STCE Newsletter

28 Jul 2014 - 3 Aug 2014

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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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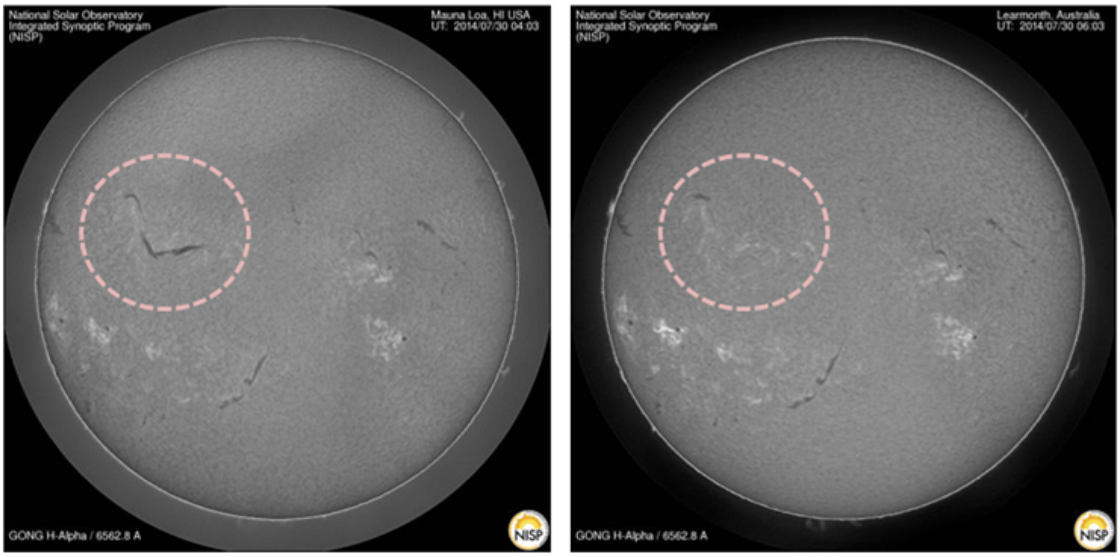
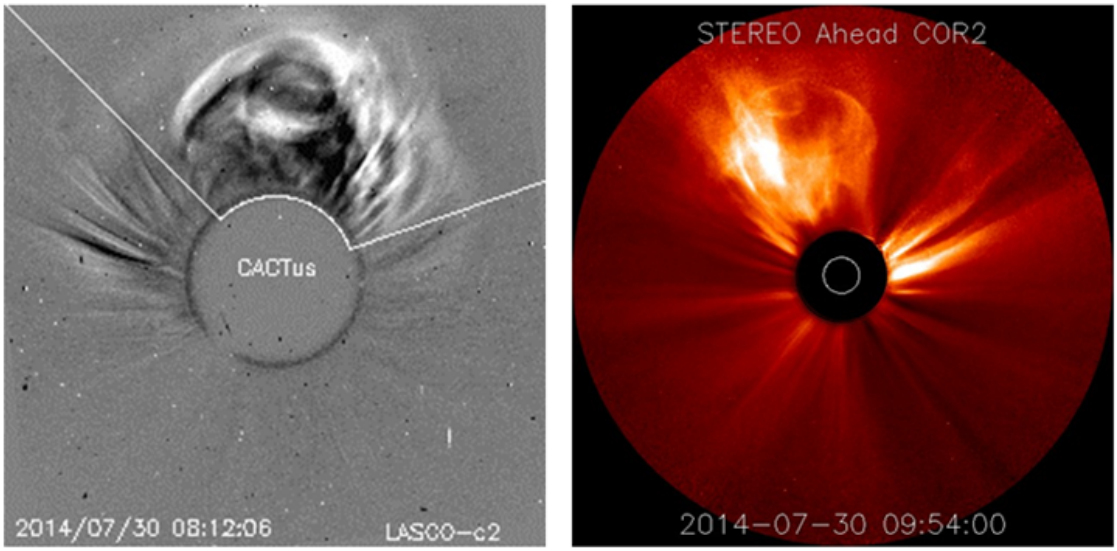
1. A filament always rings twice

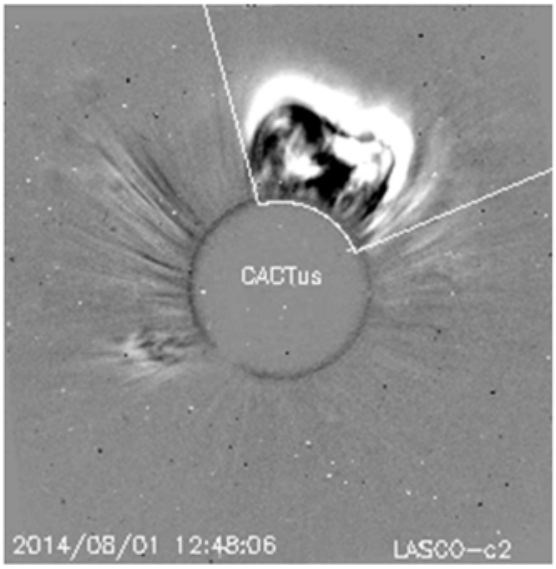
Solar filaments are clouds of ionized gas above the solar surface squeezed between magnetic regions of opposite polarity. Being cooler and denser than the plasma underneath and their surroundings, these magnetic borderlines appear as dark lines when seen on the solar disk using special filters. As filaments grow longer, they are more likely to erupt, often accompanied by a coronal mass ejection (CME).

