

# STCE Newsletter

26 Sep 2016 - 2 Oct 2016



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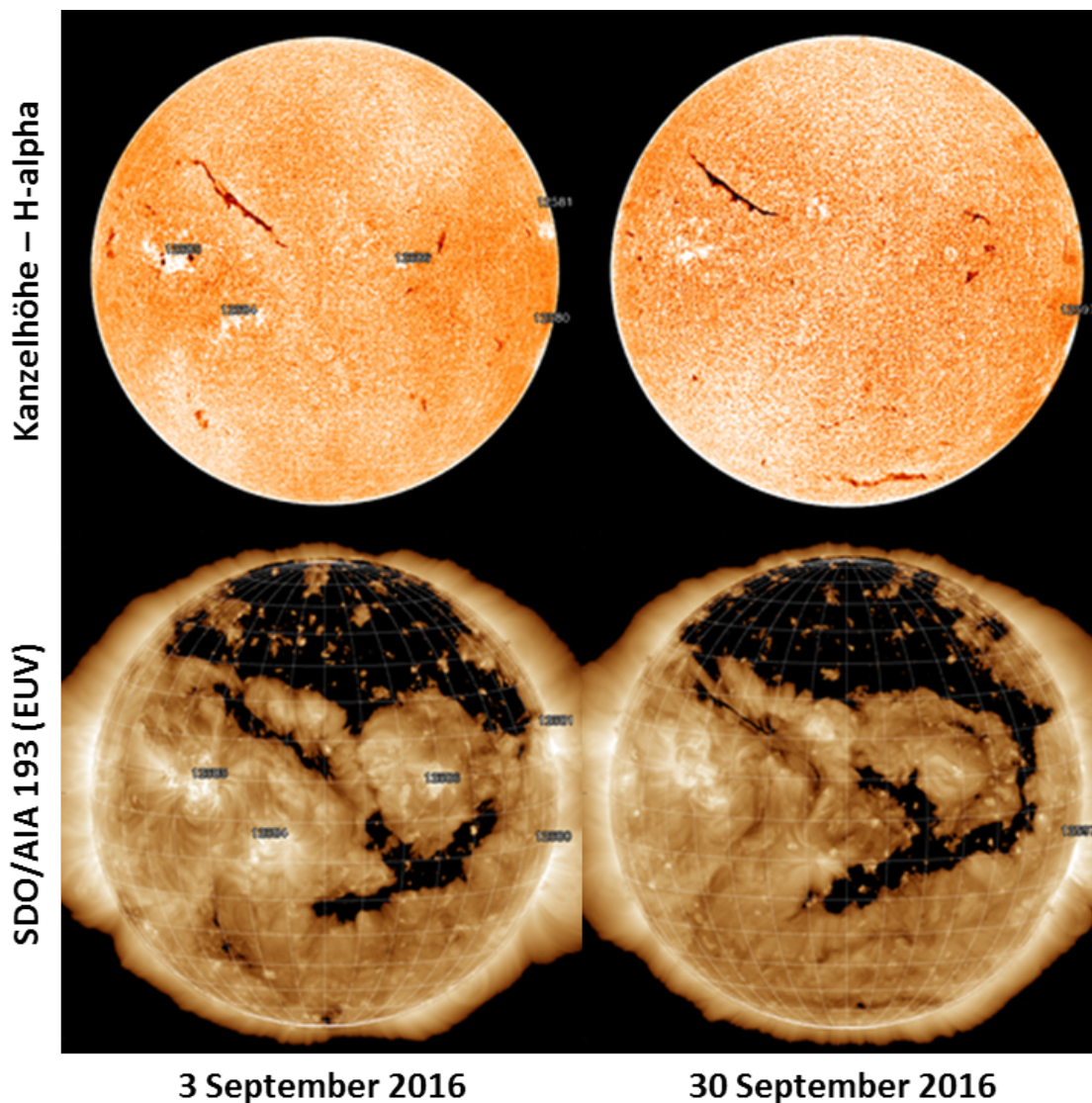
The Solar-Terrestrial Centre of Excellence (STCE) is a collaborative network of the Belgian Institute for Space Aeronomy, the Royal Observatory of Belgium and the Royal Meteorological Institute of Belgium.

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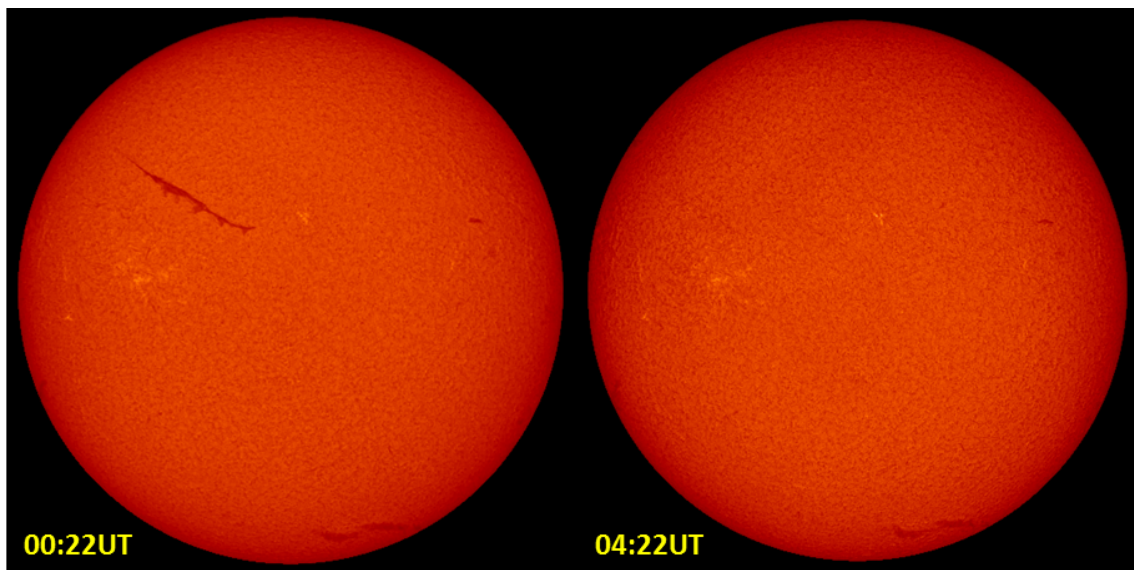
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## 1. So long, filament!

