

# STCE Newsletter

12 Aug 2024 - 18 Aug 2024



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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. First solar observations with SPADE

Deep in the hills of the Belgian Ardennes, near the tiny village of Humain, lies the STCE's radio-astronomy station. While the site may seem dormant, and even a bit abandoned, we continue to make daily radio-observations there that are crucial for our space weather prediction center as well as our research on solar activity. And thus we also keep innovating by improving our instrumentation, and implementing new techniques.

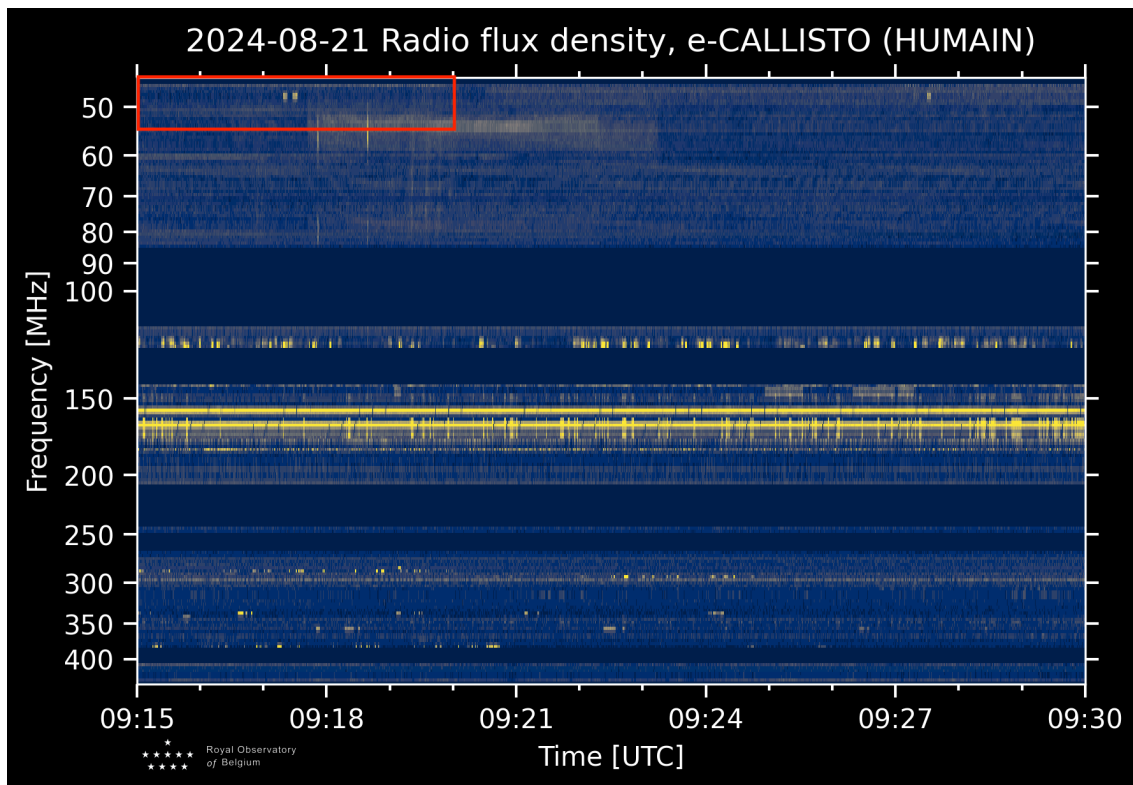
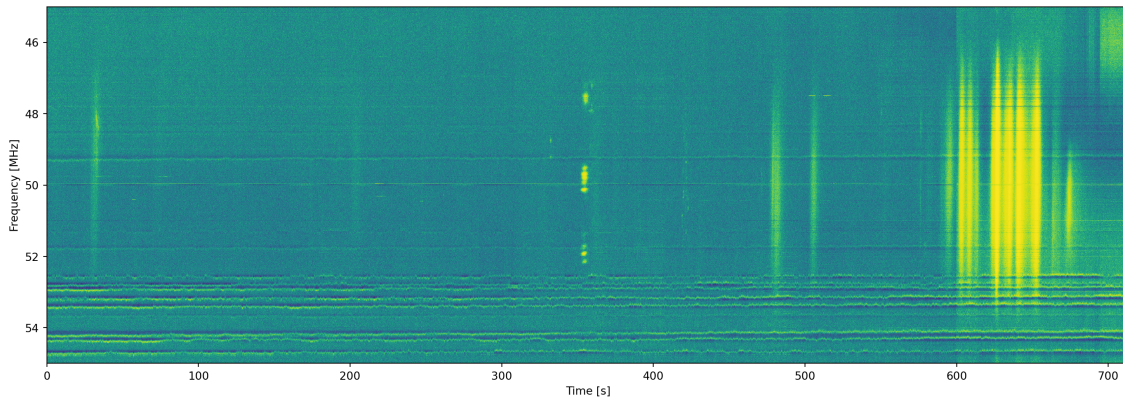
In the past couple of weeks, the radio-astronomy team has worked relentlessly on a new setup and calibration procedure for the 2 receivers which are part of the SPADE instrument. SPADE stands for Small Phased Array Demonstrator and is a small array of 8 antennas. SPADE has as main advantage that it has no technical moving parts. And we all know that moving parts can more easily break, which is quite inconvenient when the engineers and technicians are located in Brussels, more than a 100 km away.



