

# STCE Newsletter

5 May 2014 - 11 May 2014



*Published by the STCE - this issue : 16 May 2014. Available online at <http://www.stce.be/newsletter/>.*

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.

<b>Content</b>	<b>Page</b>
1. Prelude to a solar flare	2
2. SDO data centre help	4
3. ESWW11 poster release	5
4. PROBA2 Observations (5 May 2014 - 11 May 2014)	6
5. Review of solar activity (5 May 2014 - 11 May 2014)	10
6. Noticeable Solar Events (5 May 2014 - 11 May 2014)	12
7. Review of geomagnetic activity (5 May 2014 - 11 May 2014)	12
8. Geomagnetic Observations at Dourbes (5 May 2014 - 11 May 2014)	14
9. Review of ionospheric activity (5 May 2014 - 11 May 2014)	15
10. Future Events	15
11. New documents in the European Space Weather Portal Repository	16

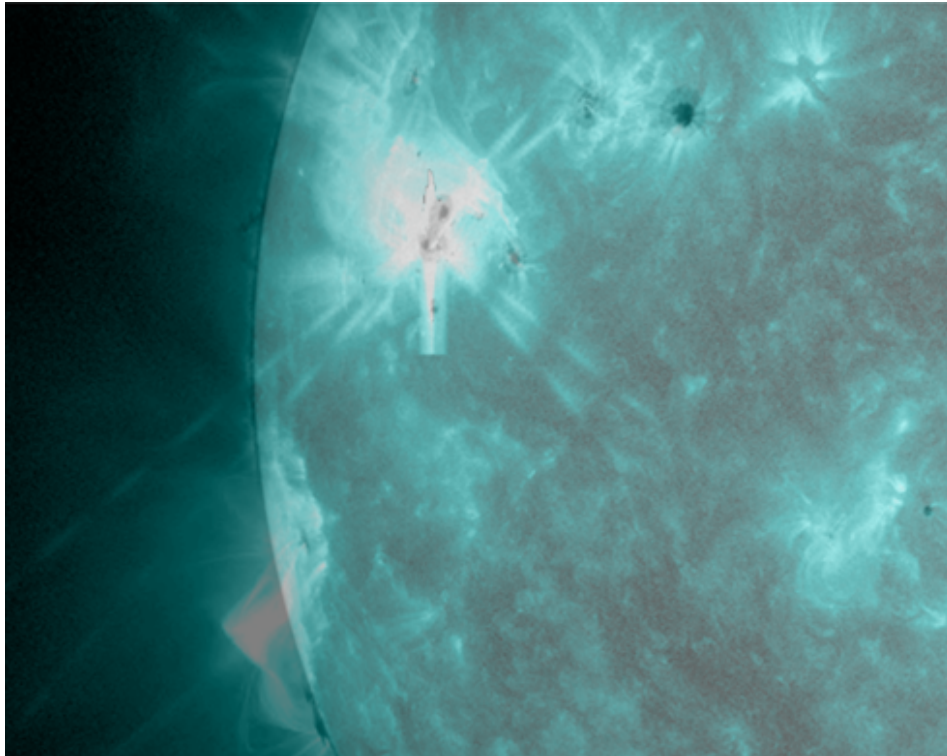
Final Editor : Petra Vanlommel  
Contact : R. Van der Linden, General Coordinator STCE,  
Ringlaan - 3 - Avenue Circulaire, 1180 Brussels,  
Belgium

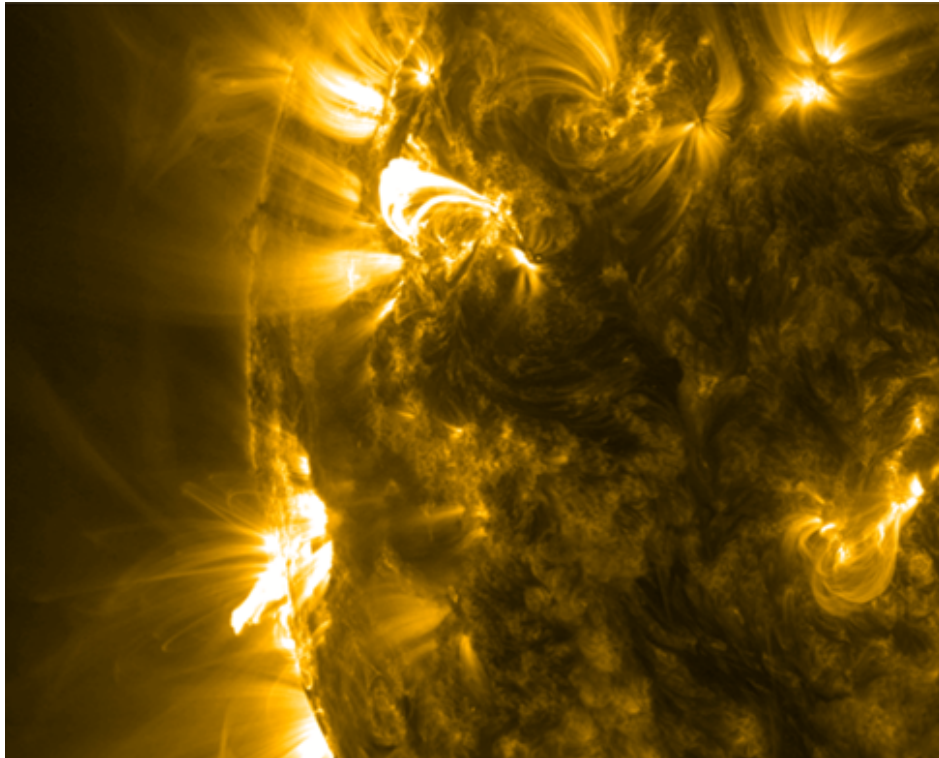
## 1. Prelude to a solar flare

On 8 May, an M5 flare took place in sunspot region NOAA 2056. This active region was part of a cluster of sunspot groups that had appeared from behind the Sun's east limb between 4 and 6 May.

