

STCE Newsletter

17 Nov 2025 - 23 Nov 2025



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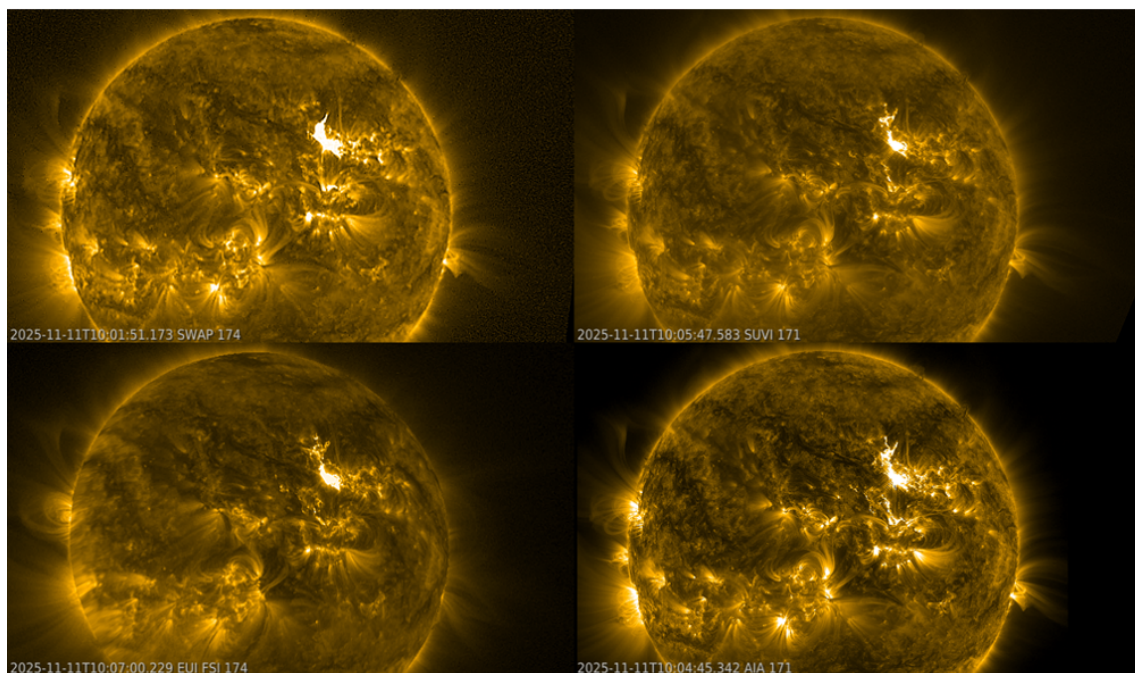
The Solar-Terrestrial Centre of Excellence (STCE) is a collaborative network of the Belgian Institute for Space Aeronomy, the Royal Observatory of Belgium and the Royal Meteorological Institute of Belgium.

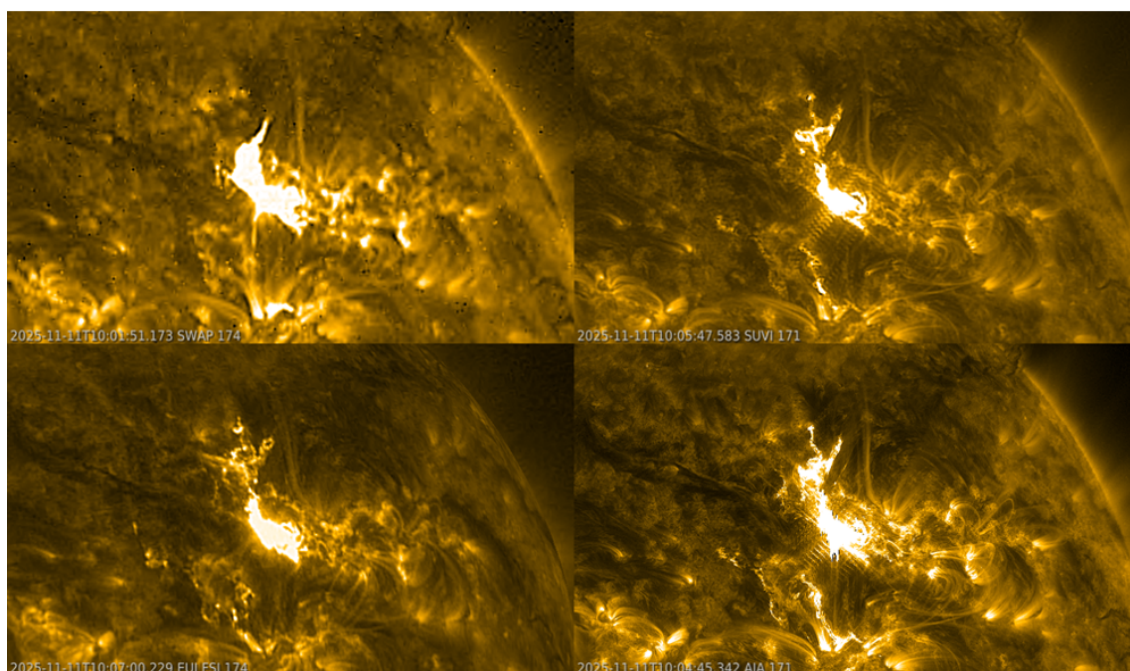
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1. X5.1 flare revisited

