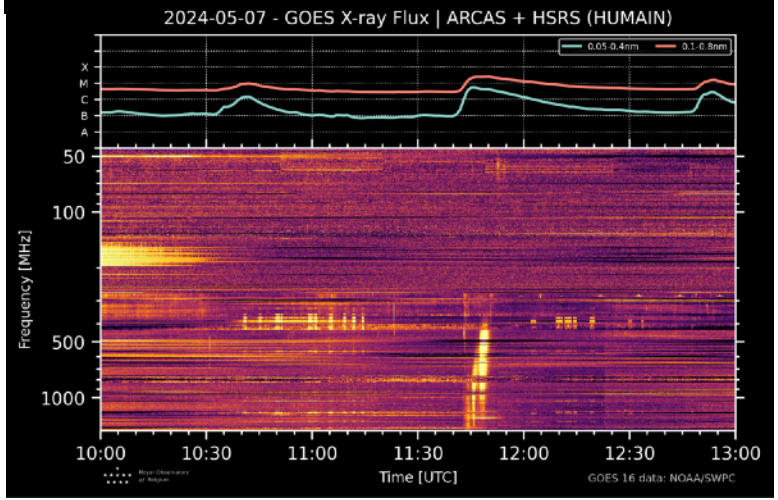
- ARCAS & Callisto : 45 – 450 MHz
- HSRS: 275 - 1495 MHz

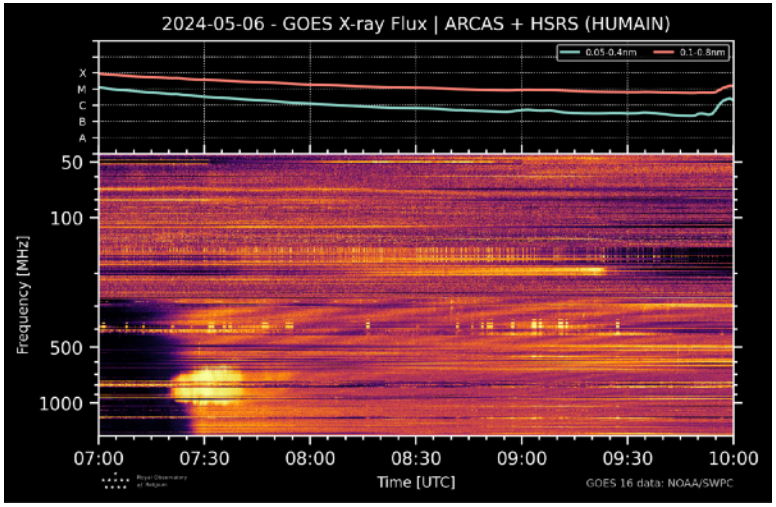
Observation period and cadence:

