

# STCE Newsletter

9 Sep 2013 - 15 Sep 2013



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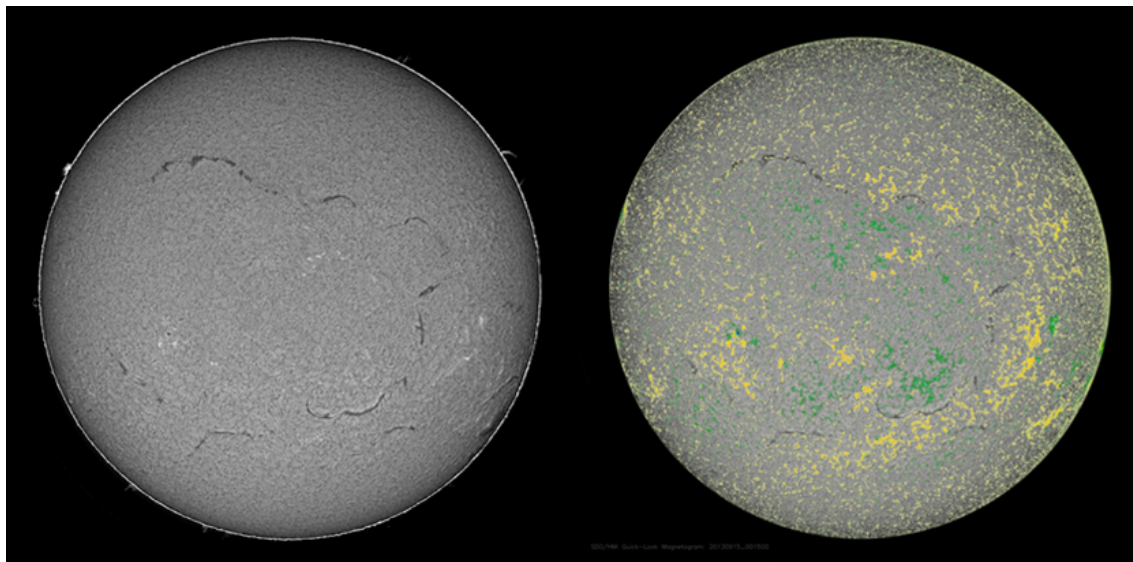
The Solar-Terrestrial Centre of Excellence (STCE) is a collaborative network of the Belgian Institute for Space Aeronomy, the Royal Observatory of Belgium and the Royal Meteorological Institute of Belgium.

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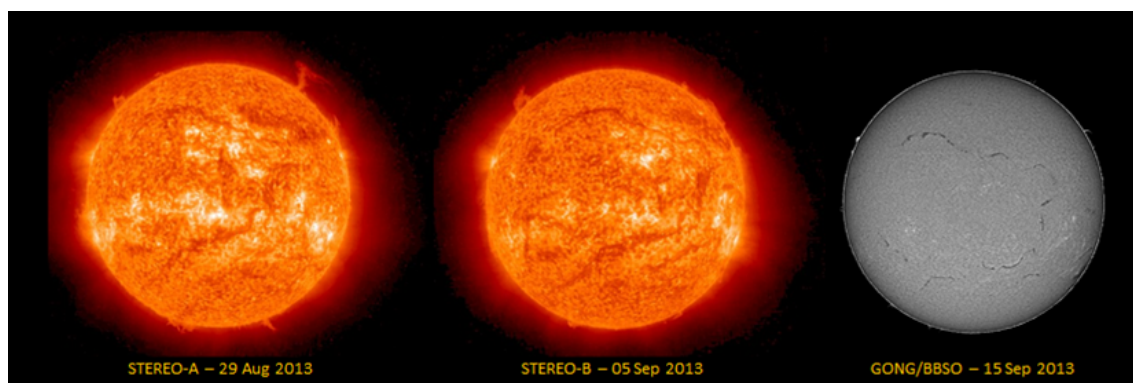
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## 1. A backside filament eruption (9 Sep 2013 - 15 Sep 2013)

A quite impressive filament eruption took place on the Sun's backside on 11 September (see the movie at <http://www.youtube.com/watch?v=XIPvrRs6dss>). 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.