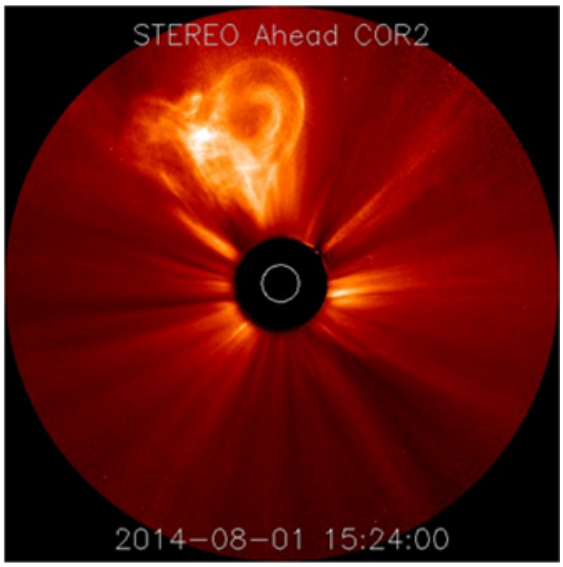


A long filament in the northeast quadrant erupted on 30 July, as can be seen in the above images from the GONG H-alpha Network. In less than 2 hours, this 60.000 km long string of ten thousand degrees hot plasma was slingshot into space, leaving the area on the solar disk remarkbly blank. Coronal dimming and post-eruptive coronal loops ("arcade") were observed, but no x-ray flare. The associated CME was mainly directed to the north, but SOHO and STEREO imagery showed some faint outlines indicating that part of the CME envelope may be directed to Earth. A glancing blow was expected by 2 August, but either missed Earth or had only some faint signature during the afternoon of 3 August with little geomagnetic effect.

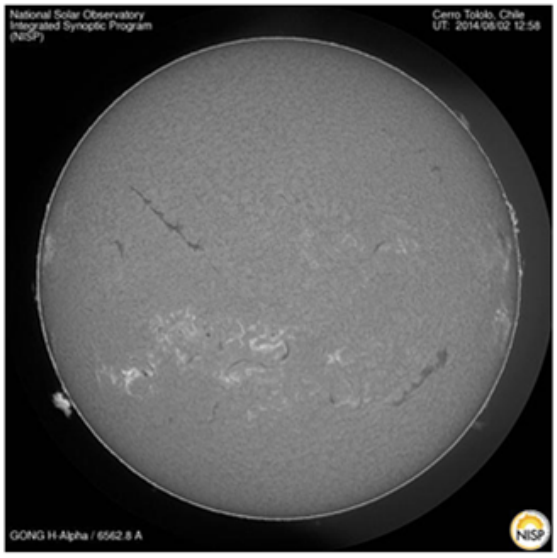


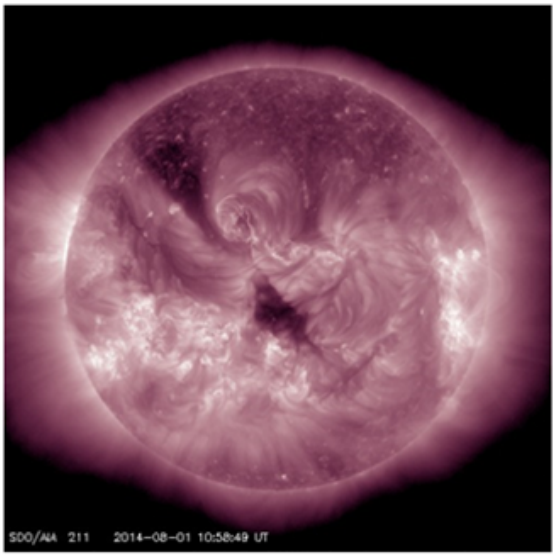
Many thought that this was the end of the story, but the filament decided to write an additional chapter to it. Indeed, a small outer end (northeast) and the original filament channel (visible only in EUV) were still intact. Becoming unstable 2 days later, another filament eruption occurred very similar to the first one, but this time the associated CME was somewhat slower (about 600 km/s compared to 800 km/s) and clearly did not have an Earth-directed component despite it being so much closer to the disk center.





One might wonder why this filament erupted (twice), whereas two other filaments which were even slightly longer, did not erupt (see H-alpha image underneath on the left). One of the reasons may be because of the shape of the filament. The erupting filament had an L-shape that may have caused locally increasing stresses. The two other filaments were fairly straight or mildly curved at most. Another reason may be that the two quiet filaments were far away from any active areas such as sunspot groups, whereas the erupting filament was sitting right on top (north) of a small equatorial coronal hole and to the west of a coronal hole extension (see the SDO/AIA 211 image on the right). Interaction between the filament and the coronal holes may have caused the necessary instabilities for an eruption. Other reasons, combinations not excluded, are possible.



