STCE Newsletter

22 Jun 2026 - 28 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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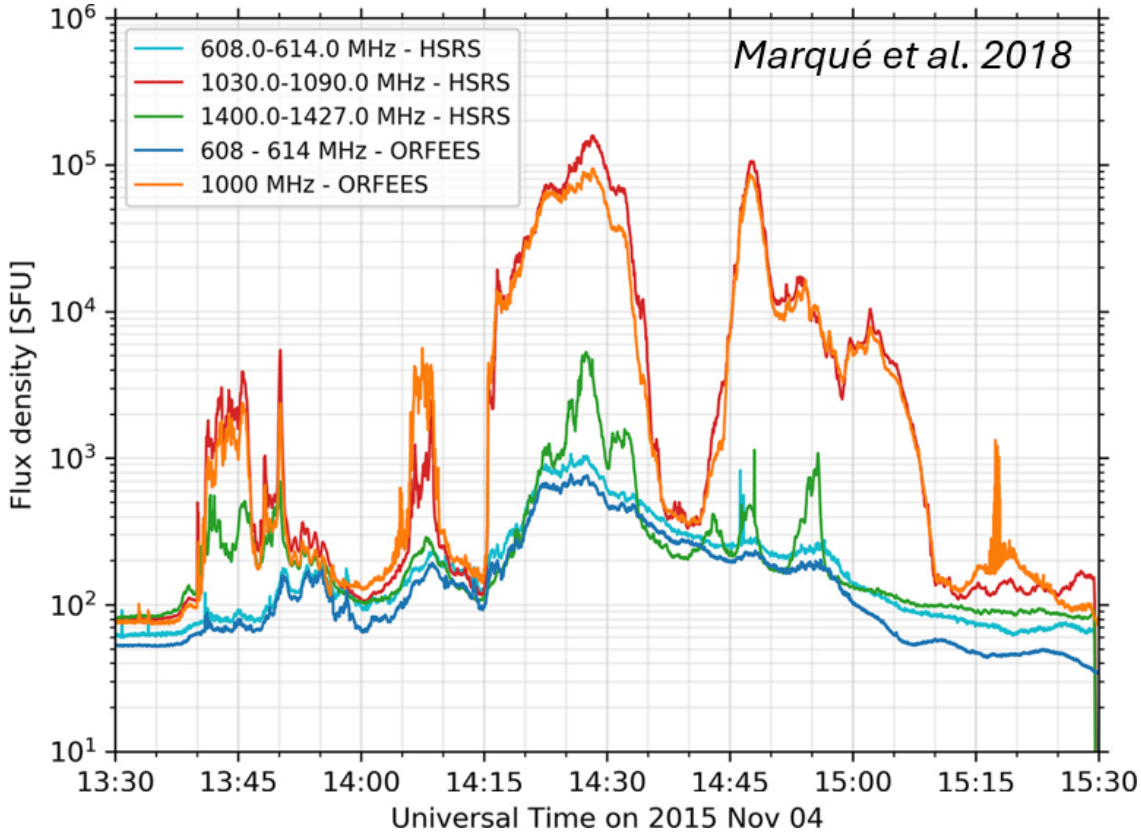
1. Solar Radio Bursts

Solar eruptions are usually characterized by significant enhancements in soft x-rays and extreme ultraviolet. Occasionally, these eruptions are also accompanied by strong emissions at radio frequencies. These Solar Radio Bursts (SRBs) may manifest themselves over the entire radio frequency range, i.e. from the ionospheric cut-off frequency around 15 MHz to several GHz. Hence, strong SRBs may affect technologies such as radar and communication devices operating at these frequencies. Examples are numerous: from the recent radio communication incident on 14 December 2023 over the disturbance of the Swedish air traffic control radar on 4 November 2015 (Marque et al. 2018 - https://doi.org/10.1051/swsc/2018029) to the interference with GNSS receivers (Global Navigation Satellite Systems such as GPC and Galileo) on 6 December 2006 (Cerruti et al. 2008 - https://doi.org/10.1029/2007SW000375). Note these impacts concern dayside locations only.



