

STCE Newsletter

16 Sep 2013 - 22 Sep 2013



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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.

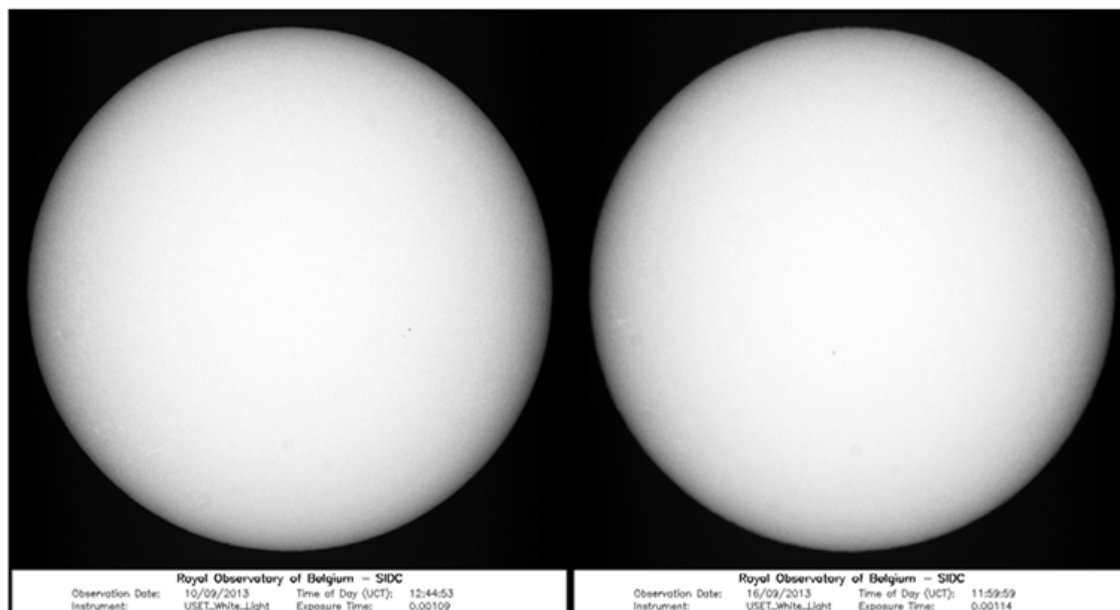
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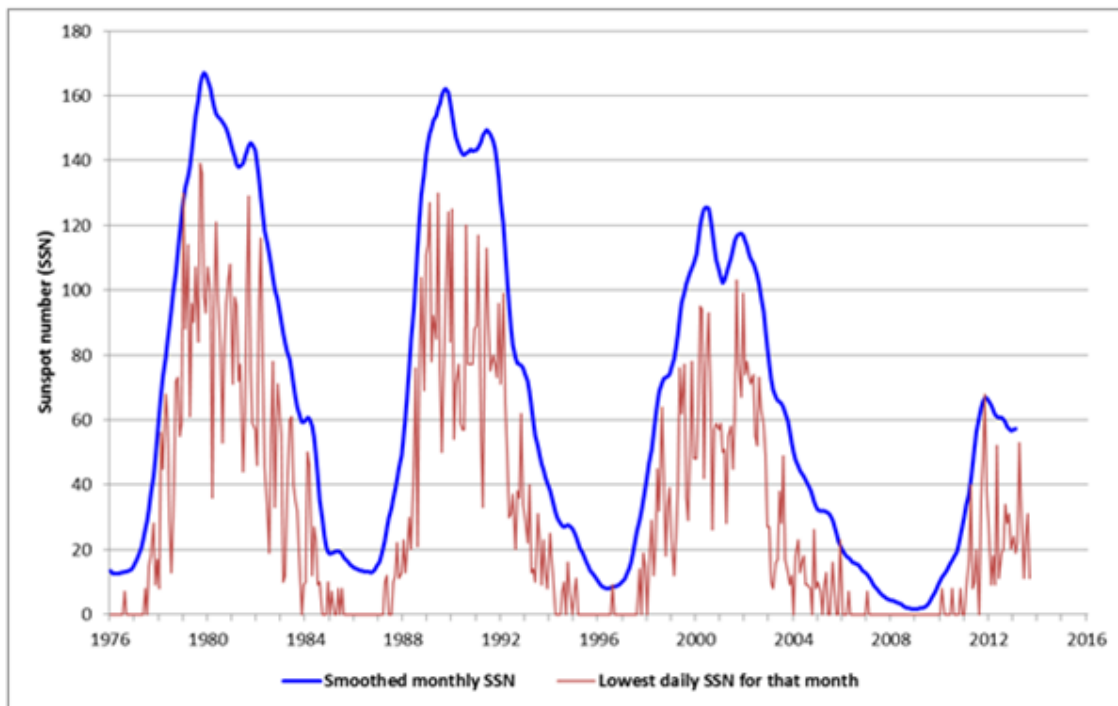
1. The Sun on (extended) summer leave (16 Sep 2013 - 22 Sep 2013)

All solar observers and space weather monitors have noticed it: Over the last few weeks, solar activity has dropped again to very low levels.

