STCE Newsletter

17 Aug 2015 - 23 Aug 2015

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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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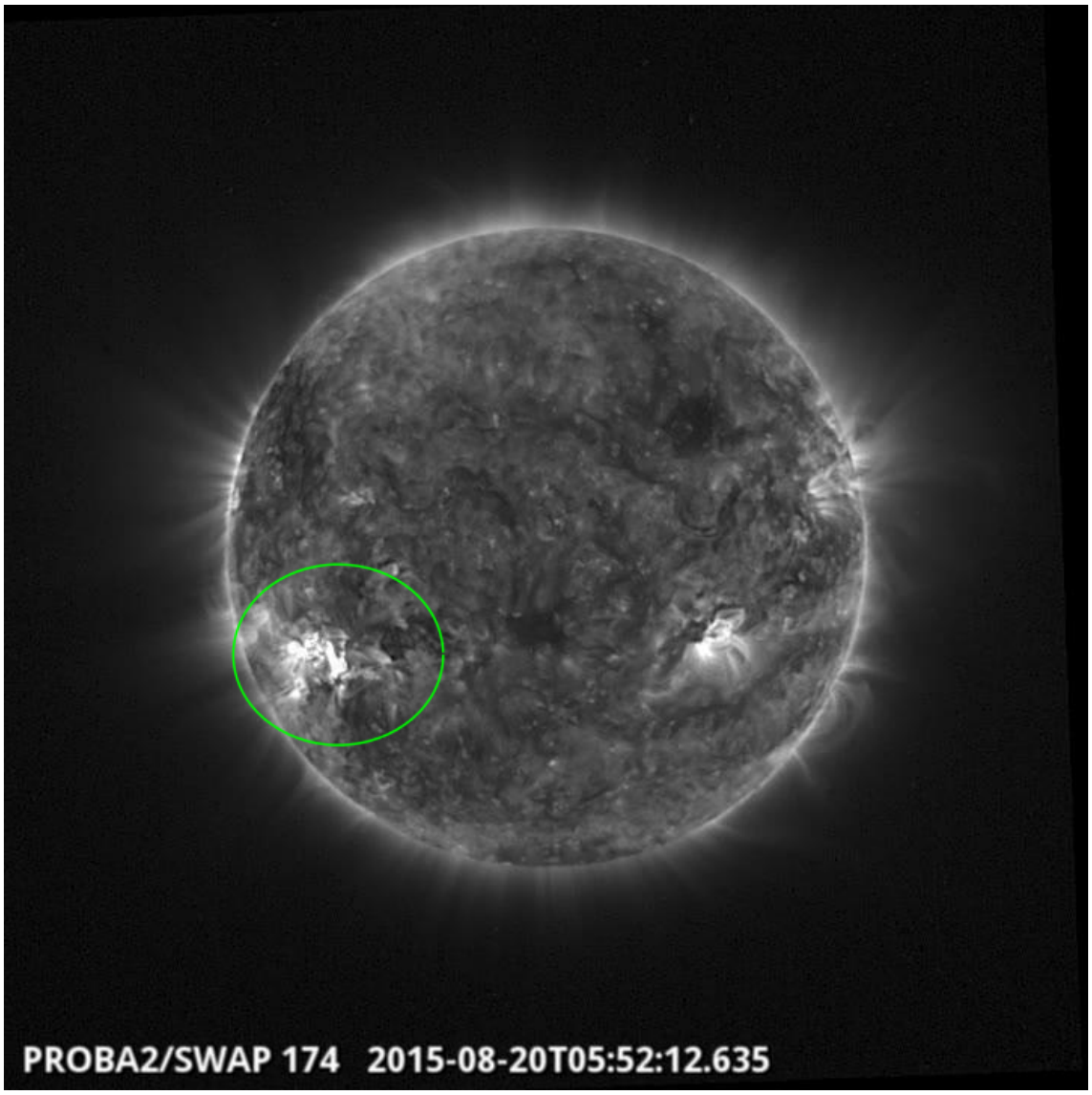
1. PROBA2 Observations (17 Aug 2015 - 23 Aug 2015)

Solar Activity

Solar flare activity fluctuated between very 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 282).
http://proba2.oma.be/swap/data/mpg/movies/weekly_movies/weekly_movie_2015_08_17.mp4
Details about some of this week's events, can be found further below.