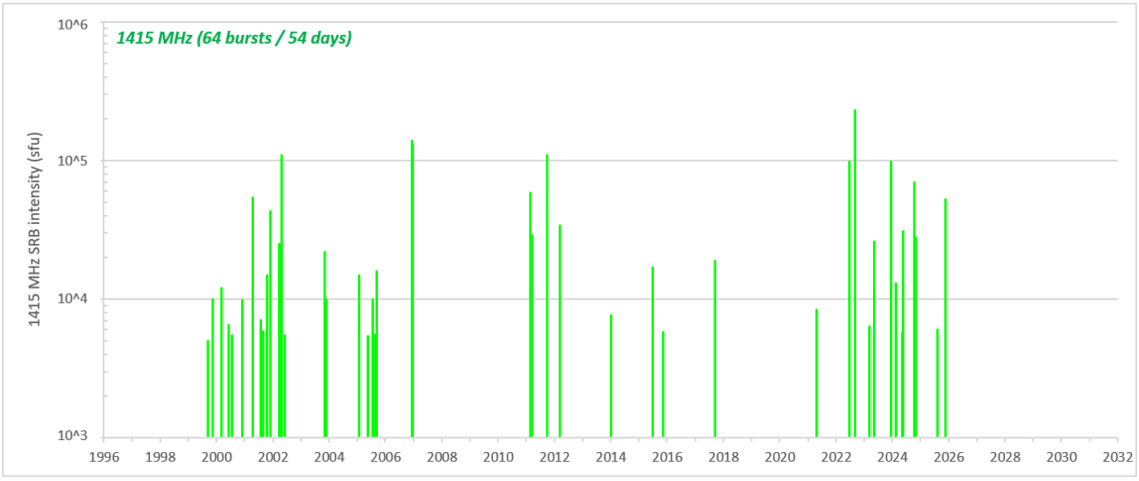
The aforementioned examples obviously require strong intensities at the affected frequencies, meaning that this kind of disturbances do not happen too often. This begs the question: how often? NOAA/SWPC maintains a list of solar radio bursts in their daily "Solar and Geophysical Event Reports", whose archive can be found in their "warehouse" (https://www.ngdc.noaa.gov/stp/space-weather/swpc-products/daily_reports/solar_event_reports/). The listings are based on observations of the solar radio flux density at eight frequencies (245; 410; 610; 1415; 2695; 4995; 8800; and 15400 MHz) reported by the United States Air Force (USAF) Radio Solar Telescope Network (RSTN). This network is composed of 4 stations, globally distributed: Learmonth (Australia), San Vito (Italy), Palehua (Hawaii, USA), and Sagamore Hill (Massachusetts, USA) - see e.g. McKee et al. 2023 - https://doi.org/10.1051/swsc/2023001). Though this data set may be incomplete -Nita et al. (2002 - https://iopscience.iop.org/article/10.1086/339577) has suggested up to 50% of bursts on some frequencies are missing- and has its limitations, it certainly provides a good "first idea" (Giersch et al. 2017 - https://doi.org/10.1002/2017SW001658).

The table underneath provides for each frequency a typical value for solar cycle minimum and solar cycle maximum, as well as the values at which the RSTN radiometer saturates. The typical values for solar cycle minimum and maximum were calculated from the Learmonth observations (one of the RSTN stations) for the minimum and maximum year of the last 3 solar cycles (SC23 to 25; NCEI). For the saturation values, these are nominal values that can vary by more than 50% depending on calibration (maintenance alignments, non-linearity,...). Any bursts reported near these maximum values are thus questionable because of the possibility that the radiometer was saturated and thus the event's magnitude may have been significantly above the reported value (Giersch et al. 2017). The SRB intensities can then be checked against other (non-RSTN) stations, such as the Owens Valley Solar Array (OVSA), Nobeyama (https://solar.nro.nao.ac.jp/norp/index.html), the Humain Solar Radioastronomy Station (https://www.sidc.be/humain/ah_last_hours), or stations of the e-Callisto network (https://www.e-callisto.org/Data/data.html).