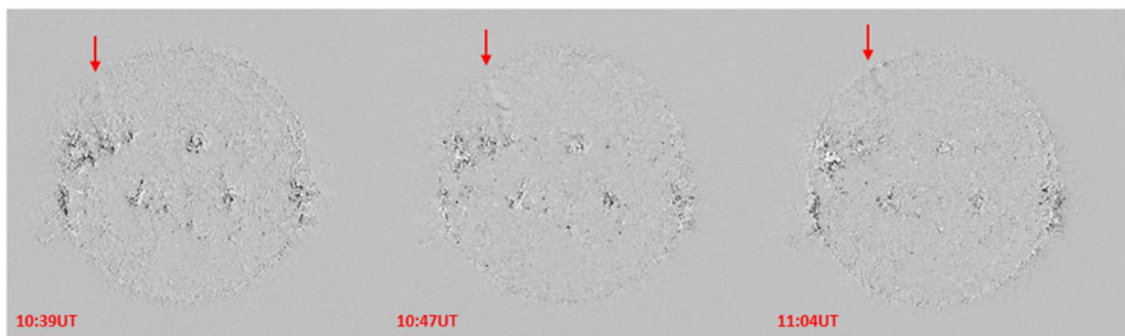
A movie of the event can be seen at <http://youtu.be/kfvz5fo6EYs>

Image underneath shows the flare near its maximum (10:07UT) as seen through SDO's AIA 131 filter (temperature of million degrees) overlaid on a white light image (SDO/HMI). The flare is located over the trailing part of NOAA 2056, which harbored a delta (i.e. 2 spots of opposite magnetic polarity within the same penumbra).

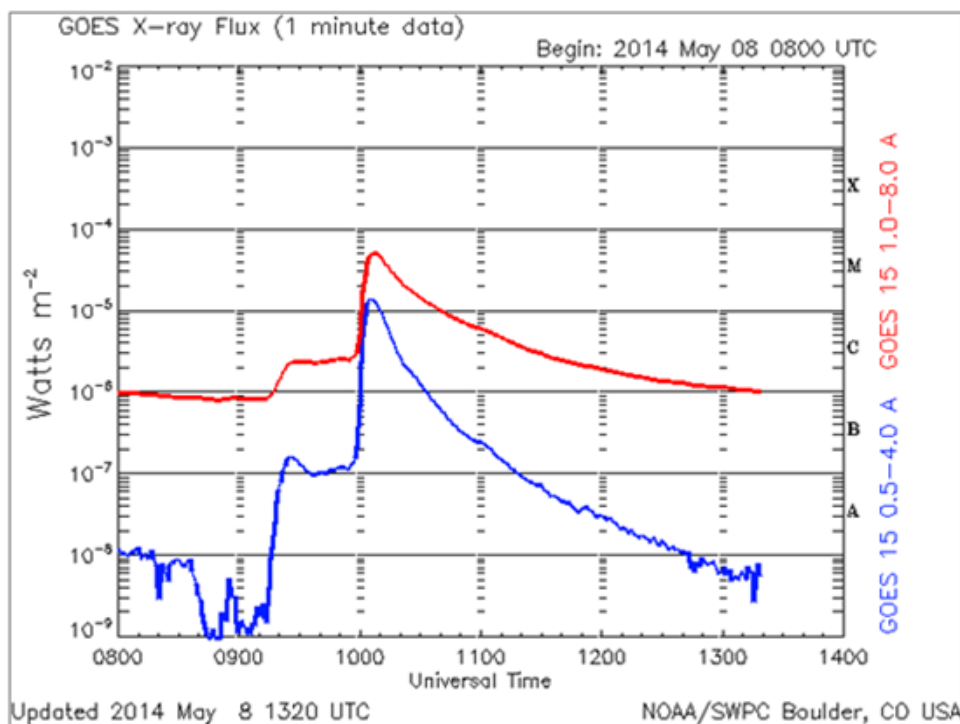




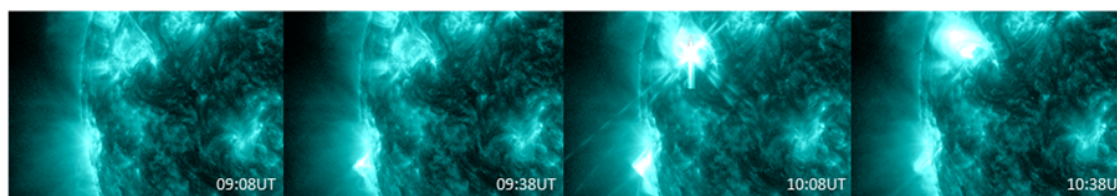
After the flare, SDO filters showing somewhat "cooler" temperatures of the Sun's atmosphere revealed the presence of post-flare coronal loops over the blast site (AIA 171 image above at 11:38UT). Scientists of the PROBA2 Science Centre noticed also a weak EIT-wave (<http://www.stce.be/news/241/welcome.html>) heading to the north between 10:30 and 11:10UT. The wave is best seen in difference images made by PROBA2's SWAP instrument (image underneath, and movie at [http://proba2.oma.be/swap/movies/20140508\\_swap\\_diff.mp4](http://proba2.oma.be/swap/movies/20140508_swap_diff.mp4) ). SOHO's coronagraphs did not reveal a clear coronal mass ejection (CME) associated to this event.



