

# STCE Newsletter

4 Dec 2023 - 10 Dec 2023



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

# 1. PROBA2 Observations

## Solar Activity

Solar flare activity fluctuated from low to moderate during the week.

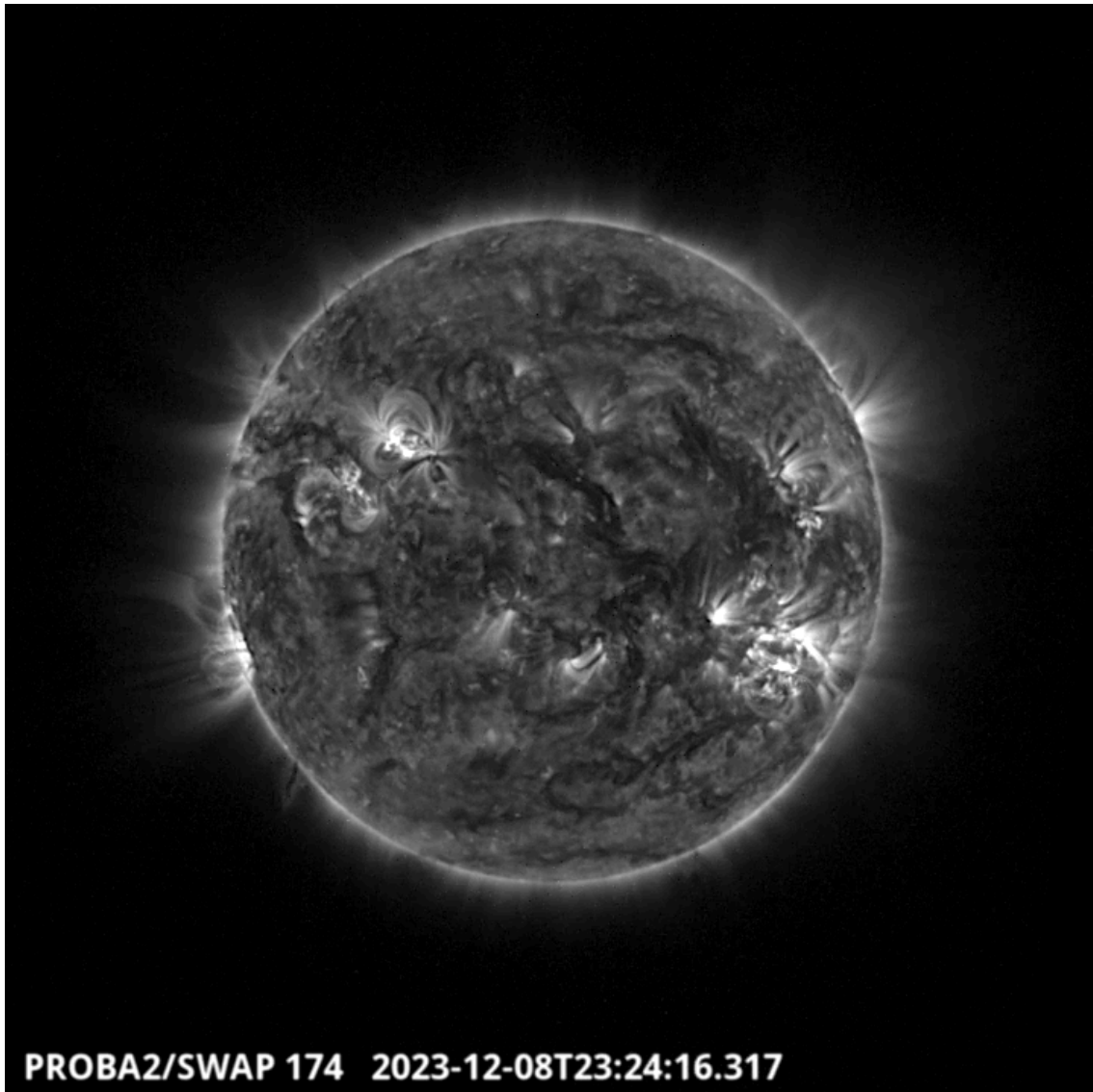
In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: <https://proba2.oma.be/ssa>  
This page also lists the recorded flaring events.

