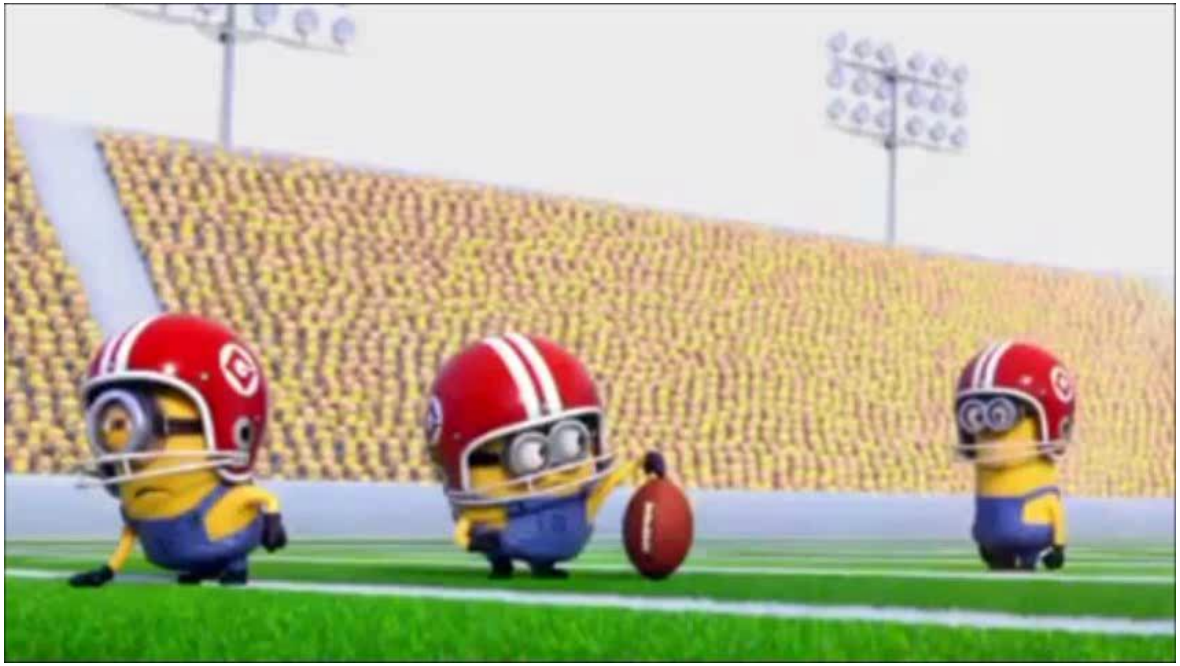
SPACE WEATHER INTRODUCTORY COURSE

Collaboration of

Solar-Terrestrial Centre of Excellence

Koninklijke luchtmacht

Koninklijk Nederlands
Meteorologisch Instituut
Ministerie van Infrastructuur en Milieu



Space Weather into practice – SIDC/RWC & URSIgram

Jan Janssens

SIDC/RWC & URSIgram - Contents

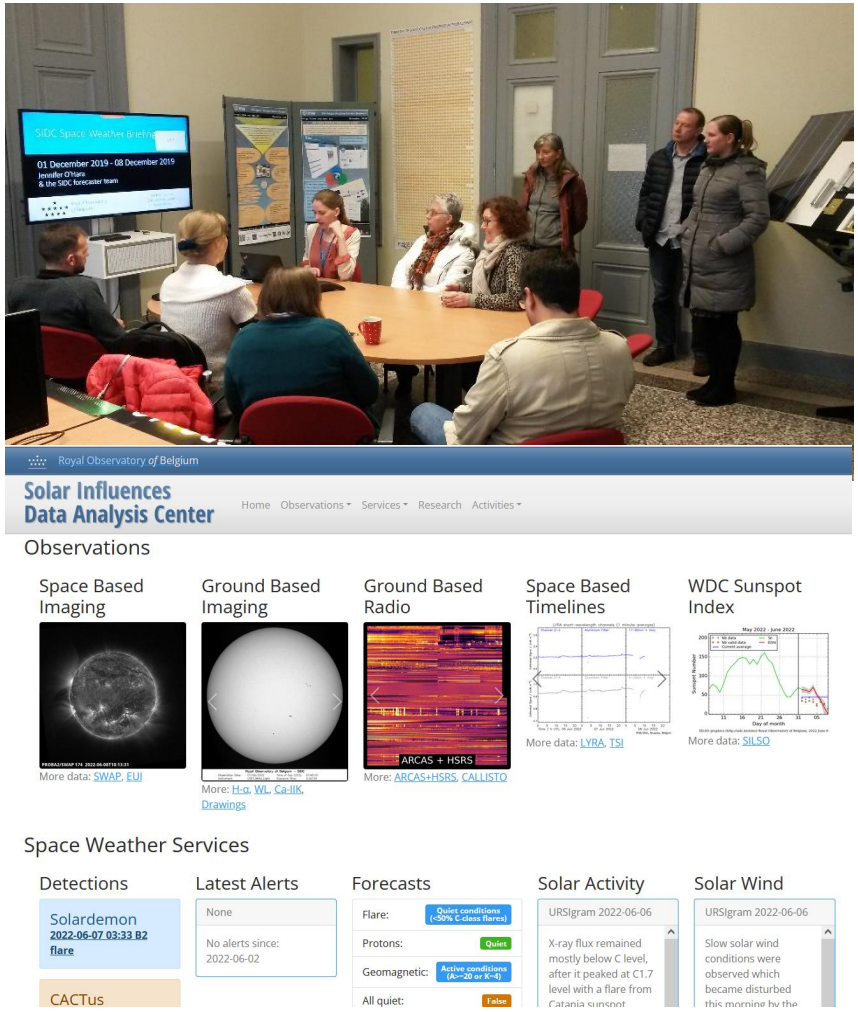
- SIDC/RWC
- SWx alerts
- Exercises

SIDC/RWC & URSIgram - Contents

- SIDC/RWC
- SWx alerts
- Exercises

The SIDC / RWC
Regional Warning Centre Brussels

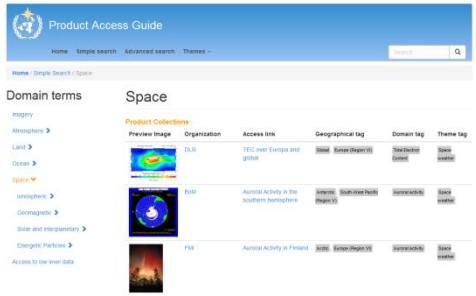
- Team of +/- 8 SWx forecasters
  - Scientists
    - Cumul job
    - Experts
  - Weekly tour of duty
    - 7/7, 14/24
    - Back-up by automated services and tools
  - IT supported
    - Previweb
      - Interface
    - Web page
    - Mailing service
  - Regular meetings
  - ICAO support: PECASUS
    - HF COM, radiation, GNSS