- 6:30 – 16:30, 7/7d

Humain ground-based radio telescopes

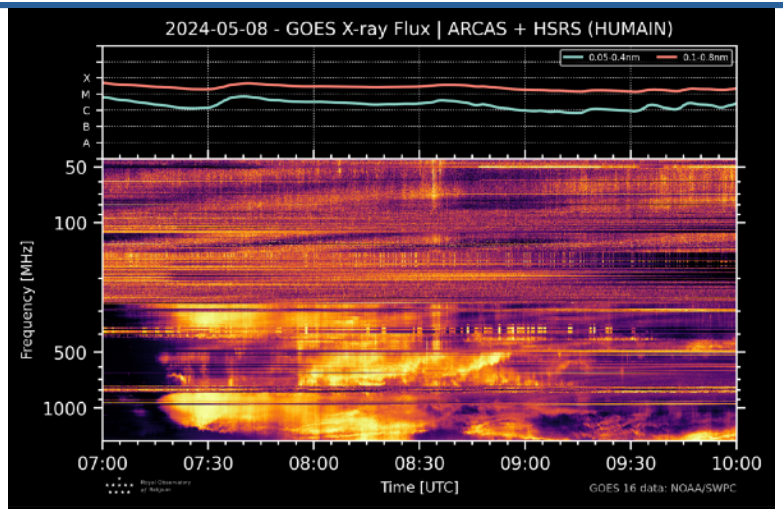


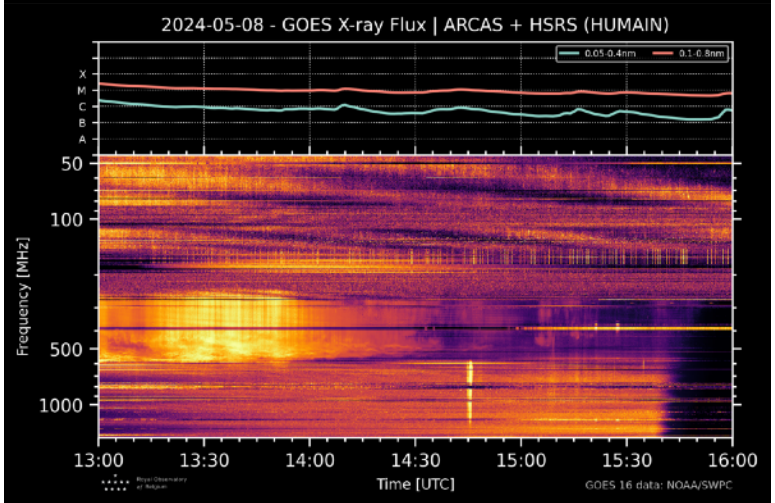


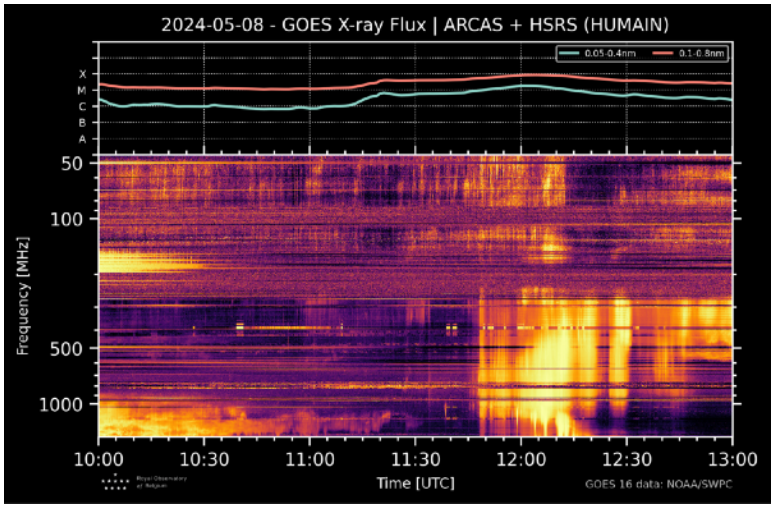


- Series of radio bursts observed from May 4 till May 14
- Mostly decimetric type IV bursts (energetic electrons trapped in post flare loops)
- 2 major events on May 8 and May 9