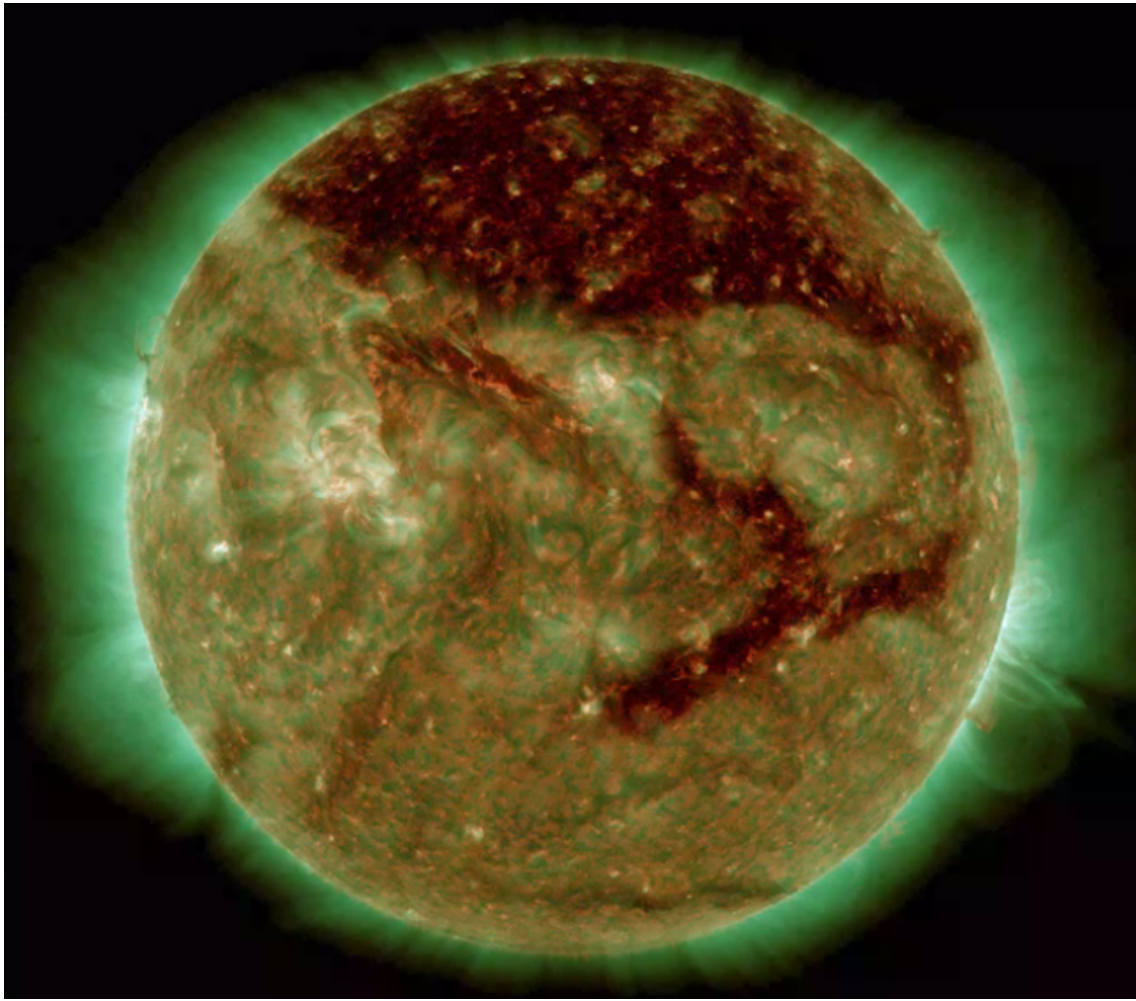
A filament eruption took place early on 1 October (movie at <https://youtu.be/dDhC0CsKTmk> ). This filament had a respectable length of about 40 degrees, i.e. more than 10% of the solar circumference or well over the average Earth-Moon distance. The feature was already visible during the previous solar rotation early September, when it transited the solar disk uneventfully (see this news item at <http://www.stce.be/news/361/welcome.html> ).



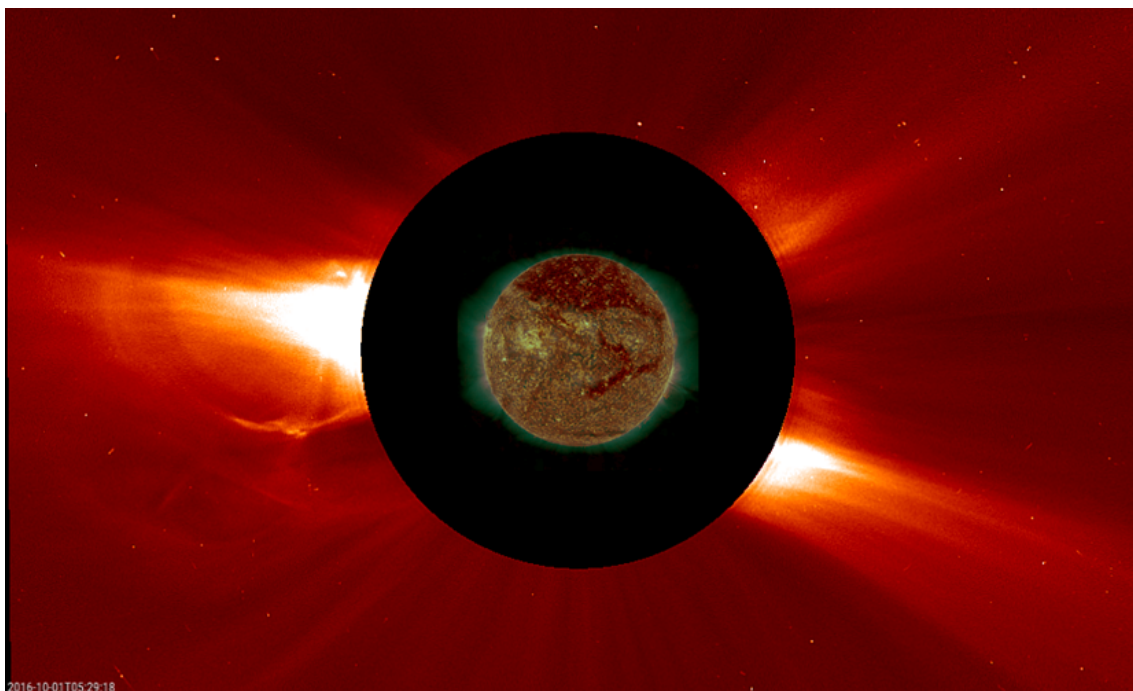
Solar filaments are clouds of ionized gas above the solar surface squeezed between magnetic regions of opposite polarity. Being cooler and denser than the plasma underneath and their surroundings, they appear as dark lines when seen on the solar disk using special filters, such as Hydrogen-alpha (H-alpha; 656.28 nm). The image underneath was taken using such a filter by ground-based observatories of the GONG H-alpha Network (<http://halpha.nso.edu/> ). It shows the Sun on 1 October at 00:22UT (left) and only 4 hours later (right). In that relatively short time, the filament completely erupted and the "scar" in the northeast quadrant entirely disappeared.