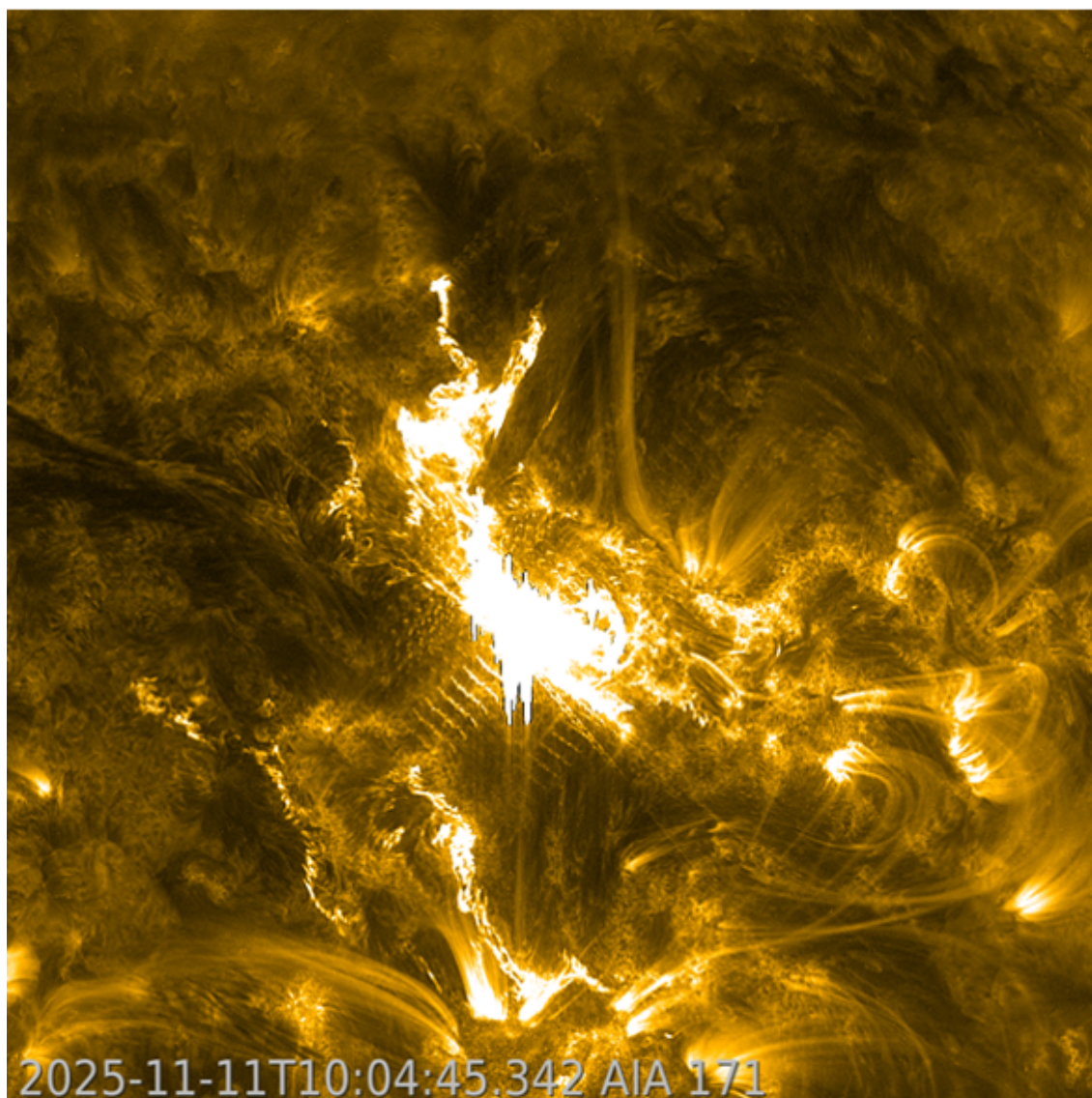
On 11 November 2025, the largest solar flare of the year so far erupted. The X5.1 flare reached its peak at 10:04 UTC. The event was imaged by all relevant solar satellites and their extreme ultraviolet (EUV) cameras: PROBA2 (SWAP), GOES (SUVI), Solar Orbiter (FSI and HRI), SDO (AIA), and STEREO-A (EUVI). The combination images underneath were created with SWHV (Space Weather JHelioViewer - https://swhv.oma.be/user_manual/). They show first nearly full-sun EUV images of the event, highlighting the flare's location and the coronal wave (also known as EIT wave or EUV wave - see this STCE newsitem at <https://www.stce.be/news/241/welcome.html>). The second figure zooms in on the blast site and shows other features such as coronal dimming (<https://www.stce.be/news/625/welcome.html>) and post-flare coronal loops (<https://www.stce.be/news/316/welcome.html>). Top left is from PROBA2/SWAP, top right is from GOES/SUVI, lower left is Solar orbiter (FSI), and lower right is from SDO/AIA. The related clips are available in the online version of this newsitem at <https://www.stce.be/news/793/welcome.html>