A weekly overview movie can be found here (SWAP week 715). [https://proba2.sidc.be/swap/data/mpg/movies/weekly\\_movies/weekly\\_movie\\_2023\\_12\\_04.mp4](https://proba2.sidc.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2023_12_04.mp4)

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

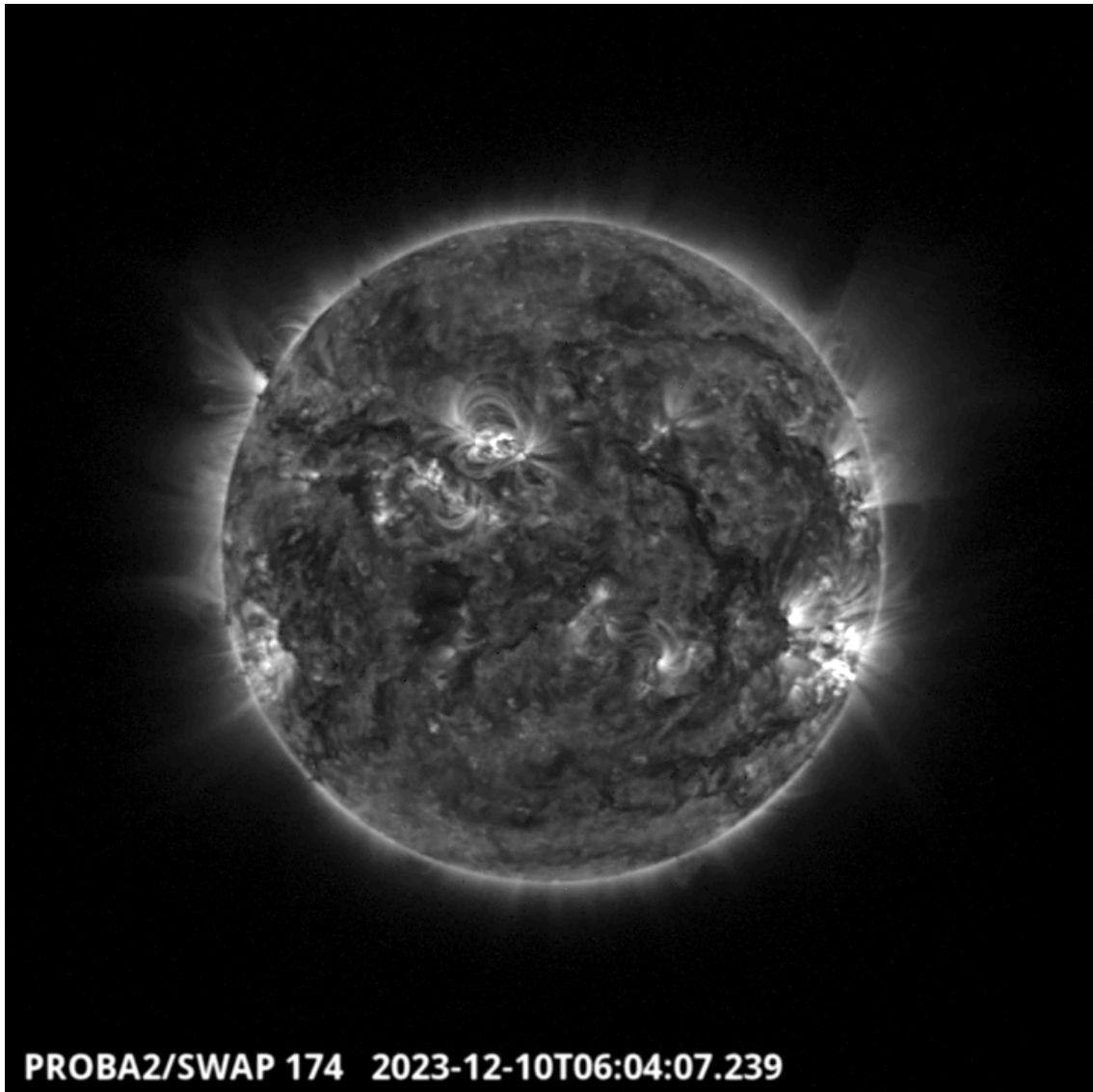
If any of the linked movies are unavailable they can be found in the P2SC movie repository here <https://proba2.oma.be/swap/data/mpg/movies/>