The principle of SPADE is that by adding the signal of all channels, we can make a virtual antenna (even more sensitive than each individual antenna) pointing at the zenith. If we take for example, the central antenna as a reference, we can point the array towards the Sun by delaying the signal of each antenna with respect to the reference. In practice this is done by multiplying each channel by a certain phase. This phase is calculated according to geometrical considerations and the position of the Sun in the sky.

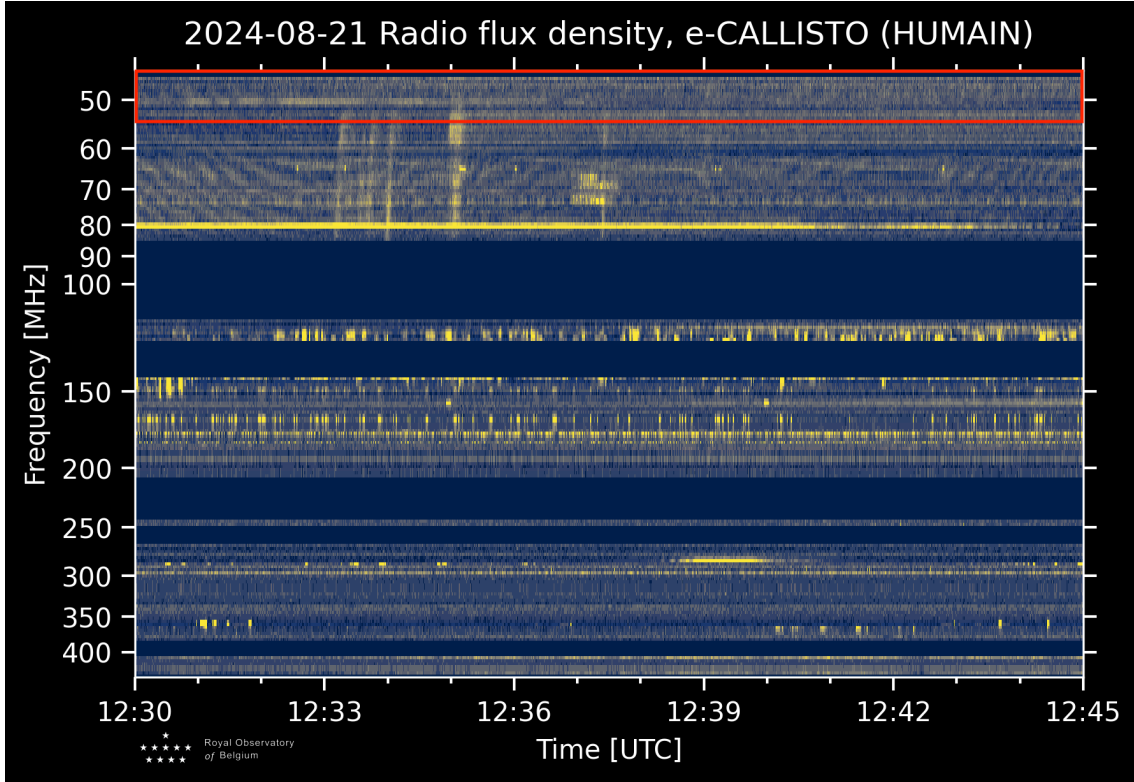
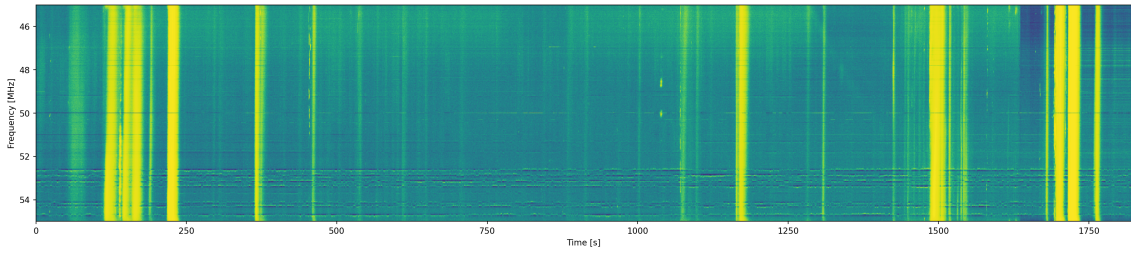
### First Observation