Filaments are structures that only survive by the stability of the surrounding magnetic fields. In movies using H-alpha and extreme ultraviolet (EUV) filters, the northeast part can be seen to become unstable and start erupting around 01:15UT, taking with it the rest of the filament during the subsequent 2 hours. The northeast edge of the filament was the closest to the huge coronal hole (as seen in EUV: see SDO image underneath; <http://sdo.gsfc.nasa.gov/> ), so some interaction between the two is a possible cause for the eruption. No x-ray flare seems to have been associated with the event, as the sole flare during that time -a tiny B3.4 flare peaking at 02:19UT- was related to a small eruption near the Sun's northeast limb.



The SDO image above was taken at 04:30UT, showing a coronal dimming (also known as "transient coronal hole") near the location of the departed filament. This is indicative that plasma (charged particles) was ejected from the Sun into space puncturing a temporary hole in the Sun's atmosphere. Sure enough, SOHO's coronagraphs observed a coronal mass ejection (CME) billowing away from the Sun (image underneath), albeit at a moderate plane-of-the-sky speed of barely 300 km/s (CACTus; <http://www.sidc.oma.be/cactus/>). This CME was not directed to Earth.



## **2. PROBA2 Observations (26 Sep 2016 - 2 Oct 2016)**

### **Solar Activity**

Solar flare activity fluctuated between very low and low 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: <http://proba2.oma.be/ssa>

This page also lists the recorded flaring events.

A weekly overview movie can be found here (SWAP week 340).

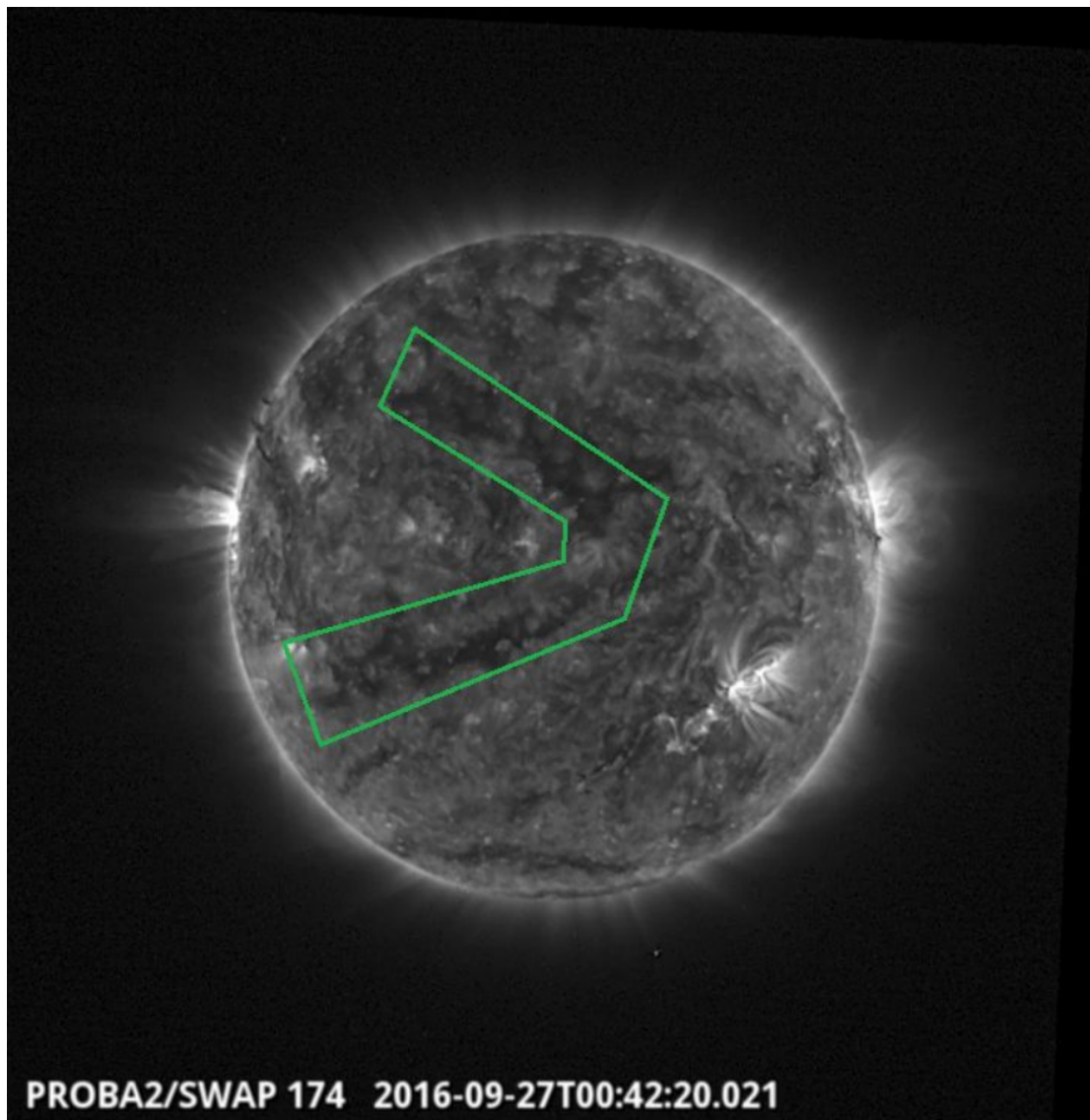
[http://proba2.oma.be/swap/data/mpg/movies/weekly\\_movies/weekly\\_movie\\_2016\\_09\\_26.mp4](http://proba2.oma.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2016_09_26.mp4)