Friday Dec 08



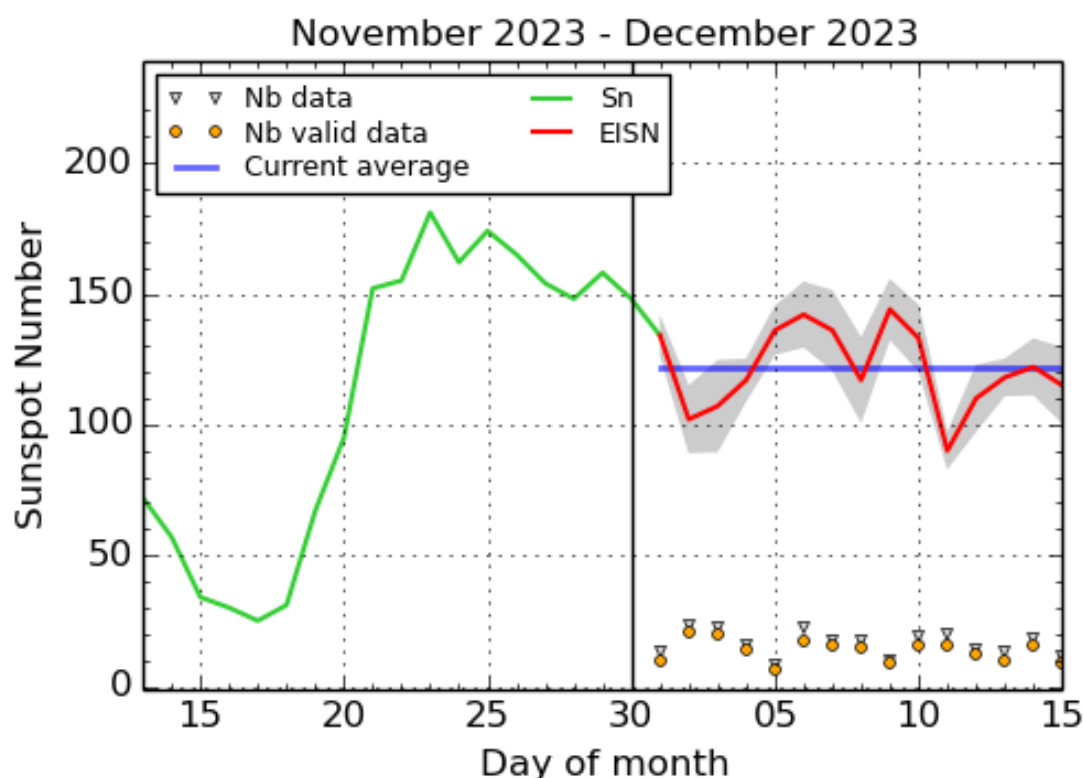
The largest flare of the week is a M5.8. It has been produced by the NOAA active region 3511 which is located on the South West part of the solar disk. Find a SWAP movie of the event here. [https://proba2.sidc.be/swap/movies/20231208\\_swap\\_movie.mp4](https://proba2.sidc.be/swap/movies/20231208_swap_movie.mp4)

Sunday Dec 10



Elongated coronal hole from NorthEast to SouthEast part of the solar disk. Find a SWAP movie of the event here. [https://proba2.sidc.be/swap/movies/20231210\\_swap\\_movie.mp4](https://proba2.sidc.be/swap/movies/20231210_swap_movie.mp4)

## 2. International Sunspot Number by SILSO



SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium, 2023 December 15

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.