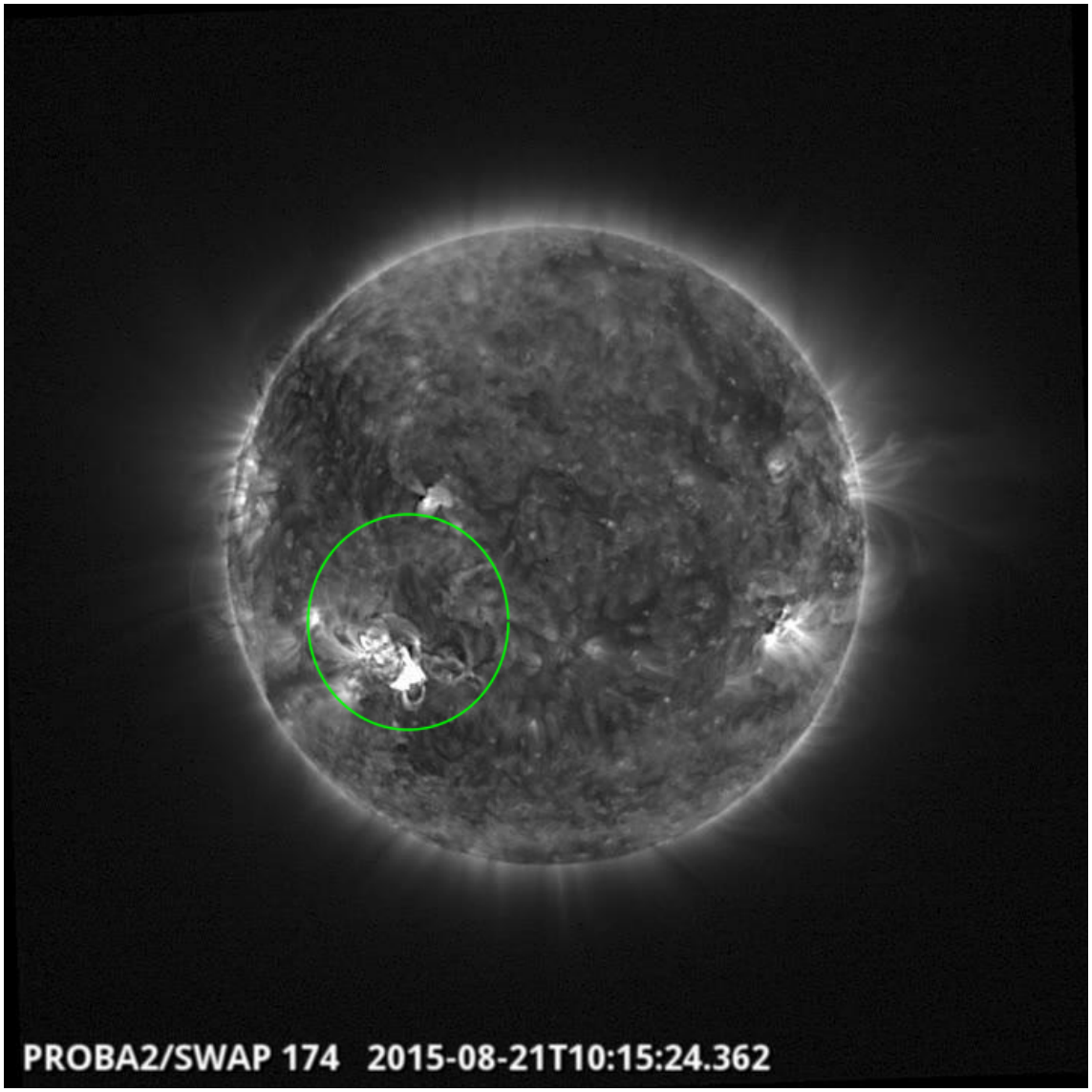
Thursday Aug 20



Mflare and dimming in the south east @ 05:52 UT SWAP image
Find a movie of the event here (SWAP movie)

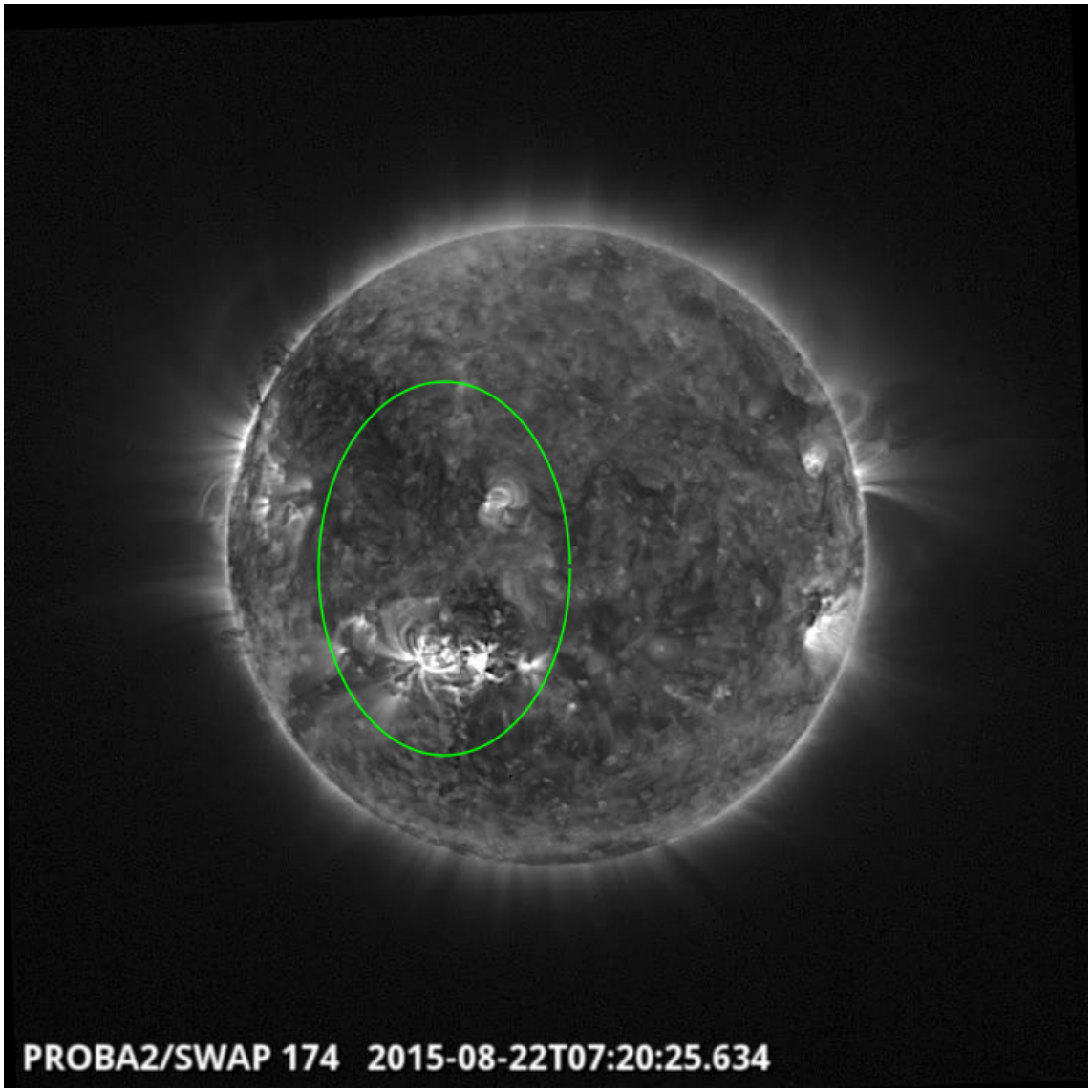
http://proba2.oma.be/swap/data/mpg/movies/20150820_swap_movie.mp4

