

STCE Newsletter

6 Oct 2025 - 12 Oct 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.

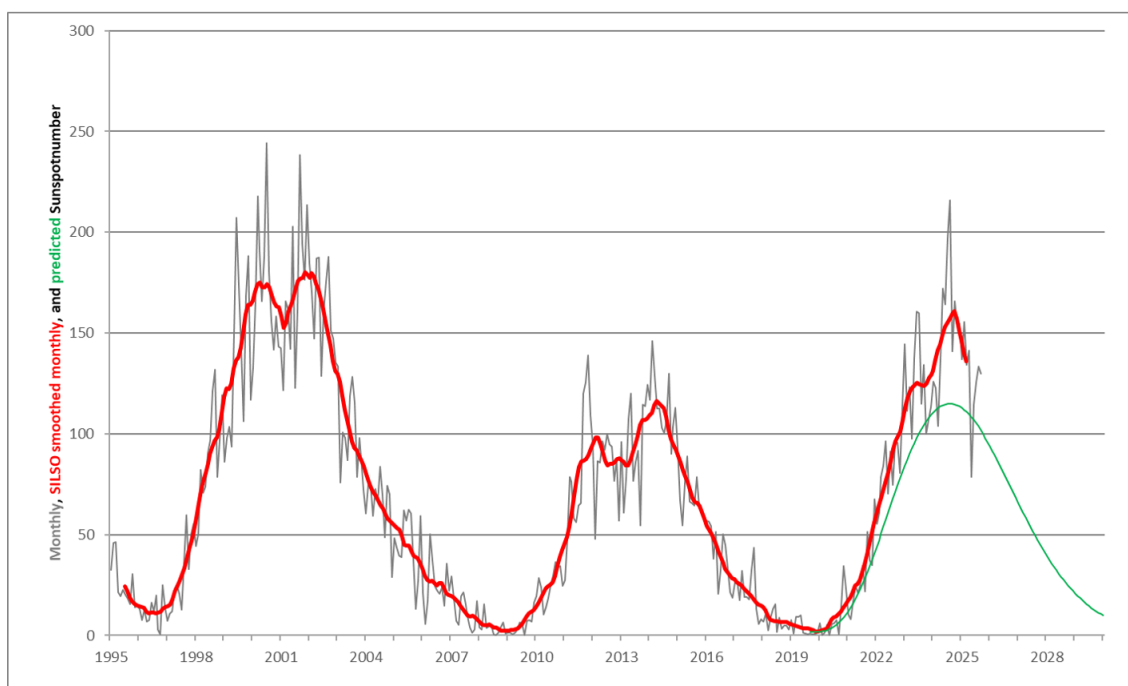
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1. Progress of SC25