Humain ground-based radio telescopes

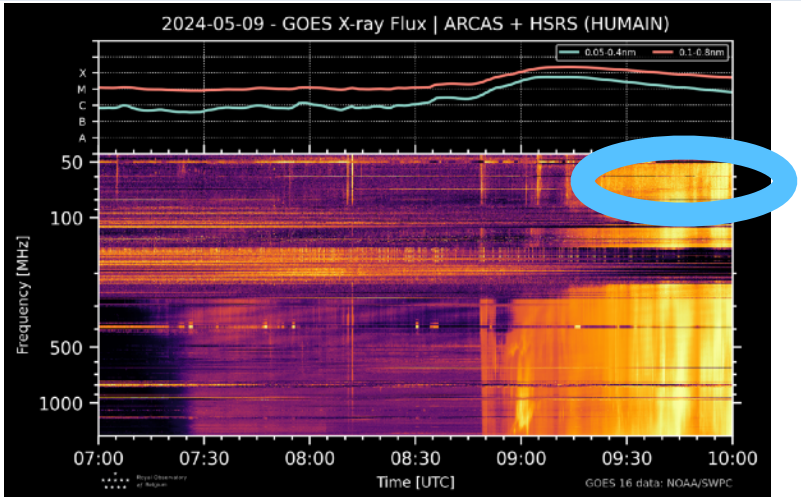


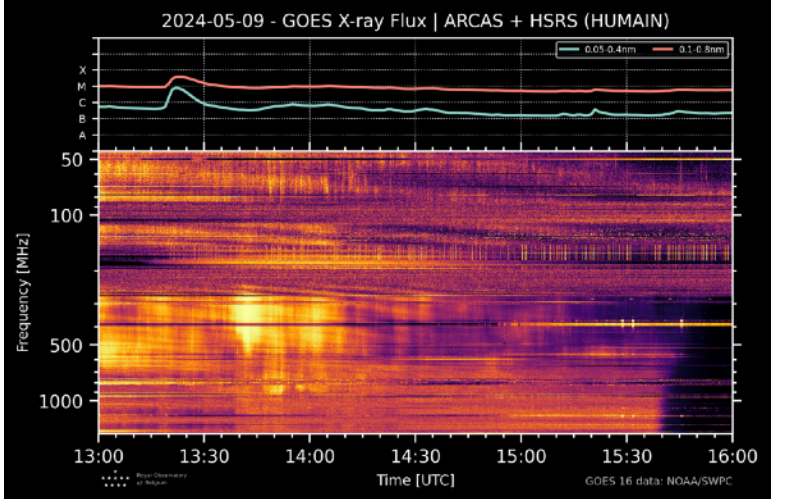


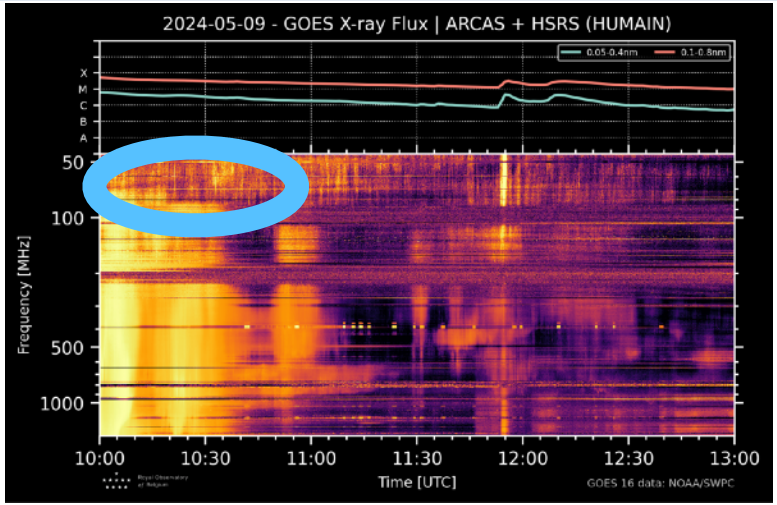


May 8
Multiple type IV bursts from start to near end of observations

Humain ground-based radio telescopes



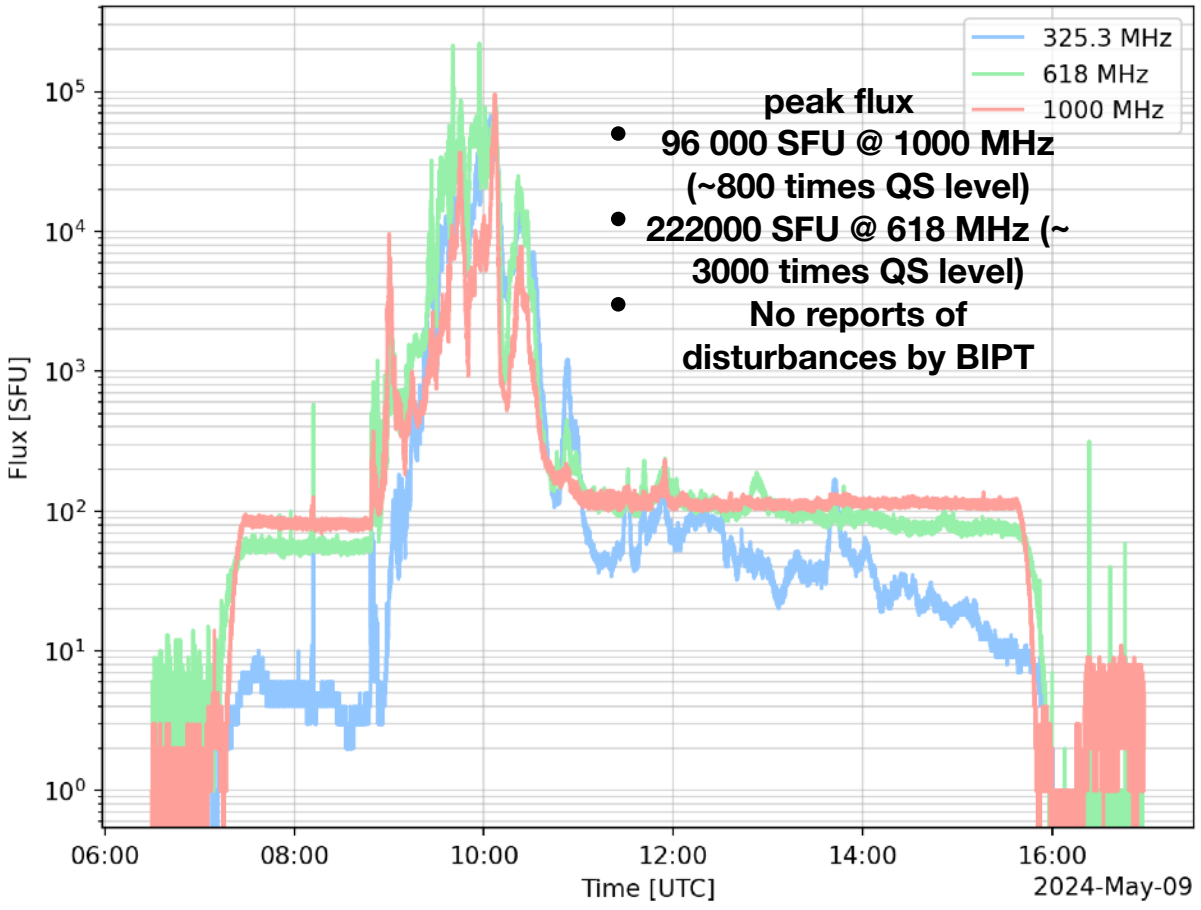




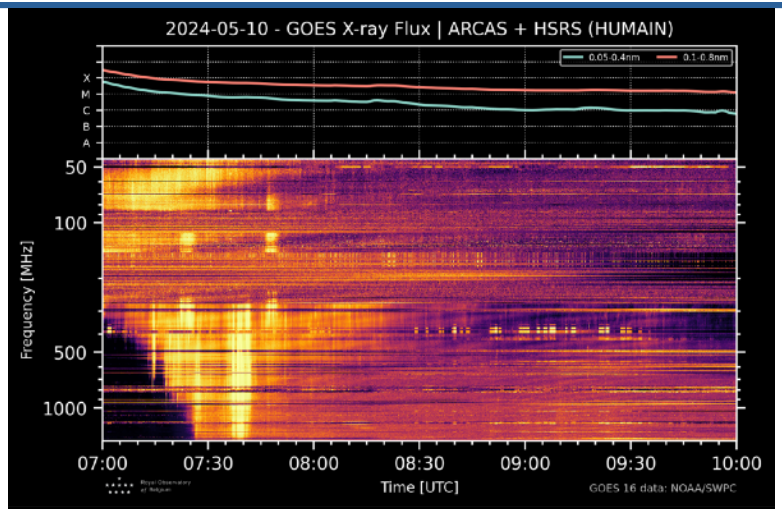
May9

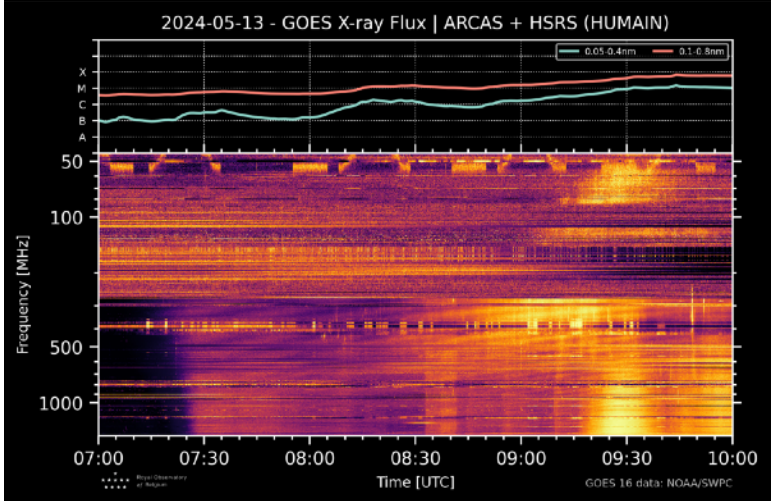
- **Very intense type IV burst linked to X class flare**
