STCE Newsletter

1 Jun 2026 - 7 Jun 2026

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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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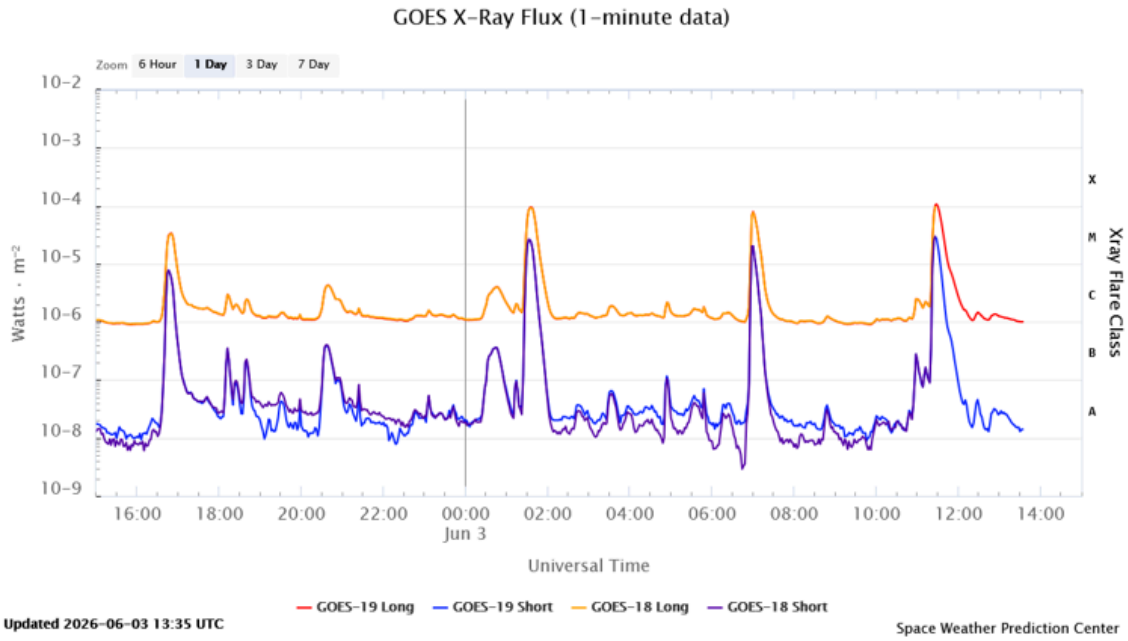
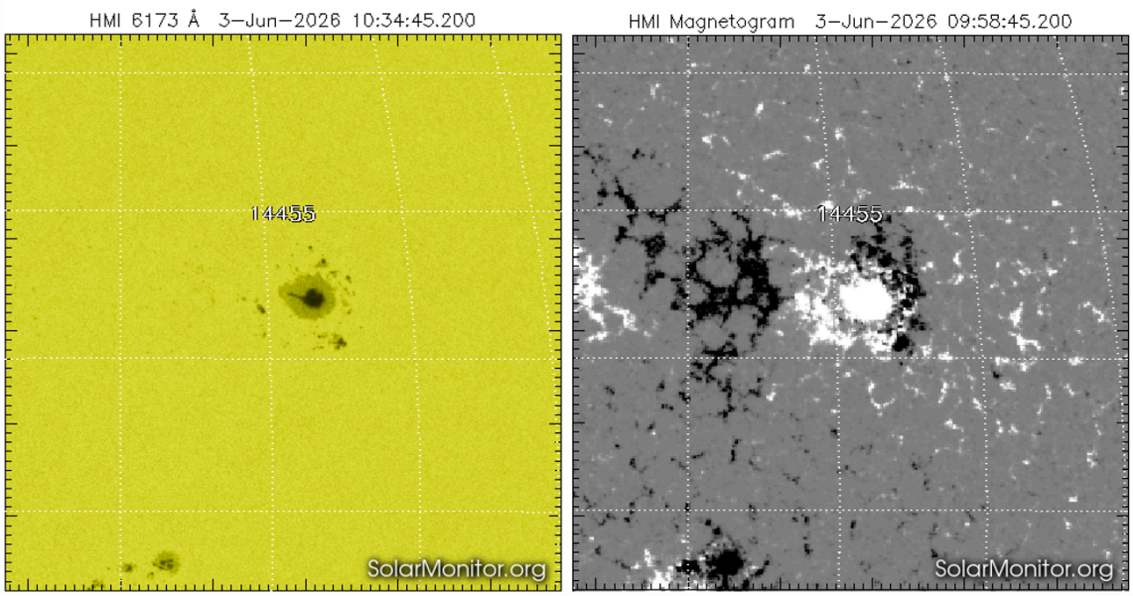
1. Itchy NOAA 4455