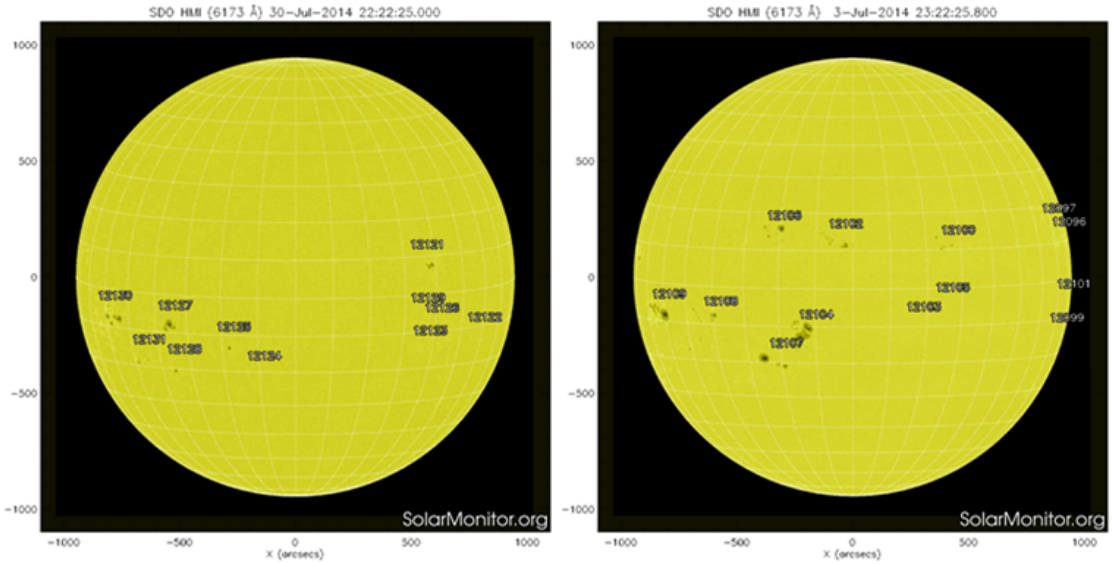


A movie of the two eruptions as seen in SDO/AIA 193, as well as of the associated CMEs seen by SOHO/LASCO (CACTUS) and STEREO-A (solar farside) can be seen at http://youtu.be/6OZF-mdyBr8

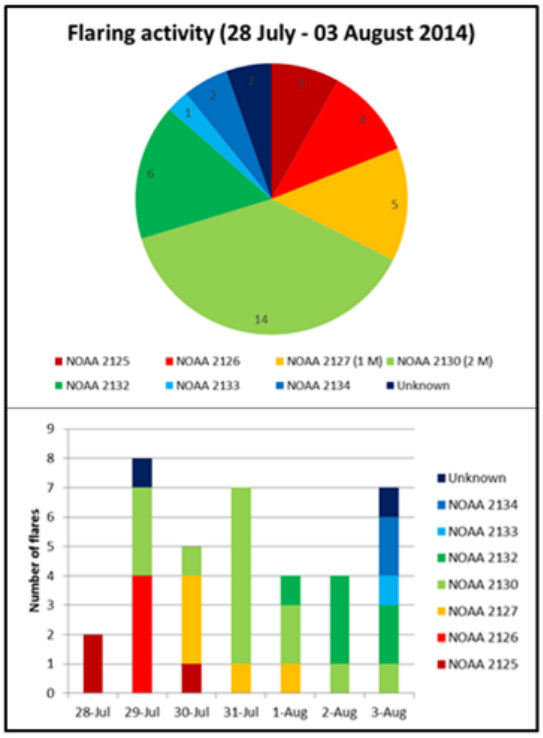
Credits - Image and data were taken from the GONG H-alpha Network (http://halpha.nso.edu/), SOHO (http://sohowww.nascom.nasa.gov/), STEREO (http://stereo.gsfc.nasa.gov/), SDO (http://sdo.gsfc.nasa.gov/), CACTUS (http://www.sidc.oma.be/cactus/) and Helioviewer (http://helioviewer.org/).

2. Review of solar activity (28 Jul 2014 - 3 Aug 2014)

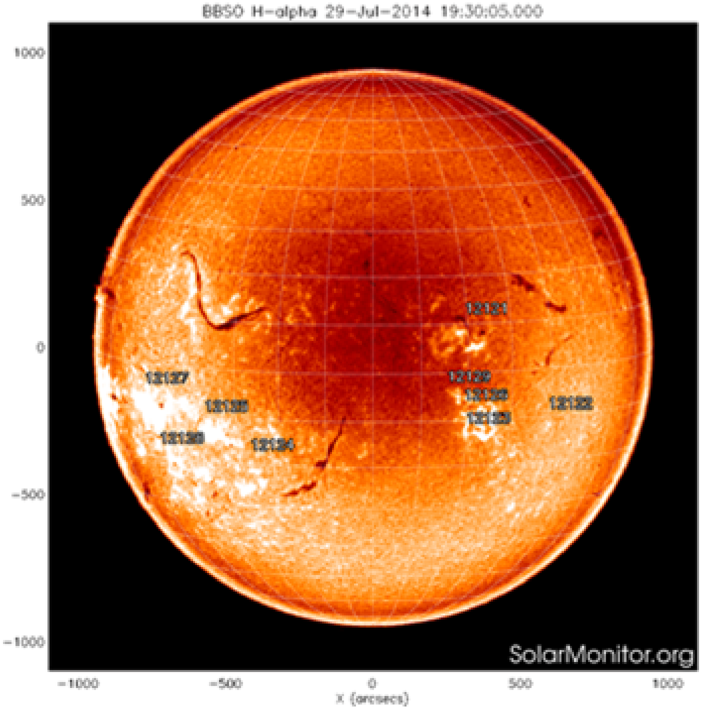
The beginning of the week continued the return of a cluster of active regions on the southern hemisphere that was also present a solar rotation ago. See the comparison underneath (left image: 30 July, right image: 3 July).



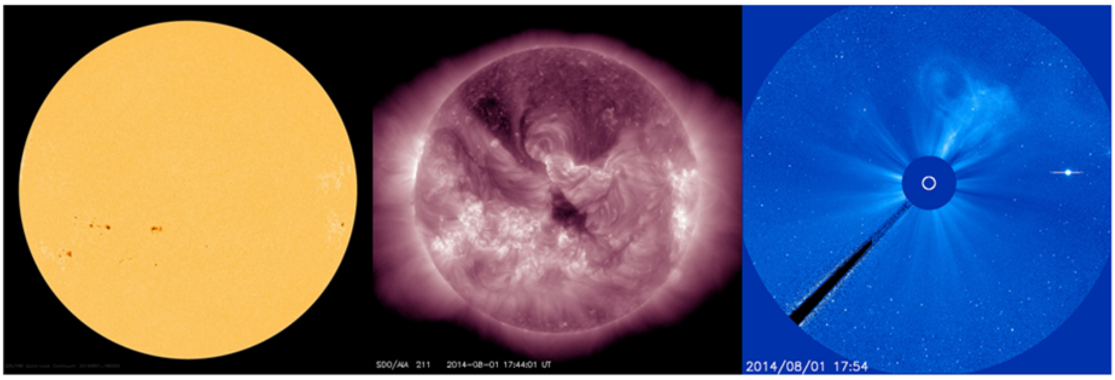
A total of 34 C- and 3 M-class flares were observed, two thirds of which were produced by sunspot regions NOAA 2127, 2130 and 2132. NOAA 2127 produced an M1 flare on 1 August, and NOAA 2130 was the source of 14 C-class and 2 M-class flares, including the strongest event of the week (M2.5 peaking on 31 July at 11:14UT) and an M2 flare on 1 August. The bulk of the coronal mass ejection (CME) associated to the 1 August M-class flaring was directed to the southeast and away from Earth.