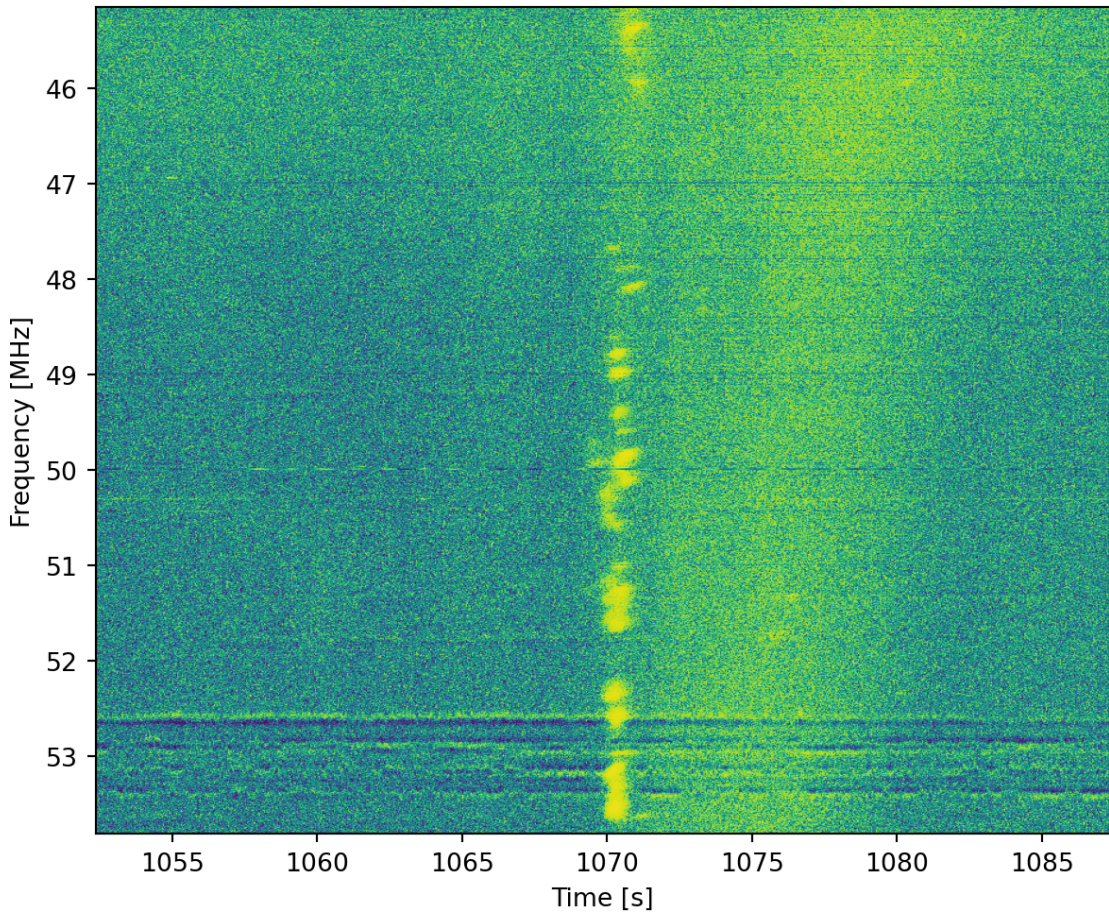
After adding up the 8 channels, we make a spectrum and then observe for a while to make a dynamic spectrum such as the one below. This image shows almost 12 minutes of observations between 09:08 UT and 09:20 UT on August 21 2024. A CALLISTO spectrum from Humain is shown for comparison, with the corresponding frequency band highlighted in red. Note that the CALLISTO spectrum starts at 09:15 UT only. We see on the SPADE spectrum a group of type III bursts, barely visible on CALLISTO. This highlights the complementarity of these different instruments that are operating side by side in Humain.



### More fun with SPADE

Still on August 21, we observed for about 30 minutes with SPADE, and caught a type III storm, linked to the large sunspot groups currently visible on the solar disk. Nothing is visible with CALLISTO due to its much lower sensitivity. The SPADE spectrum also shows fine structure for some of the type IIIs, called stria bursts, which are linked to inhomogeneities in the corona. And so SPADE opens the door to new research: who knows what else we will see?





## 2. PITHIA-NRF Trans-National Access Open Call

PITHIA-NRF launches its seventh call. This is the FINAL call in the frame of PITHIA-NRF project to provide effective and convenient access to the best European research facilities for observations of the upper atmosphere, including the plasmasphere, ionosphere and thermosphere. The access is organised through the Trans-National Access (TNA) programme, and provides an opportunity for researcher and other users to execute and carry out their own projects at one of the PITHIA-NRF research facilities, including the STCE.

The call is open from 15 August 2024. It is an Open Call and applications are handled as they arrive with typical evaluation times of 2 to 3 weeks. If accepted the projects can commence for organisation and realisation from September 2024 and the project report must be submitted at the latest by the end of February 2025. The call closes on 27 September 2024.

More information about the call can be obtained from the call website: <https://pithia-nrf.eu/pithia-nrf-users/tna/tna-calls/seventh-tna-call>

Access can be requested by scientific users from academia, Small and Medium Enterprises, large companies and public organizations by propose a scientific project and fill in the online application form (<https://pithia-nrf.eu/forms/tna-application-form-7>).