Friday Aug 21



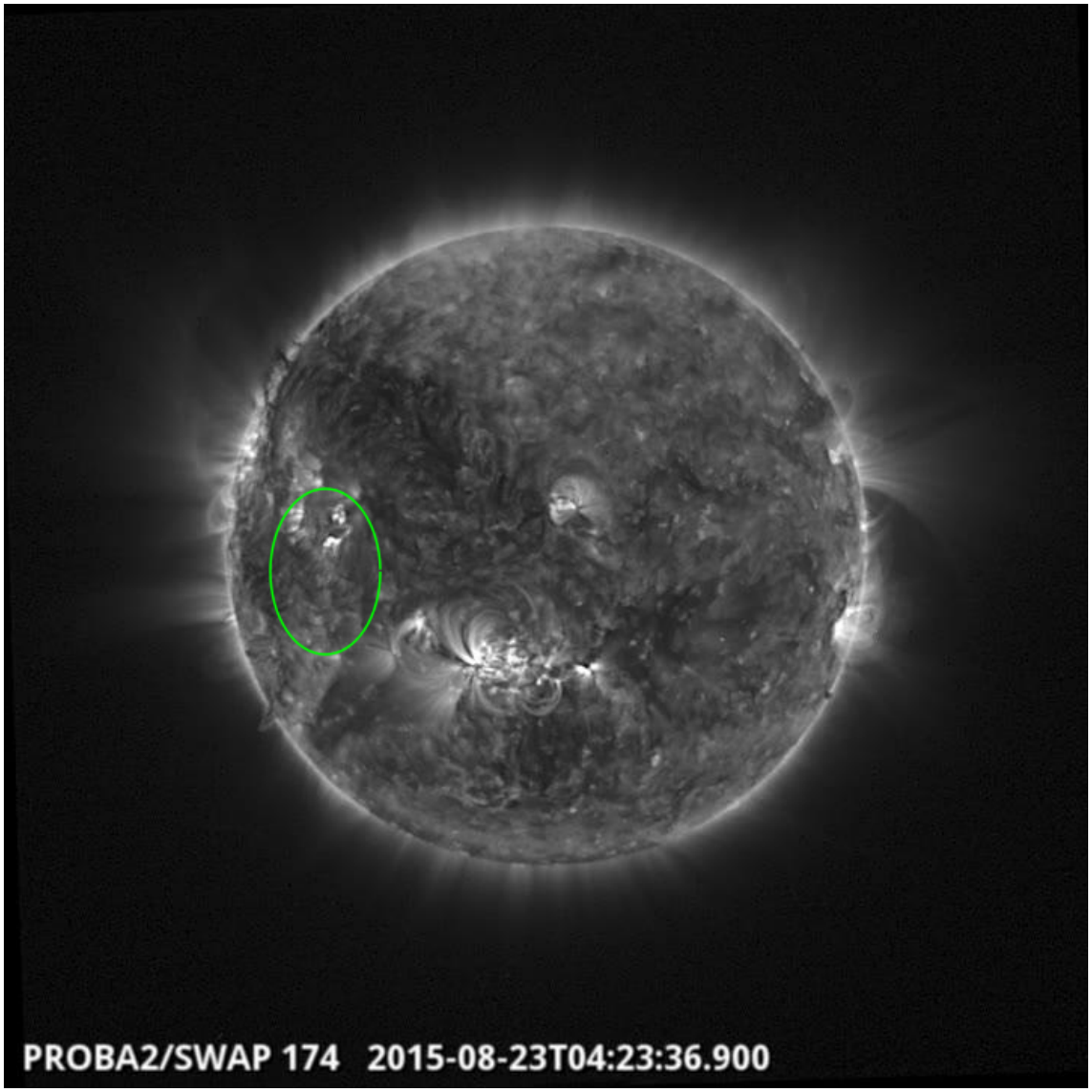
Mflare in the southeast @ 10:15 UT SWAP image
Find a movie of the event here (SWAP movie)
http://proba2.oma.be/swap/data/mpg/movies/20150821_swap_movie.mp4

Saturday Aug 22



Mflare and wave in the south east @ 07:20 UT SWAP image
Find a movie of the event here (SWAP movie)
http://proba2.oma.be/swap/data/mpg/movies/20150822_swap_movie.mp4

Sunday Aug 23



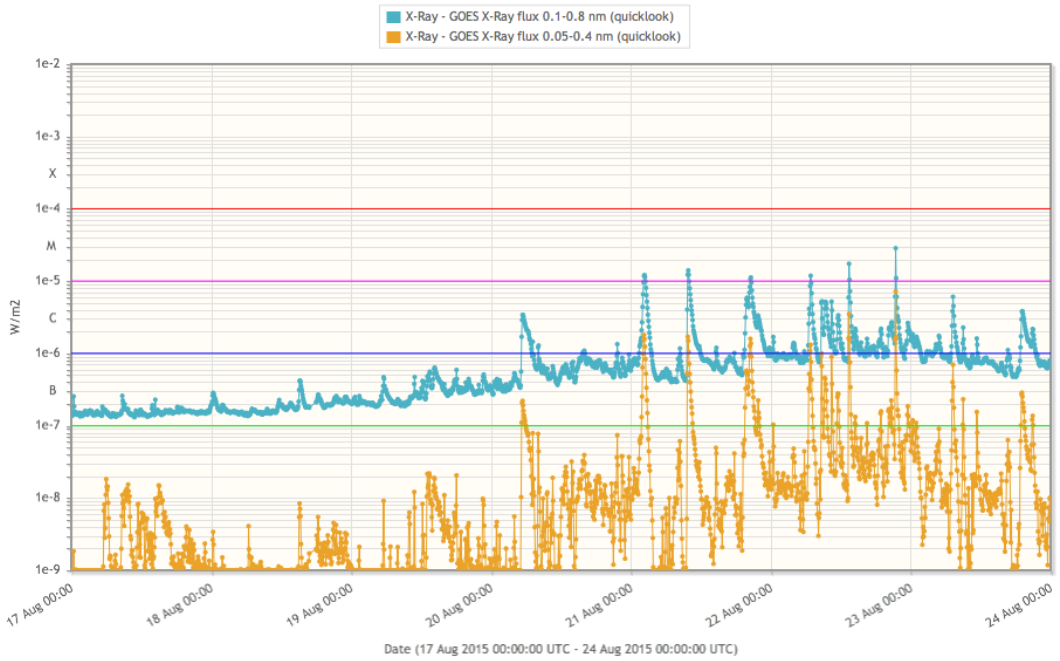
Filament eruption in the east @ 04:23 UT SWAP image
Find a movie of the event here (SWAP movie)
http://proba2.oma.be/swap/data/mpg/movies/20150823_swap_movie.mp4