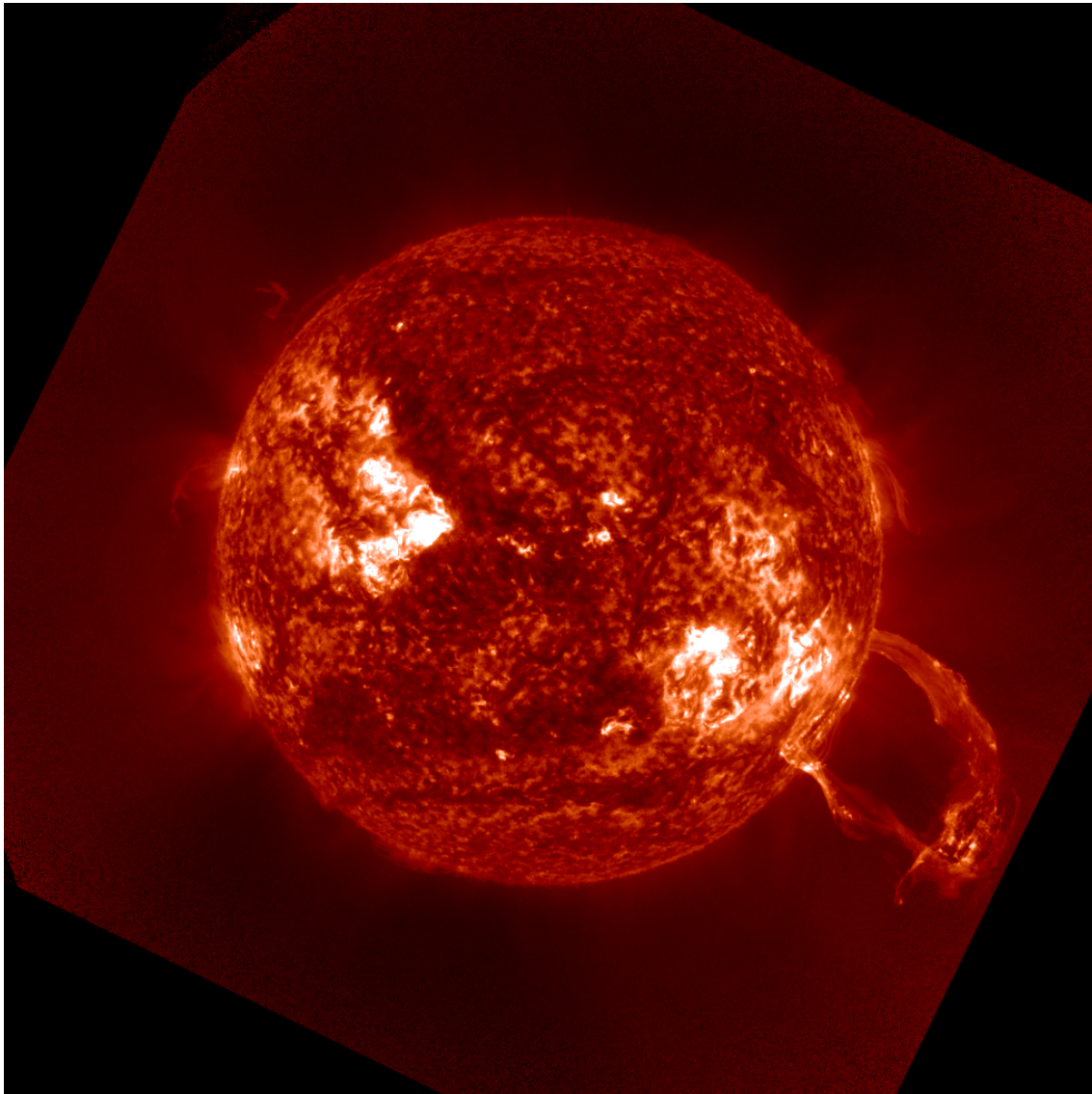
The STCE's SC25 Tracking page (<https://www.stce.be/content/sc25-tracking>) has been updated to reflect the latest evolution of some critical space weather parameters for the ongoing solar cycle 25 (SC25). It covers various aspects of space weather, from sunspot numbers over geomagnetic indices all the way to cosmic rays. The multiple graphs allow for a comparison with previous solar cycles at similar stages in their evolution.

The graph below shows the monthly and SILSO smoothed monthly sunspot number (SIDC/SILSO - <https://www.sidc.be/SILSO/home>) from around the start of SC23 up to the current SC25. The prediction for the ongoing solar cycle 25, which started in December 2019, is displayed in green. Following high solar activity in 2023 and 2024, the smoothed monthly sunspot number reached a maximum of 160.9 in October 2024. As a result, SC25 maximum is well above the initial prediction by the SC25 Panel (115), but also well below the moderately strong SC23 (180.3). Since its maximum late 2024, the overall solar activity has been gradually declining. Over the last 4 months, i.e. from June till September 2025, only 2 X-class solar flares and 1 severe geomagnetic storm have been recorded. Nonetheless, it is virtually certain that over the next 2-3 years there will still be some episodes with very enhanced solar and geomagnetic activity.



Following the high activity last year, many other parameters such as the 10.7cm radio flux and the number of proton events are now showing a declining trend. In contrast, some other parameters are exhibiting an overall increase. An example is the ramp-up of the greater than 2 MeV electron fluence following the increased number of coronal holes and their associated high-speed wind streams. Another example is the number of solar filaments and prominences, which remains at a high level. The year 2025 actually has seen some spectacular prominence eruptions so far. Solar prominences are clouds of charged particles ("plasma") above the solar surface squeezed between magnetic regions of opposite magnetic polarity. Being cooler and denser than the plasma underneath and their surroundings, they appear as bright blobs when seen near the solar limb and as dark lines when seen on the solar disk (then they are called "filaments"). The larger (longer) these features, the more likely they will erupt. Special filters are required to observe them, such as in the Hydrogen-alpha (H-alpha) line in the red part of the solar spectrum, or in some extreme ultraviolet (EUV) passbands. The

imagery underneath shows a recent prominence eruption from 30 September, taken by the GOES/SUVI instrument (<https://www.swpc.noaa.gov/products/goes-solar-ultraviolet-imager-suvi>). The associated coronal mass ejection was not directed to Earth.