### 3. Review of Space Weather

WEEK 1233 from 2024 Aug 12

#### **Solar Active Regions and flares**

Solar flaring activity was at mainly moderate levels throughout the week and reached high levels on August 14. There were a total number of 19 active regions (ARs) observed on the visible solar disk over the week. A total of 24 C-class flares, 17 M-class flares and 1 X-class flares were observed. The strongest of which was a X1.11-flare, with peak time at 06:40 UTC on August 14 and is associated with NOAA AR 3784. NOAA AR 3774, 3777, 3780, 3784 and 3790 all produced M-class flares this week.

#### **Coronal mass ejections**

Multiple Coronal Mass Ejections (CMEs) were observed during the week. Of the ones analyzed one had an Earth-directed component: a partial halo CME which was seen in LASCO-C2 data at 09:50 UTC on August 14. This CME was associated with the X1.11-flare on August 14 and arrived at Earth around 13:30 UTC on August 17.

#### **Coronal Holes**

A negative polarity, mid-latitude Coronal Hole (CH) began to transition across the central meridian in the northern hemisphere on August 12. A second positive polarity, high-latitude CH began to transition the central meridian in the southern hemisphere on August 15. No impact was seen of the associated high-speed streams of either of the CHs.

#### **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 remained below the 1000 pfu threshold.  
The 24h electron fluence was at nominal levels.

#### **Solar wind**

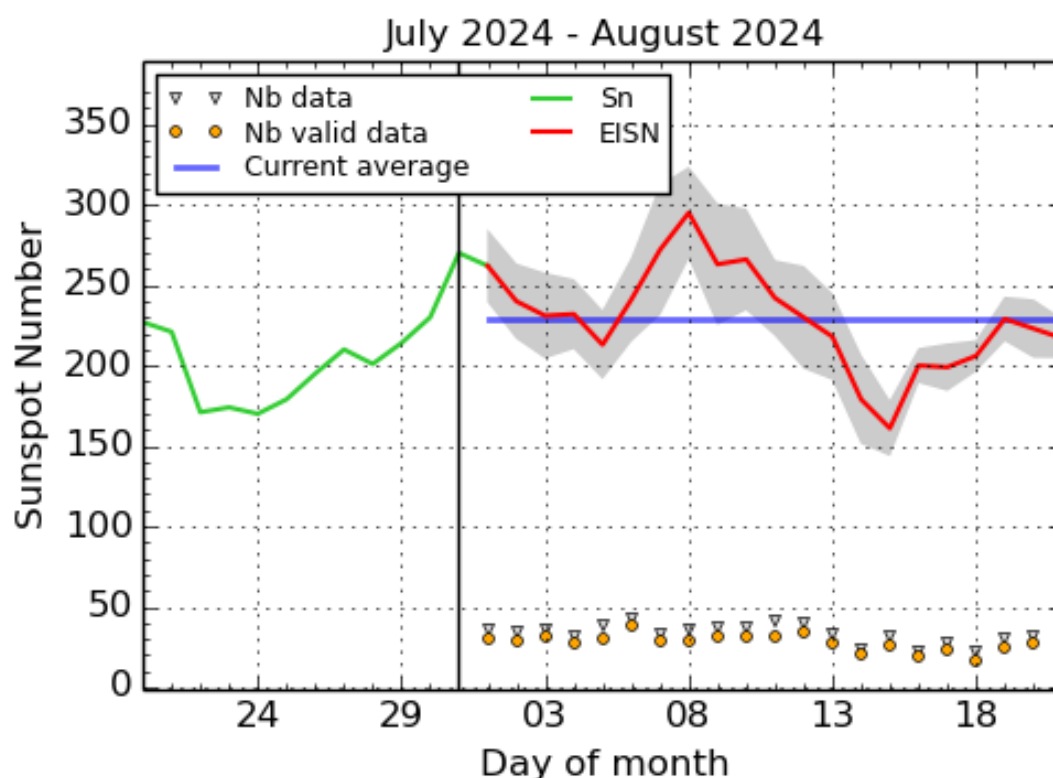
At the beginning of the week the solar wind was under the influence of an ICME and the solar wind speed varied between 408 km/s and 534 km/s. The interplanetary magnetic field varied between 8nT and 23 nT, with the Bz reaching a minimum value of -20 nT.

The solar wind returned to the slow solar wind regime on August 14 and became perturbed again on August 17 because of an ICME arrival associated with the partial halo CME from August 14. A shock was observed in the solar wind around 13:30 UTC on August 17. The interplanetary magnetic field jumped from 7nT to 17 nT, the solar wind speed increased from 324 km/s to 430 km/s, and the solar wind density rose from 2 particles/cm<sup>3</sup> to 12 particles/cm<sup>3</sup>.

#### **Geomagnetism**

Geomagnetic conditions reached severe storm levels globally (Kp=8) and moderate storm levels locally (Kbel=6) on August 12, due to an ICME passage. The geomagnetic conditions returned to quiet to unsettled levels on August 14. On August 17 they reached mayor storm levels globally (Kp=7) and moderate storm levels locally (Kbel=6), due to the passage of another ICME and returned to quiet and unsettled levels on August 19.

## 4. International Sunspot Number by SILSO



SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium, 2024 August 21

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 moderate to high during the week.