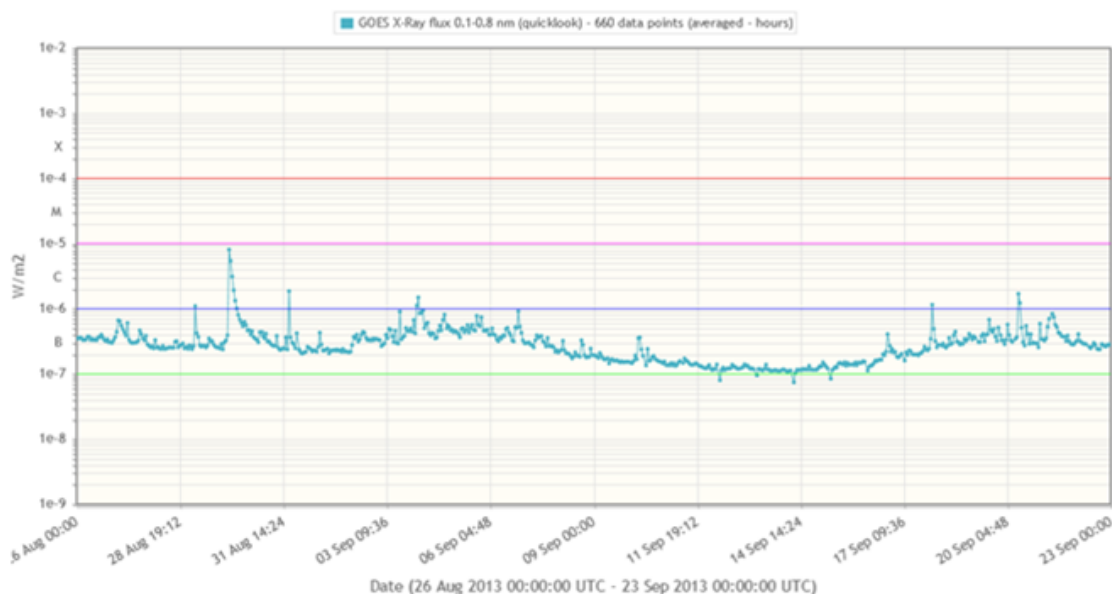
Indeed, as can be seen in the first part of this movie (SDO; <http://youtu.be/ZOQIkLdgZSA>), sunspots have been really scarce for about 2 weeks starting 5 September. Between 8 and 12 September, a few tiny sunspot groups performed a perfect relay to avoid an otherwise spotless solar disk. It would have been the first spotless day since 14 August 2011! Images from 10 and 16 September underneath were made using the white light telescope of the Uccle Solar Equatorial Table (USET). In both cases, they show only one tiny sunspot group on the solar surface.

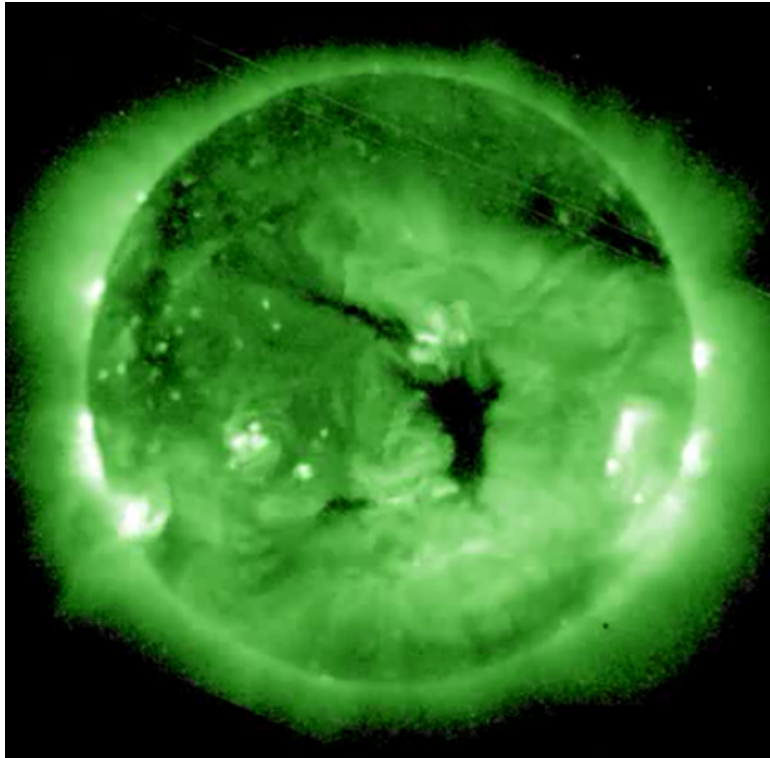


The graph below shows the evolution of the smoothed monthly sunspot number (blue) since 1976, and the lowest daily sunspot number recorded for these months (red; unsmoothed). Low daily sunspot numbers, similar to the ones recorded over the last few weeks, are very uncommon during the maximum years of solar cycles (SC) with a moderate to high amplitude such as SC21 to 23. In this respect, SC24 looks very similar to other low activity solar cycles that occurred e.g. around the 1900's.