2. Review of Solar and Geomagnetic Activity

WEEK 1293 from 2025 Oct 06

Solar Active Regions (ARs) and flares

Solar flaring activity was mostly low during the week, with the only exception being SIDC flare 5702, an M2.0 that peaked on 9 Oct at 12:31 UTC. 45 C-class flares were registered over the same period with two C9 flares being by far the brightest (the rest of the flares were below C6). Those two flares were SIDC flare 5691 (peaked on 7 Oct at 20:07 UTC) and SIDC flare 5721 (peaked on 12 Oct at 13:50 UTC).

The M2.0 flare, one of the C9, and 16 other C-class flares are associated with SIDC Sunspot Group 639 (NOAA Active Region [AR] 4246, Beta magnetic configuration), while the other C9 flare was emitted by SIDC Sunspot Groups 657 (NOAA AR 4236, Beta-Gamma magnetic configuration).

Coronal mass ejections

SIDC Coronal Mass Ejection (CME) 578, was launched on 7 Oct at 10:36 UTC and originated from SIDC sunspot group 665 (NOAA Active Region 4244, Alpha magnetic configuration). It delivered a glancing blow on 11 Oct.

Coronal Holes

SIDC Coronal Hole (CH) 116, an equatorial coronal hole with a negative polarity, first reached the central meridian on October 08. An associated High Speed Stream (HSS) arrived on Earth on 11 Oct.

Proton flux levels

The greater than 10 MeV proton flux was at nominal levels during the week.

Electron fluxes at GEO

The greater than 2 MeV electron flux, as measured by GOES 19, was above the 1000 pfu alert threshold from the start of the week until the end of 7 Oct and had a peak value of 24000 pfu. For the rest of the week it fluctuated around the alert level with the highest peak at 16000 pfu.

The 24-hour electron fluence was at high levels on 6 Oct but dropped to moderate levels the next day. It remained at these levels for the rest of the week.

Solar wind

The week started with the Solar Wind (SW) featuring a fast SW regime that only lasted a few more hours. The SW conditions remained at a slow SW regime until the arrival of a glancing blow, associated with SIDC CME 577, at the early hours of 9 Oct. The blow lasted for approximately half a day and another glancing blow, associated with SIDC CME 578, arrived at the early hours of 11 Oct. This second blow lasted until the noon of 12 Oct and partially coincided with the arrival (at the late hours of 11 Oct) of the HSS associated with SIDC CH 116.

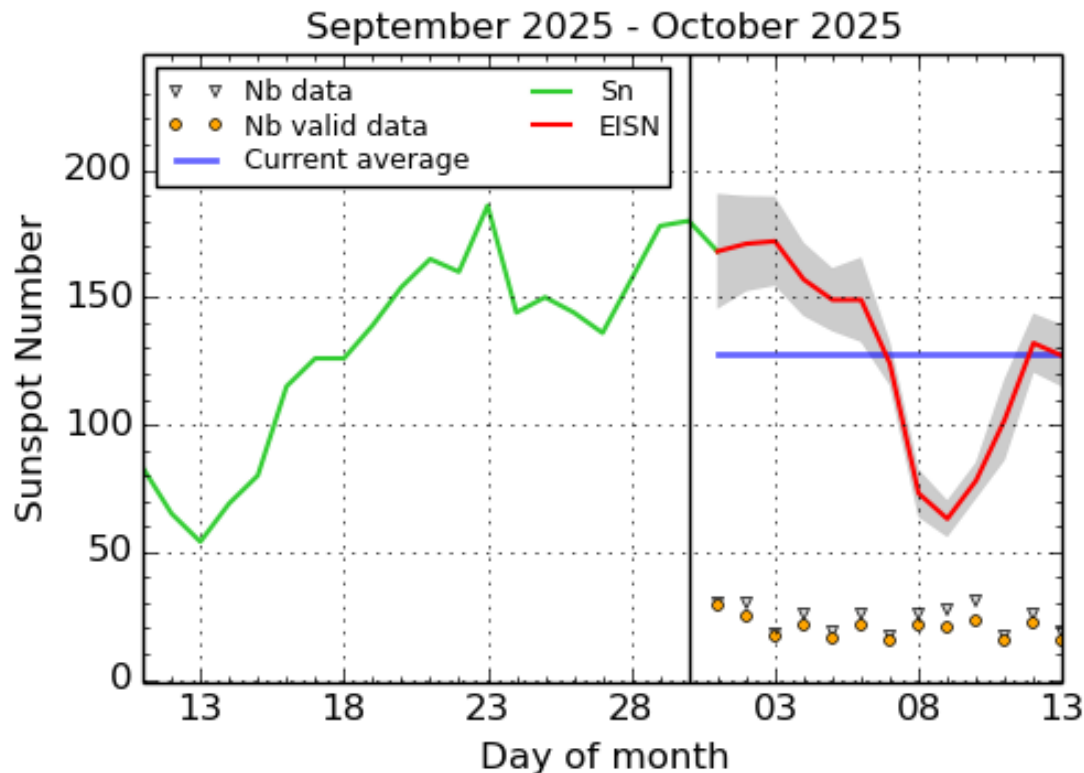
While in the slow SW regime, the SW speed ranged between 270 and 480 km/s, while the HSS arrival increased the SW speed to 800 km/s. The interplanetary magnetic field (B) ranged between 2 and 12 nT when in slow SW conditions, and raised to 15 and 17 nT during the two glancing blows. The North-South component of the interplanetary magnetic field (Bz) fluctuated between -8 and 11 nT during the slow SW periods, between -6 and 13 nT during the first glancing blow, and between -10 and 10 nT during the second.