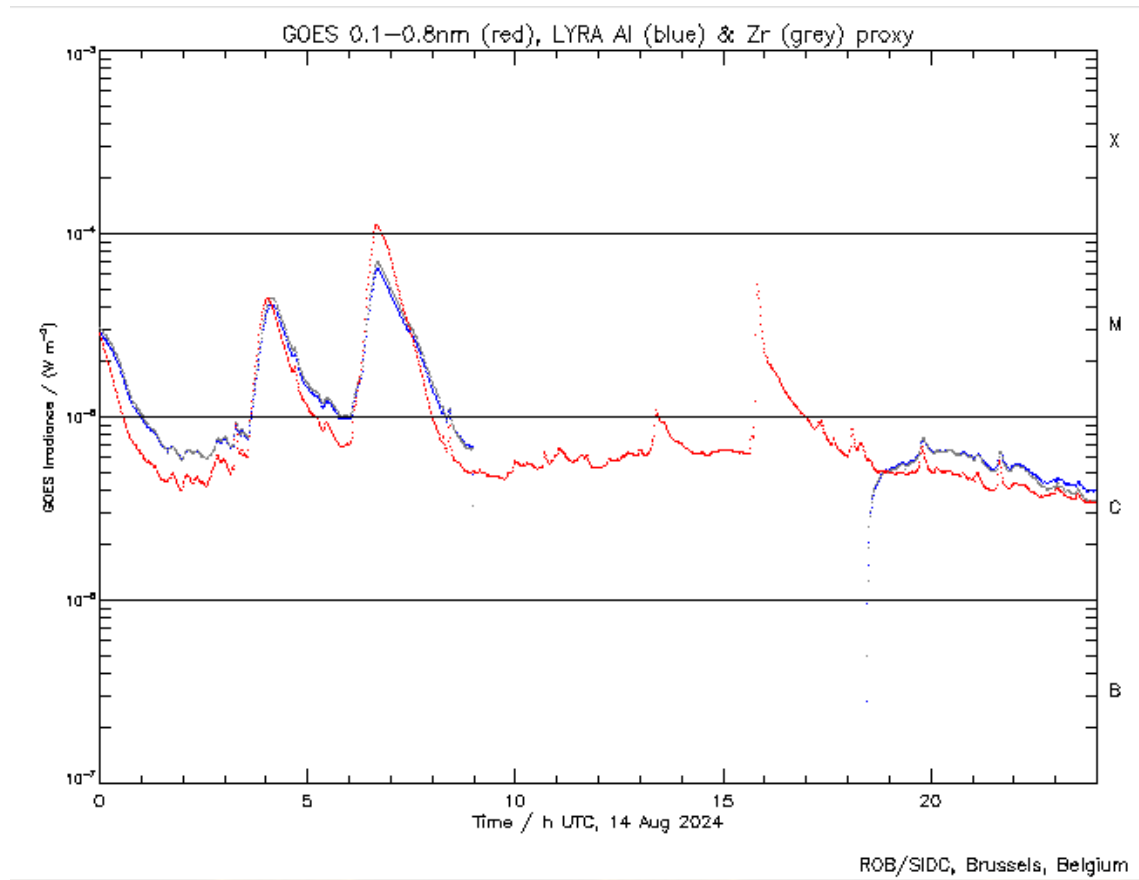
In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: <https://proba2.oma.be/ssa>  
This page also lists the recorded flaring events.

A weekly overview movie can be found here (SWAP week 751): [https://proba2.sidc.be/swap/data/mpg/movies/weekly\\_movies/weekly\\_movie\\_2024\\_08\\_12.mp4](https://proba2.sidc.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2024_08_12.mp4)