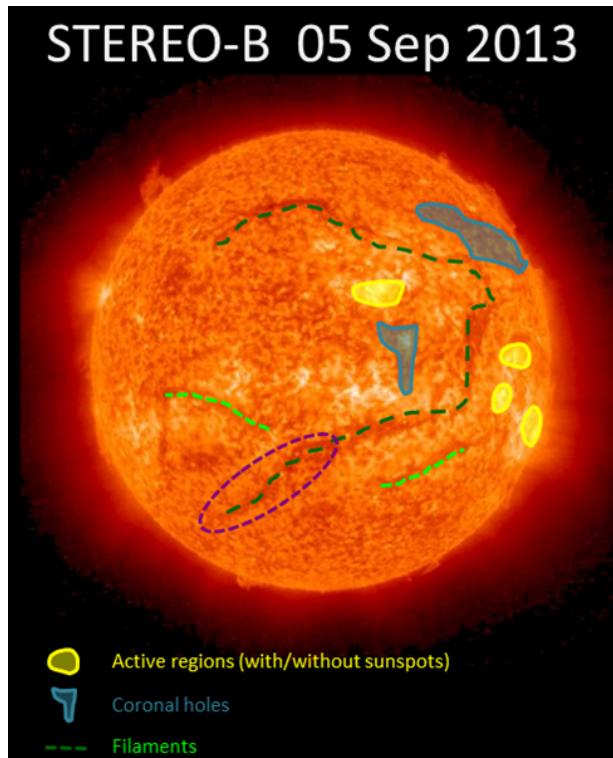


The picture above on the left dates from 15 September and shows a lengthy filament structure seen in the light of Hydrogen-alpha (H-alpha), which provides a view on the "cool" chromosphere of the Sun. The picture above on the right shows the same feature, this time in combination with an overlaid SDO magnetogram. Green is positive polarity (magnetic field lines coming out of the solar surface), yellow is negative polarity (field lines returning to the solar surface). Clearly, there's a huge filament structure caught between the various fields of opposite polarity. It has the shape of an inverted "c" (its opening is to the left) and is stitched together from filamentary chunks as it is meandering between the magnetic fields, active regions and coronal holes.

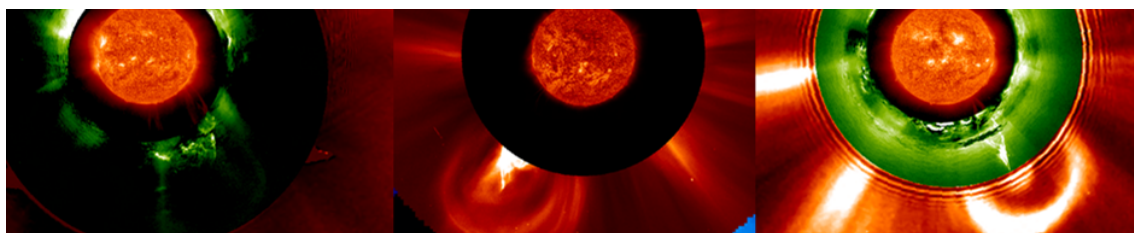


This big structure exists already for one solar rotation, starting to form around 20 August while rotating out of view and over the Sun's west limb (as observed from Earth). As it transited the backside of the Sun and became visible for resp. STEREO-A and STEREO-B, the structure could clearly be seen and remained well visible for the rest of the solar rotation. See this movie at <http://youtu.be/mPulSoNKq4g> ,

