LYRA

the **L**arge-**Y**ield **Ra**diometer onboard PROBA2

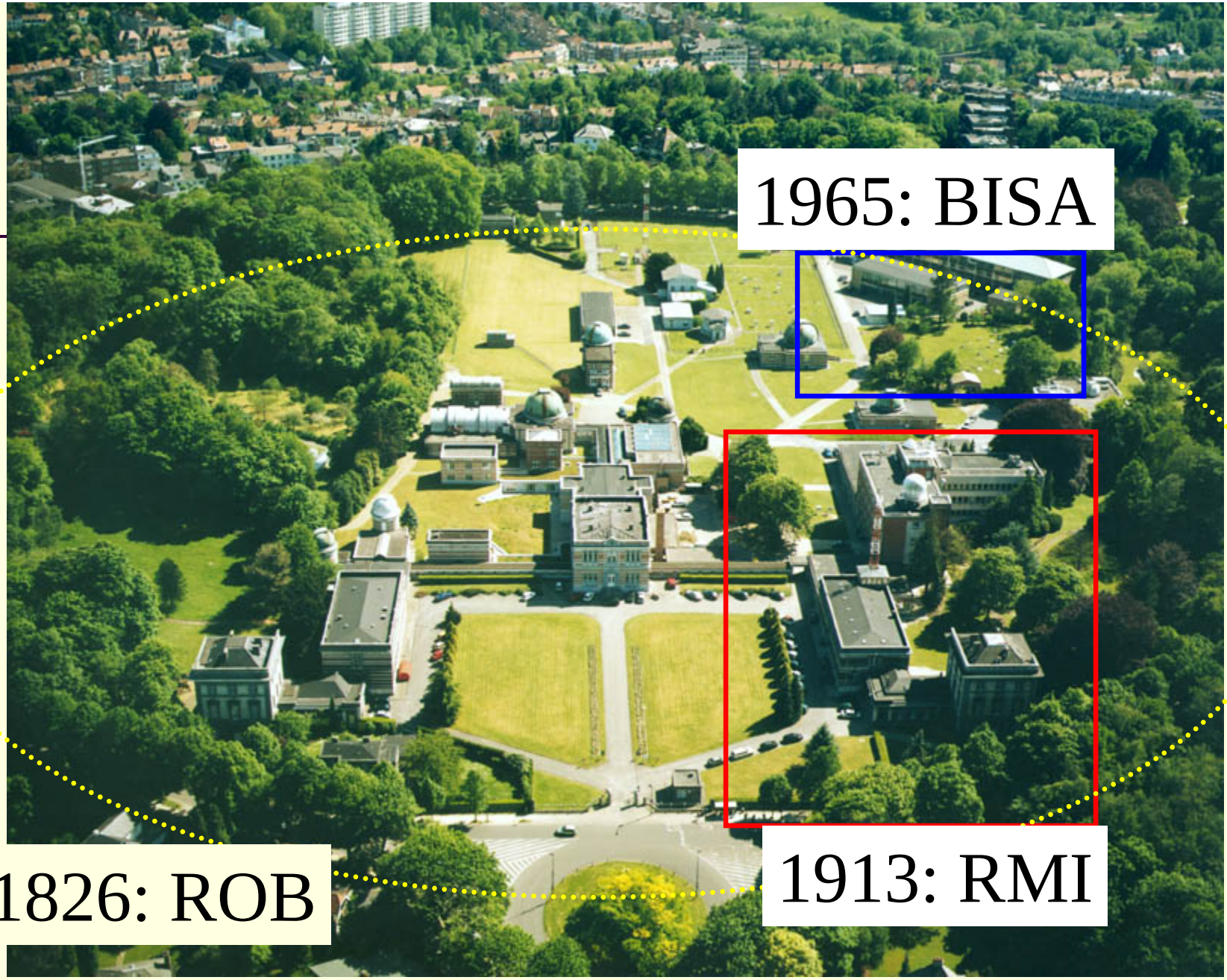
Space weather data and services at ROB/SIDC

Ingolf E. Dammasch (Royal Observatory of Belgium)

Solar and Heliospheric Influences on the Geospace
Bucharest, Romania, 01-05 October 2012

Contents

- Royal Observatory of Belgium
- Sunspot numbers
- Solar Images
- PROBA2 Science Center
- SDO Data Center
- Radio Observations
- Analysis Software
- Space Weather Forecast



BISA = Belgian Institute for Space Aeronomie, RMI = Royal Meteorological Institute

SPACE POLE

KSB - ORB

Koninklijke Sterrenwacht van België
Observatoire Royal de Belgique
Königliche Sternwarte von Belgien
Royal Observatory of Belgium

KMI - IRM

Koninklijk Meteorologisch Instituut
Institut Royal Météorologique
Königliches Meteorologisches Institut
Royal Meteorological Institute

BIRA-IASB

Belgisch Instituut voor Ruimte-Aëronomie
Institut d'Aéronomie Spatiale de Belgique
Belgian Institute for Space Aeronomy

STCE (www.stce.be)

- Solar-Terrestrial Center of Excellence
- Not a new institute but a network structure
- Physics expertise from Sun to Earth:
- …on flares, protons, solar wind, CME propagation, 10cm flux, geomagnetism,…
- Aim: Daily forecasts, fast alerts, bulletins, scientific research, collaboration, ESWW conference,…

ROB (www.astro.oma.be)

- Royal Observatory of Belgium

- Founded in 1834
- In Uccle (Brussels) since 1890

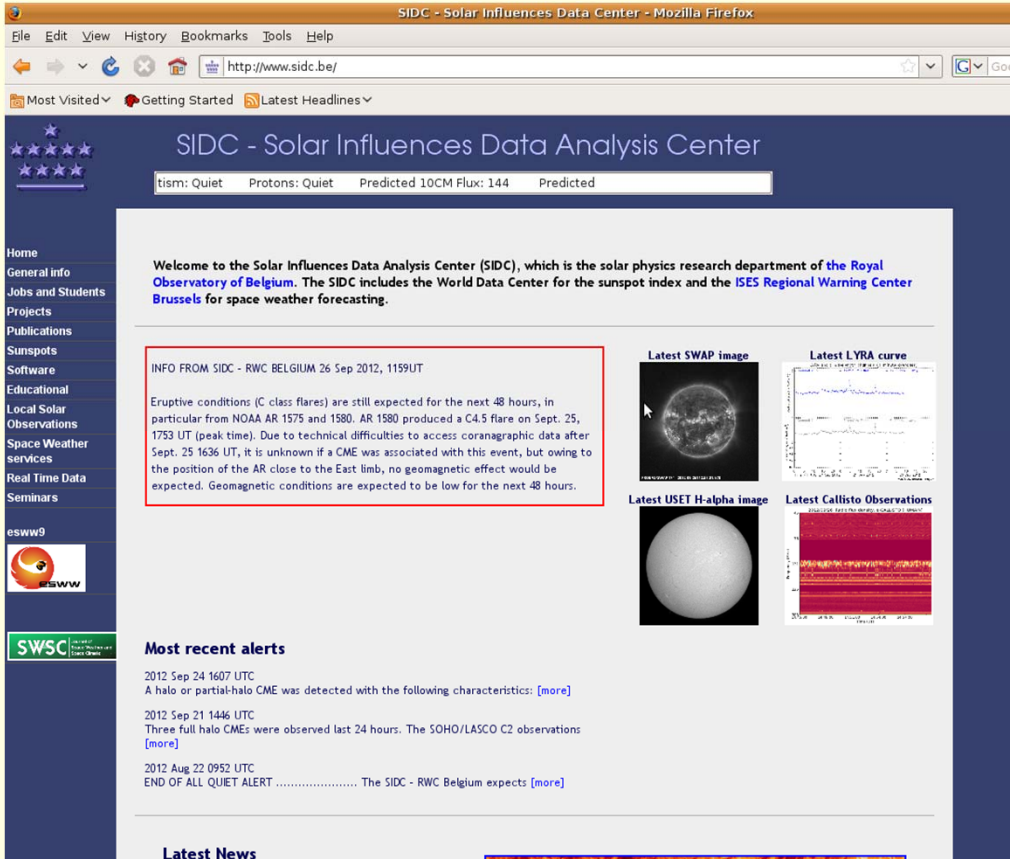
- Personnel: ~ 150
  (60 scientists + 90 technicians)

  Departments:
- 1. Geophysics
  (Seismology, Time, GPS)
- 2. Astrometry
- 3. Astrophysics
- 4. SIDC
  (Solar Physics, Space Weather)

SIDC (www.sidc.be)

- Solar Influences Data analysis Center
  Solar Physics (pure science) + Space Weather (applied science)

- Since 1981:
  World Data Center
  for the sunspot index
- Since 2000:
  Regional Warning Center
- Participation:
  SOHO (EIT, LASCO)
  STEREO (SECCHI)
  PROBA2 (SWAP, LYRA)
  SDO
  Solar Orbiter



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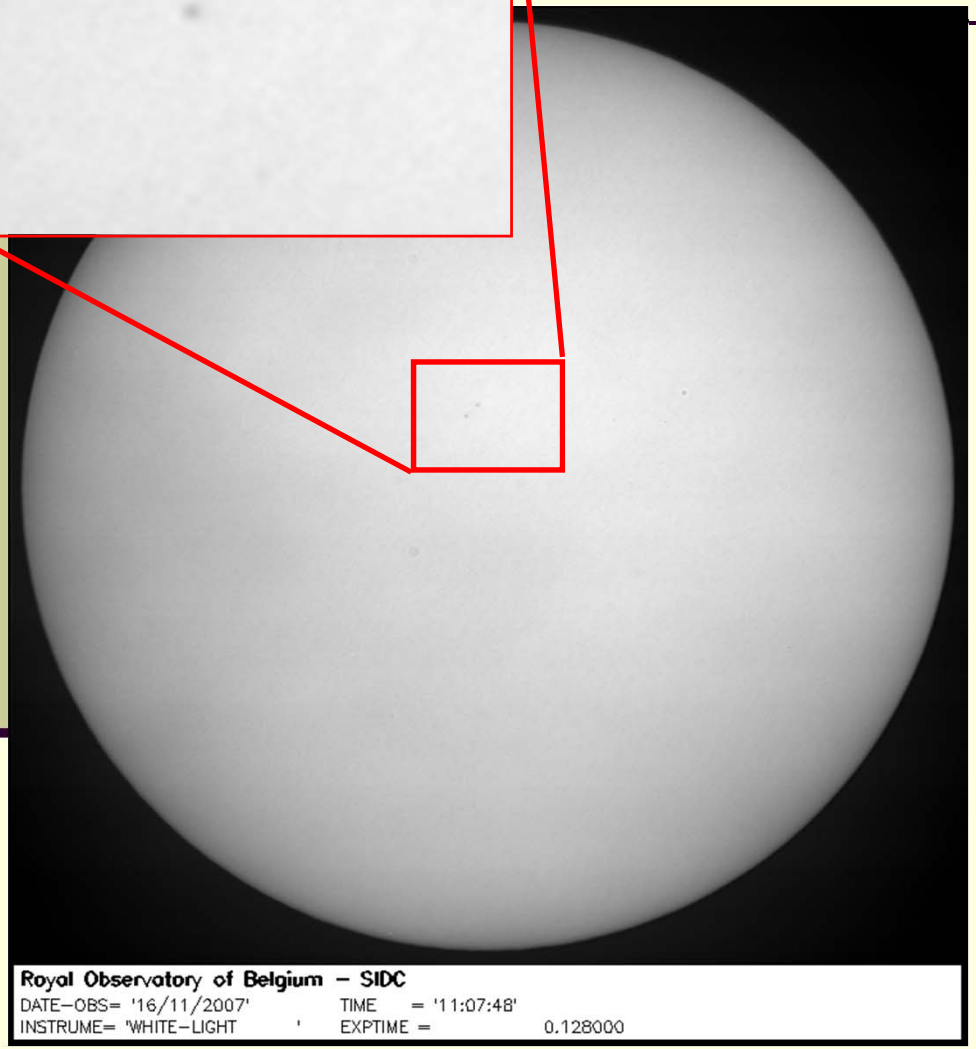
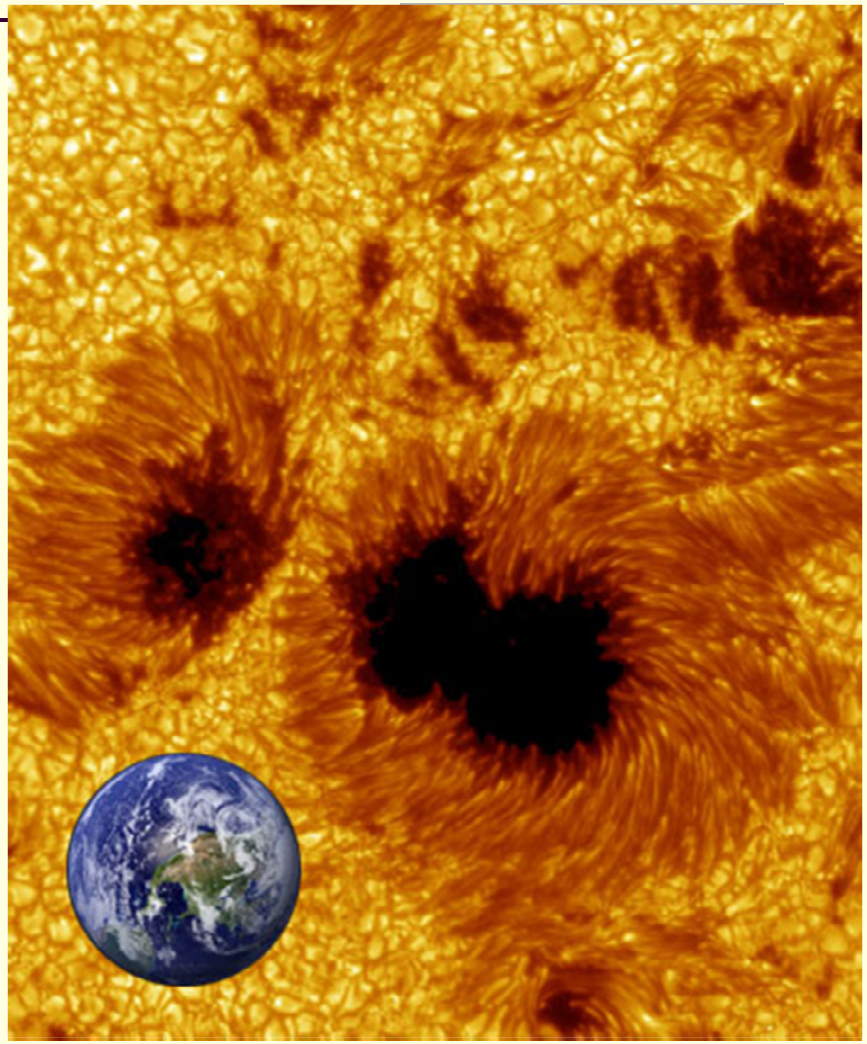
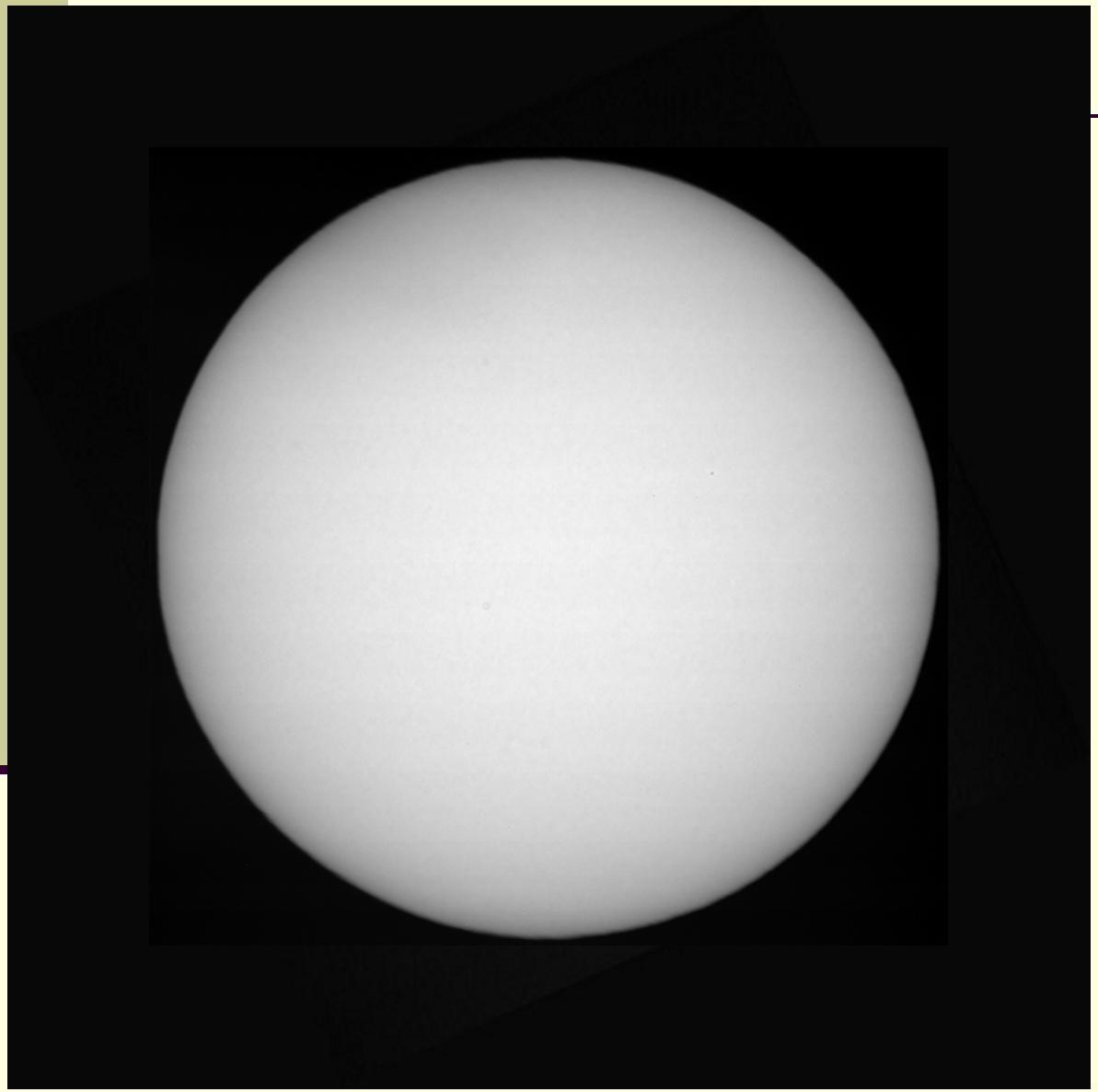
Swedish Solar Telescope





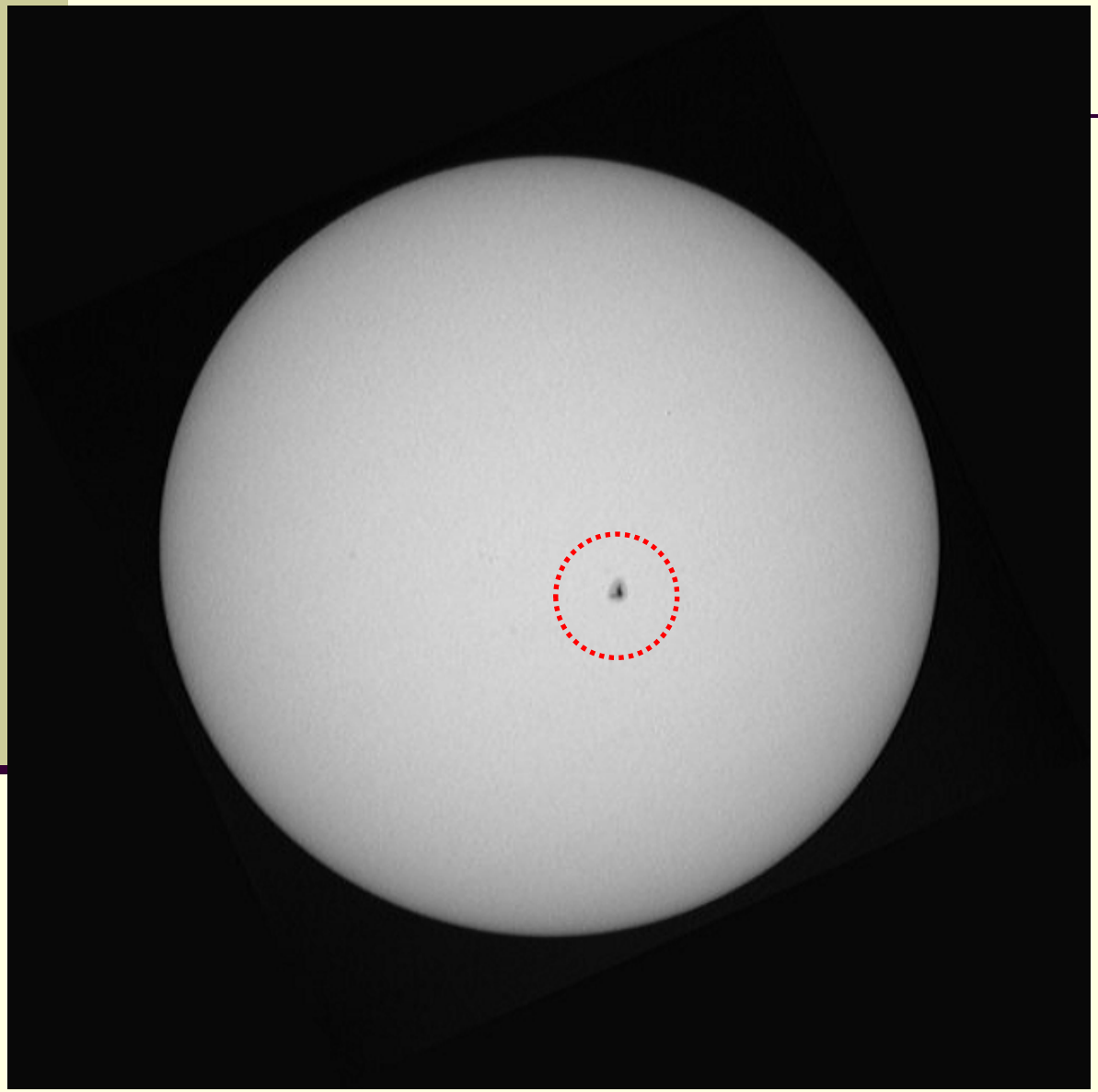
What are sunspots and why do we care?

