

STCE Newsletter

18 Sep 2017 - 24 Sep 2017



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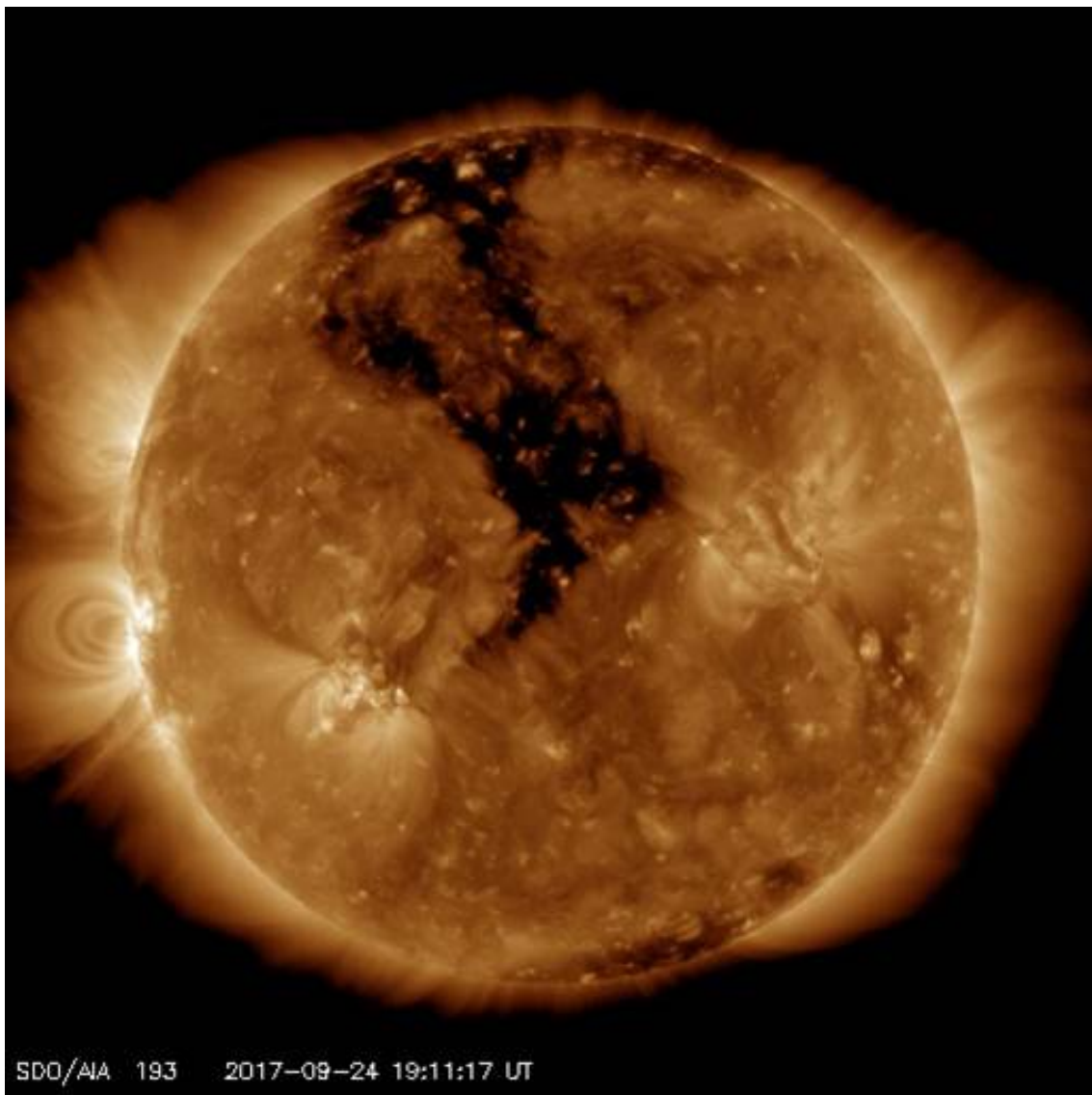
The Solar-Terrestrial Centre of Excellence (STCE) is a collaborative network of the Belgian Institute for Space Aeronomy, the Royal Observatory of Belgium and the Royal Meteorological Institute of Belgium.

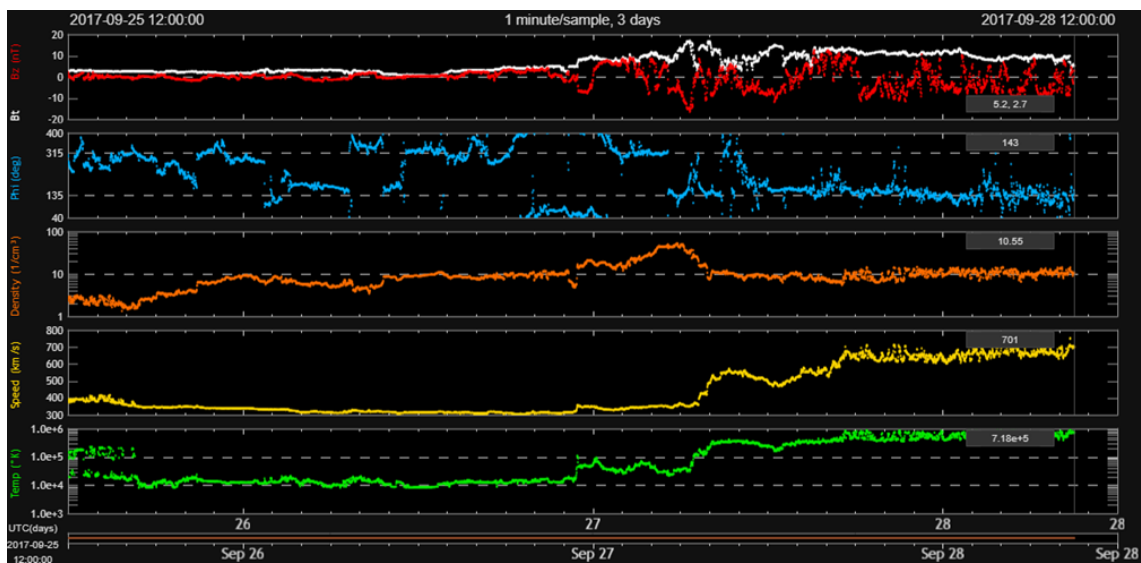
Content	Page
1. Recurrent Coronal Hole	2
2. PROBA2 Observations (18 Sep 2017 - 24 Sep 2017)	5
3. Review of solar activity (18 Sep 2017 - 24 Sep 2017)	7
4. The International Sunspot Number	10
5. Review of geomagnetic activity	10
6. Geomagnetic Observations at Dourbes (18 Sep 2017 - 24 Sep 2017)	12
7. SIDC space weather briefing	12
8. Review of ionospheric activity (18 Sep 2017 - 24 Sep 2017)	14
9. Future Events	15

