

CCMC & ROB Partnership Outlook

CCMC Workshop 2018

M. J. West

on behalf of J. Andries & the Operational Space Weather Services Team

Solar Influences
Data Analysis Centre
www.sidc.be



Royal Observatory
of Belgium

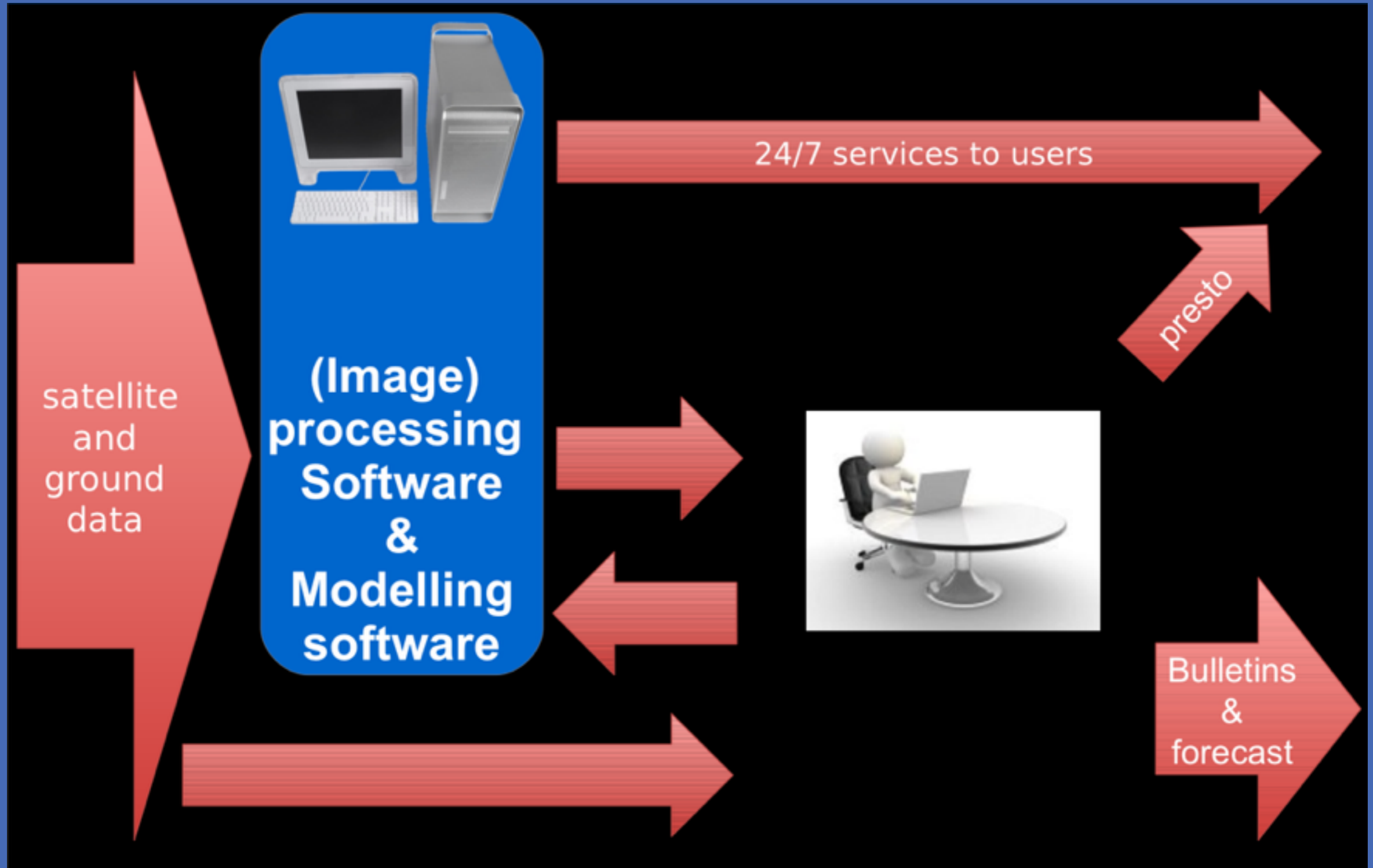
ROB/SIDC Space Weather Services

Solar Influences
Data Analysis Centre
www.sidc.be



Royal Observatory
of Belgium

SWE MONITORING & FORECAST CENTRE



OBSERVATIONS AND DATA GATHERING

In house ground based instruments
(Solar Optical and Radio)

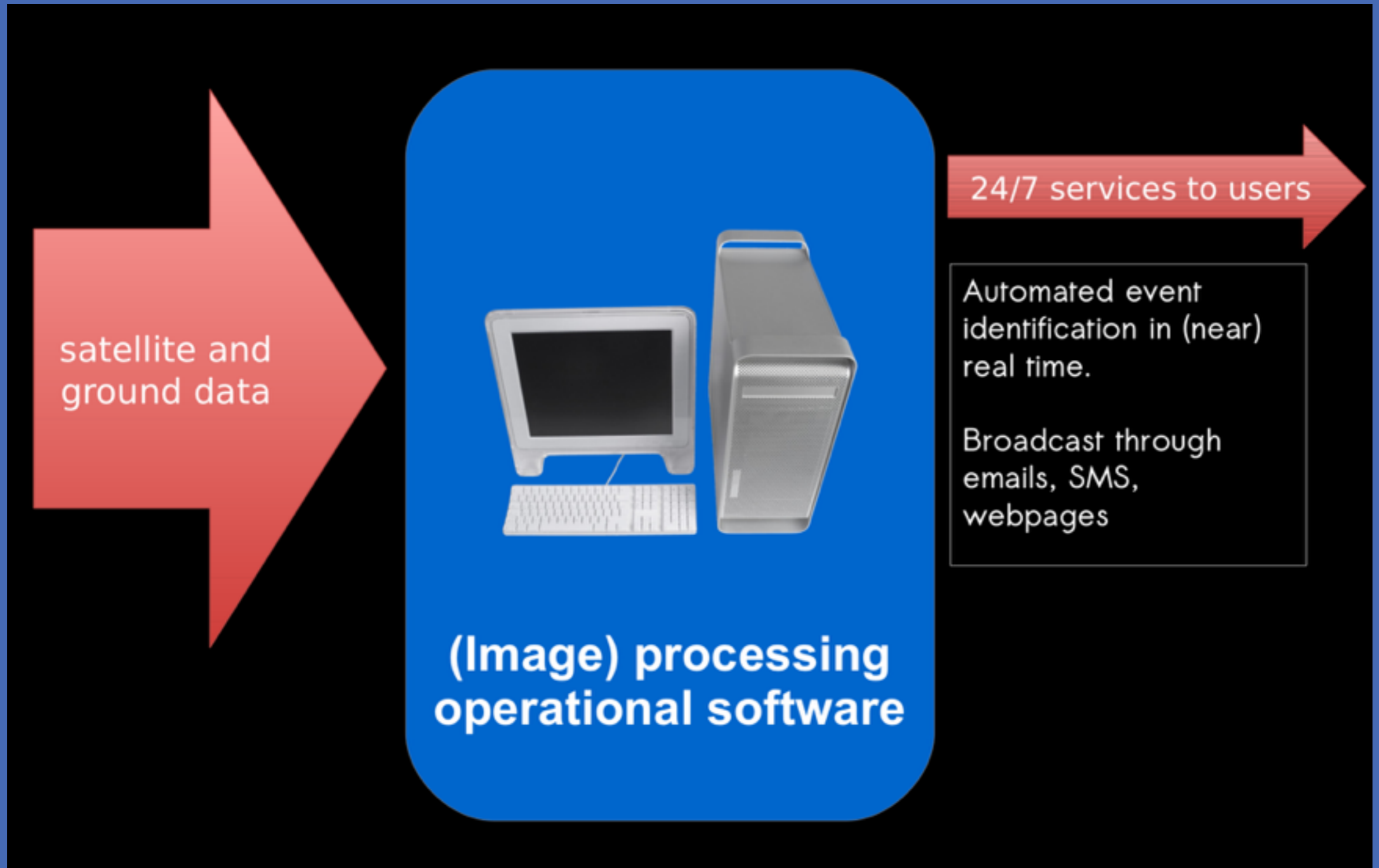
In house satellite instrument operation (Solar EUV)

Routine automated data import from various
external sources

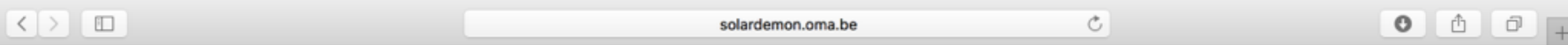
SDO data mirror

NOAA/SWPC data connection

24/7 SERVICES THROUGH AUTOMATION



FLARE/DIMMING/WAVE DETECTION (SDO/AIA, <20MIN DELAY)



Solar Demon Flare Detection (qlk)

Quick-look! running in real time on SDO/AIA 94 QKL data
3 minute cadence, typical delay 15 minutes
(detection version 1.00)
([view all Solar Demon detection tools](#))

Detector 24h operating status:
[Green bar]