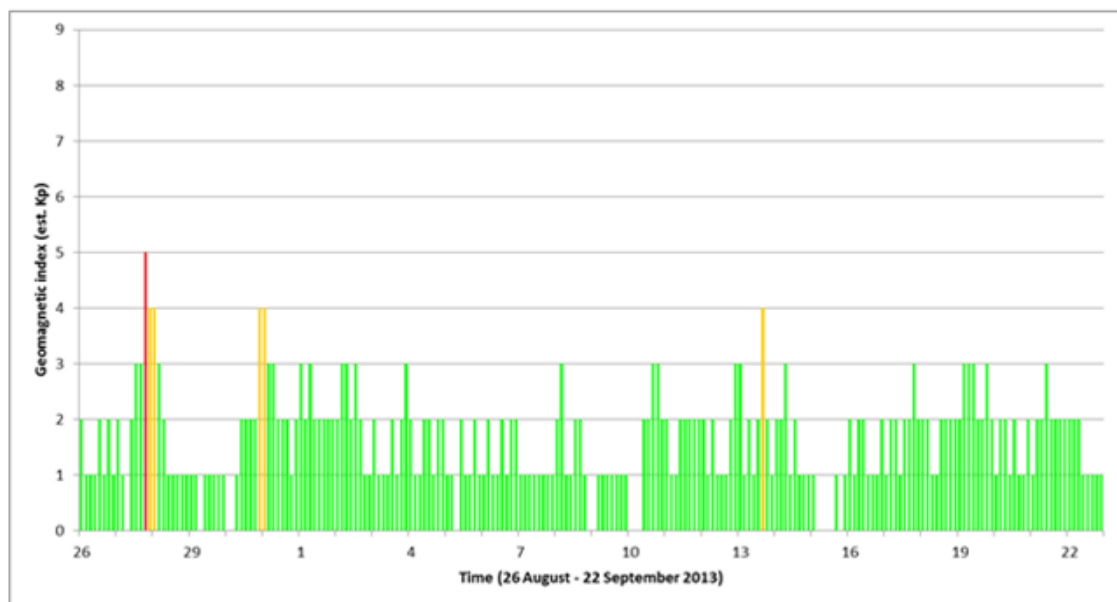
The low solar activity was also noticeable in other solar indices, such as the x-ray flux measured by the GOES satellite which displayed a pronounced low between 7 and 17 September (see part 2 of the movie at <http://youtu.be/ZOQIkLdgZSA> with images from GOES' Solar X-ray Imager). In fact, for this period of 11 consecutive days, not a single solar flare was recorded, not even in the low C-class! Since measurements began in the mid-1970's, there have been no such long periods without C-flares during the maximum years of the solar cycles. A similar story can be told for the medium flares ("M-class"), with the most recent M-flare dating back already from 17 August.





Hence, it will come as no surprise that also geomagnetically, we have experienced some very quiet weeks. Indeed, the last (minor) geomagnetic storm dates back from 27 August. However, the current stormless period of about a month is not so extraordinary compared to the previous three solar cycles. These cycles all had 2 or 3 periods with up to 6 weeks of geomagnetic calm during their years of maximum solar activity. SC24 does distinguish itself from the three others by having several 2-month periods with no geomagnetic storming. The longest stretch occurred from 25 November 2012 till 28 February 2013, or 96 days without strong geomagnetic disturbances.

It will be interesting to see if and when the Sun is going to wake up from this prolonged nap!



Credits - Data and imagery were taken from SDO/HMI (<http://sdo.gsfc.nasa.gov/>), GOES/SXI (<http://www.swpc.noaa.gov/sxi/index.html>), NOAA/SWPC (<http://www.swpc.noaa.gov/Data/index.html>), WDC for Geomagnetism/Kyoto (<http://wdc.kugi.kyoto-u.ac.jp/wdc/Sec1.html>), SIDC (<http://www.sidc.oma.be/index.php>), USET (<http://www.sidc.oma.be/uset/index.php>).

2. Space Weather for Engineers

How it started

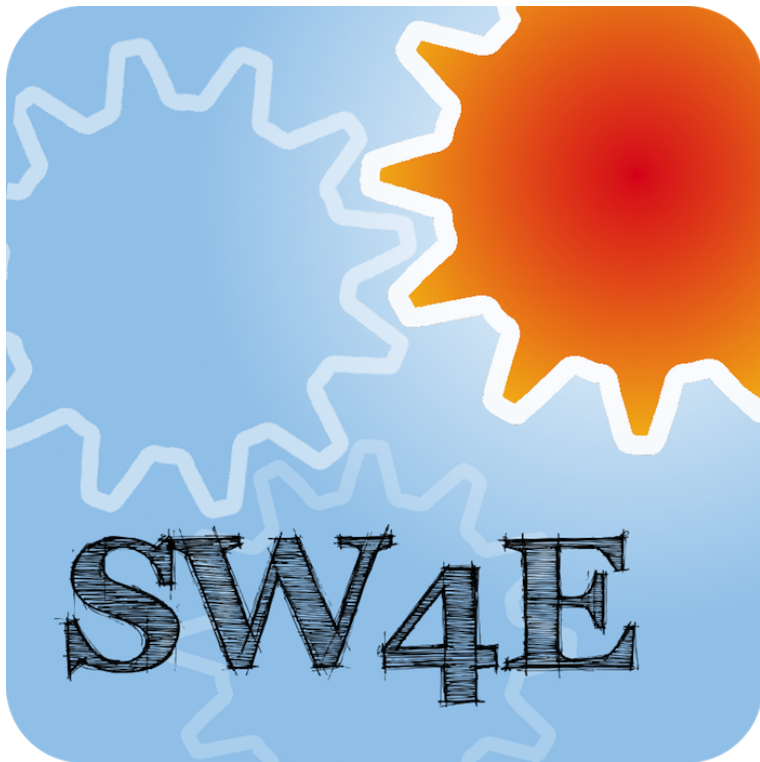
The morning of September 1, 1859, the English astronomer Richard Carrington studies as usual the Sun in his private observatory. While making drawings of sunspots, he notes 2 white light flashes of which the range and intensity suddenly grows and disappears after a few moments. The next day, compasses were not able to point north, the telegraph burst with anger. The early seeds of something like Space Weather were planted, although it was not yet called like that at those times.

Now, more than 150 years later, Space Weather is an emerging field that impacts a broad spectrum of groups and human activities. There is no international consensus on a definition of Space Weather, but we can state that Space Weather describes the conditions in space that affect Earth and its technological systems.

Space Weather Science

Since a few decades, space Weather scientists have done a lot of research and want to share their knowledge and understanding. As such, we organize Space Weather for Engineers. This course aims to make people, and engineers in particular, aware of the solar or spatial origin of the disturbances and disruptions that are witnessed in many ground based and spatial technological systems, and to explain the physical mechanisms behind them, to indicate where to find the relevant predictive data and to train how to interpret them in order to lower the risk of damage to technical equipment and economic losses. As a matter of fact, Space Weather predictions are readily available nowadays and the Space Weather community has been working hard to make them widely accessible.