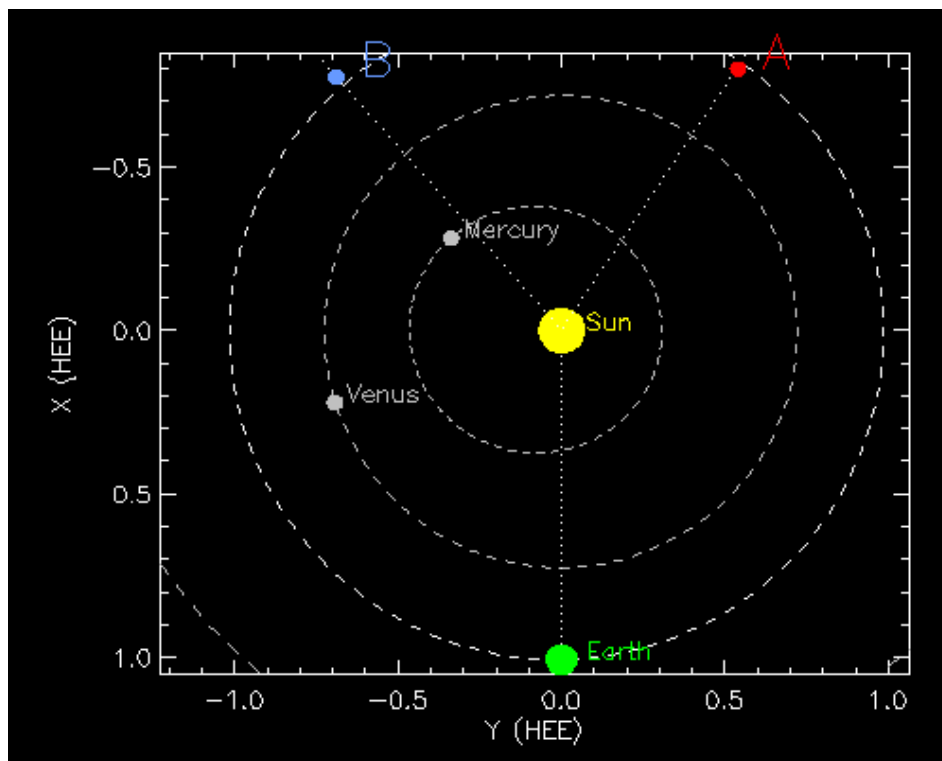
as well as the picture above. Note the STEREO-images depict the Sun in extreme ultraviolet (hot inner atmosphere). Here, the active regions show up as bright areas, while coronal holes show up as dark patches (especially the big one near the upper right corner). See the annotated STEREO-B image underneath. Coronal holes are not visible in H-alpha.



The filament eruption concerned only the end of the southern part of the filament structure, as indicated by a purple ellipse on the image above. Its length is still a respectable 450,000 km, a bit more than the average Earth-Moon distance. The eruption occurred during the morning hours of 11 September. It produced a typical coronal mass ejection (CME), with a bright leading loop, a dark cavity and a dense filament core. The image underneath shows the CME at around 10:30UT, as seen by STEREO-B, SOHO and STEREO-A (left to right).



From these different vantage points, the CME had quite a different outlook. Indeed, as the eruption took place in the direction and to the south of STEREO-B, its coronagraphs showed a wider filament core than those on SOHO and STEREO-A, which observed the propagating CME near resp. the east and west limb of the visible solar disk. See the sketch underneath for the different vantage points of the satellites at the time of the eruption.



Credits - Imagery was taken from the GONG H-alpha network (<http://halpha.nso.edu/> ), SDO (<http://sdo.gsfc.nasa.gov/> ), SOHO (<http://sohowww.nascom.nasa.gov/> ) and STEREO (<http://stereo.gsfc.nasa.gov/beacon/> )

## 2. PROBA2 Observations (9 Sep 2013 - 15 Sep 2013)

Solar (flaring) activity was very low throughout the week. Nevertheless, about a dozen of prominence eruptions were identified along the solar limb, half of them being rather spectacular and half of them occurred during the week-end.

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: [http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR181\\_Sep9\\_to\\_Sep15/2013\\_09\\_09\\_00\\_00\\_07\\_2013\\_09\\_15\\_22\\_56\\_19\\_SWAP\\_174\\_\\_AIA\\_304-hq.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR181_Sep9_to_Sep15/2013_09_09_00_00_07_2013_09_15_22_56_19_SWAP_174__AIA_304-hq.mp4) (SWAP174; HelioViewer.org). Details about some of this week's events, can be found further below.