Geomagnetism

The global geomagnetic conditions reached minor storm levels on 11 Oct between 06:00 and 09:00 UTC (NOAA Kp 5-) and on 12 Oct between 18:00 and 21:00 UTC (NOAA Kp 5+). These short-lived storms were the results of a glancing blow from a CME that arrived on 11 Oct and a HSS that arrived on 12 Oct. For the rest of the week the global geomagnetic conditions varied between quiet and active levels (NOAA Kp 1- to 4+).

The local geomagnetic conditions were less variable and ranged between quiet and active levels (K BEL 2-4).

3. International Sunspot Number by SILSO



SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium, 2025 October 13

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.

4. PROBA2 Observations

Solar Activity

Solar flare activity fluctuated from low to moderate 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 here: <https://proba2.oma.be/ssa>

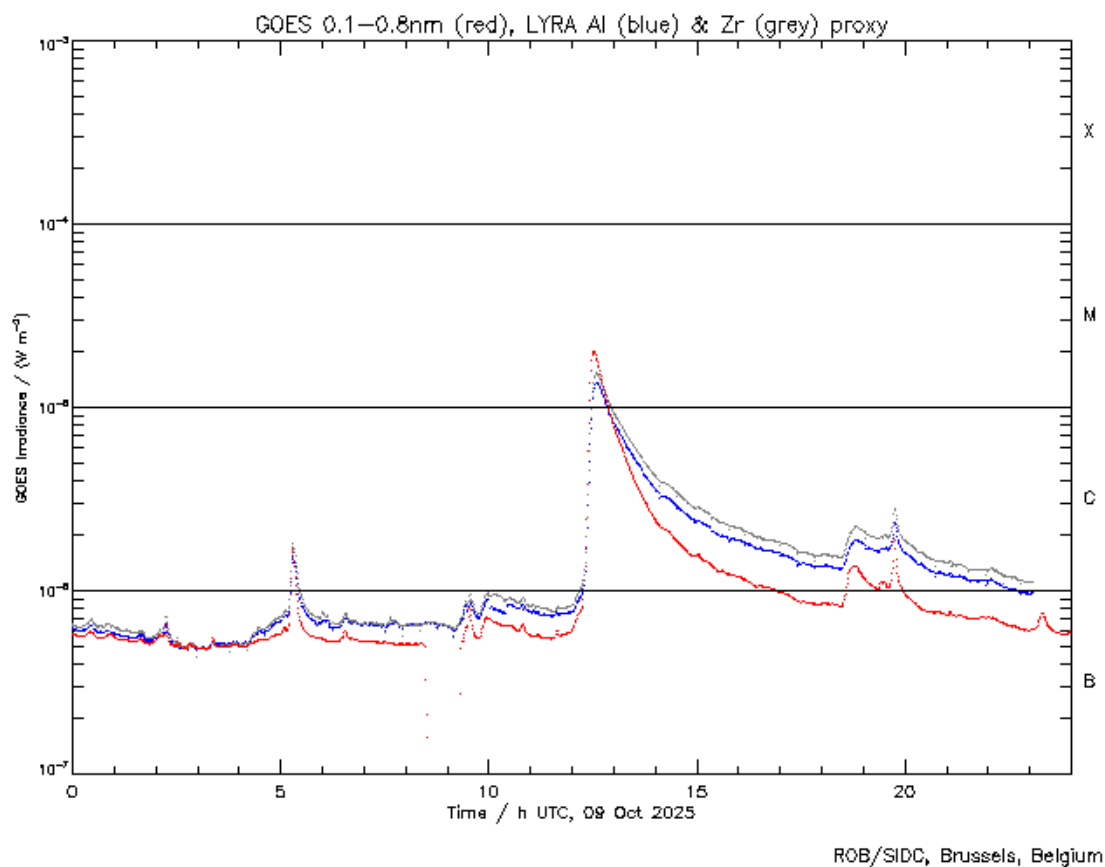
This page also lists the recorded flaring events.