Space Weather for Engineers is only 1 click away: <http://www.stce.be/sw4e/>



3. PROBA2 Observations (16 Sep 2013 - 22 Sep 2013)

Solar (flaring) activity evolved from very low to low until Saturday, and back to very low on Sunday.

In order to view the activity of this week in more detail, we suggest going 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.

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

Wednesday September 18th:



Eruption on South East Limb @ 03:07 - SWAP difference image.

Thursday September 19th:



Prominence Eruption in South East Quadrant @ 03:03 - SWAP difference image. Find a movie of the event here: http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR182_Sep16toSep22/Events/20130919_Eruption_EastLimb_0303_swap_diff.mp4 (SWAP difference movie).

Friday September 20th:



Prominence Eruption on South East Limb @ 21:44 - SWAP difference image. Find a movie of the event here: http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR182_Sep16toSep22/Events/20130920_PromEruption_SouthWest_2144_swap_diff.mp4 (SWAP difference movie).

Saturday September 21th:



Eruption in North East Quadrant @ 07:55 - SWAP difference image. Find a movie of a sequence of events leading to the eruption here: http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR182_Sep16toSep22/Events/20130921_PromEruption_NorthEast_0755_swap_diff.mp4 (SWAP difference movie).

Sunday September 22th:



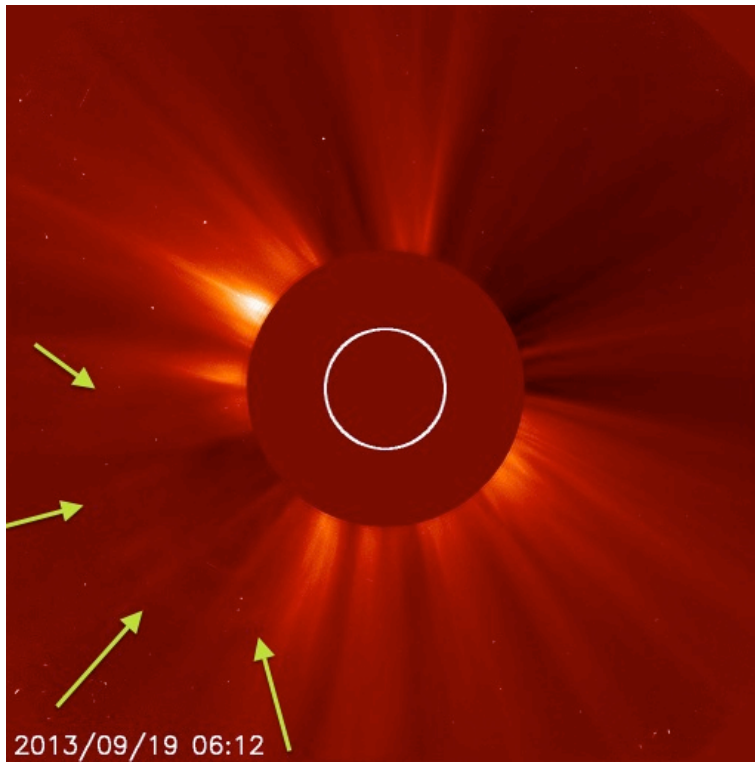
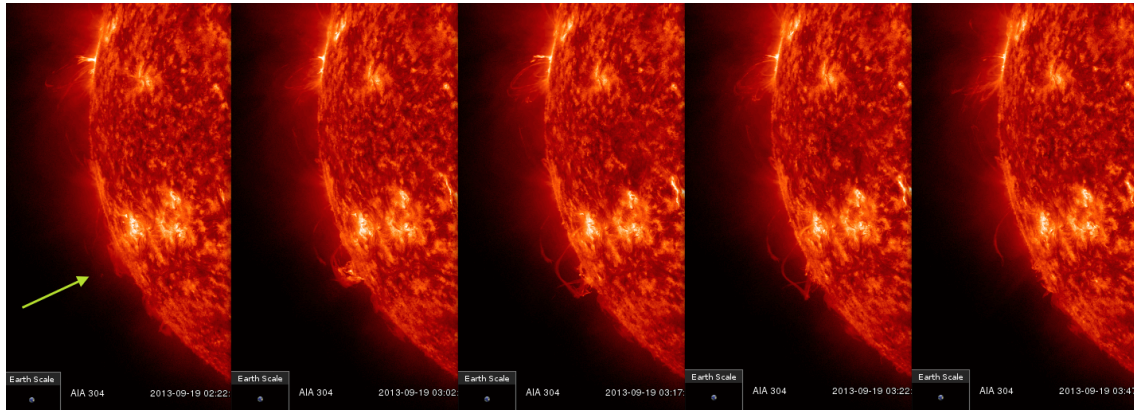
Prominence Eruption on South West Limb @ 04:45 - SWAP difference image. Find a movie of this event here: http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR182_Sep16toSep22/Events/20130922_PromEruption_SouthWest_0445_swap_diff.mp4 (SWAP difference movie).