**Tuesday September 10th:**



Prominence Eruption on South East Limb @ 12:36 - SWAP difference image. Find a movie of the event here: [http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR181\\_Sep9\\_to\\_Sep15/Events/20130910\\_FilamentEruption\\_SouthEastQuad\\_1236\\_swap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR181_Sep9_to_Sep15/Events/20130910_FilamentEruption_SouthEastQuad_1236_swap_diff.mp4) (SWAP difference movie)

**Wednesday September 11th:**



Prominence Eruption on South East Limb @ 09:29 - SWAP difference image. Find a movie of the event here: [http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR181\\_Sep9\\_to\\_Sep15/Events/20130911\\_PromEruption\\_SouthEast\\_0929\\_wap\\_diff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR181_Sep9_to_Sep15/Events/20130911_PromEruption_SouthEast_0929_wap_diff.mp4) (SWAP difference movie)



**Saturday September 14th:**



Eruption on East Limb @ 11:22 - SWAP difference image

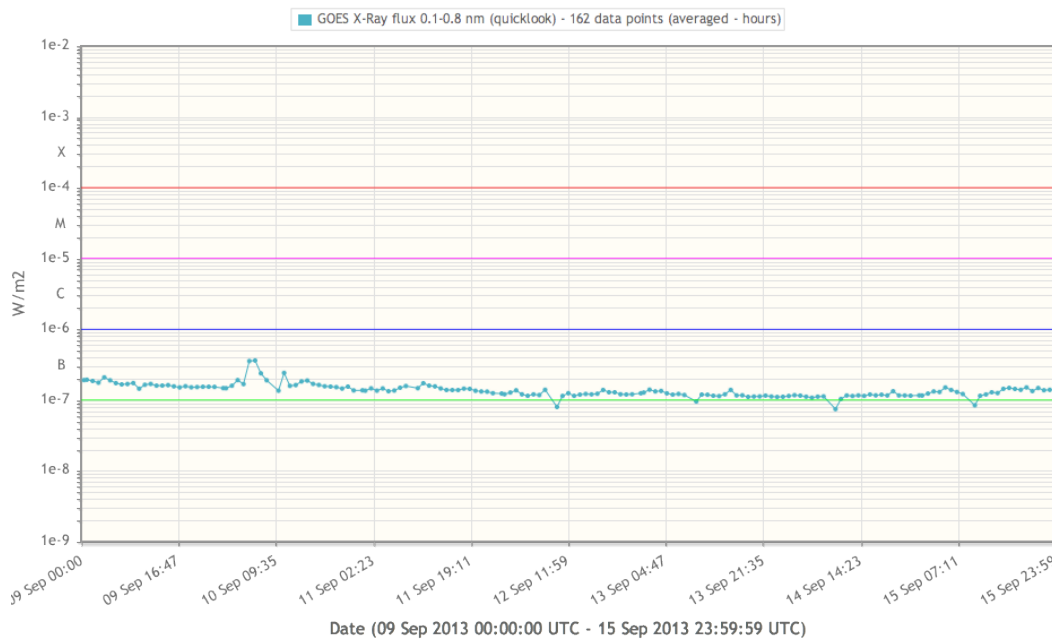


Big Prominence Eruption on South East Limb @ 04:15 - SWAP difference image

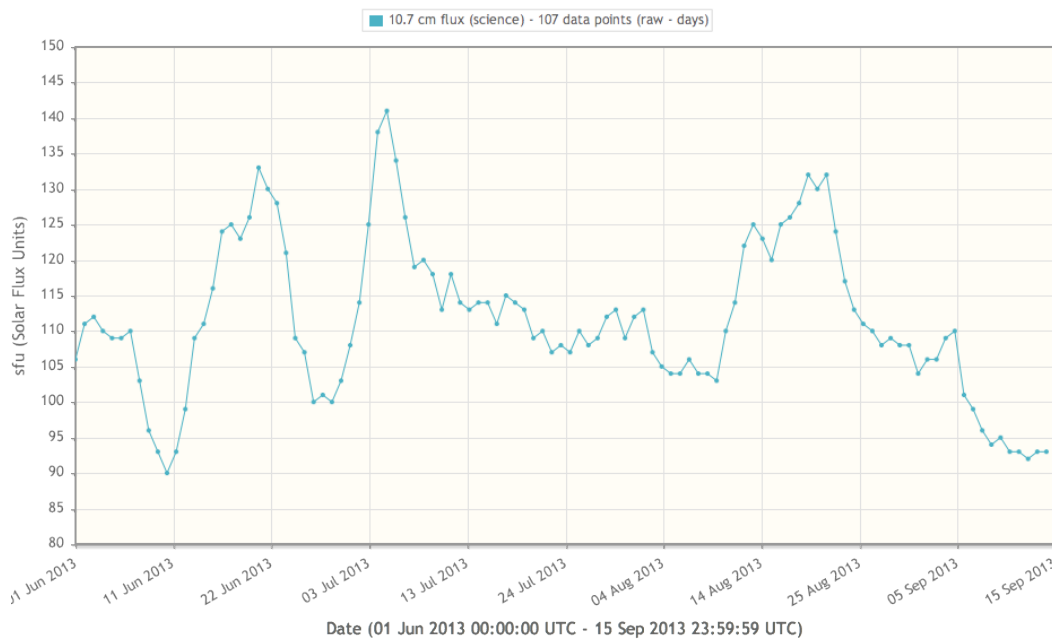
### 3. Review of solar and geomagnetic activity (9 Sep 2013 - 15 Sep 2013)

#### Solar Activity

Solar activity was very low throughout the week, no C-class flares were detected. The X-ray curve had a flat profile and was situated near the bottom of the B-level.



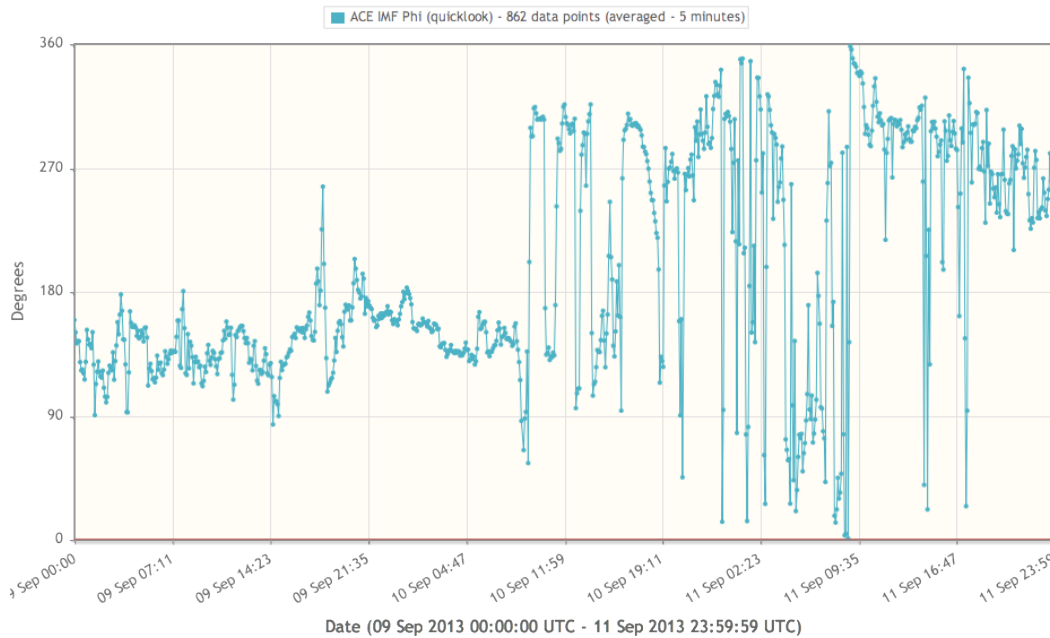
The F10cm flux has reached also low levels compared with the previous months as can be seen in the picture below.