A 30 degrees long filament erupted around 04:30UT on 30 July in the northeast solar quadrant. Coronagraphic imagery indicated a possible glancing blow from the associated CME on 2 August. The same filament channel was the source of another filament eruption on 1 August (around 10:15UT). However, the associated CME was directed mainly to the north and did not seem to have an Earth-directed component despite its proximity to the disk's center.



Two 25-30 degrees long filaments in the northeast and southwest quadrant remained stable. A small equatorial coronal hole (CH) with positive magnetic polarity passed the central meridian (CM) on 1 August.



A movie of the solar activity in white light (sunspot groups), EUV (coronal holes, flares, and filament eruptions), and coronagraphic images (CMEs) can be seen at http://youtu.be/fVLY_Mp1ELU

3. Noticeable Solar Events (28 Jul 2014 - 3 Aug 2014)

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
31	1101	1114	1121		M2.5				35	2130
01	1443	1448	1457		M2.0		340	III/1	35	2130
01	1755	1813	1848		M1.5		97	III/2CTM/1II/2IV/1	32	2127

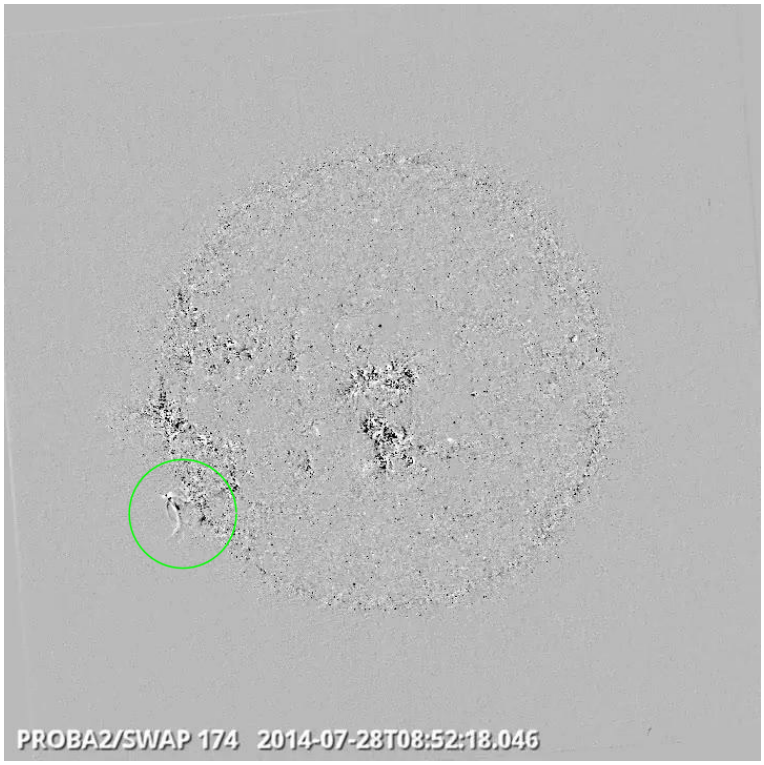
LOC: approximate heliographic location
XRAY: X-ray flare class
OP: optical flare class
10CM: peak 10 cm radio flux
TYPE: radio burst type
Cat: Catania sunspot group number
NOAA: NOAA active region number

4. PROBA2 Observations (28 Jul 2014 - 3 Aug 2014)

Solar Activity

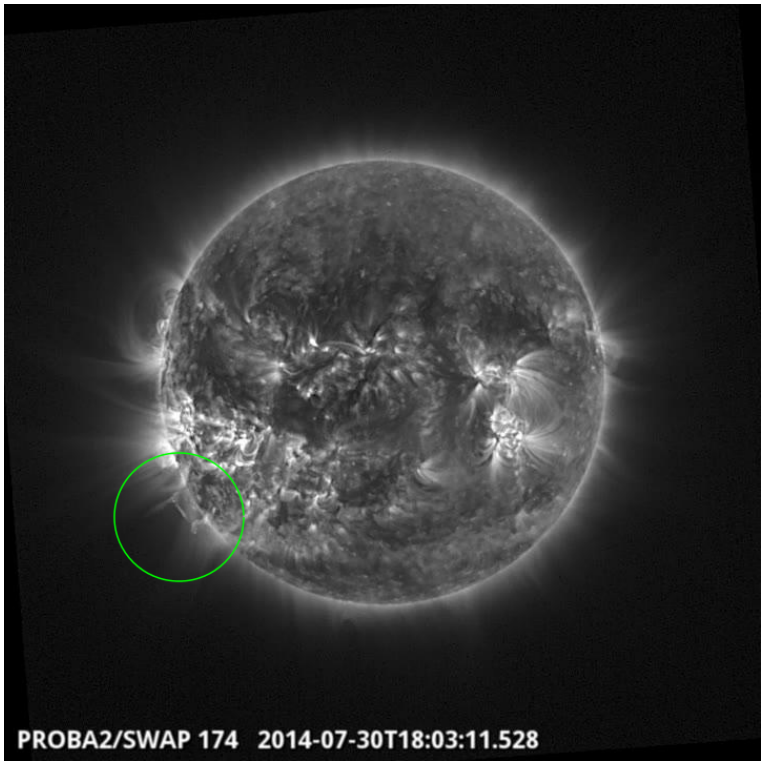
Solar flare activity fluctuated between low and moderate during the week.
In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: http://proba2.oma.be/ssa
This page also lists the recorded flaring events.
A weekly overview movie can be found here (SWAP week 227).
http://proba2.oma.be/swap/data/mpg/movies/WeeklyReportMovies/WR197_Dec30_Jan5/weekly_movie_2013_12_30.mp4
Details about some of this week's events, can be found further below.