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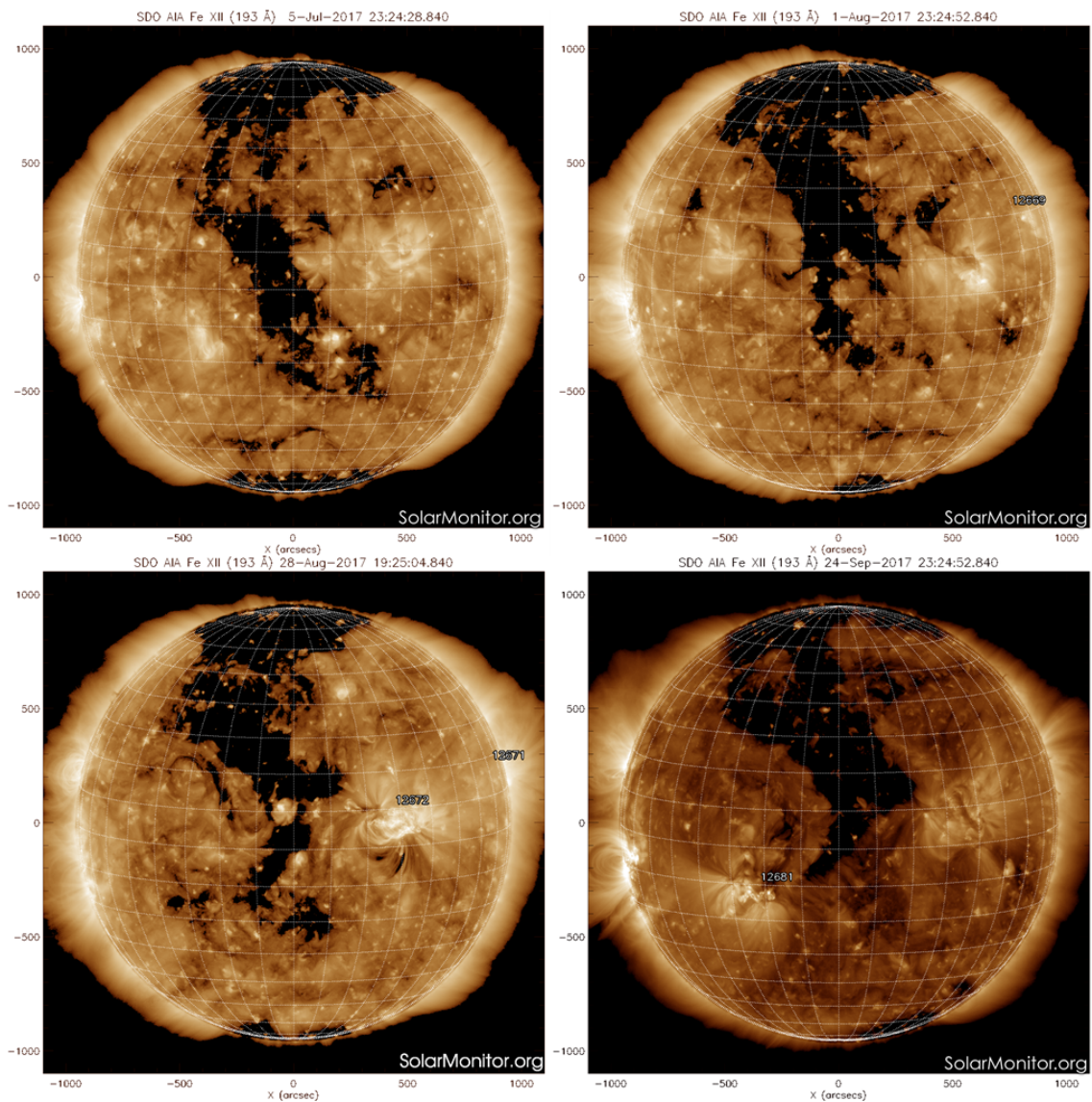
1. Recurrent Coronal Hole

Earth is currently under the influence of the high speed stream (HSS) associated with the extension of the northern polar coronal hole (CH). This trans-equatorial CH transited the Sun's Central Meridian around 24 September (see SDO image underneath - <https://sdo.gsfc.nasa.gov/>). The associated particle stream arrived at Earth late on 26 September, with wind speeds picking up on 27 September and reaching peak values around 710 km/s and Bz at -17 nT (DSCOVR - <http://www.swpc.noaa.gov/products/real-time-solar-wind>). See resp. the yellow and red curves in the DSCOVR graph underneath. As a result, global geomagnetic indices indicate a strong geomagnetic storm is in progress (Kp = 7 - See this news item at <http://www.stce.be/news/243/welcome.html> for more info on this index). Locally, K Dourbes is at minor storming conditions. With the storm still in progress, further geomagnetic storming episodes are expected over the next few days.





This is already the 4th transit of this CH over the solar disk. It started to develop early June, and crossed the Central Meridian (CM) on resp. 5 July, 1 August, 28 August and 24 September. See the SDO imagery underneath. It has a positive magnetic field, meaning that the magnetic field lines in are directed away from the Sun.