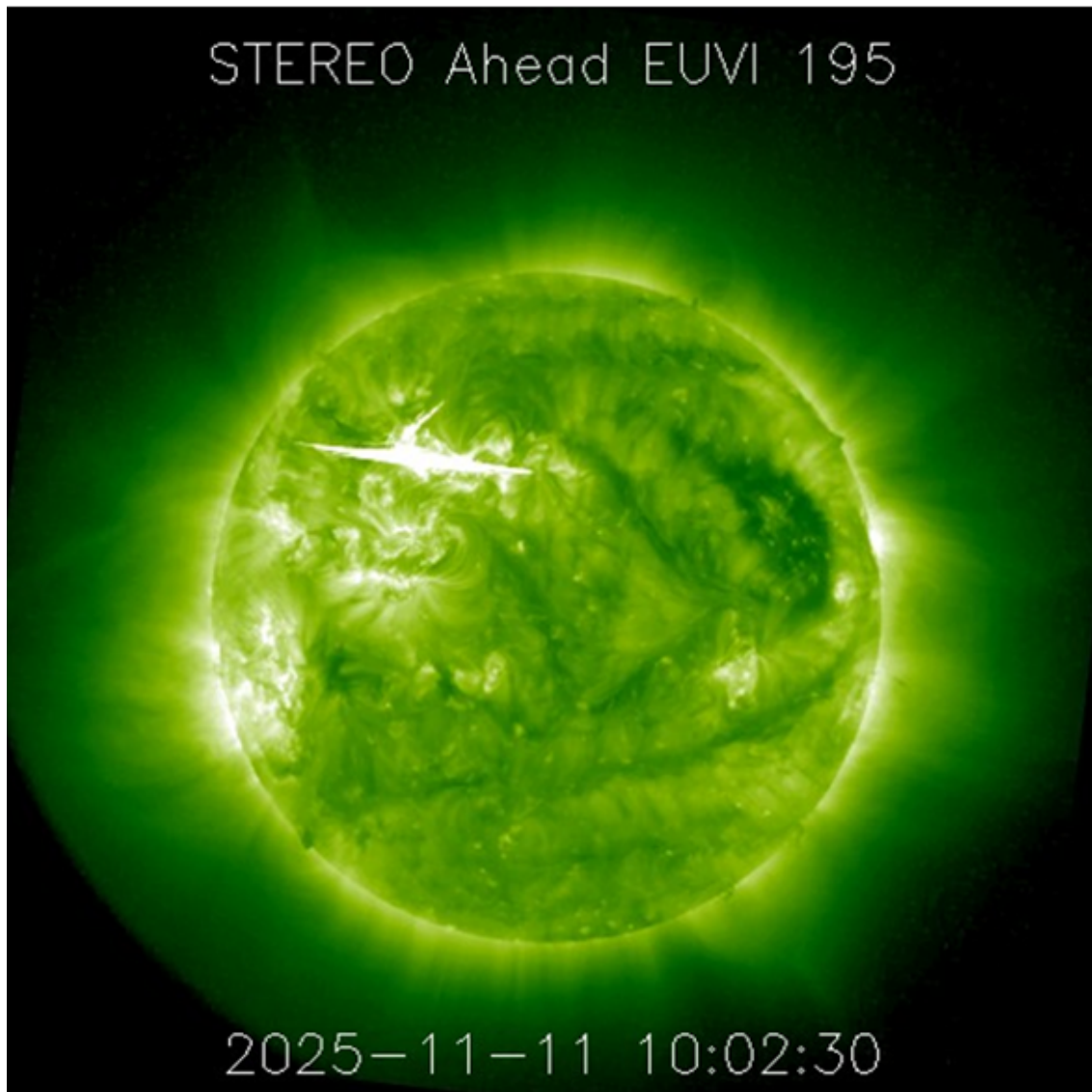
The clips cover 2 hours, from 09:30 to 11:30 UTC. They were made with the images available in SWHV. These clips show detail differences in image cadence, resolution of the images ("sharpness"), and sensitivity to pixel saturation (blooming - see elsewhere in this newsitem as well as this STCE newsitem at <https://www.stce.be/news/499/welcome.html>). A table comparing the instruments in terms of resolution, image cadence, field-of-view and pixel system can be found underneath. Some of these data, such as resolution or cadence can change for various reasons, such as the varying distance to the Sun, the observing mode, and the filter that is being used. In this case, filters at 17.1 nm and 17.4 nm were used, showing the lower corona (outer atmosphere of the Sun) at temperatures of respectively 700.000 and 1 million degrees. Note that SWHV does not contain all the images, or it may take a while to get them all available. For the 2-hour coverage, there were 120 images for AIA, about 20 for SWAP and FSI, but only 6 for SUVI. HRI images were not available yet in the SWHV database, and for EUVI only 1 image was available. Also, at the time of the X5 flare, Solar Orbiter was 26 million km closer to the Sun than Earth. Standing-by the release of the HRI images, the highest resolution and cadence images of the X5 flare that are currently available, are those from SDO/AIA. A zoomed image of the eruption taken by AIA 171 can be found underneath.

Satellite	Instrument	Wavelength	Spatial resolution	Cadence	Field of view	Sensor system
PROBA2	SWAP	17.4 nm	3.2" / px	1 image / 1 - 2 min	54' x 54'	Active Pixel
GOES	SUVI	17.1 nm	2.5" / px	1 image / 10 sec	53' x 53'	anti-blooming
Solar Orbiter	FSI	17.4 nm	4.5" / px	1 image / 10 min	3.8° x 3.8°	Active Pixel
Solar Orbiter	HRI	17.4 nm	0.5" / px	1 image / 1 sec	17' x 17'	Active Pixel
SDO	AIA	17.1 nm	0.6" / px	1 image / 10 - 30 sec	41' x 41'	-
STEREO-A	EUVI	17.1 nm	1.6" / px	1 image / 75 sec - 10 min	Circular; ~51'	-