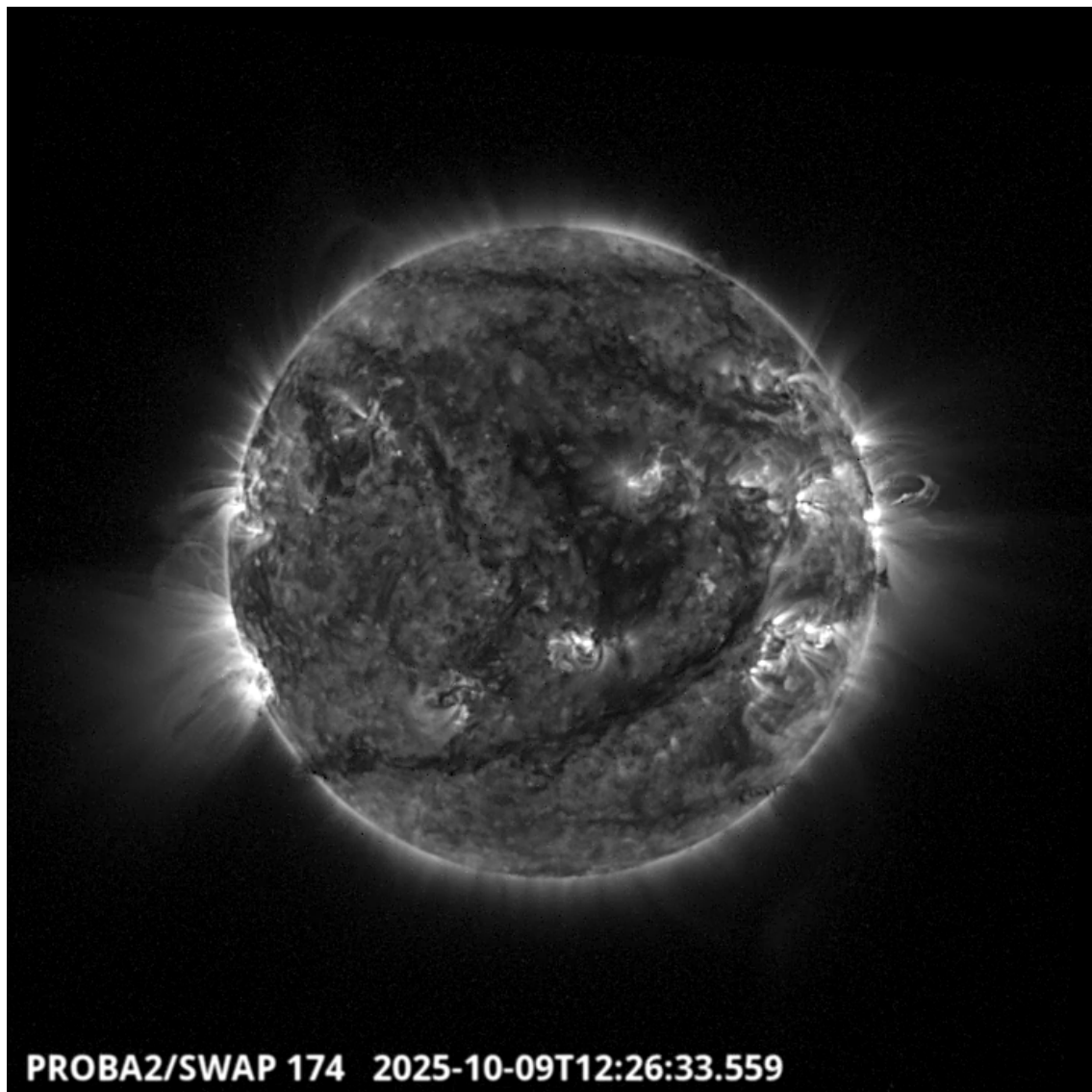
A weekly overview movie can be found here (SWAP week 811): https://proba2.sidc.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2025_10_06.mp4

