STCE Newsletter

22 Dec 2025 - 28 Dec 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. Proba-3 made it to the Belgian year overview

In the national Belgian channel year overview, Proba-3 was announced as a masterstroke from Belgium.

Alzheimer's patients, a feat from Belgium in space and horny diatoms: this was 2025 in science.

Space expert Wim De Maeseneer was amazed by an acrobatic feat in space this year. 'This year, two satellites, largely built in Belgium, created an artificial solar eclipse for the first time,' he explains. 'One covers the sun, while the other records the eclipse with a camera.'
'To do this, the two satellites have to fly exactly 144 metres apart, with a margin of error of no more than 1 millimetre. And they have to do this while flying around the Earth at a speed of thousands of kilometres per hour. Nothing like this has ever been done before.'

'Thanks to this technical feat, we can study the corona, or the atmosphere of the sun, much better. It is much hotter than the sun itself, but we still don't know exactly why that is. Space weather also occurs there, such as solar storms that can disrupt GPS signals.'
'Well, in order to study the corona, we used to have to wait for a natural solar eclipse. But now we can choose when, and for hours at a time. The Proba-3 satellites have already created more than 50 artificial solar eclipses.'

Newsitem, in Dutch: https://www.vrt.be/vrtnws/nl/2025/12/12/dit-was-2025-in-wetenschap-onze-redactie-blikt-terug/

2. Review of space weather

Solar Active Regions (ARs) and flares

Solar flaring activity was low to moderate with several C-class flares and four M-class flares. The largest flare was a M5.1 flare (SIDC Flare 6496) peaking at 01:50 UTC on Dec 27, which was produced by SIDC Sunspot Group 745 (NOAA Active Region 4325). The source region (SIDC Sunspot Group 745) of the flare had a beta configuration of its photospheric magnetic field. There were 18 numbered alpha, beta, beta-gamma, beta-delta, and beta-gamma-delta active regions on the visible solar disc. At the end of the week, 11 sunspot groups were visible.

Coronal mass ejections

A wide coronal mass ejection (CME) (around 110 deg) on the NE quadrant was first observed in SOHO/LASCO-C2 images around 05:00 UTC on Dec 22. This CME was possibly associated with the flaring activity from SIDC Sunspot Groups 735 and 736 (NOAA Active Region 4317). It was expected to miss the Earth and it did not arrive to Earth.
Another CME was observed on SOHO/LASCO-C2 images around 10:36 UTC on Dec 22, which was possibly associated with a filament eruption around 09:00 UTC on the SE quadrant (S02 E37) of the Sun. It had a projected speed of about 400 km/s and a projected width of about 90 deg. A glancing blow was expected but it was not detected at Earth.
Third CME was detected in the E limb at 02:24 UTC on Dec 27 in SOHO/LASCO-C2 data. It had a projected speed of 350 km/s and a projected width of 90 degree. This CME was possibly associated with a M5.1 flare (SIDC Flare 6496, S09 E74, peak at 01:50 UTC on Dec 27) produced by SIDC Sunspot Group 745 (NOAA Active Region 4325), but the source was not very clear. Possibly associated type II radio emissions were detected at 01:47 UTC on Dec 27. This CME was expected to miss the Earth and it did not arrive to Earth.

Coronal Holes

SIDC Coronal Hole (CH) 128 (recurrent, positive polarity, elongated CH in the southern hemisphere), which started to cross the central meridian on Dec 20, had passed the central meridian on Dec 28. The high speed streams (HSSs) related to this coronal hole enhanced the solar wind parameters near Earth during Dec 21-28. Another recurrent CH (SIDC CH 140) in the northern hemisphere, which has a negative polarity, started to cross the central meridian from Dec 28.

Proton flux levels

The greater than 10 MeV GOES proton flux was nominal.

Electron fluxes at GEO

The greater than 2 MeV electron flux, as measured by GOES-18 and GOES-19 satellites, was above the threshold level for few hours during Dec 22-23, and it was mostly above the threshold level during Dec 23-28. It was in response to the high speed streams (HSSs) from the recurrent, positive polarity, elongated coronal hole (SIDC Coronal Hole 128) in the southern hemisphere which crossed the central meridian during Dec 20-28. The 24-hour electron fluence was at moderate levels between Dec 24-28.

