STCE Newsletter

30 Mar 2026 - 5 Apr 2026

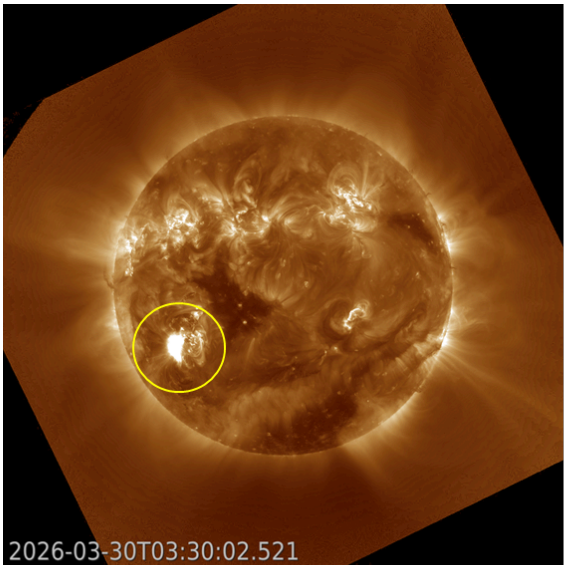
Published by the STCE - this issue : 10 Apr 2026. Available online at https://www.stce.be/newsletter/ .

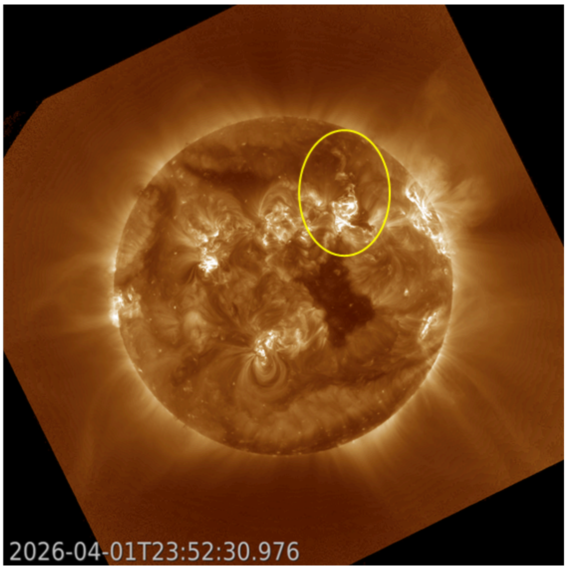
The Solar-Terrestrial Centre of Excellence (STCE) is a collaborative network of the Belgian Institute for Space Aeronomy, the Royal Observatory of Belgium and the Royal Meteorological Institute of Belgium.

Final Editor : Petra Vanlommel
Contact : R. Van der Linden, General Coordinator STCE, Ringlaan - 3 - Avenue Circulaire, 1180 Brussels, Belgium