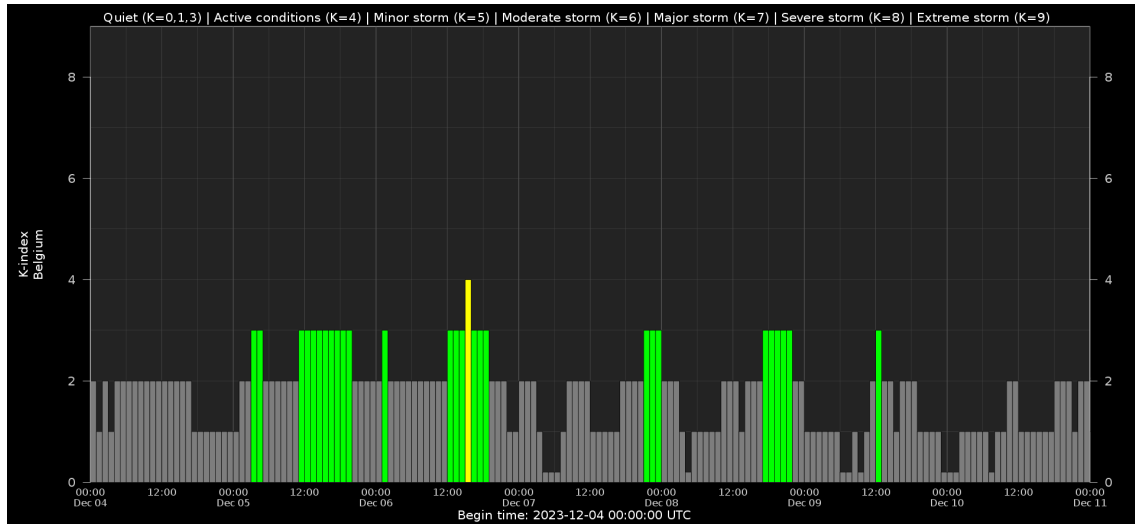
## 3. Noticeable Solar Events

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
05	0639	0644	0648	N18E87	M1.5	1F				3513
05	2059	2110	2117	N20E70	M1.0	1N				3513
05	2117	2120	2125		M1.4					3513
06	0530	0541	0552	N18E66	M2.1	2N		III/1		3513
06	2126	2144	2155	N20E55	M2.3	1B				3513
08	2257	2307	2314	S21W47	M5.4	1B		III/3	79	3511
09	0941	0955	1006	S21W54	M1.5	SF		III/2	79	3511
09	1303	1319	1337		M1.0			III/1	79	3511
10	0342	0353	0358	S20W66	M2.3	SF				3511
10	2237	2243	2247		M1.4					3511

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

## 4. Geomagnetic Observations in Belgium



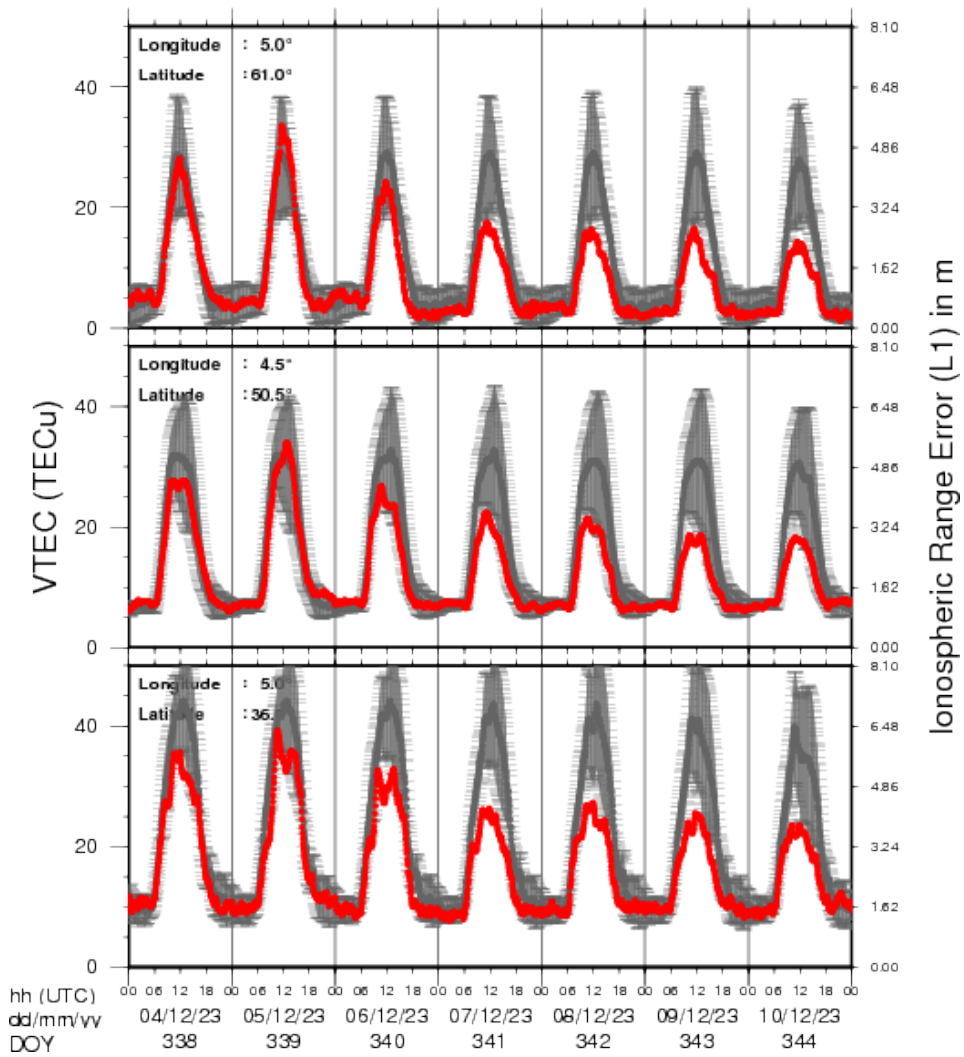
Local K-type magnetic activity index for Belgium based on data from Dourbes (DOU) and Manhay (MAB). Comparing the data from both measurement stations allows to reliably remove outliers from the magnetic data. At the same time the operational service availability is improved: whenever data from one observatory is not available, the single-station index obtained from the other can be used as a fallback system.