Frequency (MHz)	Typical values (sfu)		Saturation level RSTN (sfu)
	SC min	SC max	
245	12	25	$5 . 10^5$
410	25	45	$5 . 10^5$
610	35	65	$5 . 10^5$
1415	50	120	$1 . 10^5$
2695	70	170	$5 . 10^4$
4995	120	220	$5 . 10^4$
8800	210	300	$5 . 10^4$
15400	520	580	$5 . 10^4$

The bursts derived from the daily NOAA reports cover the period of 1996-2025, so a bit more than 2.5 solar cycles. Only bursts with an intensity of at least 5000 sfu (solar flux unit, 1 sfu = 10-22 W m-2 Hz-1) were selected, regardless of the frequency. This value comes from the intensity that SRBs must have (measured at a frequency of 1415 MHz) to affect GNSS applications. There has been some dispute over the exact level of solar flux that causes an effect on GNSS equipment. Often quoted values are 40.000 sfu (Klobuchar et al., 1999 - https://doi.org/10.1007/PL00012794), around 10.000 sfu (Cerruti et al. 2006, https://doi.org/10.1029/2006SW000254), 4000-12.000 sfu (Chen et al. 2005 - https://doi.org/10.1029/2004RS003066), and 1800 sfu (Yue et al. 2018 - https://doi.org/10.1016/B978-0-12-812700-1.00022-4). For practical reasons, it was decided to settle on a value of 5000 sfu, with the option that -if so required- this limit can be lowered for some frequencies in a future effort. Plenty of factors play indeed a role: from the solar zenith angle over the technicalities of the measurement devices to the sensitivity of the technology affected (see Giersch et al. for an overview of the limitations of the NOAA/RSTN reports). The related graphs at the STCE Solar Cycle Tracking page are not corrected for any of these, with only a few obvious errors eliminated. They only show one burst per day (the most intense), as very occasionally during episodes of significant solar activity, several strong SRBs may occur at the same frequency in a single day. Such occurrences are rare and affect most often the 245 MHz and 410 MHz frequencies. Note also that during a solar eruption not all radio frequencies are affected as strongly, and that the difference in intensity between the frequencies may be considerable.

These graphs have been added to the STCE's Solar Cycle Tracking page at https://www.stce.be/content/sc25-tracking . The aim is to have them actualized once a year, during the first update. The graph underneath is an example for the frequency of 1415 MHz, with a total of 64 bursts (larger than 5000 sfu) recorded on 54 different days during the 30-year period, and only the most intense burst for that day displayed.



2. Space Weather End User Workshop of ICAO

On the 8th and 9th of June, the STCE participated to the 2nd Space Weather End User Workshop of ICAO (the International Civil Aviation Organisation). This workshop was hosted by SANSA (South African National Space Agency) at their offices in Hermanus (South-Africa).

As member of the PECASUS consortium, the STCE is in charge of issuing the Space Weather Advisories for ICAO, but has also an active role in the End User Engagement and Exercice task group.

During this workshop, Yana Maneva (Royal Observatory of Belgium/STCE) guided the participating end-users through an interactive Space Weather Exercice. The scenario of this exercice was based the space weather event of the 18-22 Jan 2026. Going step by step through the space weather event, highlighting

step by step the associated impacts on aviation, and showing the associated advisories, the end-users were asked about how they react to these advisories and how the service could be even improved to be even more actionable for the end-users.
These kind of end-user workshops are key to tailor even further the service to the needs of the end-users, and was a great opportunity to engage more with the African aviation sector.

Will be continued!

3. Review of Solar and Geomagnetic Activity

WEEK 1330 from 2026 Jun 22

Solar Active Regions (ARs) and flares

Solar flaring activity was low throughout the week. There were a total number of 10 active regions observed on the visible solar disk over the week. A total of 36 C-class flares (no M-class, no X-class) were observed.
The strongest flares was the C9.5 flare peaking on 2026-06-28 20:59 from SIDC Sunspot group 899 (NOAA AR 4475). SIDC SG 899 and 886 were the most active Active Regions over the paset week and produced the majority of the C-class flares this week.

Coronal mass ejections

During the past week, there was one CME (Coronal Mass Ejection) with an Earth directed component, seen in LASCO-C2 data on June 26 at 21:15 UTC. This CME originated from S10W10 and was mainly directed to the south.