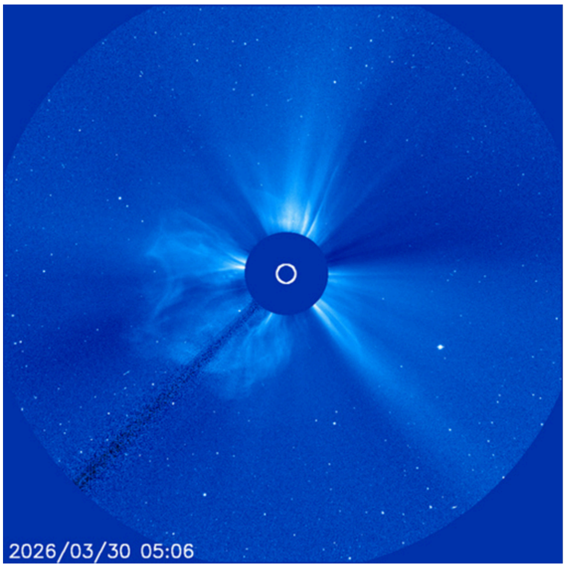
1. A wimp and a bully

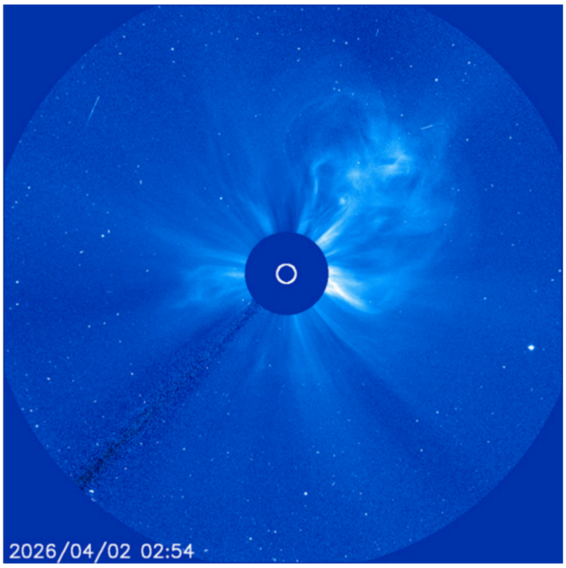
Last week, the Sun launched 2 coronal mass ejections (CMEs, i.e. magnetic clouds filled with charged particles) towards the Earth. The first CME was associated with a strong X1.4 flare that peaked at 03:19 UTC on 30 March. It was produced by active region NOAA 4405 (SIDC Sunspot Group 836 - https://www.sidc.be/services/event-chains/sunspots) - as discussed in this STCE newsitem at https://www.stce.be/news/811/welcome.html The eruption is shown in the extreme ultraviolet (EUV) images by GOES/SUVI 195 underneath left.
The other CME was related to a filament eruption late on 1 April which was associated with a C-class flare. Solar filaments are clouds of charged particles ("plasma") above the solar surface squeezed between magnetic regions of opposite polarity. Being cooler and denser than the plasma underneath and their surroundings, they appear as dark lines when seen on the solar disk. The eruption of the filament is shown in the imagery to the right. Note that NOAA 4405 and the filament were located respectively 30 degrees east and 30 degrees west of the central meridian, i.e. the Sun's north-south line.
The darkish structure near the disk's centre is a small, well-defined coronal hole, i.e. a hole in the solar atmosphere through which particles can freely escape along the open magnetic field lines into space. The magnetic field of the associated high speed stream (HSS) had a negative polarity, i.e. its magnetic field lines were oriented towards the Sun. Clips of the two eruptive events can be found in the online version of this newsitem at https://www.stce.be/news/813/welcome.html





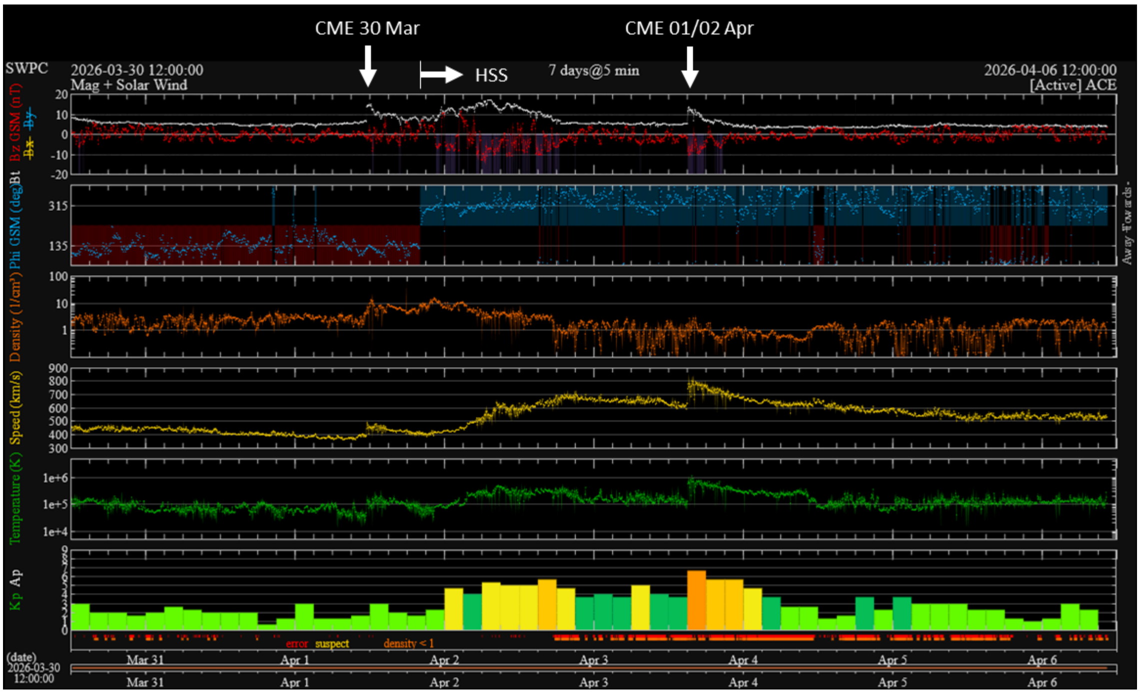
The associated CMEs are shown in the coronagraphic imagery underneath (SOHO/LASCO C3). Both are halo CMEs, meaning one can trace the faint outlines of the CME's shock all around the Sun, which is hidden behind the coronagraph's occulting disk. At the same time, it is clear that in both cases the bulk of the CME is directed away from the Sun-Earth line: the core of the first CME is directed to the southeast ("lower left"), whereas the core of the second CME is directed to the north-northwest ("upper right"). Nonetheless, most forecast centres settled for a 70-90% chance of arrival of these CMEs, and that the speed of the first CME was higher than that of the second CME, respectively about 1500 km/s and 1000 km/s.