The table underneath summarizes the main features of the HSS during the previous passages. First column gives the passage over the CM, then the estimated arrival time of the particle stream at Earth, the approximate peak in solar wind speed (km/s) and vertical component of the magnetic field (B_z ; in nT). For comparison, the undisturbed solar wind values are resp. about 400 km/s and between +3 and -3 nT. During the previous passages, the geomagnetic effects were limited to brief episodes of minor geomagnetic storming (Kp), with Dst (Storm Time Disturbance index - <https://www.ngdc.noaa.gov/stp/geomag/dst.html>) barely reaching -50 nT. This time however, the influence is much more intense, with Kp reaching 7 and Dst already at -100 nT and further decreasing as the geomagnetic storm unfolds. Once again, it shows that the Earth environment is more vulnerable to solar wind disturbances during spring and autumn, the so-called Russell-McPherron effect (see <http://adsabs.harvard.edu/abs/1973JGR....78...92R>). If the CH survives another solar rotation, then we may be in for more strong geomagnetic storming next month.

Estimated		Estimated peak values		Preliminary	
CM passage	Arrival HSS at Earth	Wind speed (km/s)	Bz (nT)	NOAA Kp	Kyoto Dst (nT)
5 July	8 July / 23UT	640	-12	5	-33
1 August	3 August / 10UT	780	-17	4	-30
28 August	31 August / 01UT	750	-19	5	-50
24 September	26 September / 23UT	710	-17	7	-100

2. PROBA2 Observations (18 Sep 2017 - 24 Sep 2017)

Solar Activity

Solar flare activity remained very 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.

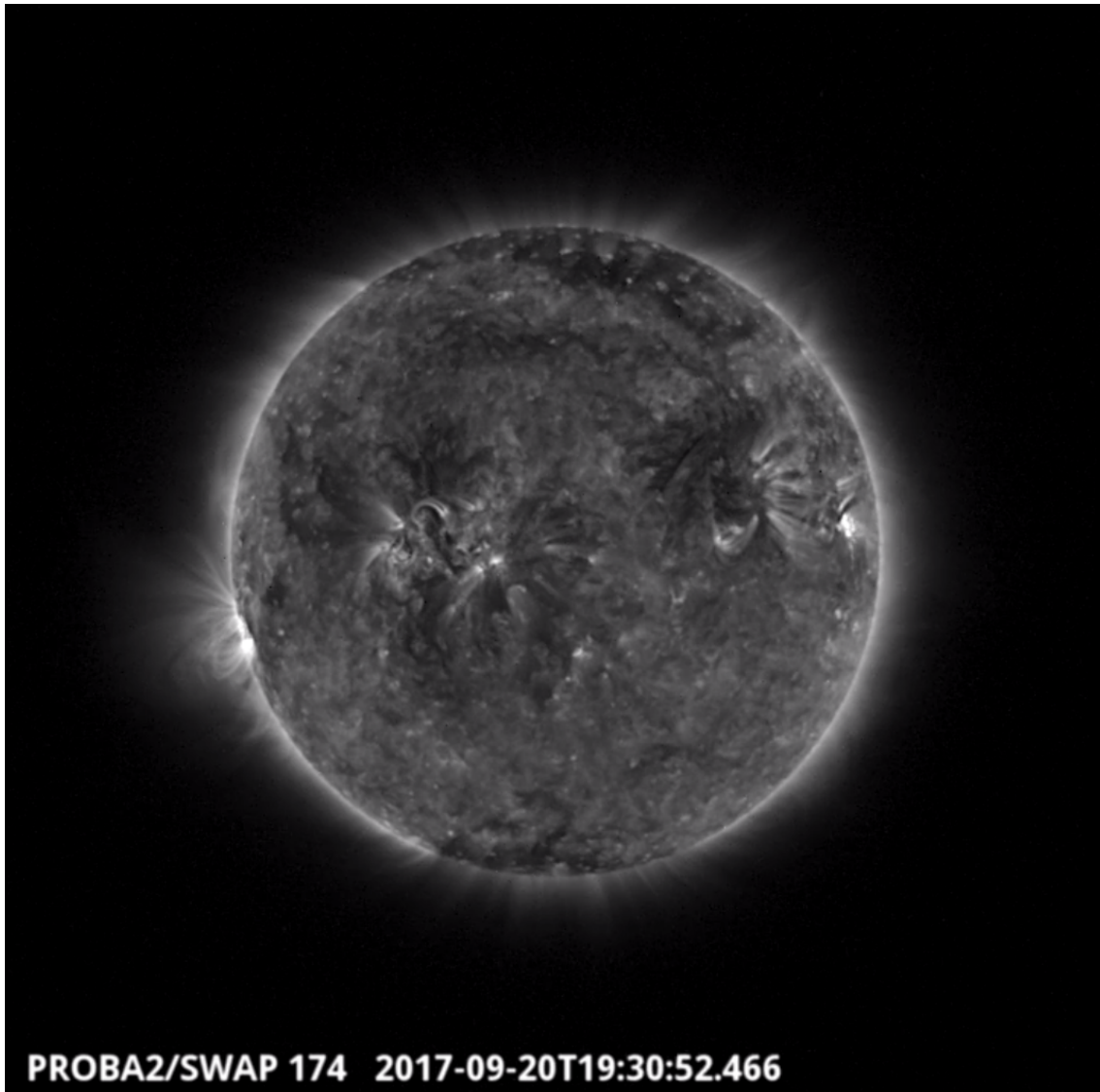
A weekly overview movie can be found here (SWAP week 391):

http://proba2.oma.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2017_09_18.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/>

Wednesday Sep 20



The largest flare of the week was a B-class (B8.4) flare and was observed by SWAP on 2017-Sep-20. The flare and associated eruption are visible near the western limb of the Sun in the SWAP image above at 19:30 UT.