2. Review of solar activity

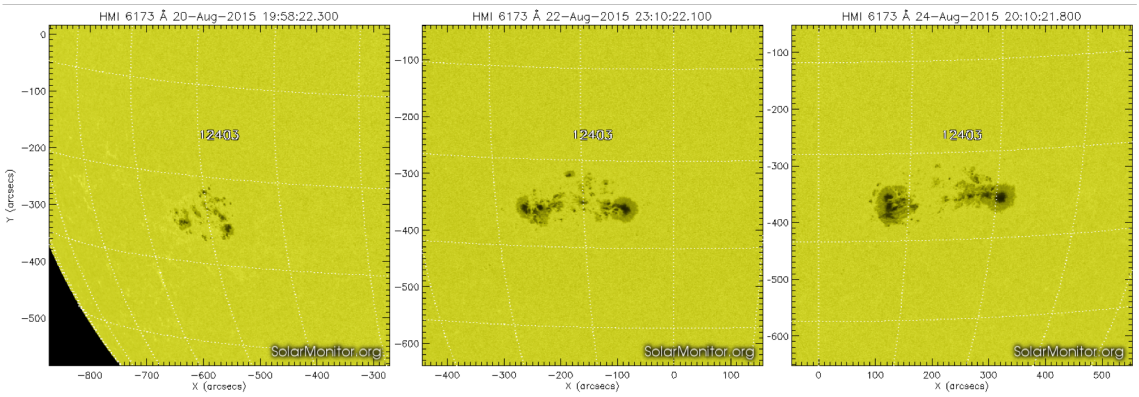
Solar activity varied dramatically over the course of the week.

From Aug 17 to 19 solar activity was low, with no solar flares above the B-class level and no CMEs. However, there was one coronal hole that increased geomagnetic activity to K-index values of 5. There was a small filament destabilisation and eruption at 17:00 UT on Aug 19 close to the south east limb of the Sun. It was not Earth directed.

Once AR 2403 rotated over the east limb on Aug 18, it started to show significant growth and flux emergence mid-week. The region evolved from a Macintosh:Dac/Type:Beta to Macintosh:Dkc/ Type:Beta-Gamma and finally to a Macintosh:Ekc/Type:Beta-Gamma-Delta region by the end of the week. In the series of images taken by SDO/HMI you can follow its growth.



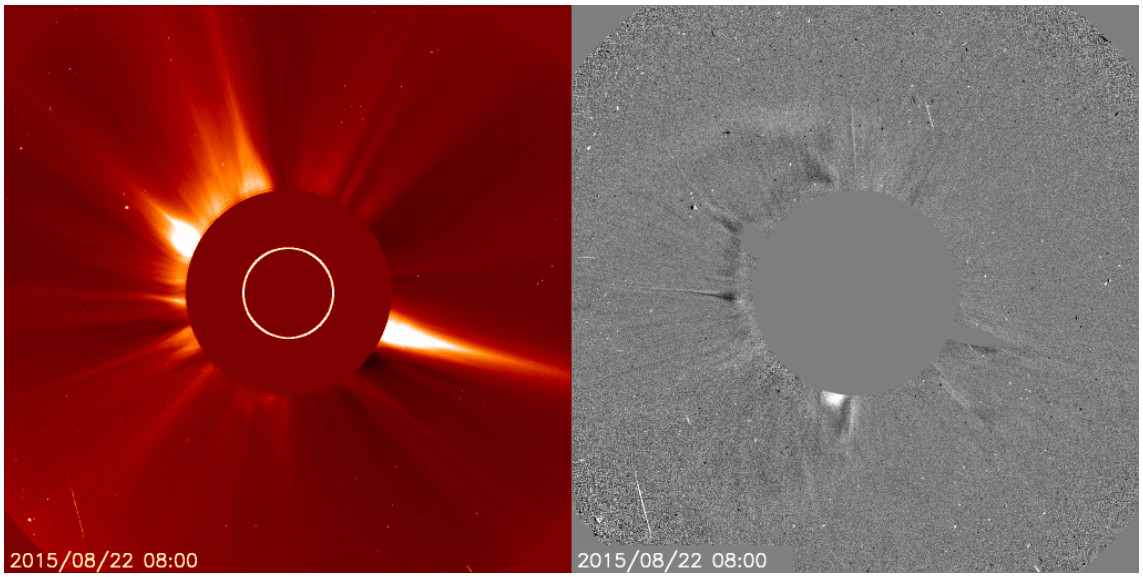
As a consequence it produced C-class flares Aug 20. Between Aug 21 and 23, AR 2403 went on to produce multiple C-class and 6 M-class flares. In the GOES graph, you clearly see the increase of the background X-ray towards the second part of the week.