Based on these parameters, the forecast centres expected an arrival time for the first CME on 31 March around 16:30UTC, and a moderate to severe geomagnetic storm (Kp ranging between 6 and 8 - see the STCE SWx Classification page at https://www.stce.be/educational/classification#geomag). For the second CME, an arrival time on 4 April around 02:00UTC was expected, with active to moderate storming geomagnetic conditions (Kp ranging between 4 an 6) anticipated (CCMC - https://kauai.ccmc.gsfc.nasa.gov/CMEscoreboard/).

The accuracy of these forecasts was mixed. Both CMEs did arrive, with in each case the passage of a shock observed in the solar wind parameters, as shown by the white (magnetic field strength) and yellow (speed) curve in the annotated chart underneath (ACE). This confirms that the bulk of both CMEs was indeed directed away from Earth. Less well predicted were the arrival time of the CMEs and the strength of the ensuing geomagnetic storm. In the first case, the relatively small shock arrived only on 1 April at 11:30UTC, that's 19 hours later than predicted and well outside the typical uncertainty margins for these forecasts. There's no smoking gun to explain this difference. As a result, there was no geomagnetic storm, and only unsettled conditions (Kp = 3 ; bar chart at the bottom) were recorded. The second CME arrived already on 3 April at 15:00UTC, about 11 hours earlier than expected. The associated disturbance of the Earth's magnetic field resulted in a strong (Kp = 7-) geomagnetic storm. So the predictions did a better job in this case, but still.



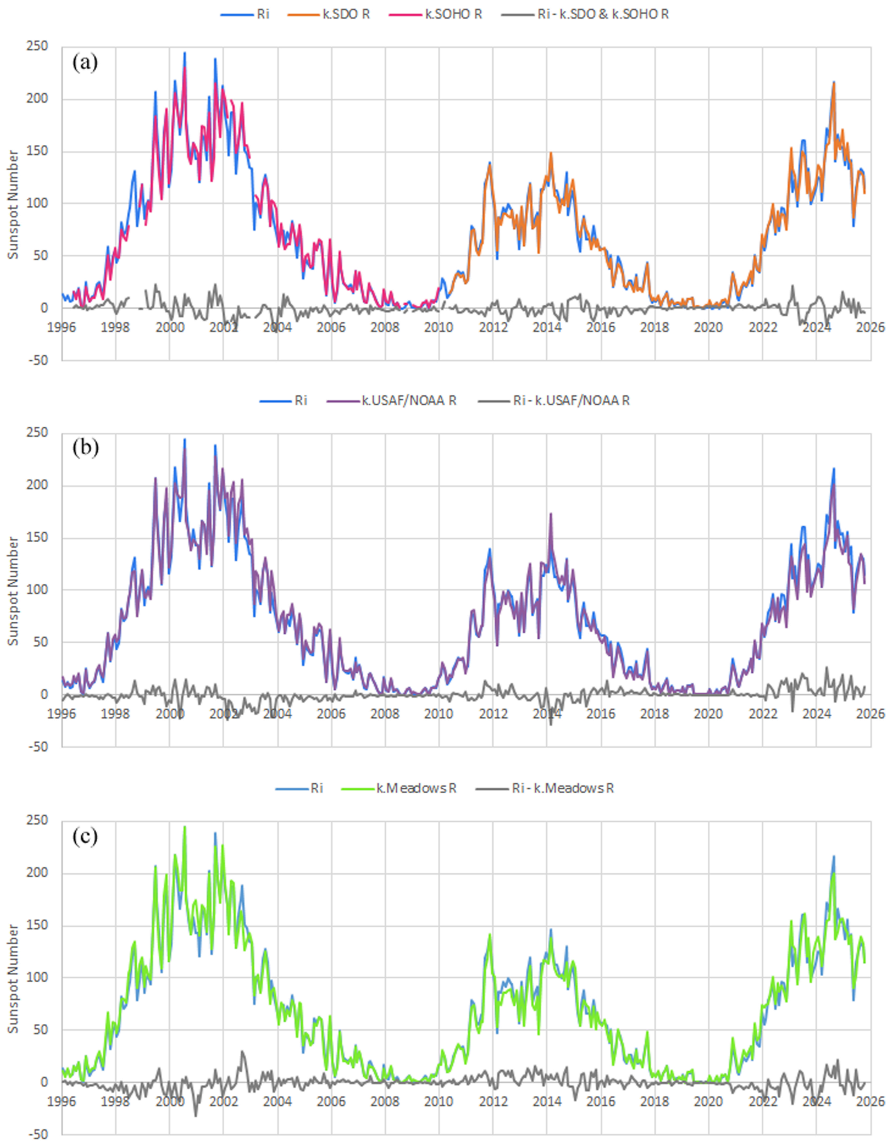
The chart above also shows the arrival of the high speed stream associated with that equatorial coronal hole mentioned before, late on 1 April. Solar wind speed reached 700 km/s a day later, and was still above 500 km/s by the end of the Easter weekend. The geomagnetic field responded with a moderate geomagnetic storm (Kp = 6-) on 2 April. The resulting aurora were actually photographed from space. NASA astronaut and Artemis II Commander Reid Wiseman took the picture (https://www.nasa.gov/image-detail/fd02_for-pao/) of Earth underneath from the Orion spacecraft's window on 2 April. The aurora can be seen as a thin green sliver near the top and bottom of the Earth's disk. Note that the Earth is "flipped" in this image, with the northern polar light at the bottom and the southern polar light at the top. Africa is the brownish land mass to the lower left. An annotated image is provided by astronomer Dennis Mamanna (Facebook - https://www.facebook.com/photo/?fbid=1535636108564613).