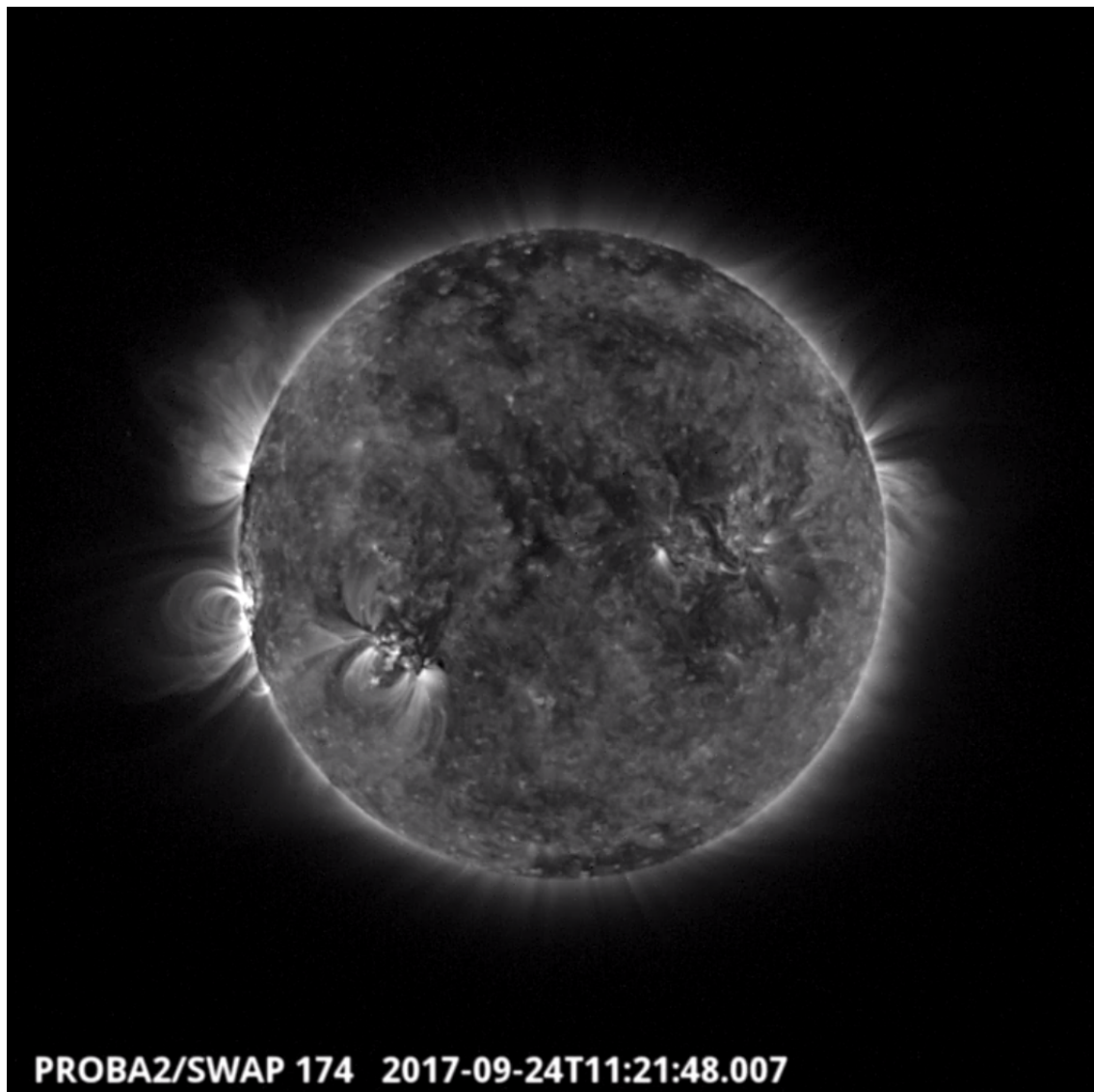
Find a movie of the event here (SWAP movie):

http://proba2.oma.be/swap/movies/20170920_swap_movie.mp4

and here (SWAP difference movie):

http://proba2.oma.be/swap/movies/20170920_swap_diff.mp4

Sunday Sep 24



SWAP observed a B2.7 flare from NOAA active region 2682 as it began to appear over the eastern limb of the Sun on 2017-Sep-24. The flare is shown in the SWAP image above at 11:21 UT and resultant flows along the loops can be seen in the SWAP movies below.

Find a movie of the event here (SWAP movie):

http://proba2.oma.be/swap/movies/20170924_swap_movie.mp4

and here (SWAP difference movie):

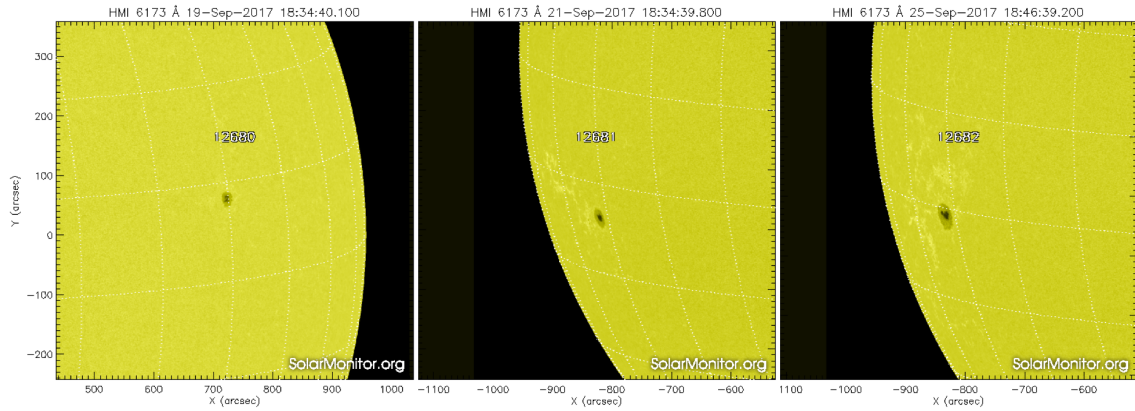
http://proba2.oma.be/swap/movies/20170924_swap_diff.mp4