Coronal Holes

Three negative polarity coronal holes crossed the central meridian between June 22 and June 24.

Proton flux levels

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

Electron fluxes at GEO

The greater than 2 MeV electron flux crossed the 1000 pfu threshold on June 26 and stayed above since then. The 24h electron fluence increased to
moderate levels since June 26.

Solar wind

At the start of the week the solar wind at Earth was slow. Between June 24
and June 26, the solar wind was fast (around 750 km/s) and the
interplanetary magnetic field was around 12nT, with the Bz reaching a
minimum value of -6 nT.

Geomagnetism

Geomagnetic conditions became active with a isolated period of minor storm following the high speed stream arrival of the coronal hole on June 24 and 25, but have returned again to quiet conditions since.

4. PROBA2 Observations

Solar Activity

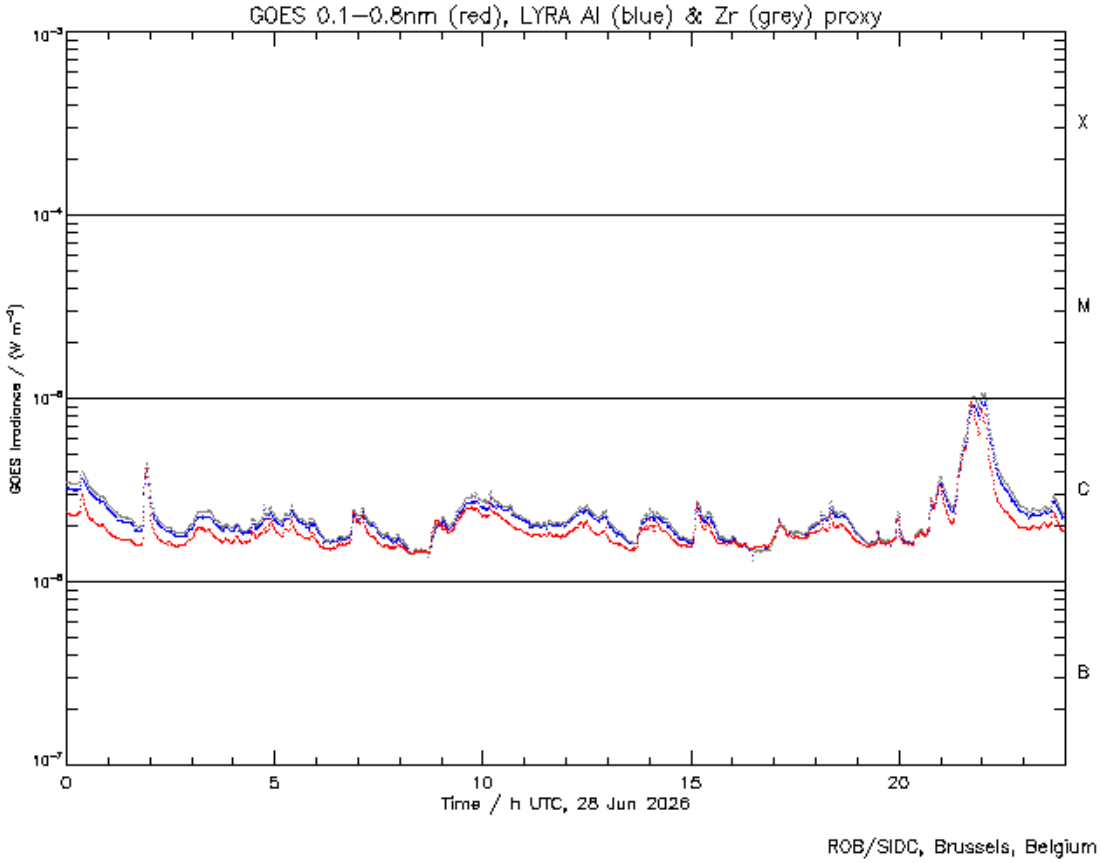
Solar flare activity was low during the week.
In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: https://proba2.oma.be/ssa