2. The International Sunspot Number revisited

An interesting paper has been published end 2025: 'An independent assessment of the International Sunspot Number since 1996' by Peter Meadows.
Peter is an observer of the SILSO network. SILSO is the World Data Centre for the International Sunspot Number and takes care of the production, validation, distribution and preservation of this index of solar activity. This index goes back to early 1600!

Laure Lefevre, Director of the WDC-SILSO: 'This is actually a great paper written by one of our own observers supporting our evidence.'

Figure 1 (from the paper) shows the comparison between the International Sunspot Number and different solar indices.



Monthly International Sunspot Number Ri compared with (a) SOHO/MDI and SDO/HMI image derived sunspot number, (b) USAF/NOAA SRS sunspot number and (c) the author's own sunspot number. Differences are also shown.

The findings of this paper (cf. Figure 1) "support the overall consistency and reliability of the International Sunspot Number. They also highlight the value of space-based white-light observations for sunspot number derivation, as they are unaffected by atmospheric seeing and provide a stable reference for long-term solar activity monitoring. Independent cross-checks of this kind remain vital for maintaining confidence in the datasets that underpin solar-terrestrial and space-weather research."

Laure Lefevre: 'The independent cross-checks are indeed what we should focus on. Space-based observations to derive the Sunspot Number have been tested: they give similar results but different - as any proxy does - and the differences need to be characterized. So they are interesting for comparison.'

From this it is clear that space-based data should not replace ground based data into the computation of the International Sunspot Number just yet. Not until we have had the time to fully characterize the relationship between the two.

Laure Lefevre continues: 'In the SILSO network, we mainly gather information from projection methods, drawings or eye-based observations. CCD observations are not commonly used so as to keep the homogeneity of this historical series. This paper is a good introduction for what is to come, since we are preparing a systematic study assessing the stability of SN since the recalibration in 2015.'

The paper: https://iopscience.iop.org/article/10.3847/2515-5172/ae1cbb

3. PROBA2 Observations

Solar Activity

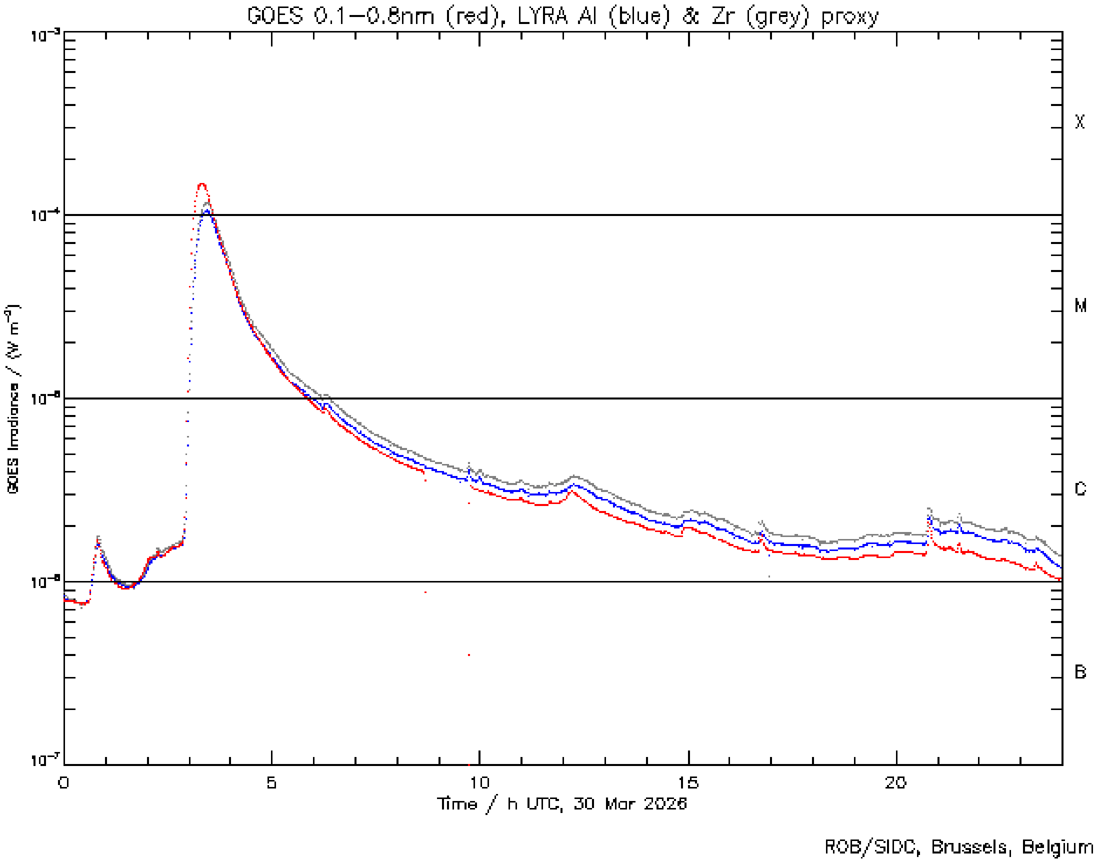
Solar flare activity fluctuated from low to high during the week.
In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: https://proba2.oma.be/ssa
This page also lists the recorded flaring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