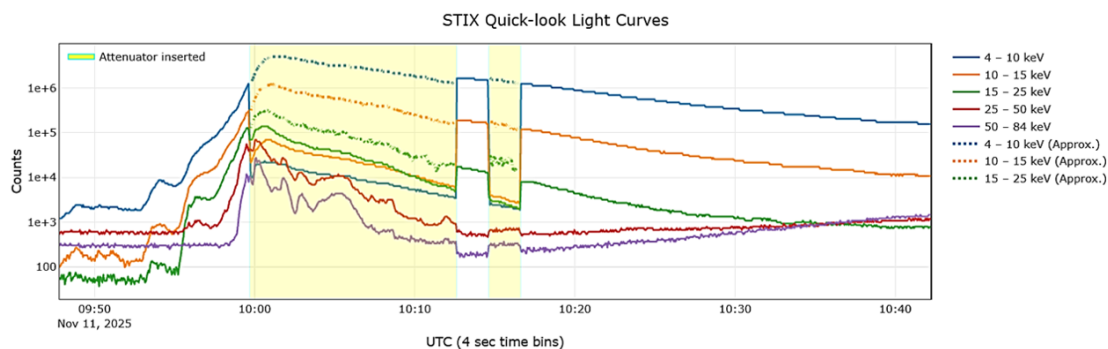


For EUVI, one can change the filter to e.g. EUVI 195 which has more images available and shows the corona at a slightly higher temperature near 1.3 million degrees. Because STEREO-A is about 50 degrees ahead of the Earth at the moment, the flare as seen by EUVI appears in the eastern ("left") solar hemisphere, contrary to the other solar images which have the event in their western ("right") hemisphere. The EUVI 195 image underneath shows the X5 flare as a bright streak, a consequence of the so-called blooming, i.e., saturation of CCD cells, corresponding to the brightest part of a flare source, and spilling of excessive electrons from these cells along CCD columns. This is a typical feature for AIA and EUVI images, whereas SWAP and FSI/HRI have an active pixel system (SIDC/PROBA2 <https://proba2.sidc.be/about/SWAP/electronics>) against this blooming (see e.g. this STCE newsitem at <https://www.stce.be/news/712/welcome.html> for advantages). GOES/SUVI has also some way to deal with blooming (Darnel et al. 2022 ; <https://doi.org/10.1029/2022SW003044>). For EUVI imagery, scientists have used the presence, more precisely the length, of the light streak from a strong flare as a proxy for the intensity of that flare in soft x-rays (Chertok et al. 2015 ; <https://doi.org/10.1007/s11207-015-0738-4>). In this case, the maximum length of the observed streak (around 10:02 UTC) indicates a peak flux in the X1.8-X7.0 range, with X3.5 as the most likely value (corrected for the GOES

rescaling as outlined by NOAA/NCEI https://www.ncei.noaa.gov/data/goes-space-environment-monitor/access/science/xrs/GOES_1-15_XRS_Science-Quality_Data_Readme.pdf).



A similar approach can be taken using the hard x-ray measurements by the Spectrometer Telescope for Imaging X-rays (STIX ; Krucker et al. 2020 ; <https://doi.org/10.1051/0004-6361/201937362>) on board Solar Orbiter. The methodology has been outlined by Stiefel et al. (2025 ; <https://doi.org/10.1051/0004-6361/202452574>), and was also briefly discussed in this STCE newsitem at <https://www.stce.be/news/712/welcome.html> Based on the STIX observations shown underneath (STIX data Center - <https://datacenter.stix.i4ds.net/view/flares/list>), the eruption reached an estimated GOES soft x-ray intensity between X2.1 and X8.2, with X4.0 the most likely value. Hence, both the EUVI as the STIX proxied values were close to the actual observed soft x-ray value of X5.1, as observed by GOES.



Estimated GOES class at 2025-11-11 10:01:13.023: X4.0, 1-sigma C.I.: [X2.1,X8.2]