Interestingly, the x-ray flux as observed by the GOES15 satellite shows an increase well before the flare's peak at 10:07UT. Indeed, around 09:15UT, the x-ray flux gradually started to increase and stayed at C2-level for nearly half an hour (see graph underneath).



However, this "step-up" originated from a region at or just beyond the southeast solar limb. SDO--imagery (AIA 131) clearly demonstrates a flare starting around 09:15UT. At nearly 10:00UT, as the x-ray flux from the flare in NOAA 2056 rapidly rose, the x-ray flux from the source near the east limb declined. Hence, the stepped x-ray flux profile originated from two different sources.



Credits - Data and imagery were taken from SDO/AIA and HMI (<http://sdo.gsfc.nasa.gov/data/aiahmi/>), PROBA2/SWAP (<http://proba2.oma.be/ssa>) and GOES15/XRS ([http://www.swpc.noaa.gov/rt\\_plots/xray\\_1m.html](http://www.swpc.noaa.gov/rt_plots/xray_1m.html)).

## 2. SDO data centre help

The Solar Dynamics Observatory was in 2010 brought into an Earth orbit. It got the task to observe our Sun in all its glory which the spacecraft performs with verve producing tons of data distributed to Europe by the European SDO data centre located in Brussels.

### Major update

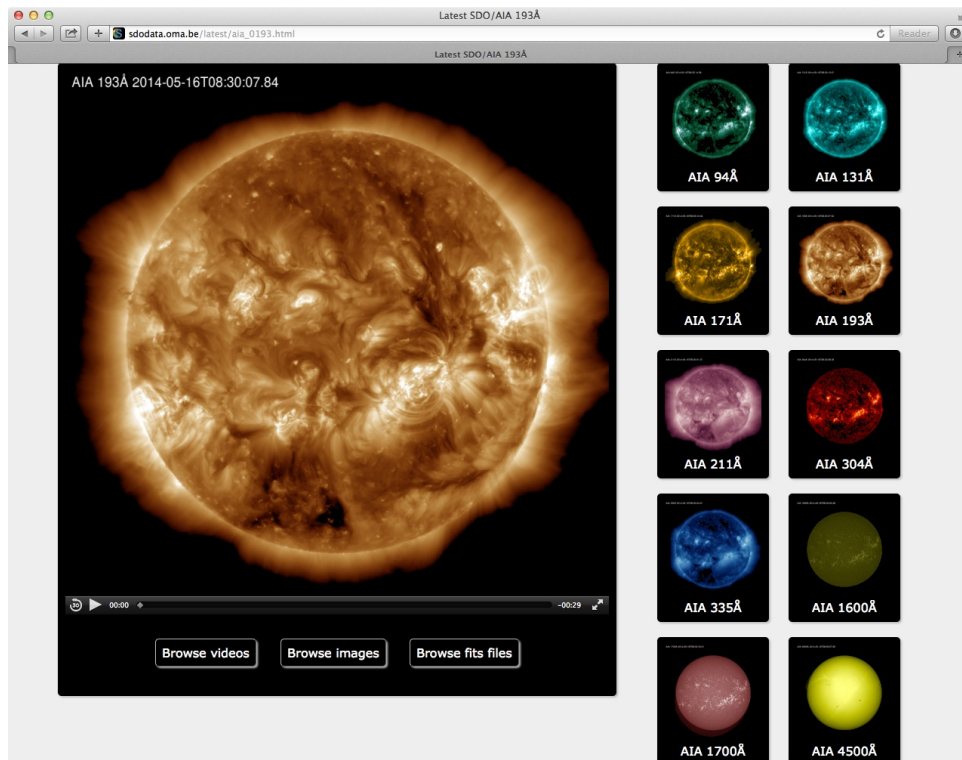
To provide the best possible service, the centre is interested in your feedback and set up a four question short survey. If you first need to be acquainted to the SDO data centre tricks and moves, please feel free to browse to the page explaining the use of the SDO wizard. It is in fact a play ground for solar scientists

interested in real time data, major events, solar software with exotic names of animals of recent and long passed eras in paleontology:  
<http://sdoatsidc.oma.be/web/sdoatsidc/DataAccessWizardSDO>

This brings you smoothly to the survey  
<http://sdoatsidc.oma.be/web/sdoatsidc/Survey>

Thanks for your input!

A snapshot of the latest data SDO page



### 3. ESWW11 poster release

ESWW11 - the 11th edition of the European Space Weather Week can count also this year on visual support





**November 17 - 21, 2014**  
**Liège, BELGIUM**



SPACECRAFT · IONOSPHERE & GNSS · PLANETARY SYSTEMS · NUMERICAL SW PREDICTIONS ·  
GEOSPACE · SOLAR PARTICLES · ENTERPRISES · SW SCIENCE, ENGINEERING AND APPLICATIONS ·  
SPACE BASED OBSERVATIONS · SPACE CLIMATE

[www.stce.be/esww11](http://www.stce.be/esww11)

Programme Committee  
M. Messori (Ita), A. Belchak (Via Chai, NGA), A. Glover (Via Chai, ESA), V. Bothmer (USOE), E. Clarke (US),  
M. A. Cliver (US), M. Hoppood (AUSTRALIA), D. Heyndericks (Belgium), A. Hilgers (ESA), D. Jackson (Australia),  
G. Lawrence (Ita), J. Lilensten (Belgium), J.-P. Luntoma (USA), D. Matthaei (Ita), D. Paschold (Ita), S. Poedts (Belgium),  
R. Van der Linden (STCE), P. Vanlommel (STCE)

Local Organization  
Solar-Terrestrial Centre of Excellence, Belgium



more on <http://www.stce.be/esww11>

## 4. PROBA2 Observations (5 May 2014 - 11 May 2014)

Solar flare activity fluctuated between low and moderate during the week.