Last processed image:
[Green bar]
0 hours and 15 minutes ago (2018-04-25 17:21 UTC)

Last detected flare:
120 hours and 30 minutes ago (2018-04-20 17:06 UTC)

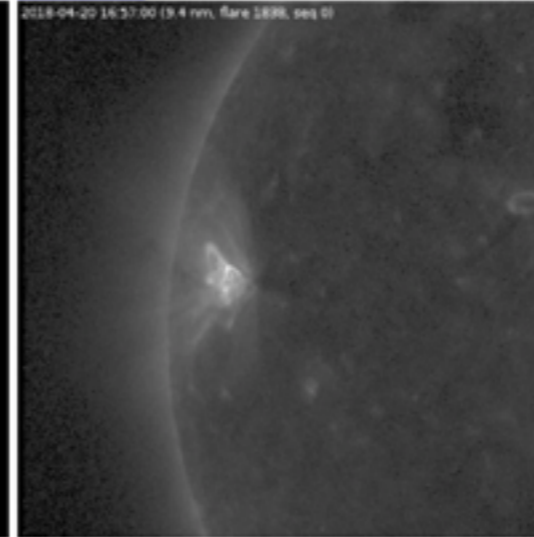
Filters (category)
-- [All classes](#)
[Only C class flares and above](#)
[Only M class flares and above](#)
[Only X class flares and above](#)

Filters (time)
[Last 7 days](#)
-- [Last 14 days](#)

detected flares during last 2 weeks



[Flare 1838](#)

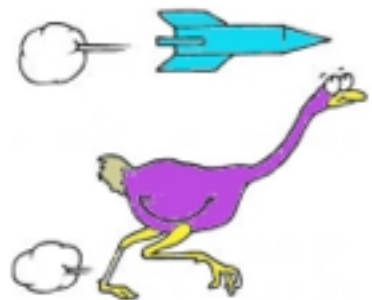


Overview of flares

| | est. class | start | peak | end | # | lat | lon | dist. R _☉ | AR | est. flux | GOES flux | GOES peak time | COMESSEP | # det. | dimming | EUV Wave |
|--------------------|------------|-------|-------|-------|----------------------|-----|-----|----------------------|---------|-----------|-----------|----------------|----------|--------|---------|----------------------|
| April, 2018 | | | | | | | | | | | | | | | | |
| 20 | B4 | 17:03 | 17:03 | 17:06 | 1838 | 5 | -63 | 0.90 | AR 2706 | 3.7 | 5.3 | 17:02 | -1 | 0 | 2 | wave |

The research leading to these results has received funding from the European Commission's Seventh Framework Programme (FP7/2007-2013) under the grant agreement nr. 263506 [AFFECTS], and grant agreement nr. 263252 [COMESSEP]
Solar Demon is still under construction.
([Legal notices](#) - SWSC (Volume 5, A18, 2015) research article: [Solar Demon - an approach to detecting flares, dimmings, and EUV waves on SDO/AIA images](#))

FLARE DETECTION AND LOCALIZATION (PROBA2/SWAP, <4H DELAY)



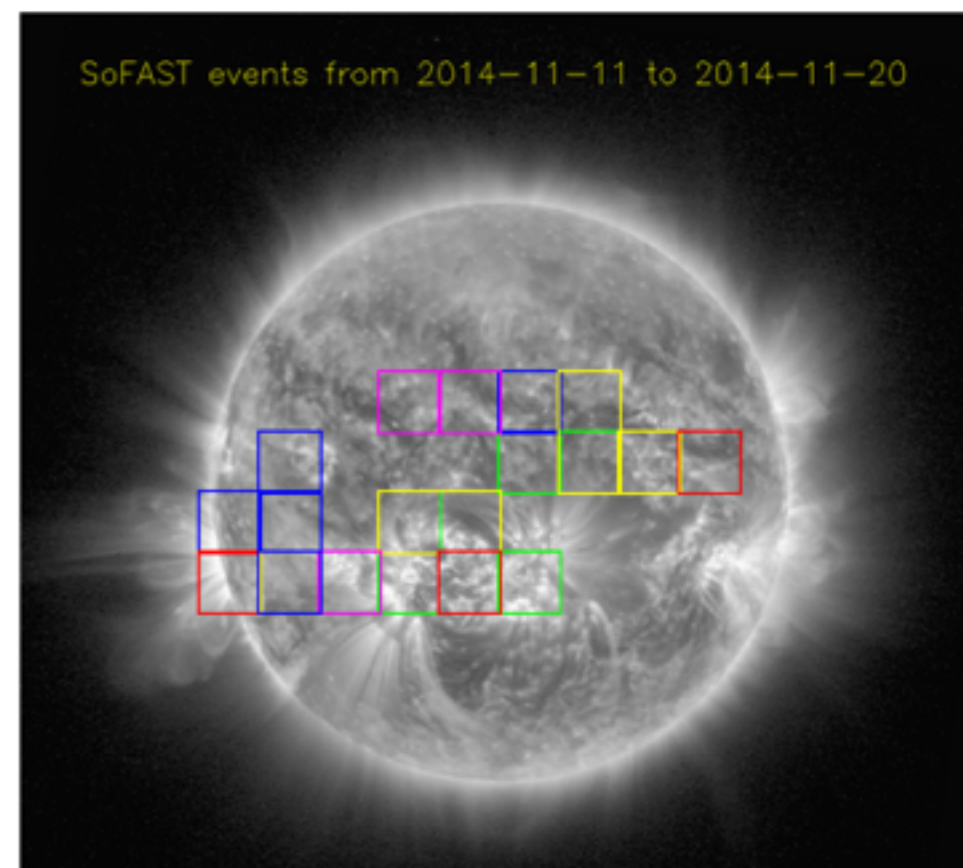
SoFAST 1.2.0

The 'Solar Flare Automated Search Tool'

EUV-flares detected by SoFAST

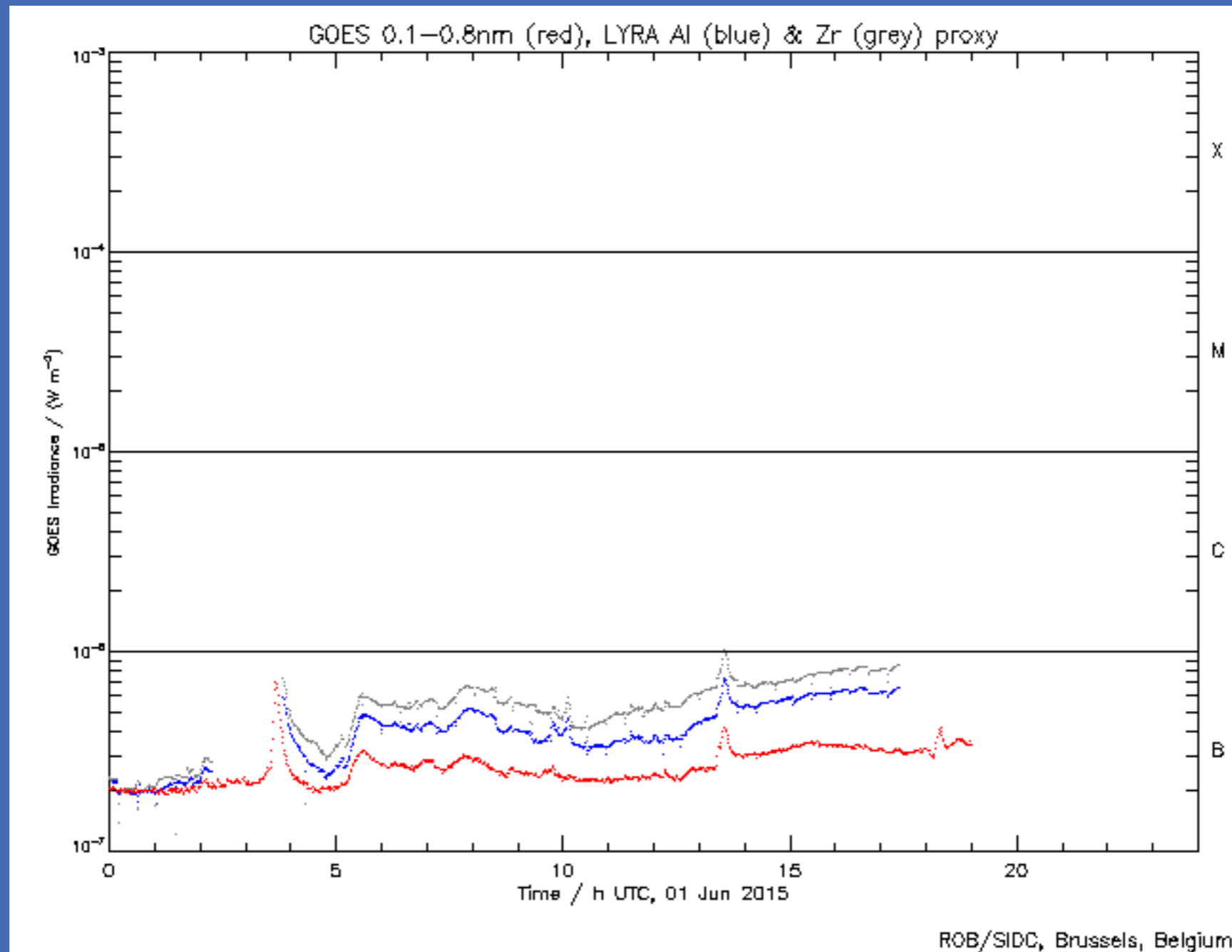
```
:Issued: Thu Nov 20 09:51:09 2014
:Product: SoFAST catalogue (http://www.sidc.be/sofast)
#-----
# Instrument: SWAP| Detector: CMOS APS 1024 x 1024
# Flare-threshold : 2 | Rebinsize : 16 | Maxhits : 4 | Offset : 65
# Modus : (1) SW service
#
# first SWAP image this run: swap_lv1_20141111_000051.fits
# last SWAP image this run: swap_lv1_20141120_055440.fits
#
#-----
# Output: Detected EUV-flare list with the following characteristics:
#
# EUV FLARE:          FLARE number
# date:              Day of observation
# start:            Start time, earliest indication of detection (hh:mm UT)
# end:              End time, last indication of detection (hh:mm UT)
# pos:              Derived position (Heliographic coordinates)
# size:             Spatial size of event in number of macropixels
# #images:          Duration of event in number of images (dt)
# EUV-significance: EUV relative variability in %
```