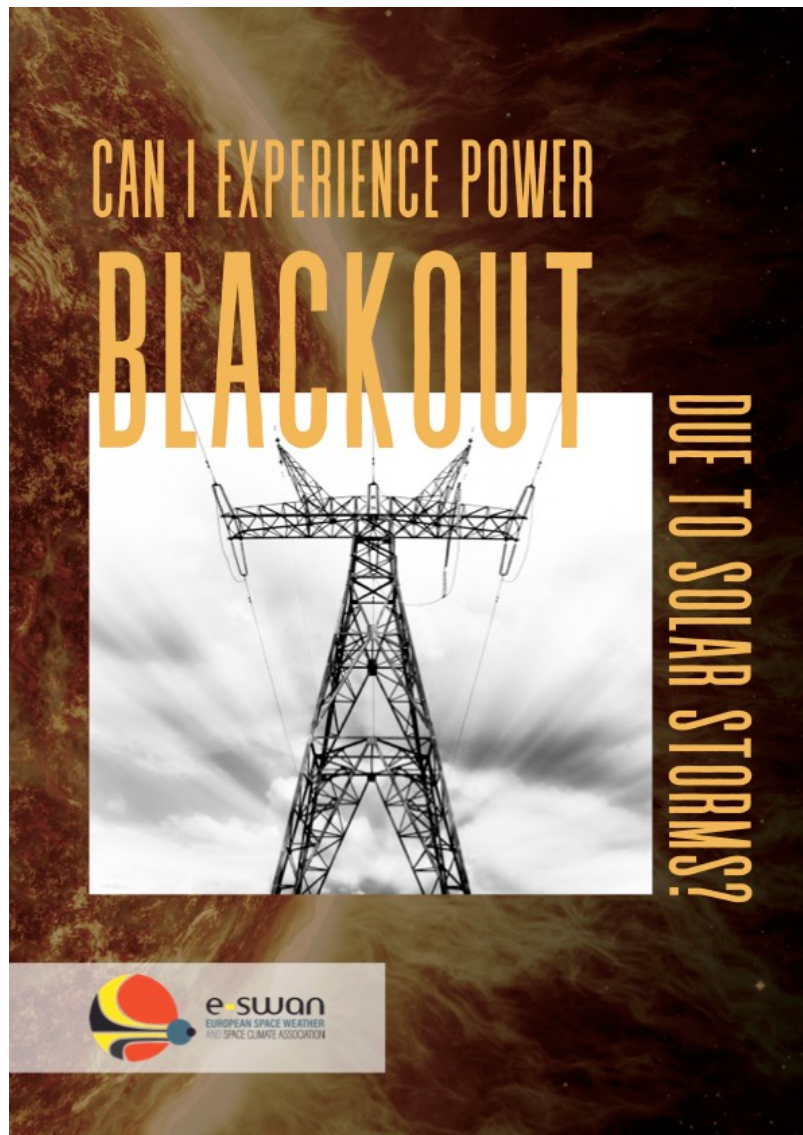
2. E-SWAN Booklet Series

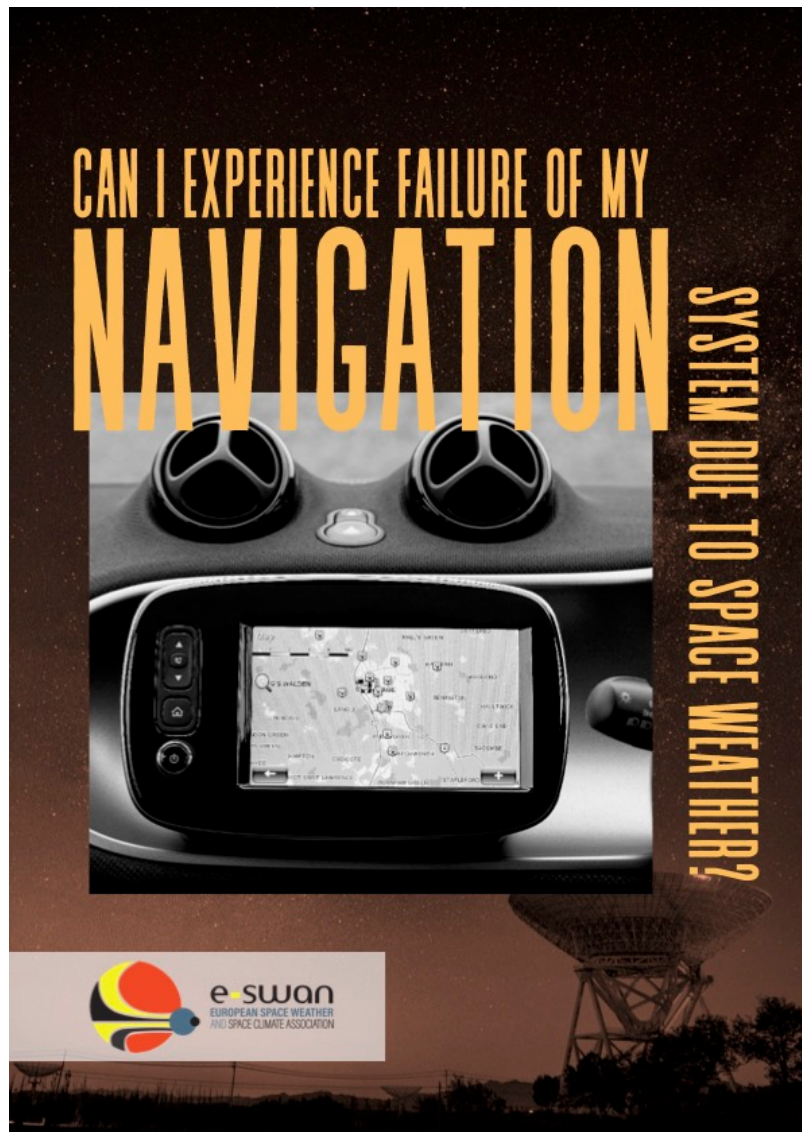
The European Space Weather and Space Climate Association (E-SWAN) is an international non-profit association established in 2022. The mission of E-SWAN is to unite, sustain, and develop Space Weather and Space Climate activities in Europe. E-SWAN has a very active Education and Outreach Committee (EOCom). This committee is dedicated to reaching out to the Space Weather and Space Climate community and the general public.

A EOCom project is the development of a booklet series. These booklets address the real-world impact of solar and geomagnetic activity, focusing on how such phenomena can influence everyday activities and industries, tailored to engage a general audience.

The first booklet that was published, discusses blackouts due to solar storms and was translated from English into several other languages. The EOCom continues to work on more booklets and translations.

All booklets can be found through our STCE space weather info shop: <https://www.stce.be/shop/>





3. Review of Solar and Geomagnetic Activity

Solar Active Regions (ARs) and flares

Solar flaring activity was low during the week, with 53 C-class flares observed, but no M- or X-class flares. The largest flare was a C9.9 flare (SIDC Flare 6135) peaking on November 19 at 09:53 UTC from behind the east limb.

There were a total number of 16 active regions observed on the visible solar disk over the week, SIDC Sunspot Group 693 (NOAA Active Region 4284) and SIDC Sunspot Group 706 (NOAA Active Region 4291) were the most active.

Coronal mass ejections

During the past week, no CME (Coronal Mass Ejection) with an Earth directed component was observed.

Coronal Holes

During the past week, a small polar negative polarity equatorial Coronal Hole (CH) crossed the central meridian on November 17, a positive polarity mid-latitude CH crossed the central meridian on November 22-23 and a positive polarity equatorial CH crossed the central meridian on November 23.

Proton flux levels

The greater than 10 MeV GOES proton flux remained below the 10pfu threshold for the entire week.

Electron fluxes at GEO

The greater than 2 MeV electron flux was mainly below the 1000 pfu threshold entire week, with just short crossings of the threshold on November 19 and November 20.