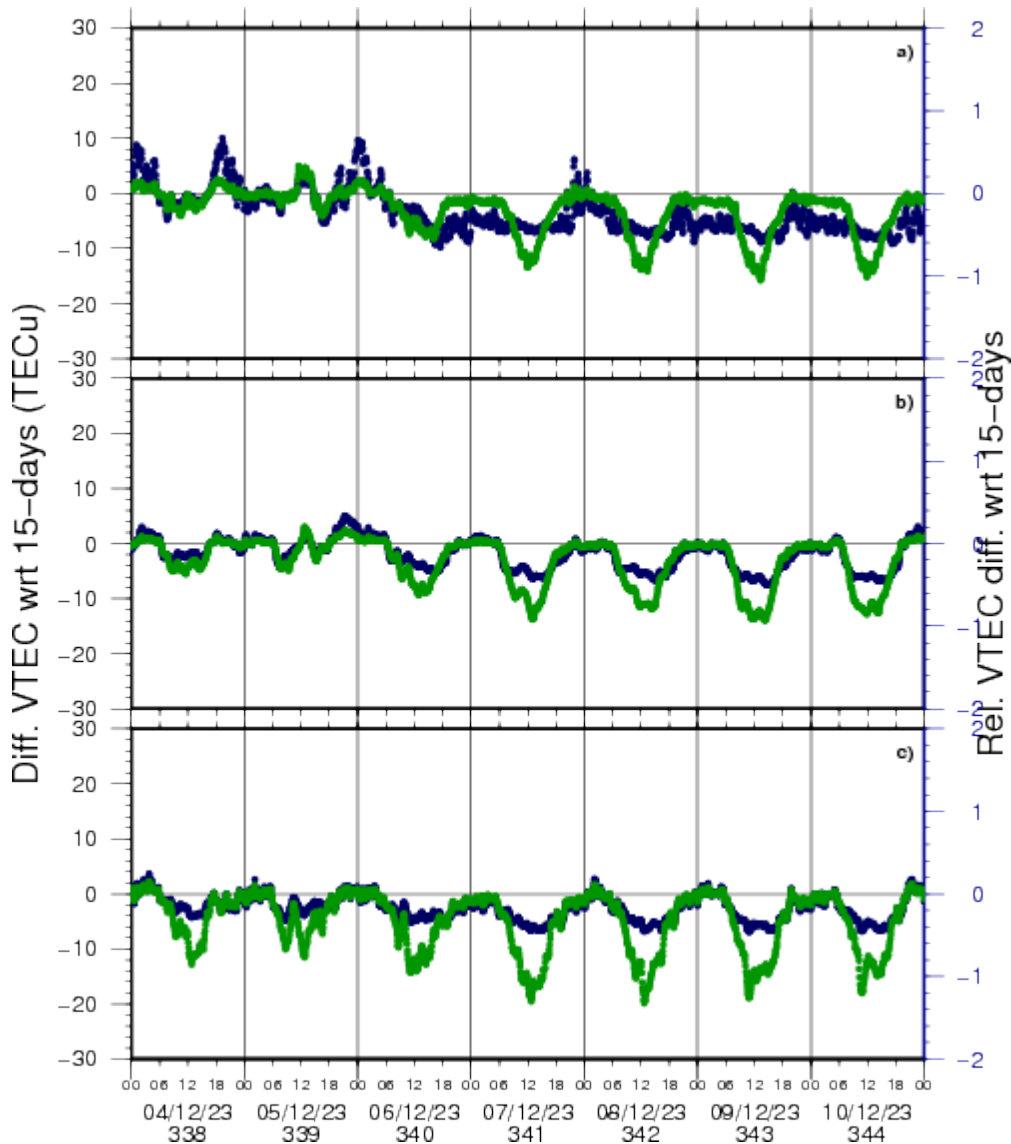
Both the two-station index and the single station indices are available here: [http://ionosphere.meteo.be/geomagnetism/K\\_BEL/](http://ionosphere.meteo.be/geomagnetism/K_BEL/)

## 5. Review of Ionospheric Activity

NEW! The time series below illustrates (in green) the VTEC deviation from normal quiet behaviour.