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/>

Thursday Oct 09





The largest flare of this week was an M2.0, it was observed by LYRA (top panel) and SWAP (bottom panel). The flare peaked on 2025-Oct-09 at 12:31 UT and occurred on the North West limb of the solar disk, originating from active region NOAA 4236. Find a SWAP movie of the event here: https://proba2.sidc.be/swap/movies/20251009_swap_movie.mp4

5. Noticeable Solar Events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
09	1211	1231	1252		M2.0					4236

LOC: approximate heliographic location

XRAY: X-ray flare class

OP: optical flare class

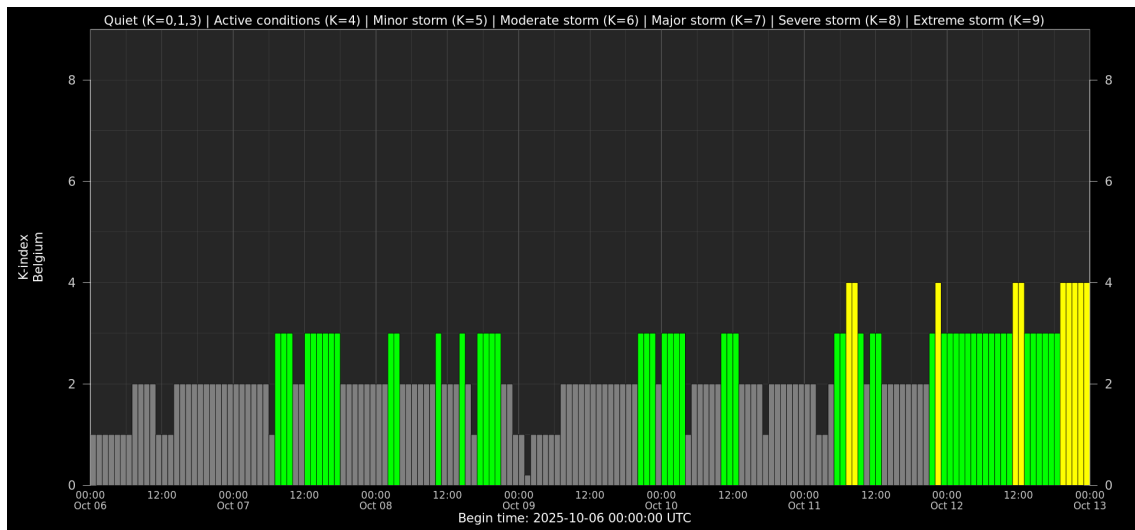