3. Review of solar activity (18 Sep 2017 - 24 Sep 2017)

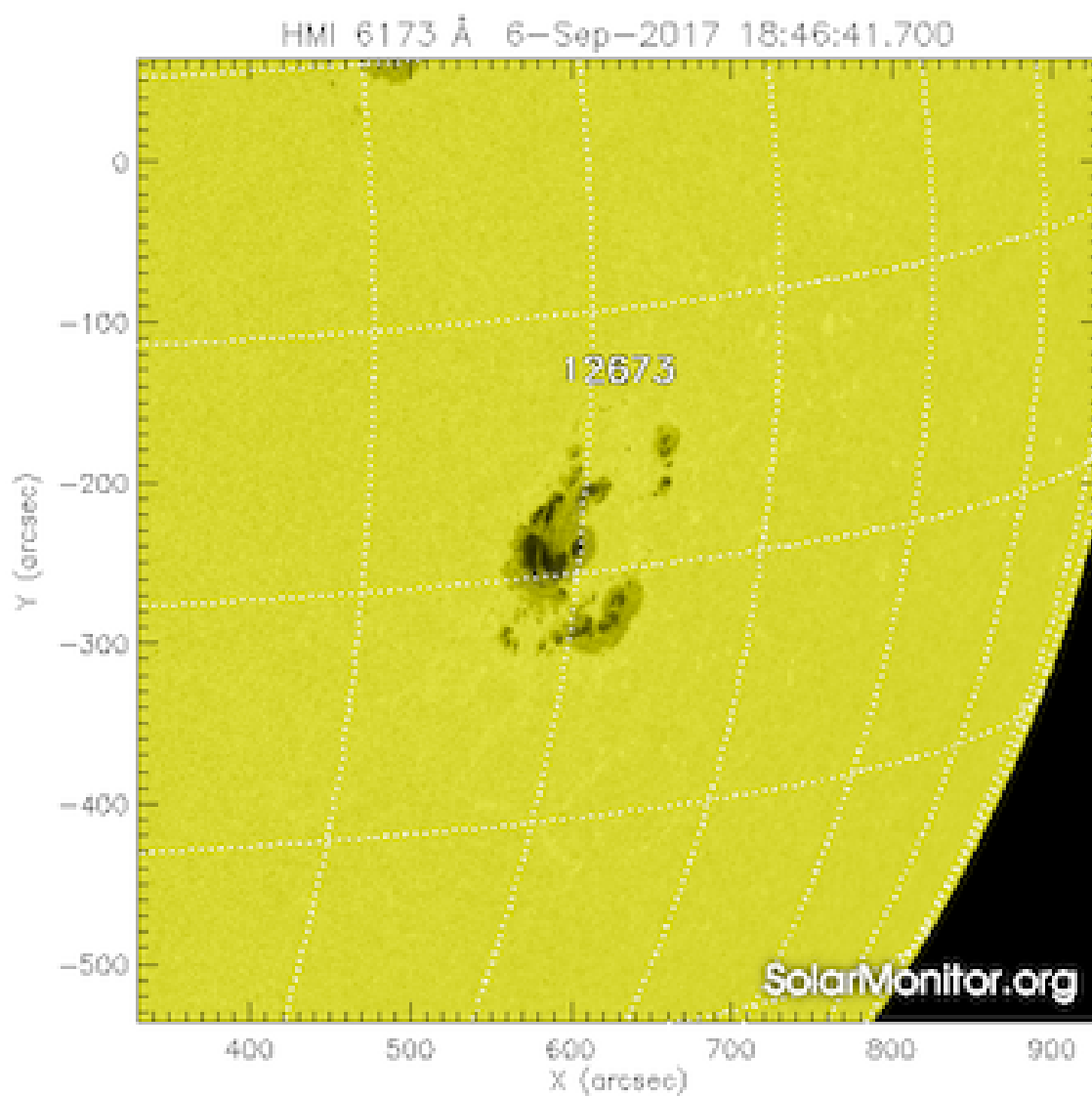
Solar activity was low with only a few B-class flares. Three active regions have transited the solar disc: Catania sunspot group 55, 56 and 57 (NOAA active region 2680, 2681 and 2682). The Catania sunspot group 57 (NOAA active region 2682) is the returning region Catania 46 (NOAA 2673), which was very

active with several X-class flares on its previous transit. It had drastically decayed and returned on the East limb as a unipolar sunspot group (alpha magnetic class) on the September 23.

Catania sunspot group 55, 56 and 57, respectively NOAA active regions 2680, 2861 and 2682 spotted by SDO/HMI.