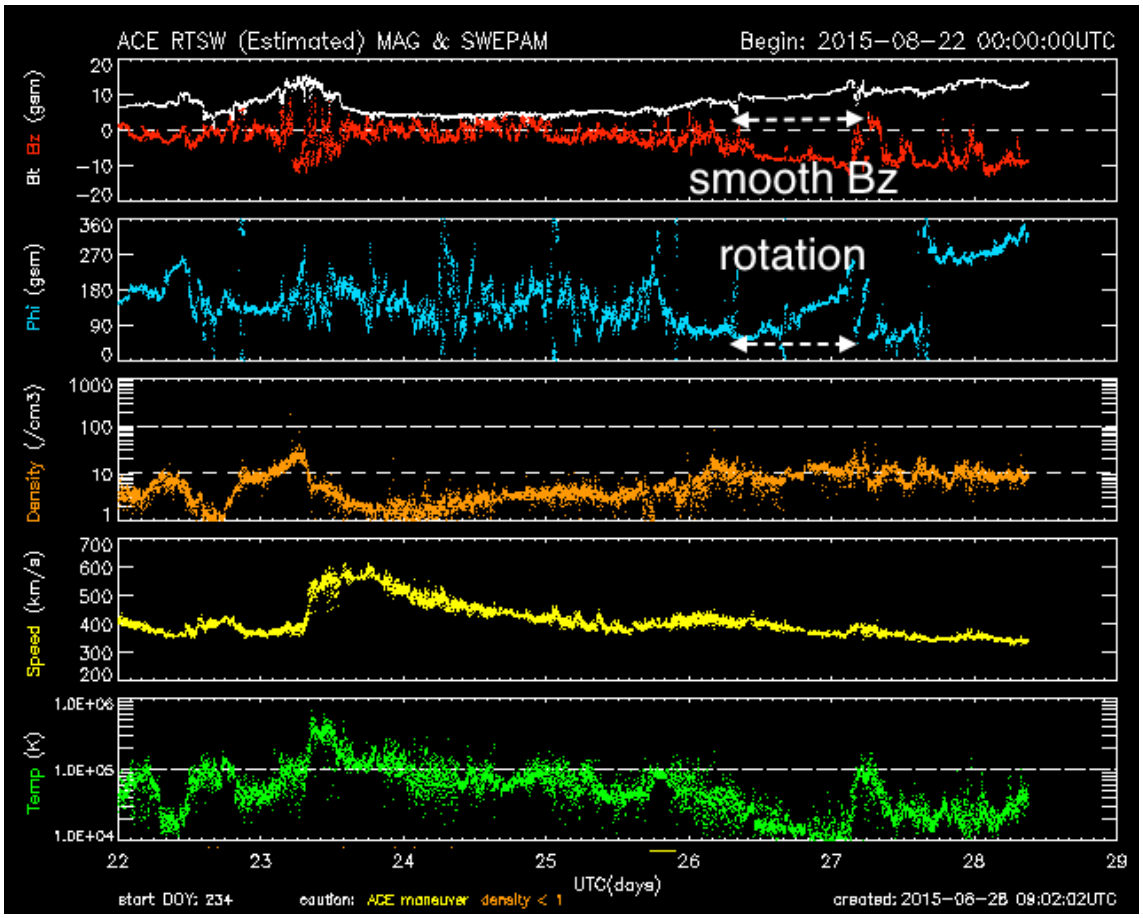
Several of the flares exhibited associated coronal dimmings observed in the AIA 193 Å bandpass, indicating the presence of an associated CME. However, only two partially Earth directed CMEs were noted.

Firstly a CME associated with the M1.4 flare on Aug 21, 09:48 UT. At that time, the AR was located at S17E26, and the CME was largely directed to the south east. The CME had a speed of around 300 km/s according to CACTus.

Secondly, a very faint halo CME, first observed in LASCO imagery at 07:12 UT, Aug 22 associated with the M1.2 flare. Although it is difficult to estimate the speed with which the CME is travelling toward the Earth in the absence of STEREO data, it is estimated to be roughly around 650 km/s.



A link between this CME and the passage of a magnetic structure with a slowly rotation magnetic field is possible. The magnetic structure was not preceded by a shock. More next week, but we give you already an ACE preview.



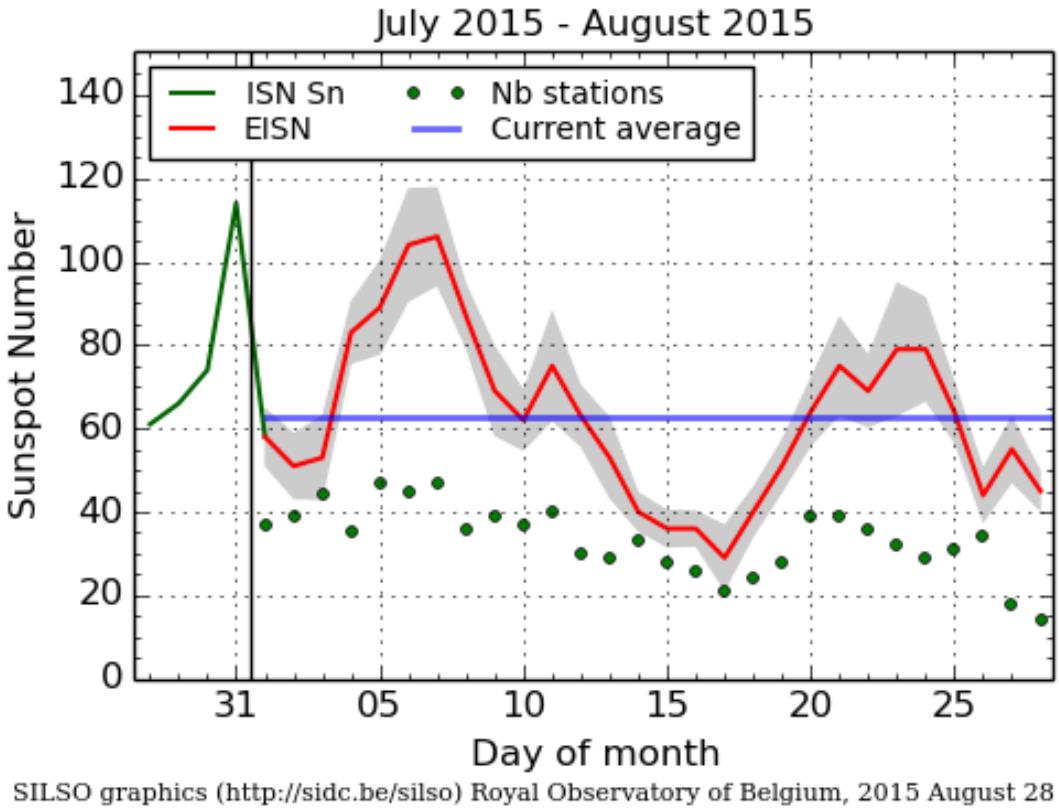
Throughout the week other ARs remained quiet and did not produce any flares above the B-class level. Proton activity remained quiet.