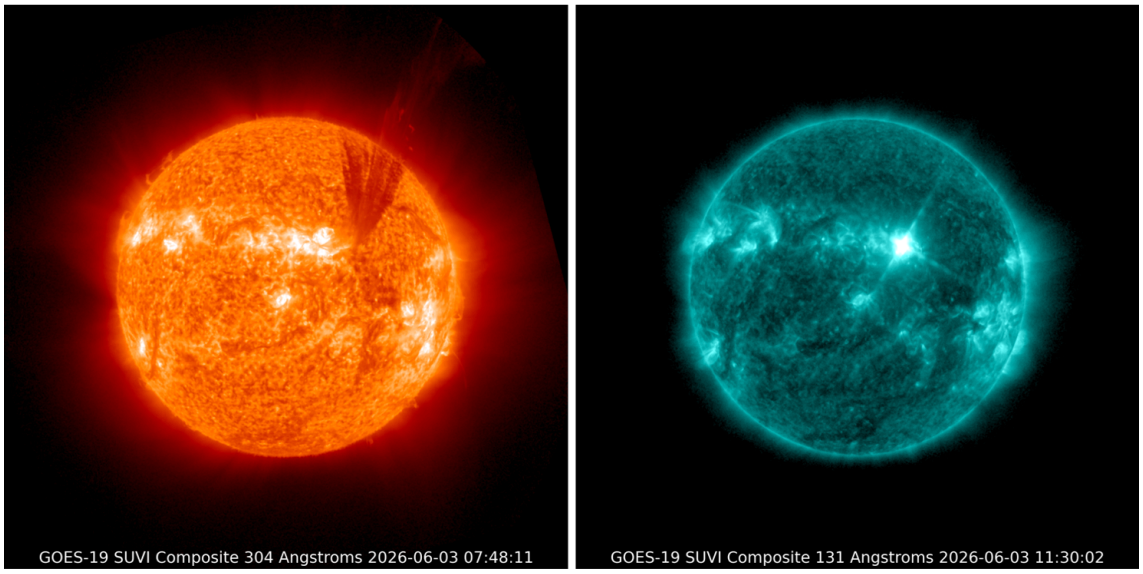
SIDC Sunspot Group 860 (NOAA Active Region 4455) developed a complex magnetic structure on 2 June. Then, early on 3 June, it started to produce significant flares: an M9.3 at 01:36 UTC, an M7.7 flare at 07:00 UTC, and an X1.0 flare at 11:28 UTC. Note that "M" is considered a flare of "medium" strength, and "X" an "eXtreme" solar flare. The graph underneath shows the evolution in soft x-rays as recorded by GOES.



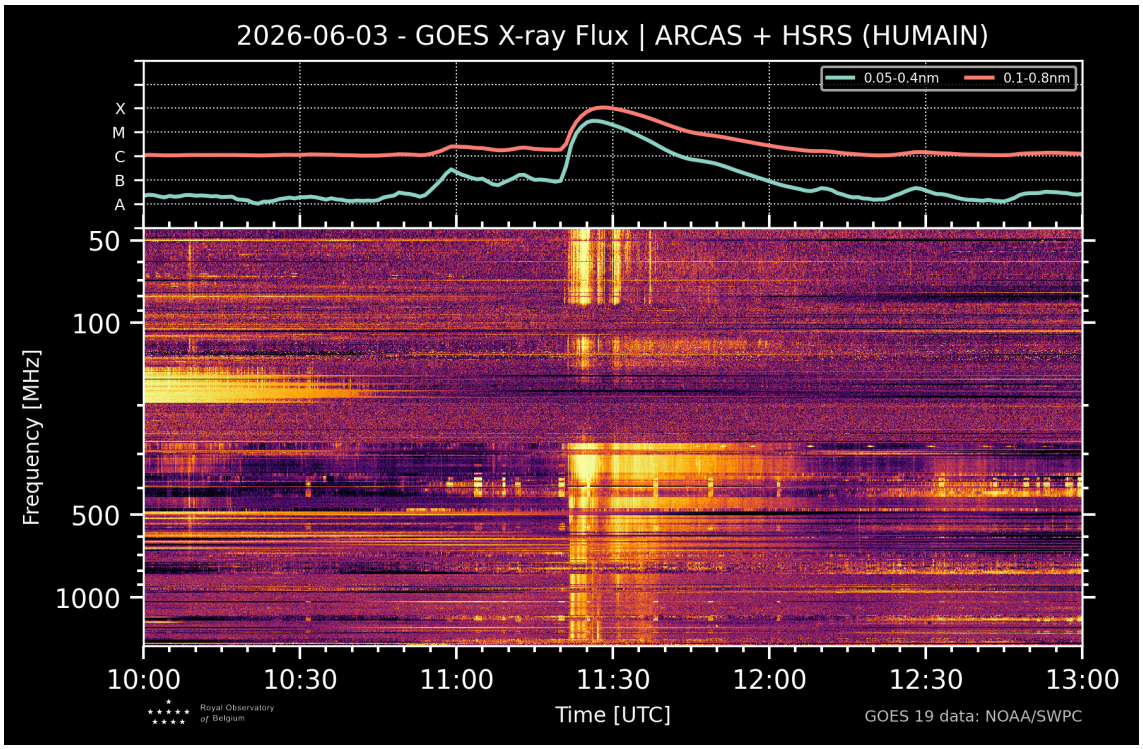
In white light, NOAA 4455 looked deceivingly simple (just a symmetric, big sunspot with some minor spots close-by), but the catch was in the detail. The few small spots which were partially surrounding the main big spot had an opposite magnetic polarity. This can be seen in the SDO imagery underneath, with on the left the white light image and on the right the magnetogram (note the proximity of the "black" satellite sunspots close to the "white" main spot). This magnetic configuration is known for its high flaring potential, which has been dealt with in previous newsitems (more examples e.g. in these newsitems at https://www.stce.be/news/531/welcome.html and https://www.stce.be/news/268/welcome.html). Following the trio of strong flares, this magnetic structure started to dissipate and no further M-class flaring from this region was recorded.