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

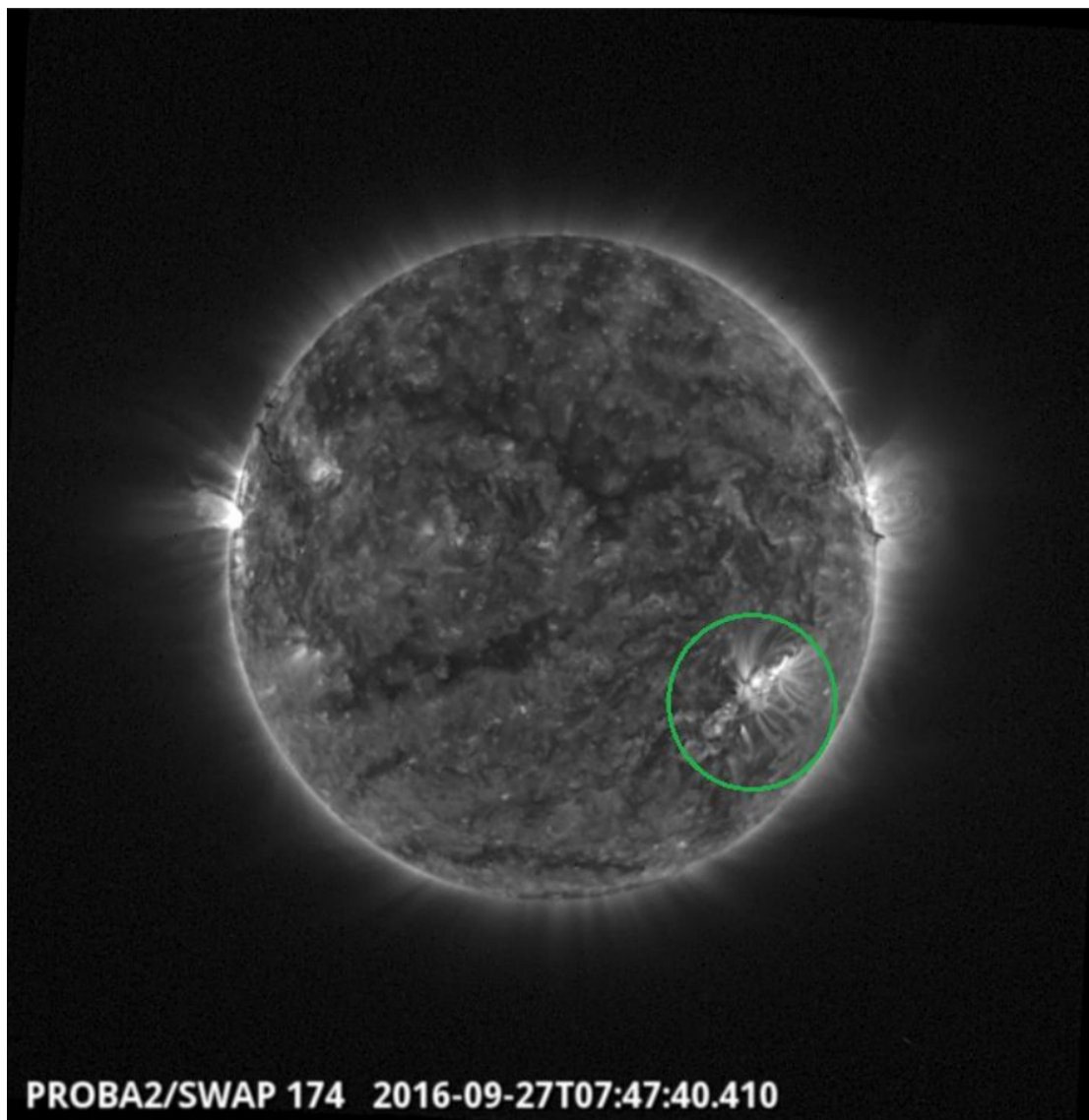
If any of the linked movies are unavailable they can be found in the P2SC movie repository here

[http://proba2.oma.be/swap/data/mpg/movies/weekly\\_movies/](http://proba2.oma.be/swap/data/mpg/movies/weekly_movies/)

Thursday Sep 27

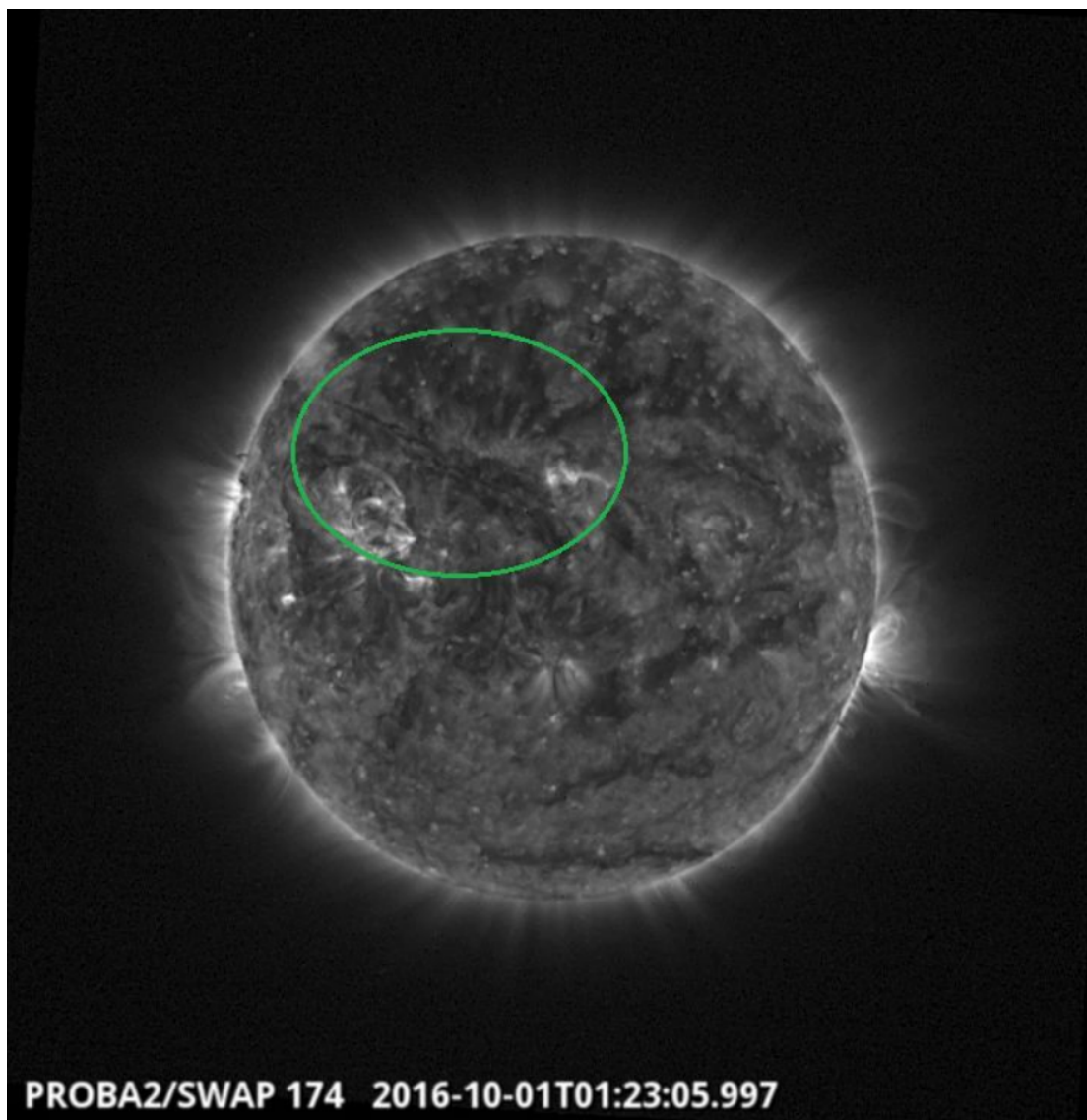


A thin centrally located coronal hole dominated the solar disk throughout the week  
Find a movie of the events here (SWAP movie)  
[http://proba2.oma.be/swap/data/mpg/movies/20160927\\_swap\\_movie.mp4](http://proba2.oma.be/swap/data/mpg/movies/20160927_swap_movie.mp4)