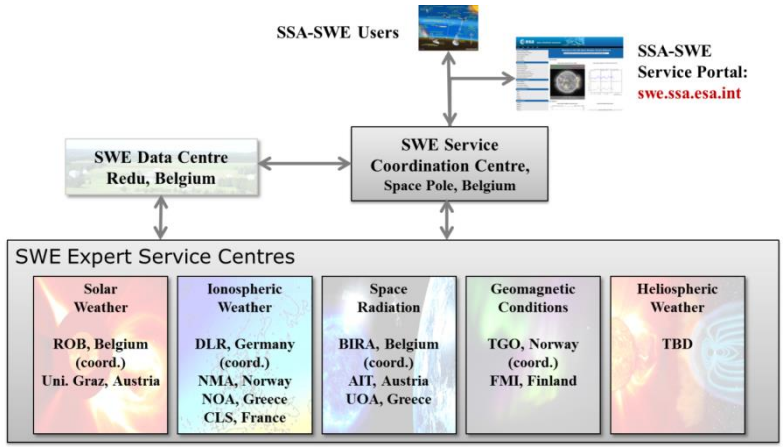


SIDC: Solar Influences Data analysis Center – ICAO: International Civil Aviation Organization - HF: High Frequency – GNSS: Global Navigation Satellite System ; PECASUS: Partnership for Excellence in Civil Aviation Space weather User Services

The SIDC / RWC
Regional Warning Centre Brussels

- International context
  - ISES
    - International Space Environment Service
  - ESA / SSCC
    - SSA Space Weather Coordination Centre
    - Services and expertise
  - World Meteorological Org.
  - ICAO / PECASUS
    - International Civil Aviation Organization





SSA: Space Situational Awareness

URSIgram

https://www.sidc.be/

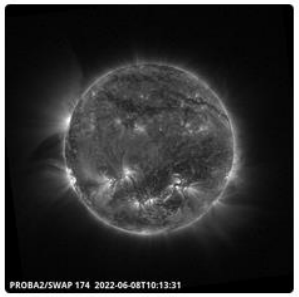
Royal Observatory of Belgium

Solar Influences Data Analysis Center

Home | Observations | Services | Research | Activities

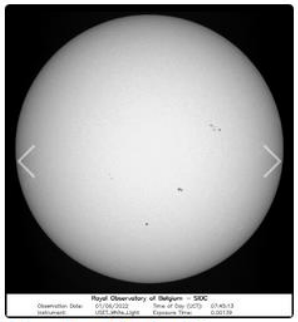
Observations

Space Based Imaging



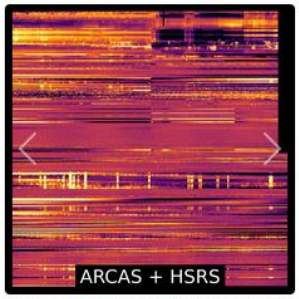
More data: SWAP, EUI

Ground Based Imaging



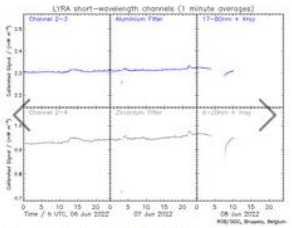
More: H-α, WL, Ca-IIK, Drawings

Ground Based Radio



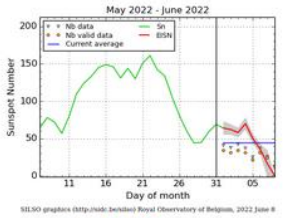
More: ARCAS+HSRS, CALLISTO

Space Based Timelines



More data: LYRA, TSI

WDC Sunspot Index



More data: SILSO

Space Weather Services

Detections

Solardemon
2022-06-07 03:33 B2 flare

CACTus

Latest Alerts

None

No alerts since: 2022-06-02

Forecasts

Flare:	Quiet conditions (<50% C-class flares)
Protons:	Quiet
Geomagnetic:	Active conditions (A>=20 or K=4)
All quiet:	False

Solar Activity

URSIgram 2022-06-06

X-ray flux remained mostly below C level, after it peaked at C1.7 level with a flare from Catania sunspot

Solar Wind

URSIgram 2022-06-06

Slow solar wind conditions were observed which became disturbed this morning by the

The weekly bulletin

```
:Issued: 2017 Jan 30 1406 UTC
:Product: documentation at http://www.sidc.be/products/bul
#-----------------------------------------------------------------#
# SIDC Weekly bulletin on Solar and Geomagnetic activity          #
#-----------------------------------------------------------------#
WEEK 839 from 2017 Jan 23
SOLAR ACTIVITY
---------------
Solar activity was very low to low, with a single C-class flare produced by spotless
active region NOAA 2627 near the west limb on 28 January (C2 flare peaking at
21:09UT). A new region, NOAA 2629, developed quickly on 24 January and was
responsible for most of the B-class flaring on 24-26 January. The other regions were
mostly quiet and decaying. No earth-directed coronal mass ejections (CMEs) were
observed in available coronagraphic imagery. The greater than 10MeV proton flux was
at nominal levels. A small positive equatorial coronal hole (CH) started its transit
of the central meridian on 23 January, and a negative trans-equatorial CH was
transiting the central meridian (CM) by the end of the period.
GEOMAGNETIC ACTIVITY
--------------------
Solar wind conditions near Earth were determined by the high speed stream (HSS) from
the small positive coronal hole (CH). The co-rotating interaction region (CIR) that
preceded it, drove a small shock on 26 January at 07:12UT. The proper HSS arrived a
few hours later around 13:45UT of the same day, with solar wind speed gradually
increasing from an initial 375 km/s up to values near 670 km/s around 06UT on 27
January. Bz oscillated wildly between -12 nT and +13 nT, preventing the development
of a strong geomagnetic disturbance. As a result, only active geomagnetic conditions
were observed on 26 and 27 January, while the rest of the week was at quiet levels
with an occasional unsettled episode.
--------------------------------------------------------------------------
DAILY INDICES
DATE           RC   EISN  10CM   Ak   BKG    M   X
2017 Jan 23   ///    057   084   006   B1.0   0   0
2017 Jan 24   053    042   082   003   B1.0   0   0
2017 Jan 25   064    046   085   005   B1.4   0   0
2017 Jan 26   053    039   083   012   B1.1   0   0
2017 Jan 27   033    028   080   021   A9.1   0   0
2017 Jan 28   ///    029   079   010   A8.5   0   0
2017 Jan 29   ///    032   077   007   A8.2   0   0
--------------------------------------------------------------------------
# RC   : Sunspot index (Wolf Number) from Catania Observatory (Italy)
# EISN : Estimated International Sunspot Number
# 10cm : 10.7 cm  radioflux (DRAO, Canada)
# Ak   : Ak Index Wingst (Germany)
# BKG  : Background GOES X-ray level (NOAA, USA)
# M,X  : Number of X-ray flares in M and X class, see below (NOAA, USA)
--------------------------------------------------------------------------

NOTICEABLE EVENTS SUMMARY
DAY BEGIN MAX  END  LOC    XRAY OP  10CM Catania/NOAA RADIO_BURST_TYPES
NONE
```