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.

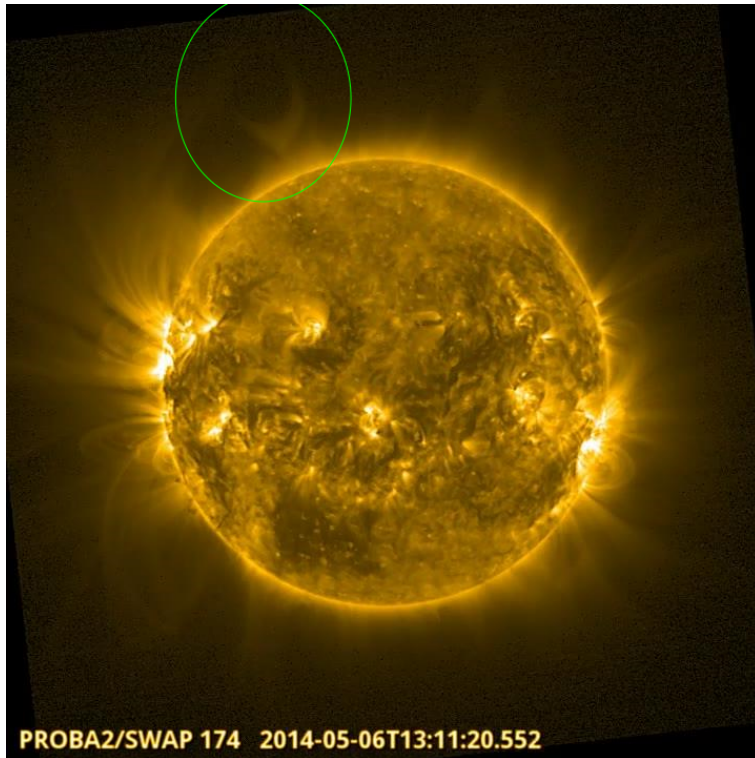
The weekly SWAP overview movie can be found here: [http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR215\\_May05\\_May11/weekly\\_movie\\_2014\\_05\\_05.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR215_May05_May11/weekly_movie_2014_05_05.mp4) (SWAP week 215).

At 2 occasions the Sun is seen to be off-pointed East, due to special campaigns.

Early in the week (Tue, Wed), some quite large scale structures and eruptions can be observed in the eastern corona (North and South, respectively).

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

Tuesday May 06



Cavity eruption, North East Limb @ 13:11 - SWAP image



Eruption on West Limb @ 23:06 - SWAP difference image

Find a movie here: [http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR215\\_May05\\_May11/20140506\\_EruptionWestLimb\\_2304\\_SWAPdiff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR215_May05_May11/20140506_EruptionWestLimb_2304_SWAPdiff.mp4) (SWAP difference movie)

### Friday May 09



Eruption on West Limb, extending up to SWAP FOV @ 02:51 - SWAP difference image

Find a movie here: [http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR215\\_May05\\_May11/20140509\\_Eruption\\_WestLimb\\_0251\\_SWAPdiff.mp4](http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR215_May05_May11/20140509_Eruption_WestLimb_0251_SWAPdiff.mp4) (SWAP difference movie)