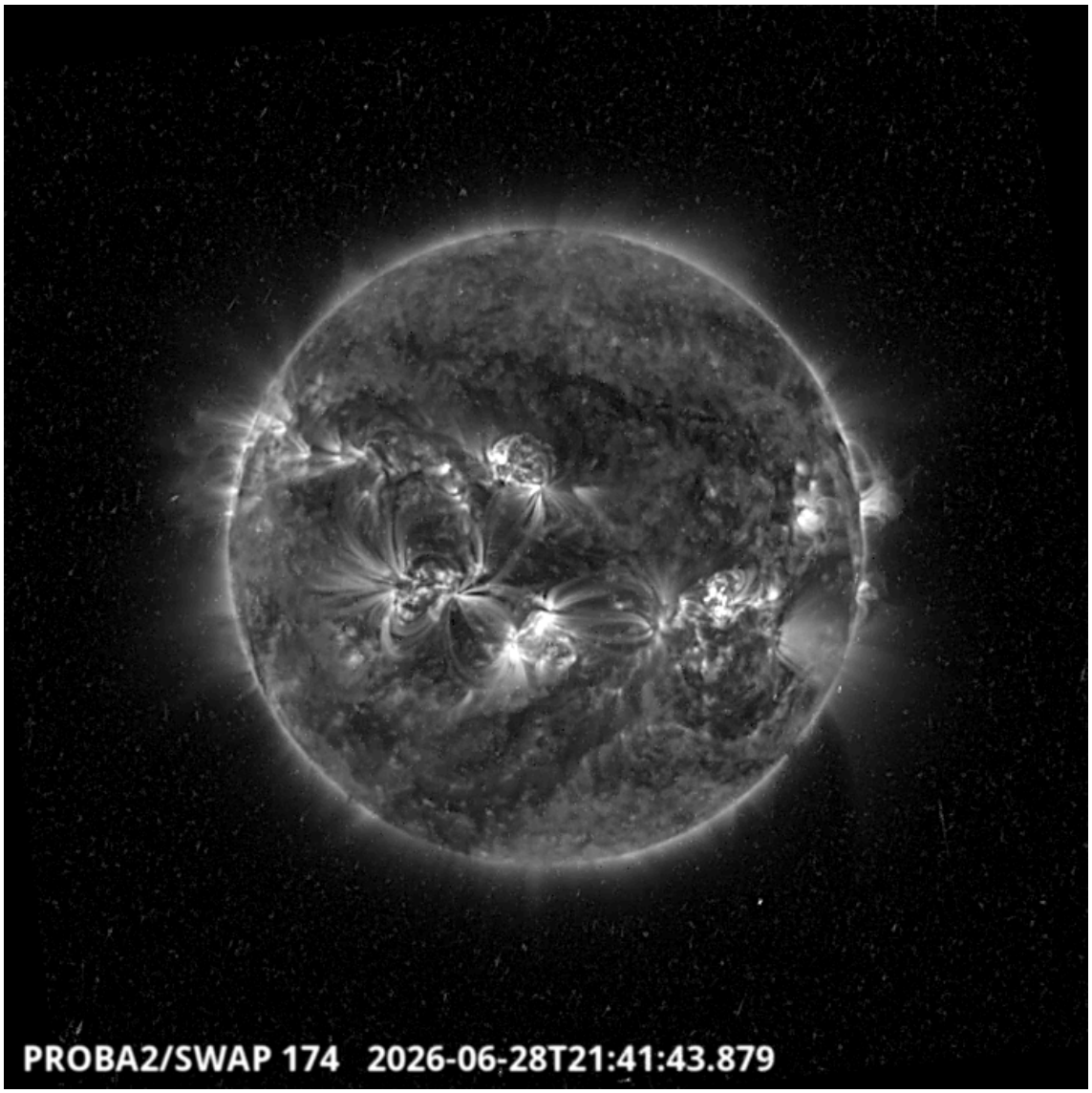
This page also lists the recorded flaring events.