4. Review of solar and geomagnetic activity (16 Sep 2013 - 22 Sep 2013)

SOLAR ACTIVITY

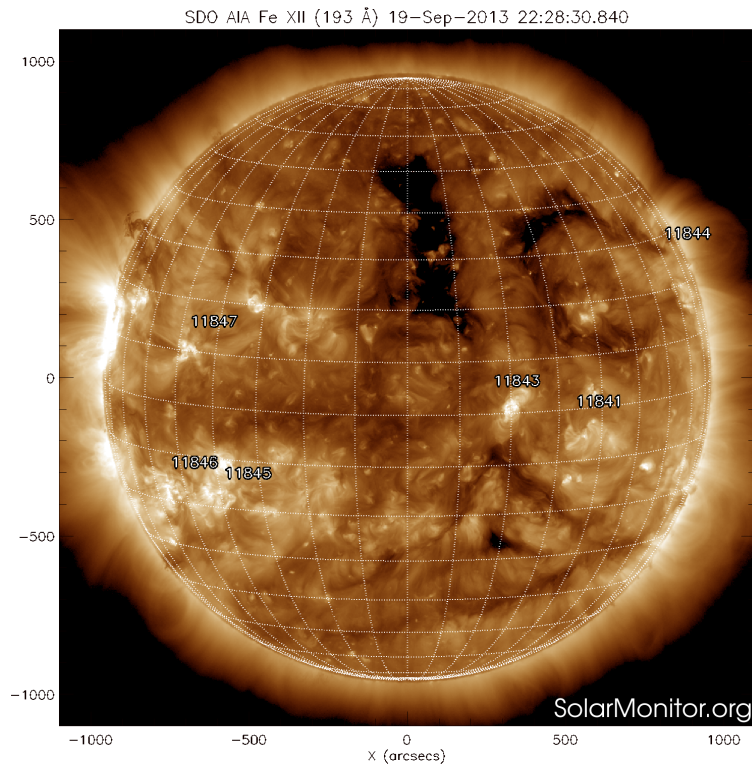
During this week the flaring activity was very low, with only nine low C-class flares reported by GOES. The strongest flare of the week was the C3.9 flare on September 18, peaking at 03:15 UT. The flare originated from the NOAA AR 1846 which was at that moment situated at the east solar limb.

A prominence erupted near the Catania sunspot group 76 (NOAA AR 1845) on September 19 around 3UT. The eruption was associated with a coronal dimming, an EIT wave (see the section 'proba2' of this STCE newsletter) and a partial halo CME. The CME was first observed in the SOHO/LASCO C2 field of view at 03:48 UT, had an angular width of about 180 degrees and a speed around 300 km/s. Note that the measured speed is always a projected speed. This means that the plasma travelling through the 3 dimensional space is projected in the 2 dimensional plane of view of the coronagraph. The bulk of the CME mass was directed southward of the ecliptic plane. The first picture is a series of SDO/304 images in which the plasma of the prominence rises and is finally ejected. The second picture is a view of the coronal mass ejection in the coronagraph LASCO/C2.



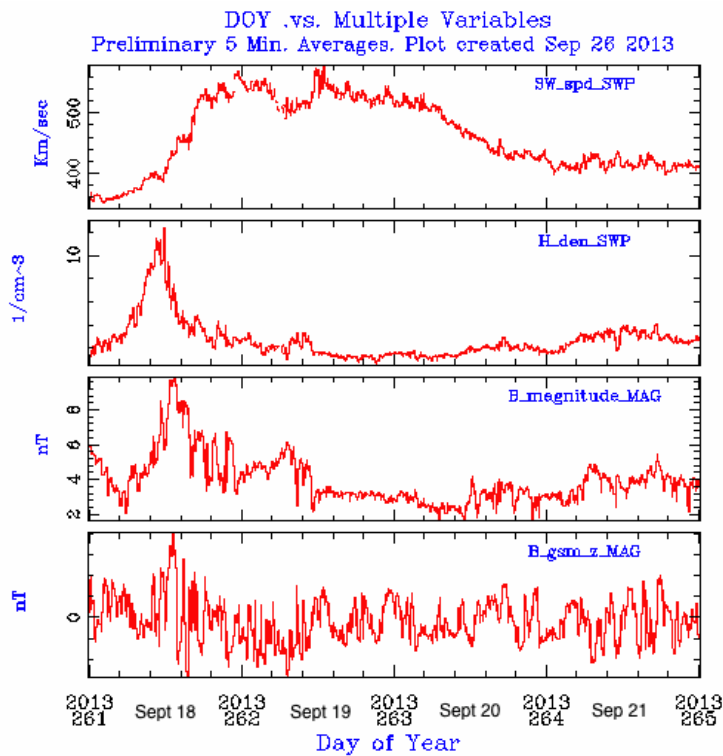
There was no signature in the solar wind monitored by the satellite ACE in the following days. ACE is located at the L1 point, this is 1 hour upstream of the Earth.

A northern coronal hole (CH) situated between 20° and 55° latitude, with a width of 10° , was observed this week. The CH reached the central meridian on September 19.



GEOMAGNETIC ACTIVITY

A co-rotating interaction region (CIR) characterised by a stronger magnetic field and denser solar wind plasma arrived at the Earth in the afternoon of September 18. In this region, a slow and fast wind interact. The interplanetary magnetic field (IMF) magnitude had the maximum value of about 10 nT on September 18. The solar wind curve increased rather smoothly in the course of the day to a value around 600 km/s on September 19. This fast wind is associated with the CH that reached the central meridian on September 13. The graph below shows the solar wind ACE data from September 19 up to September 21 with the speed in the top panel, density in the second panel, the total IMF in the third panel and the z-component of the IMF in the bottom panel.