Spotless Sun



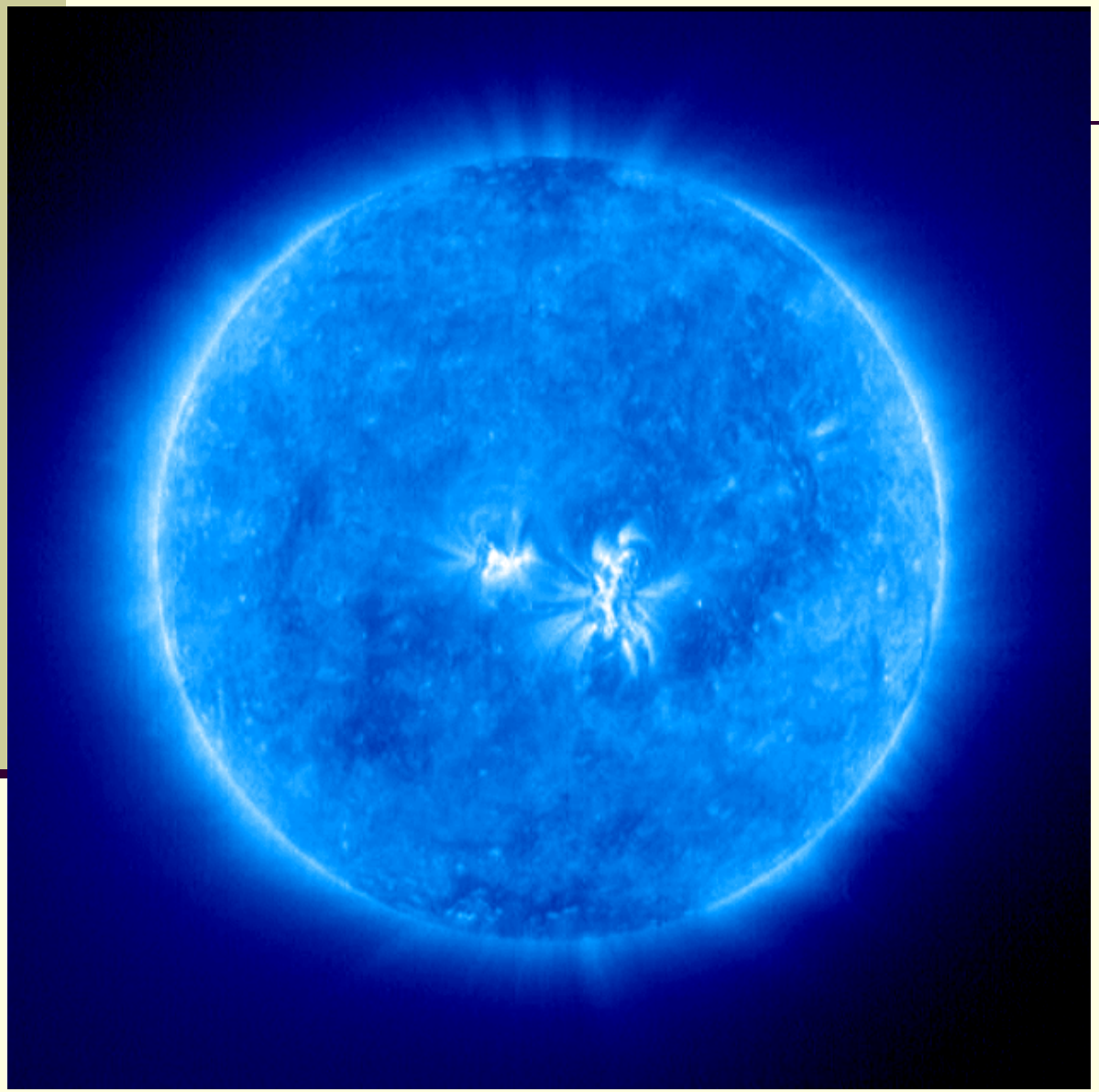
USET telescope
Uccle, ROB
22 Jan 2008

Sunspots



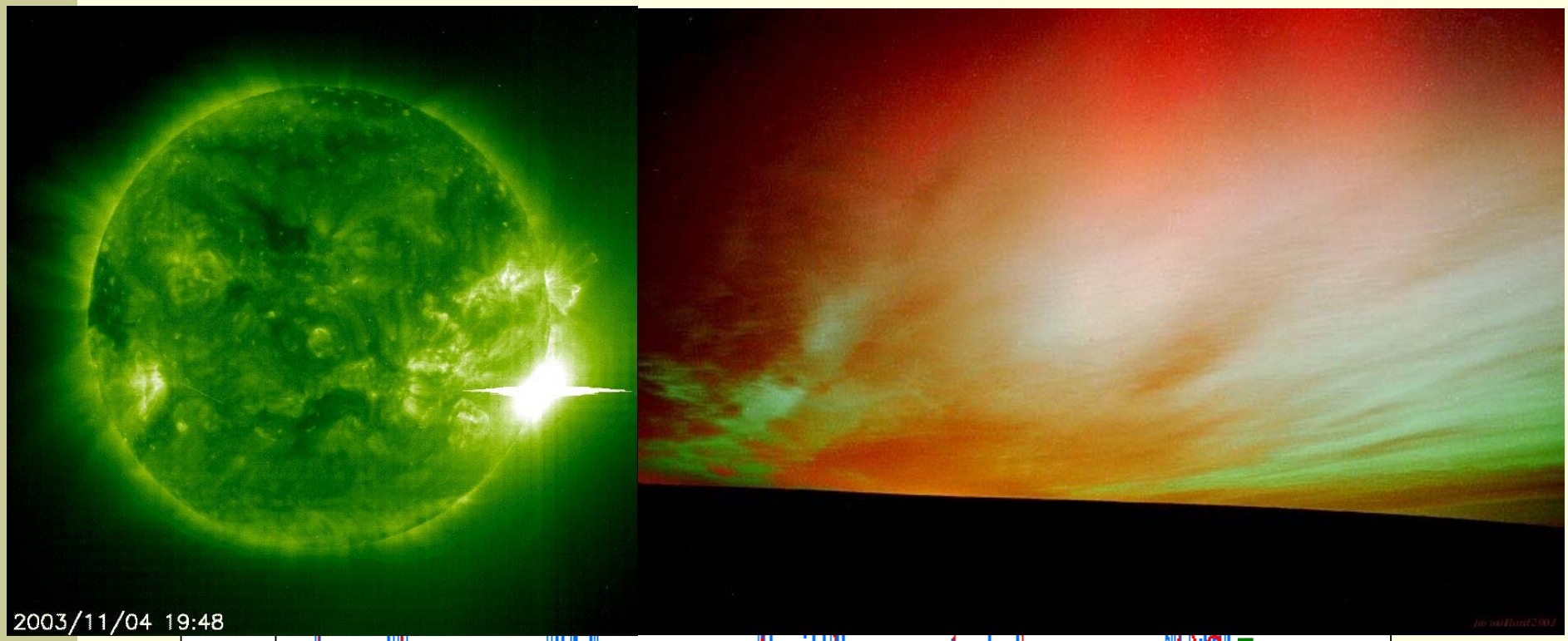
USET telescope
Uccle, ROB
01 May 2007

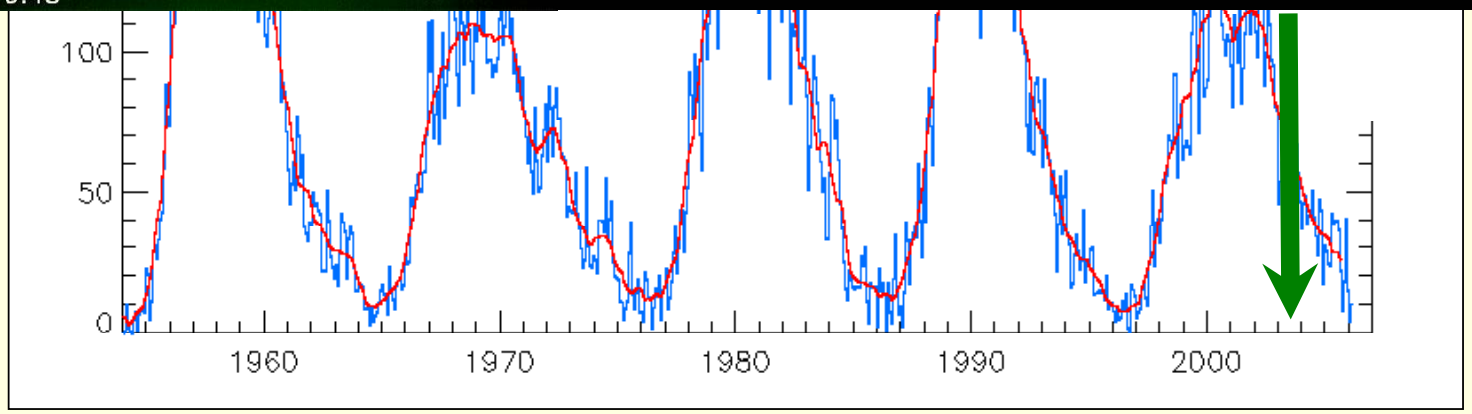
Solar Eruptions

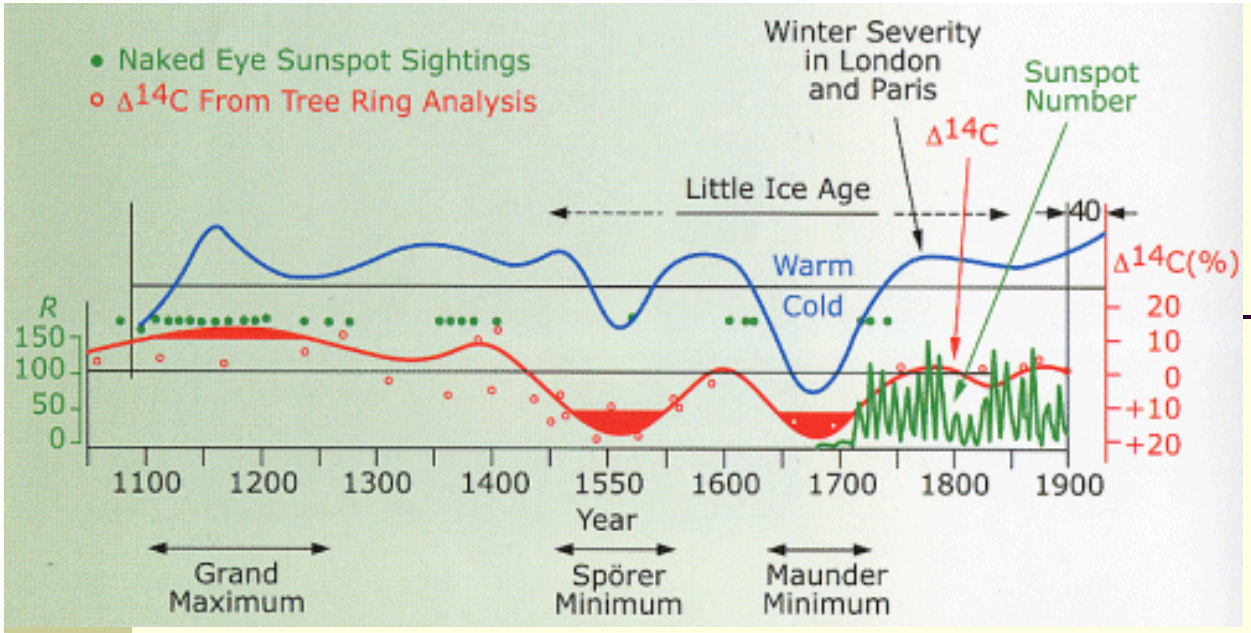


EIT telescope
SOHO (ESA/NASA)

Solar Influences



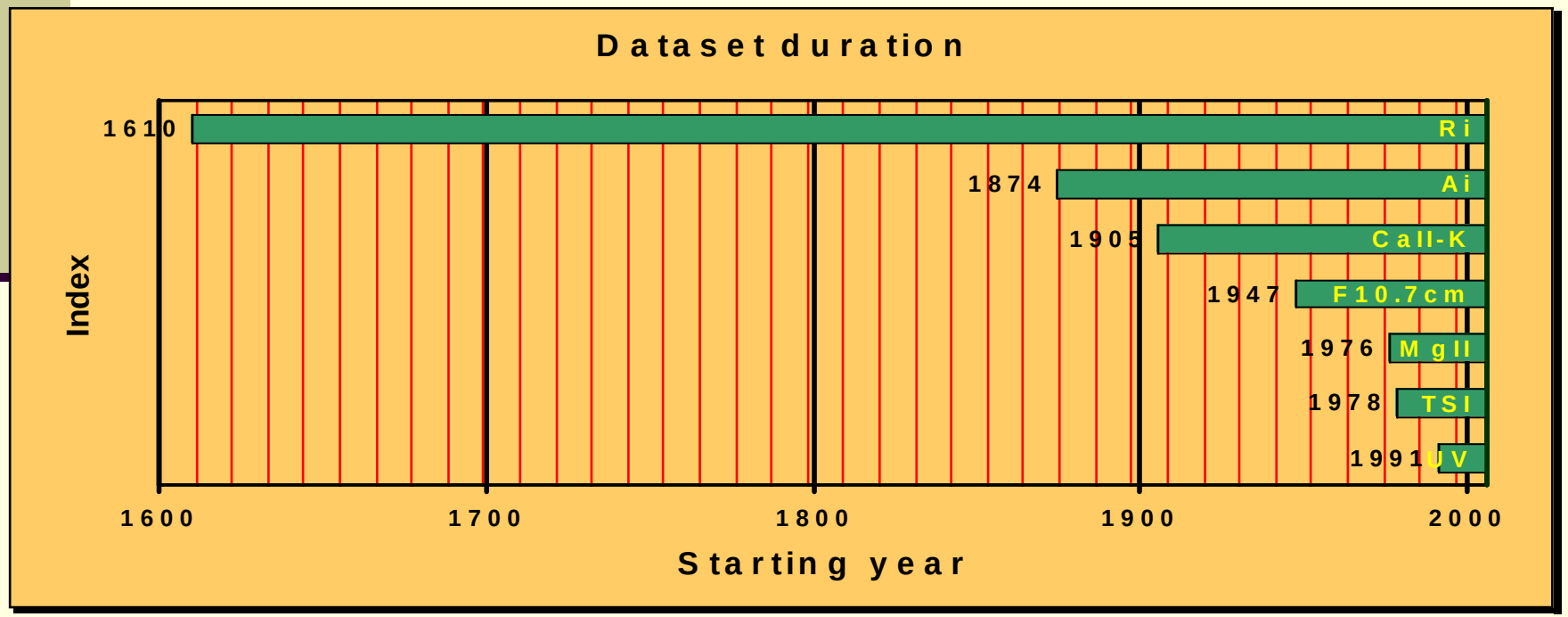




John A. Eddy, Science (1976)

ADS: 440 papers with reference ‘sunspot number’ between 2000 and 2006 (now: 5317 altogether)

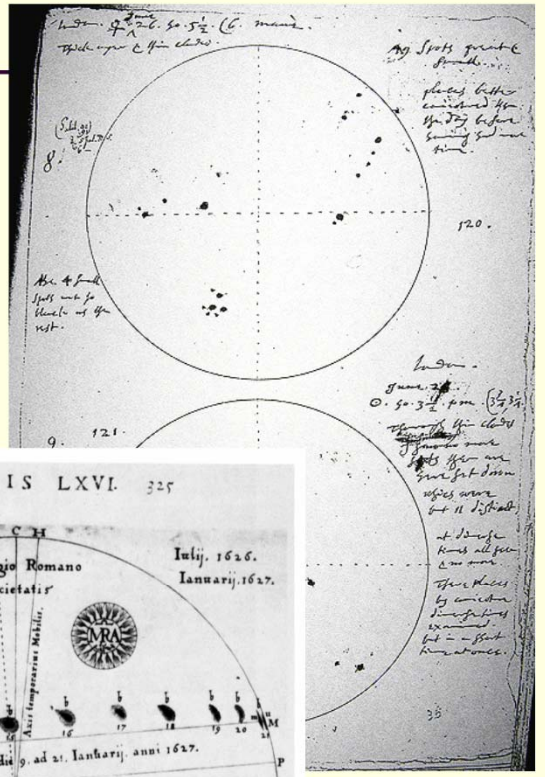
Google: 212.000 hits on “sunspot number” or ”sunspot index” (now 17 900 000)



Discovery of sunspots (first half 17th century)

Sunspots first systematically observed in Europe in:

Italy: G. Galileo
Germany: C. Scheiner
England: T. Harriot
Low Countries: J. & D. Fabricius



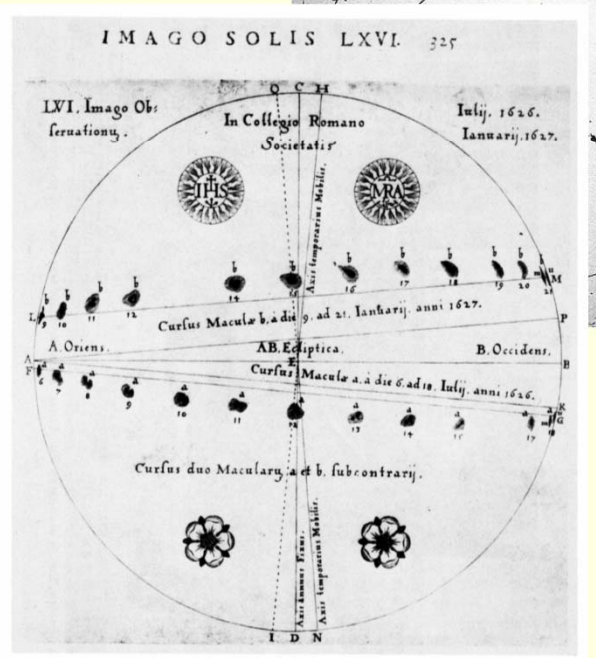
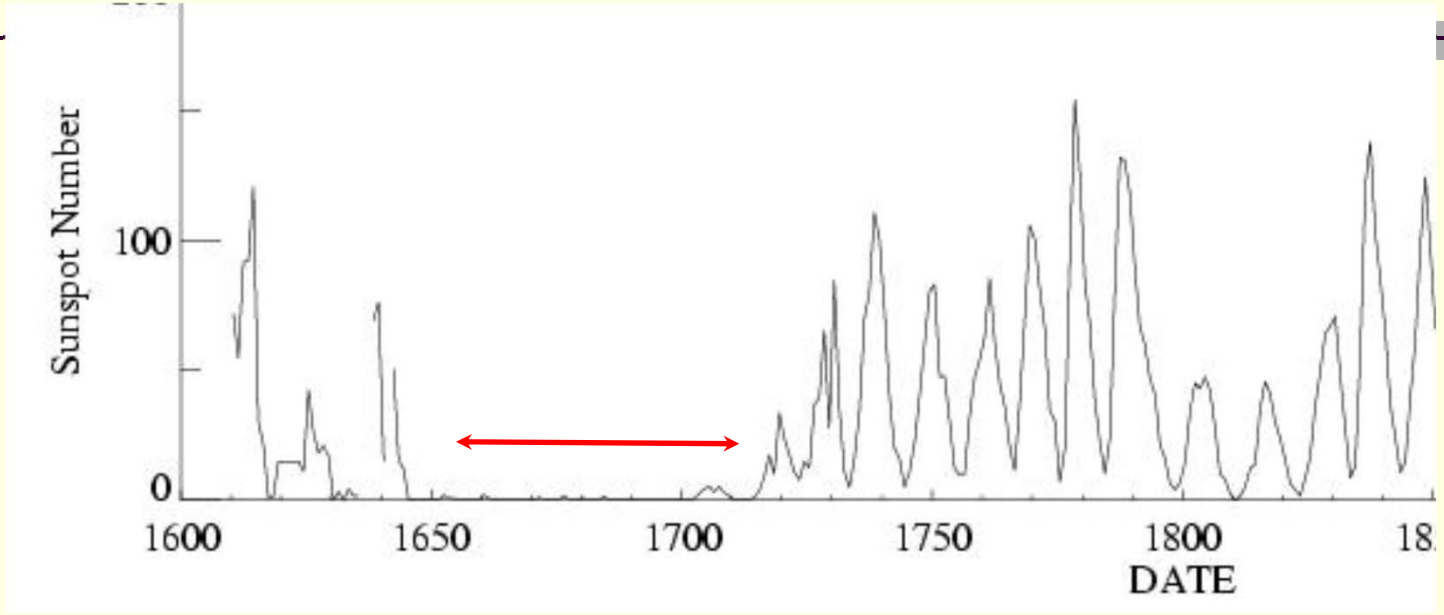


PLATE 1.1. Sunspot drawing from Scheiner's *Rosa Ursina*, showing the apparent paths of two spots across the solar disk at different times of the year. In both spots the umbra and penumbra are clearly distinguished.

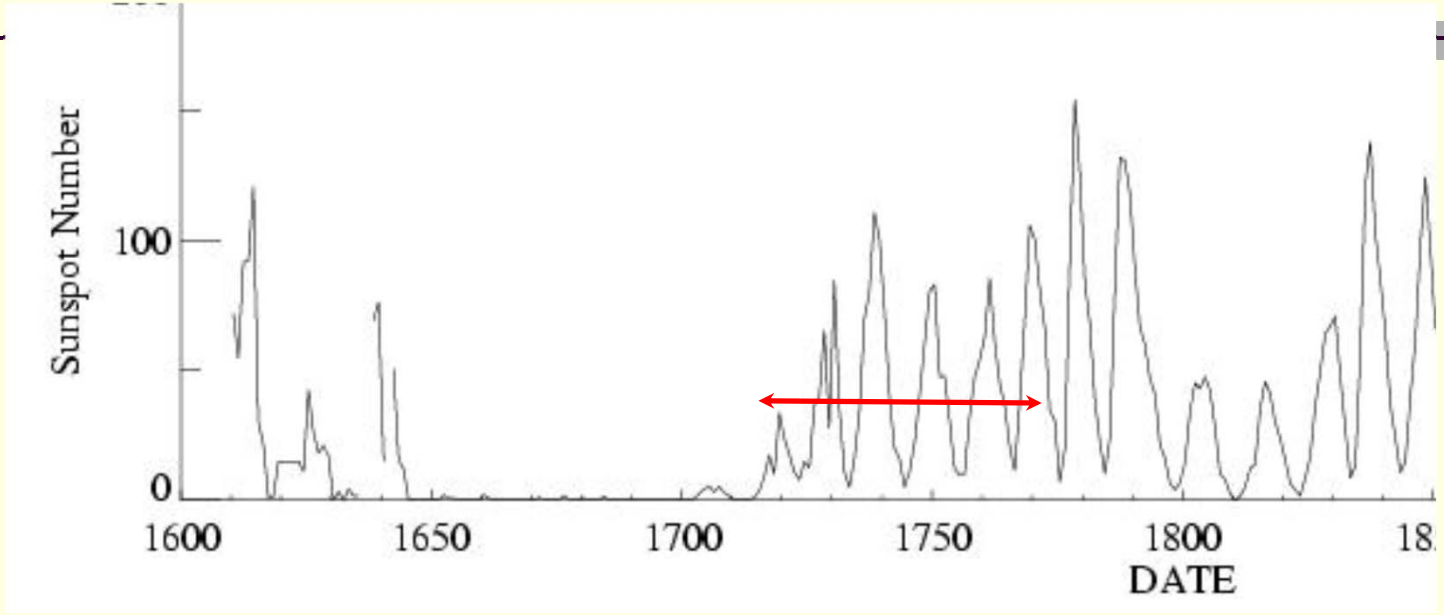
But then sunspots disappear ....

Early history (Maunder minimum)



Around 1700:
Johannes **Hevelius** [1611-1687]
John **Flamsteed** [1646-1719]
Gassendi, Cassini, Picard, La Hire, Eimmart
A. Wilson [1714-1786]: sunspot depression.