A weekly overview movie can be found here (SWAP week 848). https://proba2.sidc.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2026_06_22.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.sidc.be/swap/data/mpg/movies/

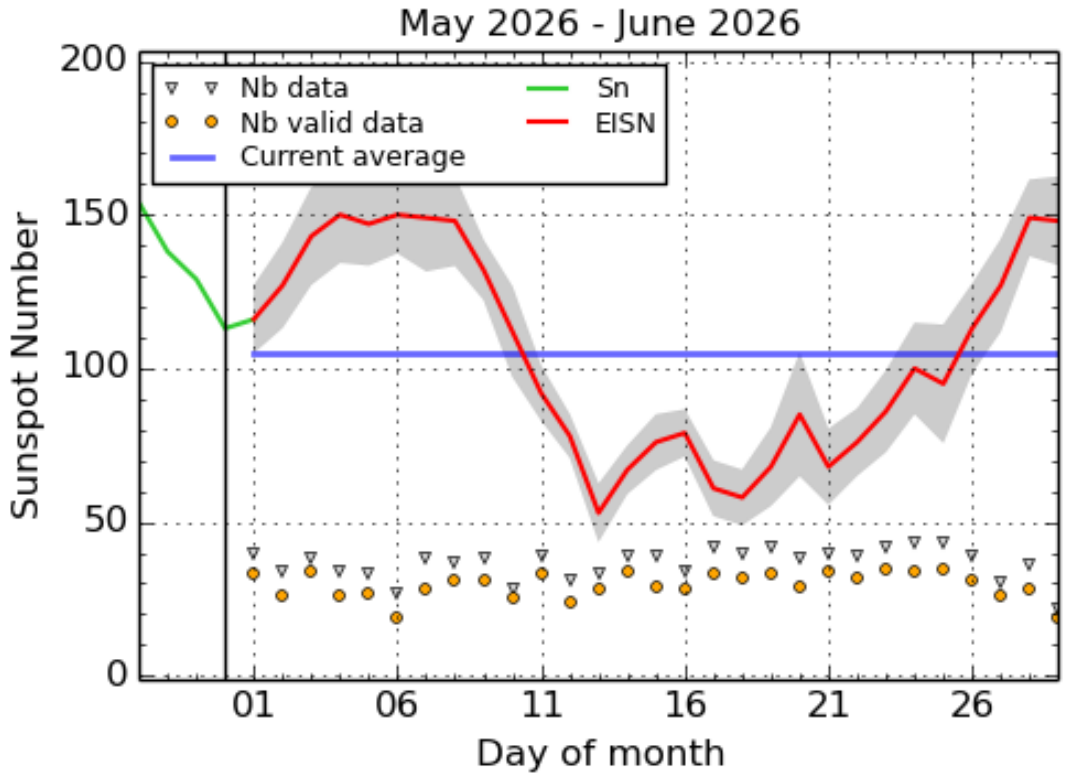
Sunday Jun 28





The largest flare of this week was a C9.5, and it was observed by LYRA (top panel) and SWAP (bottom panel). The flare peaked on 2026-Jun-28 at 21:44 UT and occurred in the South West part of the solar disk, originating from active region NOAA4475 (SIDC 899). Find a SWAP movie of the event here https://proba2.sidc.be/swap/movies/20260628_swap_movie.mp4

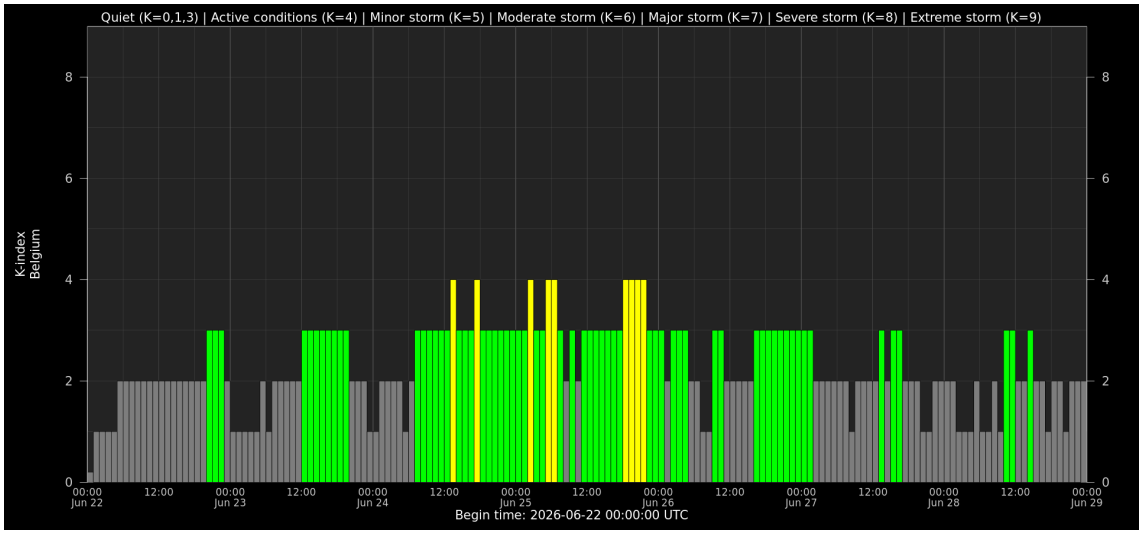
5. International Sunspot Number by SILSO