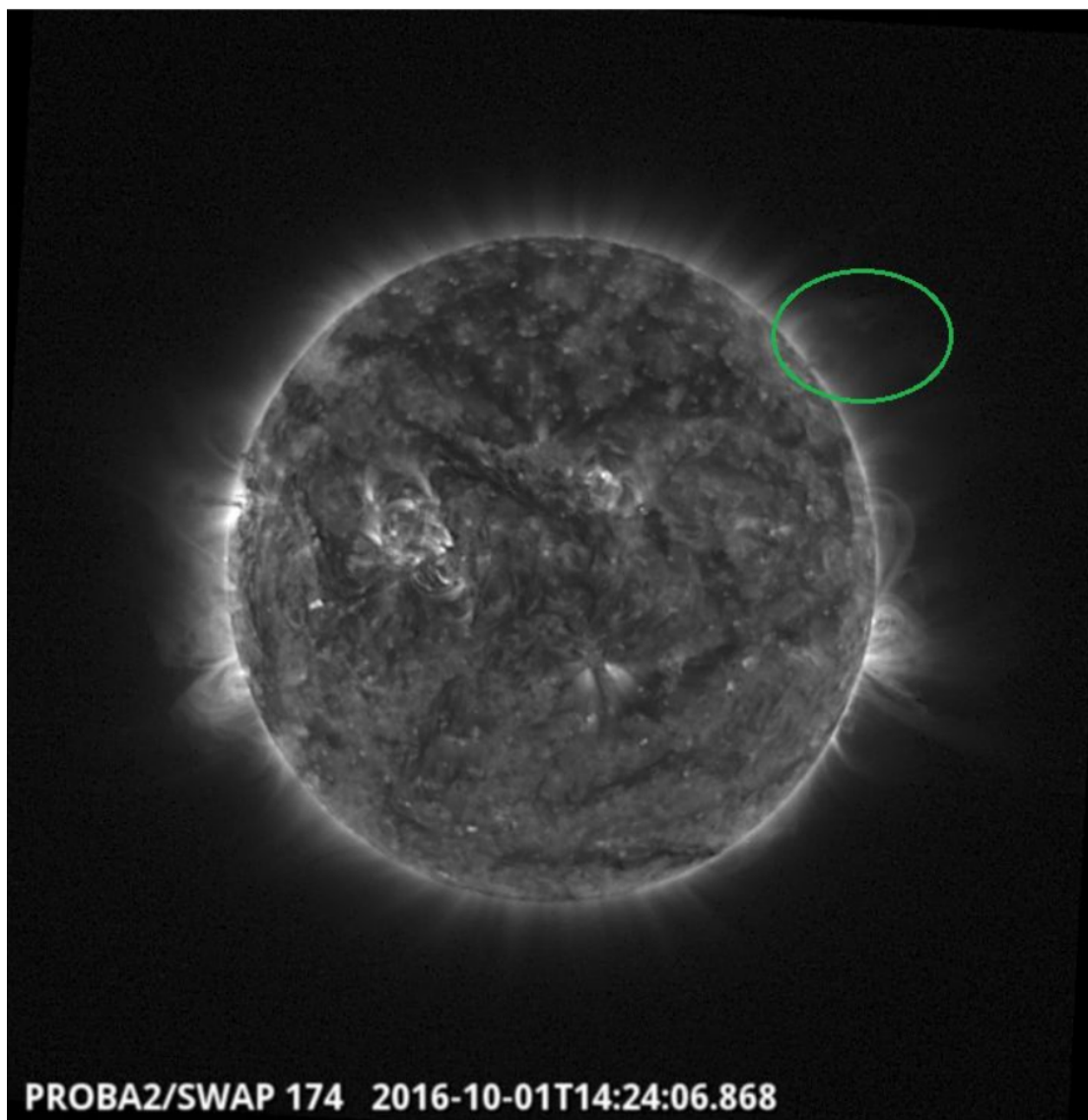


NOAA AR 2597 produced the largest flare of the week, a C1.0 class flare, which peaked at 07:48 UT. This group was most active throughout the week producing several B-class flares. Find a movie of the events here (SWAP movie)  
[http://proba2.oma.be/swap/data/mpg/movies/20160927\\_swap\\_movie.mp4](http://proba2.oma.be/swap/data/mpg/movies/20160927_swap_movie.mp4)

**Saturday Oct 1**

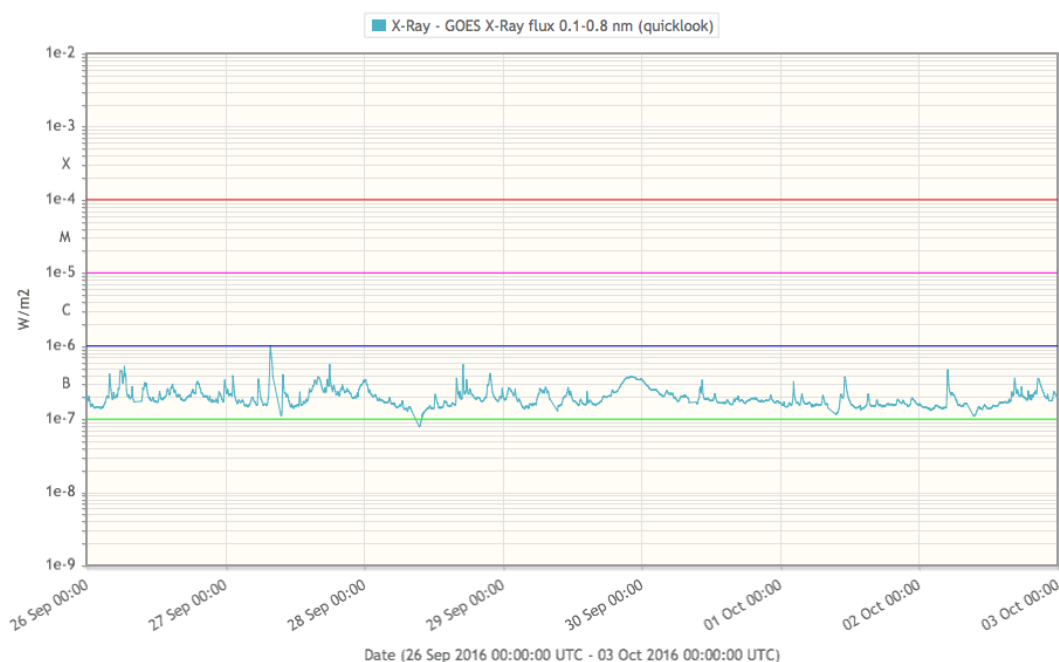


A large filament located in the northern hemisphere erupted  
On Oct 1 at about 01:20 UT. The eruption was associated with a coronal  
dimming, EUV wave and CME. Find a movie of the events here (SWAP movie)  
[http://proba2.oma.be/swap/data/mpg/movies/20161001\\_swap\\_movie.mp4](http://proba2.oma.be/swap/data/mpg/movies/20161001_swap_movie.mp4)