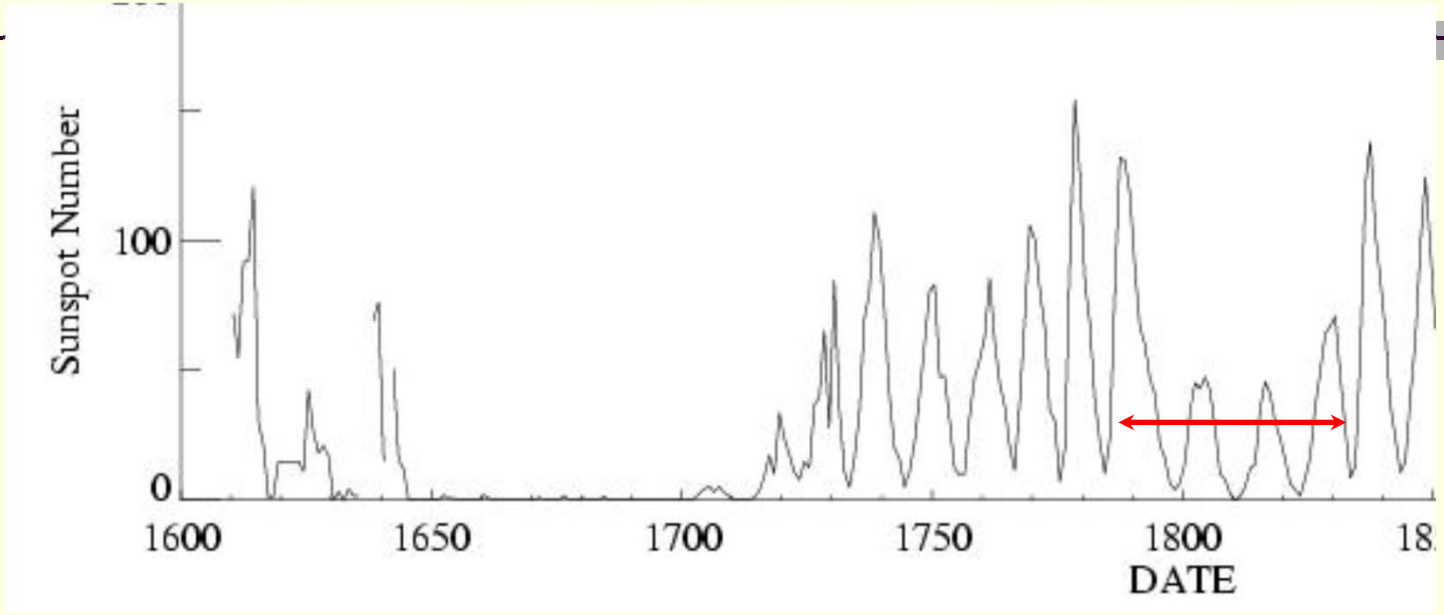
18th century

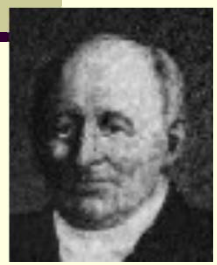


Low interests for sunspots, few observers

- William Herschel (1779-1818)
- Horrebow (1761-1777)
- Staudacher (1749-1787)
- Flaugergues (1788-1825)

Discovery of the Schwabe cycle





S. Heinrich Schwabe [1789-1875](Obs.:1826-1868)

- Search for a Vulcan (sub-Mercurian) planet
- 1843: **discovery of the 11 year sunspot cycle**, based on 17 years of observations

Johannes Rudolph Wolf [1816-1893] :

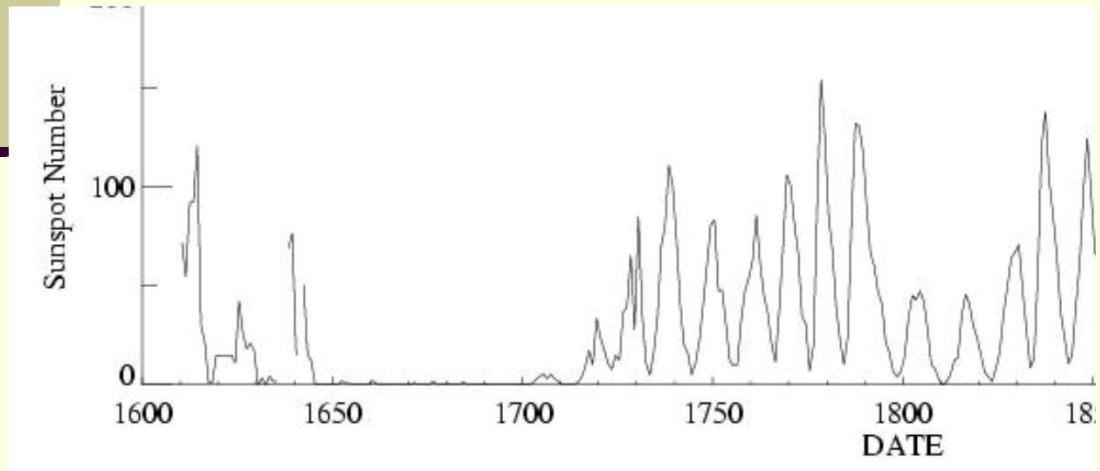
- **1848:Introduction of the Wolf formula:**

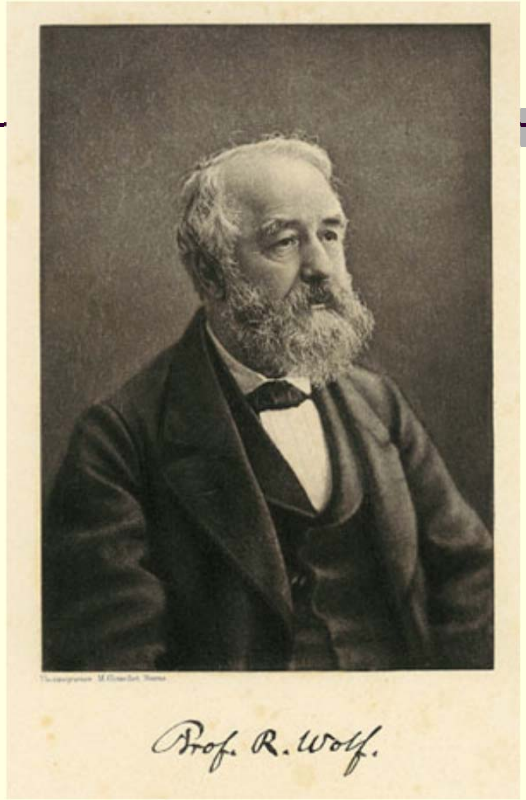
$$R = k(10 g + f)$$

- 1865: completion of the **Zürich Observatory** (alt:469m). (Director: R.Wolf 1863-1893)

- Zürich as the primary station, with auxiliary observers used to fill in the observing gaps.

- **Recovery of early observations back to 1610**:





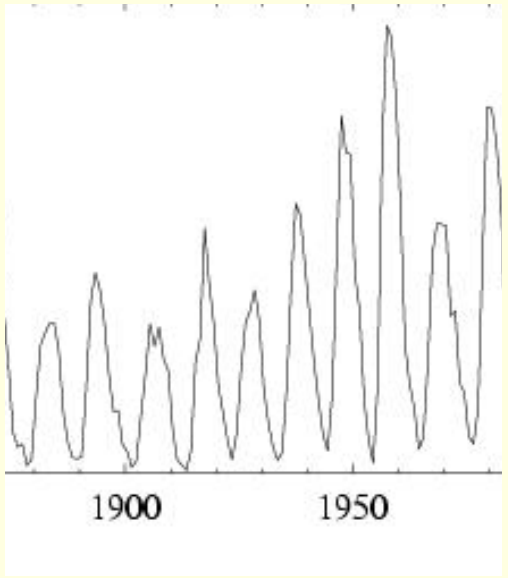
Zurich period (1882-1980)

1865: building of the
Swiss Federal Observatory
now Institute for Astronomy (ETH)

Wolfer

Brunner

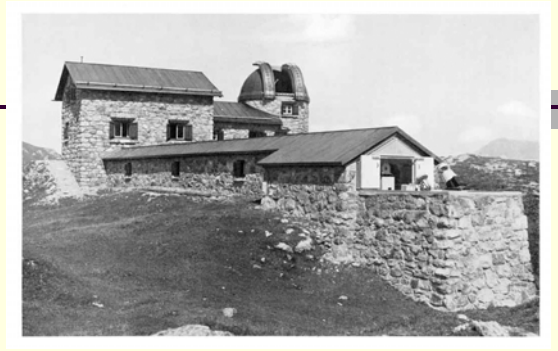
Waldmeier

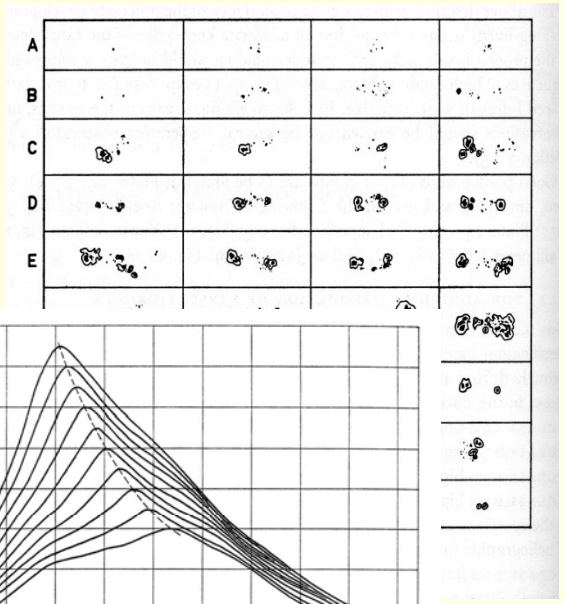


1882-1980

The last successor of Wolf in Zurich

- **Max Waldmeier** (director: 1945-1979):
  - 1957-1958 (IGY): Zürich is designated by the URSI as World Data Center for the sunspot number.
  - Creates the Zürich sunspot group classification.
  - “Standard Curves” prediction method for amplitude and maximum of solar cycle.





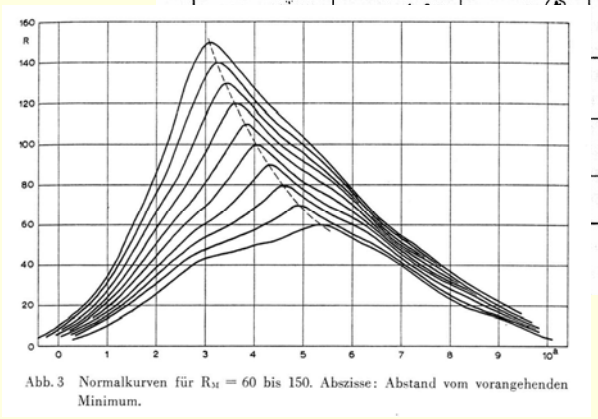


Abb. 3 Normalkurven für $R_M = 60$ bis 150. Abszisse: Abstand vom vorangehenden Minimum.

The end of the Zurich sunspot number Rz

EIDGENÖSSISCHE STERNWARTE ETH OBSERVATOIRE ASTRONOMIQUE FEDERAL

Telefon 01 32 44 00 8006 Zürich Schmelzbergstrasse 25
Direktor: ~~Prof. Dr. M. Waldmeier~~
Prof.Dr.K.Dressler

Astrophysikalisches Observatorium
7050 AROSA
Telefon 081 31 16 48

Specola Solare
6605 LOCARNO-MONTI
Telefon 093 31 27 76

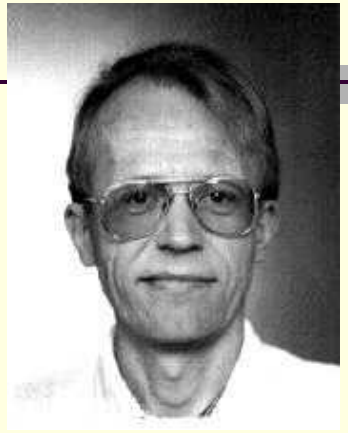
Zurich, February 18, 1980

To all observing stations
contributing to the determination of
the Zürich Relative Sunspot Number

Dear Colleagues,

The recipients of the monthly Zürich Sunspot Bulletin have been informed by Dr. Zelenka, 3 January 1980, that the determination of relative sunspot numbers will not be continued here beyond the end of 1980. Dr. V. Bumba, President of Commission 10 of the IAU, has been informed about this decision in a letter of December 17, 1979.

The excellent correlation between the Zürich sunspot number R_z on the one hand and the independently determined American (AAVSO) Relative Sunspot Number R_A, as well as the Ottawa 10 cm solar radio flux S_a on the other hand, guarantees that there will be no break in the information contained in the century-long time series of R_z. Both R_A and S_a can be translated into R_z (a non-linear curve needs to be used for S_a) with sufficient accuracy, thanks to the three decades of overlap in the observations of R_z with those of R_A and S_a.



Jan Stenflo

- bad seeing
- priority on fundamental research, not monitoring
- existing alternatives for Rz

Protest!

INTERNATIONAL ASTRONOMICAL UNION
UNION ASTRONOMIQUE INTERNATIONALE

EXECUTIVE COMMITTEE

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Assistant General Secretary: P. A. WAYMAN
Executive Secretary: A. JAPPEL

Dr. C. M. Minnis
Secretary General, URSI
Rue de Nieuwenhove 81
B - 1180 BRUSSELS
BELGIQUE

GS/374

November 1, 1978

Dear Dr. Minnis,

As you may know the Executive Council and the XXIst Plenary Meeting of COSPAR held in Innsbruck (Austria) in May/June 1978, adopted among others the following Decision No. 6/78 proposed by Working Group 4 (see COSPAR Information Bulletin No. 82, August 1978, p.25):

"COSPAR,
noting that there are plans to discontinue the continuous observations from which the Zurich sunspot numbers are derived,
strongly recommends to the appropriate national organization the continuation of these long-term observations which are vital and irreplaceable for improvement of our understanding of solar-terrestrial relationship,
and,
further recommends that IAU, IUGG, URSI and other interested organizations support the continuation of these essential observations."

From the two standpoints I have dealt with above, it is clear to me the crucial ways in which the modern scientific community is dependent on the hallowed sunspot number as derived by your institution, and the serious effects an abrupt termination of one of the longest series of consistent measurements in all of science would have in a number of major research areas as well as practical applications.

I hope these expressions, which are based on very broad contacts with the Solar-Terrestrial community, will be of use to you in your considerations of the future work of your institute.

Sincerely yours,

A. H. Shapley
Chairman, MONSEE Steering Committee
Scientific Committee on Solar-Terrestrial Physics

I fully understand that newly coming young scientists (and directors) are anxious to get rid of "service" and prefer "creative science". However, at least one homogeneous set of a characteristic index of solar activity should be maintained. The areas of sunspots at Greenwich disappeared, McMath numbers of plages are to die in one or two years from now, and Wolf number should be abolished. I am sure that our successors, after a few decades, will be quite unhappy about these discontinuities in the "solar service" in the 1970's.

Yours sincerely,

Dr. Z. Svestka.

BILTHOVENLAAN 21 - 3527 HS - UTRECHT - THE NETHERLANDS - TELEPHONE (030) 93 71 45 - TELEX 47224

"Recommendations and Resolutions

I. Commission 10, recognizing that the long series of relative sunspot numbers is a unique link with the course of solar activity in the past,

Recommends that all institutions that have demonstrated interest and competence in the work of obtaining sunspot numbers should continue the series.

II. Commission 10, recognizing that the 2800 MHz solar flux provides a standard quantitative index of solar activity for use in solar and solar-terrestrial studies,

Recommends that those institutions making such measurements should continue to do so."

I hope this will correct an unfortunate and entirely erroneous implication.

Sincerely,

John A. Eddy

JAE/vmm

1981: Creation of the SIDC Sunspot Index Data Center

Contractual agreement Zurich-Brussels

1. Beginning January 1, 1981, the international service of the Wolf number will be provided by the "Sunspot Index Data Center" (SIDC) under the responsibility of Dr. A. Koeckelenbergh, in collaboration with Département de Radioastronomie et de Physique Solaire de l'Observatoire Royal de Belgique (Uccle) and Institut d'Astronomie et d'Astrophysique de l'Université Libre de Bruxelles.

2. The objectives of SIDC are defined as follows:
   (a) Determination and prompt monthly distribution of the "Provisional Sunspot Number" to international institutions and services being in need of these data.
   (b) Determination and distribution of the "Predictions of the Smoothed Monthly Sunspot Numbers".
   (c) Determination and annual distribution of the "International Definitive Wolf Numbers R".
   (d) Research work leading to a better definition of the characteristic indices of solar activity.

3. A Working Group of the principal collaborators in the sunspot patrol will assist the SIDC. The main objective of this group will be to guarantee continuity and assure homogeneity between the series of Wolf numbers published by SIDC and the previously published numbers.

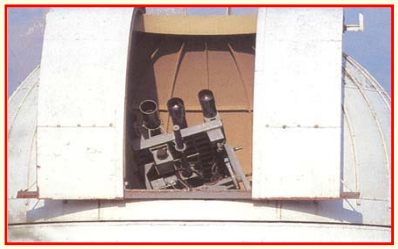
4. To maintain the homogeneity of the series the provisional sunspot numbers will be based primarily on observations obtained at the station in Locarno (Specola Solare). A phone or telex connection between Locarno and Brussels will assure that the observations for a whole month will be available at the last day of each month. The provisional numbers would also be partially based on observations in Zürich in the case that an observing station would remain there. The data will be evaluated by SIDC in the same way as Zürich has done it. R_Z will be renamed R_I (international relative number).

Cortesi

Locarno

International endorsement, IAU, FAGS

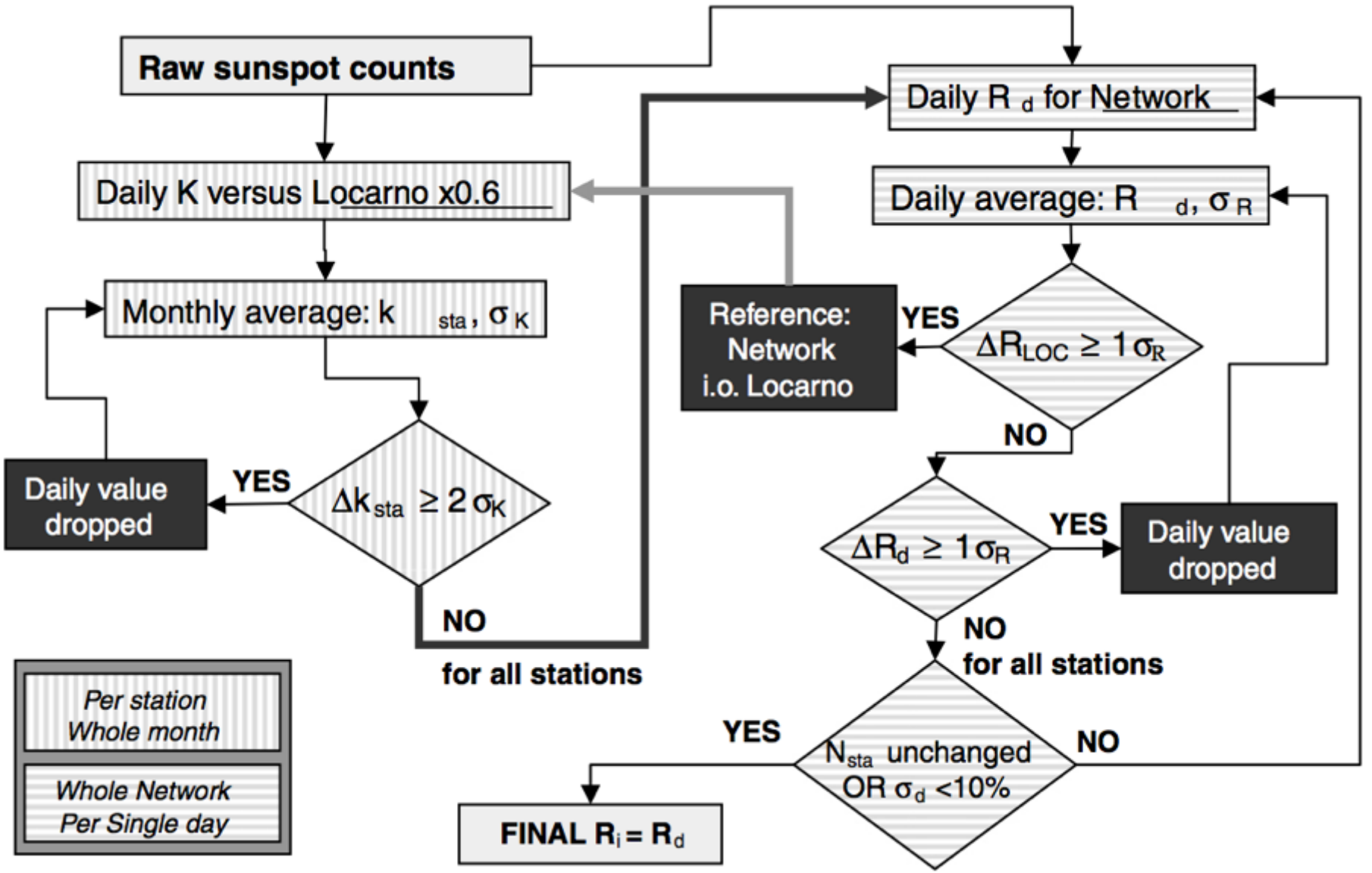
SIDC=WDC for the Sunspot Index

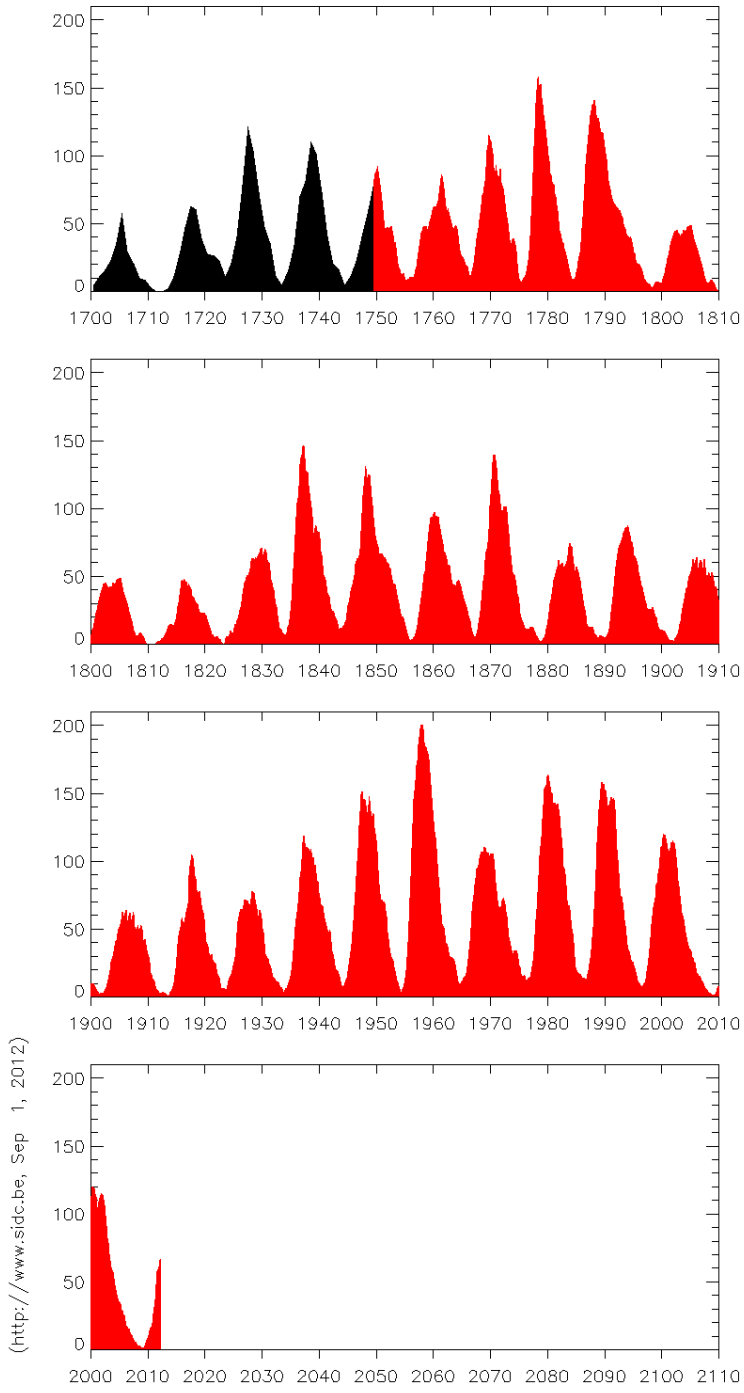


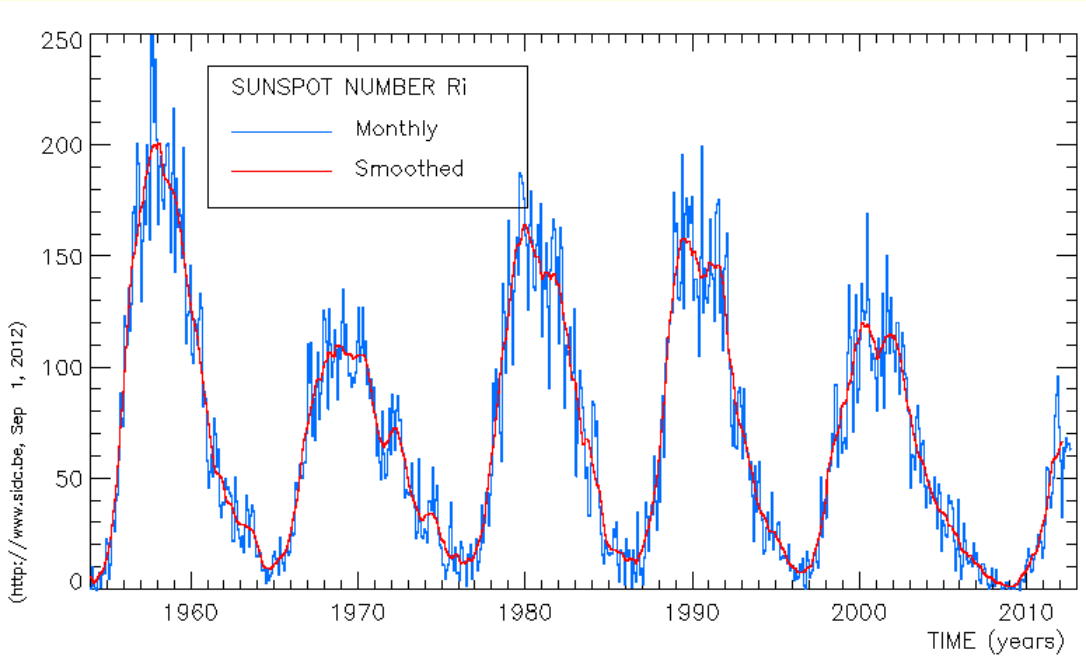
Tintin & L'etoile Mysterieuse (Herge)