**Saturday May 10**



Backside eruption behind West Limb @ 04:25 - SWAP difference image

**Saturday, Sunday, Monday May 10/11/12**

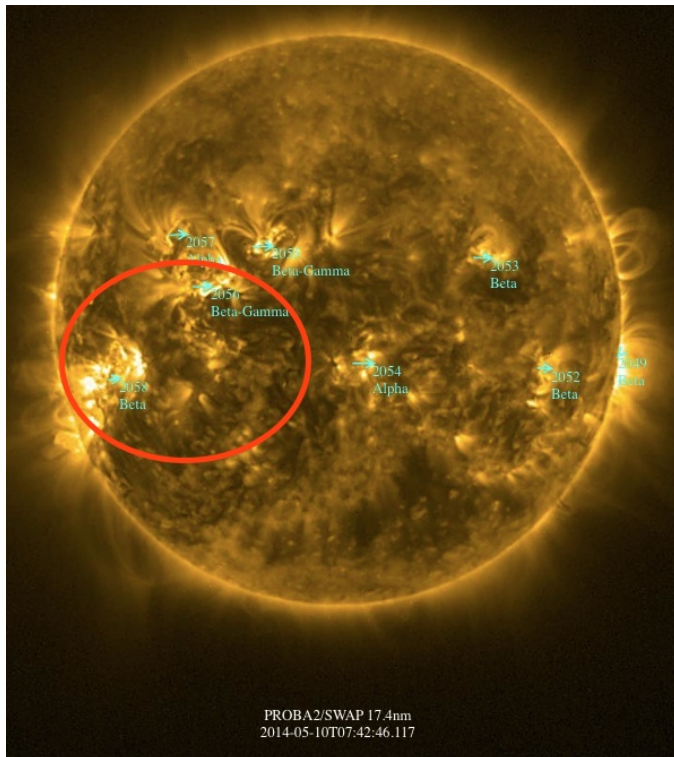
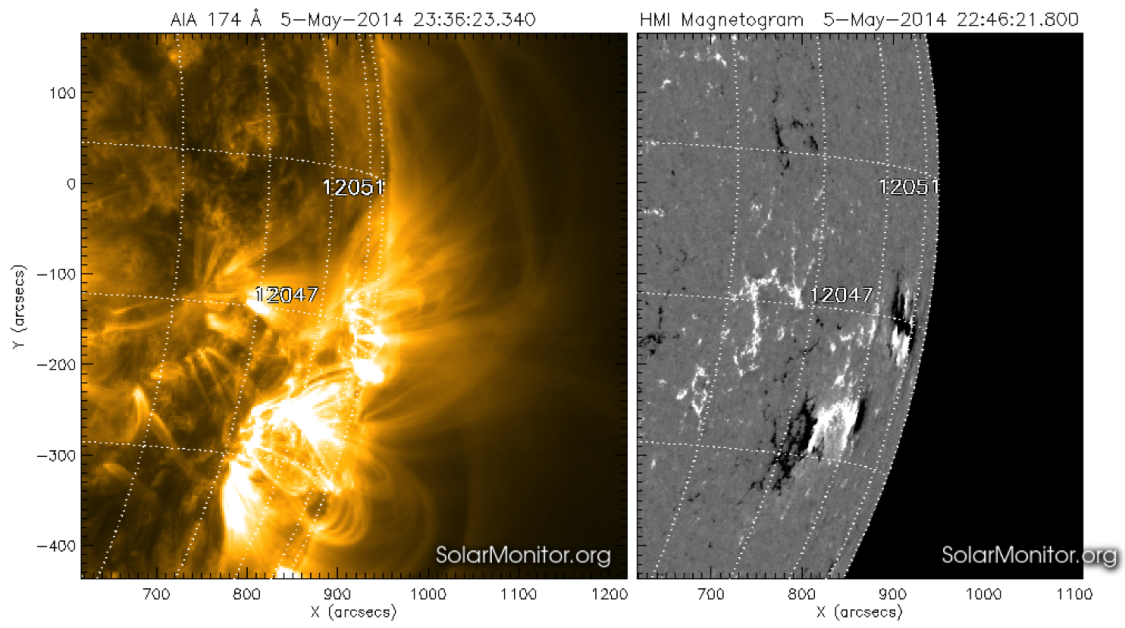


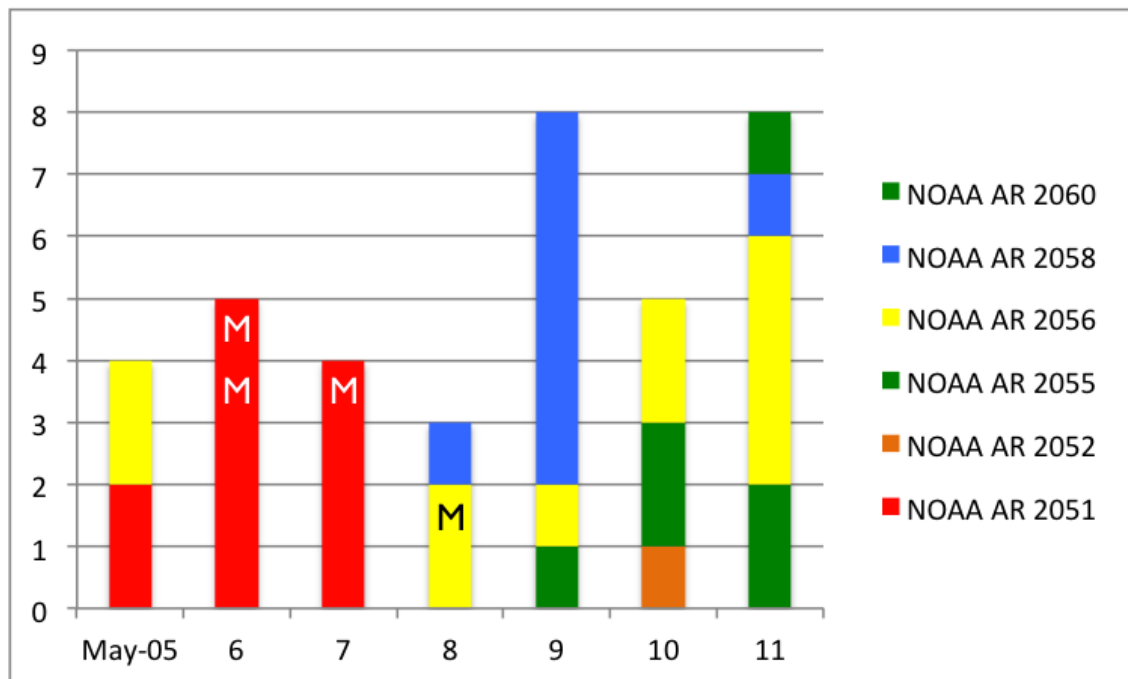
Multiple and extended flow-activity along the South-East limb @ 17:54 on Saturday - SWAP difference image (see the daily movies of 10/11/12 of May)

## **5. Review of solar activity (5 May 2014 - 11 May 2014)**

The background X-ray radiation was mostly at the high B level with a total of 33 C flares and 4 M flares associated with an active region.

NOAA AR 2051 was a member of club 'most active regions' with 8 C-flares and 3 M-flares. Other notable groups were AR 2056 and 2058 which turned into view from behind the east limb during the week. AR 2056 produced the biggest flare: an M5.3. The first picture below show AR 2051 on May 5 ready to end its trip over the solar disk. Its most energetic flares were produced at a moment when the region was rotating over the west limb. The SWAP EUV image shows the complete solar disk with special focus on 2056 and 2058. The chart nicely shows the distribution of flares over time and regions.