Monday Jul 28

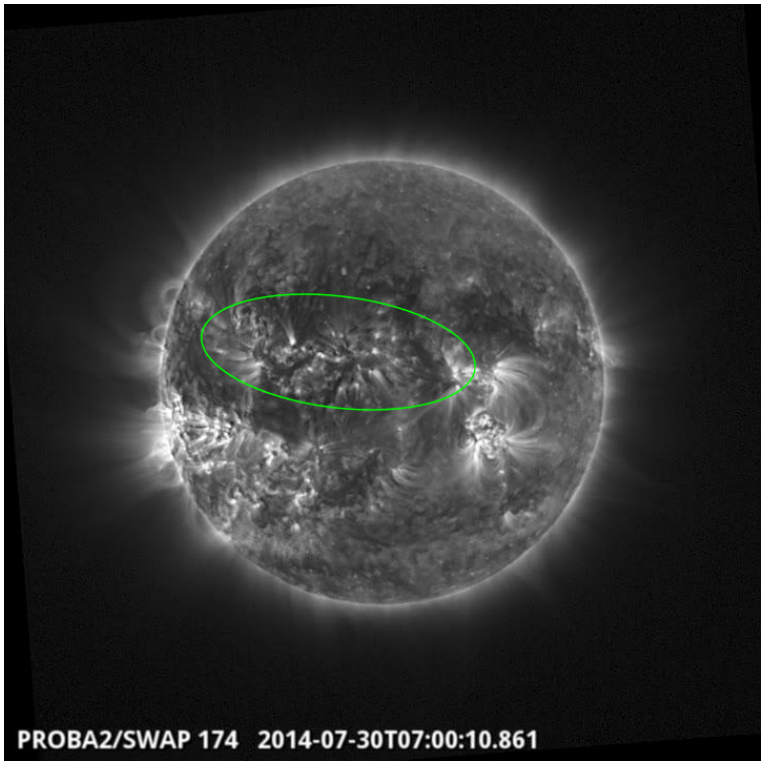


Eruption on the east limb @ 08:52 SWAP difference image
Find a movie of the events here (SWAP difference movie)
http://proba2.oma.be/swap/data/mpg/movies/20140728_swap_diff.mp4

Wednesday Jul 30

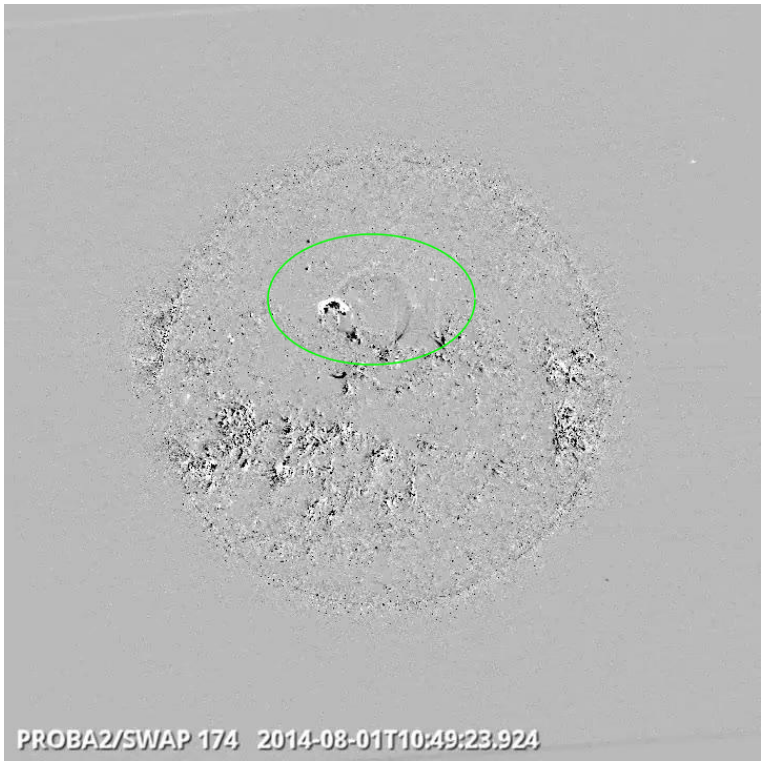


Flow in the centre @ 07:00 SWAP image
Find a movie of the event here (SWAP movie)
http://proba2.oma.be/swap/data/mpg/movies/20140730_swap_movie.mp4