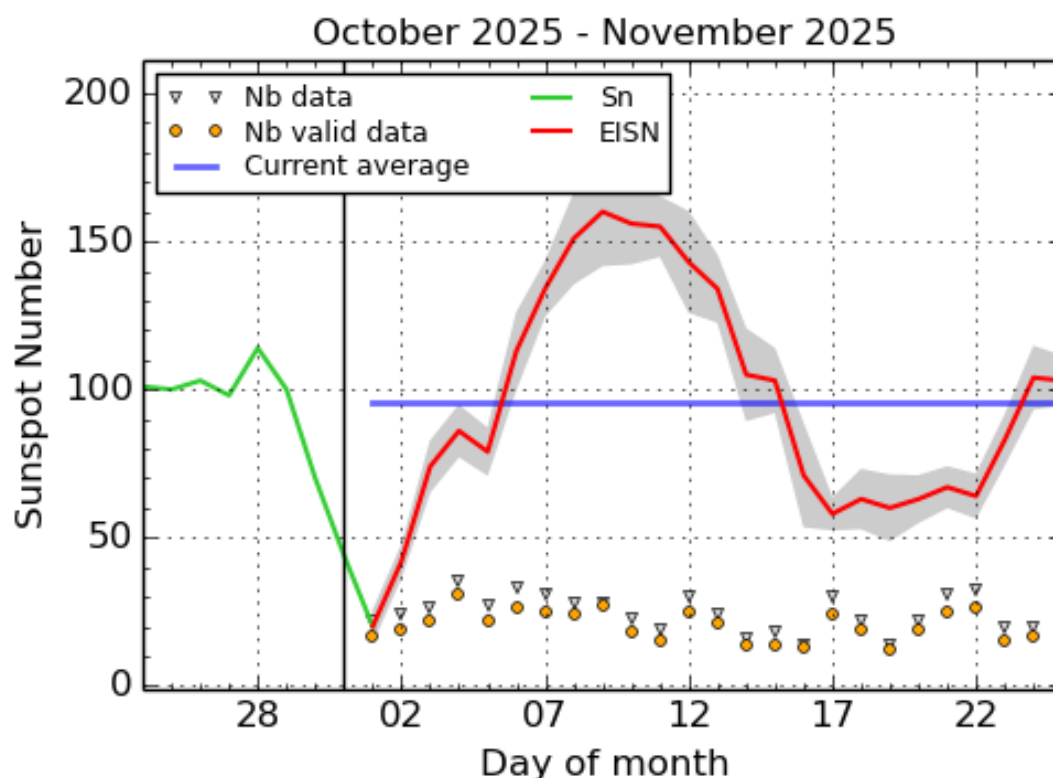
Solar wind

Slow solar wind conditions were recorded during the entire week. The solar wind ranged between 330 and 500 km/s. The interplanetary magnetic field varied between 5 and 17nT, with the Bz reaching a minimum value of -7 nT.

Geomagnetism

Geomagnetic conditions were mainly quiet to unsettled, with isolated active period (Kp4) on November 23 16:00 UTC.

4. International Sunspot Number by SILSO



SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium, 2025 November 25

The daily Estimated International Sunspot Number (EISN, red curve with shaded error) derived by a simplified method from real-time data from the worldwide SILSO network. It extends the official Sunspot Number from the full processing of the preceding month (green line), a few days more than one solar rotation. The horizontal blue line shows the current monthly average. The yellow dots give the number of stations that provided valid data. Valid data are used to calculate the EISN. The triangle gives the number of stations providing data. When a triangle and a yellow dot coincide, it means that all the data is used to calculate the EISN of that day.

5. PROBA2 Observations

Solar Activity

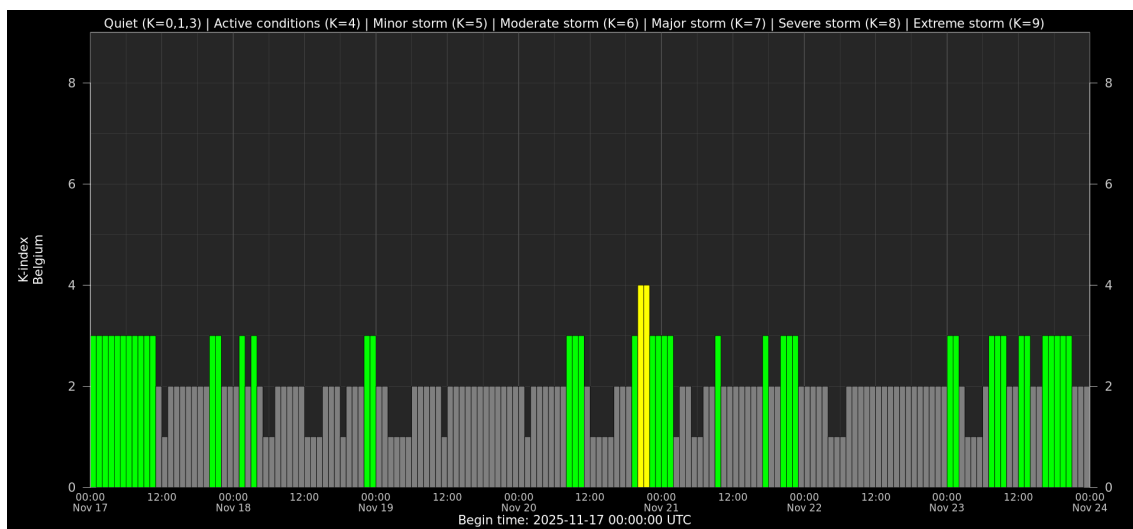
Solar flare activity was low during the week. In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: <https://proba2.oma.be/ssa>

This page also lists the recorded flaring events. A weekly overview movie can be found here (SWAP week 817): http://proba2.oma.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2025_11_17.mp4

Details about some of this week's events can be found further below. If any of the linked movies are unavailable they can be found in the P2SC movie repository here: <https://proba2.oma.be/swap/data/mpg/movies/>

No special events were observed with LYRA or SWAP throughout the week.