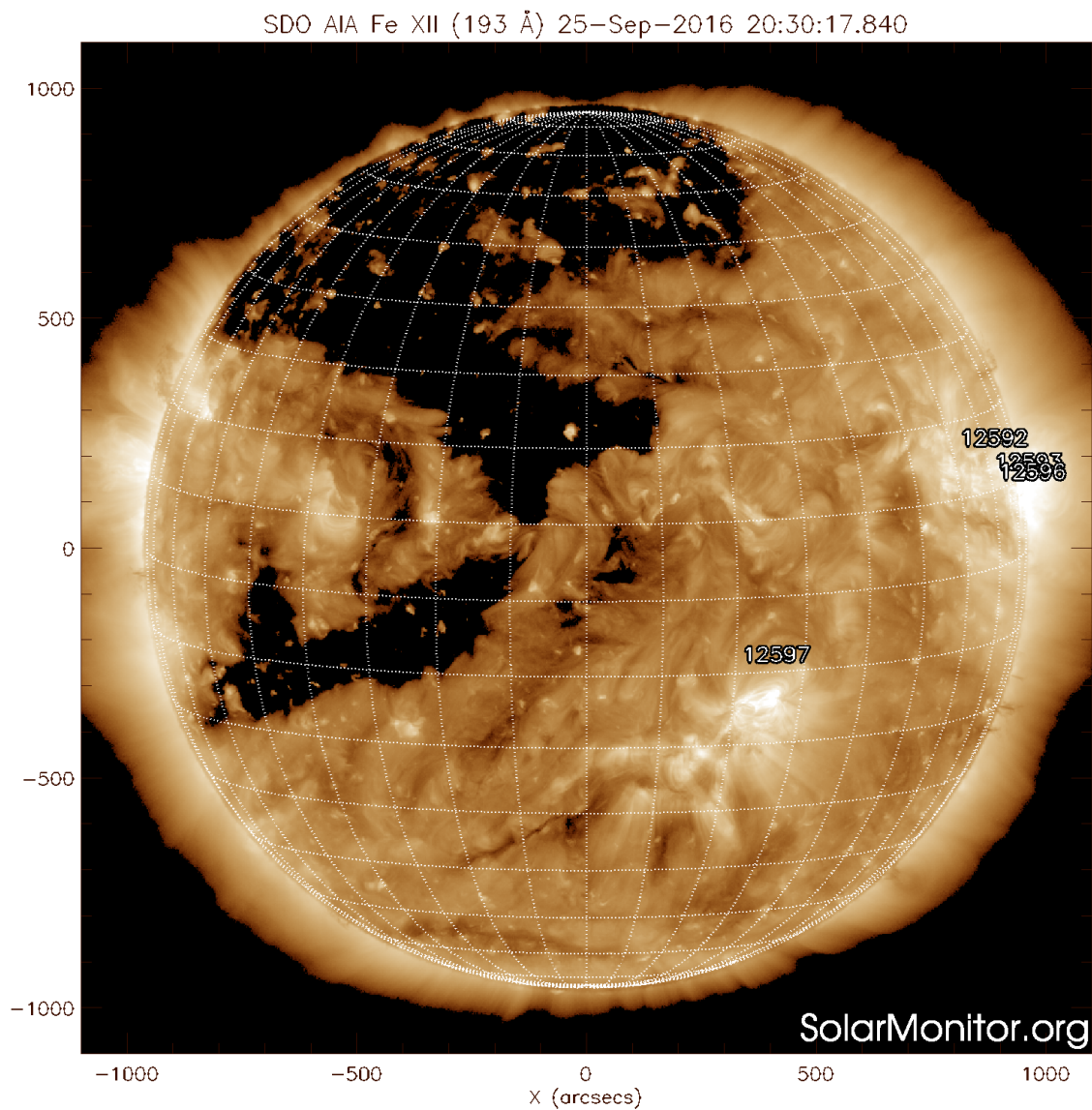
A small CME erupted off of the the north-east limb at 14:24 UT on 01 October.  
Find a movie of the events here (SWAP movie)  
[http://proba2.oma.be/swap/data/mpg/movies/20161001\\_swap\\_movie.mp4](http://proba2.oma.be/swap/data/mpg/movies/20161001_swap_movie.mp4)

### 3. Review of solar activity



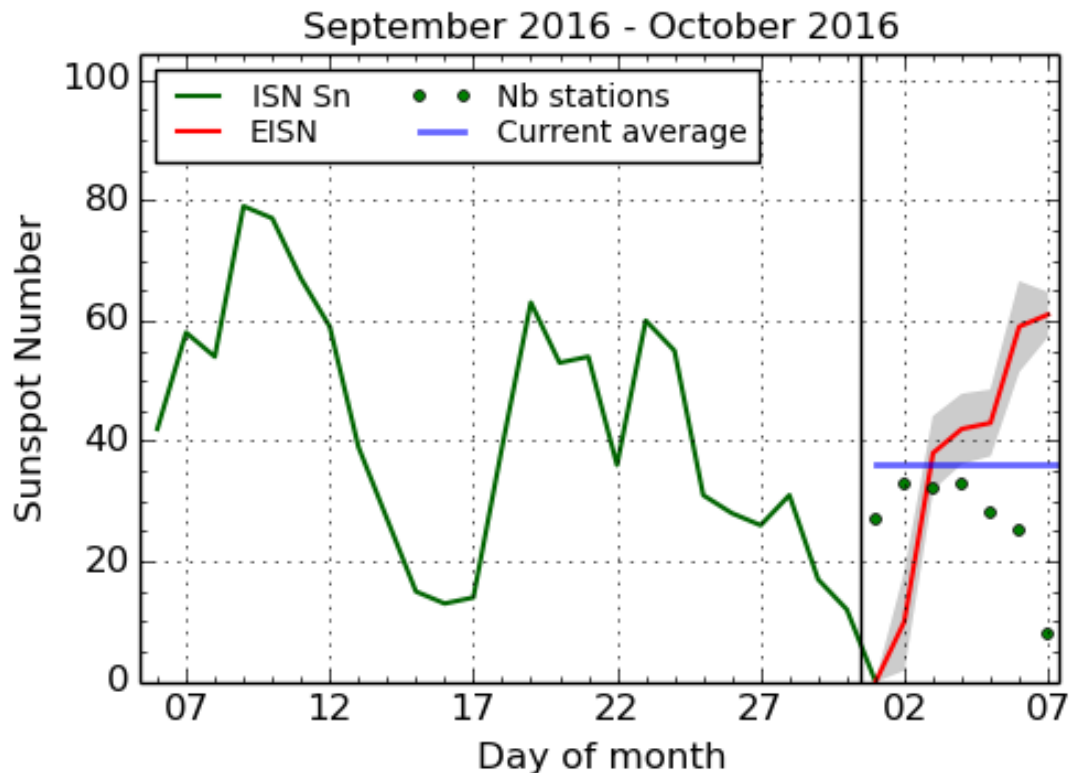
Solar activity was very low with only 1 C-class flare and several B-class flares observed by GOES. The confined C1.0 flare (peaked at 07:48 UT on September 27) originated from the NOAA AR 2597 which at that moment had beta-gamma configuration of its photospheric magnetic field.