3. Noticeable Solar Events (17 Aug 2015 - 23 Aug 2015)

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	TYPE	Cat	NOAA
21	0156	0218	0237	S16E39	M1.2	1F				2403
21	0934	0948	1007	S17E26	M1.4	2B	73	II/1		2403
21	1910	2034	2050	S12E26	M1.1	1N		III/1		2403
22	0639	0649	0659	S15E20	M1.2	1B	62	II/2IV/2		2403
22	1317	1323	1329	S15E19	M2.2	1N				2403
22	2119	2124	2128	S15E15	M3.5	1B				2403

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

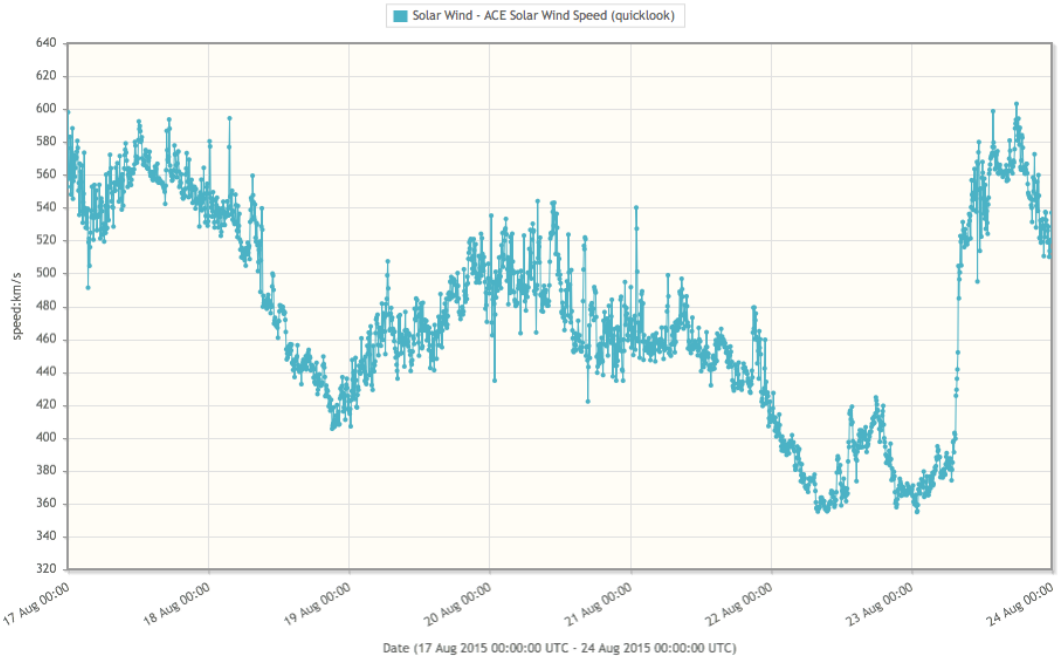
4. Estimated International Sunspot Number

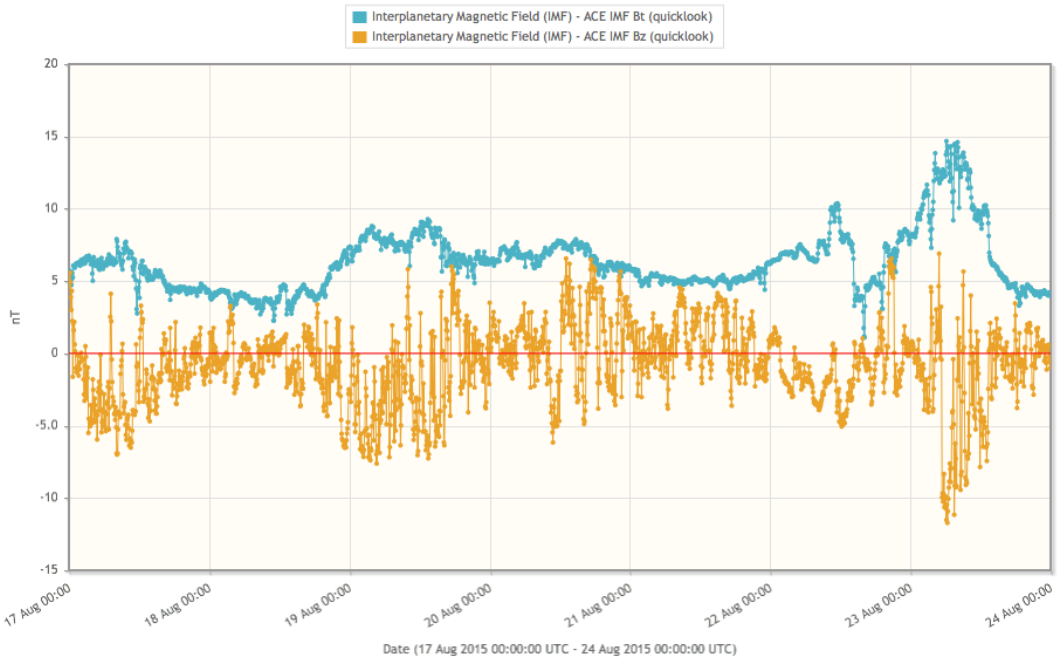


Daily Estimated International Sunspot Number (EISN, red curve with shaded error) derived by a simplified method from real-time data from the worldwide SILSO network. It extends the official Sunspot Number from the full processing of the preceding month (green line). The plot shows the last 30 days (~ one solar rotation). The horizontal blue line shows the current monthly average, while the green dots give the number of stations included in the calculation of the EISN for each day.

5. Review of geomagnetic activity

For the majority of the week the solar wind speed varied between 400 and 600 km/s, the total interplanetary magnetic field (IMF) strength remained largely between 8 and 10 nT and the Bz component varied between +8 and -8 nT. The presence of two small coronal holes that rotated toward the western limb induced quiet to active geomagnetic conditions throughout the week.