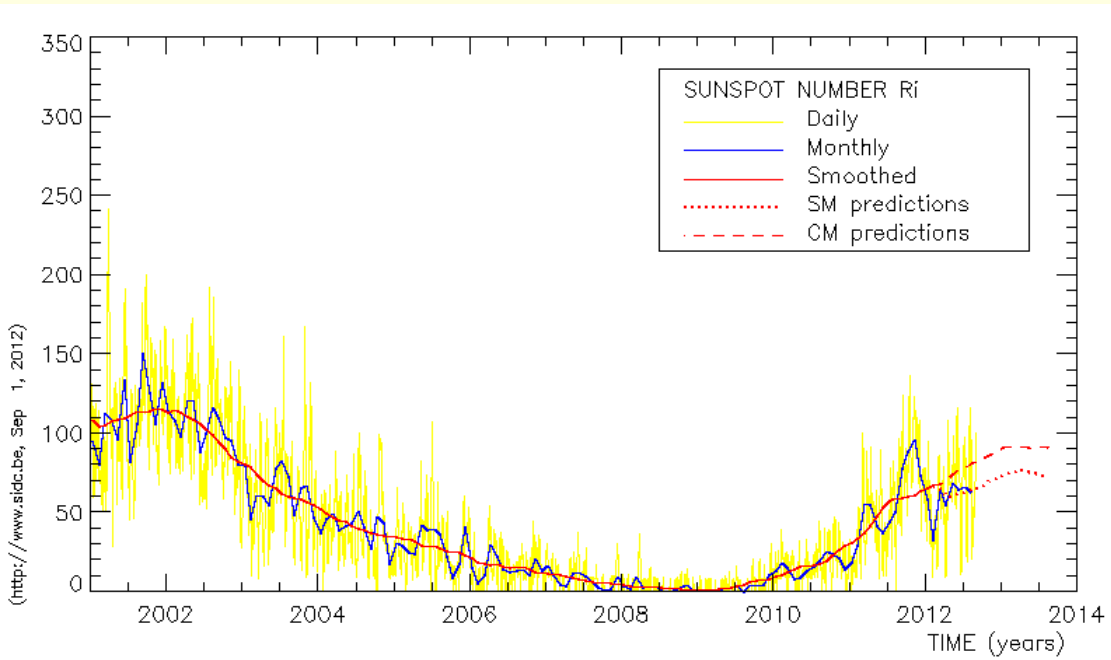
02															Clear
03															Clear
04															Clear
05															Clear
06	0930	2	1	1	11										Clear
07															Clear
08															Clear
09	1200	3	0	0	0										Clear
10															Clear
11															Clear
12															Clear
13															Clear
14	0859	4	0	0	0										Clear
15	0855	4	0	0	0										Clear
16	0900	3	1	3	13										Clear
17	1000	2	1	3	13										Clear
18	1115	2	1	1	11										Clear
19	1030	2	1	1	11										Clear
20	0945	2	0	0	0										Clear
21	1345	2	0	0	0										Clear
22	1250	3	0	0	0										Clear
23	1500	2	0	0	0	0	0	0	0	0	0	0	0	0	Clear
24															Clear
25															Clear
26															Clear
27															Clear

2007-11-22	SUZUKI JAPAN	03:00:00	3	0	0	0	0	0	0	0	0	0	0	0	0
2007-11-22	UCCLE BELGIUM	12:50:00	3	0	0	0									
2007-11-23	CATANIA ITALY - USSPS code 31405-	08:30:00	4	0	0	0	0	0	0	0	0	0			
2007-11-23	CULGOORA NARRABRI AUSTRALIA	00:50:00	3	0	0	0	0	0	0	0	0	0			
2007-11-23	DE BACKER BOOM BELGIUM	13:30:00	4	1	1	11	1	1	11	0	0	0	1	1	11
2007-11-23	DUBOIS LANGEMARK BELGIUM	09:11:00	2	0	0	0	0	0	0	0	0	0			
2007-11-23	HAVANA SOLAR STATION CUBA	15:00:00	4	0	0	0	0	0	0	0	0	0			
2007-11-23	HVEZDAREN PRESOV (SLOVAKIA) Mgr.Peter Ivan - Hvezdaren a planetarium Dilongova 17- 080 01 Presov	08:50:00	2	0	0	0	0	0	0	0	0	0	0	0	0
2007-11-23	JEFFREY CARELS (BELGIUM)	09:00:00	2	0	0	0	0	0	0	0	0	0	0	0	0
2007-11-23	JOHNSTON GWYNEDD ENGLAND	05:50:00	3	0	0	0	0	0	0	0	0	0			
2007-11-23	SKALNATE SLOVAKIA	10:50:00	2	0	0	0	0	0	0	0	0	0	0	0	0
2007-11-23	SOBOTA SLOVAKIA	11:45:00	4	0	0	0	0	0	0	0	0	0	0	0	0
2007-11-23	SUZUKI JAPAN	00:15:00	3	0	0	0	0	0	0	0	0	0	0	0	0
2007-11-23	UCCLE BELGIUM	15:00:00	2	0	0	0	0	0	0	0	0	0	0	0	0


Raw sunspot counts
Daily K versus Locarno x0.6
Monthly average: k sta , σ K
Daily value dropped
YES
Δk sta ≥ 2 σK
NO
for all stations
Daily R d for Network
Daily average: R d, σ R
Reference: Network i.o. Locarno
YES
ΔRLOC ≥ 1 σR
NO
ΔRd ≥ 1 σR
YES
Daily value dropped
NO
for all stations
YES
Nsta unchanged OR σd <10%
NO
FINAL Ri = Rd
Per station Whole month
Whole Network Per Single day


1700 1710 1720 1730 1740 1750 1760 1770 1780 1790 1800 1810
1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 1910
1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010
2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 2110
0 50 100 150 200
(http://www.sidc.be, Sep 1, 2012)


SUNSPOT NUMBER Ri
Monthly
Smoothed
1960 1970 1980 1990 2000 2010
TIME (years)
0 50 100 150 200 250
(http://www.sidc.be, Sep 1, 2012)


SUNSPOT NUMBER Ri
Daily
Monthly
Smoothed
SM predictions
CM predictions
2002 2004 2006 2008 2010 2012 2014
TIME (years)
0 50 100 150 200 250 300 350
(http://www.sidc.be, Sep 1, 2012)

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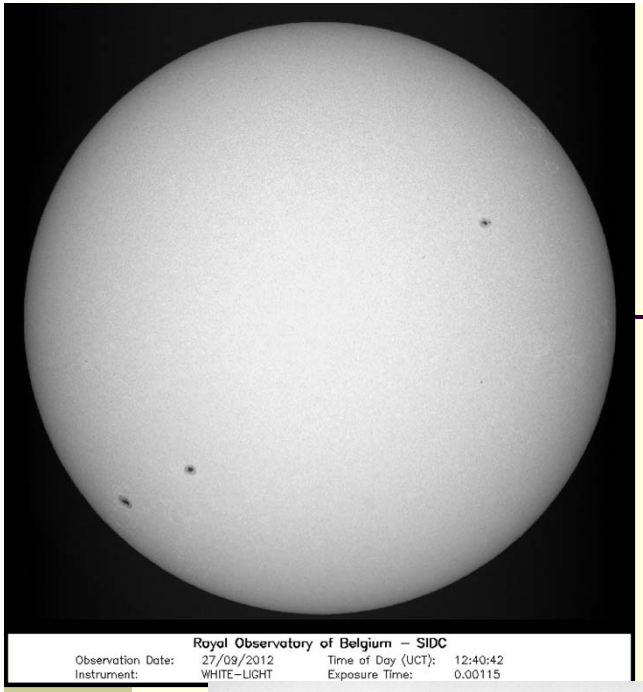
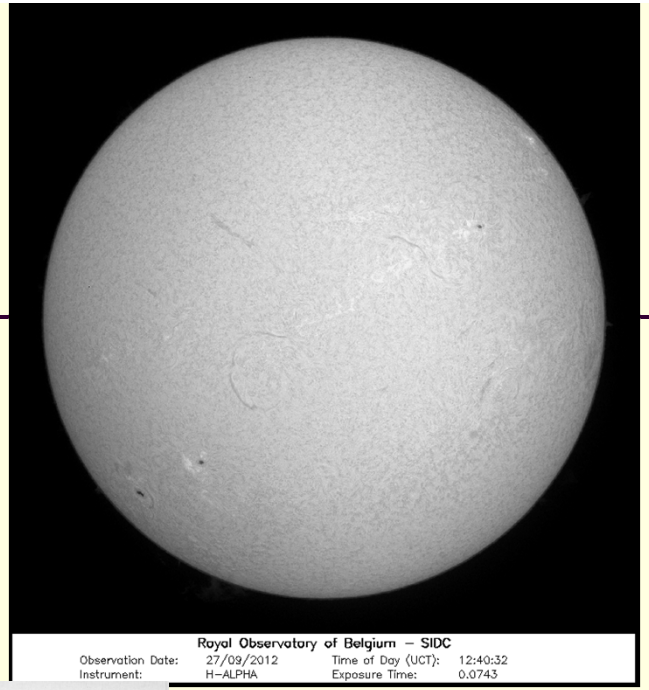
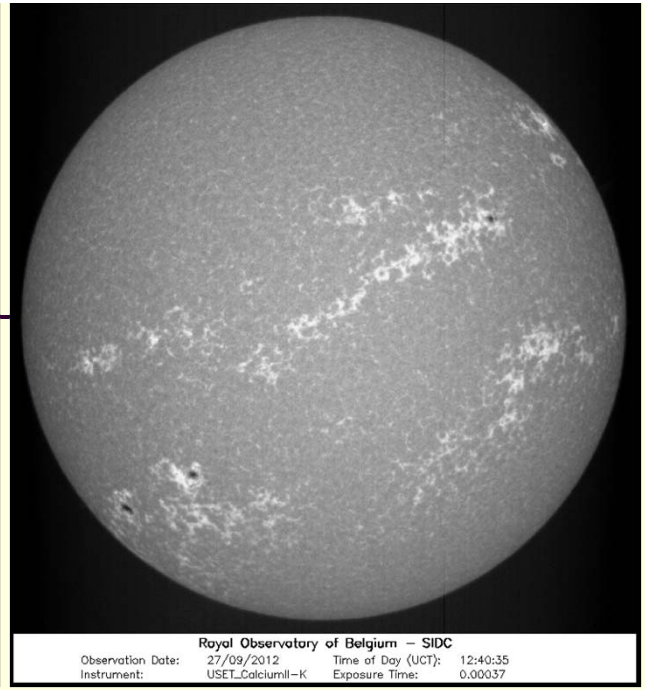
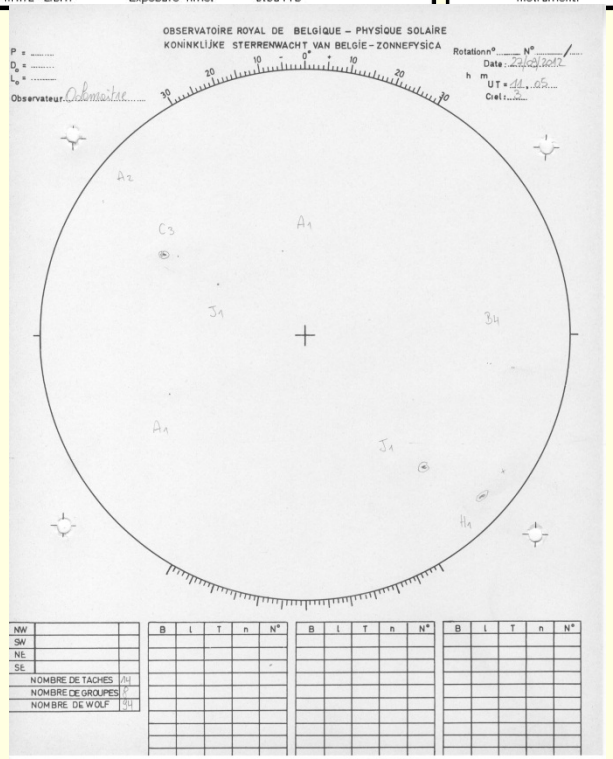
USET (www.sidc.be/uset/)

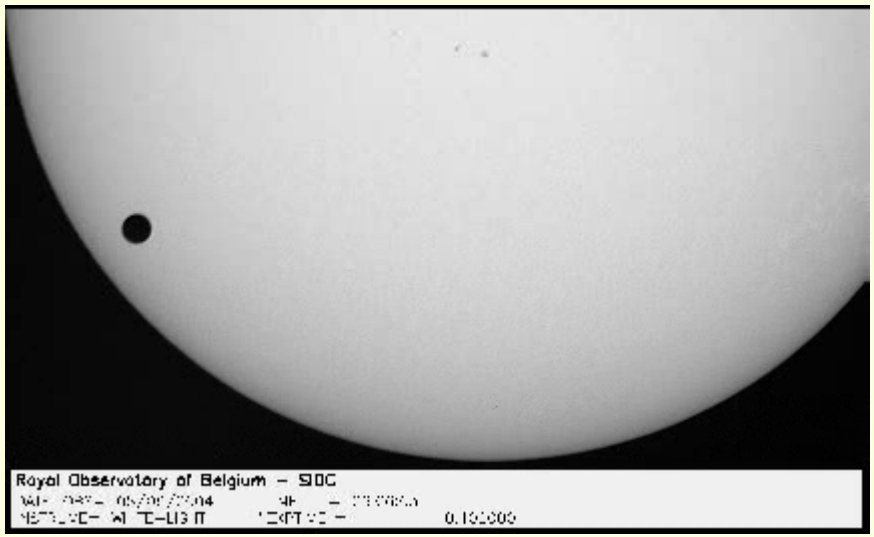
- Uccle Solar Equatorial Table
- Operational since 1955
- 2007 updated with
  CCD imaging systems
- White-light images
- H-alpha images
- Ca-IIK images
- Archive
- Mosaics
- Animations
- Drawings











Venus Transit 08 Jun 2004

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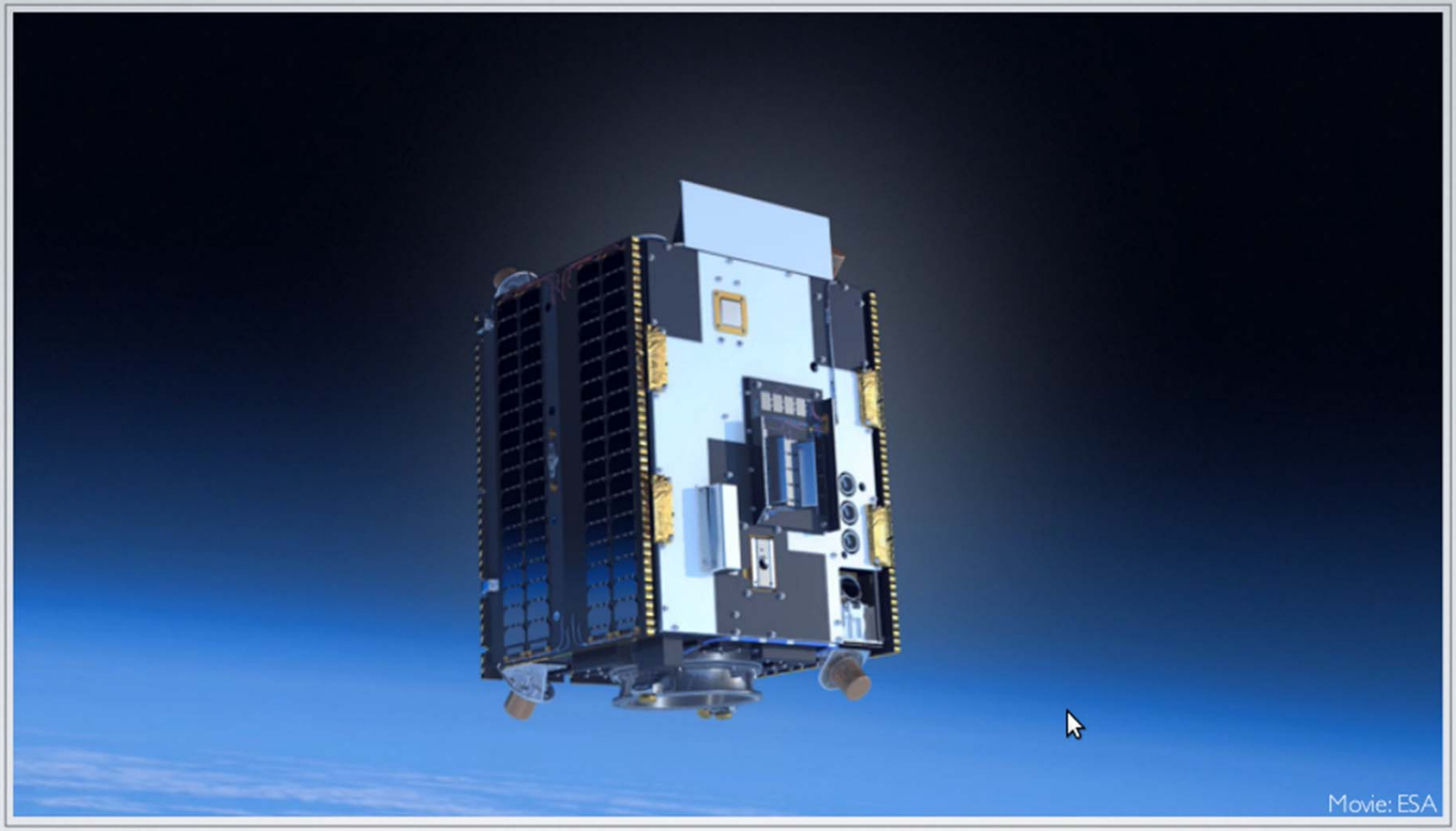
PROBA2

Project for **O**n-**B**oard **A**utonomy

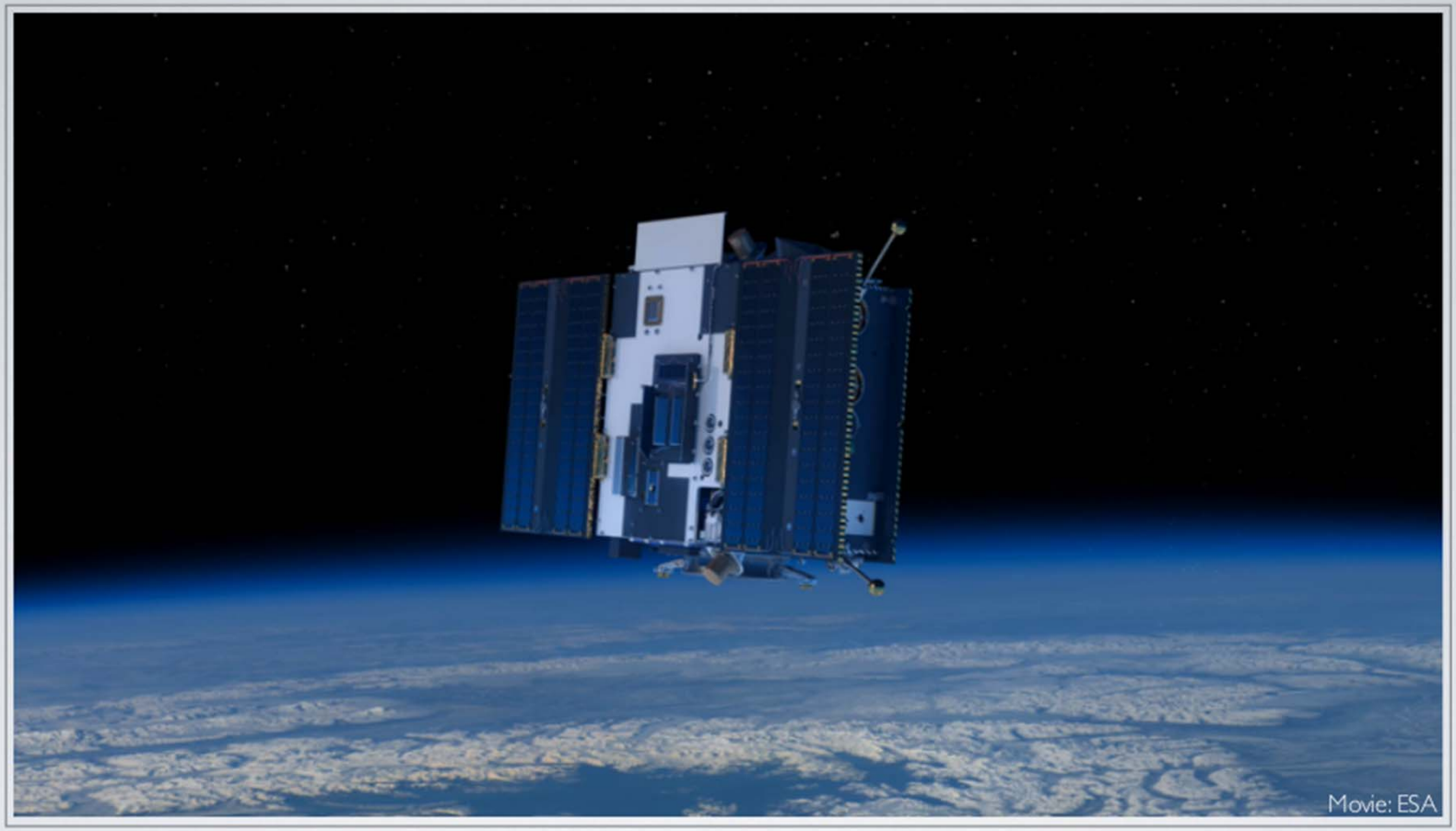
Microsatellite in sun-synchronous orbit 725 km altitude