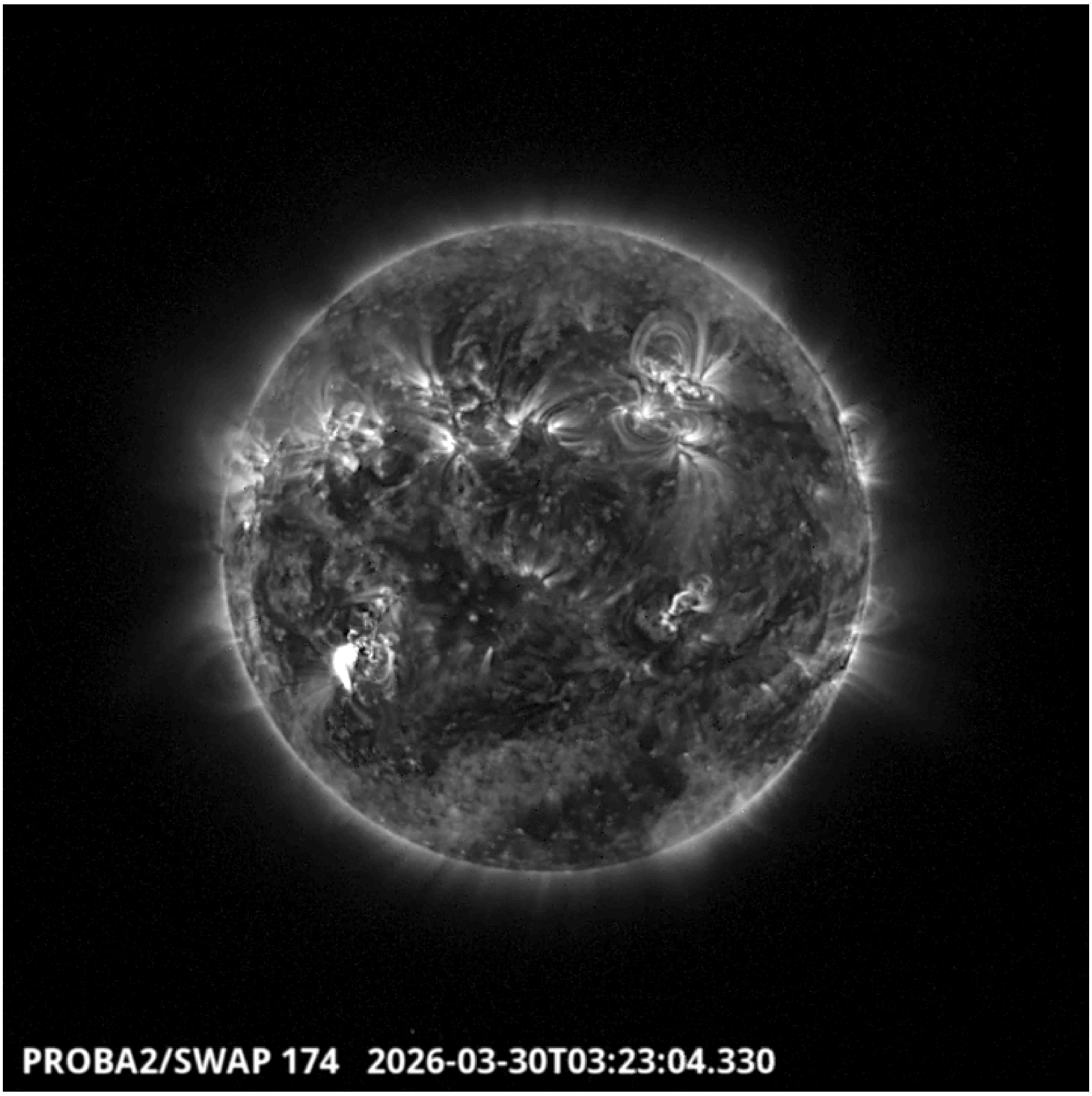
A weekly overview movie (SWAP week 836) can be found here: https://proba2.sidc.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2026_03_30.mp4.

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/.