The strong flares of 3 June differed in the ejection of material into space. The most spectacular was the M7 flare, as shown in extreme ultraviolet in the GOES/SUVI 304 image on the left. The image to the right shows the X1 flare in a different wavelength covering much higher temperatures of several million degrees (SUVI 131).

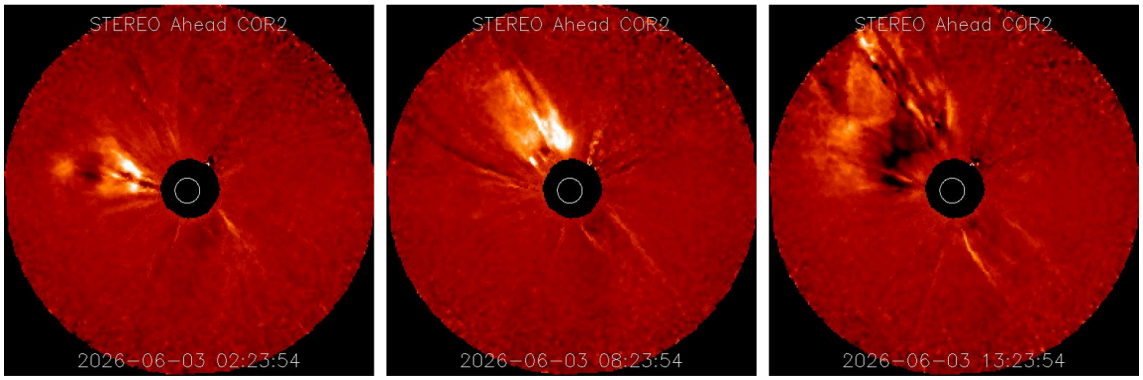


All three of the strong flares produced significant radio emission at the observed radio frequencies, but in all cases the frequencies at 1415 MHz (GNSS - Global Navigation Satellite Systems, such as GPS, Galileo,...) and at 2800 MHz (10.7cm solar radio flux) were least affected. The Humain Radioastronomy Station (HuRAS) was able to record the radio emission associated with the X1 flare. Time is on the vertical axis, and frequency on the vertical axis with the lowest values on top. The evolution in soft x-rays is on top (GOES). Type III radio bursts are the most prominent in this radiospectrogram (see the STCE SWx classification page for more info - https://www.stce.be/educational/classification).

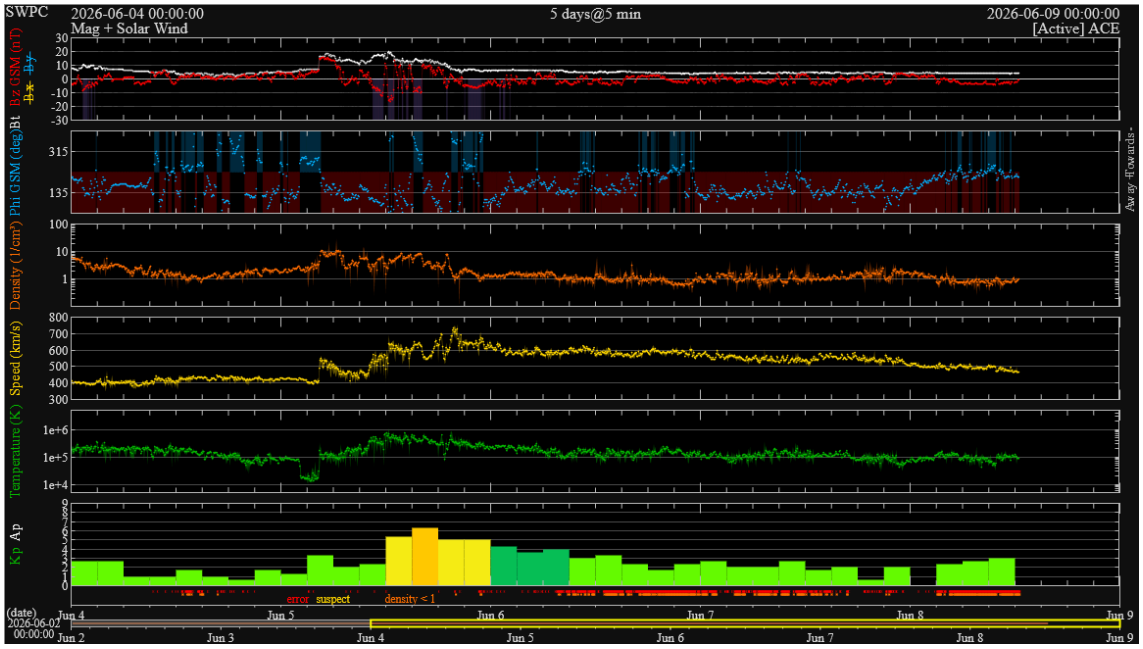


In the SIDC's daily spaceweather bulletin, the SIDC forecaster wrote that each eruption was associated with a coronal mass ejection (CME):
- Firstly, a halo CME, associated with the M9.3 flare ... , seen in SOHO LASCO-C2 and seen STEREO-A COR2 imagery starting at June 03 at 01:53 UTC.
- Secondly, a partial halo CME (directed to the north-west), detected in SOHO LASCO-C2 imagery from 07:58 UTC on June 03, associated with the M7.7 flare ...
- Thirdly, a partial halo CME (directed to the north-west), detected in SOHO LASCO-C2 images from 11:48 UTC on June 03, associated with the X1.0 flare ...