10CM: peak 10 cm radio flux

TYPE: radio burst type

Cat: Catania sunspot group number

NOAA: NOAA active region number

6. Geomagnetic Observations in Belgium

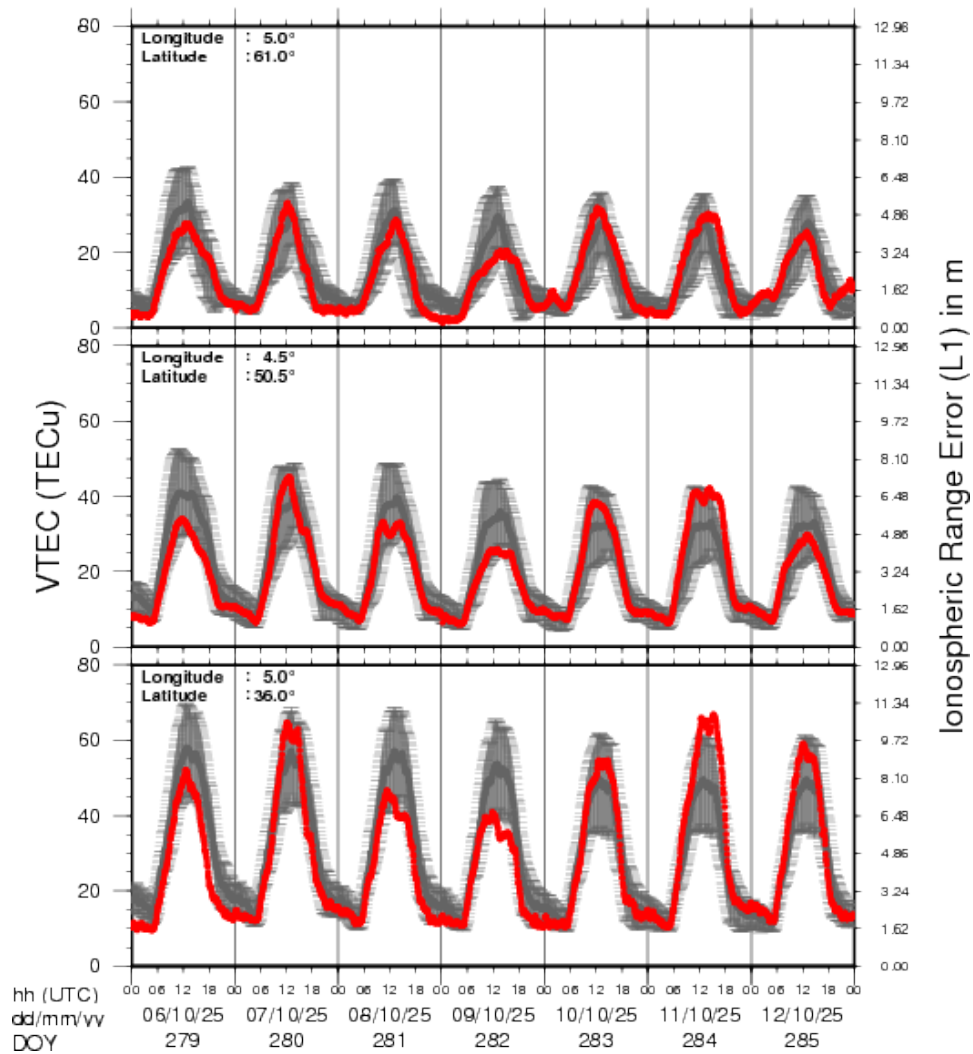


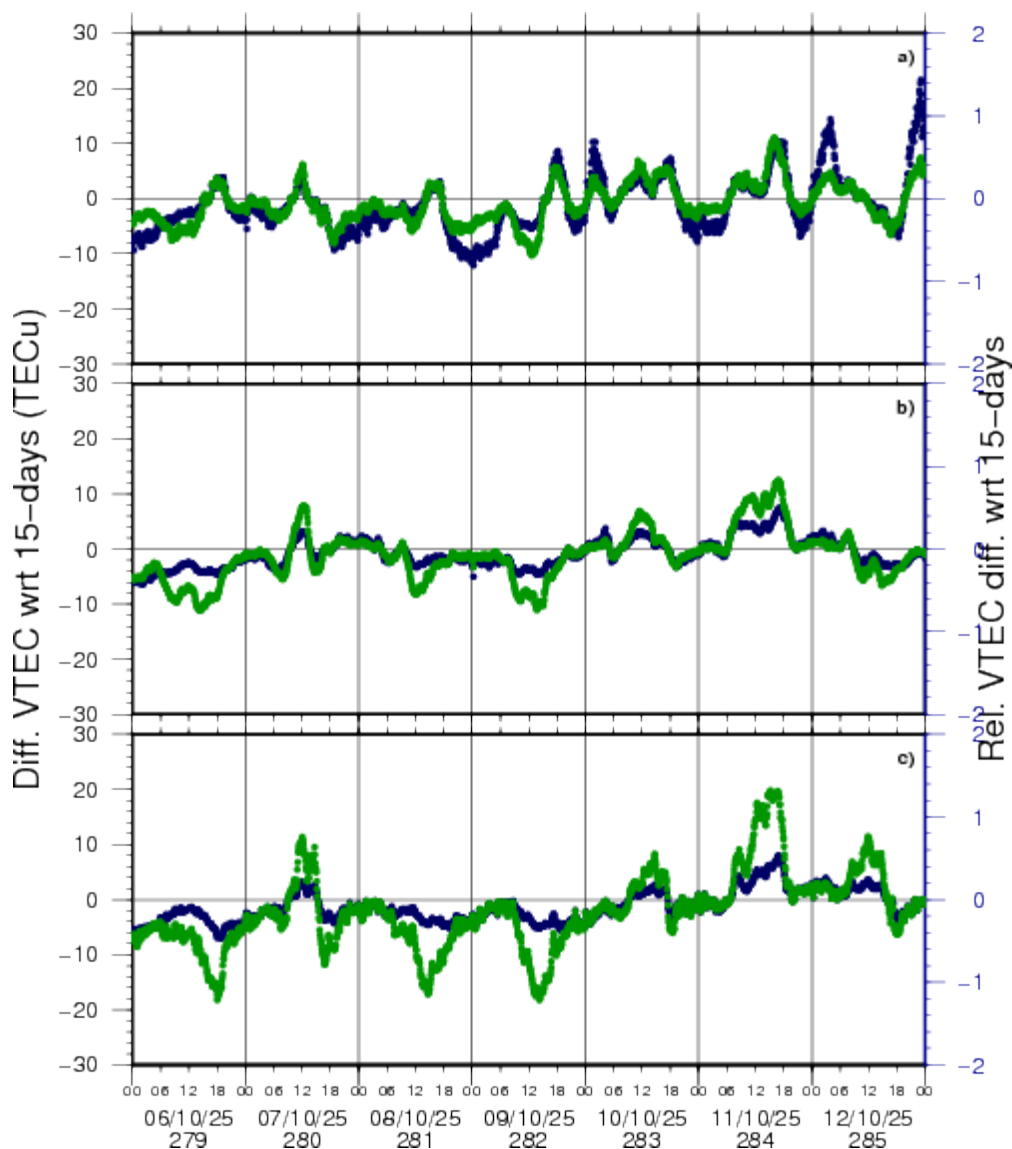
Local K-type magnetic activity index for Belgium based on data from Dourbes (DOU) and Manhay (MAB). Comparing the data from both measurement stations allows to reliably remove outliers from the magnetic data. At the same time the operational service availability is improved: whenever data from one observatory 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 6 Oct 2025 till 12 Oct 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).