SoFAST events from 2014-11-11 to 2014-11-20

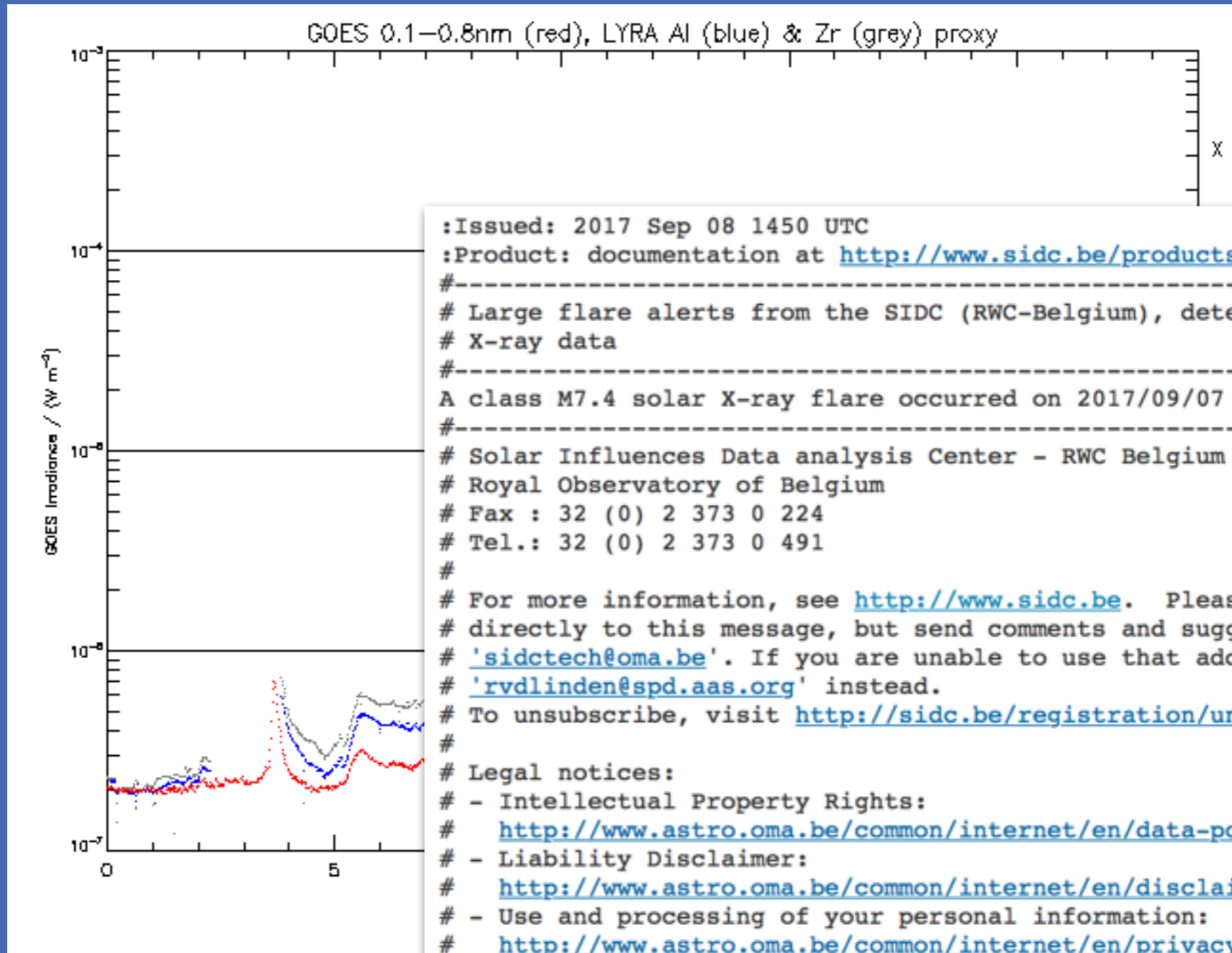


26-APR-2018 - NEAR REAL TIME SERVICES
FLARE DETECTION
(GOES + PROBA2/LYRA)

Royal Observatory
of Belgium



FLARE DETECTION (GOES + PROBA2/LYRA)



```
:Issued: 2017 Sep 08 1450 UTC
:Product: documentation at http://www.sidc.be/products/flaremail
#-----#
# Large flare alerts from the SIDC (RWC-Belgium), detected in GOES #
# X-ray data #
#-----#
A class M7.4 solar X-ray flare occurred on 2017/09/07 with peak time 14:54UT
#-----#
# Solar Influences Data analysis Center - RWC Belgium #
# Royal Observatory of Belgium #
# Fax : 32 (0) 2 373 0 224 #
# Tel.: 32 (0) 2 373 0 491 #
# #
# For more information, see http://www.sidc.be. Please do not reply #
# directly to this message, but send comments and suggestions to #
# 'sidctech@oma.be'. If you are unable to use that address, use #
# 'rvdlinden@spd.aas.org' instead. #
# To unsubscribe, visit http://sidc.be/registration/unsub.php #
# #
# Legal notices: #
# - Intellectual Property Rights: #
# http://www.astro.oma.be/common/internet/en/data-policy-en.pdf #
# - Liability Disclaimer: #
# http://www.astro.oma.be/common/internet/en/disclaimer-en.pdf #
# - Use and processing of your personal information: #
# http://www.astro.oma.be/common/internet/en/privacy-policy-en.pdf #
#-----#
```

26-APR-2018 - NEAR REAL TIME SERVICES

CME DETECTION & CHARACTERISATION (SOHO/LASCO, <6H DELAY)

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of Belgium

CACTUS 2.5.0
A software package for 'Computer Aided CME Tracking'

CMEs detected by Cactus

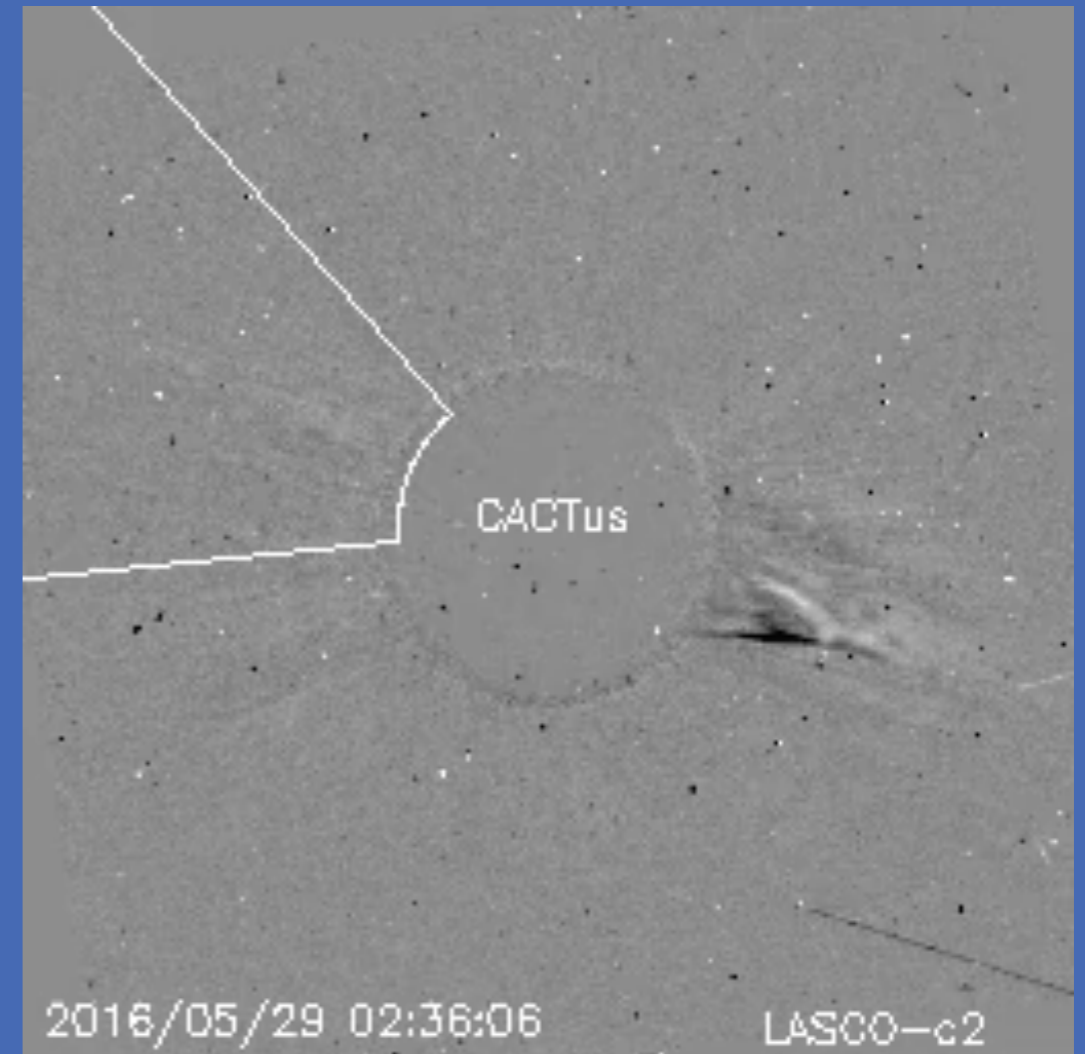
Created: Sat Feb 8 20:50:07 2014
Product: CACTUS catalogue (http://sidc.be/cactus)
Instrument: LASCO | Detector: c2 # Instrument: LASCO | Detector: c2
Threshold: 0.30 | Factor: 2 | Minimal CME width: 5