6. Geomagnetic Observations in Belgium

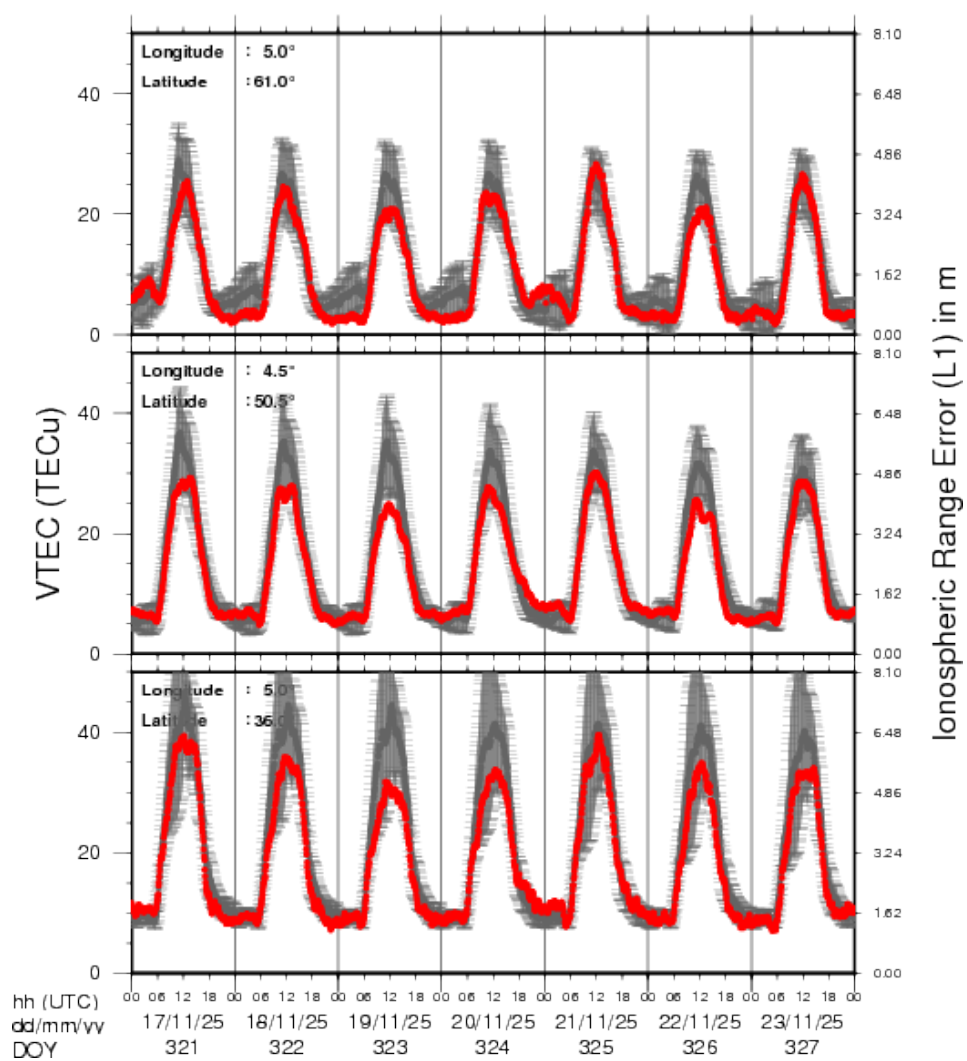


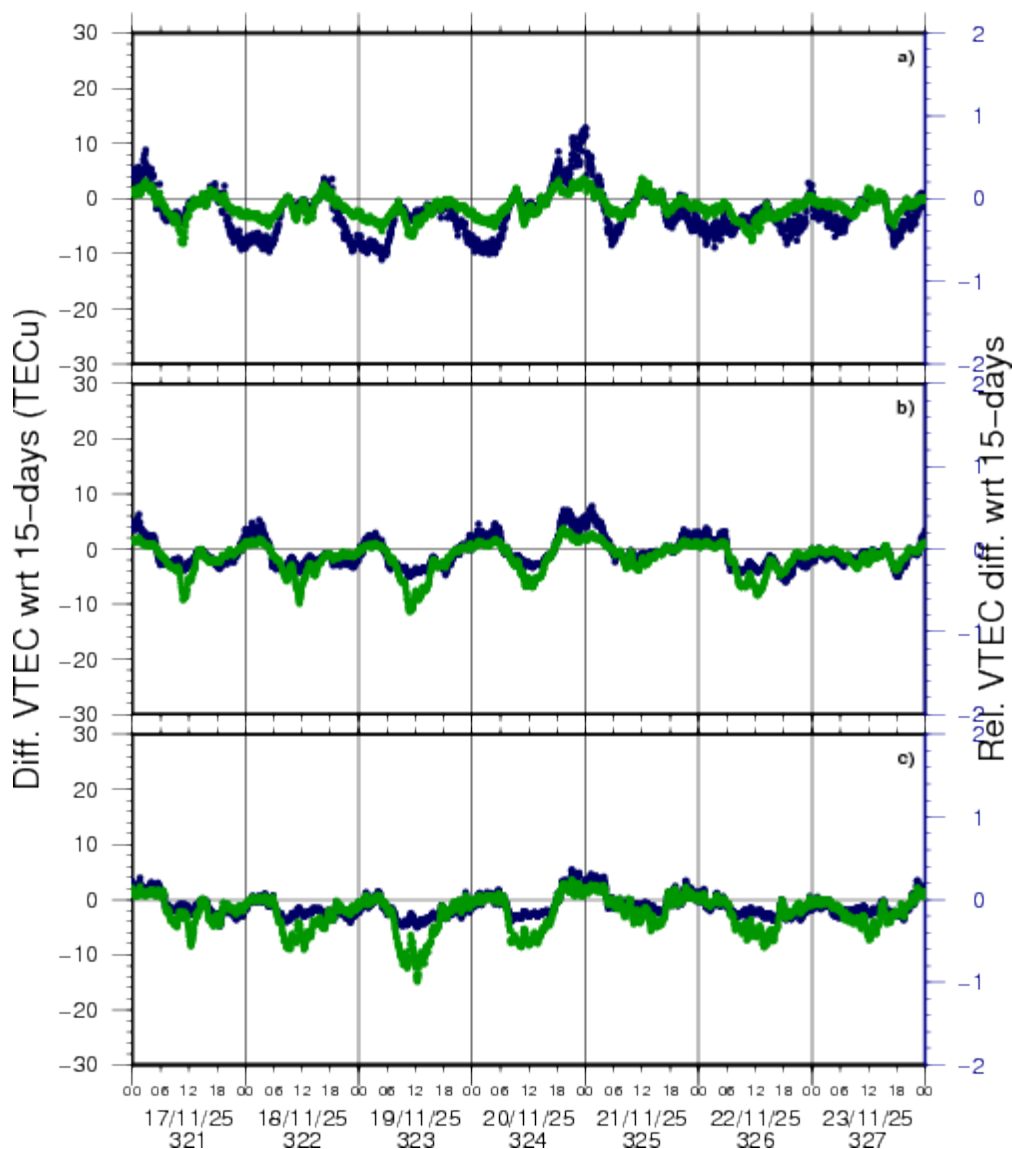
Local K-type magnetic activity index for Belgium based on data from Dourbes (DOU) and Manhay (MAB). Comparing the data from both measurement stations allows to reliably remove outliers from the magnetic data. At the same time the operational service availability is improved: whenever data from one observatory is not available, the single-station index obtained from the other can be used as a fallback system.