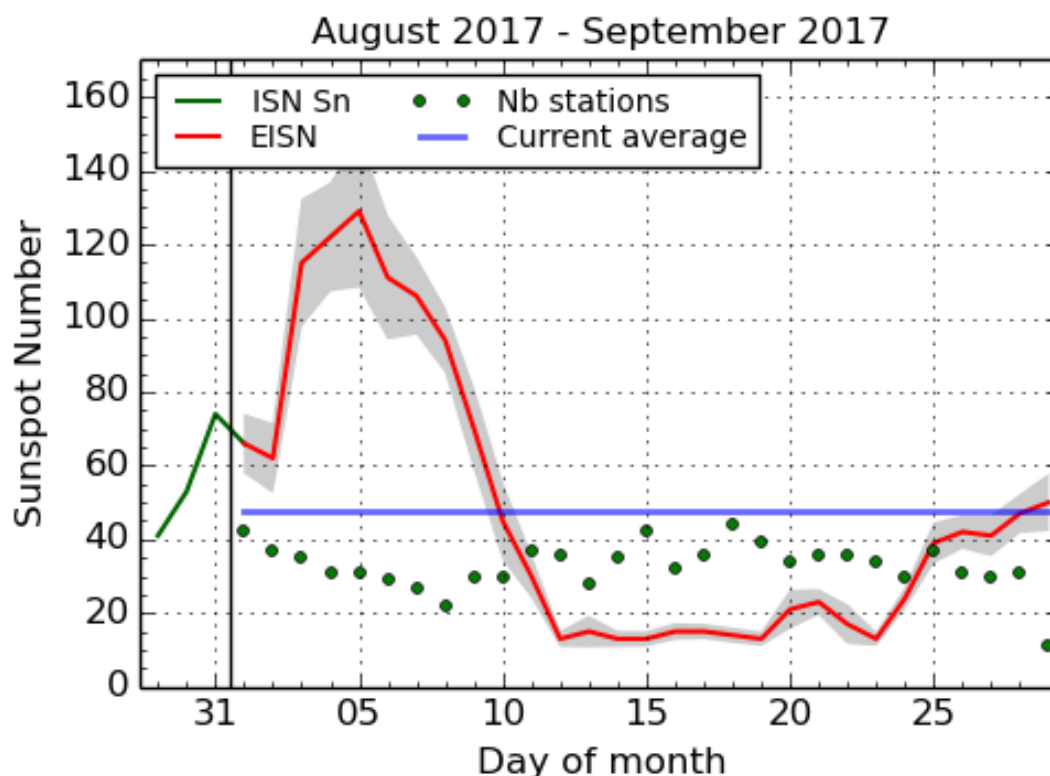


For comparison, this is how Catania sunspot group 57 (NOAA AR 2682) looked like a Catania sunspot group 46 (NOAA AR 2673) in SDO/HMI on September 6.



No Earth directed CMEs have been observed and the solar protons remained at background levels over the past 24 hours.

4. The International Sunspot Number

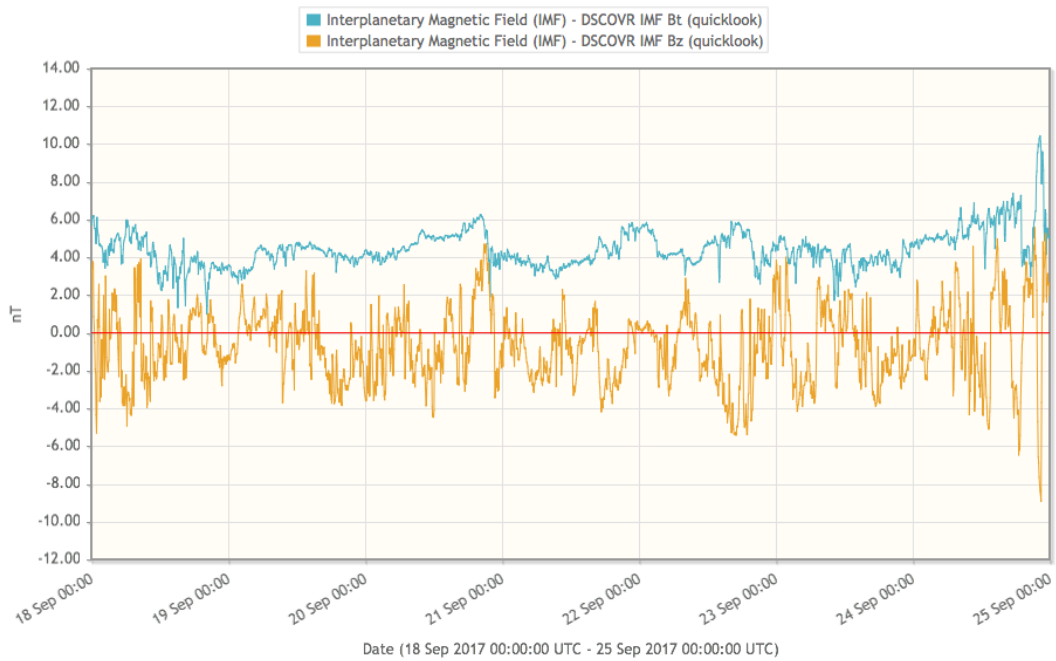
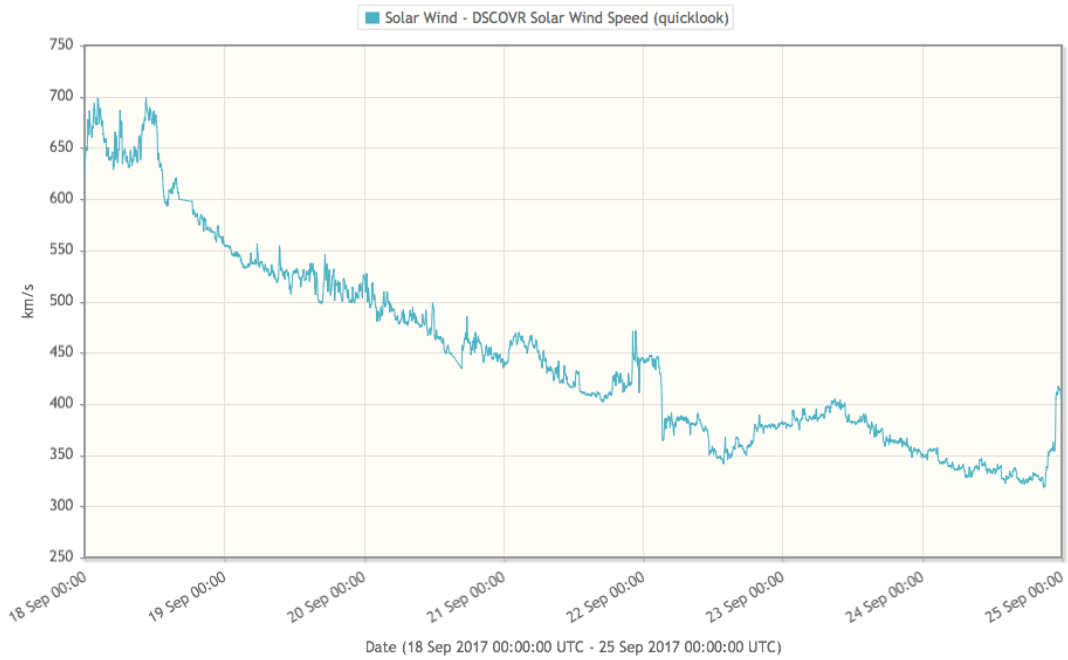


iILSO graphics (<http://sidc.be/silso>) Royal Observatory of Belgium, 2017 September 29