First c2: 2014/02/02 00:00:05.456 23518104.Fra
Last c2: 2014/02/08 20:32:07.072 23519183.Fra
First c3: 2014/02/02 02:30:04.752 23287365.Fra
Last c3: 2014/02/08 19:54:04.085 23288281.Fra

Output: Detected cmeapp with the following characteristics:

- CME: CME number
- Flow: Flow number. Flows are suspicious detections, their color in the detectionmap is dark blue
- U0: onset time, earliest indication of lift-off
- dur0: duration of lift-off (hours)
- pa: principal angle, counterclockwise from North (degrees)
- da: angular width (degrees)
- v: median velocity (km/s)
- dv: variation (1 sigma) of velocity over the width of the CME
- mlow: lowest velocity detected within the CME
- maxv: highest velocity detected within the CME
- halo?: II if da>90, III if da>180, IV if da>270, indicating potential halo/partial halo CME

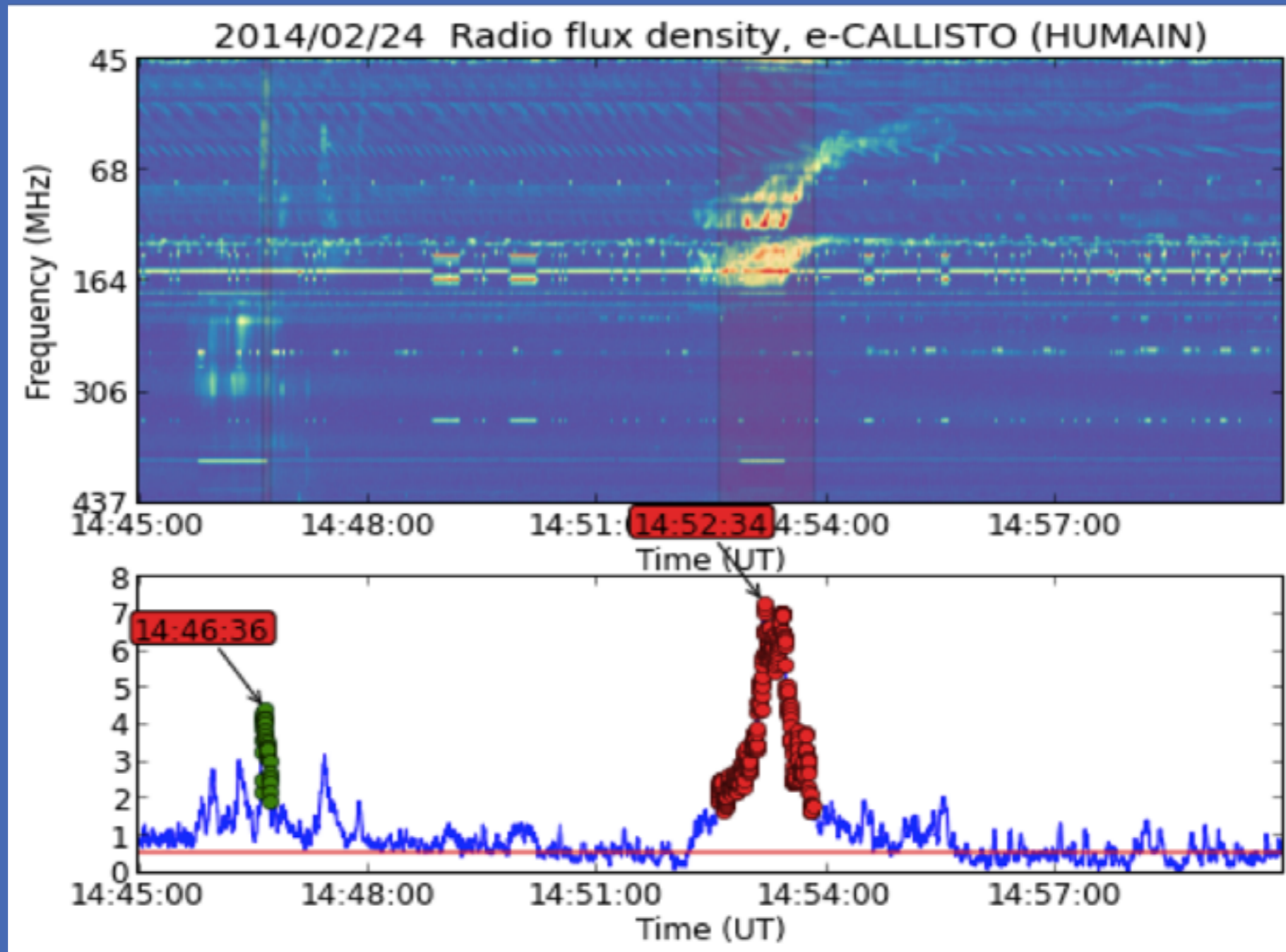
| # CME | U0 | dur0 | pa | da | v | dv | mlow | maxv | halo? |
|-------|------------------|------|-----|-----|------|------|------|------|-------|
| 0054 | 2014/02/08 18:00 | 03 | 104 | 070 | 0455 | 0043 | 0371 | 0547 | |
| 0053 | 2014/02/08 13:36 | 02 | 156 | 018 | 0207 | 0029 | 0186 | 0259 | |
| 0052 | 2014/02/08 10:00 | 09 | 089 | 036 | 0385 | 0099 | 0168 | 0578 | |
| 0051 | 2014/02/08 05:48 | 01 | 253 | 020 | 0612 | 0183 | 0322 | 1041 | |
| 0050 | 2014/02/08 04:36 | 02 | 096 | 010 | 0205 | 0147 | 0129 | 0496 | |
| 0049 | 2014/02/07 22:24 | 03 | 083 | 024 | 0247 | 0036 | 0174 | 0278 | |
| 0048 | 2014/02/07 22:24 | 03 | 187 | 108 | 0328 | 0136 | 0195 | 0726 | |
| 0047 | 2014/02/07 21:24 | 01 | 243 | 012 | 0655 | 0073 | 0522 | 0730 | |
| 0046 | 2014/02/07 20:24 | 01 | 063 | 008 | 0178 | 0053 | 0121 | 0254 | |
| 0045 | 2014/02/07 19:48 | 03 | 102 | 044 | 0166 | 0043 | 0124 | 0298 | |
| 0044 | 2014/02/07 16:00 | 05 | 077 | 052 | 0212 | 0069 | 0126 | 0405 | |
| 0043 | 2014/02/07 13:25 | 02 | 186 | 018 | 0257 | 0026 | 0284 | 0281 | |
| 0042 | 2014/02/07 09:24 | 02 | 304 | 006 | 0202 | 0077 | 0126 | 0325 | |
| 0041 | 2014/02/07 07:36 | 00 | 027 | 012 | 0268 | 0062 | 0227 | 0400 | |
| 0040 | 2014/02/07 02:00 | 04 | 020 | 026 | 0275 | 0129 | 0126 | 0508 | |
| 0039 | 2014/02/06 18:36 | 08 | 343 | 040 | 0102 | 0023 | 0180 | 0135 | |
| 0038 | 2014/02/06 13:25 | 02 | 088 | 026 | 0498 | 0115 | 0322 | 0694 | |
| 0037 | 2014/02/06 12:12 | 02 | 249 | 008 | 0219 | 0053 | 0147 | 0297 | |
| 0036 | 2014/02/06 10:36 | 01 | 315 | 016 | 0268 | 0069 | 0221 | 0424 | |
| 0035 | 2014/02/06 08:12 | 03 | 063 | 048 | 0248 | 0060 | 0125 | 0355 | |
| 0034 | 2014/02/06 06:32 | 01 | 183 | 008 | 0679 | 0027 | 0679 | 0730 | |
| 0033 | 2014/02/06 03:24 | 02 | 324 | 006 | 0207 | 0095 | 0148 | 0388 | |
| 0032 | 2014/02/06 02:24 | 04 | 308 | 028 | 0158 | 0177 | 0122 | 0666 | |
| 0031 | 2014/02/06 00:36 | 04 | 207 | 088 | 0296 | 0052 | 0199 | 0405 | |
| 0030 | 2014/02/05 22:52 | 02 | 162 | 026 | 0437 | 0053 | 0142 | 0822 | |
| 0029 | 2014/02/05 21:48 | 01 | 107 | 016 | 0255 | 0078 | 0124 | 0259 | |