Quite a number of (partial) halo CME events were recorded, but none of them was front sided. The CME's associated with the solar activity of NOAA AR 2051 occurred when it was at or well behind the western limb.

## 6. Noticeable Solar Events (5 May 2014 - 11 May 2014)

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
06	0841	0903	0921	S15W84	M1.8	SF		III/2	36	2051
06	2201	2209	2220	S10W57	M1.0	SF		III/2	36	2051
07	1607	1629	1703	N15E50	M1.2	SF		III/1		2051
08	0920	1007	1018		M5.2		390			
08	0959	1007	1018	N8E54	M5.2	2B	390		43	2056

LOC: approximate heliographic location  
 XRAY: X-ray flare class  
 OP: optical flare class  
 10CM: peak 10 cm radio flux

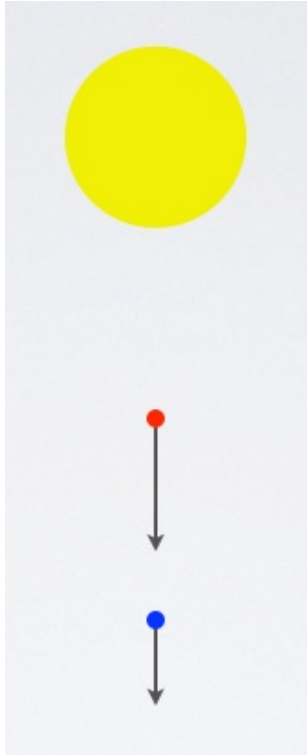
TYPE: radio burst type  
 Cat: Catania sunspot group number  
 NOAA: NOAA active region number

## 7. Review of geomagnetic activity (5 May 2014 - 11 May 2014)

Enhanced solar wind conditions after the arrival of the April 29 CME on May 3, were declining at the start of the week. After a shock arrival around 21:35 UT May 7, possibly related to the May 3 CME (see STCE news letter), a new period of increased solar wind values started with Bz reaching a maximal negative value around -12nT. Towards the end of the week these enhanced values persisted due to coronal hole high speed stream influence and speeds climbed to over 400 km/s but total magnetic field declined to around 5nT. It probably concerns the northern coronal hole which was near the meridian on May 7.

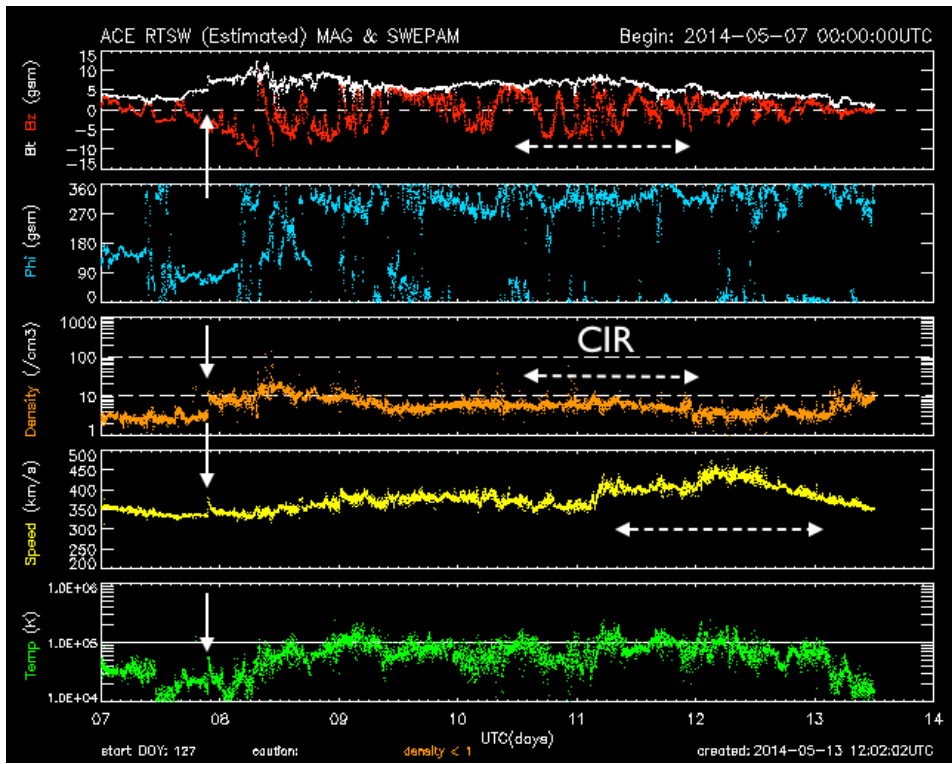
A typical coronal hole signature includes first an increase in Bt and density followed by a gradual increase in speed of the solar wind plasma. Because the Sun rotates, a fast solar wind particle (red) from a coronal hole can follow the same physical radial path of a slow solar wind particle (blue). When the fast wind

catches up with the slow wind in front of it, a compressed, both magnetically and in terms of density, plasma structure is formed which rotates as fast as the Sun rotates around its axis.