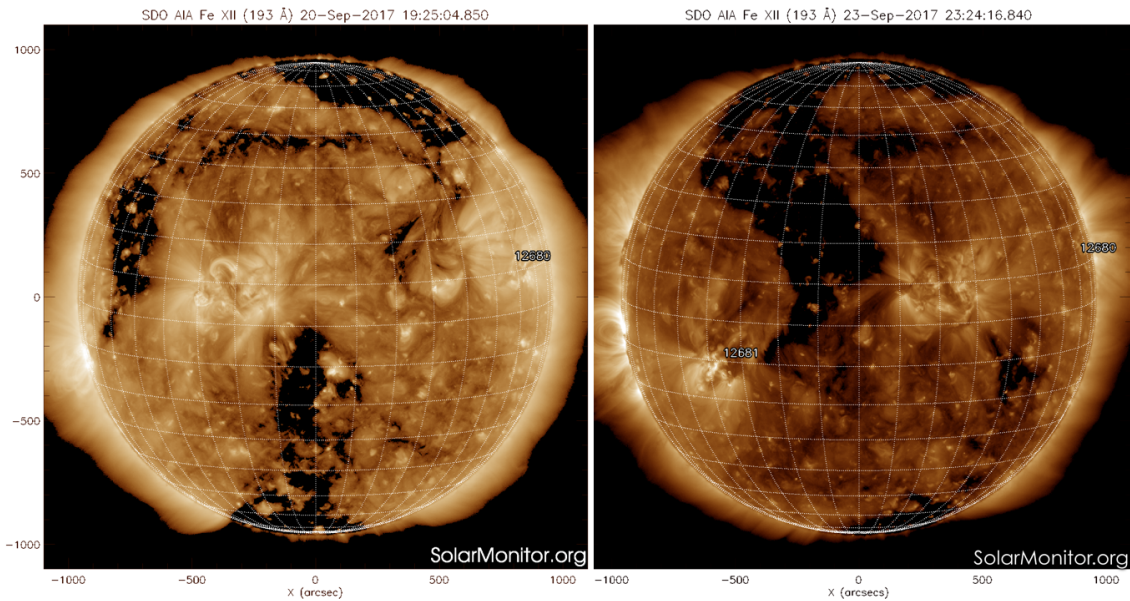
The daily Estimated International Sunspot Number (EISN, red curve with shaded error) derived by a simplified method from real-time data from the worldwide SILSO network. It extends the official Sunspot Number from the full processing of the preceding month (green line). The plot shows the last 30 days (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

In the beginning of the week, September 18, the Earth was in the fast solar wind with a speed around 700 Km/s, associated with a low-latitude extension of the northern polar coronal hole which reached central meridian on September 09. The wind speed was continuously declining from mid September 18 to reach finally around 320 km/s on September 24. The interplanetary magnetic field magnitude remained below 6-7 nT and the Bz component fluctuated between +/- 6 nT.

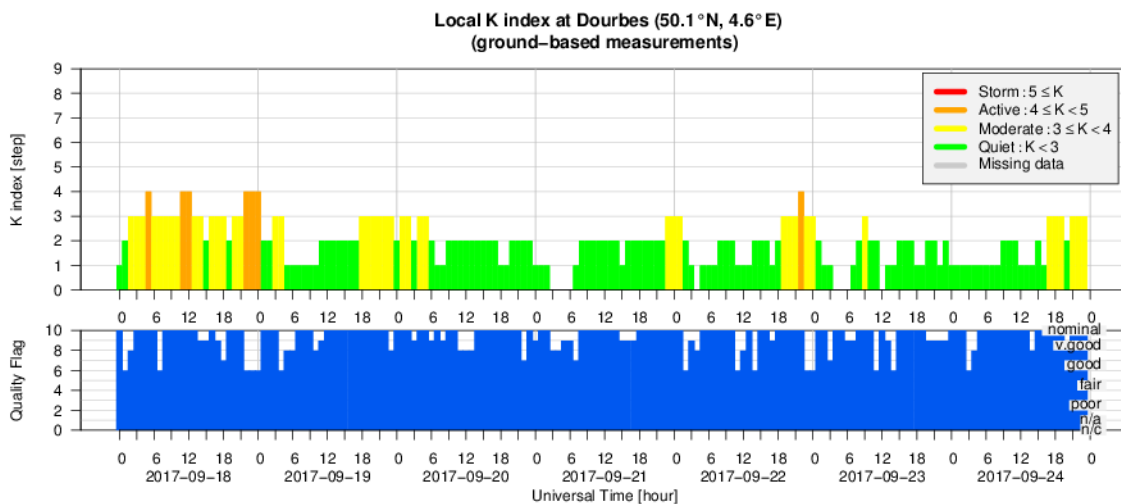


A small equatorial coronal hole reached the central meridian on September 20. A larger potentially geoeffective coronal hole reached the central meridian on September 24.



Disturbed geomagnetic conditions were observed in the beginning of the week with K-Dourbes up to 4 and Kp-NOAA up to 5 due to the fast solar wind and the southward Bz component of the interplanetary magnetic field over several consecutive intervals. After September 18 at 12:00 UT, the geomagnetic conditions were then mostly quiet to unsettled with Kp (NOAA) and local K (Dourbes) indices ranging between 0-3. The local K (Dourbes) reached unexpectedly 4 late on September 22, while the solar wind remained in its nominal condition. This was probably due to the Bz component being mostly negative over a short preceding period of time.