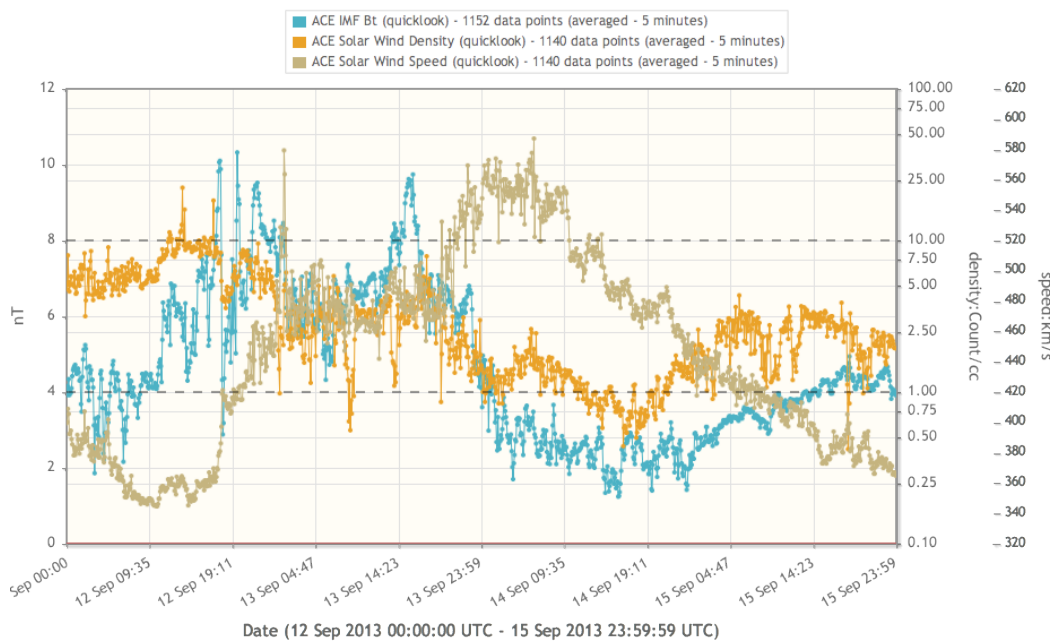


## Geomagnetic Activity

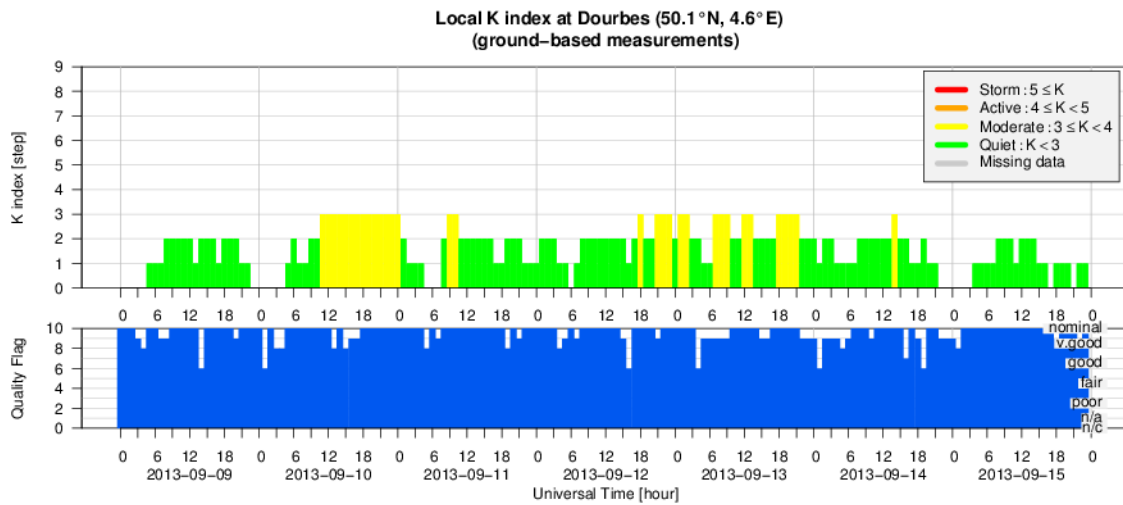
Geomagnetic conditions were quiet at Dourbes most of the week. Unsettled levels were reached on September 10 due to a sector boundary crossing. In the graph below, one can see that the angle denoting the direction of the interplanetary magnetic field near the L1 point changed from values between 90 and 180 degrees to values fluctuating near 360 (or 0) degrees.