Monday March 30





The largest flare of this week was an X1.4, and it was observed by LYRA (top panel) and SWAP (bottom panel). The flare peaked on 2026-Mar-30 at 03:19 UT and occurred in the south-eastern quadrant of the Sun, originating from active region NOAA4405.
Find a SWAP movie of the event here: https://proba2.sidc.be/swap/movies/20260330_swap_movie.mp4.

4. Review of space weather

Solar Active Regions (ARs) and flares

Solar flaring activity was high to moderate over the past week, with a clear decreasing trend toward the end of the period.
An X1.4 flare (SIDC Flare 7290) on 30 March from SIDC Sunspot Group 836 (NOAA Active Region 4405) marked the highest activity level and was associated with a fast coronal mass ejection (SIDC CME 644). In the following days, activity remained moderate, with several M-class flares observed. The most significant events were an M3.5 flare (SIDC Flare 7316) on 02 April from SIDC Sunspot Group 835 (NOAA Active Region 4404), and an M7.5 flare (SIDC Flare 7328) on 04 April from SIDC Sunspot Group 838 (NOAA Active Region 4409).

SIDC Sunspot Group 838 (NOAA Active Region 4409) became the dominant active region throughout the week. It evolved from a Beta-Gamma to a more complex Beta-Gamma-Delta magnetic configuration and was the main source of sustained C-class and M-class flaring activity. Toward the end of the period, this region showed signs of gradual decay, although it remained the most active region on the disk. Other regions, including SIDC Sunspot Group 835 (NOAA Active Region 4404), contributed to flaring earlier in the week but decayed thereafter. Most remaining sunspot groups exhibited simple Alpha or Beta configurations and were stable or in decay. The total number of sunspot groups ranged between 7 and 10 over the week.

Coronal mass ejections (CME)

A fast full halo CME (SIDC CME 644) was observed in SOHO/LASCO-C2 on 30 March at 03:24 UTC, associated with an X1.4 flare (SIDC Flare 7290) from SIDC Sunspot Group 836 (NOAA Active Region 4405). The event was accompanied by a Type II radio emission, indicating a coronal shock with an estimated speed of about 1870 km/s. CACTus reported a projected speed of about 1020 km/s and a full halo signature. Further analysis indicated a propagation speed of about 1800-1850 km/s, direction around S15E30, and an angular width of about 45 degrees. The CME was assessed as Earth-directed, with an estimated arrival time of 25-35 hours. A shock and Interplanetary CME (SIDC CME 645) was detected at Earth on 03 April around 15:05 UTC, leading to a geomagnetic storm.

Another CME (SIDC CME 645), associated with a filament eruption on 01 April around 23:00 UTC near N28W25, propagated mainly northwest. Despite this, the wide shock extent allowed its arrival at Earth, with a shock was detected at Earth on 03 April around 15:05 UTC.

The CME of 02 April, associated with an M3.5 flare (SIDC Flare 7316) from SIDC Sunspot Group 835 (NOAA Active Region 4404), was narrow and directed northwest and was not considered Earth-directed.

Coronal Holes

The most dominant coronal hole was SIDC Coronal Hole 149, an equatorial one with negative polarity, which crossed the central meridian on 30 March and remained well-developed while rotating across the western solar disk. Its associated high-speed solar wind stream had a significant and prolonged influence on Earth throughout the week.
SIDC Coronal Hole 142, a mid- to high-latitude coronal hole with negative polarity, rotated onto the visible disk early in the week, crossed the central meridian on 03 April, and subsequently moved to the western side of the Sun

Proton flux levels

The greater than 10 MeV proton flux remained below the event threshold (10 pfu) over the past week. A gradual enhancement was observed early in the period, with values increasing to elevated but sub-threshold levels. STEREO-A observed a likely far-sided solar source. Following this enhancement, proton fluxes showed a steady declining trend, returning toward near-background levels by the end of the week.
Higher energy channels (greater than 100 MeV and greater than 500 MeV) remained at background levels throughout, and no solar energetic particle (SEP) event was detected.

Electron fluxes at GEO

The greater than 2 MeV electron flux showed significant variability over the past week. Fluxes decreased to low levels early in the period due to geomagnetic storm-related magnetospheric depletion, followed by a gradual recovery. Subsequently, electron fluxes increased to moderate and high levels under the influence of the high-speed solar wind stream associated with SIDC Coronal Hole 149. Temporary dropouts were observed, but overall fluxes remained elevated toward the end of the week. The 24-hour fluence reached moderate to high levels.

Solar wind

Solar wind went from slow to strongly disturbed and then gradually declined. The disturbed part was driven by two successive interplanetary shocks and their interaction with a high-speed solar wind stream (HSS). An initial solar wind shock was observed at Earth on 01 April around 11:30 UTC, associated with the arrival of the ICME (SIDC CME 644) linked to the X1.4 flare on 30 March. Solar wind increased from about 370 km/s to approximately 510 km/s, while the total interplanetary magnetic field (IMF) (Bt) increased from about 6-7 nT to around 16 nT. The Bz component was variable with intervals of southward orientation.