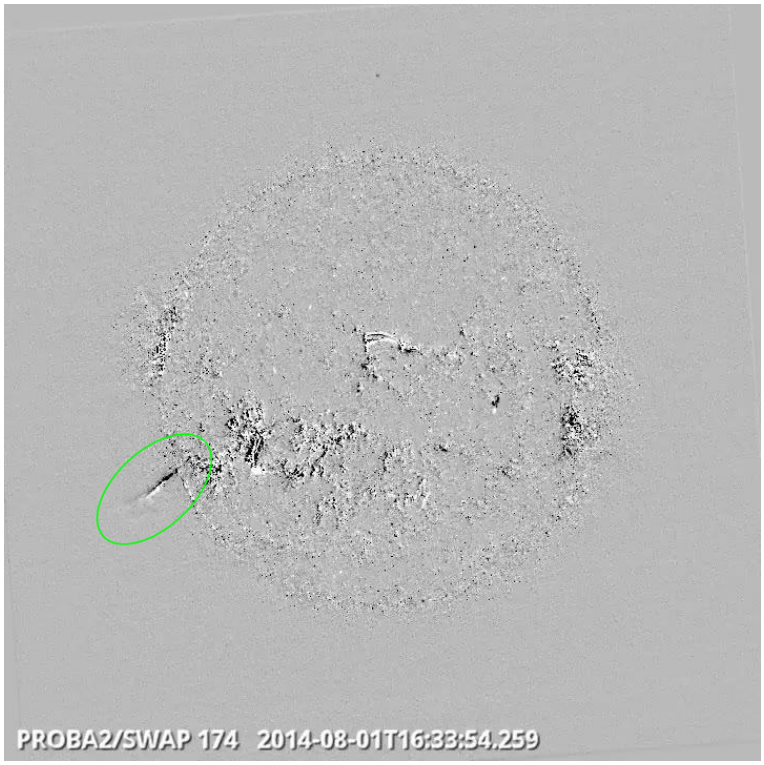


Failed eruption on the east limb @ 18:03 SWAP image
Find a movie of the event here (SWAP movie)
http://proba2.oma.be/swap/data/mpg/movies/20140730_swap_movie.mp4

Friday Aug 01



Eruption and arcade loops in the centre @ 10:49 SWAP difference image
Find a movie of the event here (SWAP difference movie)
http://proba2.oma.be/swap/data/mpg/movies/20140801_swap_movie.mp4



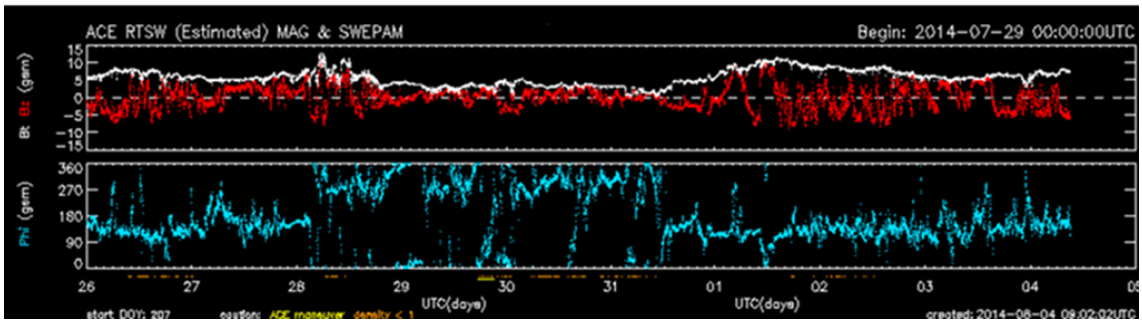
Surge on the east limb @ 16:33 SWAP difference image
Find a movie of the event here (SWAP difference movie)
http://proba2.oma.be/swap/data/mpg/movies/20140801_swap_movie.mp4

Saturday Aug 02

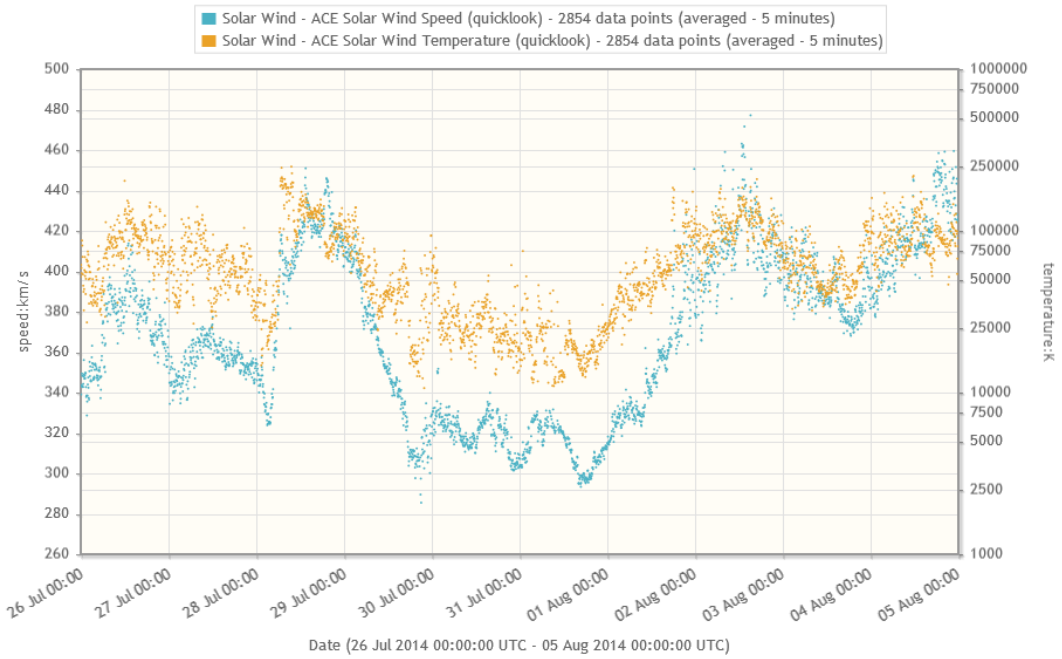
Eruption on the west limb @ 00:54 SWAP difference image
Find a movie of the event here (SWAP difference movie)
http://proba2.oma.be/swap/data/mpg/movies/20140802_swap_movie.mp4