SILSO graphics (http://sidc.be/silso) Royal Observatory of Belgium, 2026 June 29

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.

6. Geomagnetic Observations in Belgium

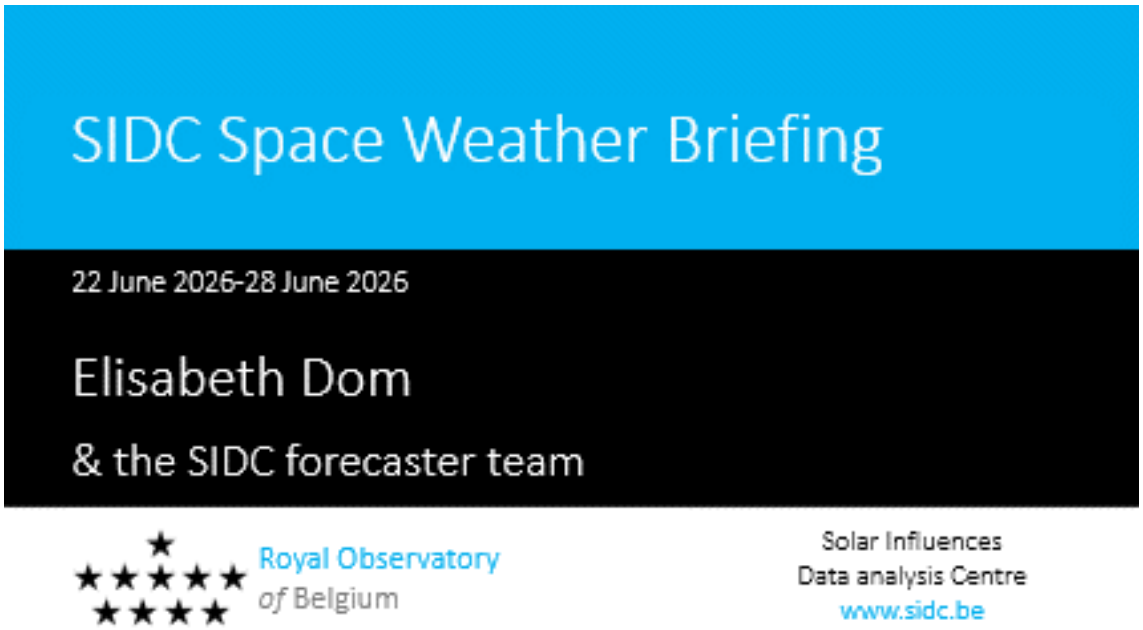


Local K-type magnetic activity index for Belgium based on data from Dourbes (DOU) and Manhay (MAB). Comparing the data from both measurement stations allows to reliably remove outliers from the magnetic data. At the same time the operational service availability is improved: whenever data from one observatory 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. SIDC Space Weather Briefing

The forecaster on duty presented the SIDC briefing that gives an overview of space weather from 22 to 28 June 2026.

The pdf of the presentation: https://www.stce.be/briefings/20260629_SWbriefing.pdf



8. 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.

* 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 4, 2026, STCE seminar: Magnetosphere-Ionosphere Coupling in the Auroral Zones of Earth and Jupiter, Brussels, Belgium
* 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

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