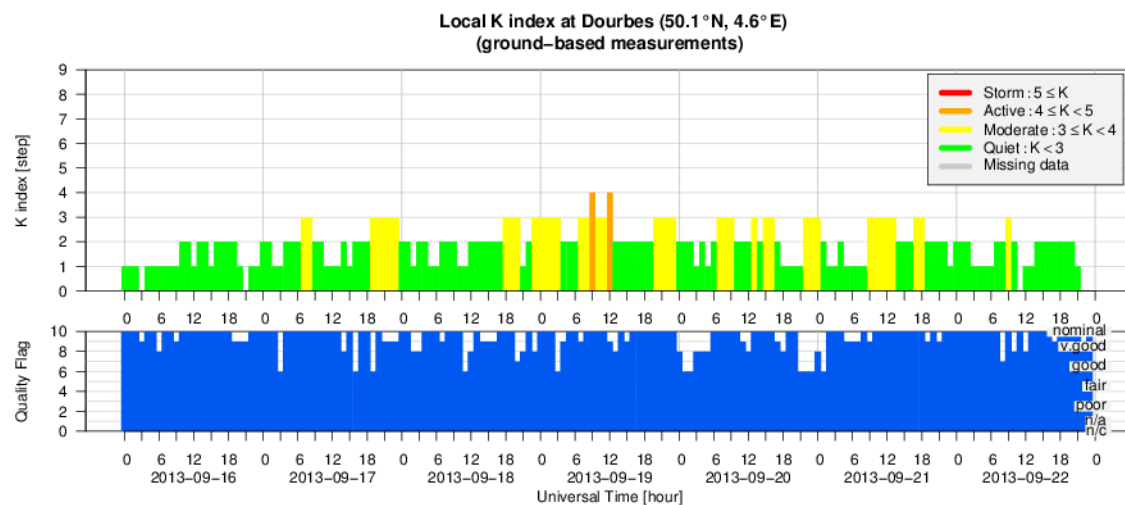


The CIR and CH fast stream resulted in unsettled to active geomagnetic conditions ($K = 4$ reported by Dourbes) on September 18 and September 19.

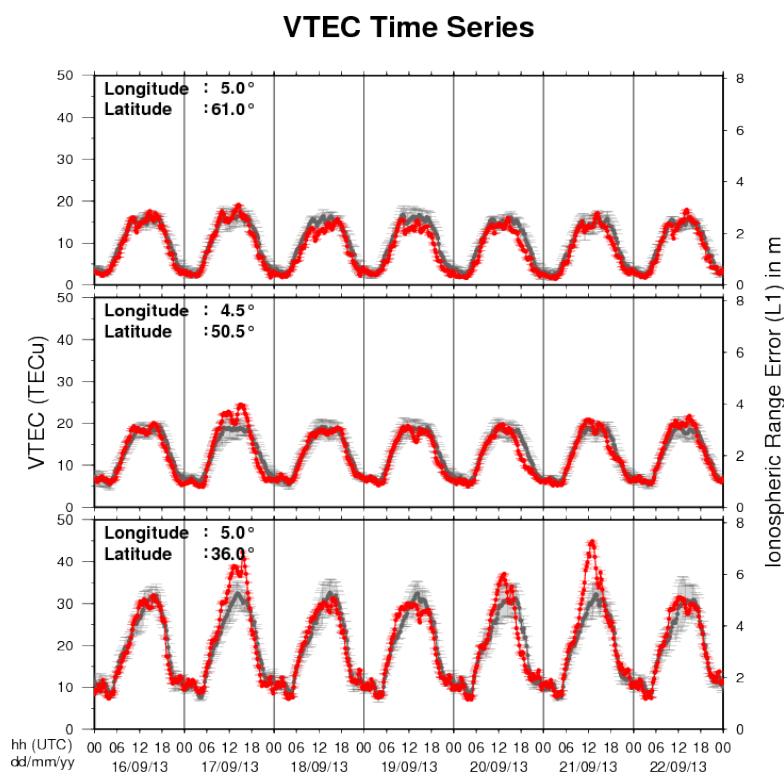
During the rest of the week, the IMF magnitude was stable around 5 nT.

We can already give a glimpse on the bulletin of next week. The fast stream linked with the CH mentioned in the section 'Solar Activity' and which was at the central meridian on September 19, did arrive. More next week.

5. Geomagnetic Observations at Dourbes (16 Sep 2013 - 22 Sep 2013)



6. Review of ionospheric activity (16 Sep 2013 - 22 Sep 2013)



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 for some more explanations ; for detailed information, see http://gnss.be/ionosphere_tutorial.php

7. Future Events

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

STEREO/WAVES & WIND/WAVES workshop on Solar Radio Emissions on Santorini, Greece

Start : 2013-10-07 - End : 2013-10-11

The aim of the workshop is to review the "state of the art" theories about generation and propagation of Solar radio burst and discuss the observational constraints and results that have been provided in this area by the WIND & STEREO missions during the last 20 years. Furthermore the STEREO & WIND observations will be put in the context of other missions such as RHESSI and ground based observatories. Finally, the preparation for the future explorations foreseen with Solar Orbiter and Solar Probe Plus will be discussed.

Website:

<http://type3stereo.sciencesconf.org/>

2nd Asian-Pacific Solar Physics Meeting, in Hangzhou, China

Start : 2013-10-24 - End : 2013-10-26

Initiated by Profs. Fang and Choudhury, the first Asian-Pacific Solar Physics Meeting (APSPM) was held in Bangalore two years ago. During the meeting, a consensus was achieved that it might be a good idea to have the APSPM every three years. Somehow the second APSPM was proposed to be held by mainland China in 2013. APSPM is aimed to exchange the recent research results in solar physics in the emerging asian-pacific region.

Asian-pacific regions are getting more and more active in solar physics, as signified by the construction of big facilities, including the Hinode satellite (Japan), SOXS (India), Chinese Solar Radio Heliograph, and Optical & Near-Infrared Solar Eruption Tracer (ONSET). Therefore, colleagues have agreed to hold regional solar physics meetings regularly. The first Asian-Pacific Solar Physics Meeting (APSPM) was held in Bangalore during March 22-24 2011. During the meeting, a consensus was achieved that it might be a good idea to have the APSPM every three years. Somehow the second APSPM was proposed to be held by mainland China in 2013. APSPM is aimed to exchange the recent research results in solar physics in the emerging asian-pacific region.