Launched on Nov. 2, 2009



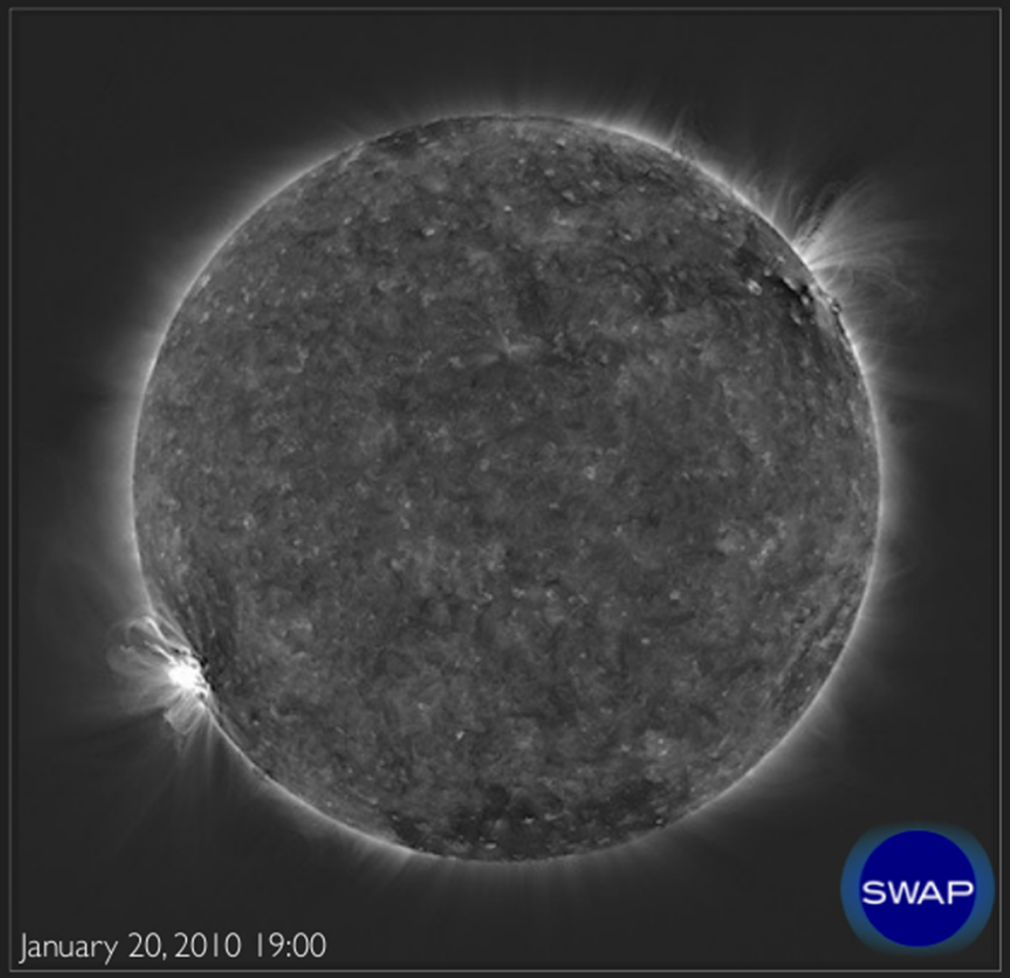
ESA TECHNOLOGY MISSION

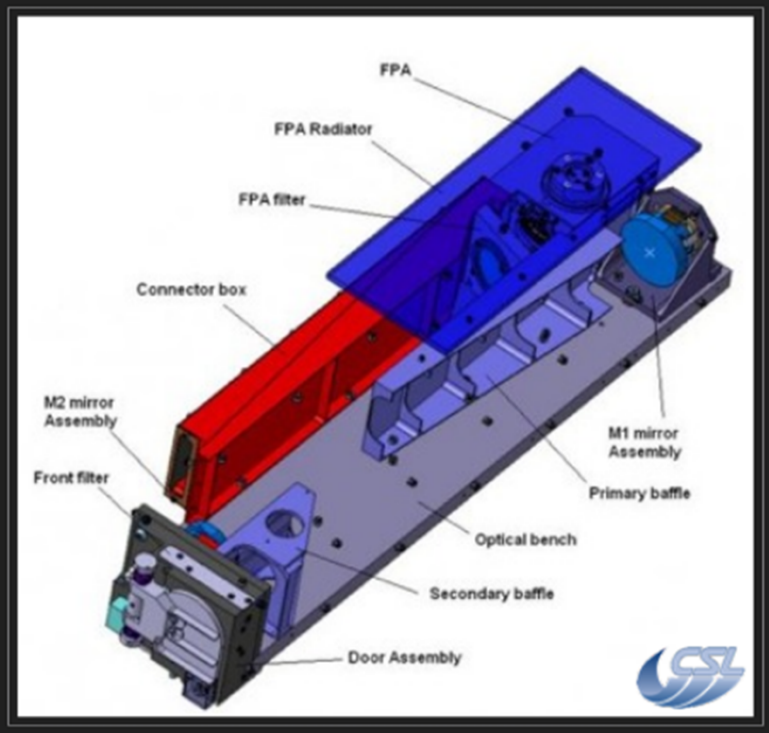
4 innovative instruments: SWAP, LYRA, TPMU, DSLP
17 technological experiments
in-orbit demonstration



ESA SCIENCE MISSION

SWAP and LYRA observe the Sun in EUV and XUV
nominal operations since March



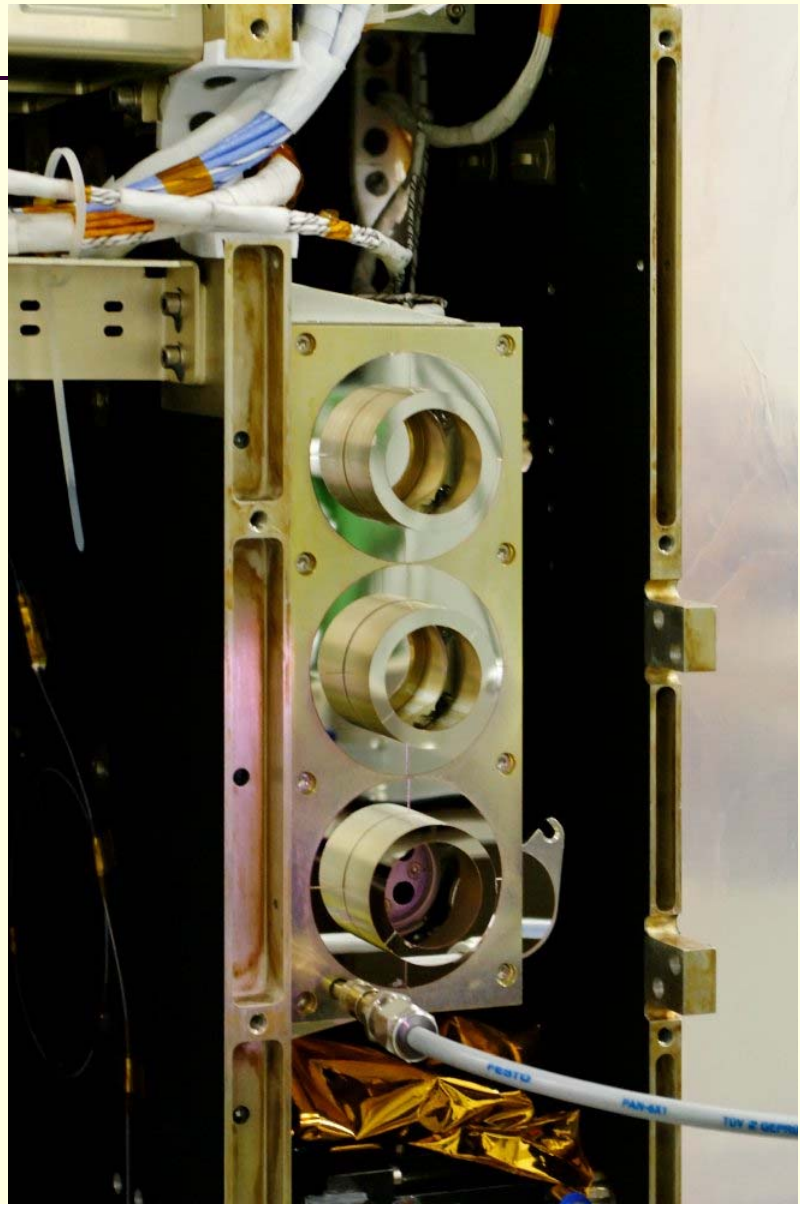


SWAP EUV IMAGER

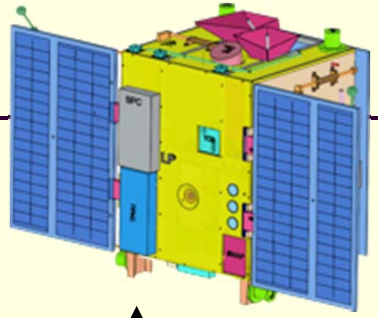
Observes the 1 million degree corona in EUV light

LYRA: the Large-Yield RAdiometer

- 3 instrument units (redundancy)
- 4 spectral channels per head
- 3 types of detectors,
  Silicon + 2 types of
  diamond detectors (MSM, PIN):
  - radiation resistant
  - insensitive to visible light
    compared to Si detectors
- High cadence up to 100 Hz



PROBA2 science center



telemetry

science products

Redu, Belgium

commanding

data

P2SC

server

operator interface

Welcome to the PROBA2 Science Center

About PROBA2

- Mission
- Spacecraft
- Launch and Orbit
- Operations Calendar
- Science Payload

Science

- Guest Investigator Program
- Publications

Data

- LYRA Data
- SWAP Data
- Data analysis software
- Spacecraft Ancillary Data
- Terms of use

Community

- Scientific community involvement
- Meetings
- Outreach

Highlights

About the PROBA2 Science Center

The PROBA2 Science Center, located at the Royal Observatory of Belgium in Brussels, oversees scientific operations and data processing for ESA's PROBA2 spacecraft. The P2SC is the primary archive and distribution center for data from SWAP and LYRA, as well as the primary maintainer of calibration tools, data analysis software, and additional instrument data. The P2SC is also home to the science operations center, where instrument observing plans are devised and, with the help of ESA's Spacecraft Operations Center in Redu, Belgium, loaded onto the spacecraft. Finally, the P2SC serves as the main site for coordination of the PROBA2 Science Working Team, coordinating special scientific campaigns, supporting science data users and guest investigators, and organizing PROBA2 outreach efforts.

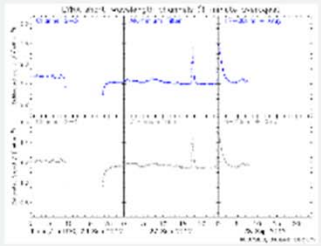
PROBA2 is a small ESA satellite with a scientific mission to explore the active Sun and its effect on the near-earth environment and a broader mission to provide a test platform for new instrument and platform technology. The mission overview page provides additional information about PROBA2 and its on board instrumentation and advanced platform technology.

If you require special assistance, you can contact the instrument teams directly using the contact page on this site.

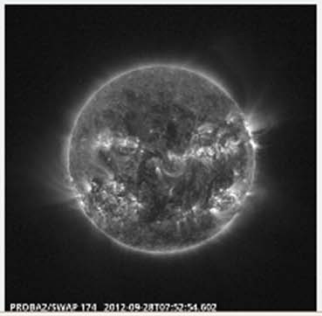
Job: Instrument Scientist

Applications are invited for a postdoctoral position at the Solar Influences Data analysis Center (SIDC) at the Royal Observatory of Belgium (ROB). Read more...

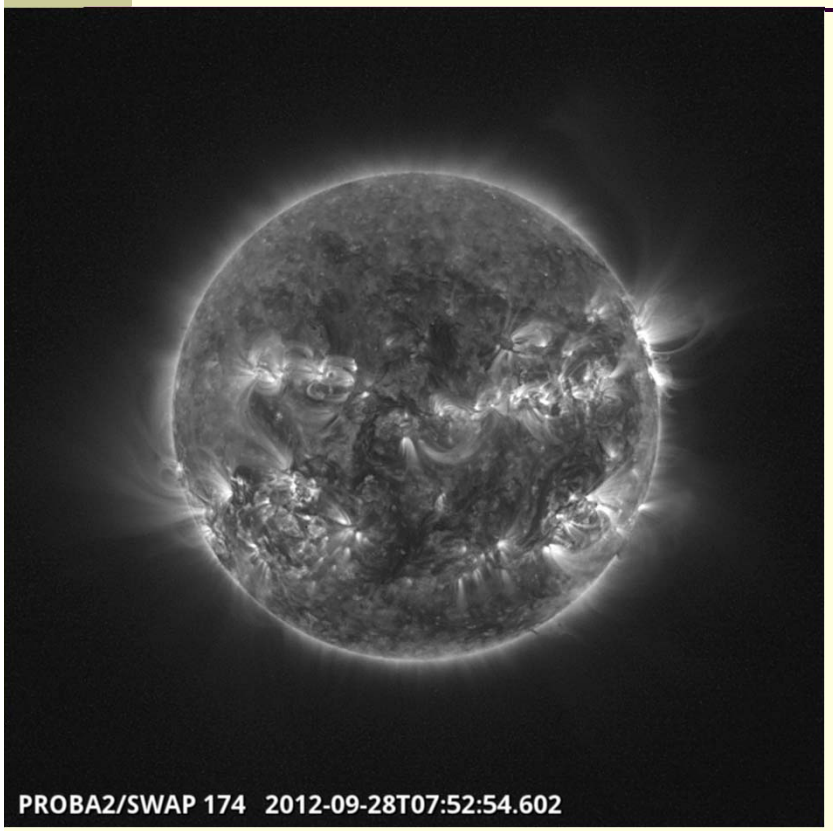
LYRA Latest



SWAP Latest

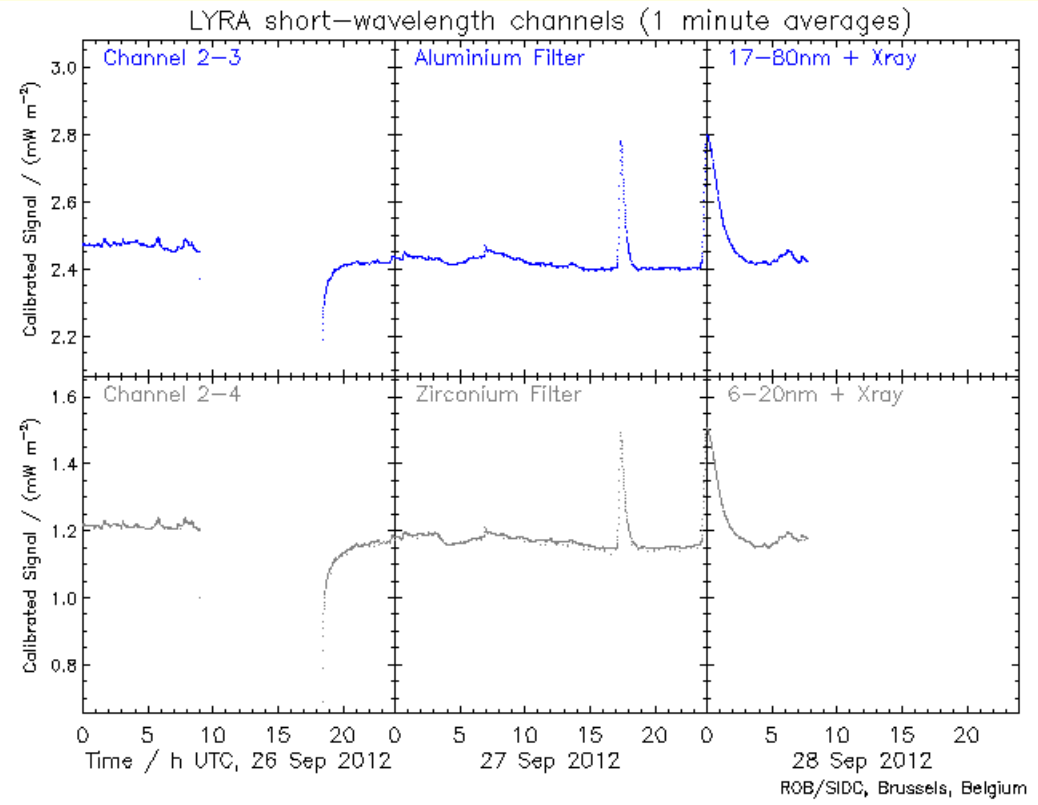


Typical PROBA2 data products



SWAP

LYRA



Time for some animations?

How to be involved?

Scientists are welcome to

- use PROBA2 data
- propose special observation campaigns

Guest Investigator Program welcomes proposals for dedicated (joint) observations in the frame of a science project:

- Funds available for a stay at PROBA2 Science Center
- Scientist can take part in the commanding of the instruments
- Will gain expertise in the instrumental effects

- *Next announcement (for 2013-14):* May 2013
- *Proposal deadline and selection:* June 2013
- *First visits:* September 2013 onwards

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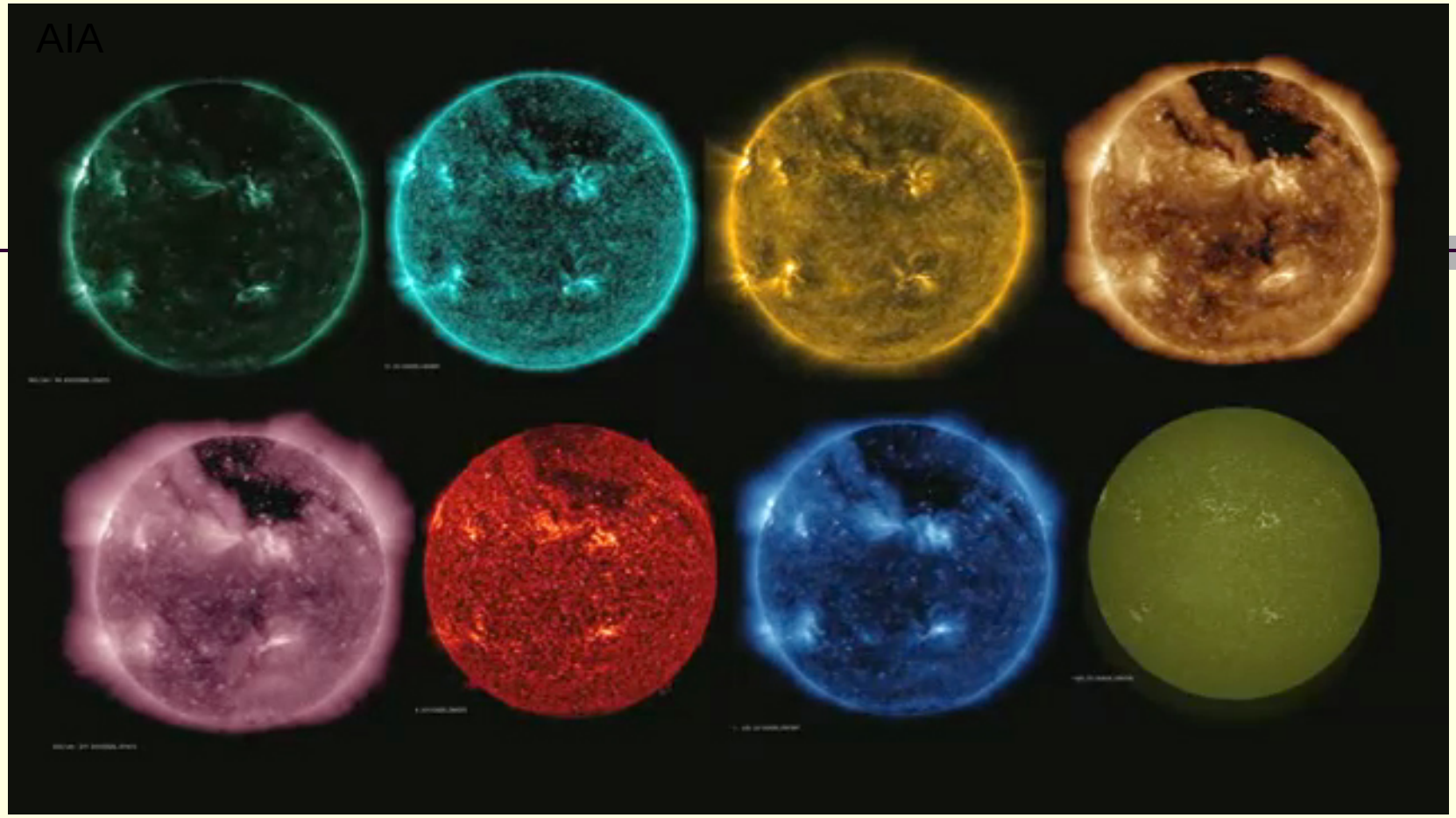
Introduction

- As from NASA policy:
  - SDO data are freely available
- Problem:
  - SDO delivers between 1000 and 10000 more data than previous missions such as SOHO, TRACE, or STEREO
- Two limitations users run up against:
  - physically accessing the data
  - processing (exploiting) the data

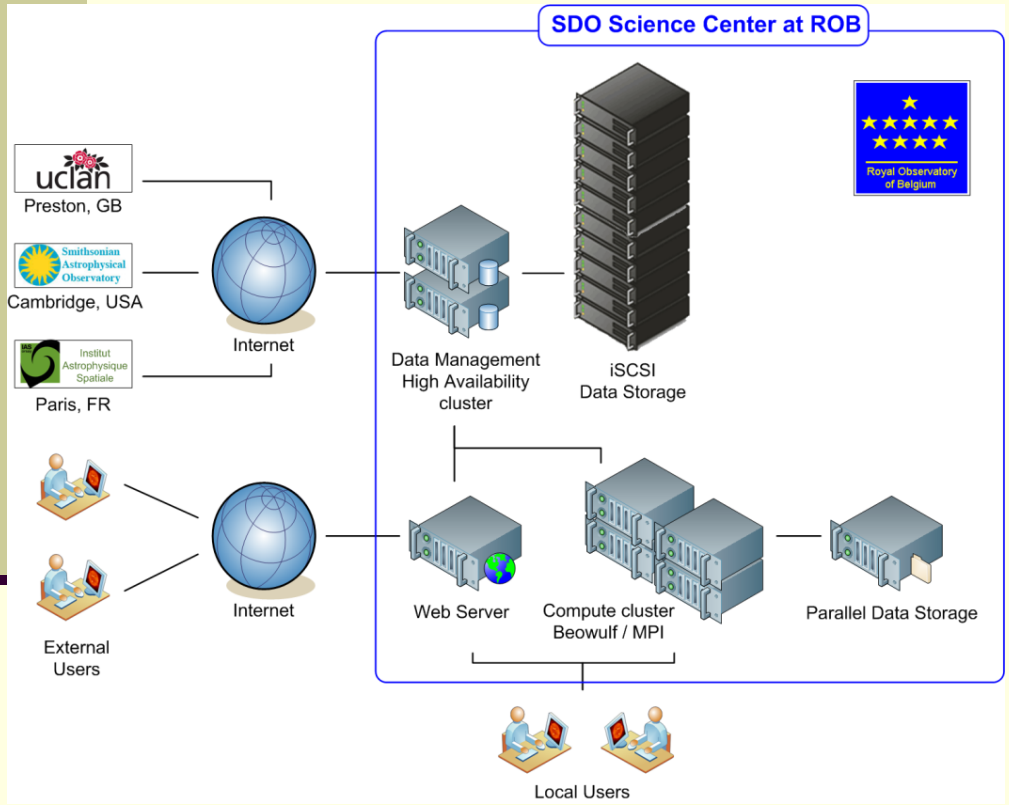
- Conclusion: Some effort is needed to make the data ‘freely’ available in practice!



HMI (Helioseismic and Magnetic Imager): 4k x 4k images of LOS magnetogram, intensitygram, dopplergram, and vector magnetogram every 45 sec

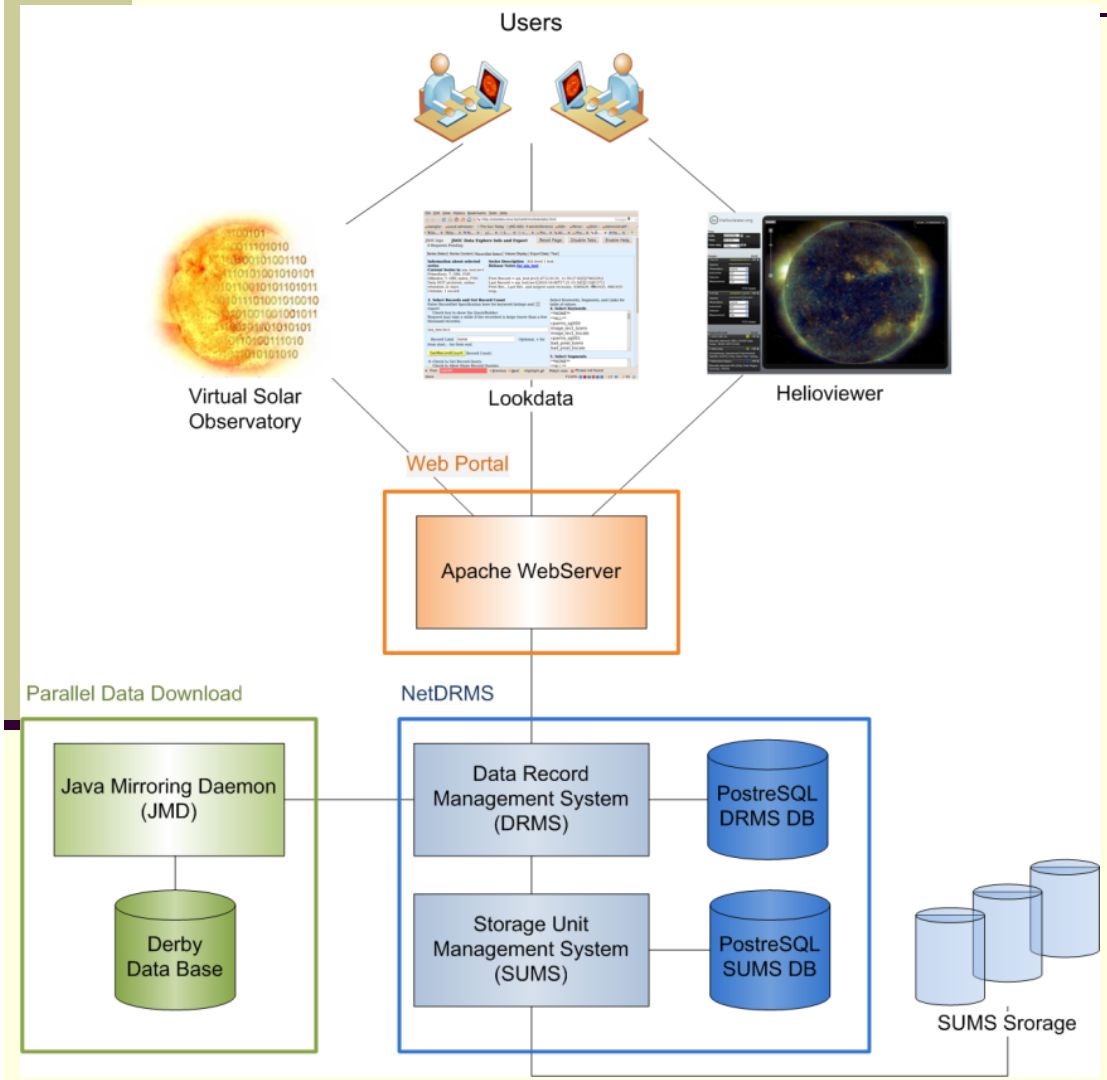
AIA (Atmospheric Imaging Assembly): 4k x 4k images in 10 wavelengths every 10s.