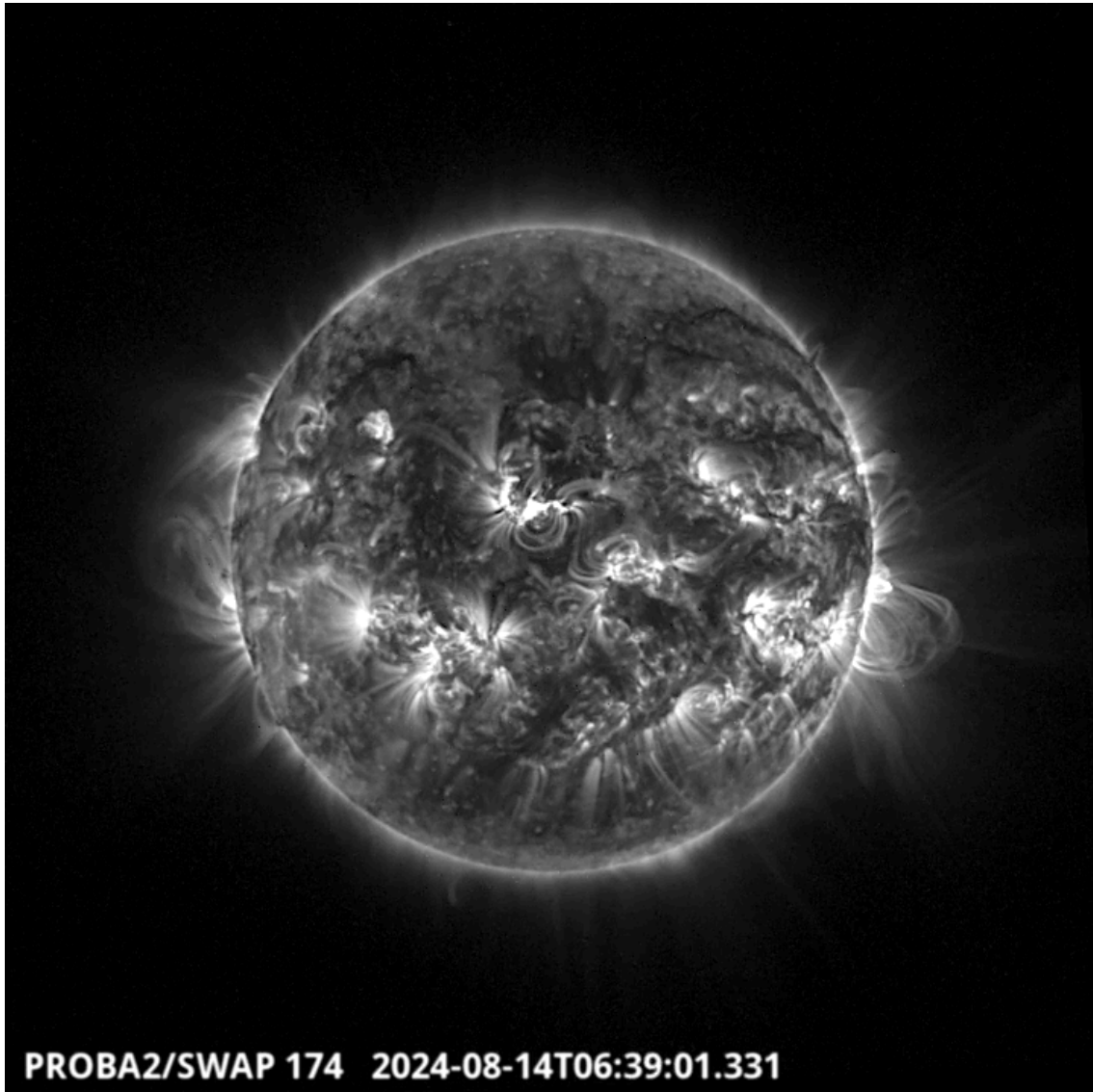
Details about some of this week's events can be found further below.

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 Aug 14







The biggest flare of the week is a X1.1 captured by LYRA and SWAP. It was produced around 6:40 UT by the NOAA active region 3784 located in the North East part of the solar disk. Find a SWAP movie of the event here: [https://proba2.sidc.be/swap/movies/20240814\\_swap\\_movie.mp4](https://proba2.sidc.be/swap/movies/20240814_swap_movie.mp4)

## 6. Noticeable Solar Events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
12	0823	0848	0859		M1.0			VI/2	44	3777
12	2247	2257	2304		M1.2					3784
13	1725	1729	1734	N15E11	M1.0	SF				3784
13	2238	2245	2257		M1.3			III/1	44	3777
13	2326	2344	0006	N13E7	M4.2	1		III/2		3784
14	0333	0402	0427		M4.4					3774
14	0600	0640	0708	N12E5	X1.1	2		VI/2IV/1III/2		3784
14	1316	1324	1338		M1.0			III/1		3784
14	1539	1549	1557	N14W1	M5.3	S		III/2		

15	0335	0348	0356	S10W62	M1.1	SF		45	3780
16	1313	1324	1335		M1.3		III/2		3780
17	1024	1033	1042	N17W42	M1.6	1N	III/2		3784
17	1122	1144	1156	S16W23	M1.1	SF			3785
17	2137	2148	2157	S9E47	M1.1	1			3790
17	2157	2206	2214		M1.4				3790
18	0150	0204	0212		M2.4				3784
18	0407	0416	0431		M1.1				3784
18	0715	0730	0744	N18W52	M1.2	SF			3784
18	2052	2107	2122		M1.3				3796
18	2346		0013	S4E70	M1.4	SF			3796