This was followed by the onset and strengthening of a high-speed solar wind stream from SIDC Coronal Hole 149, with solar wind speeds increasing further to 600-660 km/s and sustained periods of southward Bz.

A second, stronger solar wind shock was detected at Earth on 03 April around 15:05 UTC, associated with the arrival of a subsequent ICME (SIDC CME 645), likely linked to a filament eruption on 01 April. Solar wind speed increased abruptly from about 600 km/s to approximately 850 km/s. The IMF was enhanced, with Bt increasing from about 5 nT to around 14 nT, and Bz showed sustained southward values down to about -11 nT. Following the second shock, solar wind parameters remained strongly enhanced before gradually declining toward moderately elevated levels by the end of the week, with speeds decreasing to about 500-550 km/s and weaker IMF conditions.

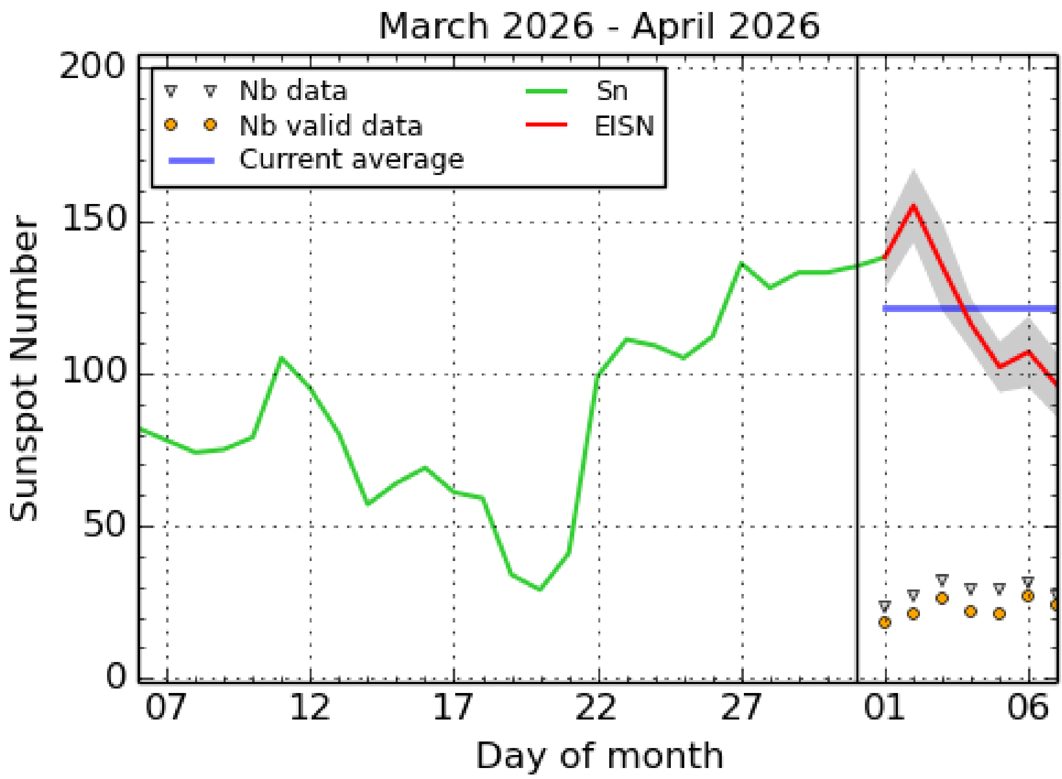
Geomagnetism

Geomagnetic conditions over the past week ranged from quiet to major storm levels. Early in the period, conditions were quiet to unsettled.

Following the arrival of the ICME (SIDC CME 644) on 01 April, geomagnetic activity increased to active and minor storm levels (Kp up to 5-6), supported by enhanced solar wind conditions and periods of southward IMF.

On 03 April, the arrival of a second ICME (SIDC CME 645), combined with ongoing high-speed solar wind stream influence from SIDC Coronal Hole 149 and sustained southward Bz, led to a major geomagnetic storm. The global NOAA Kp index reached up to 7, while the local K index (Belgium) reached up to 6. Following the main phase, geomagnetic activity gradually decreased to unsettled, with occasional active intervals driven by residual high-speed stream influence and variable IMF conditions.

5. International Sunspot Number by SILSO



SILSO graphics (http://sidc.be/silso) Royal Observatory of Belgium, 2026 April 7

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. Noticeable Solar Events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
30	0247	0319	0344		X1.4			II/2	68	4405
02	1723	1815	1834	N12W16	M3.5	2B		VI/2III/2	67	4404
03	0745	0756	0758		M1.3				73	4409
03	1246	1250	1252		M1.3					
04	0107	0117	0123		M7.5				73	4409
04	0738	0758	0814	N2W7	M1.7	SF			73	4409
04	1158	1211	1222	N2W9	M1.2	1F			73	4409
04	2254	2304	2314		M1.0				73	4409