Email alerts of halo CMEs give a few days lead time for geomagnetic storms
<http://sidc.be/cactus>

RADIO BURST DETECTION (HUMAIN/ECALLISTO, <15MIN DELAY)

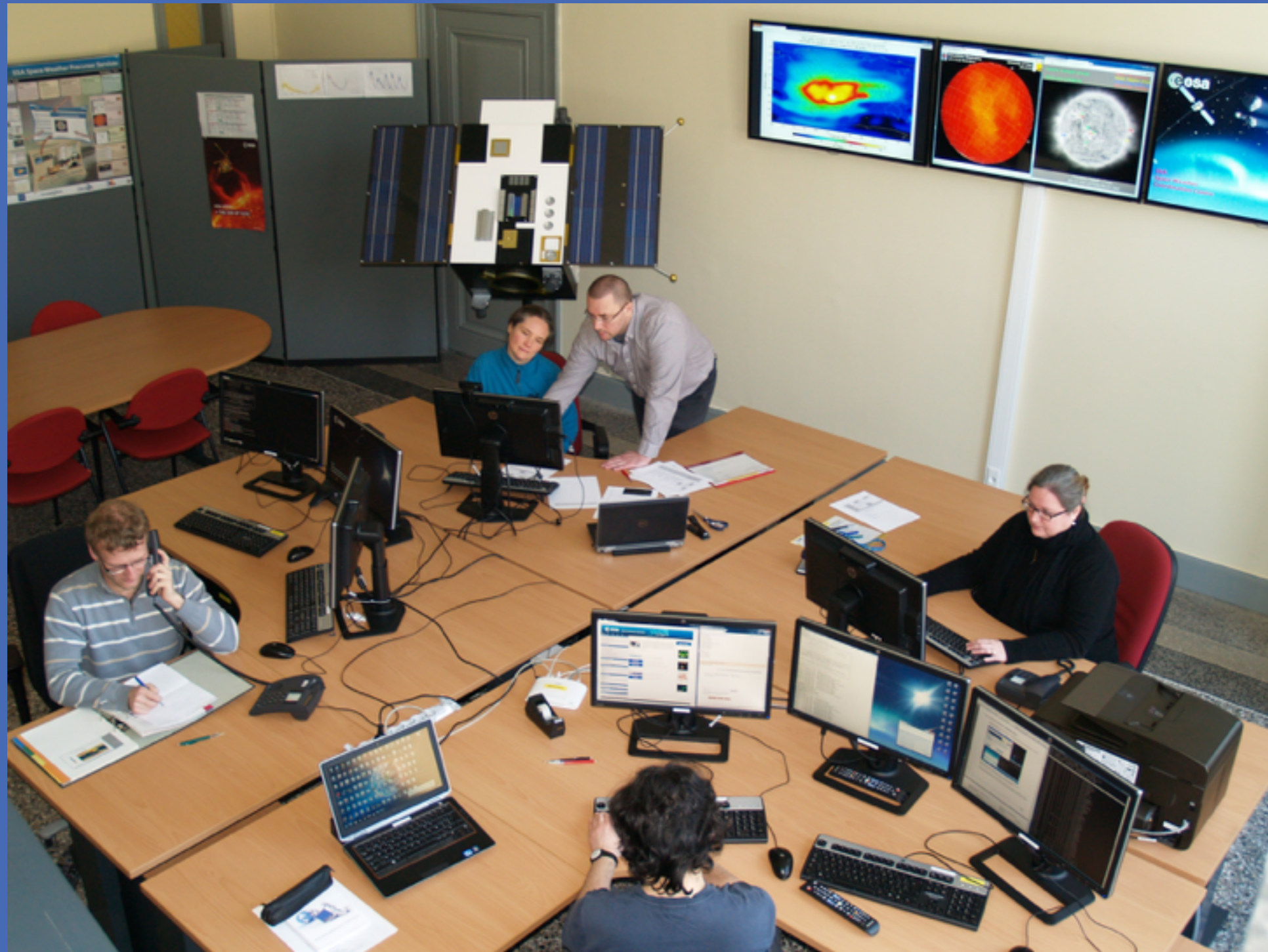
Autom. Burst detection



26-APR-2018 - FORECAST EXPERTISE

HUMAN EXPERT MODERATION/ ANNOTATION

Royal Observatory
of Belgium

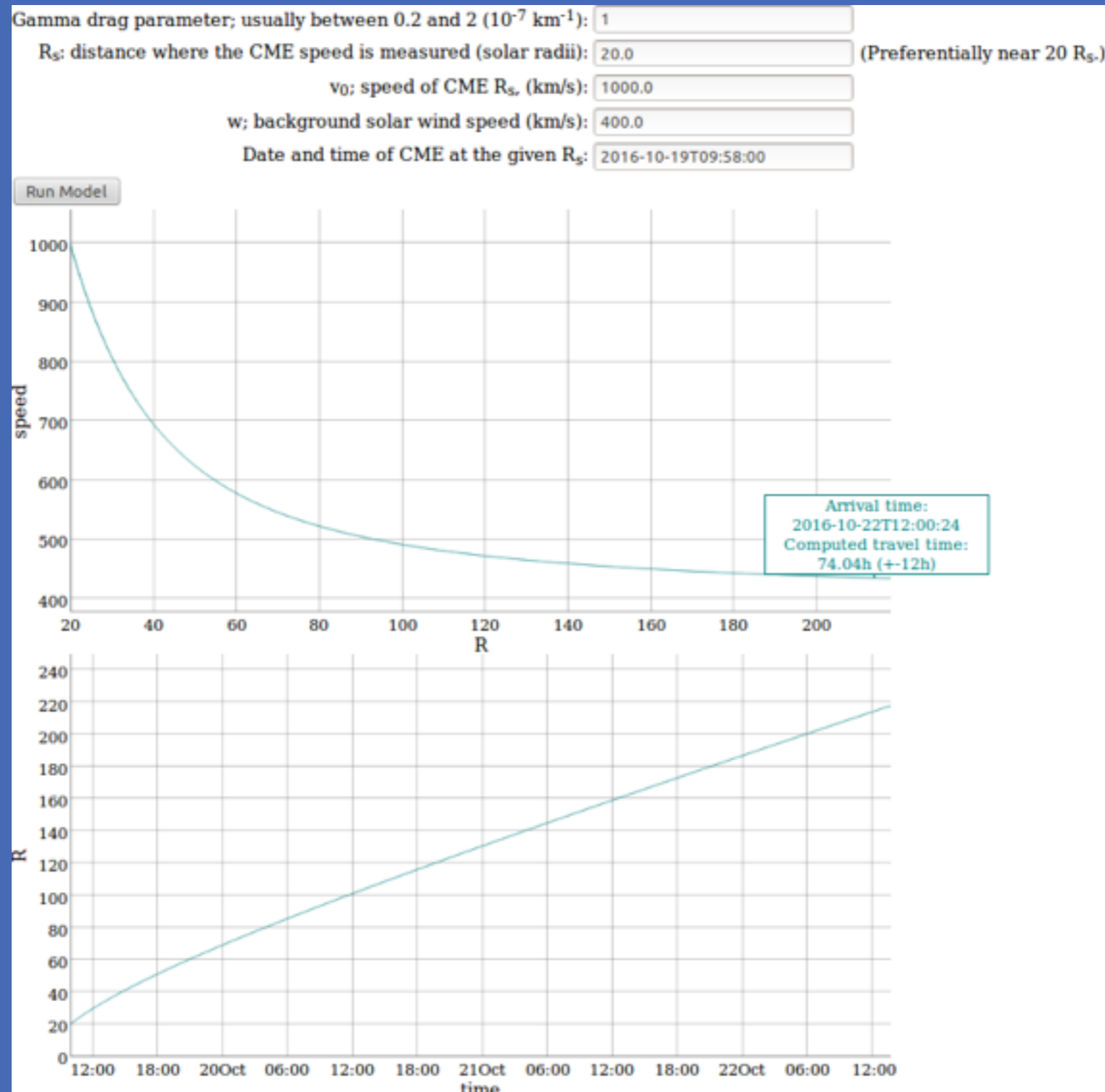


Solar Influences Data Analysis Centre www.sidc.be

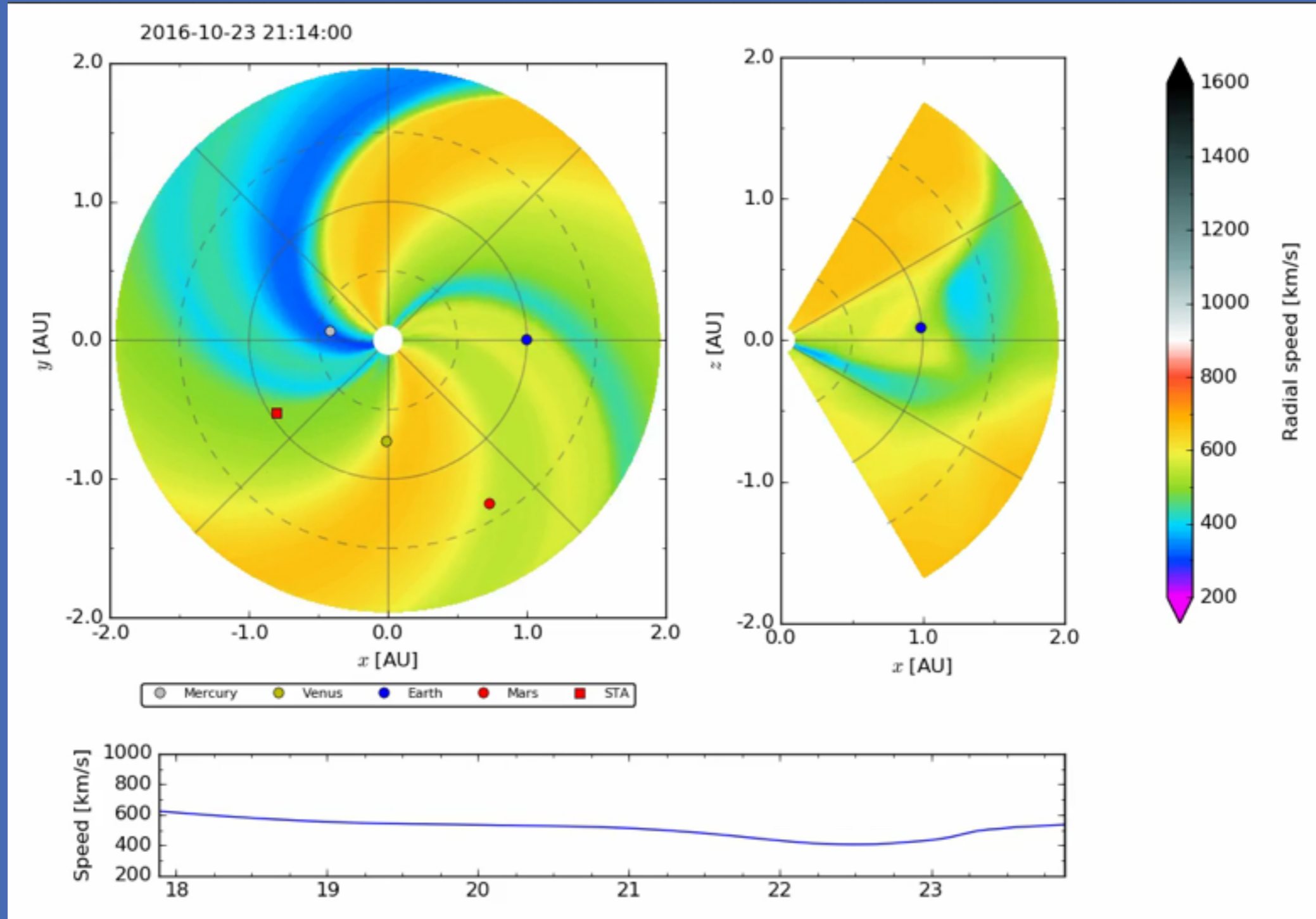
Tools



TOOLS FOR STANDARD CALCULATIONS



PHYSICS BASED MODELS: E.G. EUHFORIA



DEDICATED DUTY FORECASTER INTERFACES (INCLUDING STATISTICAL MODEL OUTPUTS + IMPORTED EVENTS)

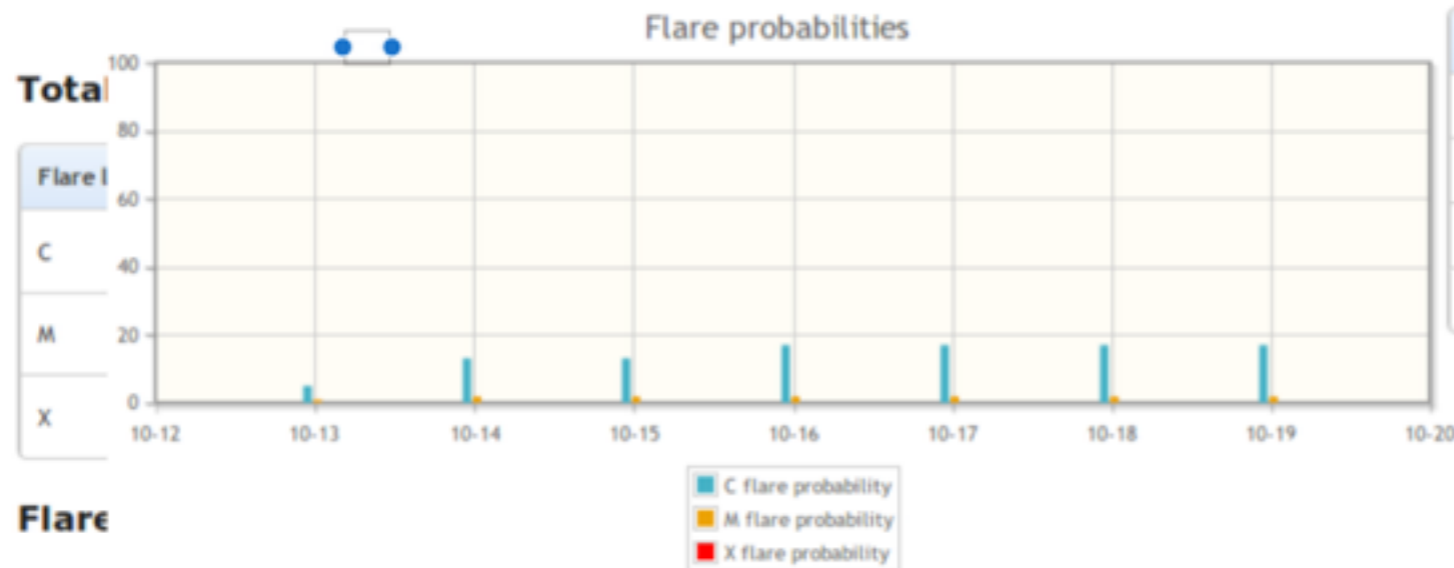
Forecast Weekly Presto Cactus All quiet CME arrival Monthly bulletin Quarterly
Links

UTC time: 9:41:35 Date: 2016-10-19 Forecaster: West Matthew You are logged in as: jessea [Logout](#)

Catania is up to date. Click [Click here](#) if you want to refresh the regions anyway.

Forecast regions Forecast 10cm flux Forecast K Finish forecast

| Catania info (Last update: 2016-Oct-18) | | | | | | NOAA info (Last update: 2016-Oct-19) | | | | | Probabilities for | | | |
|---|------|--------|--------|-----------|----------|--|-----------|-----------|-----------|----------|-------------------|---------|---------|--------|
| Number | area | nspots | Zurich | Longitude | Latitude | Number | Macintosh | Mag. type | Longitude | Latitude | C flare | M flare | X flare | Proton |
| 44 | 3 | 1 | J | 79.0 | 12.0 | 2600 | Hsx | Alpha | 89.0 | 12.0 | -- ▾ | -- ▾ | -- ▾ | -- ▾ |
| 47 | 7 | 16 | D | 18.0 | 7.0 | 2602 | Cao | Beta | 27.0 | 7.0 | -- ▾ | -- ▾ | -- ▾ | -- ▾ |