LOC: approximate heliographic location

TYPE: radio burst type

XRAY: X-ray flare class

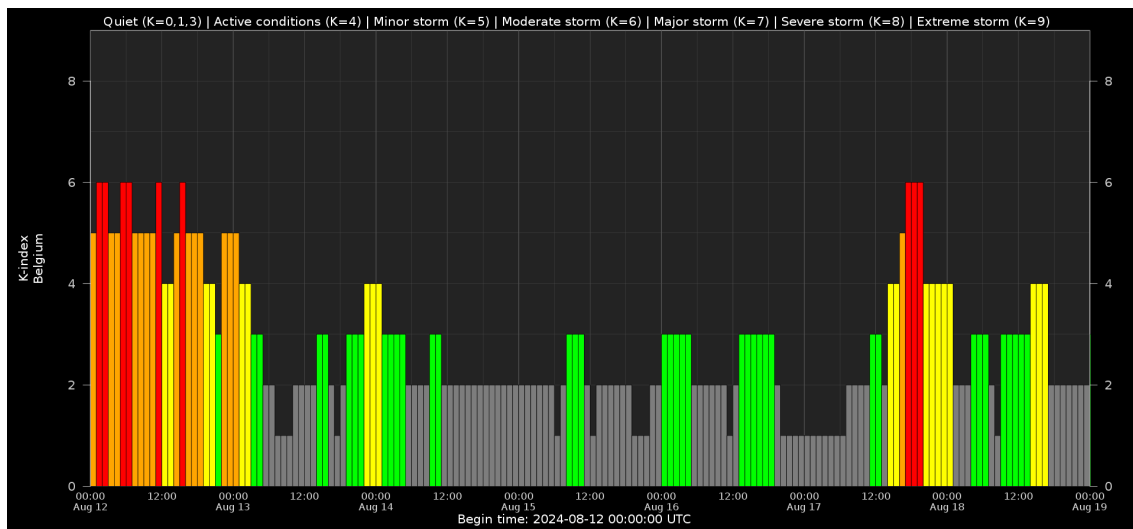
Cat: Catania sunspot group number

OP: optical flare class

NOAA: NOAA active region number

10CM: peak 10 cm radio flux

## 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/](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 August 11 to 18.

The pdf of the presentation can be found here: [https://www.stce.be/briefings/20240819\\_SWbriefing.pdf](https://www.stce.be/briefings/20240819_SWbriefing.pdf)