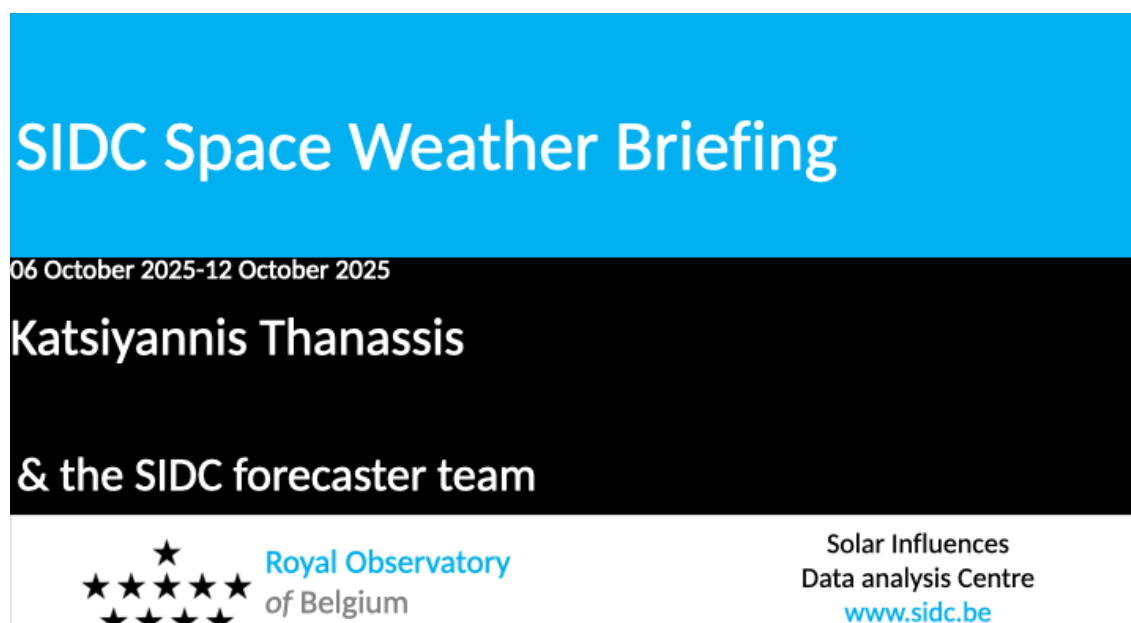
The Sun's radiation ionizes the Earth's upper atmosphere, the ionosphere, located from about 60km to 1000km above the Earth's surface. The ionization process in the ionosphere produces ions and free electrons. These electrons perturb the propagation of the GNSS (Global Navigation Satellite System) signals 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 to October 6 to 12.

The pdf of the presentation can be found here: https://www.stce.be/briefings/20251013_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.

- * Oct 23-25, ESWW Space Weather Training by Umea University and STCE, Kiruna, Sweden - Full
- * Oct 27-31, European Space Weather Week, Umea, Sweden - <https://esww.eu/>
- * Nov 17-19, STCE Space Weather Introductory Course, Brussels, Belgium - register: <https://events.spacepole.be/event/217/> - Full
- * 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)



Space Weather Education Centre

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