STCE Newsletter

23 Jan 2017 - 29 Jan 2017

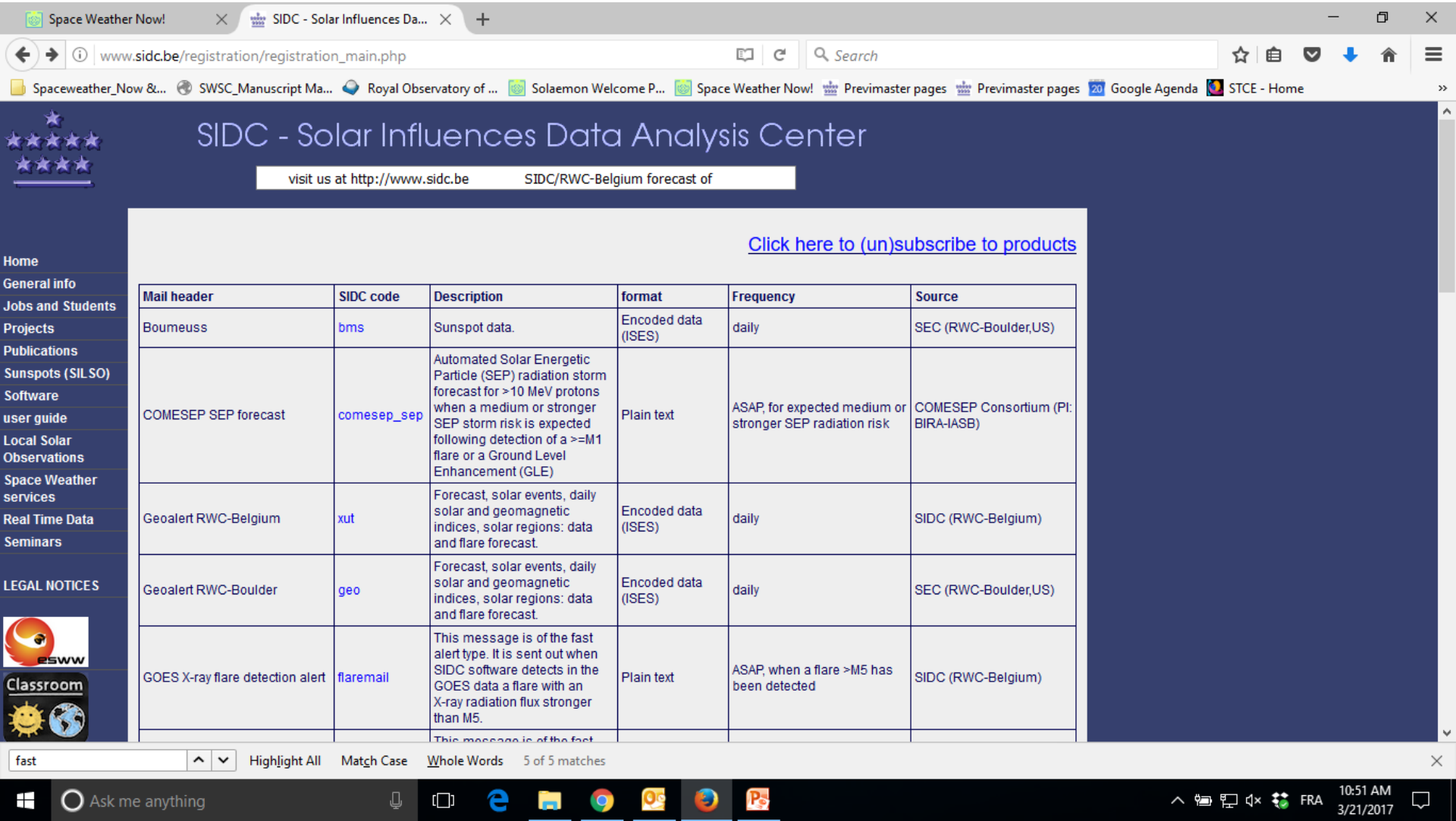
Published by the STCE - this issue : 3 Feb 2017. Available online at http://www.stce.be/newsletter/ .

The Solar-Terrestrial Centre of Excellence (STCE) is a collaborative network of the Belgian Institute for Space Aeronomy, the Royal Observatory of Belgium and the Royal Meteorological Institute of Belgium.

The space weather briefing as a ppsm : http://www.stce.be/movies/SIDCbriefing-2017-01-30_pv.ppsm

SIDC products – Free online

https://www.sidc.be/registration/



Mail header	SIDC code	Description	format	Frequency	Source
Boumeuss	bms	Sunspot data.	Encoded data (ISES)	daily	SEC (RWC-Boulder,US)
COMESEP SEP forecast	comesep_sep	Automated Solar Energetic Particle (SEP) radiation storm forecast for >10 MeV protons when a medium or stronger SEP storm risk is expected following detection of a >=M1 flare or a Ground Level Enhancement (GLE)	Plain text	ASAP, for expected medium or stronger SEP radiation risk	COMESEP Consortium (PI: BIRA-IASB)
Geoalert RWC-Belgium	xut	Forecast, solar events, daily solar and geomagnetic indices, solar regions: data and flare forecast.	Encoded data (ISES)	daily	SIDC (RWC-Belgium)
Geoalert RWC-Boulder	geo	Forecast, solar events, daily solar and geomagnetic indices, solar regions: data and flare forecast.	Encoded data (ISES)	daily	SEC (RWC-Boulder,US)
GOES X-ray flare detection alert	flaremail	This message is of the fast alert type. It is sent out when SIDC software detects in the GOES data a flare with an X-ray radiation flux stronger than M5.	Plain text	ASAP, when a flare >M5 has been detected	SIDC (RWC-Belgium)

SIDC/RWC & URSIgram - Contents

- SIDC/RWC
- SWx alerts
- Exercises

Fast alerts: automatic detection by SIDC software

Flare > M5
SIDC in GOES X-ray

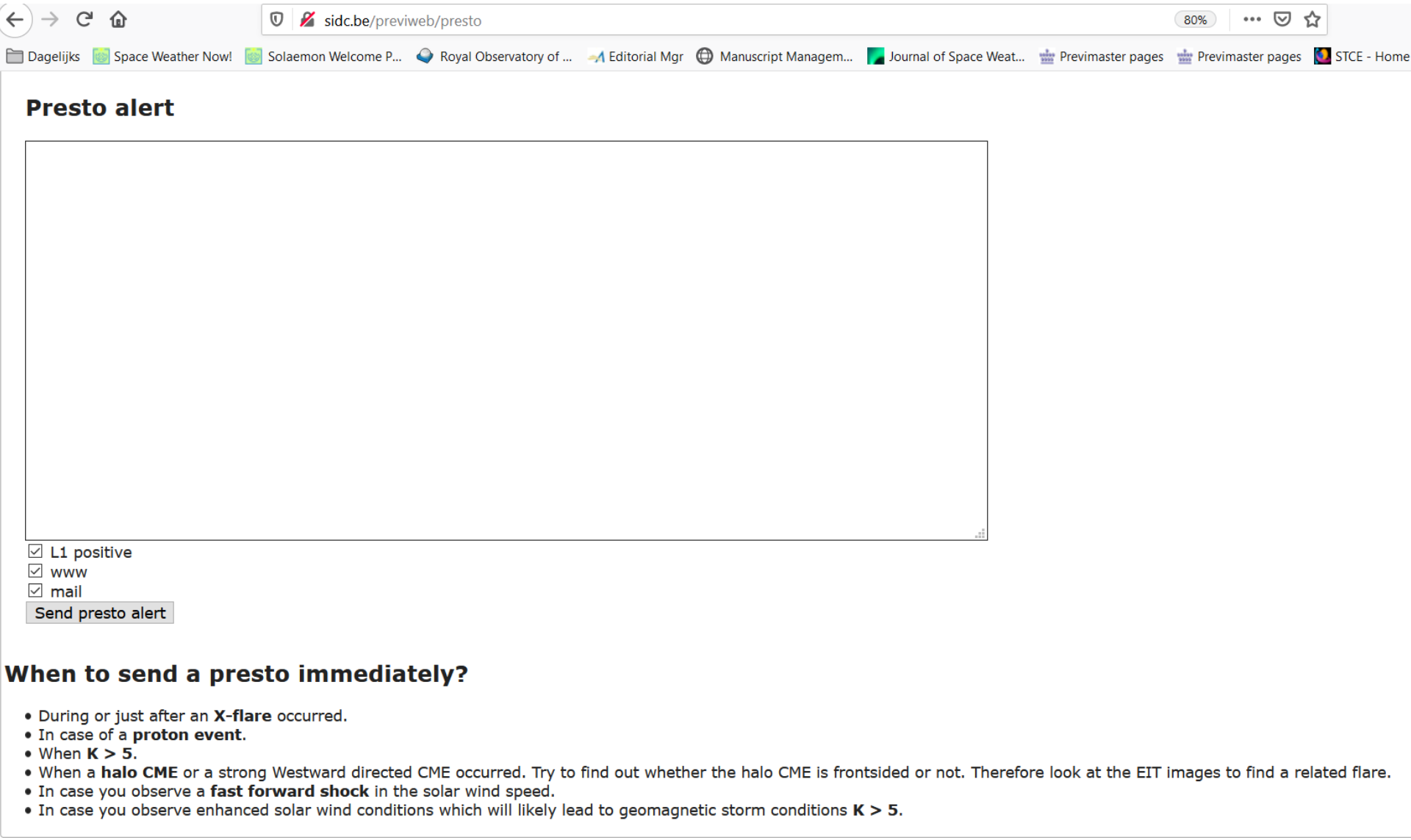
```
:Issued: 2016 Jul 24 0516 UTC
:Product: documentation at http://www.sidc.be/products/flaremail
#-----------------------------------------------------------------------#
# Large flare alerts from the SIDC (RWC-Belgium), detected in GOES      #
# X-ray data                                                            #
#-----------------------------------------------------------------------#
A class M5.5 solar X-ray flare occurred on 2016/07/23 with peak time 05:31UT
#-----------------------------------------------------------------------#
# 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    #
#-----------------------------------------------------------------------#
```