# VTEC Time Series





VTEC time series at 3 locations in Europe from 4 Dec 2023 till 10 Dec 2023

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

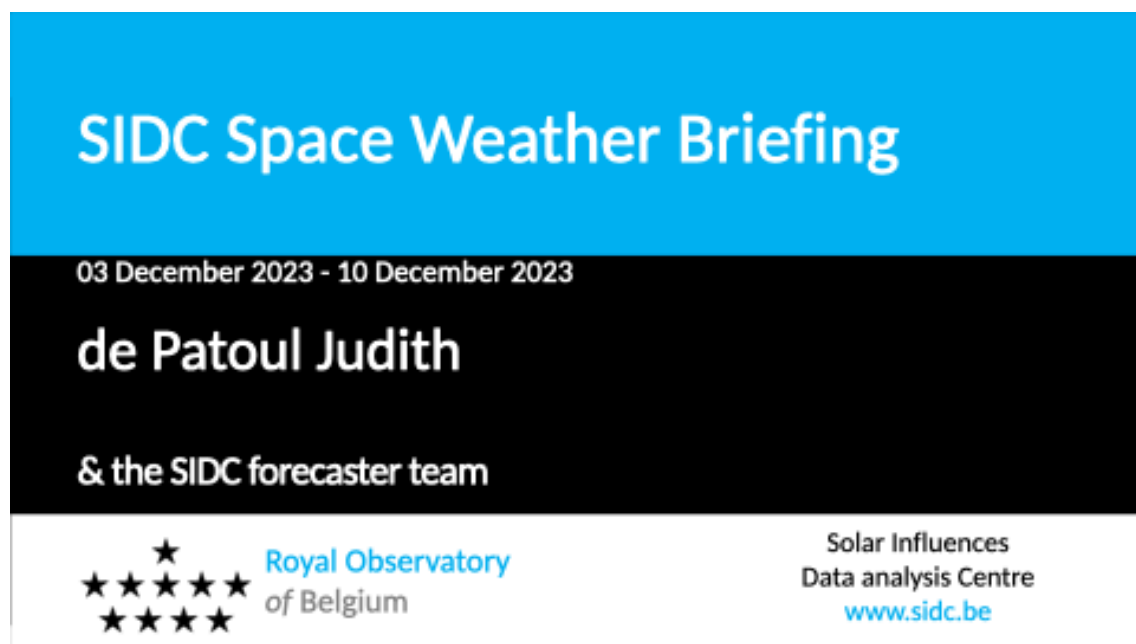


electrons. These electrons perturb the propagation of the GNSS (Global Navigation Satellite System) signals by inducing a so-called ionospheric delay.

See [http://stce.be/newsletter/GNSS\\_final.pdf](http://stce.be/newsletter/GNSS_final.pdf) for some more explanations ; for detailed information, see [http://gnss.be/ionosphere\\_tutorial.php](http://gnss.be/ionosphere_tutorial.php)

## 6. The SIDC Space Weather Briefing

The Space Weather Briefing presented by the forecaster on duty from 4 to 10 December. It reflects in images and graphs what is written in the space weather report: [https://www.stce.be/briefings/20231211\\_SWbriefing](https://www.stce.be/briefings/20231211_SWbriefing)



If you need to access the movies, contact us: [stce\\_coordination at stce.be](mailto:stce_coordination@stce.be)

## 7. STCE Activities

Check out our activity calendar: activities and encounters 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.

If you want your event in our calendar, contact us: [stce\\_coordination at stce.be](mailto:stce_coordination@stce.be)

\* Jan 22-24, 2024, STCE Space Weather Introductory Course, Brussels, Belgium - Registrations are open

\* Jan 25, 2024, post-Space Weather Introductory Course, by JMG and MeteoWing, place TBD - registration is included in the Jan SWIC

\* Mar 4-5, 2024, STCE Space Weather Introductory Course, focus on aviation, online - Registrations are open

\* Apr 22-24, 2024, STCE Space Weather Introductory Course, Brussels, Belgium - Registrations are open

More info needed? Contact us: [stce\\_coordination at stce.be](mailto:stce_coordination@stce.be)

Check: <https://www.stce.be/calendar>