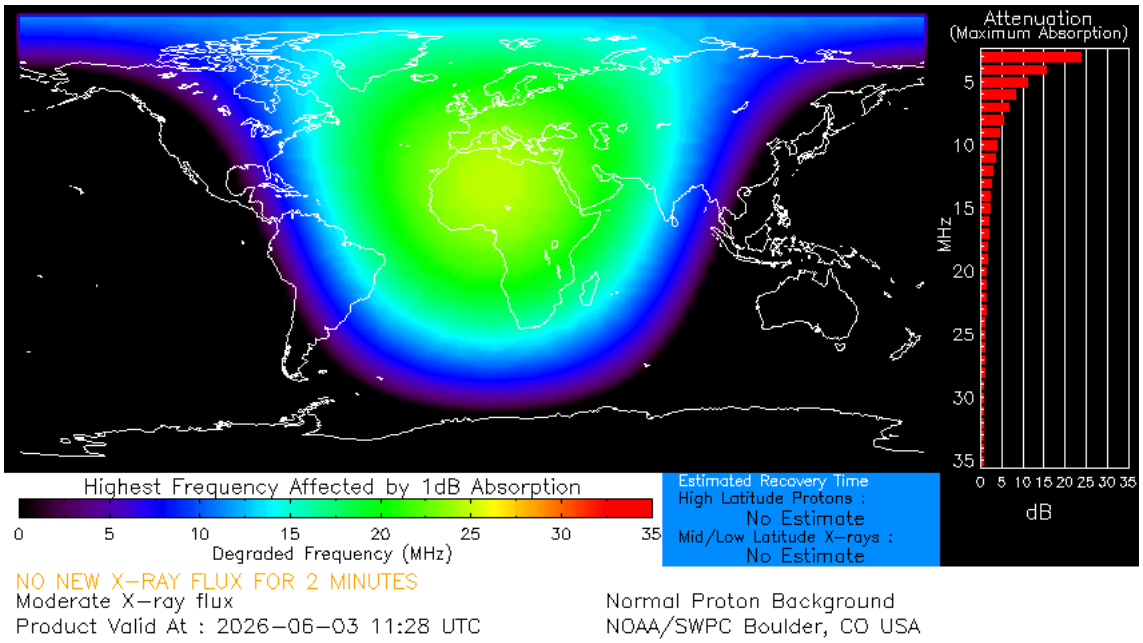
Each of the CMEs related to the 3 main eruptions of 3 June can be seen underneath in the images made by the STEREO-A/COR2 coronagraph. STEREO-A is currently located 60 degrees ahead of Earth which -in these images- is located to the left. As a result, though the bulk of each of the CMEs was not directly aimed at Earth, it was thought that each of the CMEs still might have an earth-directed component. These CMEs were expected to impact the earth environment from late on 4 June throughout 5 June, and produce a moderate to severe geomagnetic storm.



Generally slow solar wind conditions were observed until 04:30 UTC on 5 June when a shock was detected in the solar wind data (ACE - see graph underneath) likely associated with the arrival of the first CME from 3 June. The solar wind speed (yellow curve) jumped from approximately 436 km/s to 509 km/s and then gradually increased to values around 730 km/s late on 5 June. Bz, the north-south component of the interplanetary magnetic field (red curve), started out predominantly positive until 07:00 UTC on 5 June,when it started a gradual decrease to -17 nT around noon. These solar wind conditions resulted in a moderate geomagnetic storm only (Kp = 6+, and K_BEL = 6). It is not entirely clear how many of the 3 CMEs actually made it to Earth, as the solar wind parameters also seem to be influenced by the high speed stream from a small positive polarity coronal hole.



Space weather impacts were limited. The ionizing radiation of the X-class flare itself briefly affected the lower frequency portion of the High Frequency communication band (HF Com ; 3 - 30 MHz) on the dayside of the Earth. This was mainly over Europe, Africa, Greenland and the North-Atlantic Ocean. The effects of this X-class flare on HF Com can be seen in the D-RAP (NOAA/SWPC) map below. An advisory to civil aviation was issued (PECASUS - https://pecasus.eu/). Also, following the moderate geomagnetic storm, some advisories were sent for HF Com deterioration due to post-storm depression (PSD). PSD occurs when the higher frequencies in HF are no longer available (see this STCE newsitem for a more detailed explanation - https://www.stce.be/news/640/welcome.html).



2. Proba-3/ASPIICS is back in business!

After an anomaly onboard Proba-3's Coronagraph spacecraft led to loss of contact between the spacecraft and ground control last February, a tiger team worked relentlessly to get the spacecraft and its ASPIICS coronagraph back. Already in March they managed to re-establish contact with the coronagraph spacecraft.

After about 2 months of careful and gradual testing, a first formation flight was successfully performed last week. This was the moment of truth for the ASPIICS coronagraph.

"After performing very careful checks of the ASPIICS coronagraph instrument, I'm very happy to confirm that it's healthy and fully functional," says Andrei Zhukov of the Royal Observatory of Belgium, the principal investigator for ASPIICS. "Last week's formation flight allowed us to capture new images of the corona, and they look as spectacular as the ones taken before the incident occurred."