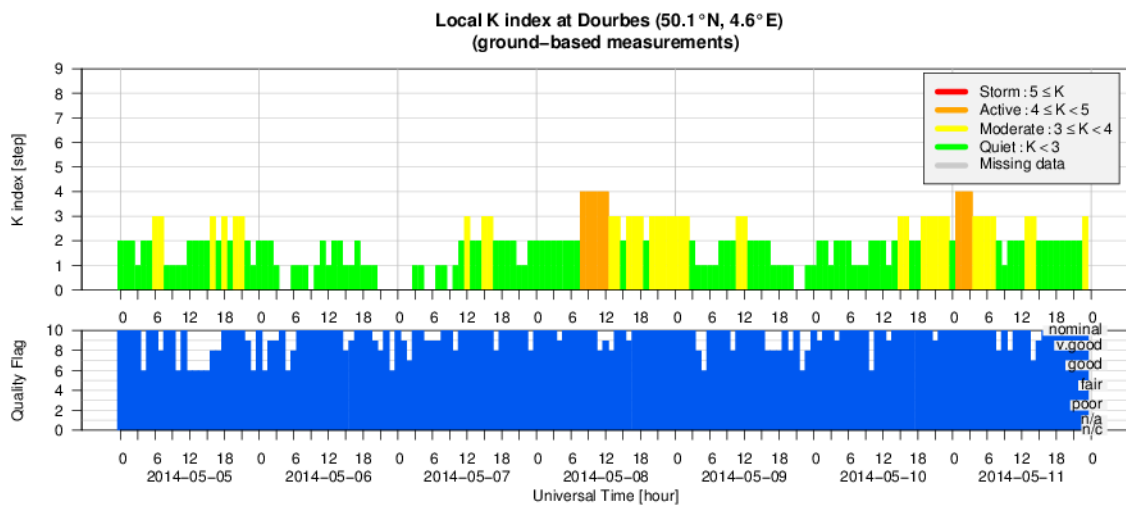
This is a co-rotating interaction region, CIR. ACE, fixed at the first Lagrangian point (L1) measures accordingly a gradually increasing solar wind speed: first the slow particles pass, followed by the fast particles. The speed curve shows a bump which comes a little later than the density/magnetic bump. As soon as the speed increases, the density and  $B_t$  decrease to conserve the mass flux. The point where the red dot overtakes the blue dot and forms a shock front (blue and red move together) is usually located behind 1AU.



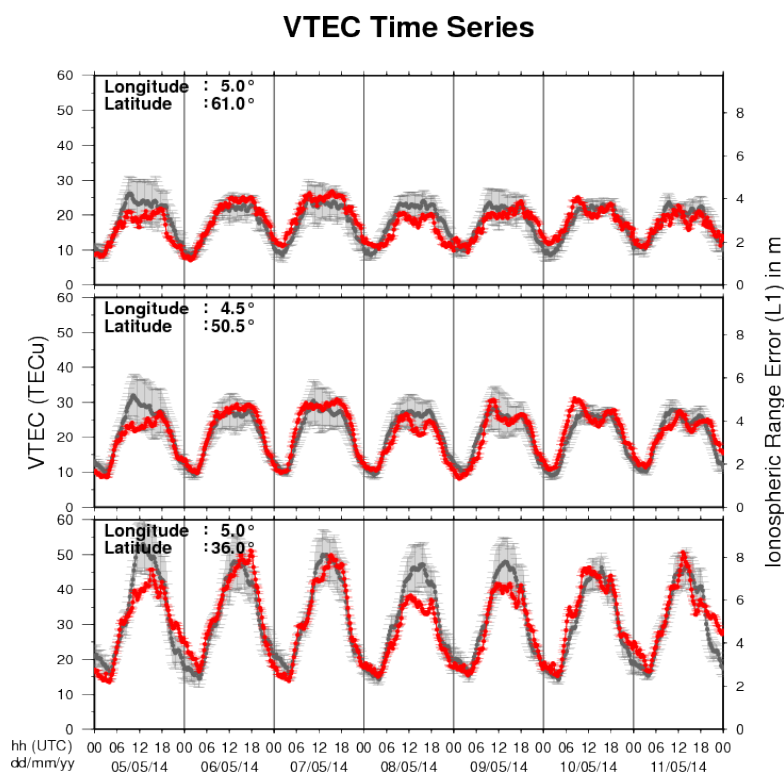


Geomagnetic conditions were mostly quiet to unsettled with two periods of active conditions following the shock arrival on May 7 and on May 11 after the onset of the high speed stream influence.

## 8. Geomagnetic Observations at Dourbes (5 May 2014 - 11 May 2014)



## 9. Review of ionospheric activity (5 May 2014 - 11 May 2014)



The figure shows the time evolution of the Vertical Total Electron Content (VTEC) (in red) during the last week at three locations:

- in the northern part of Europe (N61°, 5°E)
- above Brussels (N50.5°, 4.5°E)
- 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)

## 10. Future Events

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

**STCE workshop on degradation and inter-calibration of instruments observing in the SXR-EUV range in Brussels, Belgium**

Start : 2014-06-10 - End : 2014-06-11

The STCE workshop 'Inter-Calibration and Degradation of EUV Instruments' aims at understanding the differences observed between the various instruments observing in the SXR-EUV range and at analyzing the ageing effects that affect their results. It targets imagers as well as spectrometers and photometers. The workshop will be followed by two days of working sessions (June 12-13) organized by the Solar EUV Irradiance Working Group (also supported by the STCE). These working sessions are in the continuity of similar events organized in 2011, 2012 and 2013, but they are open to new participants and you are welcome to join if you are interested.

Website:

<http://www.stce.be/euvworkshop2014/>

### **3rd SWARM science meeting in Copenhagen, Denmark**

Start : 2014-06-19 - End : 2014-06-20

During the summer of 2014 DTU Space will host the 3rd Swarm Science Meeting, sponsored by the European Space Agency, ESA . This meeting will take place at the IDA Conference Centre in Copenhagen on June 19th to 20th 2014 and is open to the science community at large.