Halo CME (width > 150°)
CACTus in SOHO/LASCO

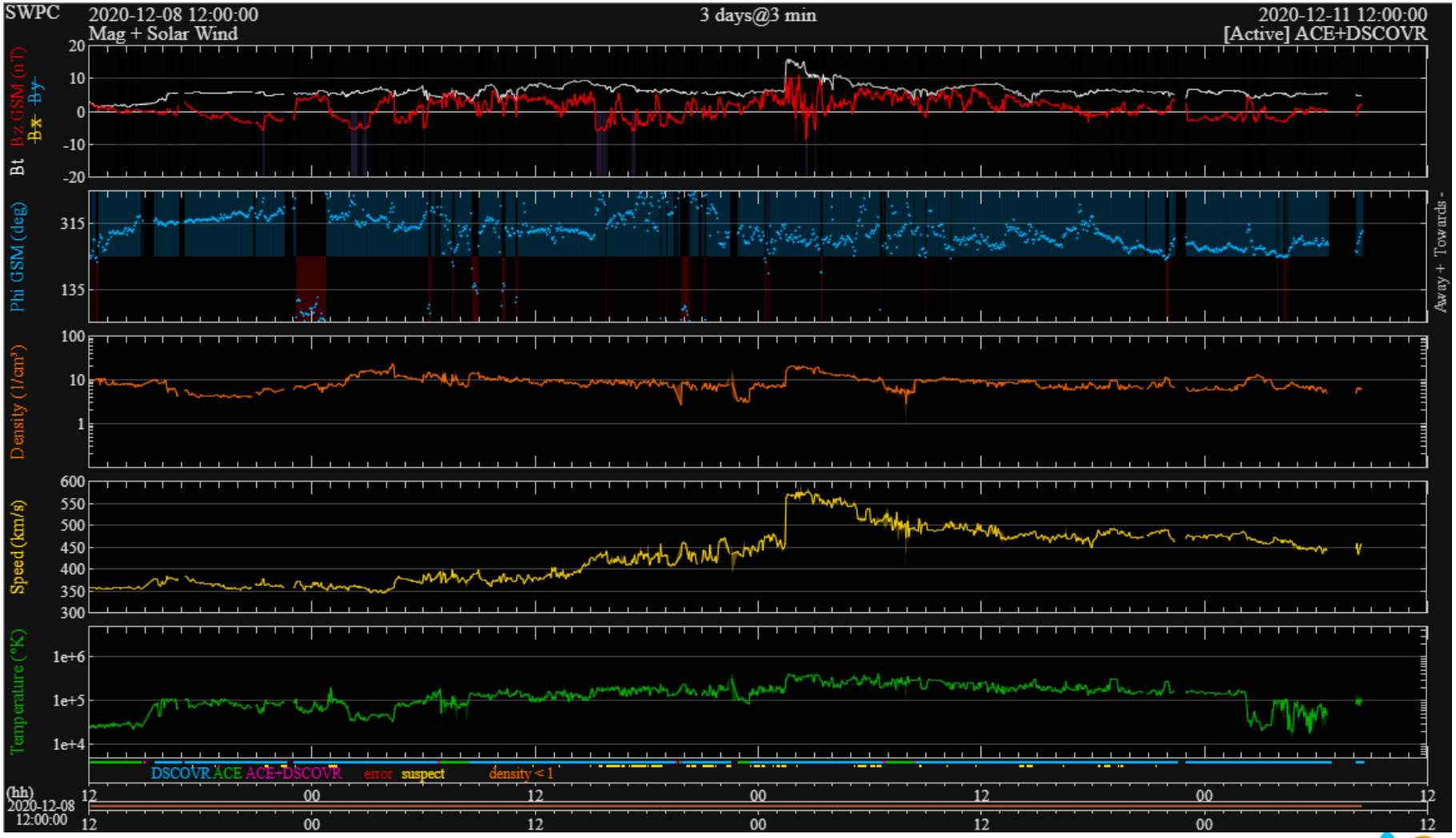
```
:Issued: 2016 Nov 05 1349 UTC
:Product: documentation at http://www.sidc.be/products/cactus
#-----------------------------------------------------------------------#
# HALO CME ALERTS from the SIDC (RWC-Belgium), generated by CACTUS      #
#-----------------------------------------------------------------------#
  A halo or partial-halo CME was detected with the following
characteristics:

            t0      | dt0| pa | da |  v   |  dv | minv| maxv|
005|2016/11/05 04:24| 03 | 338| 178| 0297| 0048| 0200| 0452

Details can be found here:
http://www.sidc.oma.be/cactus/out/latestCMEs.html

      t0: onset time, earliest indication of liftoff
     dt0: duration of liftoff (hours)
      pa: principal angle, counterclockwise from North (degrees)
      da: angular width of the CME (degrees),
       v: median velocity (km/s)
      dv: variation (1 sigma) of velocity over the width of the CME
   mindv: lowest velocity detected within the CME
   maxdv: highest velocity detected within the CME



  This message is sent whenever a CME wider than 150 degrees is detected by
cactus.
#-----------------------------------------------------------------------#
```

SOHO: Solar and Heiospheric Observatory
CACTus: Computer Aided CME Tracking
LASCO: Large Angle and Spectrometric Coronagraph