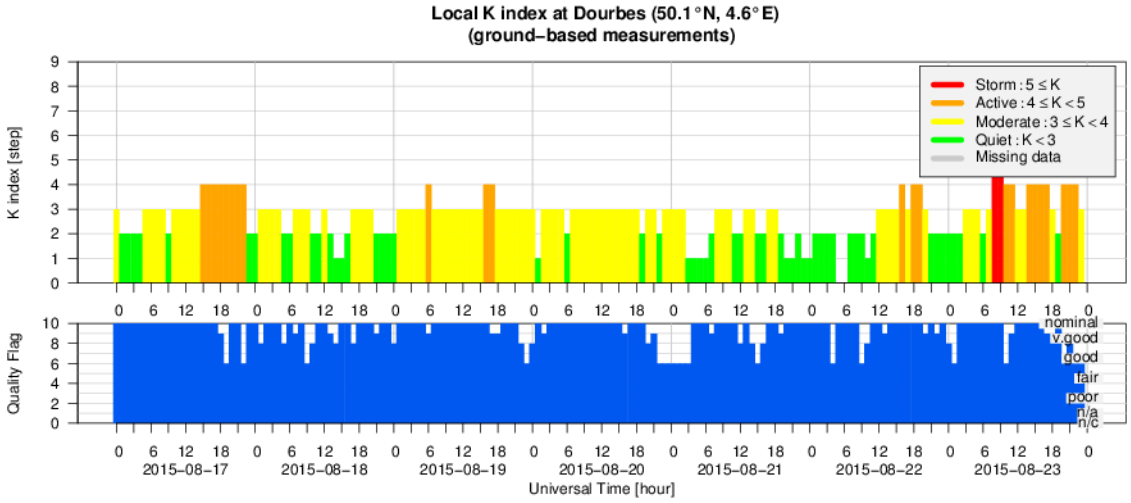


Both the Local (Dourbes) and NOAA Kp-index varied between 3 and 4 throughout the week. NOAA Kp reached 5 around 15:00 UT on Aug 17, these conditions were probably caused by a high speed stream created by a geoeffective coronal hole combined with a southward Bz.

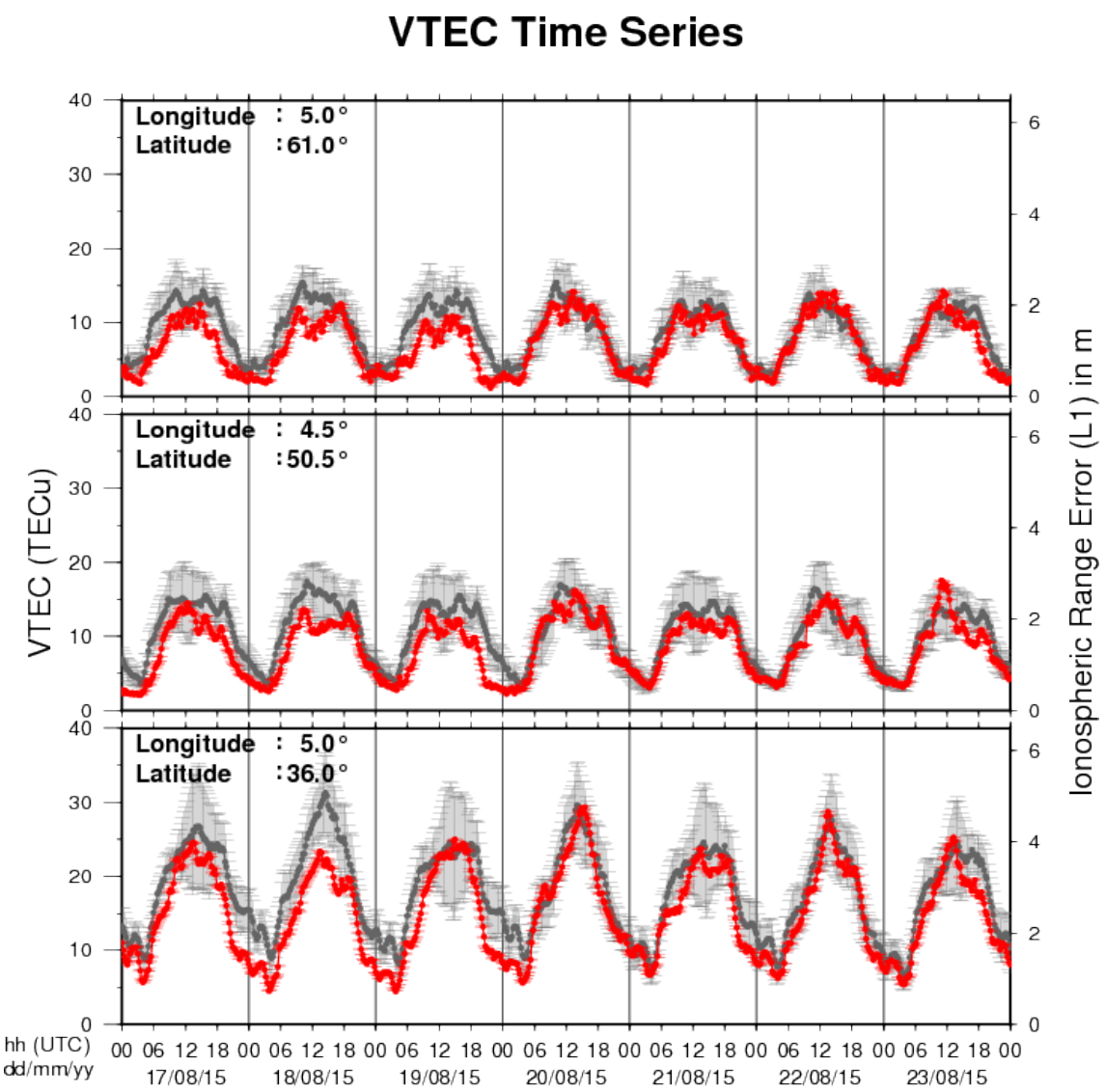
Aug 23 the solar wind speed abruptly jumped from around 400 km/s to 520 km/s between 06:00 UT and 09:00 UT, this was combined with a predominantly negative Bz IMF of -10 nT, leading to geomagnetic storm conditions. NOAA reported Kp=6 and the Dourbes station reported K=5. This event was associated

with a co-rotating interaction region where the fast stream emanating from a coronal hole catches up with the slow solar wind. The total IMF stayed around 12 nT, a small coronal hole located at S15W40 was possibly the cause of the enhanced solar wind speeds.