Website:

<http://congrexprojects.com/2014-events/Swarm/home>

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

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

### **STCE - PROBA Workshop: Belpo perspective**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the perspective of Belpo on the PROBA series and the Belgian involvement in the European space programmes.

<http://www.spaceweather.eu/en/repository/show?id=501>

### **STCE - PROBA Workshop: small can be GREAT**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the perspective of QinetiQ Space on the PROBA series.

<http://www.spaceweather.eu/en/repository/show?id=502>

### **STCE - PROBA Workshop: Proba-1 and -V from an EO perspective**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on Proba-1 and Proba-V as part of the ESA's Earth Observation Programme.

<http://www.spaceweather.eu/en/repository/show?id=503>

### **STCE - PROBA Workshop: PROBA2**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet about the PROBA2 science operations.

<http://www.spaceweather.eu/en/repository/show?id=504>

### **STCE - PROBA Workshop: PROBA-V**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the new operational mission PROBA-V, an earth observing satellite.

<http://www.spaceweather.eu/en/repository/show?id=505>

### **STCE - PROBA Workshop: Operation**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet about the operations at the PROBA satellites "nursery".

<http://www.spaceweather.eu/en/repository/show?id=506>

### **STCE - PROBA Workshop: PROBA-V experimental moon calibration method**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on a PROBA-V experimental moon calibration method.

<http://www.spaceweather.eu/en/repository/show?id=507>

### **STCE - PROBA Workshop: EPT onboard PROBA-V**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the instrument aspects, operations and science of the Energetic Particle Telescope (EPT) onboard of PROBA-V.

<http://www.spaceweather.eu/en/repository/show?id=508>

### **STCE - PROBA Workshop: coronal imaging with PROBA2/SWAP**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the challenges and successes of the coronal images SWAP onboard of PROBA2.

<http://www.spaceweather.eu/en/repository/show?id=509>

### **STCE - PROBA Workshop: Solar Irradiance Measurements with LYRA**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the Large-Yield Radiometer (LYRA) onboard of PROBA2. LYRA measures the solar irradiance in 4 bandpasses with 3 types of detectors.

<http://www.spaceweather.eu/en/repository/show?id=510>

### **STCE - PROBA Workshop: micro-cameras on PROBA-1 and 2**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the results and operations of the micro-cameras onboard of PROBA-1 and PROBA2.

<http://www.spaceweather.eu/en/repository/show?id=511>

### **STCE - PROBA Workshop: LEO impacts**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the impacts of the Low Earth Orbit radiation environment on PROBA satellites.

<http://www.spaceweather.eu/en/repository/show?id=512>

### **STCE - PROBA Workshop: ALTIUS**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on ALTIUS, an Atmospheric Limb Tracker for Investigation of the Upcoming Stratosphere.

<http://www.spaceweather.eu/en/repository/show?id=513>

### **STCE - PROBA Workshop: PROBA-3**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the future PROBA-3 satellite. PROBA-3 consists of 2 spacecraft flying in formation. The inner-satellite acts as the occulter for a chronograph observing the solar atmosphere.

<http://www.spaceweather.eu/en/repository/show?id=514>

### **STCE - PROBA Workshop: OLIVIA**

Presentation given at the STCE Workshop Science and science operations of the PROBA satellite fleet on the study of a Passive Companion Micro-Satellite to the SAOCOM-1B Satellite of Argentina, for bistatic and interferometric SAR applications.

<http://www.spaceweather.eu/en/repository/show?id=515>

### **STCE - Tomography workshop: 3D propagation of CMEs**

Presentation given at the STCE Workshop Tomography and 3D reconstruction in space science, April 2014 on 3D CME reconstruction: constraints, methods and an application.  
<http://www.spaceweather.eu/en/repository/show?id=516>

### **STCE - Tomography workshop: SDO/AIA 3D temperature/density reconstructions of the solar corona**

Presentation given at the workshop Tomography and 3D reconstruction in space science, April 2014 on temperature and density reconstruction of coronal structures. The technique which is based on Python is applied to polar plumes observed in SDO/AIA images.  
<http://www.spaceweather.eu/en/repository/show?id=517>

### **STCE - Tomography workshop: Tomography at all scales**

Presentation given at the workshop Tomography and 3D reconstruction in space science, April 2014 about the work performed at Vision Lab ASTRA: All Scale Tomographic Reconstruction Antwerp.  
<http://www.spaceweather.eu/en/repository/show?id=518>

### **STCE - Tomography workshop: estimates of energy of electron precipitation above auroral arcs**

Presentation given at the workshop Tomography and 3D reconstruction in space science, April 2014 on how the 2D energy spectra of electron above the auroral arcs are estimated. The technique uses optical ground-based observations done with ALIS, Auroral Large imaging System.  
<http://www.spaceweather.eu/en/repository/show?id=519>

### **eHEROES - where Space Weather and Communication meet**

Raising awareness and get people outside the scientific community involved in space weather becomes more and more an issue. To cross the borders of our science project eHEROES, we came up with a tide communication plan that answers the questions: what, to whom, why, when, how, by whom? The key is to link the audience and your message in a correct way. Both formal and informal education are on our tool list. This is an invited poster presented at EGU, 2014 in the session Raising and maintaining awareness of our local space weather: education and public outreach. eHEROES, Environment for Human Exploration and RObotic Experimentation in Space is an FP7 project (n° 284461, [www.eheroes.eu](http://www.eheroes.eu)).  
<http://www.spaceweather.eu/en/repository/show?id=520>