PRESTO alert: 1. Criteria



PRESTO alert: 2. Detection



PRESTO alert: 3. Send

PRESTO ALERT

Message 14 of 1168

From **Solar Influences Data analysis Center**
To **jan.janssens@oma.be**
Reply-To **no-reply-sidc@oma.be**
Date **10.12.2020 08:30**

```
:Issued: 2020 Dec 10 0727 UTC
:Product: documentation at http://www.sidc.be/products/presto
#-----------------------------------------------------------------#
# FAST WARNING 'PRESTO' MESSAGE  from the SIDC (RWC-Belgium)      #
#-----------------------------------------------------------------#
A shock was seen in the solar wind at 01:34 UT marking the arrival of the CME from 7 December. The speed jumped from 450 km/s to 560 km/s and the magnetic field from 6 nT
to 16 nT. It did not have long lasting negative Bz embedded in it, therefore only unsettled conditions were seen locally (K Dourbes =3) and active at planetary levels (Kp
= 4).
#-----------------------------------------------------------------#
# Solar Influences Data analysis Center - RWC Belgium             #
# Royal Observatory of Belgium                                    #
#                                                                 #
# Website         http://www.sidc.be.                             #
# E-mail          sidc-support@oma.be                             #
# To unsubscribe  http://www.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 #
#-----------------------------------------------------------------#
```

All quiet alert

Start/End of all quiet alert from the SIDC/RWC Belgium

Solar Influences Data analysis Center <sidc@oma.be>

Extra line breaks in this message were removed.

Sent: Mon 7/4/2016 1:33 PM

To: jan.janssens@oma.be

:Issued: 2016 Jul 04 1132 UTC
:Product: documentation at http://www.sidc.be/products/quieta
#---#
From the SIDC (RWC-Belgium): "ALL QUIET" ALERT
#---#
START OF ALL QUIET ALERT
.....
The SIDC - RWC Belgium expects quiet Space Weather conditions for the next 48 hours or until further notice.
This implies that:
* the solar X-ray output is expected to remain below C-class level,
* the K_p index is expected to remain below 5,
* the high-energy proton fluxes are expected to remain below the event threshold.
#---#
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

Start/End of all quiet alert from the SIDC/RWC Belgium

Solar Influences Data analysis Center <sidc@oma.be>

Sent: Wed 7/6/2016 12:11 AM

To: jan.janssens@oma.be

:Issued: 2016 Jul 05 2210 UTC
:Product: documentation at http://www.sidc.be/products/quieta
#---#
From the SIDC (RWC-Belgium): "ALL QUIET" ALERT
#---#
END OF ALL QUIET ALERT
.....
The SIDC - RWC Belgium expects solar or geomagnetic activity to increase. This may end quiet Space Weather conditions.
#---#
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:

PECASUS advisories

GNSS, Radiation, HF COM

FNXX02 EFKL 070850
SWX ADVISORY
DTG: 20220907/0851Z
SWXC: PECASUS
ADVISORY NR: 2022/73
NR RPLC: 2022/72
SWX EFFECT: HF COM MOD
OBS SWX: 07/0837Z HNH MNH W150 - E030
FCST SWX +6 HR: 07/1500Z NOT AVBL
FCST SWX +12 HR: 07/2100Z NOT AVBL
FCST SWX +18 HR: 08/0300Z NOT AVBL
FCST SWX +24 HR: 08/0900Z NOT AVBL
RMK: SPACE WEATHER EVENT (MAXIMUM USABLE FREQUENCY DEPRESSION) IS IN PROGRESS. IMPACT ON HIGHER HF COM FREQUENCY BANDS EXPECTED. LOWER FREQUENCY BANDS MAY BE LESS IMPACTED.
NXT ADVISORY: WILL BE ISSUED BY 20220907/1437Z=

SWX ADVISORY
DTG: 20221003/1445Z
SWXC: PECASUS
ADVISORY NR: 2022/50
SWX EFFECT: GNSS MOD
OBS SWX: 03/1342Z EQN E070 - E130
FCST SWX +6 HR: 03/2000Z NOT AVBL
FCST SWX +12 HR: 04/0200Z NOT AVBL
FCST SWX +18 HR: 04/0800Z NOT AVBL
FCST SWX +24 HR: 04/1400Z NOT AVBL
RMK: SPACE WEATHER EVENT (IONOSPHERIC DISTURBANCE) IN PROGRESS. IMPACT ON GNSS PERFORMANCE POSSIBLY LEADING TO LOSS OF GNSS SIGNALS AND/OR DEGRADATION OF TIMING AND POSITIONING PERFORMANCE.
NXT ADVISORY: WILL BE ISSUED BY 20221003/2042Z

PECASUS: Partnership for Excellence in Civil Aviation Space weather User Services ;
GNSS: Global Navigation Satellite System ; HF COM: High Frequency Communication

Space Weather into practice – URSIgram exercises

Jan Janssens

SIDC URSIGRAM 30515
SIDC SOLAR BULLETIN 15 May 2013, 1205UT
SIDC FORECAST (valid from 1230UT, 15 May 2013 until 17 May 2013)
SOLAR FLARES : Major flares expected (X-class flares expected, probability >=50%)
GEOMAGNETISM : Active conditions expected (A>=20 or K=4)
SOLAR PROTONS : Proton event expected (10 pfu at >10 MeV)
PREDICTIONS FOR 15 May 2013 10CM FLUX: 150 / AP: 017
PREDICTIONS FOR 16 May 2013 10CM FLUX: 152 / AP: 014
PREDICTIONS FOR 17 May 2013 10CM FLUX: 153 / AP: 011

COMMENT:A class X1.2 solar flare occurred today with peak time 01:48 UT, from NOAA AR 1748 which has a beta-gamma-delta magnetic configuration. It was associated with radio bursts and an increase of GOES proton flux levels, now at 5 protons/cm2-s-sr, the threshold of 10 protons/cm2-s-sr will likely be reached soon (at >=10 MeV). The increases in proton flux likely come from the CME driven shock. If the strong flares from this AR continue, the proton increases will likely be more abrupt when the magnetic connection between the flare site and the Earth is better (i.e. when the AR is in the western hemisphere). A CME was associated with the event, a shock and glancing blow can probably be expected at the Earth late on May 16 (CME speed 1700 km/s in LASCO C2).

Geomagnetic conditions are quiet, but ACE data shows a disturbance starting this morning, with currently magnetic intensity close to 15 nT (northwards, so no geomagnetic effect). There is not enough data yet to discern clearly its cause, but it is likely related to the CME on May 12 (and possibly those from the two previous days related to X-flares from NOAA AR 1748). Geomagnetic conditions are expected to be unsettled to active, with possible isolated minor storm periods.

TODAY'S ESTIMATED ISN : 099, BASED ON 11 STATIONS.

SOLAR INDICES FOR 14 May 2013
WOLF NUMBER CATANIA : 176
10CM SOLAR FLUX : 148
AK CHAMBON LA FORET : 012
AK WINGST : 009
ESTIMATED AP : 008
ESTIMATED ISN : 102, BASED ON 14 STATIONS.