Website:

<http://sdac.nju.edu.cn/~solar/>

Helicity Thinkshop on Solar Physics in Beijing, China

Start : 2013-10-27 - End : 2013-10-31

Magnetic helicity has been intensively studied from observational, theoretical, and many other aspects of solar physics. For this meeting we would like to invite solar physicists who are interested in the observational and theoretical studies of the helicity, to encourage thorough discussions on the relevant hot issues. The 1st Helicity Thinkshop was held successfully in 2009, and now the 2nd one will be held on October 27-31, 2013 in Beijing, China.

Website:

<http://sun.bao.ac.cn/meetings/HT2013/>

Workshop and School on Radio Sun in Zhengxiangbaiqi, Inner Mongolia, and Beijing, China

Start : 2013-10-28 - End : 2013-11-02

The Workshop and School on Radio Sun in Beijing and Inner Mongolia during Oct.28 - Nov. 2, 2013 is the first international academic seminar supported by the International Research Staff Exchange Scheme of the Seventh Framework Programme of the European Union (FP7-IRSES-295272-RADIOSUN).

The primary aim of this programme is to establish close research interaction and collaboration between the key research groups involved in CSRH, SSRT, and ALMA projects and in development of relevant theory and data analysis tools, through the systematic research staff and knowledge exchange, joint research efforts exploiting existing data and facilities, and preparing the future world-class partnership in exploitation of the upcoming facilities.

The Workshop and School welcome all solar physicists and students who are interested in solar radio astronomy to participate. We will discuss and exchange the scientific frontier problems, including the new-generation radio instruments (CSRH, Siberian multi-frequency radioheliograph, LOFAR, ALMA, and other new instruments), recent achievements and their scientific goals; methods and techniques of data

processing (for example, software, radio image reconstructions, and method for studying various types of solar radio fine structures); and the objectives of new observational data and new mathematical methods.

Website:

<http://beijingradiosun.csp.escience.cn/>

25th Winter School of Astrophysics: Cosmic Magnetic Fields, in La Laguna, Tenerife, Spain.

Start : 2013-11-11 - End : 2013-11-22

Magnetic fields play an important role in many astrophysical processes. But magnetic are difficult to detect and to model or understand, since the fundamental equations describing the behavior of magnetized plasmas are highly non-linear. Hence, magnetic fields are often an inconvenient subject which is overlooked or simply neglected. Such difficulty burdens the research on magnetic fields, which has evolved to become a very technical subject, with many small disconnected communities studying specific aspects and details.

The school tries to amend the situation by providing a unifying view of the subject. The students would have a chance to understand the behavior of magnetic fields in all astrophysical contexts, from cosmology to the Sun. From star-bursting regions to AGNs in galaxies. The school will present a balanced yet complete review of our knowledge. Extensions into the unknown are also important to indicate present and future lines of research.

The Winter School will bring together in a relaxed working atmosphere a number of the leading scientists in this field, PhD students and recent postdocs. The conditions for a successful interaction will be granted, including two special sessions for those students that want to present their own work.

Website:

<http://www.iac.es/winterschool/2013/>

7th Hinode science meeting in Takayama, Japan

Start : 2013-11-12 - End : 2013-11-15

Since its launch in Sep-2006, more than 600 refereed papers have been published based on Hinode observations, presenting many new and important findings to the scientific community. However, due to the unexpectedly low levels of solar activity, until now the focus has mainly been on the more quiescent aspects of the solar cycle. With the solar maximum expected this year, through cooperative observations with SDO, IRIS, and ground based observatories, Hinode observations should lead to our understanding of active Sun phenomena, such as solar flares and CMEs, to be greatly improved. Making Hinode-7 an excellent opportunity to discuss solar activity in the current solar cycle and the related science through the use Hinode data, as well as other solar/space weather data. It will also be interesting to use this meeting to broaden our focus to include the solar-stellar connection as a means to deepen our understanding of solar activity.

Momentum is also gaining for Solar-C, which is being developed as an international collaboration between Japan, US and Europe. To further discuss this mission, the Solar-C science meeting will be held on 11-Nov.

Website:

<http://www.kwasan.kyoto-u.ac.jp/hinode-7/>

Space Weather: the importance of observations in London, UK

Start : 2013-11-13 - End : 2013-11-13

Most space weather occurs due to the Sun's emissions which can affect the Earth's space environment. Modern society is ever more dependent upon ground-based & spaceborne technology which can be vulnerable to space weather. Satellites, GPS, aviation & the electric power industry are all at risk from this & hence space weather is now included on the UK's National Risk Register. It is important to have long-running, continuous observations for forecasting, nowcasting & for research in space weather. This public meeting, held during the peak of the 11 year solar cycle, addresses the deficiency in continuous, long-term observations & how this might be overcome.

Website:

<http://www.rmets.org/events/space-weather-importance-observations>

International CAWSES-II Symposium in Nagoya, Japan

Start : 2013-11-18 - End : 2013-11-22

This International CAWSES-II Symposium hosted by SCOSTEP (Scientific Committee on Solar-Terrestrial Physics) will provide an excellent opportunity to discuss the scientific accomplishments of CAWSES-II and look forward to SCOSTEP's future programs at a moment toward the end of its five-year period. The symposium will cover the six major themes of CAWSES-II tasks: 1) What are the solar influences on the Earth's climate?, 2) How will geospace respond to an altered climate?, 3) How does short-term solar variability affect the geospace environment?, 4) What is the geospace response to variable inputs from the lower atmosphere?, 5) Capacity Building, 6) Informatics and eScience. The main functions of CAWSES-II are to help coordinate international activities in observations, modeling, and applications crucial to achieving this understanding, to involve scientists in both developed and developing countries, and to provide educational opportunities for students of all levels. The symposium offers keynotes/lectures that will be interesting for all participants every morning and more specific sessions of presentations in the afternoon. We welcome all those who are involved and/or interested in CAWSES-II to Nagoya in the autumn when we will have the pleasure of being surrounded by beautiful colorful leaves of this season.