# SIDC Space Weather Briefing

11 August 2024-18 August 2024

Vansintjan Robbe

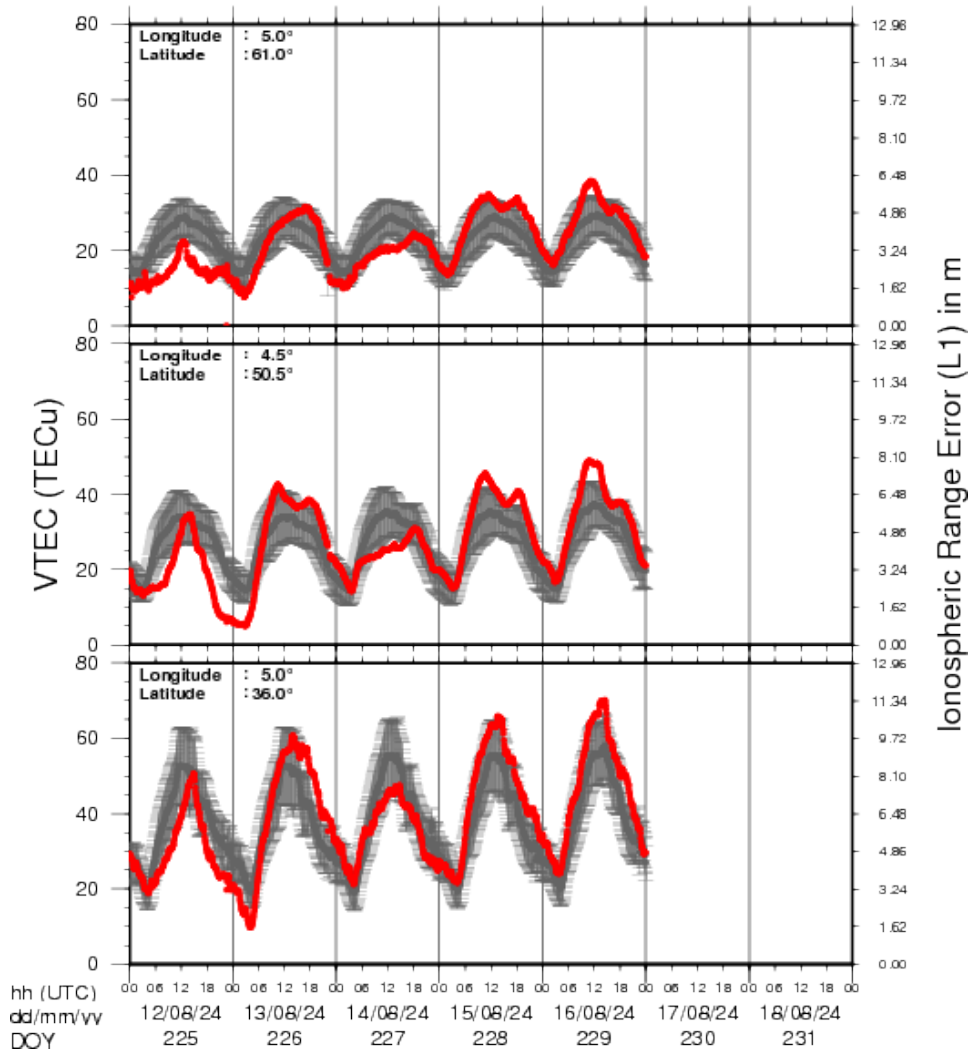
& the SIDC forecaster team

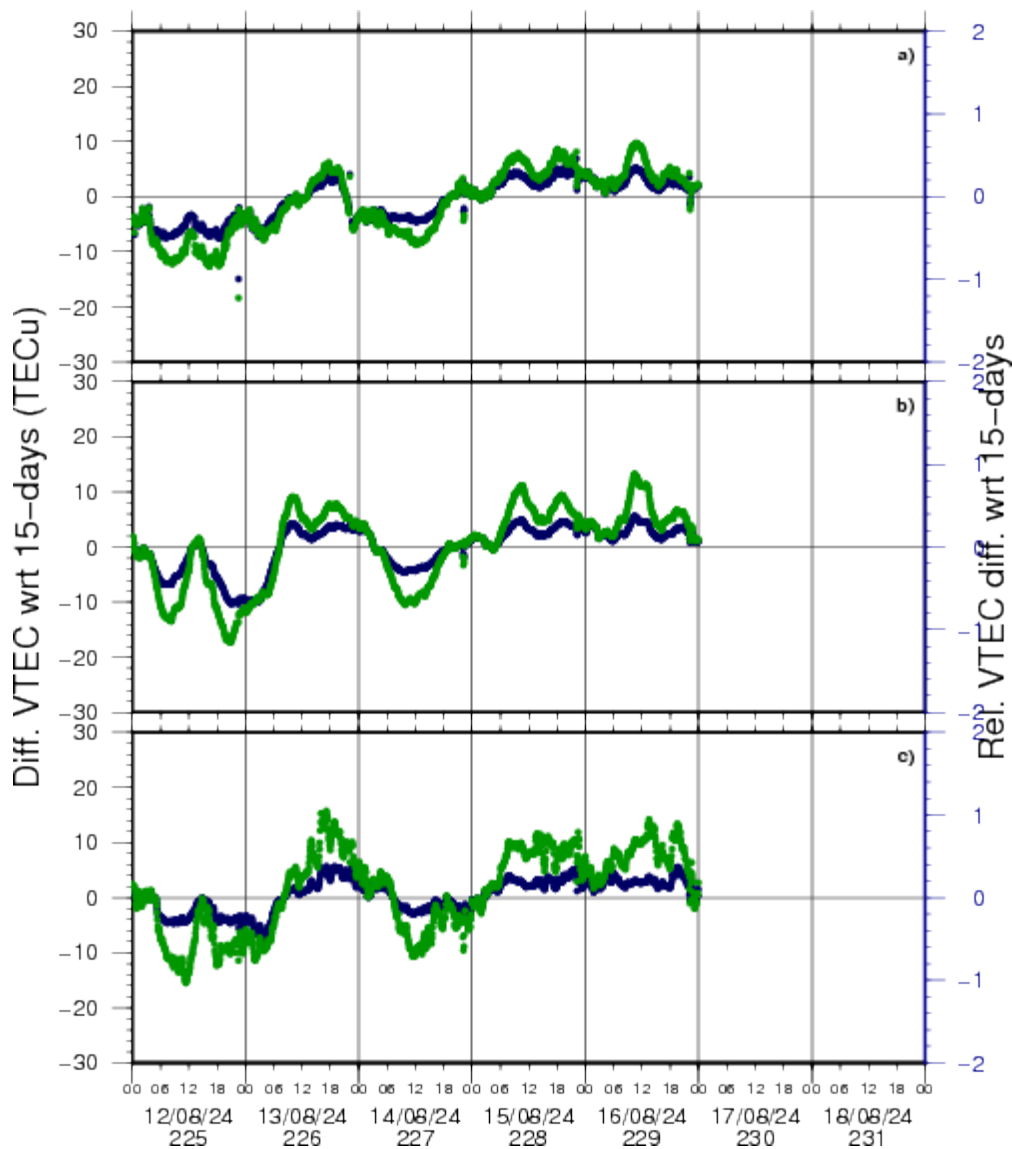


Solar Influences  
Data analysis Centre  
[www.sidc.be](http://www.sidc.be)

## 9. Review of Ionospheric Activity

### VTEC Time Series





VTEC time series at 3 locations in Europe from 12 Aug 2024 till 18 Aug 2024

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  $1\text{TECu}=10^{16}$  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](http://stce.be/newsletter/GNSS_final.pdf) for some more explanations; for more information, see <https://gnss.be/SpaceWeather>

## 10. Upcoming Activities

Courses and presentations 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.

- \* Aug 25, public lecture Help! Het stormt in de ruimte!?, ATB Natuurvrienden, Aarschot, Belgium
- \* Sep 27, STCE at the Wisenight Science festival in the Planetarium, Brussel, <https://wisenight.eu/>
- \* Sep 30 - Oct 3, STCE Space Weather Introductory Course, Brussels, Belgium - Registrations are complete - <https://events.spacepole.be/event/204/>
- \* Nov 25 - 27, STCE course: Space Weather impacts on ionospheric wave propagation, focus on GNSS and HF, Brussels, Belgium - Registrations are open, <https://events.spacepole.be/event/206/>
- \* Dec 5-6, STCE Course Space Weather impacts on aviation, Brussels, Belgium - Registrations are open, <https://events.spacepole.be/event/205/>

To register for a course or lecture, check the page of the STCE Space Weather Education Center: <https://www.stce.be/SWEC>

If you want your event in the STCE newsletter, contact us: [stce\\_coordination@stce.be](mailto:stce_coordination@stce.be)