Read the full story on the ESA webpage: https://www.esa.int/Enabling_Support/Space_Engineering_Technology/We_re_back_Proba-3_ready_for_more_science

3. Review of Solar and Geomagnetic Activity

Solar Active Regions (ARs) and flares

Solar flaring activity was low to high over the week. There were 16 numbered regions on disk over the week, but many of these were magnetically simple. The largest and most complex region on disk was SIDC Sunspot Group 860 (NOAA Active Region 4455) and this region was responsible for most of the flaring activity in the first half of the week. There were 6 M-class flares and 1 X-class flare produced by this active region.
The largest flares were an X1.0 as recorded by GOES-19 (SIDC flare 7842) and an M9.3 flare (SIDC flare 7838), peaking on June 03 at 11:28 and 01:36 UTC, respectively.
From June 04, the solar activity decreased with low activity on June 04, 05 and 07 and moderate activity on June 06 due to an isolated M1.8 flare (SIDC flare 7874), with peak time June 06 at 14:01 UTC, from the area near SIDC Sunspot Group 889 (NOAA Active region 4461).

Coronal Mass Ejections

Four Coronal Mass Ejections (CMEs) with possible Earth-directed components were identified. The first CME (SIDC CME 667), a faint asymmetric halo CME, was detected in SOHO LASCO-C2 on June 03 at 01:53 UTC. This was associated with an M9.3 flare flare (SIDC flare 7838), with peak time 2026-06-03 at 01:36 UTC and had Type II and Type IV radio emission.
The second (SIDC CME 668) was associated with an M7.7 flare (SIDC flare 7840), with peak time 07:00 UTC on June 03. An associated partial halo CME to the north-west became visible in SOHO / LASCO-C2 data from 07:58 on June 03. This event also had Type II radio emission associated with it.
The third CME (SIDC CME 669), a partial halo also directed to the north-west, was first seen in LASCO-C2 data from 11:48 UTC on June 03. This was associated with the X1.0 flare (SIDC Flare 7842).

The fourth CME (SIDC CME 670) was associated with an M1.8 flare (SIDC flare 7874) in the south-east of the solar disk and seen in SOHO/LASCO-C2 from 14:01 UTC on June 06. This event was associated with a large dimming, EUV wave and Type II radio burst.

Coronal Holes

A small equatorial, positive polarity coronal hole (SIDC Coronal Hole 166) was crossing the central meridian at the start of the week on June 01. Towards the end of the week, a small mid-latitude coronal hole in the southern hemisphere with positive polarity (SIDC Coronal Hole 159) began to transit the central meridian on June 06.

Proton flux levels

The greater than 10 MeV proton flux was below the 10pfu threshold throughout the week.

Electron fluxes at GEO

The greater than 2 MeV electron flux measured by GOES 19 and 18 was above the 1000 pfu threshold during the second half of the week, due to the influence of the fast solar wind from the CME arrival.