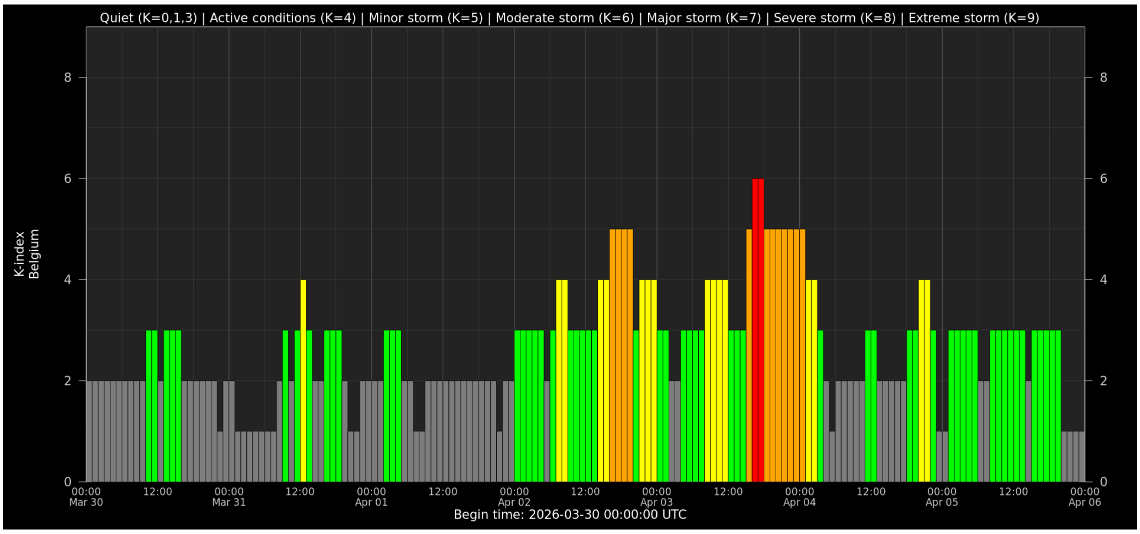
LOC: approximate heliographic location
XRAY: X-ray flare class

TYPE: radio burst type
Cat: Catania sunspot group number

OP: optical flare class
10CM: peak 10 cm radio flux

NOAA: NOAA active region number

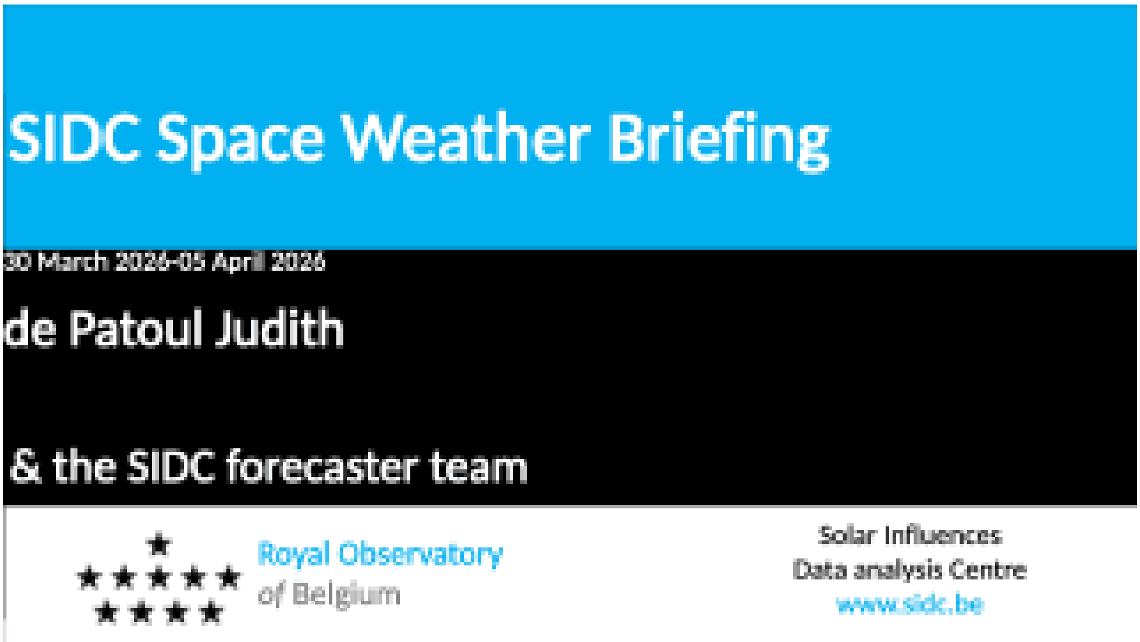
7. Geomagnetic Observations in Belgium



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 to .
The pdf of the presentation: https://www.stce.be/briefings/20260406_SWbriefing.pdf



9. Training courses and conferences

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.

* Apr 20-21, 2026, STCE cursus: inleiding tot het ruimteweer, voor leden van volkssterrenwachten, Brussels, Belgium - register: https://events.spacepole.be/event/260/
* 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/ - Reserved
* 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

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