6. Geomagnetic Observations at Dourbes (18 Sep 2017 - 24 Sep 2017)



7. SIDC space weather briefing

The Space Weather Briefing presented by the forecaster on duty from September 18 to 24. It reflects in images and graphs what is written in the Solar and Geomagnetic Activity report.

SIDC Space Weather briefing

18 – 24 September

Judith de Patoul
&
SIDC forecaster team

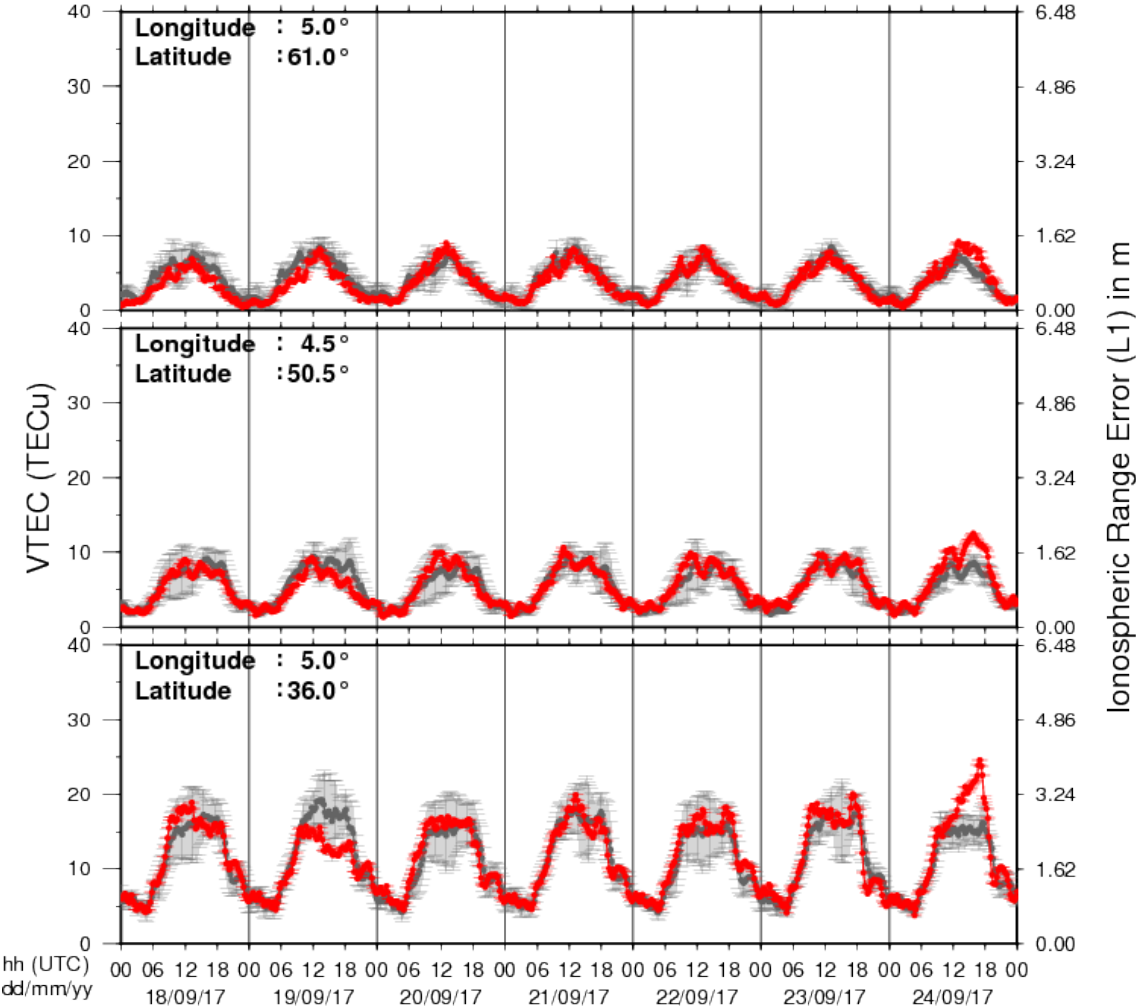
Solar Influences
Data analysis Centre
www.sidc.be



Royal Observatory
of Belgium

8. Review of ionospheric activity (18 Sep 2017 - 24 Sep 2017)

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 $TECu=10^{16}$ 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 detailed information, see http://gnss.be/ionosphere_tutorial.php

9. Future Events

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

International Workshop on Solar, Heliospheric & Magnetospheric Radioastronomy in Meudon, France

Start : 2017-11-06 - End : 2017-11-10

Jean-Louis Steinberg has been one of the major pioneers in radioastronomy. Co-founder of the Nançay Observatory, he has actively participated to, and inspired a large number of radio instruments on many international space missions. Jean-Louis Steinberg is the founder of the Space Radioastronomy laboratory of the Paris Observatory in 1963. Later on, this laboratory widened its science interests and became the DESPA (1971) and then the current LESIA (2002) which is one of the major space sciences laboratories in France. The aim of this workshop is to cover the science topics which Jean-Louis Steinberg has promoted during his career, focusing on Solar, Heliospheric & Magnetospheric radioastronomy & physics. This will be done by covering both observations from either ground facilities (NDA, RH, LOFAR, Artemis etc ...) or space missions (ISSEE, Ulysses, WIND, CLUSTER, STEREO, CASSINI, JUNO etc ...) and models/theories. A series of invited talks is also foreseen to cover the new developments in the discipline which may come with the future facilities such as Solar Orbiter, Solar Probe Plus, JUICE, JUNO, LOFAR+, SKA etc

This workshop will also be the opportunity to remember both the extraordinary personal & professional lives of Jean-Louis Steinberg especially for new generation of scientists. At the occasion of this workshop it is also expected that the Building 16 (historical Space Sciences building) on the Meudon campus will be renamed "Building Jean-Louis Steinberg".

Website:

<https://jlsworkshop.sciencesconf.org/>

European Space Weather Week 14

Start : 2017-11-27 - End : 2017-12-01

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/esww14/>