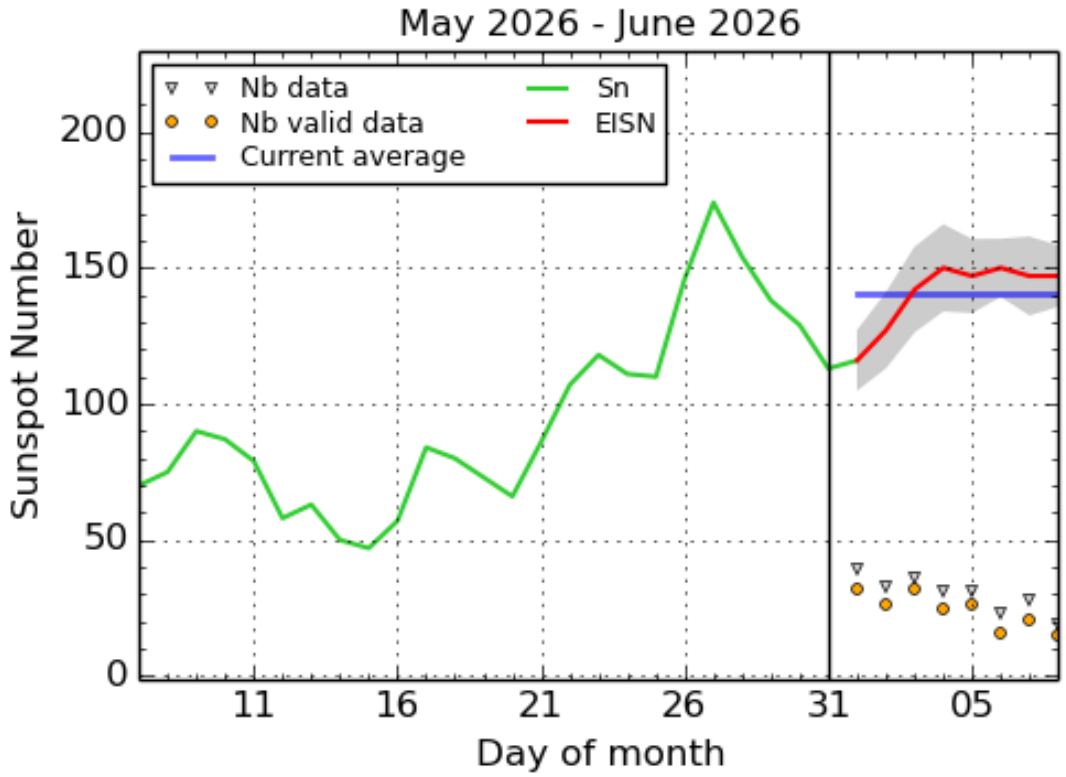
Solar wind

Between June 01 and June 04, the solar wind parameters reflected the waning influence from a high speed stream and the solar wind speed showed a decreasing trend. Around 04:30 UTC on June 05 a shock was detected in the solar wind data (ACE and DSCOVR), likely associated with the arrival of the CME from June 03 (SIDC CME 667). The interplanetary magnetic field jumped from 8 nT to 13 nT and then gradually increased to 19 nT. The solar wind speed jumped from approximately 436 km/s to 509 km/s and then gradually increased to 550 km/s. Bz was predominantly positive at this time.
The solar wind speed and magnetic field strength then decreased slightly before a second increase with a maximum speed recorded of over 700 km/s on June 05 and a minimum Bz of -17 nT, possibly due to additional ICME glancing blows. At the end of the week, the interplanetary magnetic field strength had reduced and was stable around 5 nT and the solar wind speed remain elevated with values around 500 km/s.

Geomagnetism

Geomagnetic conditions were at quiet to unsettled at the start of the week on June 01 to June 04. Minor to moderate storm conditions were reached on June 05 with NOAA KP 6+ between 15:00 and 18:00 UTC and K-BEL 6 between 17:00 and 19:00 UTC on June 05. This was in response to the ICME passage.
From June 06, the conditions reduced to active levels and quiet to unsettled conditions returned from June 07.

4. International Sunspot Number by SILSO



SILSO graphics (http://sidc.be/silso) Royal Observatory of Belgium, 2026 June 8

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

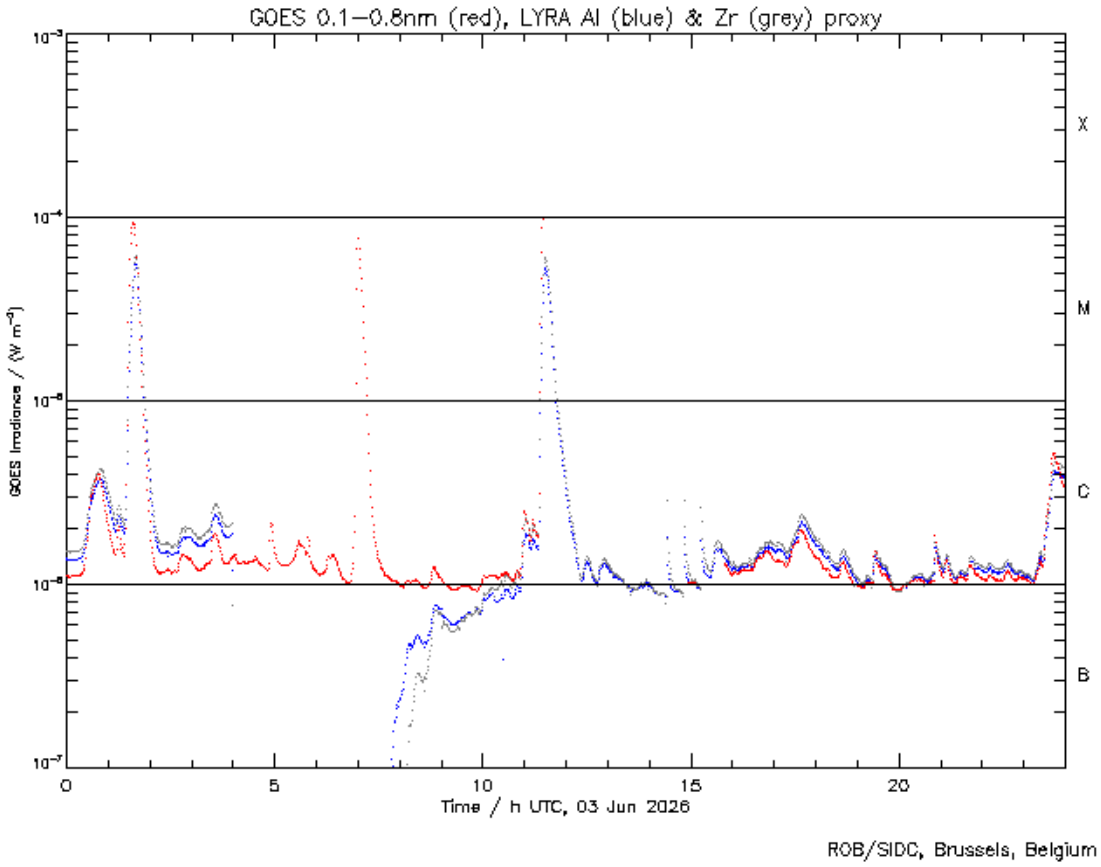
Solar flare activity fluctuated from low to high during the week.
In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: https://proba2.oma.be/ssa
This page also lists the recorded flaring events.