Data products at Belgian SDO data center



- 1K x 1K near real time AIA images and movies received 20min after acquisition, kept for 1 month
- 4K x 4K full cadence data after 4 to 5 days, kept for around six months
- 4K x 4K science quality data long term archive at 1 hour cadence

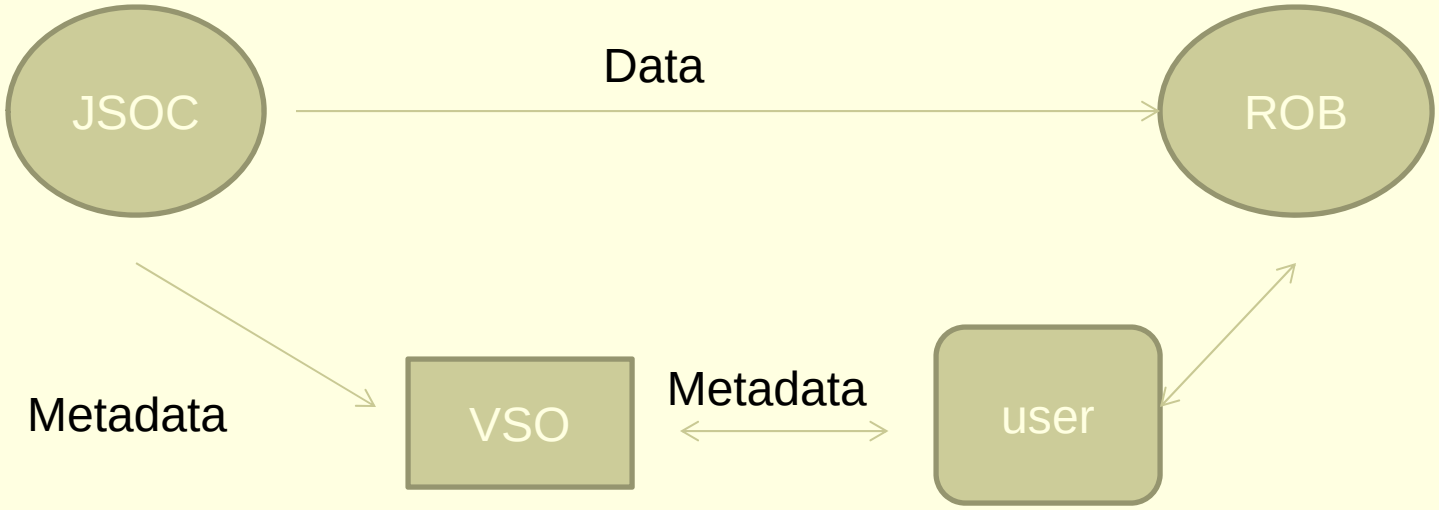
From a data centre to end-users



- The web portal allows to retrieve the data thanks to multiple interfaces :
  - Direct browser (HTTP) and FTP access to files and movies
  - Query access from command line, displayed as file system (PFS)
  - Query access from IDL/SolarSoft (VSO) and Python
  - Browser query access with the user-friendly “SDO Wizard”

Example: get data with VSO

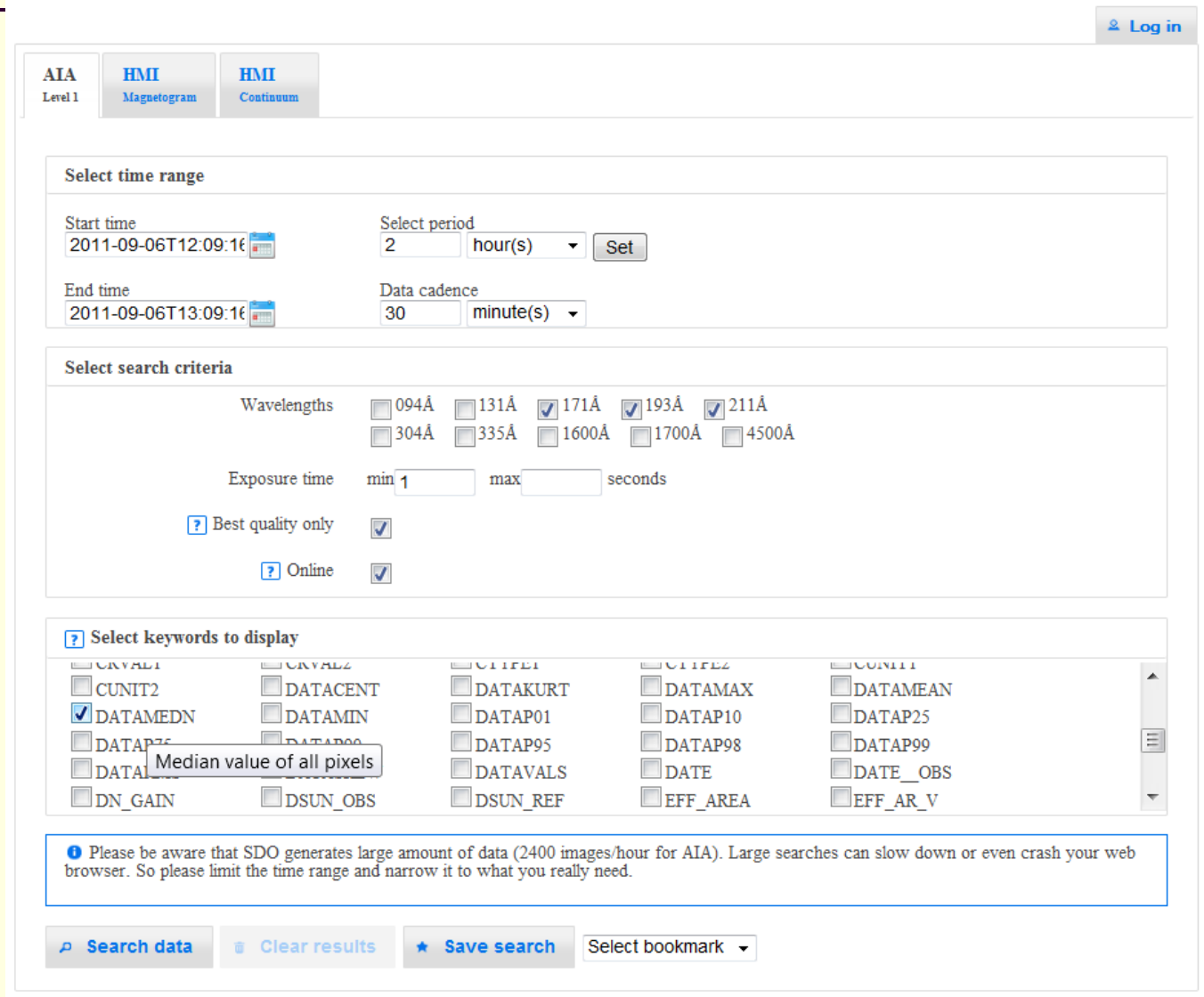
- From within IDL: vso_search : to query metadata
- vso_get with keyword site='rob' or site='uclan' to get data from remote sites



VSO=Virtual Solar Observatory: a search system for solar physics images

Example: get data with SDO Wizard

`http://sdodata.oma.be/sdo_wizard/`



Websites

- Mission data center:
  `http://sdo.gsfc.nasa.gov`
- Belgian SDO data center:
  `http://wissdom.oma.be`

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HUMAIN – Solar Radio Observations

Southern Belgium, between Brussels and Luxemburg

What are we doing?

- Solar spectral observations 45 MHz -4 GHz
  - Callisto instrument, observing since 2008
  - Phoenix 2 instrument, set up in progress
- Flux measurement 1 – 10 GHz
  - In development

Current Spectral Observations

- Callisto spectrograph (45-400 MHz)
- Callisto Network

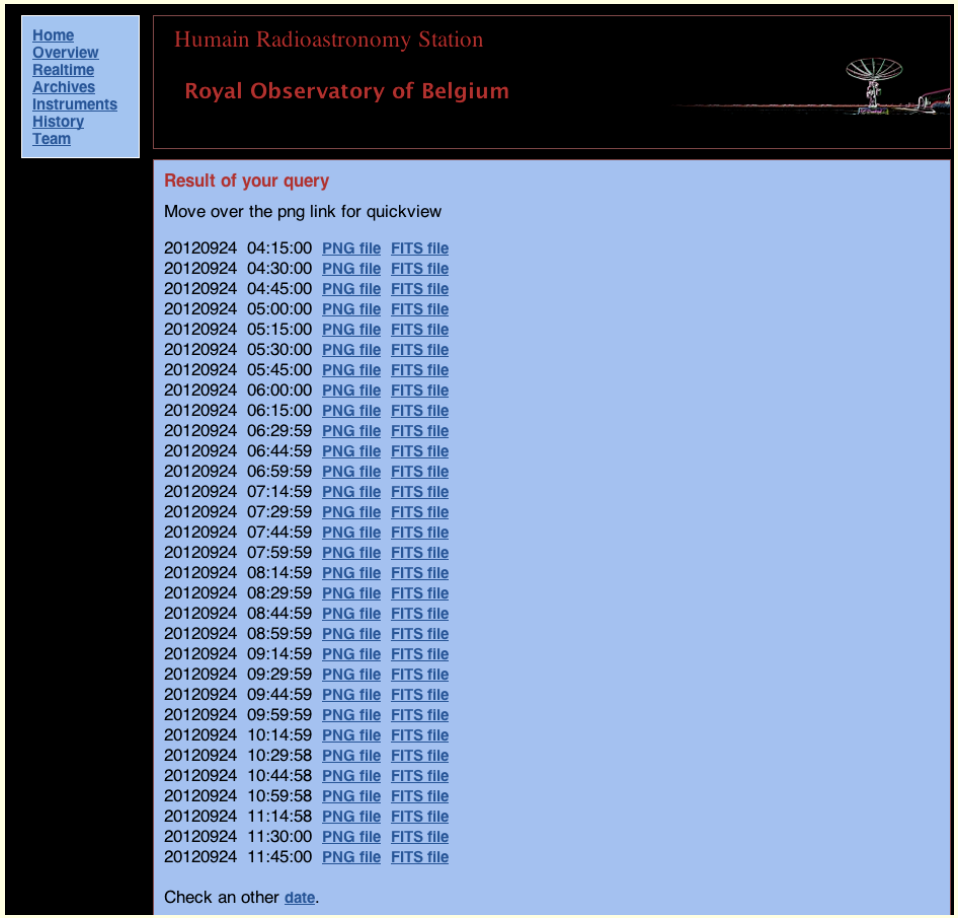
  (ETH Zürich, C. Monstein)
- Observations since May 2008:

  ~ **2500 events**
- Near real time (15 mn)

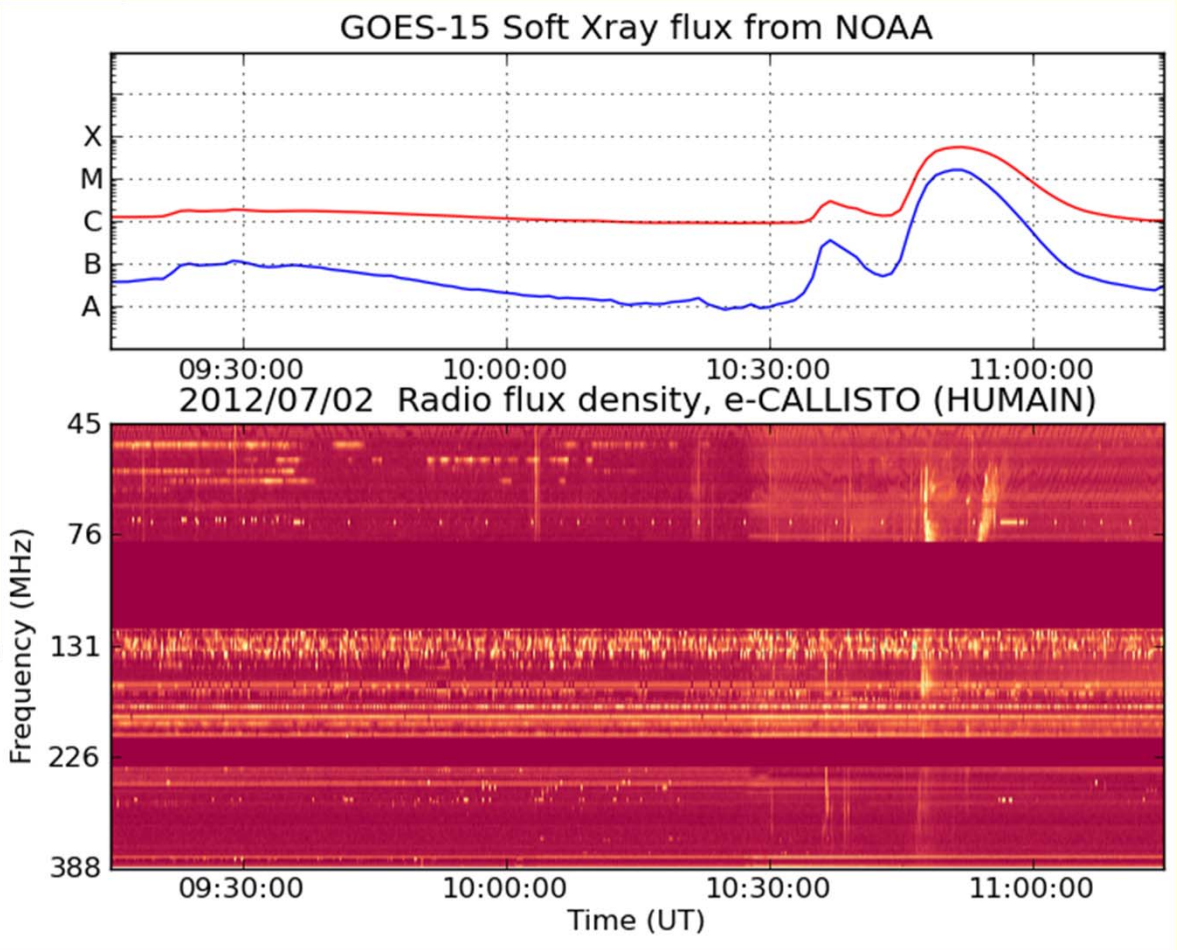
  http://sidc.be/humain

Data availibility

- FITS files (>30/day)
- 15mn duration
- Readable with:
  - IDL (Solarsoft)
  - Python (Sunpy)

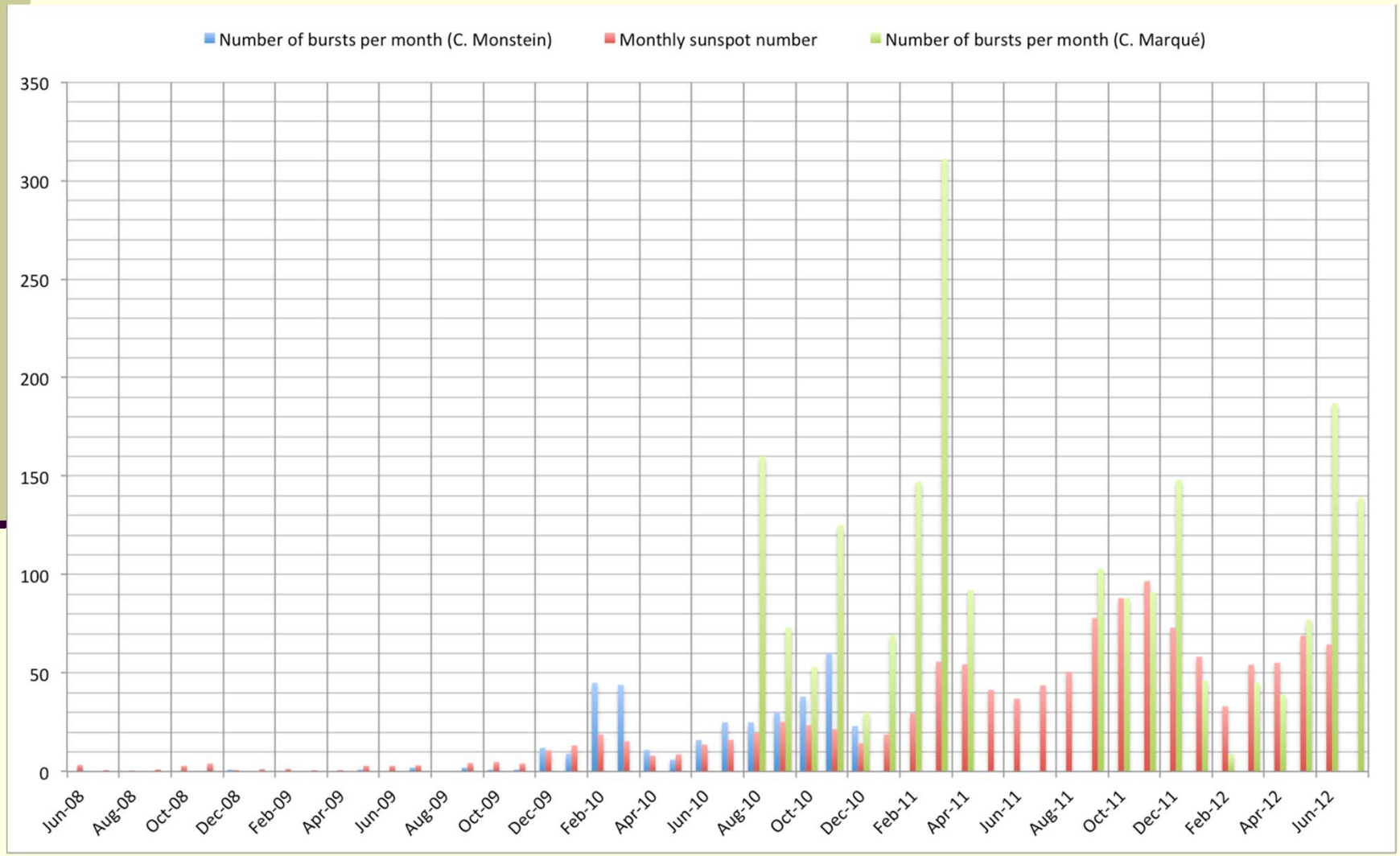


Online quicklook data

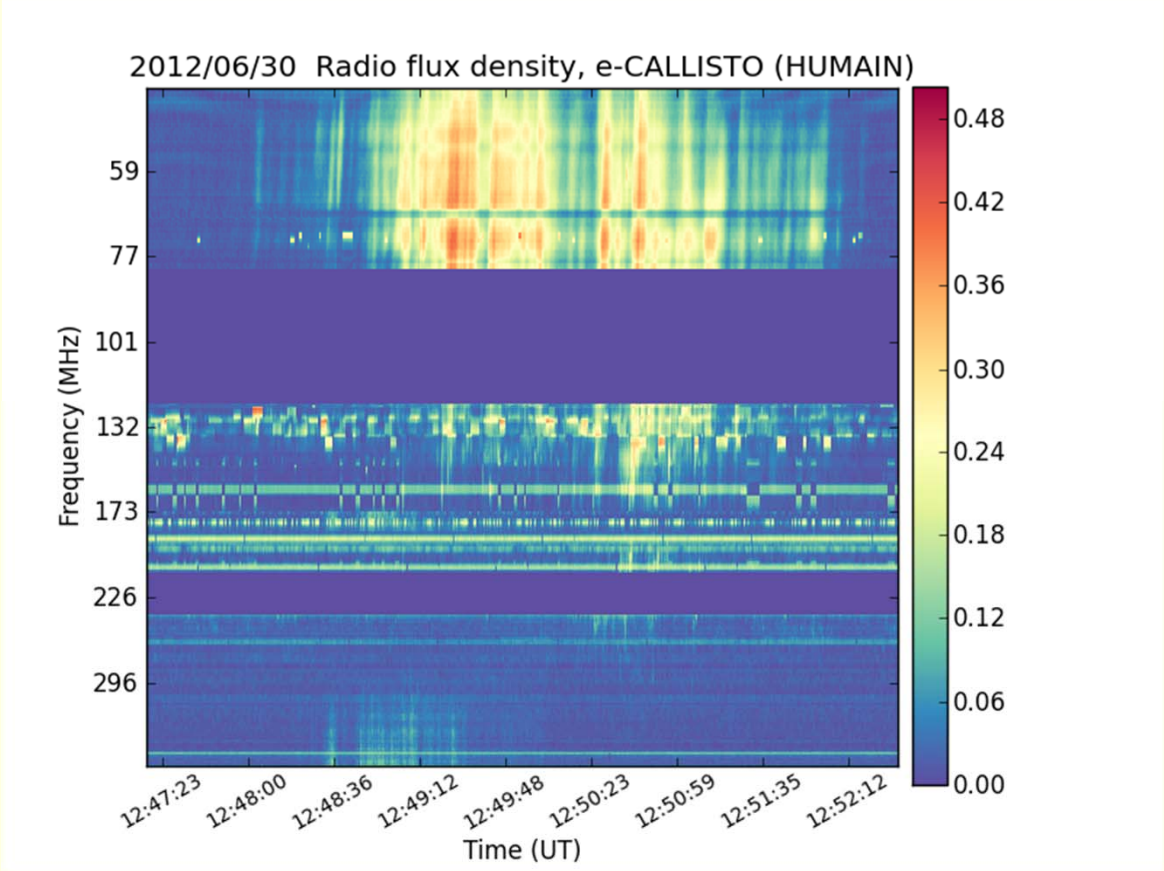


- Near real time (15 mn)
- Quicklook with GOES light curve
- Early warning for type II bursts