- **Solar flux observed even within the FM band rejection filter ! (blue)**

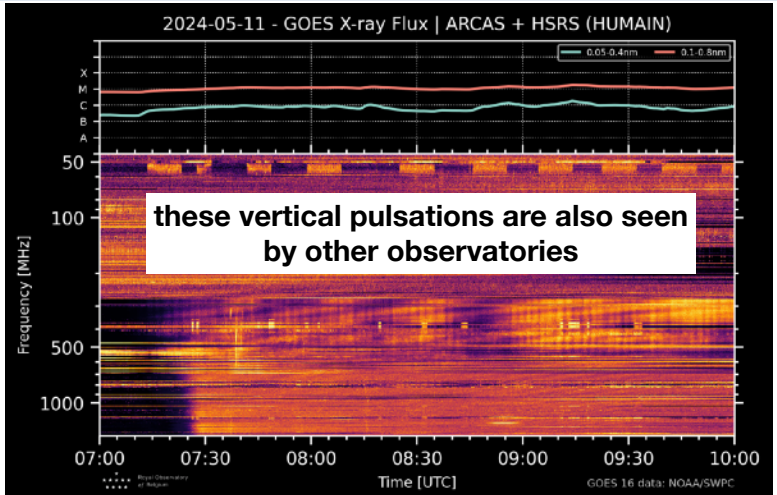
Humain ground-based radio telescopes

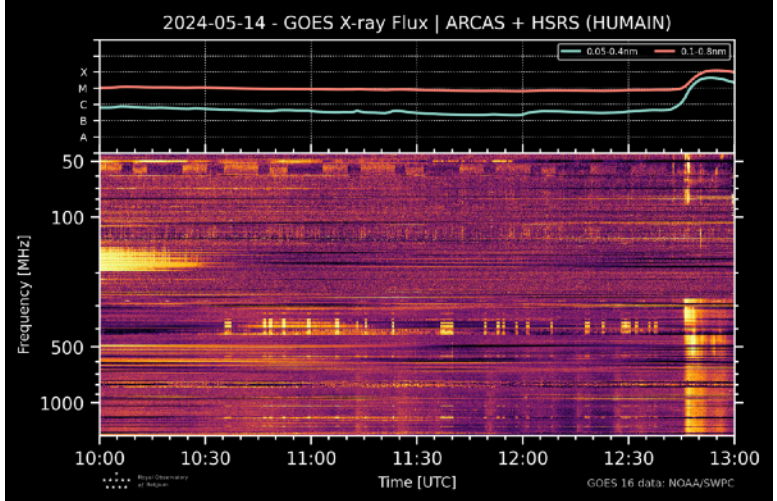


Humain ground-based radio telescopes









PROBA-2 Mission: SWAP & LYRA



Location:

- Sun-synchronous orbit
- 725 km altitude

Observations:

- SWAP: full-disk images in EUV
- LYRA: radiometers in 4 broadband channels in the EUV range