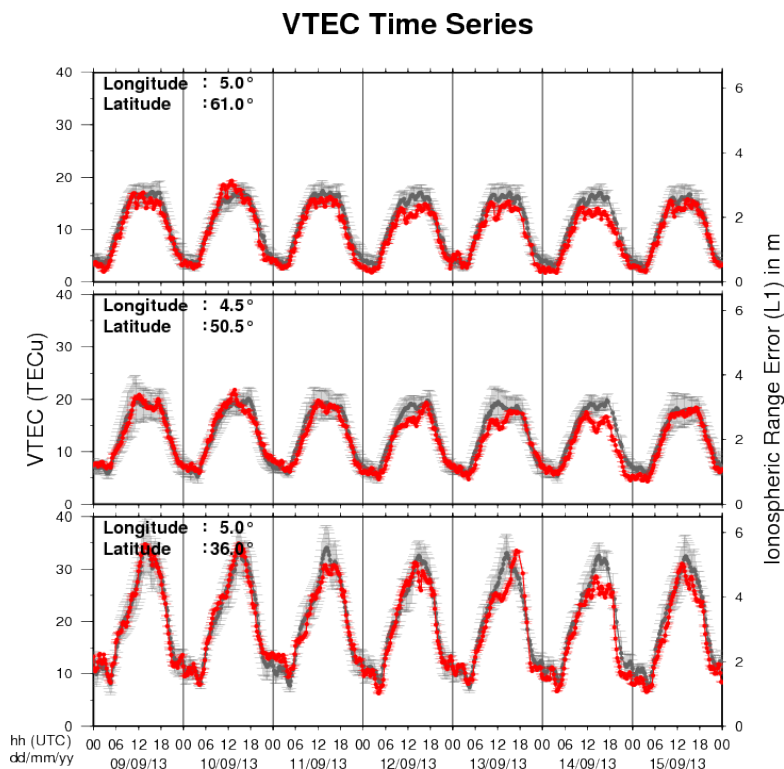
Again, unsettled levels were reached on September 13, this time due to the fast speed stream from a coronal hole: the density and the magnetic field strength increased on Sept 12 - 13. The solar wind speed started to increase gradually from late Sept 12 to peak on Sept 13. Accordingly, the density decreased since the mass flux stays - relatively - constant.



#### 4. Geomagnetic Observations at Dourbes (9 Sep 2013 - 15 Sep 2013)



#### 5. Review of ionospheric activity (9 Sep 2013 - 15 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  $TECu=10^{16}$  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. 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](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

## **7. New documents in the European Space Weather Portal Repository**

See <http://www.spaceweather.eu/en/repository>

### **SPENVIS Single Event Effects Modelling**

In this tutorial I show step by step how to calculate the single event upset rate for a planned mission with the SPENVIS SEE tool.

<http://www.spaceweather.eu/en/repository/show?id=478>

### **SPENVIS Spacecraft Charging Tools**

In this tutorial I give an overview of the spacecraft charging analysis tools, charging environment models and data sets that are available inside SPENVIS.

<http://www.spaceweather.eu/en/repository/show?id=479>

### **SPENVIS Radiation Package**

In this tutorial I give an overview of the radiation environment models and effect tools available in SPENVIS.

<http://www.spaceweather.eu/en/repository/show?id=480>