6. Geomagnetic Observations at Dourbes (17 Aug 2015 - 23 Aug 2015)



7. Review of ionospheric activity (17 Aug 2015 - 23 Aug 2015)



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. Future Events

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

The Dynamic Sun - Exploring the Many Facets of Solar Eruptive Events in Potsdam, Germany

Start : 2015-10-26 - End : 2015-10-29
Erupting prominences/filaments, surges, flares, and coronal mass ejections (CMEs) are prominent examples of the dynamic Sun. Multi-wavelength and multi-instrument observations have the potential to reveal highly energetic physical processes on the Sun reaching from the photosphere, over the chromosphere and the transition region, to the corona and beyond. Solar physicists have nowadays access to a suite of new ground-based observing facilities including, for example, the 1.5-meter GREGOR solar telescope at the Observatorio del Teide, Tenerife, Spain, the European Low Frequency Array (LOFAR), the Atacama Large Millimeter/Submillimeter Array (ALMA) in Chile, and the Coronal Multi-Channel Polarimeter for Slovakia (COMP-S) at Lomnicky Peak Observatory. A powerful fleet of space missions, for example, the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI), the Japanese Hinode, and the Solar Dynamics Observatory (SDO), adds more capabilities to investigate magnetic fields, complex plasma flows, and accelerated particle, and thermal properties of solar eruptive events. In the tradition of the series of Â»Potsdam ThinkshopsÂ«, we invite instrument specialists, observers, modellers, and theorists to exchange ideas, to stimulate discussion, to initiate future collaborations among participants, and to attract new users of instruments by showcasing the capabilities. The aim is to make progress towards a comprehensive description of solar eruptive events effectively aggregating their global properties as well as their highly dynamic fine structure. Thinkshop 12 takes place at the science park Â»Albert EinsteinÂ«, home to AIP's Great Refractor and the Solar Observatory Einstein Tower at the Telegraphenberg.
Website:
https://thinkshop.aip.de/12/cms/

IRIS-5 Workshop in Pune, India

Start : 2015-10-26 - End : 2015-10-29
The IRIS-5 workshop will be conducted at the Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India from October 26-29, 2015. This workshop is mainly aimed at the participants who could not attend IRIS-4, which is being held at Boulder, USA. Therefore, set up of the IRIS-5 workshop would be essentially be very similar to that of IRIS-4.
The main aim of the workshop is to introduce the Interface Region Imaging Spectrometer (IRIS) to students and young post docs. This would be done through tutorials on IRIS data analysis, physics of optically thick radiative transfer, MHD simulations of the solar atmosphere related to IRIS and hydrodynamic simulations of flares. There will be lectures as well as hands on sessions.
Website:
http://www.iucaa.ernet.in/~solar/Welcome.html

Solar Storm Early Forecasting in Copenhagen, Denmark

Start : 2015-11-09 - End : 2015-11-11
The fundamentally most important source of inner heliospheric plasma physics and space weather is the active Sun, its solar active region eruptions. Prediction of the evolution and influence of solar active regions on solar storms in the near-Earth environment is of particular interest to several forecasting institutions, industrial stakeholders, and the public in general.
State-of-the-art solar storm prediction tools are limited to monitoring solar active regions, registering eruptions and mass ejections while attempting, then, at extrapolating subsequent evolution and spatio-

temporal propagation: no realistic physics-based and data-driven synthesis tool exists, which is capable of predicting when a solar flare will be triggered, or when a Coronal Mass Ejection will be launched into inter-planetary space. In short, we are not yet able to answer the question: When and why do solar storms launch?
Our meeting will be focused around initiation of space weather events at the Sun. We will discuss and develop three major challenges, and we aim to develop a draft resolution road-map for those challenges during the meeting.
Website:
https://indico.nbi.ku.dk/conferenceDisplay.py?confId=817

Workshop on Solar Astronomy Big Data - IEEE ICDM in Atlantic City, NJ, USA.

Start : 2015-11-13 - End : 2015-11-13
With the launch of NASA's Solar Dynamics Observatory (SDO) mission on 02/11/2010, researchers in solar physics have entered the era of Big Data. The Atmospheric Imaging Assembly (AIA) instrument on SDO provides imaging data and the Helioseismic and Magnetic Imager (HMI) instrument on SDO provides magnetic field data. Both instruments record data at a high spatial resolution and a time cadence, amounting to about 1 Petabyte of scientific data each year. The Big Data challenges in Solar Astronomy are expected to grow even further with the inauguration of the NSF funded Daniel K. Inouye Solar Telescope (DKIST), currently under construction in Hawaii. This telescope is expected to generate: 3-5 Petabytes of data per year.

The Scientific Foundation of Space Weather

Start : 2016-06-27 - End : 2016-07-01
Website:
http://www.issibern.ch/program/workshops.html

9. New documents in the European Space Weather Portal Repository

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

PROBA2@school

Application for the annual prize Science Communication awarded by the Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten.
http://www.spaceweather.eu/en/repository/show?id=585

eHEROES - Hitchhikers' guide to space

Report on the eHEROES deliverable 'Hitchhikers' guide to space'.
http://www.spaceweather.eu/en/repository/show?id=586

eHEROES - Project summary, period 1

Report on the first period of the FP7 project eHEROES
http://www.spaceweather.eu/en/repository/show?id=587

eHEROES - Project summary, period 2

Report of the second and final period of the FP7 project eHEROES
http://www.spaceweather.eu/en/repository/show?id=588

eHEROES - Space Weather News

Report on the eHEROES deliverable 'The Space Weather News'.
http://www.spaceweather.eu/en/repository/show?id=589

eHROES - Information and Education

Report on the FP7 project eHEROES deliverable Information and Education
http://www.spaceweather.eu/en/repository/show?id=590

eHEROES - Summer School

Report on the FP7 project eHEROES summer school
http://www.spaceweather.eu/en/repository/show?id=591