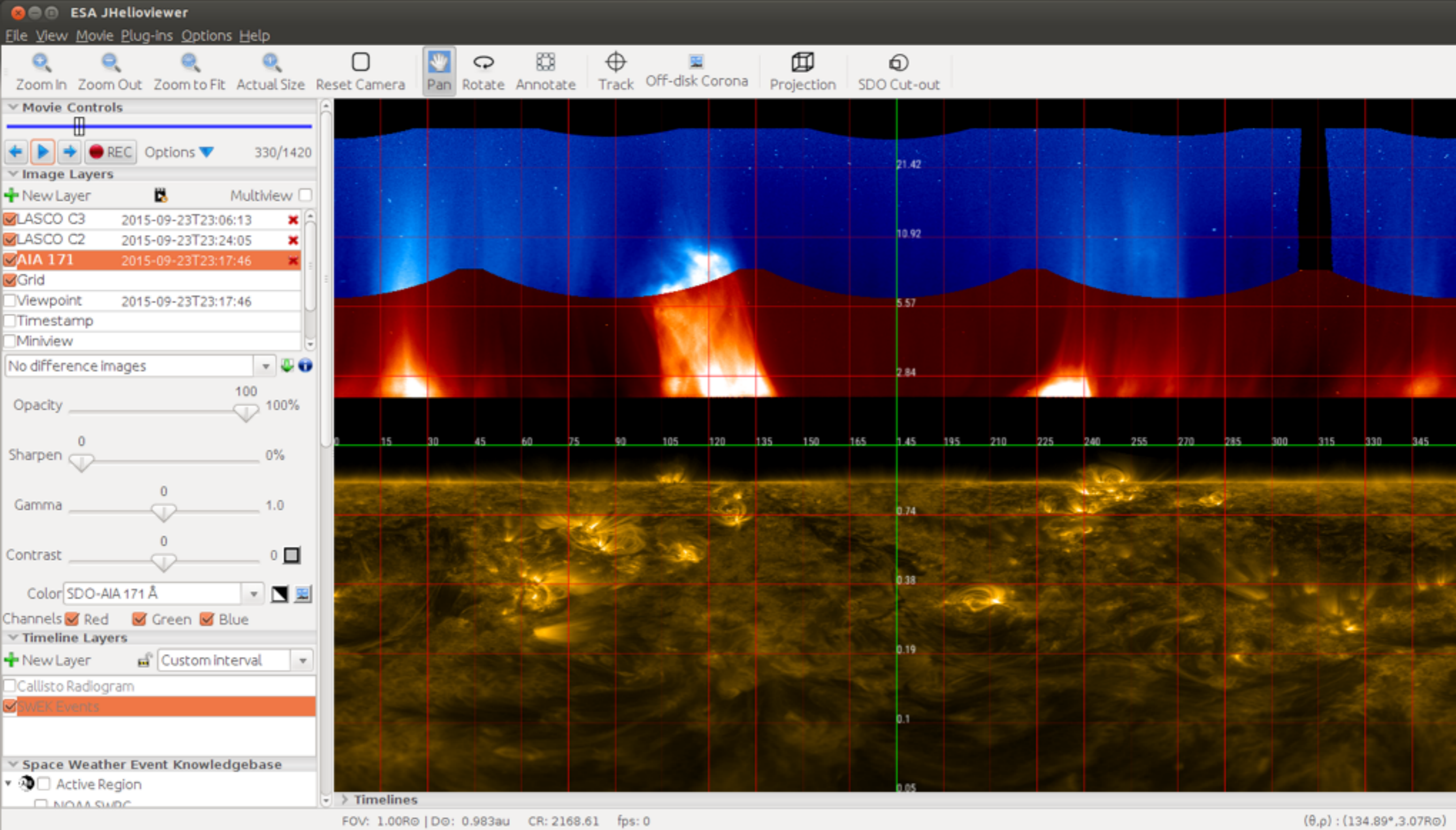
| Peak time | Flare class |
|---------------------|-------------|
| 2016-10-16 13:56:00 | B3.5 |
| 2016-10-15 04:55:00 | B3.0 |
| 2016-10-14 13:31:00 | B4.9 |
| 2016-10-14 09:00:00 | B8.6 |

Proton forecast

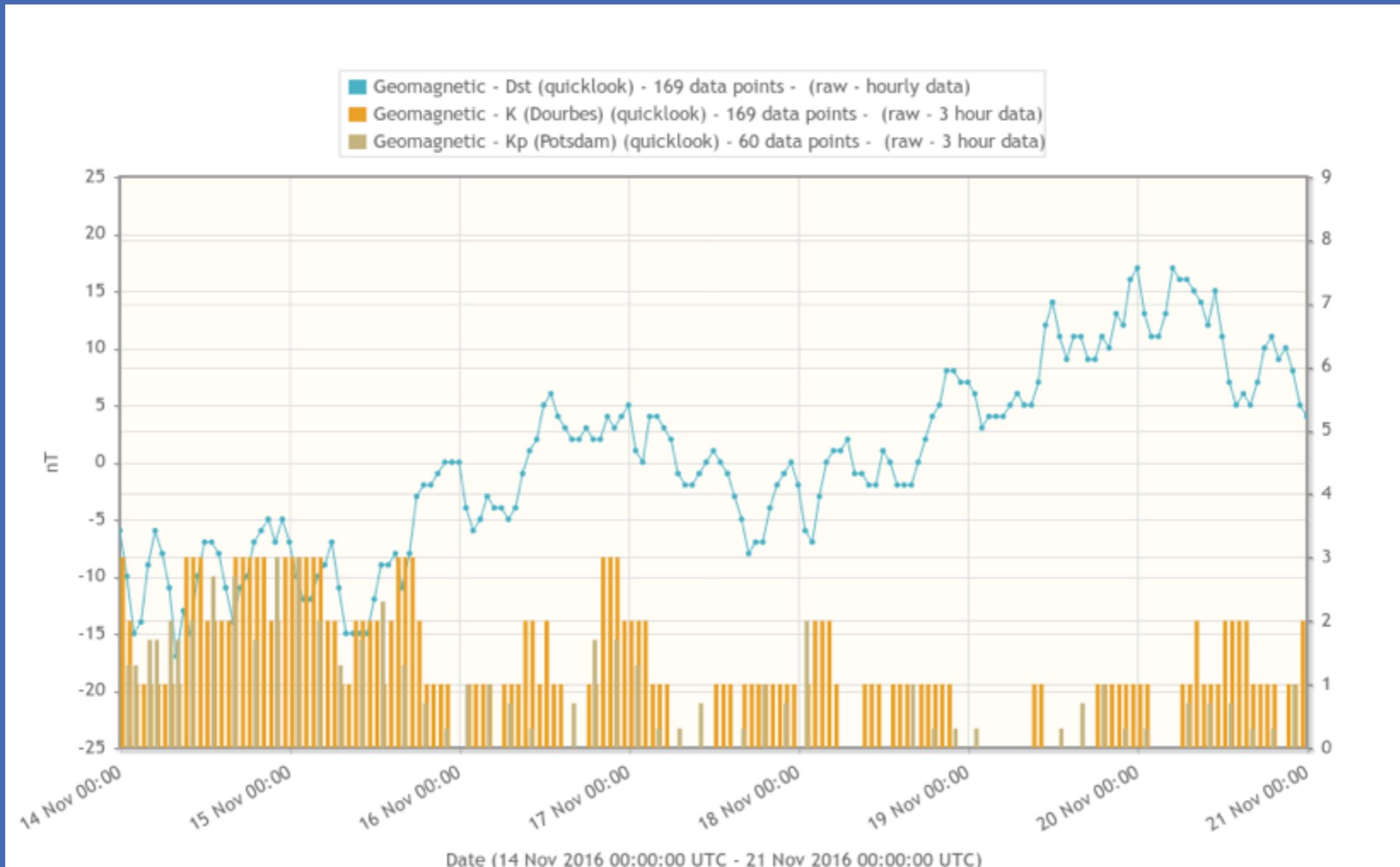
26-APR-2018 - TOOLS

IMAGE BROWSING & ANALYSIS INTERFACES (JHELIOVIEWER)

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of Belgium



TIMELINE DATA BROWSING (WWW.STAFF.OMA.BE)