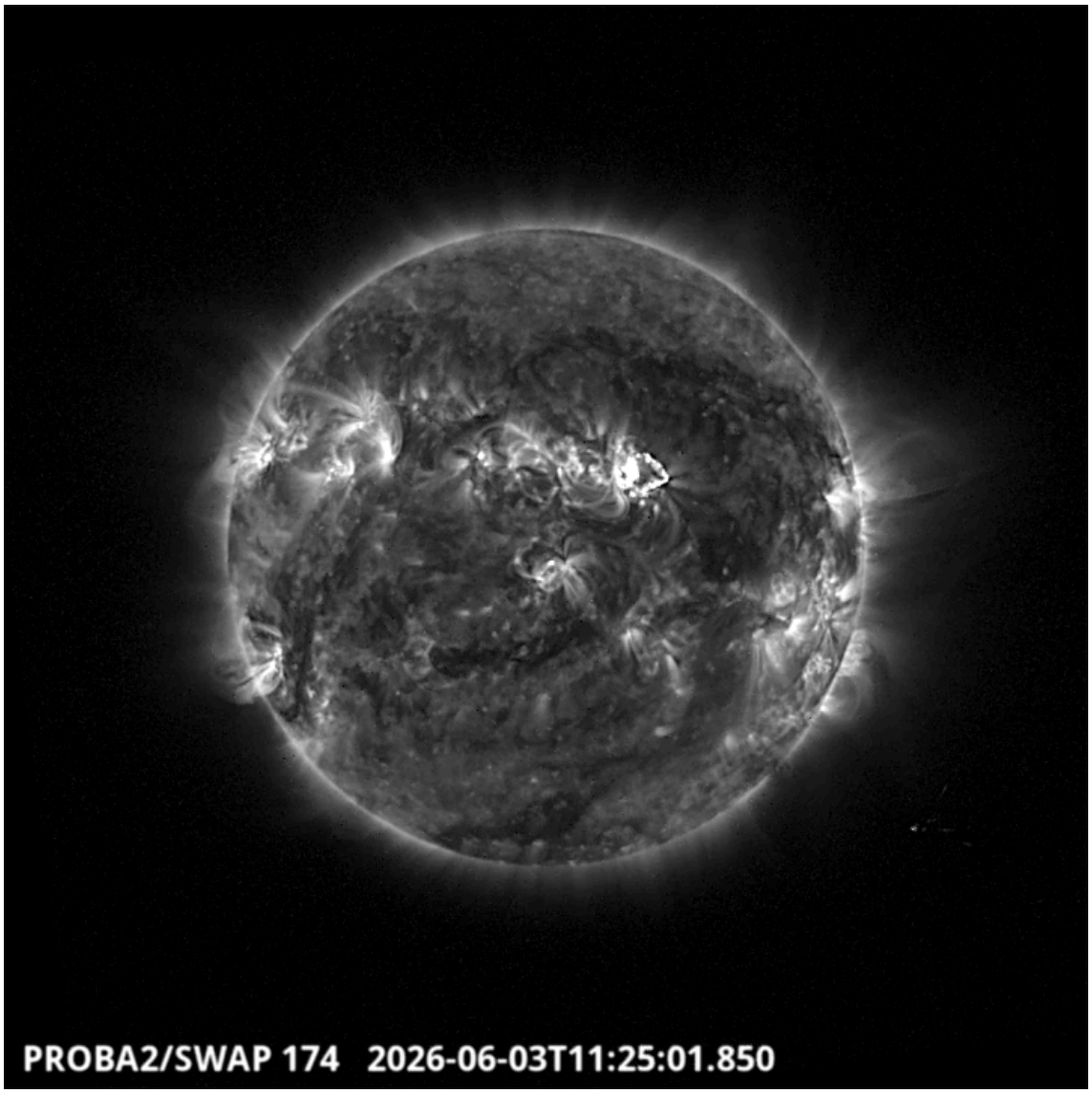
A weekly overview movie (SWAP week 845) can be found here: https://proba2.sidc.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2026_06_01.mp4.

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/.

Wednesday June 03





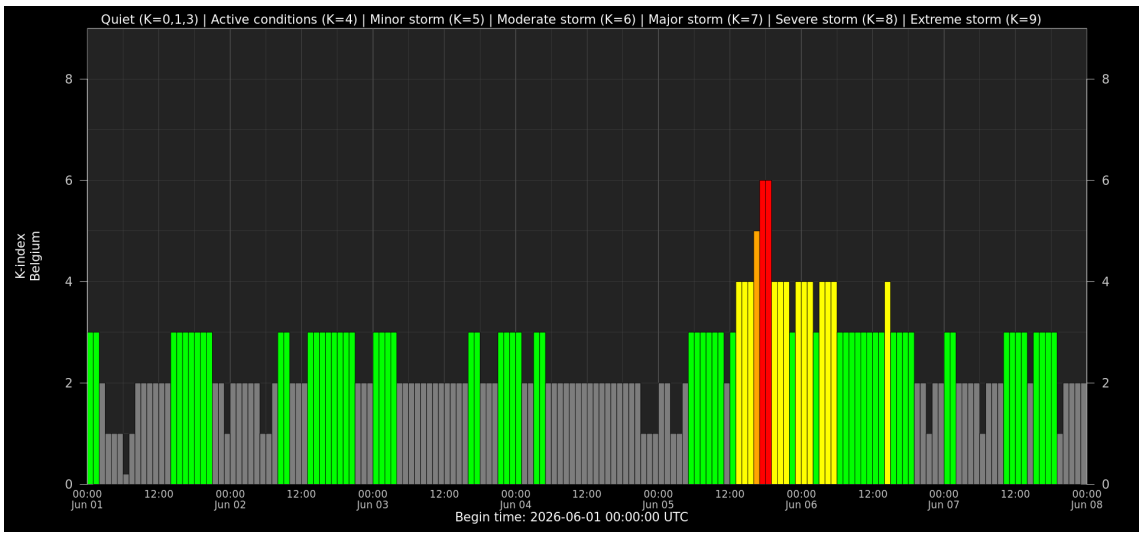
The largest flare of this week was an X1.0, and it was observed by LYRA (top panel) and SWAP (bottom panel). The flare peaked on 2026-Jun-03 at 11:28 UT and occurred in the north-western quadrant of the Sun, originating from active region NOAA4455 (SIDC 860).
Find a SWAP movie of the event here: https://proba2.sidc.be/swap/movies/20260603_swap_movie.mp4.