There were only several CMEs reported this week, and all of them were narrow (up to 100 degrees of angular width), slow and not Earth directed.



The large low latitude extension of the northern polar coronal hole, and the possibly connected elongated coronal hole on the southern hemisphere, started to cross central meridian on the mid-day of September 25 (last day of the previous week). Check the science highlight 'Return of the Behemoth' <http://www.stce.be/news/363/welcome.html>

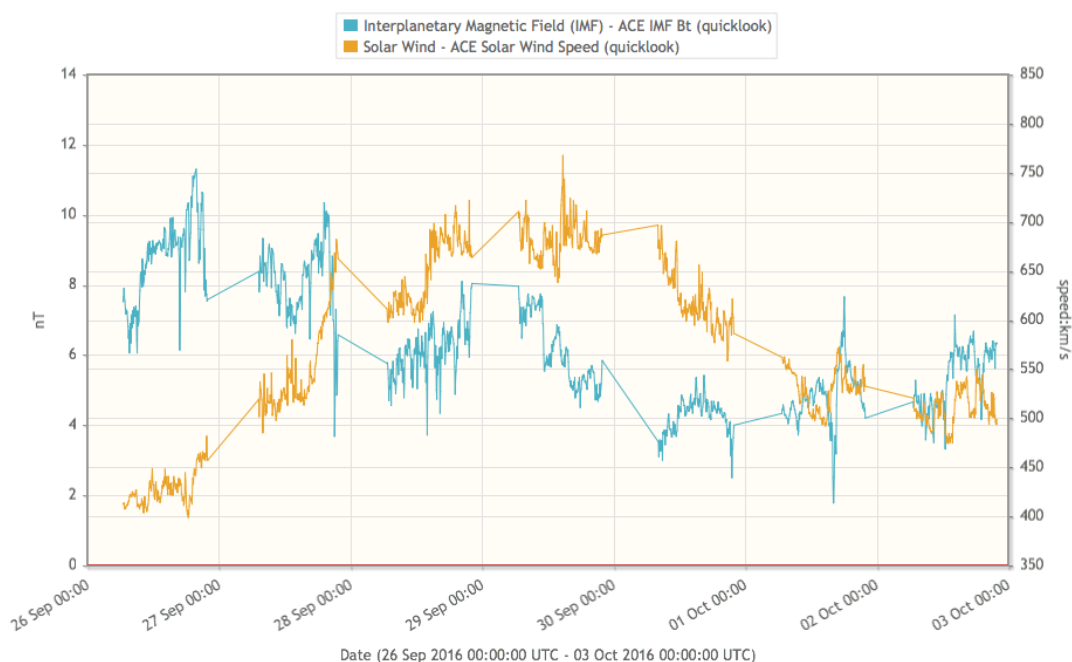
#### 4. The International Sunspot Number



SILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium, 2016 October 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). The plot shows the last 30 days (about one solar rotation). The horizontal blue line shows the current monthly average, while the green dots give the number of stations included in the calculation of the EISN for each day.

## 5. Review of geomagnetic activity (26 Sep 2016 - 2 Oct 2016)

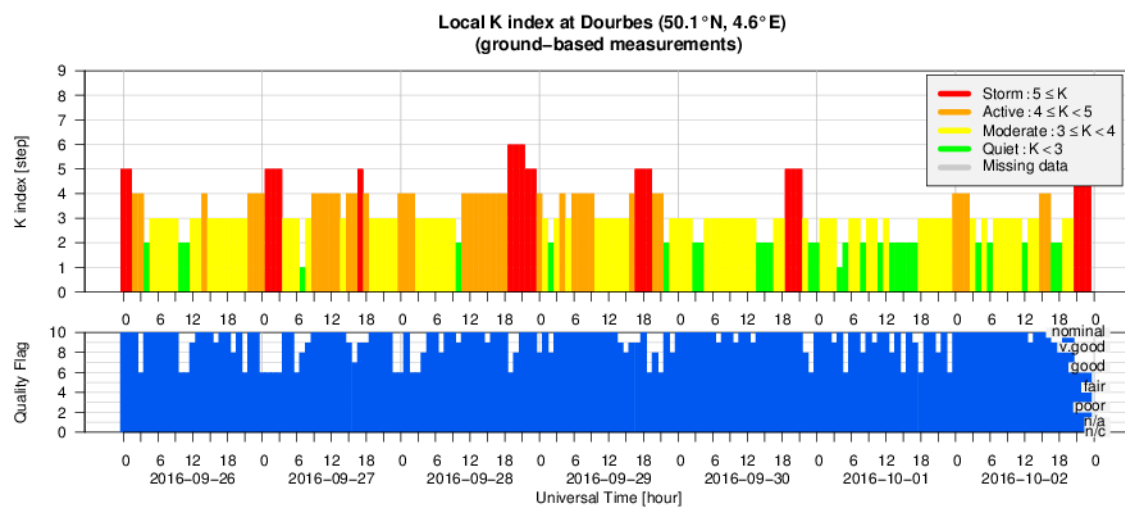


The solar wind speed and the total interplanetary magnetic field strength measured at the L1 point by ACE. The straight lines denote data gaps.

Due to the influence of the fast solar wind, associated with the low latitude extension of the northern polar coronal hole, the geomagnetic conditions during this week were most of the time active up to the storm conditions (local station at Dourbes was reporting  $K=5$ , and NOAA  $K_p=5$ ) and with even two intervals of minor storm conditions. The arrival of the fast solar wind has induced minor storm conditions in the evening of September 27 and September 28 (starting at around 18:00 UT). The combination of the fast solar wind (speeds of about 680 and 740 km/s, respectively) and the intervals of the negative value of the  $B_z$  component of the interplanetary magnetic field (down to -7 nT), has caused the storm conditions. During both of the mentioned intervals the local station at Dourbes reported  $K=6$ , and NOAA reported  $K_p=6$ .