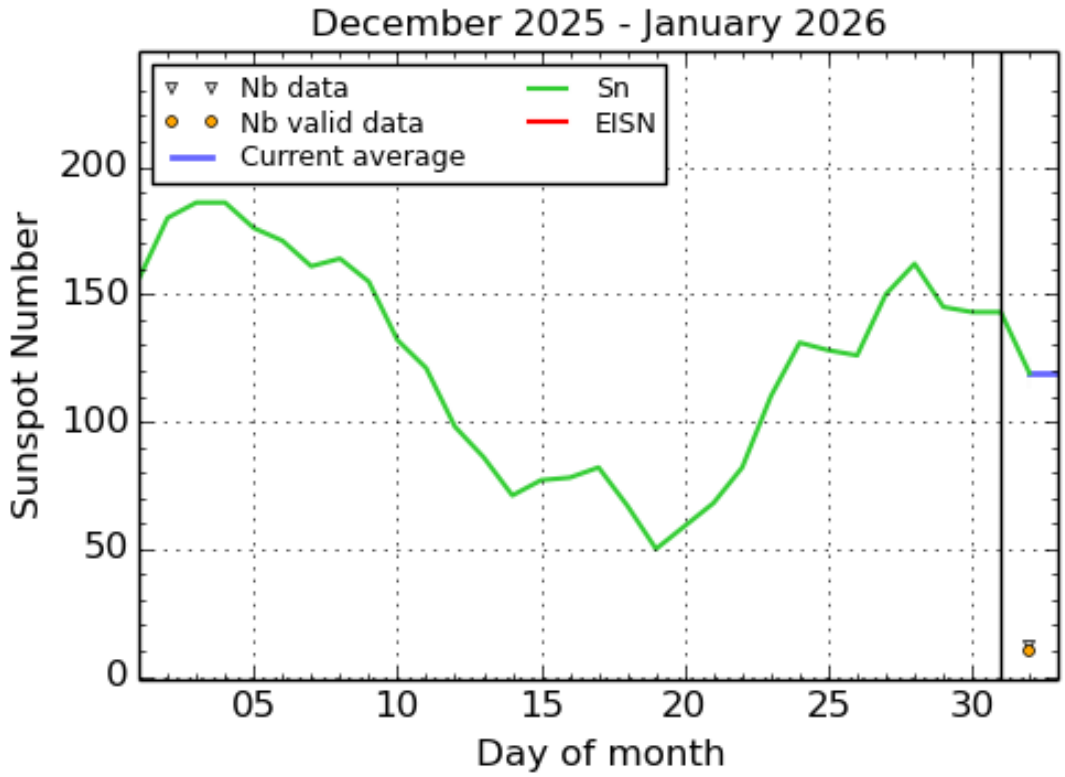
Solar wind

During the last week, Earth was under the influence of high speed streams which originated from the recurrent, positive polarity, elongated coronal hole (SIDC Coronal Hole 128) in the southern hemisphere that crossed the central meridian during Dec 20-28. The solar wind speed increased upto 840 km/s, the interplanetary magnetic field (IMF) increased upto 10 nT, and Bz component decreased to -7 nT. The solar wind speed started to decrease from 500 km/s on Dec 27 and gradually returned to slow solar wind conditions at the end of the week.

Geomagnetism

At the start of the past week, geomagnetic conditions reached a minor storm (NOAA Kp and K_BEL 5) both globally and locally. It was due to the impact of high speed streams from the recurrent, positive polarity, elongated coronal hole (SIDC Coronal Hole 128) in the southern hemisphere that crossed the central meridian during Dec 20-28. It decreased to unsettled (Kp and K_BEL 3) on Dec 24 and became quiet (Kp and K_BEL 1 to 2) at the end of the week.

3. International Sunspot Number by SILSO



SILSO graphics (http://sidc.be/silso) Royal Observatory of Belgium, 2026 January 2

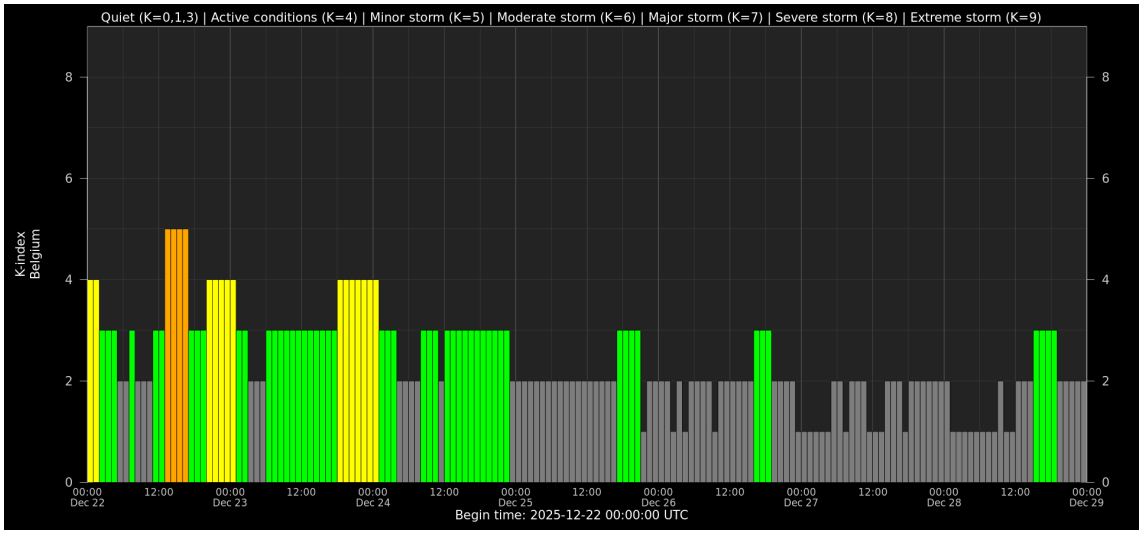
The daily Estimated International Sunspot Number (EISN, red curve with shaded error) derived by a simplified method from real-time data from the worldwide SILSO network. It extends the official Sunspot Number from the full processing of the preceding month (green line), a few days more than one solar 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. Noticeable Solar Events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
27	0138	0150	0159		M5.1			II/3		4325
28	2103	2113	2123	S7E47	M1.3	SF				4325
28	2201	2239	2254	N8W31	M4.2	1F			48	4317
28	2357	0002	0007		M2.2					4324