Both the two-station index and the single station indices are available here: http://ionosphere.meteo.be/geomagnetism/K_BEL/

7. Review of Ionospheric Activity

VTEC Time Series





VTEC time series at 3 locations in Europe from 17 Nov 2025 till 23 Nov 2025

The top figure shows the time evolution of the Vertical Total Electron Content (VTEC) (in red) during the last week at three locations:

- a) in the northern part of Europe (N 61deg E 5deg)
- b) above Brussels (N 50.5deg, E 4.5 deg)
- c) in the southern part of Europe (N 36 deg, E 5deg)

This top figure also shows (in grey) the normal ionospheric behaviour expected based on the median VTEC from the 15 previous days.

The time series below shows the VTEC difference (in green) and relative difference (in blue) with respect to the median of the last 15 days in the North, Mid (above Brussels) and South of Europe. It thus illustrates the VTEC deviation from normal quiet behaviour.

The VTEC is expressed in TECu (with $\text{TECu} = 10^{16}$ electrons per square meter) and is directly related to the signal propagation delay due to the ionosphere (in figure: delay on GPS L1 frequency).

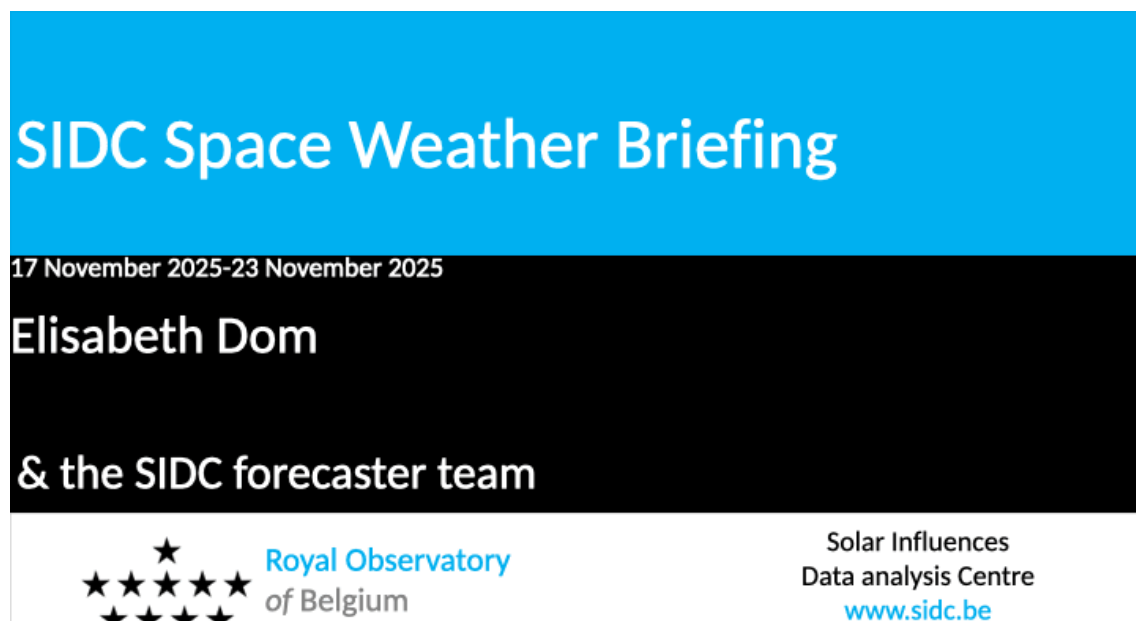
The Sun's radiation ionizes the Earth's upper atmosphere, the ionosphere, located from about 60km to 1000km above the Earth's surface. The ionization process in the ionosphere produces ions and free electrons. These electrons perturb the propagation of the GNSS (Global Navigation Satellite System) signals by inducing a so-called ionospheric delay.

See http://stce.be/newsletter/GNSS_final.pdf for some more explanations; for more information, see <https://gnss.be/SpaceWeather>

8. The SIDC Space Weather Briefing

The forecaster on duty presented the SIDC briefing that gives an overview of space weather from November 17 to 23.

The pdf of the presentation can be found here: https://www.stce.be/briefings/20251124_SWbriefing.pdf



9. Upcoming Activities

Courses, seminars, presentations and events with the Sun-Space-Earth system and Space Weather as the main theme. We provide occasions to get submerged in our world through educational, informative and instructive activities.

- * Feb 9-11, 2026, STCE Space Weather Introductory Course, Brussels, Belgium - register: <https://events.spacepole.be/event/255/>
- * Mar 16-18, 2026, STCE course: Role of the ionosphere and space weather in military communications, Brussels, Belgium - register: <https://events.spacepole.be/event/258/>
- * Apr 20-21, 2026, STCE cursus: inleiding tot het ruimteweer, Brussels, Belgium - register: <https://events.spacepole.be/event/260/>
- * Mar 23, 2026, STCE lecture: From physics to forecasting, Space Weather course, ESA Academy, Redu, Belgium
- * Jun 15-17, 2026, STCE Space Weather Introductory Course, Brussels, Belgium - register: <https://events.spacepole.be/event/256/>

* Oct 12-14, 2026, STCE Space Weather Introductory Course, Brussels, Belgium - register: <https://events.spacepole.be/event/257/>

* Nov 23-25, 2026, STCE course: Role of the ionosphere and space weather in military communications, Brussels, Belgium - register: <https://events.spacepole.be/event/259/>

* Dec 7-9, 2026, STCE Space Weather Introductory Course for Aviation, Brussels, Belgium - register: <https://events.spacepole.be/event/262/>

To register for a course and check the seminar details, navigate to the STCE Space Weather Education Center: <https://www.stce.be/SWEC>

If you want your event in the STCE newsletter, contact us: [stce_coordination at stce.be](mailto:stce_coordination@stce.be)



Website: <https://www.stce.be/SWEC>