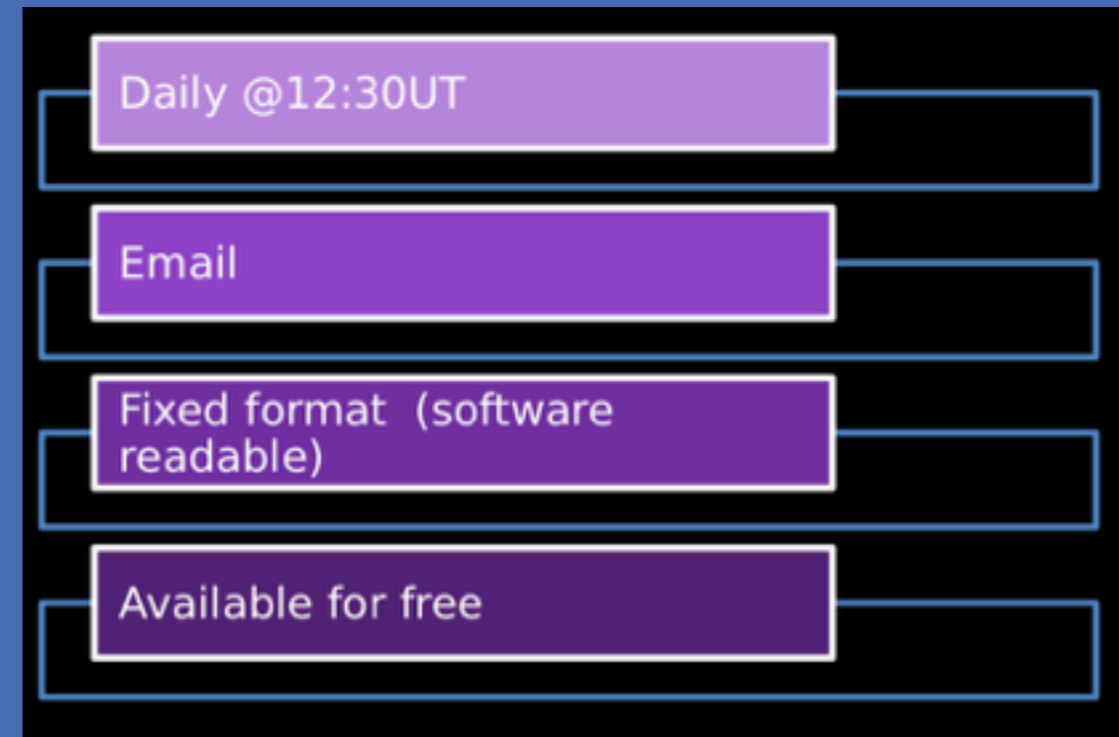
Output




```

:Issued: 2010 Dec 07 1233 UTC
:Product: documentation at http://www.sidc.be/products/meu
#-----#
# DAILY BULLETIN ON SOLAR AND GEOMAGNETIC ACTIVITY from the SIDC #
# (RWC Belgium) #
#-----#
SIDC URSIGRAM 01207
SIDC SOLAR BULLETIN 07 Dec 2010, 1222UT
SIDC FORECAST (valid from 1230UT, 07 Dec 2010 until 09 Dec 2010)
SOLAR FLARES : Quiet conditions (<50% probability of C-class flares)
GEOMAGNETISM : Quiet (A<20 and K<4)
SOLAR PROTONS : Quiet
PREDICTIONS FOR 07 Dec 2010 10CM FLUX: 089 / AP: 002
PREDICTIONS FOR 08 Dec 2010 10CM FLUX: 089 / AP: 004
PREDICTIONS FOR 09 Dec 2010 10CM FLUX: 090 / AP: 006
COMMENT: The large filament on the south-east side of the Sun has
erupted yesterday afternoon around 15:35 UT. This was clearly observed
in PROBA2/SWAP and SDO/AIA data. Also STEREO/A COR2 images show the
event, starting at 18:54 UT. The direction of the associated CME suggest
the impact of this event on the Earth will be limited. The CME speed as
measured by CACTUS is approximately 550 km/s.
We expect quiet solar conditions for the coming days. A shock in the
solar wind speed was observed by ACE yesterday due to a sector boundary
change. The solar wind speed is still low around 380 km/s. There may be
unsettled geomagnetic conditions towards the end of the forecasting
period due to a recurrent coronal hole wind stream.

```



Flare forecast (region / full disk)
Geomagnetism forecast (A/K)
F10.7 forecast

Textual report/forecast

- Solar weather
- Solar wind
- Geomagnetic conditions

ALERTS

```

:Issued: 2017 Sep 08 1432 UTC
:Product: documentation at http://www.sidc.be/products/presto
-----#
# FAST WARNING 'PRESTO' MESSAGE from the SIDC (RWC-Belgium) #
#-----#
A persistent and strongly negative value of the Bz component of the
interplanetary magnetic field (peak -17nT), is causing geomagnetic
storms at between moderate (local K 6) and severe levels (Potsdam and
NOAA Kp reaching to 8).

These storms are related to the September 6 CME.

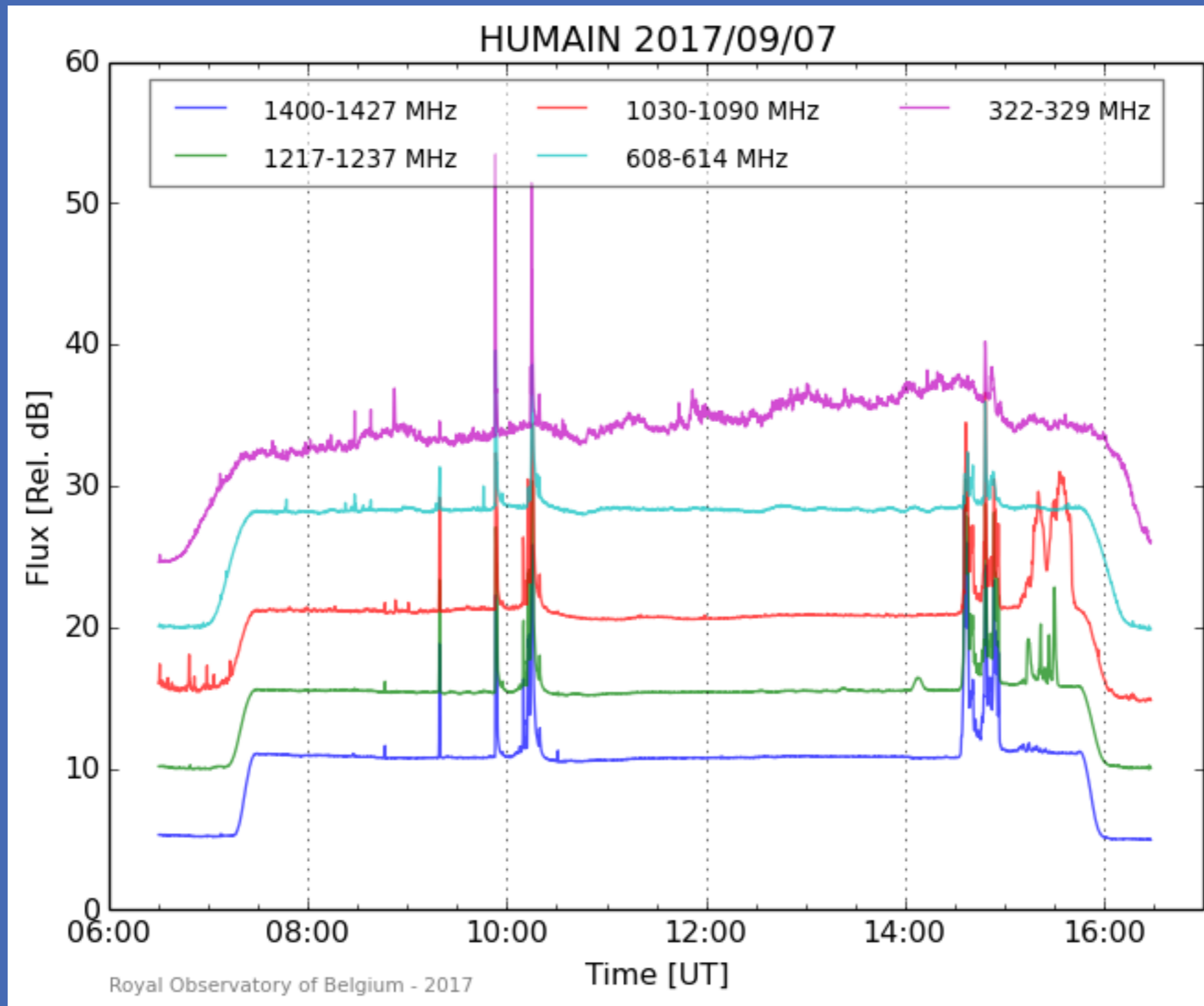
Further geomagnetic storming is expected with the levels depending on
the evolution of Bz.
In general solar wind and geomagnetic conditions should slowly subside
over the next 24-48 hours.
-----#
# Solar Influences Data analysis Center - RWC Belgium #
# Royal Observatory of Belgium #
# Fax : 32 (0) 2 373 0 224 #
# Tel.: 32 (0) 2 373 0 491 #
#-----#
# For more information, see http://www.sidc.be. Please do not reply #
# directly to this message, but send comments and suggestions to #
# 'sidctech@oma.be'. If you are unable to use that address, use #
# 'rvidlinden@spd.aas.org' instead. #
# To unsubscribe, visit http://sidc.be/registration/unsub.php #
#-----#
# Legal notices: #
# - Intellectual Property Rights: #
# http://www.astro.oma.be/common/internet/en/astrom-oma-be-en.pdf #
# - Liability Disclaimer: #
# http://www.astro.oma.be/common/internet/en/disclaimer-en.pdf #
# - Use and processing of your personal information: #
# http://www.astro.oma.be/common/internet/en/privacy-policy-en.pdf #
#-----#

```



- Under development:
- Machine readable interfaces to events and associated alert
 - Display of the events and alerts on multi-purpose interfaces (jHV, etc...)
 - Ingest products on WIS (WMO Information System)

TAILORED PRODUCTS



Discussion



TESTING TOOLS

We test the tools in real time, e.g.
EUHFORIA.

How can we work with the CCMC, as an
operational forecasting team we can help
in verifying models?

CONSISTENCY

We want consistency with the space weather community. Are we presenting the same data values/forecasts?

(We've worked on the flare scoreboard)

(Flare magnitude/width/energy?)

(Bz arrival time and magnitude?)

META DATA

Are our data/model products available with the appropriate meta data to be easily used by the modelling community?

Are there standards in place?

COMMUNICATION

A bi-annual web get together would be
constructive to discuss:

Product/product development overlap.

Consistency in presented values.

Tools we need!

Tiger team development