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

5. 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/

6. The SIDC Space Weather Briefing

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

The pdf of the presentation: https://www.stce.be/briefings/20251229_SWbriefing.pdf

SIDC Space Weather Briefing

22 December 2025-28 December 2025

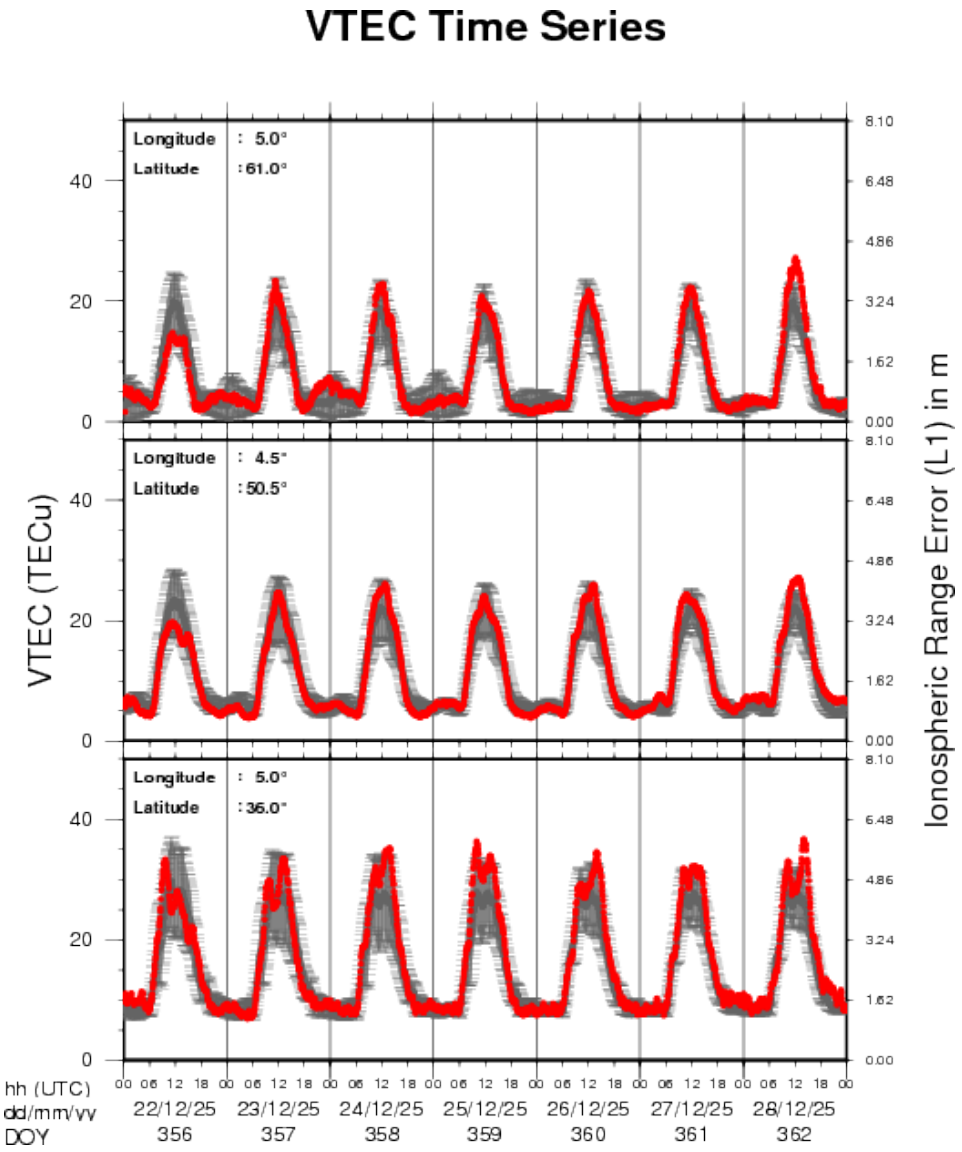
Senthamizh Pavai Valliappan

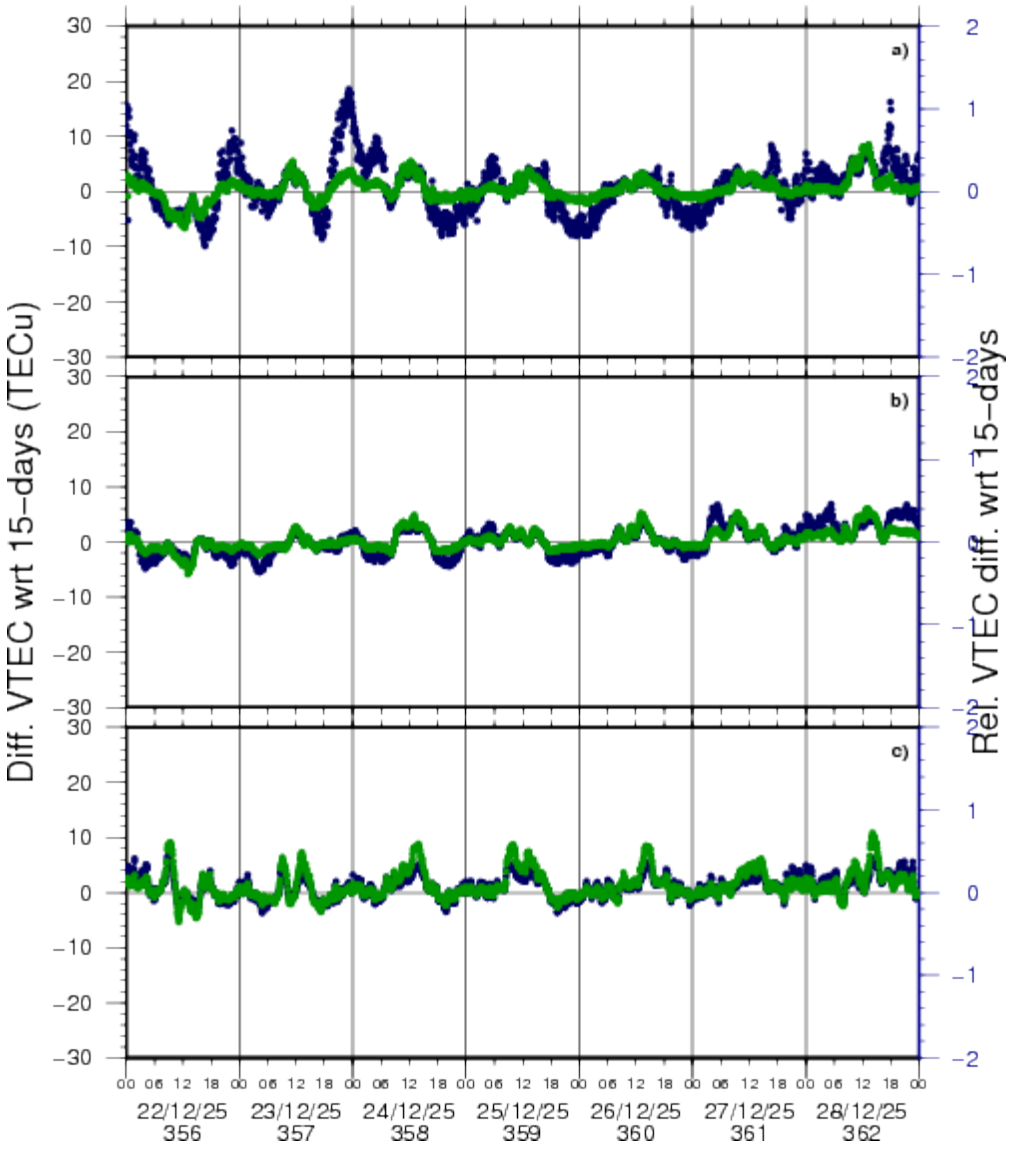
& the SIDC forecaster team

Royal Observatory *of* Belgium

Solar Influences
Data analysis Centre
www.sidc.be

7. Review of Ionospheric Activity





VTEC time series at 3 locations in Europe from 22 Dec 2025 till 28 Dec 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 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. 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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