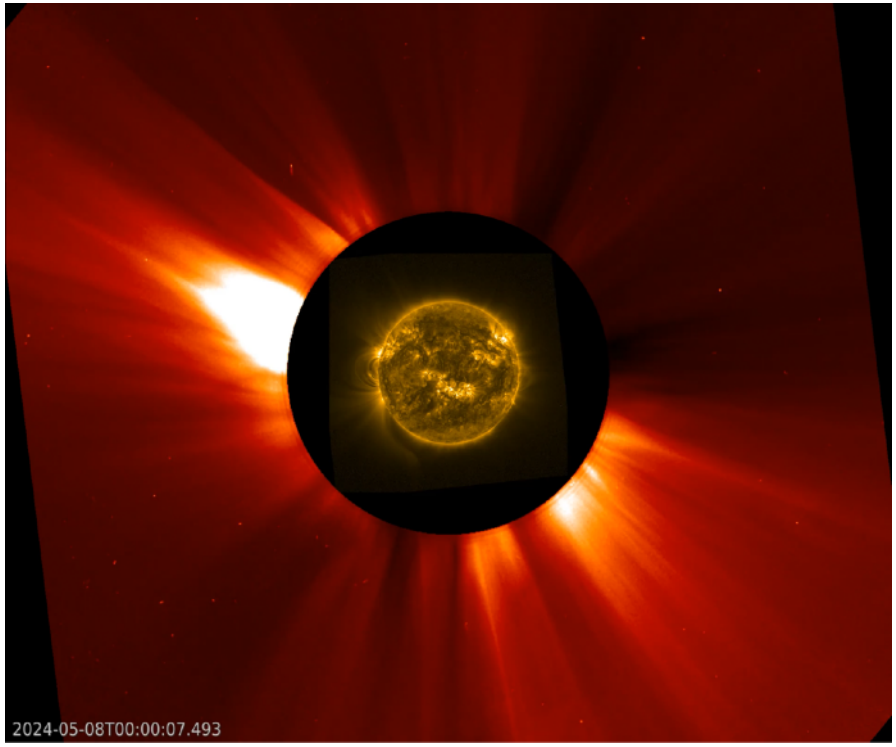
Observation period and cadence:

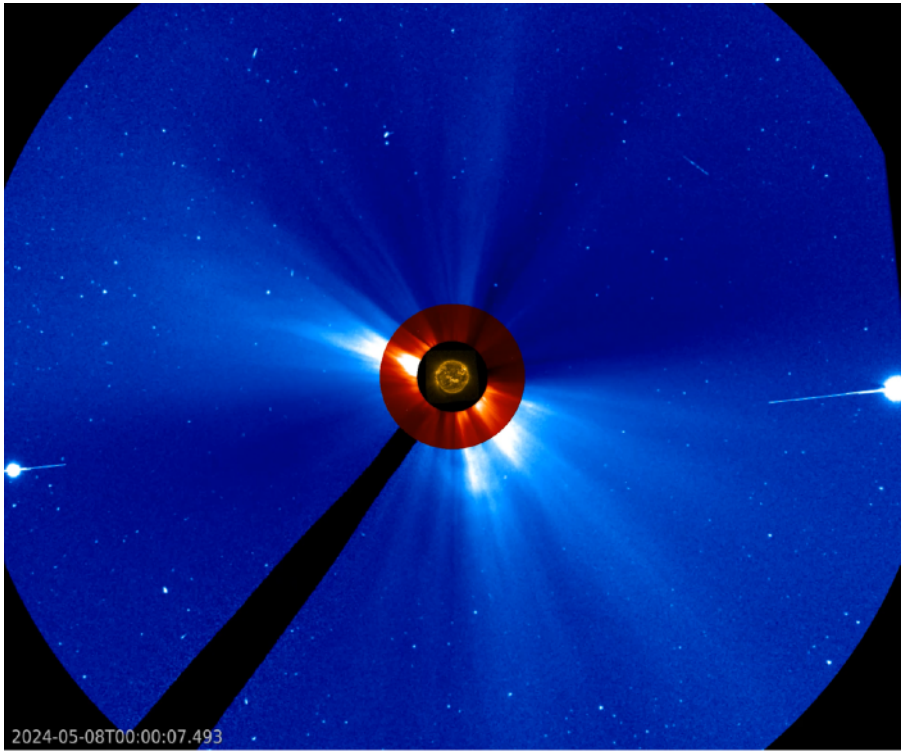
- Continuous except occultation period
- Cadence: 2 min (SWAP), 50 ms (LYRA)

Instrument lifetime:

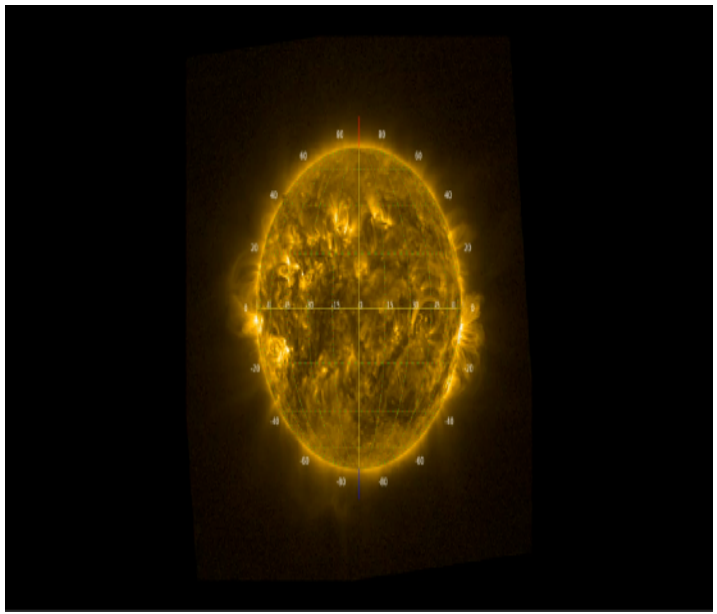
- 2009 – now

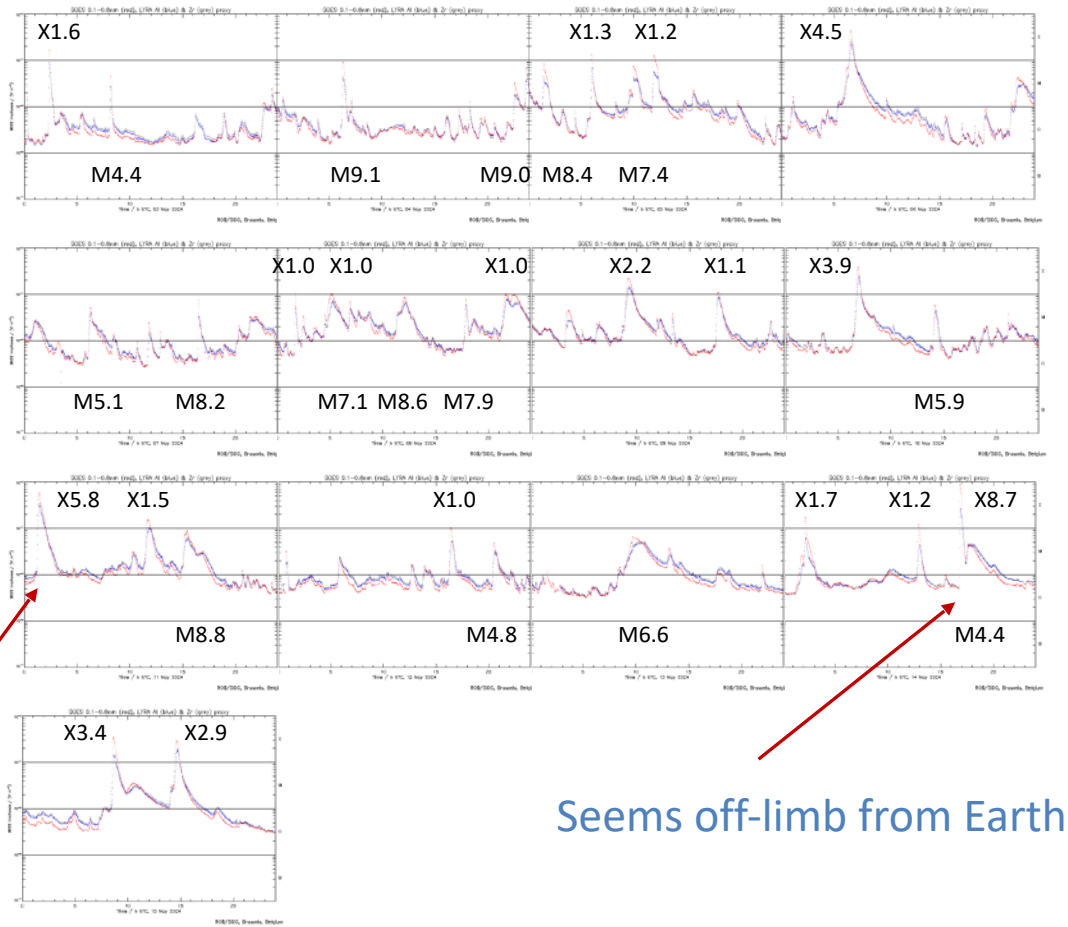
NOOA 3664 seen in the corona





NOOA 3664: flare sequence of May 2024





First joint observation between SolO and Earth-obiting instruments

Seems off-limb from Earth

Solar Orbiter Mission: EUI



Location:

- Around the sun

Observations:

- FSI: full-disk in EUV (30.4 and 17.4 nm)
- HRI EUV (17.4 nm)
- HRI Ly-α (121.6 nm)