Rise of activity cycle

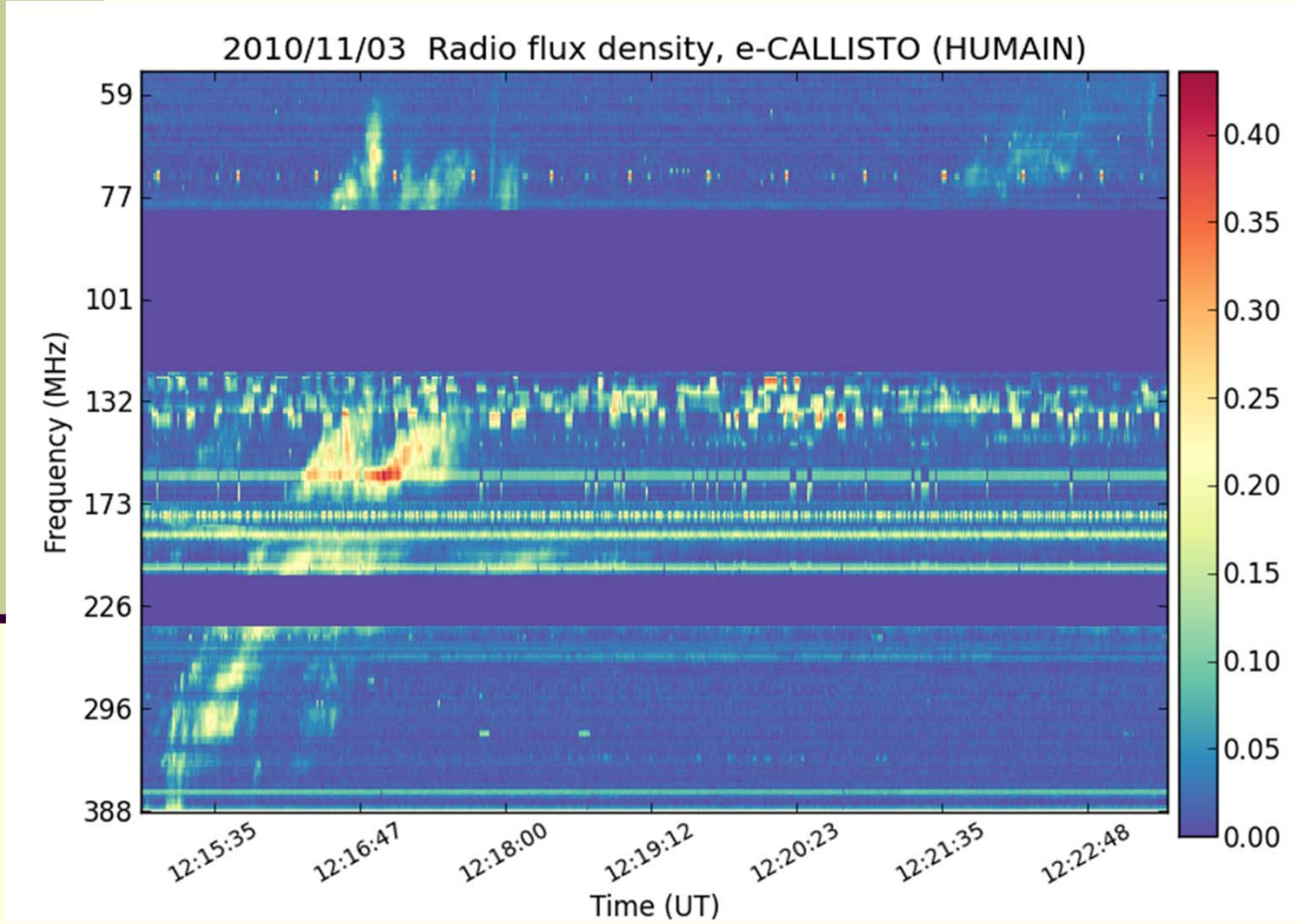


Examples of observations



Type III group

Examples of observations



Type II burst

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SIDC developments for solar monitoring

- SWB – Solar Weather Browser
  (now taken over by *helioviewer*)
- CACTUS – Computer Aided CME Tracking
  (operational) `sidc.be/cactus/`
- NEMO – Novel EIT wave Machine Observing
  (to be operational again in 2013)
- B2Xflare – Automatic flare detection
  (fading out)
- Velociraptor – motion analysis of EUV corona
  (fading out)
- SPoCA – Spatial Possibilistic Clustering Algorithm
  (AR and CH detection; formerly on EIT now on SDO images)

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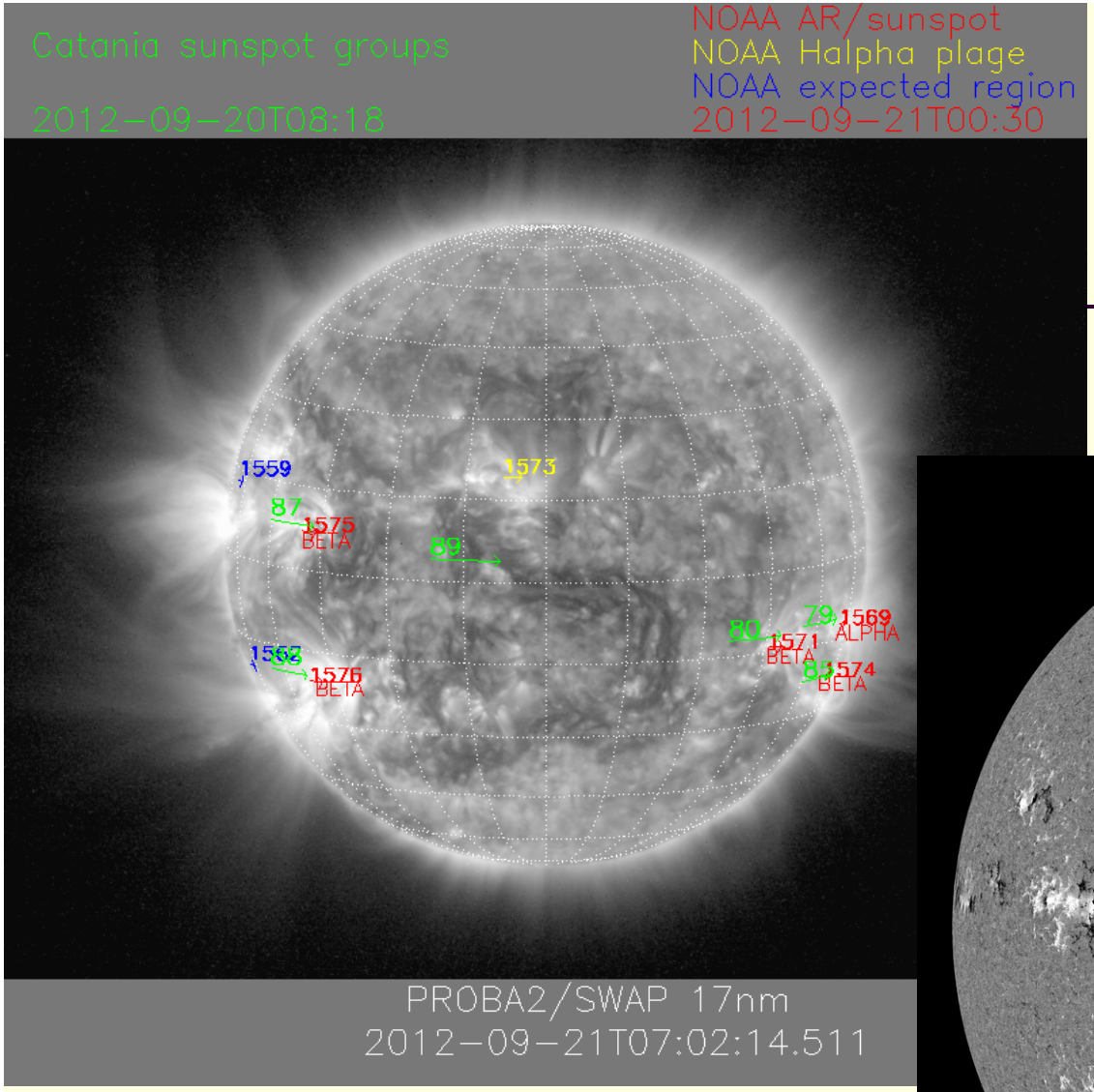
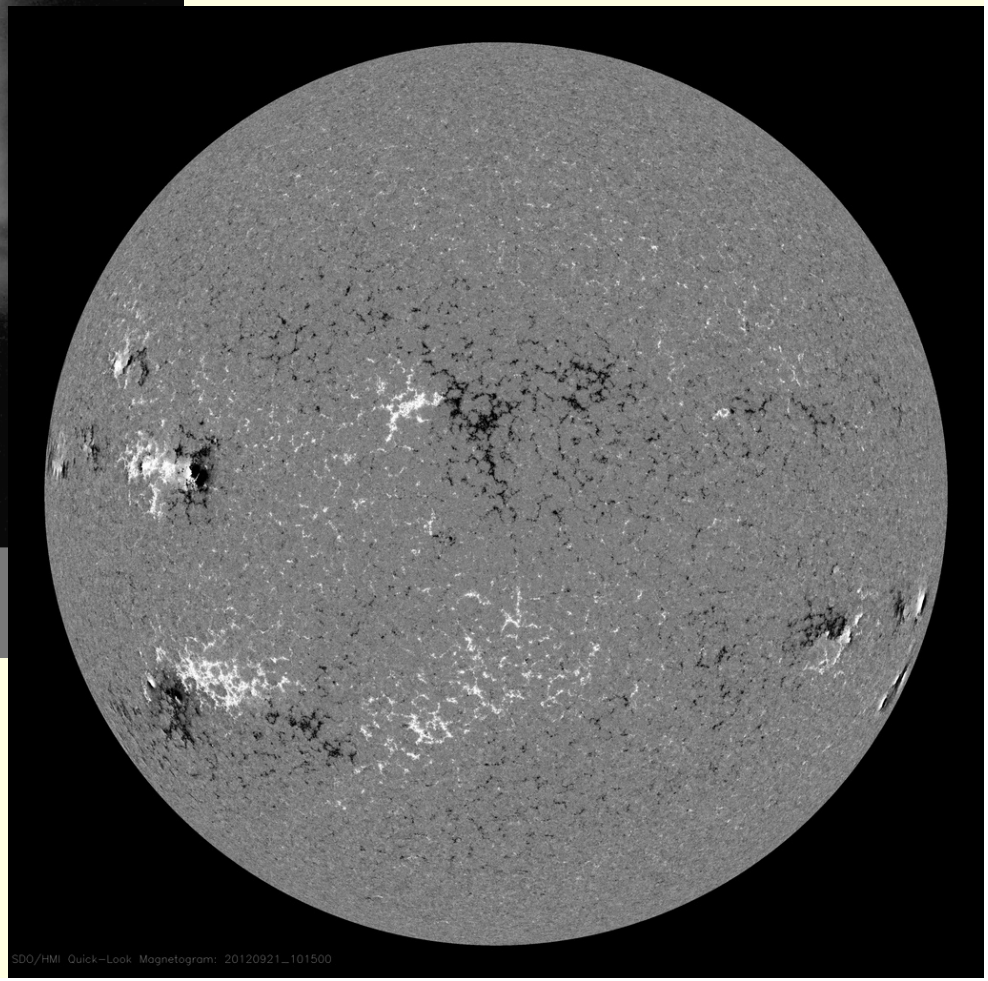
Solar Activity 17 – 21 September

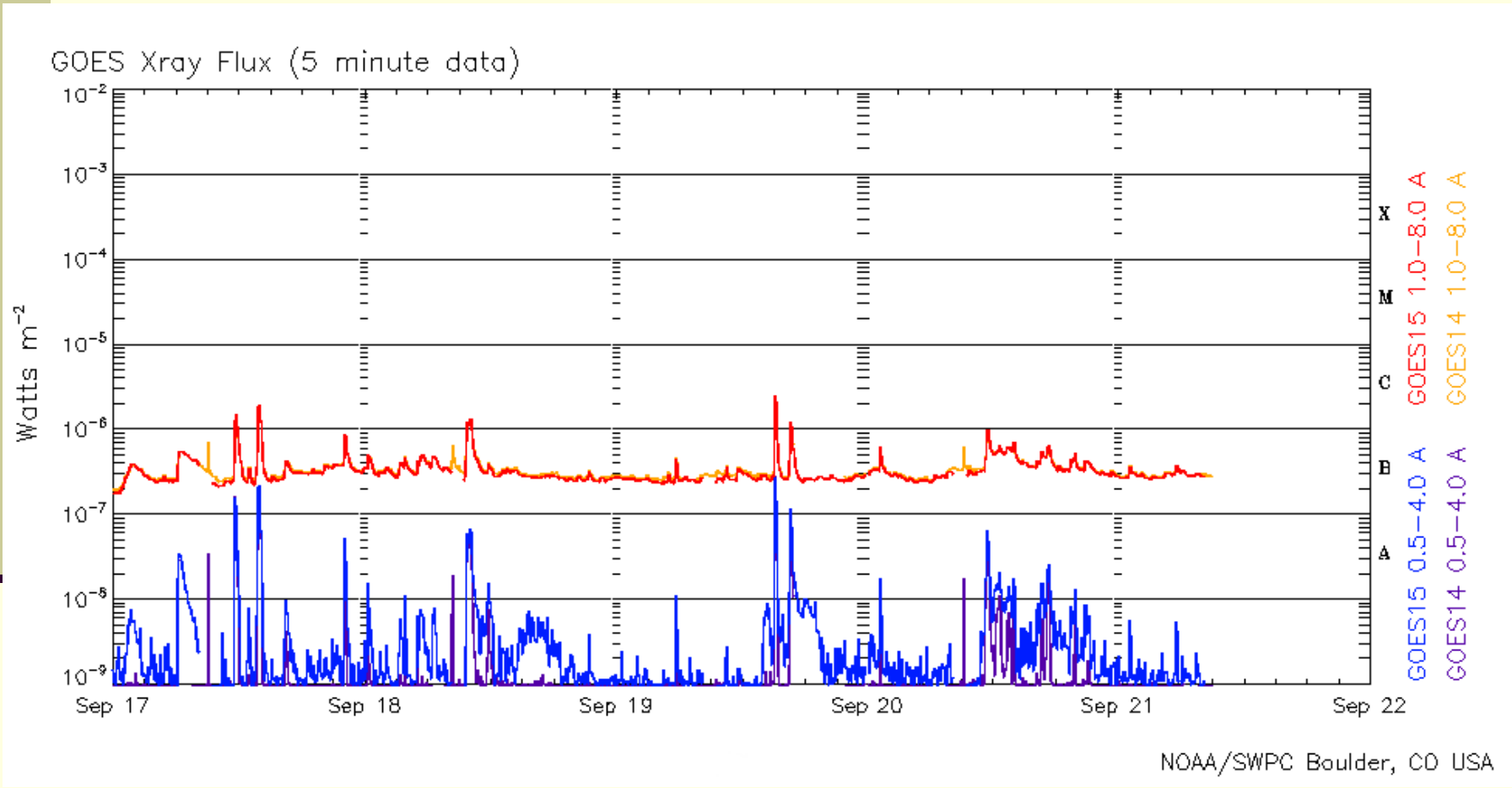
- The report from our forecaster, who was responsible for the week 17-23 Sep 2012:

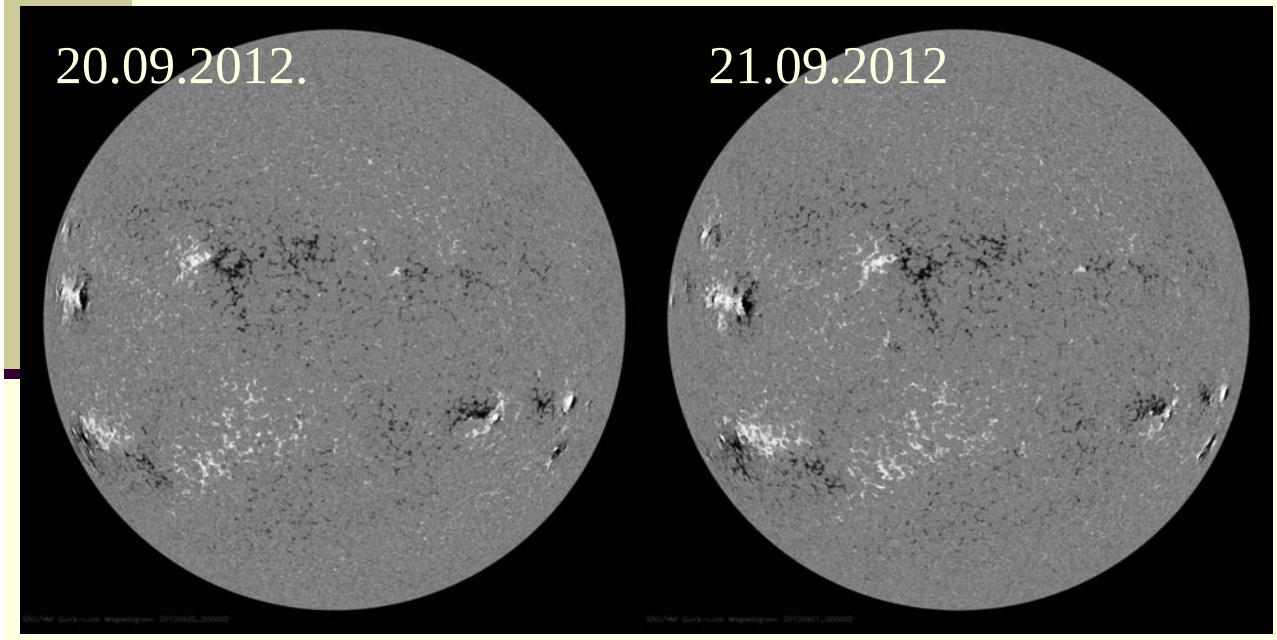
* Sun today


Catania sunspot groups
2012-09-20T08:18
NOAA AR/sunspot
NOAA Halpha plage
NOAA expected region
2012-09-21T00:30
1559
1573
87
1575
BETA
89
79
1569
ALPHA
80
1571
BETA
1574
BETA
1567
1576
BETA
PROBA2/SWAP 17nm
2012-09-21T07:02:14.511


SDO/HMI Quick-Look Magnetogram: 20120921_101500

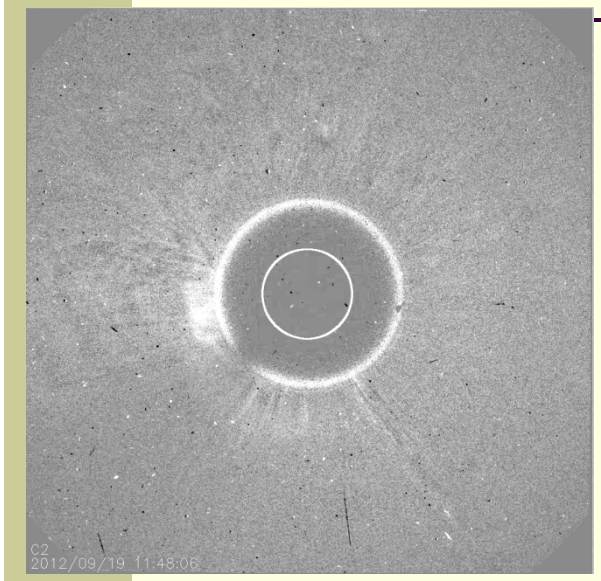
* Flares

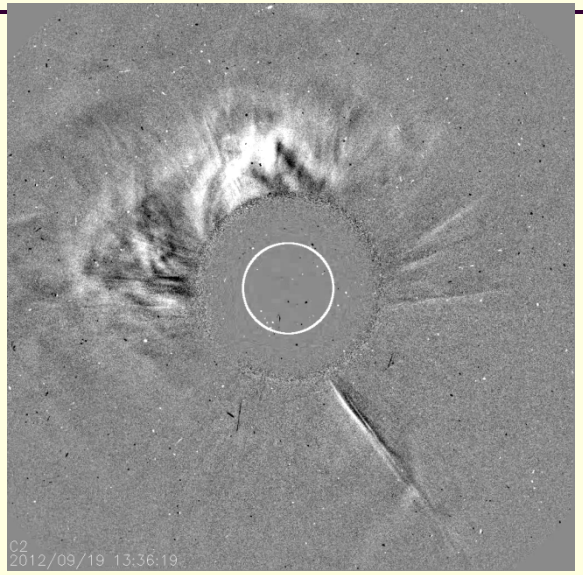

GOES Xray Flux (5 minute data)
Watts m-2
10-2
10-3
10-4
10-5
10-6
10-7
10-8
10-9
X
M
C
B
A
GOES15 1.0–8.0 A
GOES14 1.0–8.0 A
GOES15 0.5–4.0 A
GOES14 0.5–4.0 A
Sep 17
Sep 18
Sep 19
Sep 20
Sep 21
Sep 22
NOAA/SWPC Boulder, CO USA

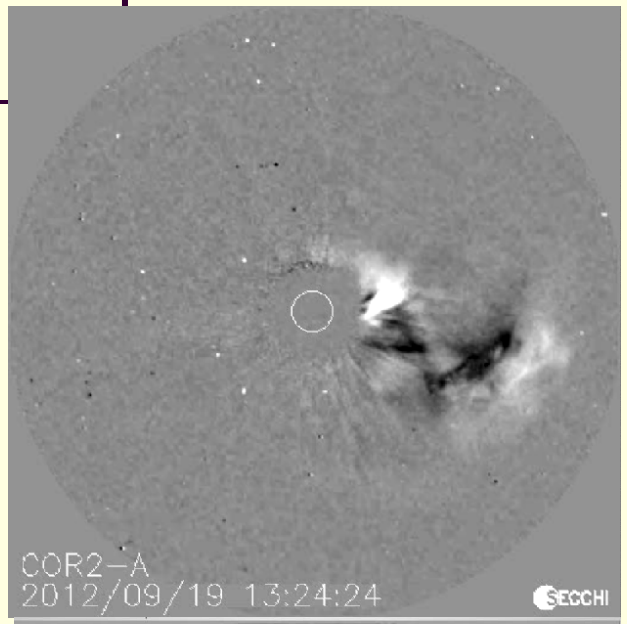


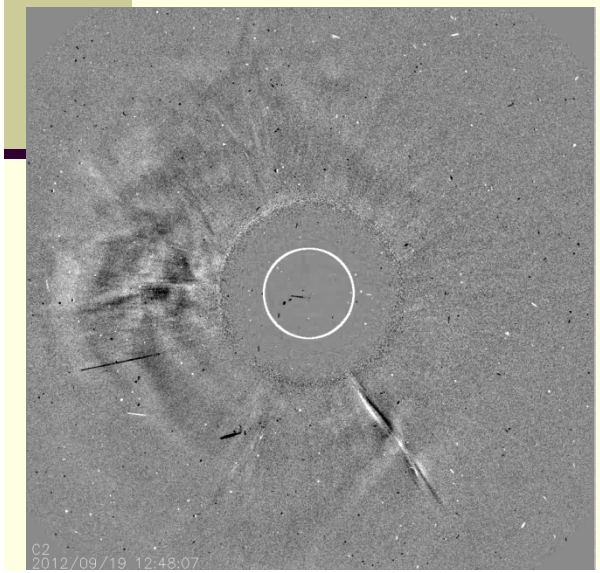
*MDI

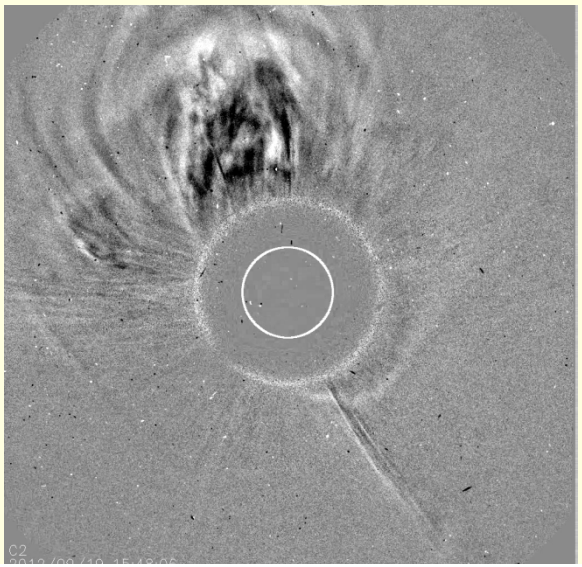
* Two backside full-halo CMEs on September 19