NOTICEABLE EVENTS SUMMARY

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	RADIO BURST TYPES	Catania	NOAA	NOTE
15	0125	0148	0158	N12E64	X1.2	2N		IV/2II/1		1748	

END

URSIgram – Exercise 1

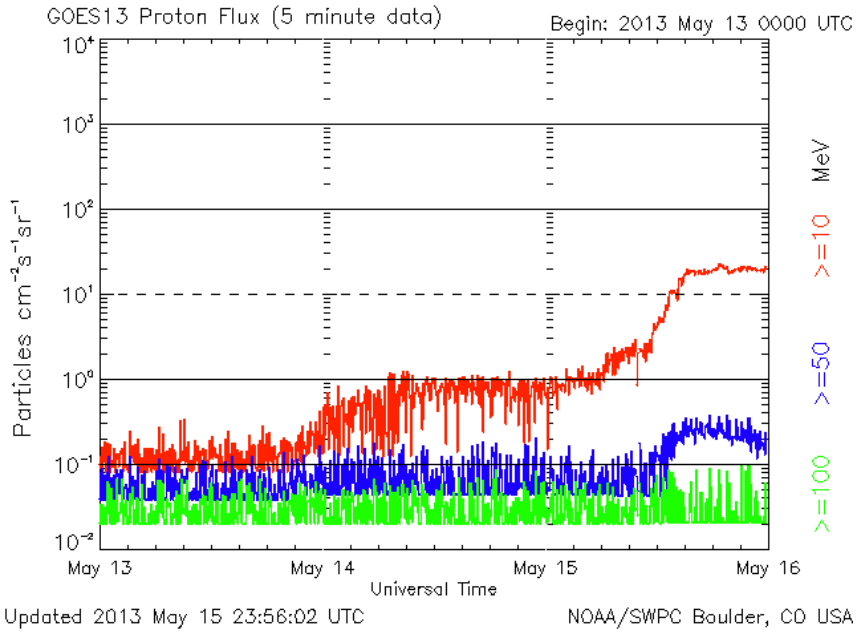
- **Setting**
  - You have received the above URSIgram. It is now 18:00UT on 15 May 2013. You have to brief your SWx colleagues.
- **Questions – Part 1 of 2: Reading-Comprehension questions**
  - Was the X1.2 flare: a) a strong flare (which class)? b) a long duration event (LDE)?
  - What kind of radio burst (SRB) is type «IV/2II/1 »?
  - 'Active geomagnetic conditions' correspond to which NOAA scale?
  - ' protons/cm2-s-sr ' : This is the unit for which parameter? What is the short notation for this unit?
  - Despite the relatively strong magnetic field strength of 15 nT, no strong geomagnetic effects were recorded from this CME. Why?
  - ' Beta-Gamma-Delta ': What's the name of the corresponding active region classification scheme? What is the simplest type possible?
  - For the geomagnetic prediction of 15 May, why is A >= 20 while Ap=17?
  - What is being evaluated under the column « OP »?

URSIgram – Exercise 1

- **Setting**
  - You have received the above URSIgram. It is now 18:00UT on 15 May 2013. You have to brief your SWx colleagues.
- **Questions – Part 2 of 2: SWx impact questions**
  - Has the >10MeV proton event threshold been reached? If yes, what would be your communications advice concerning a Dutch fregate operating north of Iceland?
  - You received a report from Gilze-Rijen Air Base (The Netherlands) about HF radio communication problems around 01:45UT. Do you think they were related to the X1.2 flare?
  - With the LASCO/C2 data now fully available, do you agree (part of) the CME is headed for Earth? Why (not)?
  - Was the X1.2 event a Tenflare? Do you think the 10.7 cm radio flux of 20:00UT will be affected?
  - « … possible isolated minor storm periods. » Do you expect important satellite communications problems?

URSIgram – Exercise 1

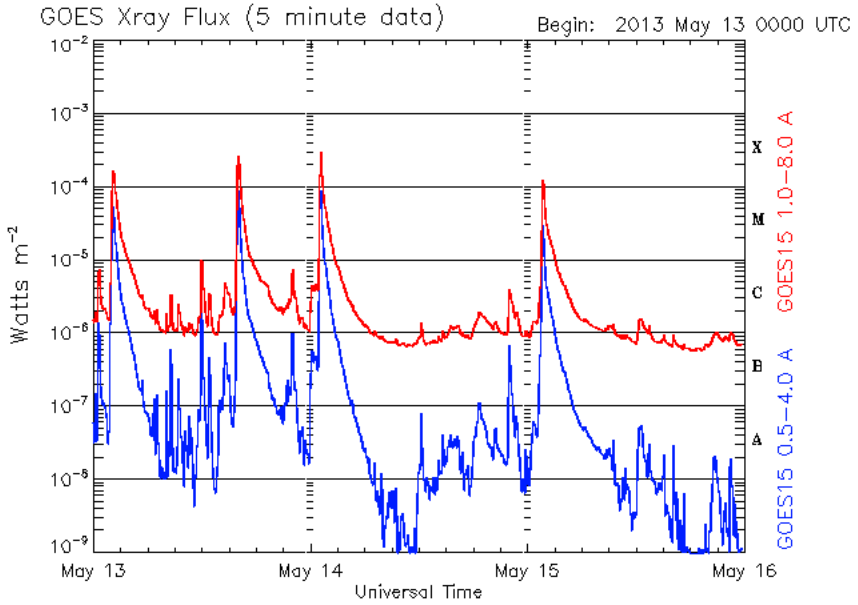
- Question 1:
  - Has the >10MeV proton event threshold been reached? If yes, what would be your communications advice concerning a Dutch submarine operating north of Iceland?

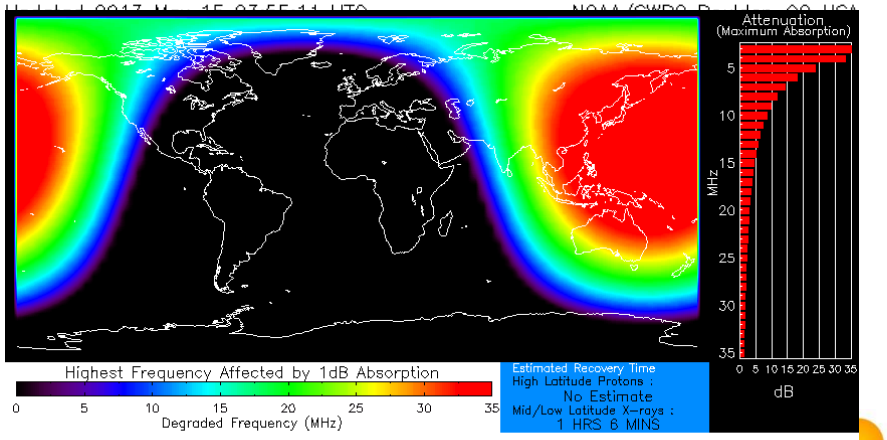


S 4	**Severe**	**Biological:** Unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** May experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** Blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.
S 3	**Strong**	**Biological:** Radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** Degraded HF radio propagation through the polar regions and navigation position errors likely.
S 2	**Moderate**	**Biological:** Passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk. **Satellite operations:** Infrequent single-event upsets possible. **Other systems:** Small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.
S 1	**Minor**	**Biological:** None. **Satellite operations:** None. **Other systems:** Minor impacts on HF radio in the polar regions.