5. Review of geomagnetic activity (28 Jul 2014 - 3 Aug 2014)

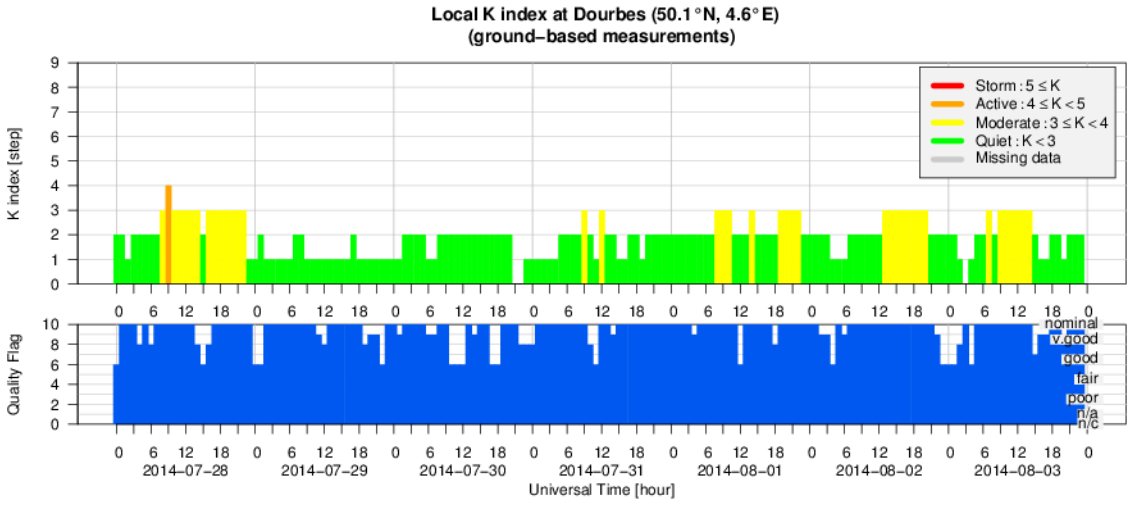
Two sector boundary crossings (SBC) were observed in the solar wind parameters: One early on 28 July, when the direction of the interplanetary field (IMF) changed from away to towards the Sun, and another one on 31 July around noon, when the IMF direction changed again to away from the Sun (see evolution of the Phi angle in graph underneath - blue line). In response to both SBCs, solar wind speed gradually increased resp. from about 330 to about 430 km/s on 28 July, and from about 300 to about 460 km/s on 2 August. Bz varied correspondingly between -8 and +11 nT, and was between -5 and +5 nT in between. Geomagnetic conditions were quiet to unsettled, except shortly after both SBCs when Dourbes recorded a brief active episode on 28 July, and on both 1 and 2 August when a single active period was recorded in the Kp-index (quiet to unsettled conditions in Dourbes).



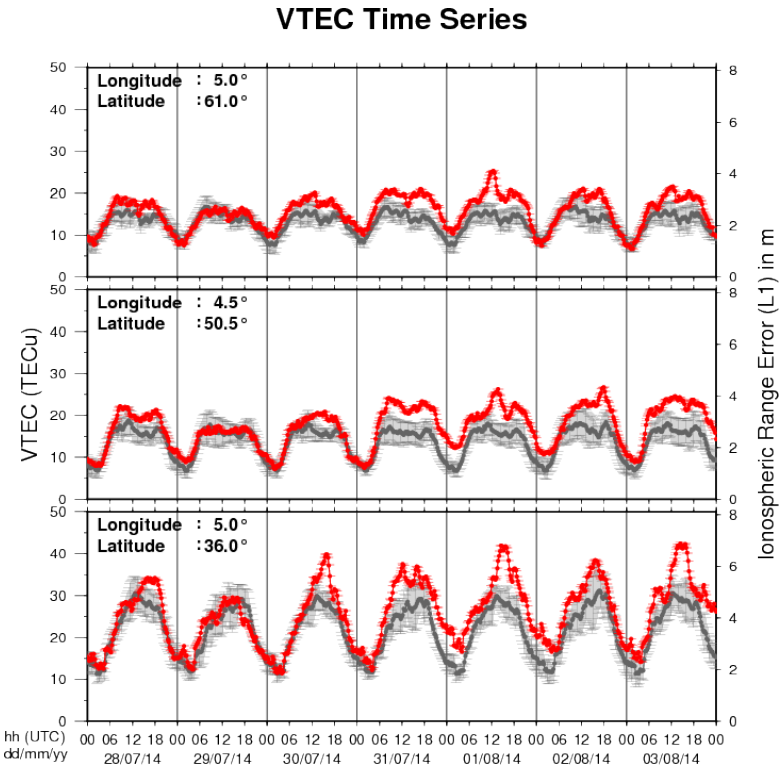
In the wake of the second SBC, two small disturbances were observed in the solar wind. The first one started on 3 August around 15:00UT, lasted about 6 hours, and may have been related to the late arrival of the 30 July CME, or to the early arrival of the CME associated to the 1 August M-flaring activity. No shock was observed (see evolution of Bz in image above - red line). The second disturbance manifested itself around 19:00UT on 3 August, when wind speed picked up again from about 370 km/s gradually increasing to around 450 km/s late on 4 August. This disturbance possibly marked the influence from the coronal hole that passed the central meridian on 1 August (see graph below). Bz reached maximum negative values of resp. -8 nT, resulting in only unsettled geomagnetic conditions.