6. Noticeable Solar Events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
02	0442	0445	0447		M1.2					4461
02	0951	1005	1019	N11E1	M1.2	1N		VI/2	37	4455
02	1631	1650	1656	N56W29	M3.3	2		III/2II/2	37	4455
03	0122	0136	0143	N13W11	M9.3	SF			37	4455
03	0649	0700	0707	N14W13	M7.7	1B		III/2II/3	37	4455
03	1119	1128	1135	N13W15	X1.0	1N		III/2IV/1	37	4455
06	1340	1401	1428	S21E24	M1.8	2N		III/2II/3	43	4461

LOC: approximate heliographic location
XRAY: X-ray flare class
OP: optical flare class
10CM: peak 10 cm radio flux
TYPE: radio burst type
Cat: Catania sunspot group number
NOAA: NOAA active region number

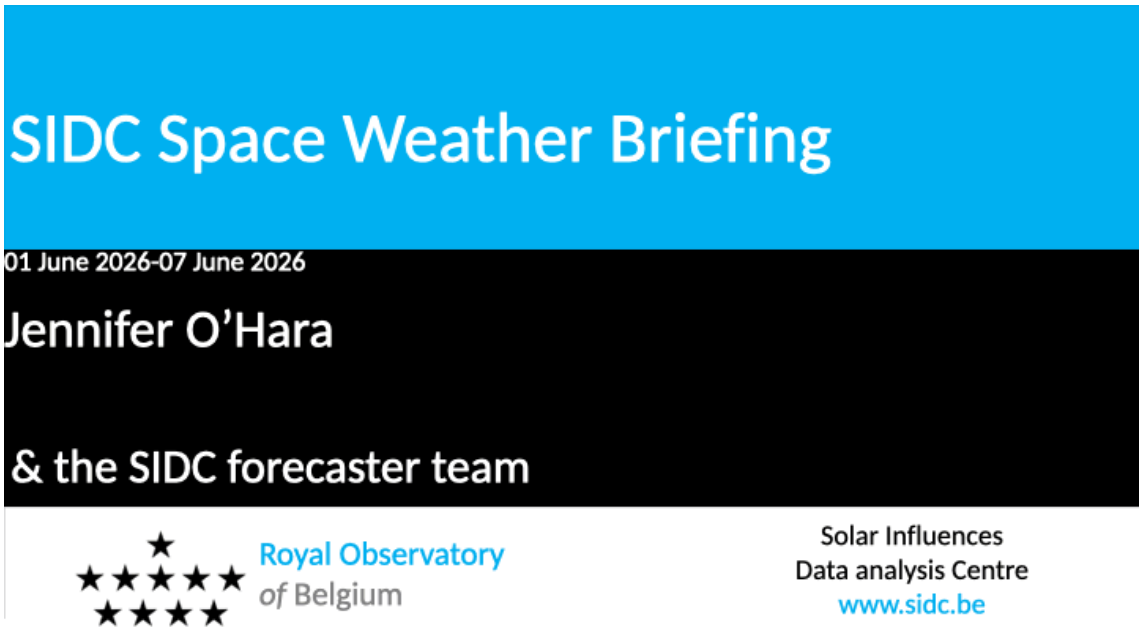
7. Geomagnetic Observations in Belgium



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/

8. The SIDC Space Weather Briefing

The forecaster on duty presented the SIDC briefing that gives an overview of space weather from June 1 to 7.
The pdf of the presentation: https://www.stce.be/briefings/20260608_SWbriefing.pdf



9. Upcoming Activities

Courses, seminars 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.

* Jun 15-17, 2026, STCE Space Weather Introductory Course, Brussels, Belgium - register: https://events.spacepole.be/event/256/ - Fully booked

* Jun 18, 2026, Post Space Weather Introductory Course, Brussels, Belgium - register: https://events.spacepole.be/event/285/

* July 8, 2026, Watching the Sun: a 200 year journey, public visits of the solar physics and space weather department, NL/FR/EN, Brussels, Belgium - book: https://200year.observatory.be/en-gb/coupole

* Aug 6, 2026, Watching the Sun: a 200 year journey, public visits of the solar physics and space weather department, NL/FR/EN, Brussels, Belgium - book: https://200year.observatory.be/en-gb/coupole

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

* Oct 15, 2026, Post Space Weather Introductory Course, Brussels, Belgium - register: https://events.spacepole.be/event/286/

* Oct 29- Nov 1, 2026, Prior to ESWW2026 - Space Weather Training Course in Firenze, Italy - Applications closed

* Nov 2-6, 2026, European Space Weather Week, Florence, Italy, https://esww2026.eswan.eu/

* 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