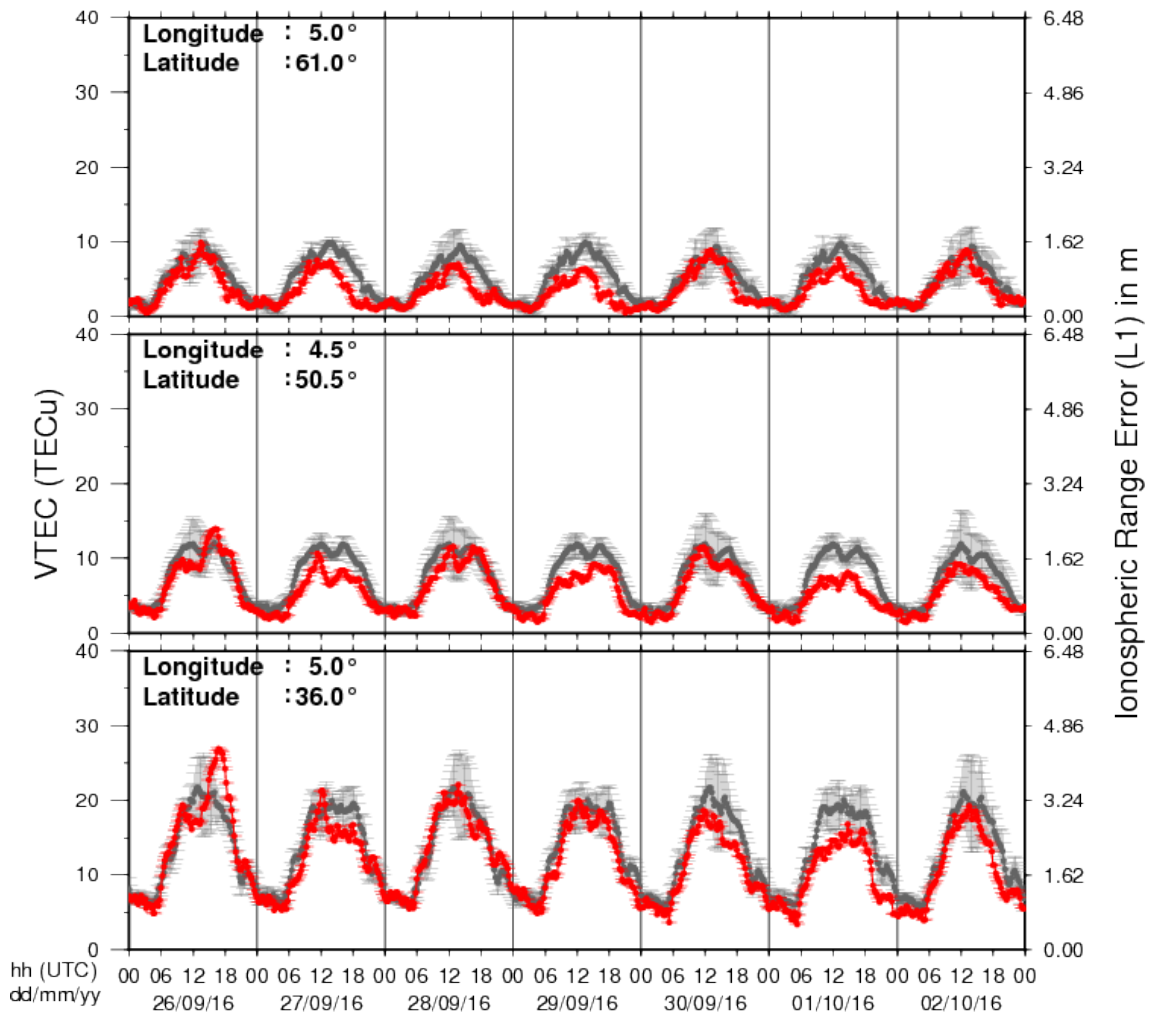
The maximum of the solar wind speed reported during last week (of about 800 km/s), was observed in the early morning of September 30.

## 6. Geomagnetic Observations at Dourbes (26 Sep 2016 - 2 Oct 2016)



## 7. Review of ionospheric activity (26 Sep 2016 - 2 Oct 2016)

### VTEC Time Series



The 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(N61°, 5°E)
- b) above Brussels(N50.5°, 4.5°E)
- c) in the southern part of Europe(N36°, 5°E)

This figure also shows (in grey) the normal ionospheric behaviour expected based on the median VTEC from the 15 previous days.

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)

## **8. Future Events**

**For more details, see <http://www.spaceweather.eu/en/event/future>**

### **4th Asia Oceania Space Weather Alliance (AOSWA) Workshop, in Jeju, Republic of Korea**

Start : 2016-10-24 - End : 2016-10-27

Website:

<http://aoswa4.spaceweather.org/index.php>

### **Global Modelling of the Space Weather Chain in Helsinki, Finland**

Start : 2016-10-24 - End : 2016-10-28

This event brings together solar, heliospheric, magnetospheric, and ionospheric communities to discuss the current state and future challenges in global modelling of the entire space weather chain. Major developments in forecasting space weather, and understanding the effects of solar eruptions requires increased communication and collaboration of these often rather distinct communities. We welcome submissions from these modelling communities and also synergetic studies utilising both observations and numerical models.

Website:

[https://pnst.ias.u-psud.fr/sites/pnst/files/global\\_modelling\\_space\\_weather\\_oct2016.pdf](https://pnst.ias.u-psud.fr/sites/pnst/files/global_modelling_space_weather_oct2016.pdf)

### **European Space Weather Week in Ostend, Belgium**

Start : 2016-11-14 - End : 2016-11-18

The ESWW is the main annual event in the European Space Weather calendar. It is the European forum for Space Weather as proven by the high attendance to the past editions. The agenda will be composed of plenary/parallel sessions, working meetings and dedicated events for service end-users. The ESWW will again adopt the central aim of bringing together the diverse groups in Europe working on different aspects of Space Weather.

Website:

<http://www.stce.be/esww13/>

### **4th SOLARNET Meeting: The Physics of the Sun from the Interior to the Outer Atmosphere, in Lanzarote (Spain)**

Start : 2017-01-16 - End : 2017-01-20

The IV SOLARNET MEETING 'The physics of the Sun from the interior to the outer atmosphere' will take place in Lanzarote (Spain) from 16th to 20th of January 2017, organized by the Instituto de Astrofísica de Canarias (IAC).

SOLARNET (High-resolution Solar Physics Network) is an EU-FP7 project coordinated by IAC with the aim of bringing together and integrating the major European research infrastructures in the field of high-resolution solar physics. SOLARNET involves all pertinent European research institutions, infrastructures, and data repositories. Networking activities, access to first-class infrastructures and joint research and development activities are being covered under SOLARNET to improve, in quantity and quality, the service provided by this European community.

The purpose of this conference is to provide a coherent picture of the Sun as a single physical system playing all the underlying physical processes measured and observed in the solar atmosphere to date.

Website:

<http://www.iac.es/congreso/solarnet-4meeting/>

## **Solar Orbiter Workshop 7: Exploring the solar environs in Granada, Spain**

Start : 2017-04-03 - End : 2017-04-06

This event will be hosted by the Instituto de Astrofísica de Andalucía - CSIC. Please mind that on April 7th the 20th SWT meeting will take place at the same venue.

Website: Unkown