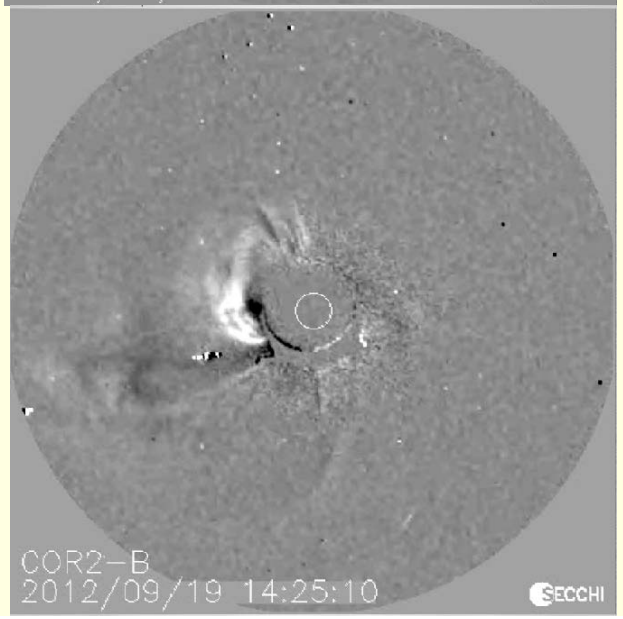




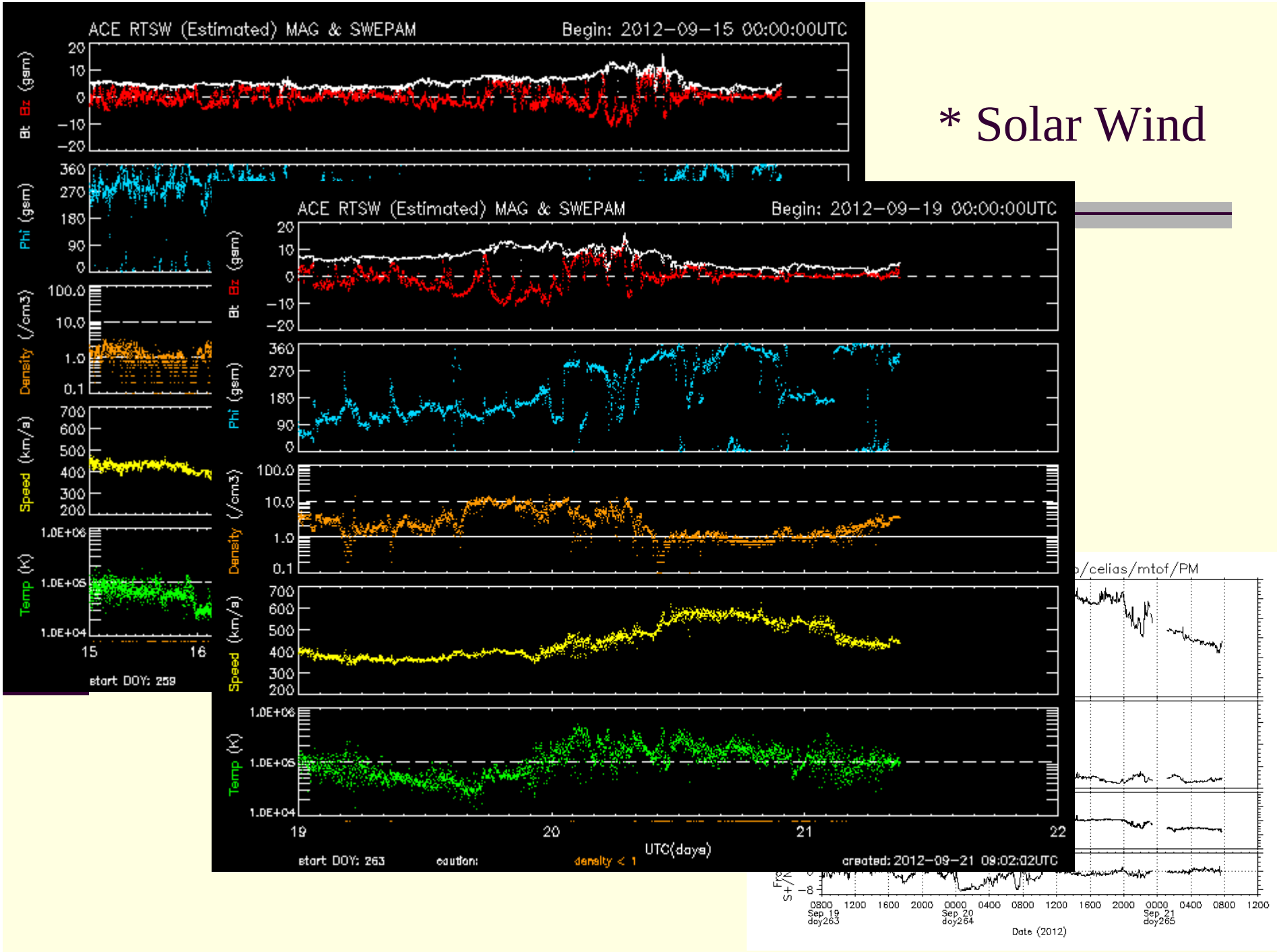


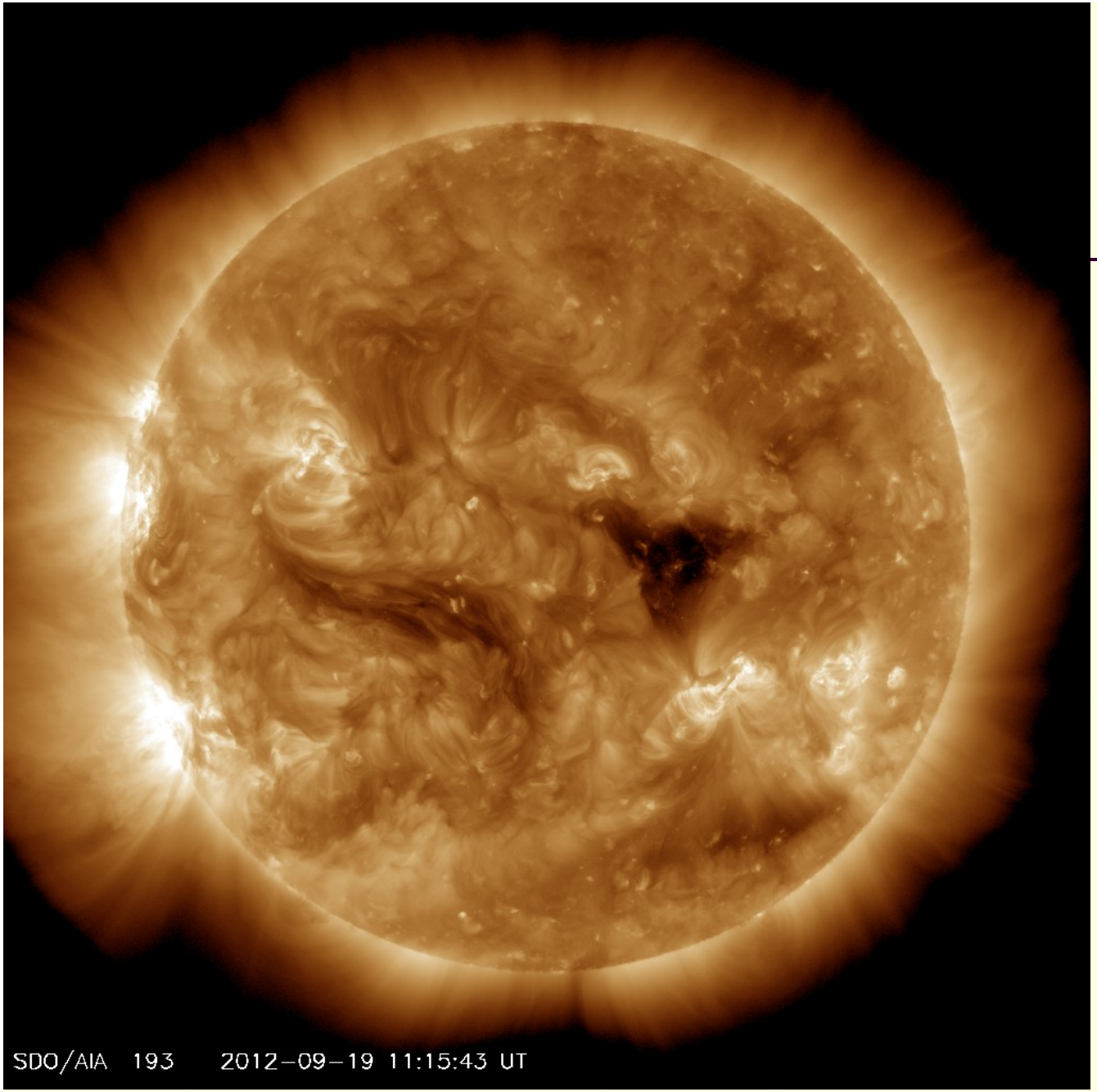






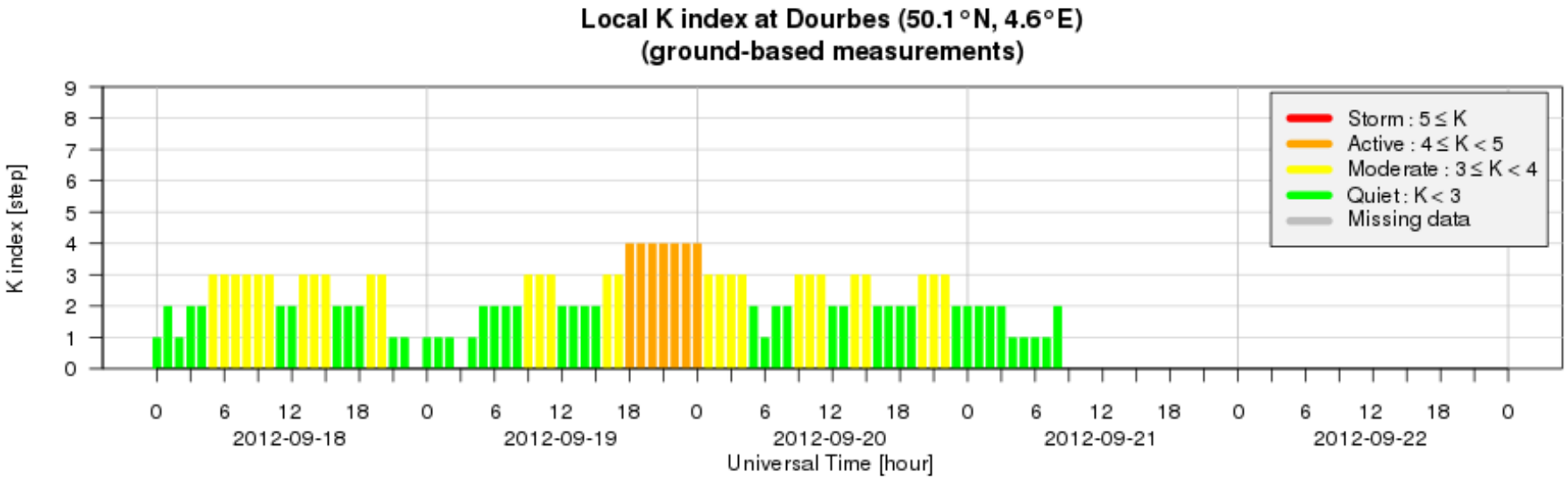
* Solar Wind

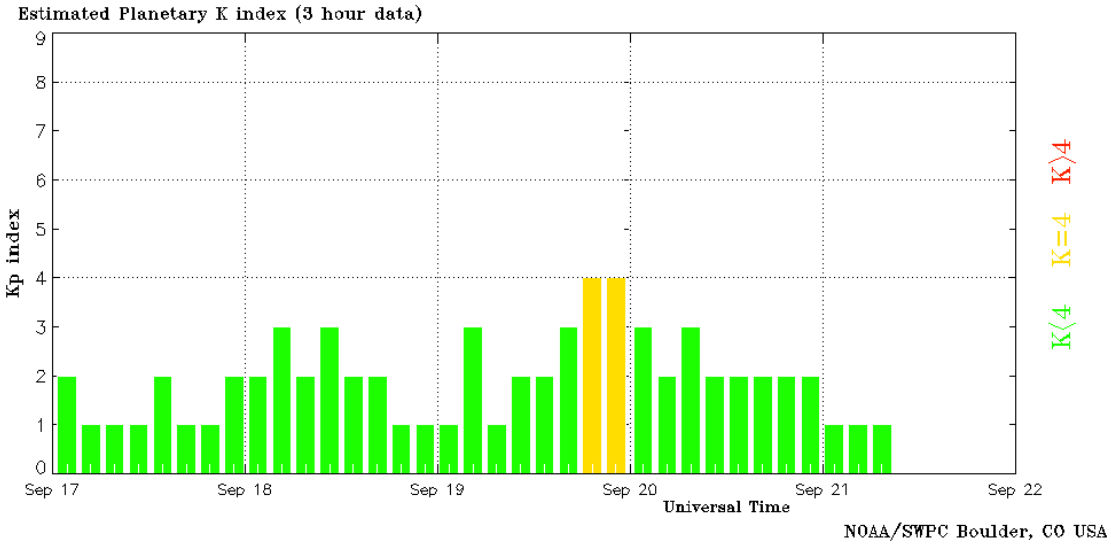

ACE RTSW (Estimated) MAG & SWEPAM
Begin: 2012-09-15 00:00:00UTC
Bt Bz (gsm)
Phi (gsm)
Density (/cm3)
Speed (km/s)
Temp (K)
start DOY: 259
ACE RTSW (Estimated) MAG & SWEPAM
Begin: 2012-09-19 00:00:00UTC
UTC(days)
start DOY: 263
caution:
density < 1
created: 2012-09-21 09:02:02UTC
Date (2012)
Sep 19 doy263
Sep 20 doy264
Sep 21 doy265



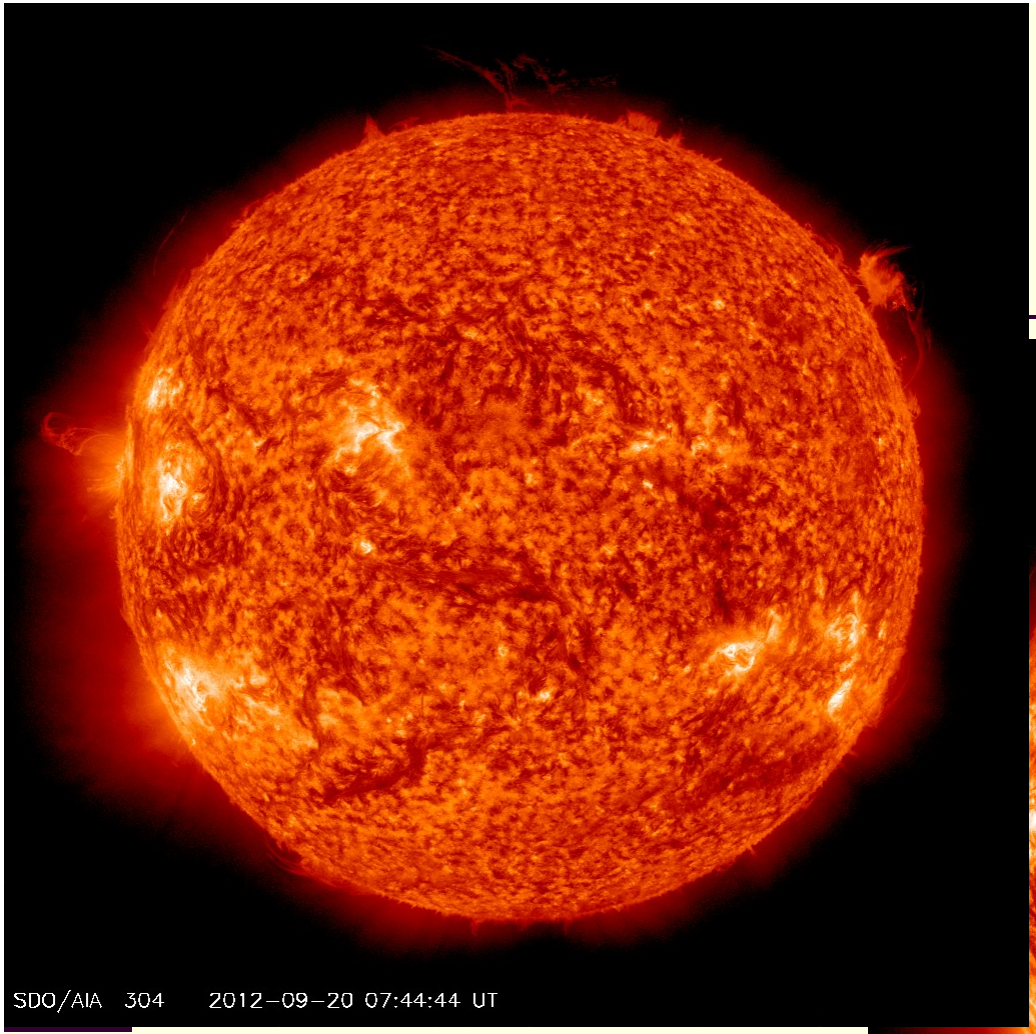
* Solar Wind

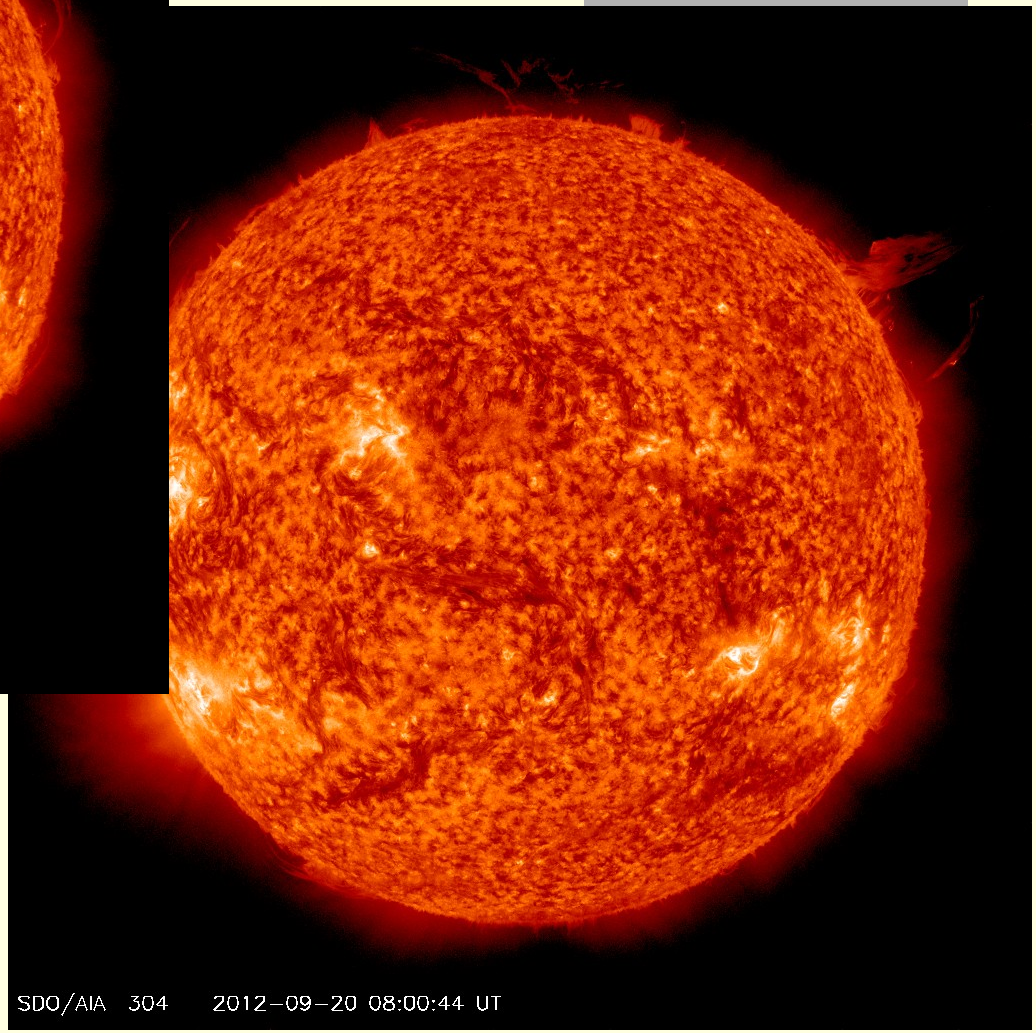
* Geomagnetism





* Prominence eruption

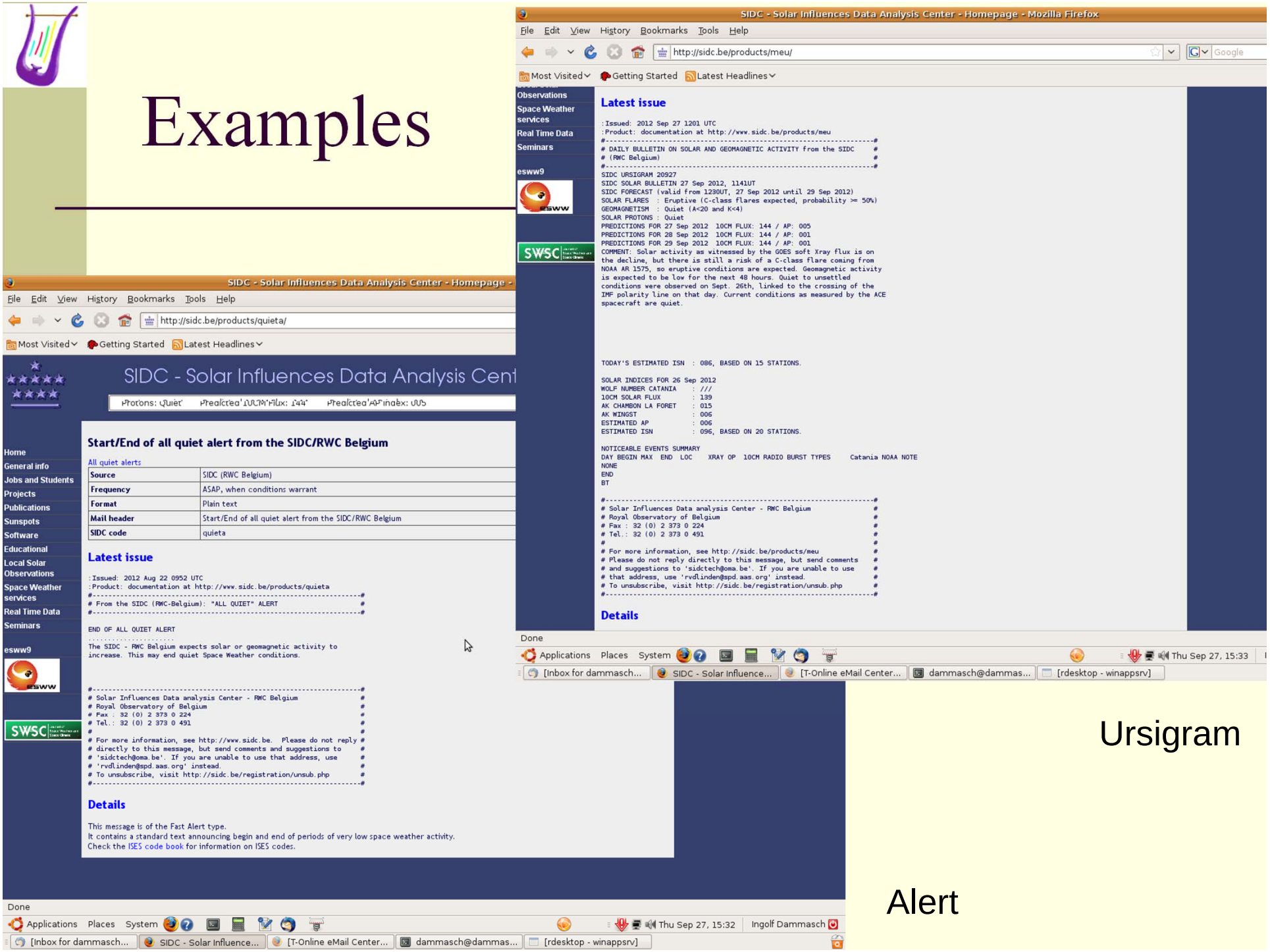




Forecaster duties

- Daily ursigram (see SIDC webpage)
- “Presto” in alert situations:
  - During or after X-flares
  - Index for geomagnetic activity k>5
  - Halo CMEs
  - Shock observed in solar wind (ACE, SOHO)
  - Proton event observed (SOHO)
  - New strong coronal hole upcoming
- Weekly summary (bulletin on solar and geomagnetic activities)
- Automatically sent by eMail to subscribing customers

Examples


SIDC - Solar Influences Data Analysis Center - Homepage - Mozilla Firefox
http://sidc.be/products/meu/
Latest issue
SIDC - Solar Influences Data Analysis Cent
Start/End of all quiet alert from the SIDC/RWC Belgium
Latest issue
Details
Ursigram
Alert

Thanks for your patience !

www.astro.oma.be
www.sidc.be
proba2.sidc.be