URSIgram – Exercise 1

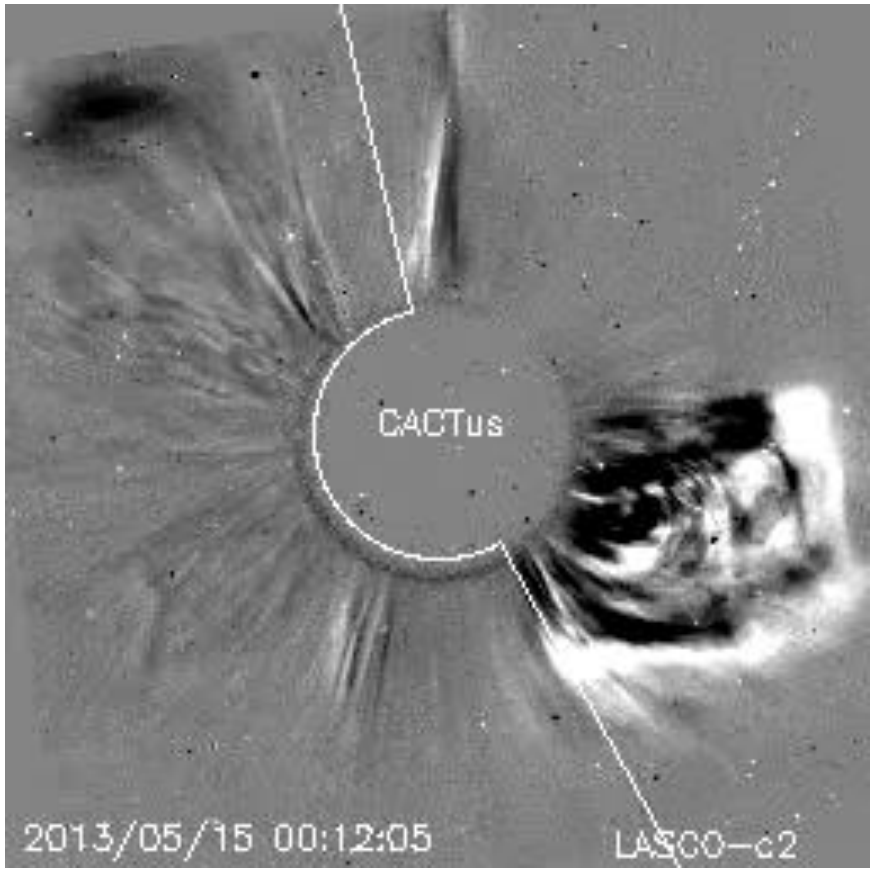
- Question 2:
  - You received a report from Gilze-Rijen Air Base (The Netherlands) about HF radio communication problems on 15 May around 01:45UT. Do you think they were related to the X1.2 flare?





URSIgram – Exercise 1

- Question 3:
  - With the LASCO/C2 data now fully available, do you agree (part of) the CME is headed for Earth? Why (not)?



URSIgram – Exercise 1

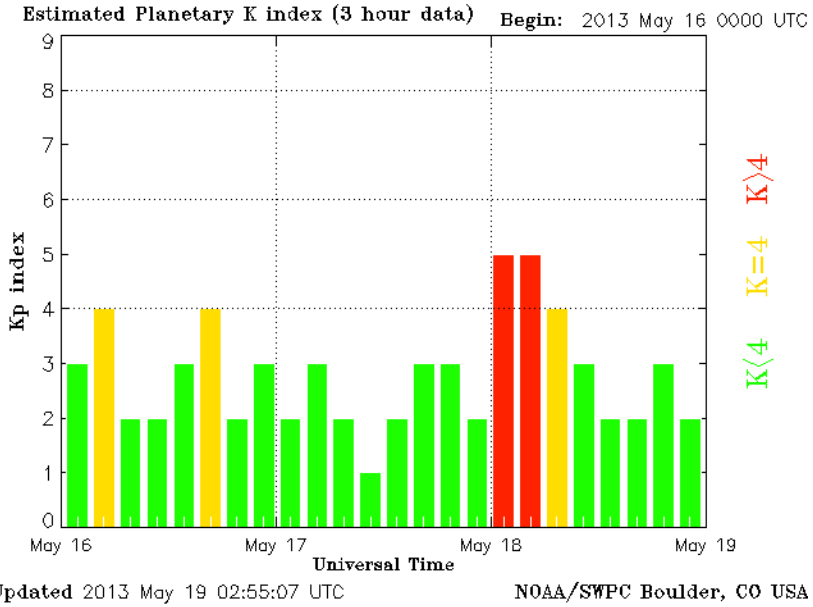
- Question 4:
  - Was the X1.2 event a Tenflare? Do you think the 10.7 cm radio flux of 20:00UT will be affected?

```
:Created: 2013 May 18 0332 UT
:Date: 2013 05 15
# Prepared by the U.S. Dept. of Commerce, NOAA, Space Weather Prediction Center
# Please send comments and suggestions to SWPC.Webmaster@noaa.gov
#
# Missing data: ////
# Updated every 30 minutes.
#                          Edited Events for 2013 May 15
#
#Event    Begin    Max      End  Obs  Q  Type  Loc/Frq   Particulars       Reg#
#-------------------------------------------------------------------------------

5160       0124   0140     0230  LEA  3   FLA  N12E64    2N      ERU       1748
5160       0125   0148     0158  G15  5   XRA  1-8A      X1.2    1.2E-01   1748
5160 +     0127   ////     0148  CUL  C   RSP  400-00*   IV/2              1748
5160 +     0127   0130     0142  LEA  G   RBR  410       240               1748
5160 +     0129   0134     0146  LEA  G   RBR  1415      300               1748
5160 +     0130   0136     0142  LEA  G   RBR  610       250               1748
5160 +     0133   0133     0146  LEA  G   RBR  245       430               1748
5160 +     0133   0142     0150  LEA  G   RBR  2695      440               1748
5160 +     0135   0141     0153  LEA  G   RBR  8800      1400              1748
5160 +     0136   0141     0154  LEA  G   RBR  15400     920               1748
5160 +     0136   0143     0151  LEA  G   RBR  4995      1000              1748
5160 +     0137   ////     0145  LEA  C   RSP  073-180   II/1    501       1748
```

```
:Product: 0516SGAS.txt
:Issued: 2013 May 16 0245 UTC
# Prepared jointly by the U.S. Dept. of Commerce, NOAA,
# Space Weather Prediction Center and the U.S. Air Force.
#
Joint USAF/NOAA Solar and Geophysical Activity Summary
SGAS Number 136 Issued at 0245Z on 16 May 2013
This report is compiled from data received at SWO on 15 May
A.  Energetic Events
Begin  Max  End  Rgn   Loc   Xray  Op 245MHz 10cm   Sweep
 0125 0148 0158  1748 N12E64 X1.2  2n 430    440    II/IV
B.  Proton Events:  A Greater than 10 MeV Proton event occurred at
15/1535Z, reached a peak flux of 23 pfu, and was ongoing as of the
writing of this summary.
```

URSIgram – Exercise 1

- Question 5:
  - « … possible isolated minor storm periods. » Do you expect important satellite communications problems?



G 3	Strong	**Power systems:** Voltage corrections may be required, false alarms triggered on some protection devices. **Spacecraft operations:** Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).
G 2	Moderate	**Power systems:** High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. **Spacecraft operations:** Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).
G 1	Minor	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations possible. **Other systems:** Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).