Website:

http://www.cawses.org/CAWSES/leaflet_CAWSES-II_120229.pdf

European Space Weather Week in Belgium

Start : 2013-11-18 - End : 2013-11-22

The 10th Edition of the European Space Weather Week will take place on 18-22nd November 2013 in Belgium. The venue will be confirmed early next year, but mark your calendars now for the 10th Anniversary of this growing European event.

The ESWW will again adopt the central aim of bringing together the diverse groups in Europe working on different aspects of Space Weather . This includes but isn't limited to the scientific community, the engineering community, applications developers, service providers and service end users. The meeting organisation will again be coordinated by the Belgian Solar-Terrestrial Centre of Excellence (STCE), ESA and the Space Weather Working Team. The local organisation will be done by the STCE.

Website:

<http://www.stce.be/esww10/>

1st SPRING Workshop in Freiburg, Germany

Start : 2013-11-26 - End : 2013-11-28

The 1st SPRING (Solar Physics Research Integrated Network Group) workshop is being held from November 26 - 28, 2013 at the scenic Brugger's Hotel Park by Titisee hosted by the Kiepenheuer-Institut für Sonnenphysik in Freiburg, Germany.

The purpose of the workshop is to work on the scientific requirements for a new ground-based network of telescopes for full-disk synoptic observations of the Sun.

The desire for such a new network is motivated by new scientific research directions in solar physics, the requirement of real-time context data for high-resolution solar telescopes, and the need of continuous, long-term, consistent, and reliable solar data as foundation for space weather prediction.

Website:

<http://www3.kis.uni-freiburg.de/~mroth/spring.html>

Space Weather: a Dialogue between Scientists and Forecasters in London, UK

Start : 2013-12-13 - End : 2013-12-13

The inclusion of space weather in the National Risk Assessment in 2012 means that there is now an urgent need for dialogue between those doing the science of space weather and those using the data to forecast, understand and mitigate the risks.

Since the Sun is currently at the peak of its cycle - a time when space weather events become more frequent - we have a timely opportunity to study how a range of solar activity ultimately lead to magnetospheric, ionospheric and ground level disturbances.

The goal of this meeting is to bring together those working across the broad range of space weather activities in the UK to discuss the current status of observations and recent new advances in the theories and models of the phenomena of space weather.

Website:

<http://www.mssl.ucl.ac.uk/~lmg/spaceweather/Overview.html>

Solar and Stellar Flares, in Prague, Czech Republic

Start : 2014-06-23 - End : 2014-06-27

The meeting in honour of Prof. Zdenek Svestka will cover issues of the physics of solar and stellar flares.

Website:

<http://solarflares2014.cz/>

40th COSPAR Scientific Assembly in Moscow, Russia

Start : 2014-08-02 - End : 2014-08-10

The 40th COSPAR Scientific Assembly will be held in Moscow, Russia from 2 - 10 August 2014. This Assembly is open to all bona fide scientists.

Website:

<http://www.cospar-assembly.org/>

International Chapman Conference on Low-Frequency Waves in Space Plasmas on Jeju Island, South Korea

Start : 2014-08-31 - End : 2014-09-05

Low-frequency waves (ULF, ELF and VLF) in space plasmas have been studied for many decades. In our solar system, such waves occur in the magnetospheres of planets and in the solar wind; more recently they have also been confirmed on the Sun. In spite of the great differences in the plasma properties of these regions, the overarching schemes are wave generation, wave propagation, and wave dissipation, which are three fundamental aspects of any kind of waves. A fourth aspect of these waves is their application, either with direct benefit to humans or for scientific pursuit. Therefore, this Chapman conference will provide a forum in which various wave communities can come together and discuss recent achievements of observational, theoretical, and modeling studies.

Website:

<http://chapman.agu.org/spaceplasmas/>

14th European Solar Physics Meeting in Dublin, Ireland.

Start : 2014-09-08 - End : 2014-09-12

The European Solar Physics Meetings aim to highlight all aspects of modern solar physics, including observation and theory that span from the interior of the Sun out into the wider heliosphere. These meetings provide a broad, yet stimulating, environment for European and international scientists to share their research in solar physics.

The meeting will mostly comprise of contributed talks and poster presentations, with several invited review talks (typically one per session). Posters will be on display for the whole meeting in close proximity to the lecture theatre. Refreshments will be served in the poster viewing area during two dedicated coffee/poster breaks on each full day.

Website: <http://www.espm14.ie/>

Solar Wind 14 in Weihai, China

Start : 2015-06-22 - End : 2015-06-26

The Fourteenth International Solar Wind Conference will be held for the first time ever in China, from 22 to 26 June 2015, at Weihai in the Shandong province. It will be jointly organized by the School of Earth and Space Sciences of Peking University and the newly-established Institute of Space Sciences of

Shandong University. The meeting will take place in the Space Science Building of Shandong University, a venue located within walking distance to the beautiful Weihai International Bathing Beach, one of the most popular scenic areas of northern China.

The conference will cover all aspects of solar wind physics, with invited reviews and contributed papers that examine the current research and outline the future research in all the relevant solar wind fields.

Website: not available yet