6. Geomagnetic Observations at Dourbes (28 Jul 2014 - 3 Aug 2014)



7. Review of ionospheric activity (28 Jul 2014 - 3 Aug 2014)



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

8. New documents in the European Space Weather Portal Repository

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

9. Future Events

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

European Planetary Science Congress 2014 in Cascais, Portugal

Start : 2014-09-07 - End : 2014-09-12
Planetary space weather can be characterised by changes in the ambient planetary magnetic field and plasma populations around the planetary environment while space climate refers to the long-term changes in space weather conditions. Space weather and space climate are driven by the changes in the Sun. The effects of Space Weather on the Earth's environment are well documented, particularly in terms of risk to satellites, communications and ground-based systems such as electrical power grids and pipelines. However, planetary space weather and space climate studies as well as better prediction models for space weather are needed. Typically differences in the magnetic field and plasma environment at different planets, as well as the distance of the planet from the sun drives different space weather effects as we move through the solar system. The use of solar wind propagation models combined with solar observations allows us to obtain and predict the interplanetary conditions around each planet.
We solicit papers on planetary as well as terrestrial space weather and space climate, where data from past and on-going space missions such as ACE, SOHO, SDO, MEX, VEX, MESSENGER and CASSINI is used. We welcome papers on observations as well as modeling of space weather and space climate in our solar system.
Website:
http://meetingorganizer.copernicus.org/EPSC2014/session/16809

Workshop on Radiation Monitoring for the International Space Station in Krakow, Poland

Start : 2014-09-09 - End : 2014-09-11
The Workshop on Radiation Monitoring for the International Space Station (WRMISS) has been held annually since 1996. The major purpose of WRMISS is to provide a forum for discussion of technical issues concerning radiation dosimetry aboard the International Space Station and other spacecraft. This includes discussion of new results, improved instrumentation, detector calibration, and radiation environment and transport models. The goal of WRMISS is to enhance international efforts to provide the best information on the space radiation environment in low-Earth orbit and on the exposure of astronauts and cosmonauts in order to optimize the radiation safety of space crew.
Website:
http://www.ifj.edu.pl/conf/wrmiss/

Geospace revisited: a Cluster/MAARBLE/Van Allen Probes Conference in Rhodos, Greece

Start : 2014-09-15 - End : 2014-09-20
The 'Geospace Revisited' conference aims at revisiting long-standing issues of geospace dynamic phenomena. New data from space missions like Cluster, THEMIS and the more recent Van Allen Probes, along with measurements from ground-based magnetometer arrays around the globe, processed with new methods and combined with theory and simulations are expected to shed light on the complex interplay of particles, fields and waves in geospace, and in particular the inner magnetosphere (radiation belts and ring current).
Website:

http://geospacerev.space.noa.gr/index.php

2014 Conference on Big Data from Space (BiDS '14) in Frascati, Italie

Start : 2014-11-12
This conference aims to bring together researchers, engineers, users in the area of Big Data in the Space sector.
The focus is on the whole data lifecycle, ranging from data acquisition by spaceborne and ground-based sensors to data management, analysis and exploitation in the domains of Earth Observation, Space Science, Space Engineering, Space Weather, etc.
Special emphasis will be put on highlighting synergies and cross-fertilization opportunities from domains like Climate Change, Solid Earth Science, Planetary Sciences, Life Science, Astrophysics, High Energy Physics, Social Sciences, etc.
We expect this conference to:
* contribute towards a common "Big Data from Space" scientific and programmatic framework
* widen competences and expertise of universities, labs and industrial actors
* foster networking of experts and users towards better access and sharing of data, tools and resources
* leverage innovation, spin-in, spin off of technologies, and business development arising from research and industry progress
Website:
http://congrexprojects.com/2014-events/BigDatafromSpace/objectives

2014 AGU Fall Meeting in San Fransisco, USA

Start : 2014-12-15 - End : 2014-12-19
The AGU Fall Meeting is the largest worldwide conference in the geophysical sciences, attracting more than 22,000 Earth and space scientists, educators, students, and other leaders. For 46 years, energized and passionate Earth and space scientists from around the world gather at the AGU Fall Meeting to connect with colleagues, broaden their knowledge base, and embrace the joy of science. The 2014 meeting takes place Monday 15 - Friday 19 December 2014.
Several sessions about space weather are foreseen:
*
When and Why Does Space weather Forecasting Fail?
*
Addressing Operational Space Weather Needs
*
Near Real Time Data for Earth Science and Space Weather Applications
*
Understanding Hemispheric Asymmetry and Space Weather
*
Connection of Solar Events With the Variability of Space Environments
*
Bz from the Sun to the Earth: Observations and Modeling
*
Solar Sources and Heliospheric Consequences of Coronal Mass Ejections in Solar Cycle 24
*
Advances in Ionospheric Forecasting - Modeling, Observations, and Validation
Abstract Submission Deadline: August 6, 2014
Website:
http://fallmeeting.agu.org/2014/

Measurement Techniques for Solar and Space Physics, in Boulder, CO, USA

Start : 2015-04-20 - End : 2015-04-24
This gathering was born out of the desire to collect in one place the latest technologies required for advancement of science in the discipline of Solar and Space Physics. In doing so, it was recognized

that the two 1998 volumes of 'Measurement Techniques in Space Plasmas' (Particles and Fields) have been a valuable reference and resource for advanced students and scientists who wish to know the fundamentals of measurement techniques and technology.
Website:
https://mtssp.msfc.nasa.gov/

26th General Assembly of the International Union of Geodesy and Geophysics (IUGG) in Prague, Czech Republic

Start : 2015-06-22 - End : 2015-07-02
We invite contributions on novel inversion methods with application across the geosciences. Of particular interest are 3D imaging, joint inversion of geodetic, geophysical and geochemical datasets, and multi-disciplinary interpretation approaches such as integration of gravity, EM and seismic data or thermo-mechanical modelling studies constrained by physical parameters.
Modelling of Space Weather Effects: Solar, Magnetospheric and Earth Resistivity Constraints (IAGA, IAMAS)
In this symposium we welcome contributions on all aspects of the modelling of space weather and its effects, from the Sun to Earth. This includes the modelling of the various interactions between travelling solar storms and the solar wind, magnetosphere, ionosphere and solid Earth and the validation of models through measurements. Contributions on models developed to aid end-users, such as satellite and power grid operators, survive the impact of space weather are also encouraged.
Website:
http://www.iugg2015prague.com/joint-inter-association-symposia.htm#JA