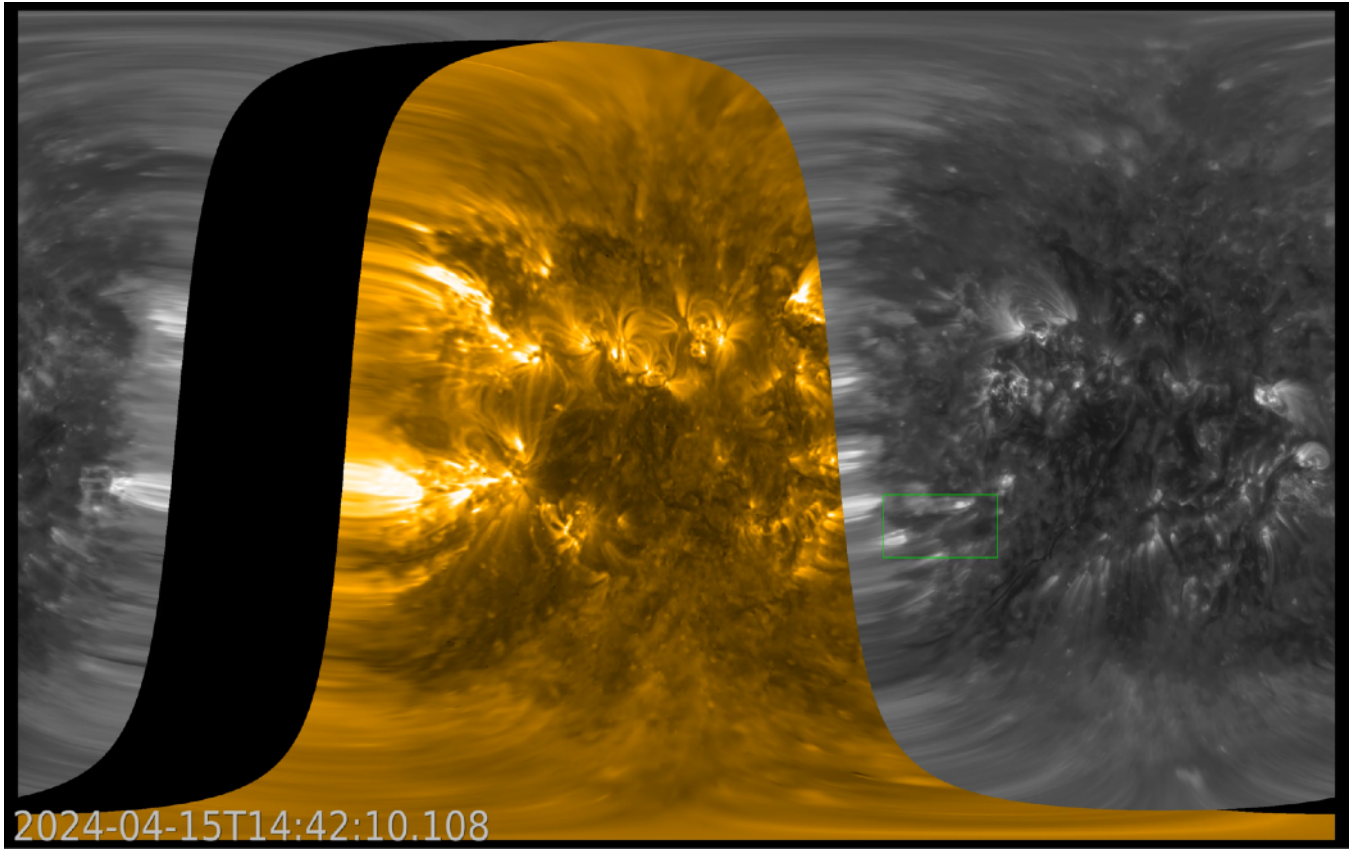
Observation period and cadence:

- Continuously (10 min)
- High cadence during dedicated campaign

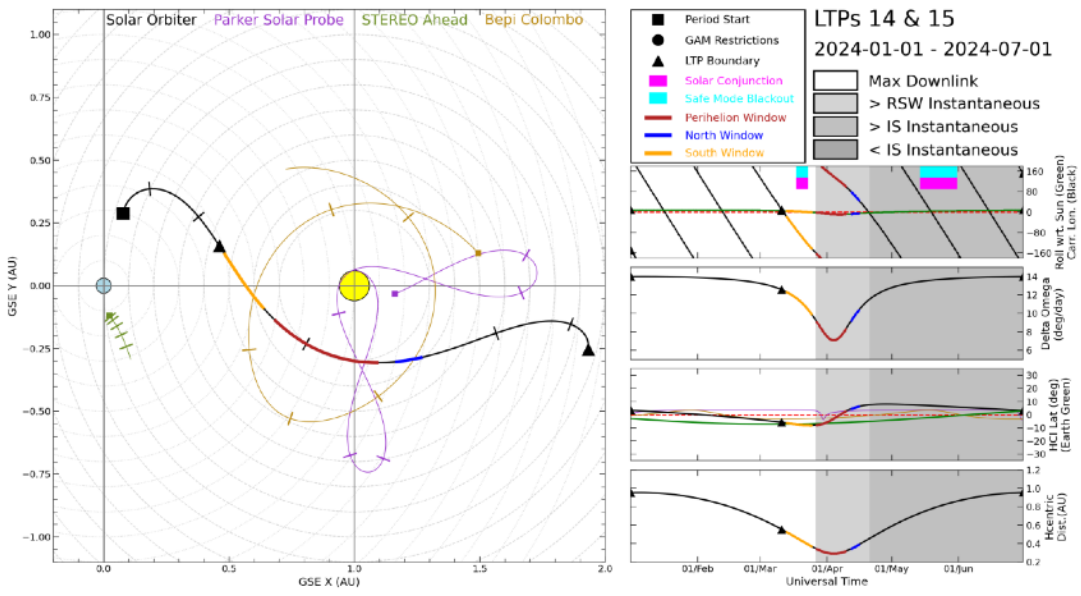
Instrument lifetime:

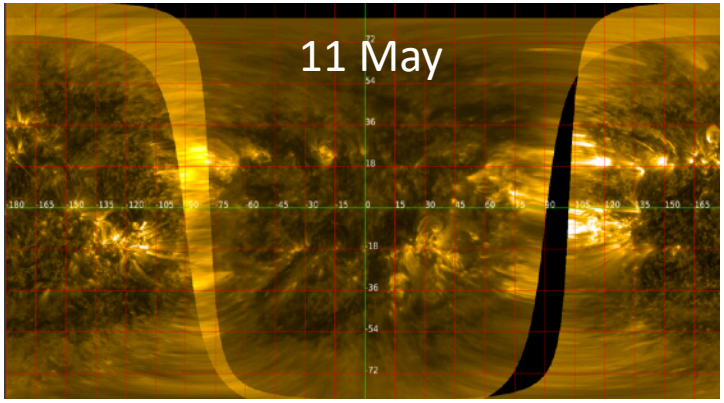
- 2020 – now

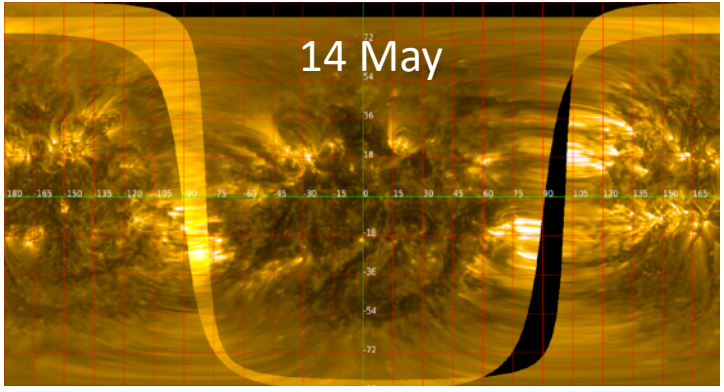
SWAP + EUI : NOAA3664 continuous tracking



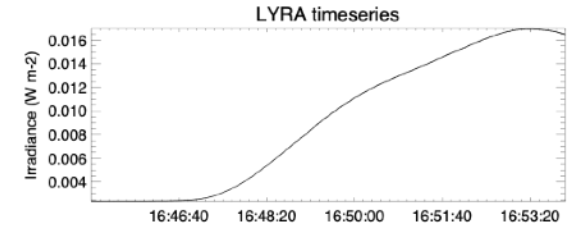
PROBA2 + EUI : flares sequence of May 2024

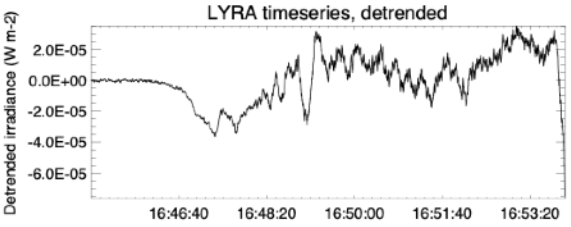


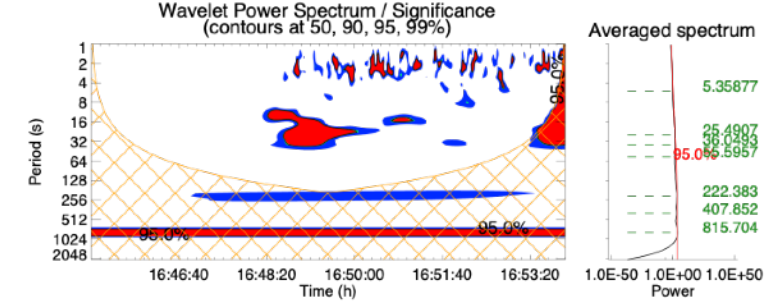


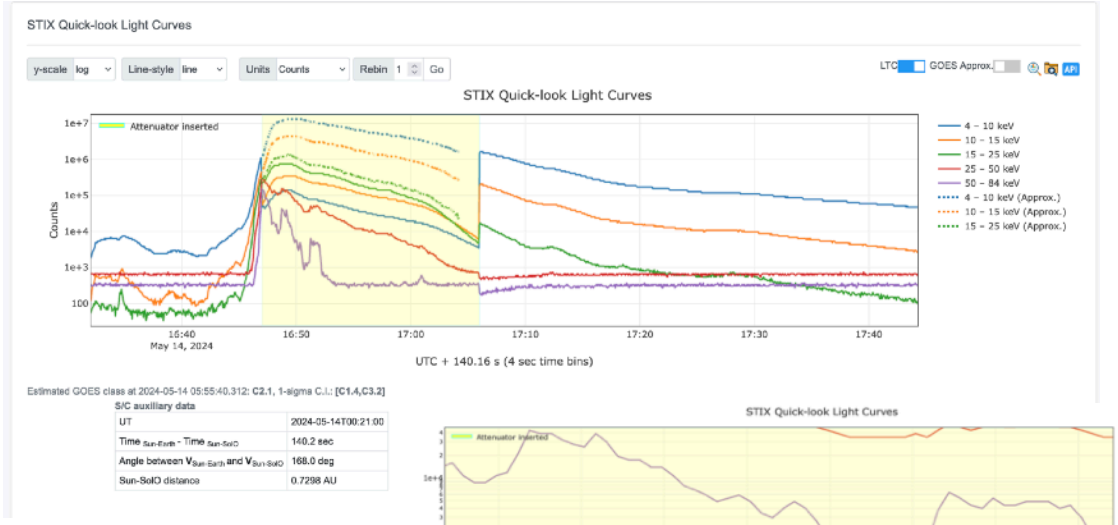


PROBA2 + EUI : X8.7 of May 14 2024









EUI was in synoptic mode:

10 min cadence with FSI 171 only

Observations will be available soon!

Conclusion

- NOAA 3664 observed with various STCE instruments
- Complementary observation of the eruptive events
  - From the photosphere to the corona
  - Different spatial & temporal resolution
  - Different mechanisms were captured