SIDC URSIGRAM 50623
SIDC SOLAR BULLETIN 23 Jun 2015, 1242UT
SIDC FORECAST (valid from 1230UT, 23 Jun 2015 until 25 Jun 2015)
SOLAR FLARES : M-class flares expected (probability >=50%)
GEOMAGNETISM : Major magstorm expected (A>=50 or K>=6)
SOLAR PROTONS : Proton event in progress (>10 MeV)
PREDICTIONS FOR 23 Jun 2015 10CM FLUX: 135 / AP: 038
PREDICTIONS FOR 24 Jun 2015 10CM FLUX: 130 / AP: 038
PREDICTIONS FOR 25 Jun 2015 10CM FLUX: 125 / AP: 018
COMMENT: NOAA active region 2371 produced an M6.5 flare, peaking at 18:23 UT on June 22. An associated full halo CME erupted, with first measurement in LASCO C2 at 18:36 UT on June 22 and has a projected speed around 1000 km/s . A few filament eruptions were recorded in the Northwest quadrant, first a small one around 22:00 UT and then an extended one starting near 4:24 UT. Coronagraphic data indicate the occurrence of (mainly westward) CMEs, but incomplete data currently prohibit full analysis.

Proton levels have descended from the peak of 1070 pfu (19UT), despite some smaller peaks and are around 30 pfu at the moment. NOAA AR 2367 is now close to the West limb and could, in case of further eruptions, elevate the proton levels again. The proton levels might also be enhanced at the expected June 22 CME arrival. Flares at the M-level are expected, with some chance (15%) for a flare at the X-level.

A shock arrived to the ACE spacecraft at 18:01 UT on June 22, marking the expected arrival of the June 21 CME. The interplanetary magnetic field (IMF) magnitude jumped to 42 nT, with long periods of negative Bz down to -39 nT. Solar wind speeds reached values between 600 and 780 km/s. The IMF magnitude has declined to a current value of 12 nT.

Minor to severe geomagnetic conditions were recorded, with severe levels between 18 and 21 UT (on June 22) and between 3 and 6 UT (on June 23). The local K at Dourbes reached K=8 at 22 UT (on June 22). A decline to unsettled levels is expected for the coming hours. Further minor to major storm levels are expected, following the expected arrival of June 22 CME around 12:00 UT on June 24.

TODAY'S ESTIMATED ISN : 042, BASED ON 14 STATIONS.

SOLAR INDICES FOR 22 Jun 2015
WOLF NUMBER CATANIA : 083
10CM SOLAR FLUX : 135
AK CHAMBON LA FORET : 108
AK WINGST : ///
ESTIMATED AP : 073
ESTIMATED ISN : 047, BASED ON 23 STATIONS.

NOTICEABLE EVENTS SUMMARY

DAY	BEGIN	MAX	END	LOC	XRAY	OP	10CM	Catania/NOAA	RADIO_BURST_TYPES
22	1739	1823	1851	N12W08	M6.5	2B	1000	92/2371	II/1

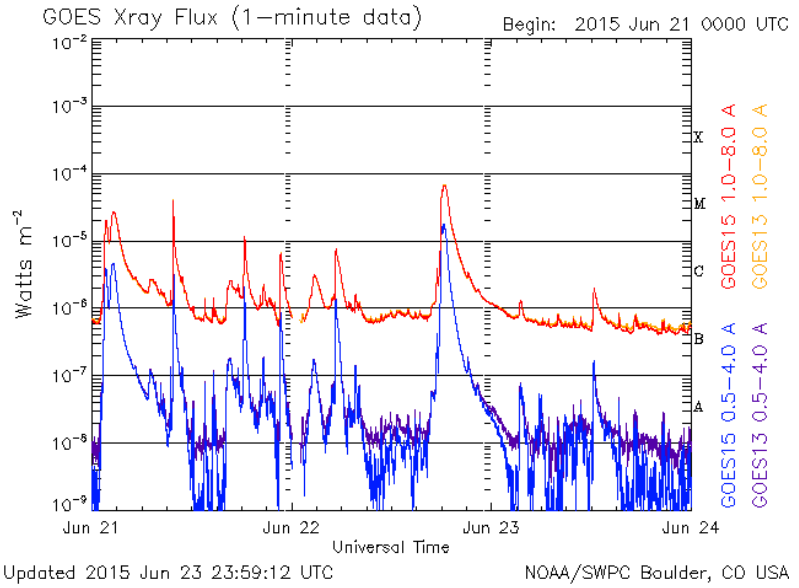
END

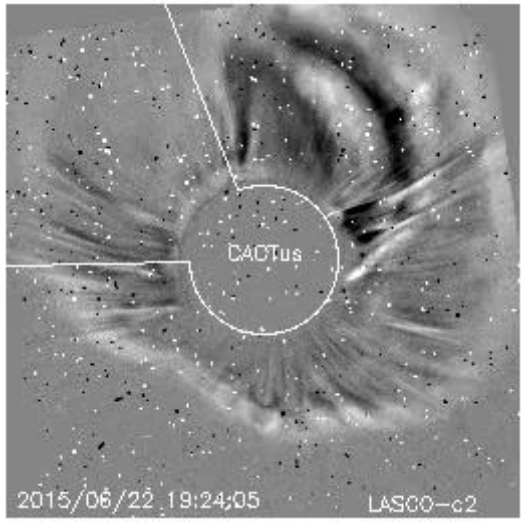
URSIgram – Exercise 2

- **Setting**
  - You have received the above URSIgram (23 June 2015 – 12:42UT). You have to brief your SWx colleagues.
- **Questions**
  - Where on the solar surface did the M6 flare take place?
  - How would you characterize the solar activity level (very low, … , very high) over the last 24 hours?
  - Did the M6 flare affect the daily 10.7cm radio flux of 22 June?
  - A proton event is in progress.
    - Do you (still) expect a GLE?
    - What would you recommend concerning arctic polar flights?
  - In terms of Dst, how strong would you expect this event to be (Quiet, … , Extreme)?
  - Based on the description of the geomagnetic storm:
    - Would you expect major satellite problems from deep di-electric charging?
    - Would you expect degradation of GNSS applications (WAAS,…)?

URSIgram – Exercise 2

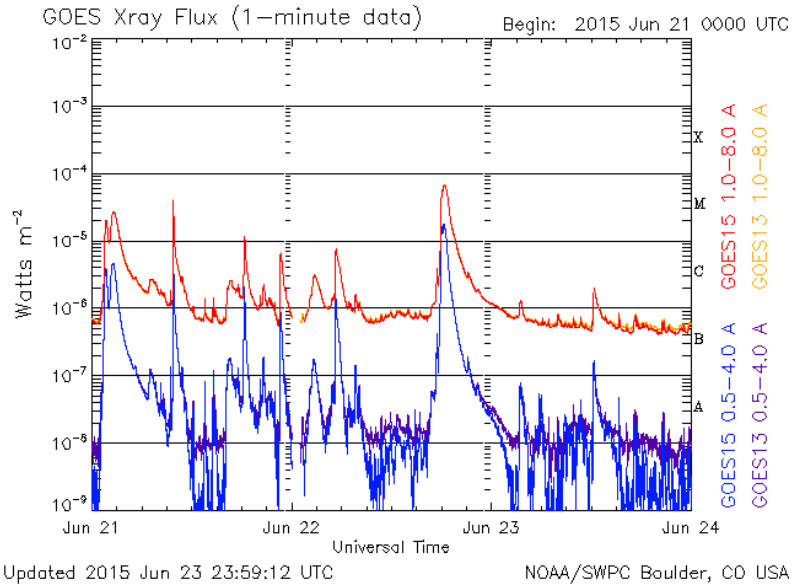
- Where on the solar surface did the M6 flare take place?

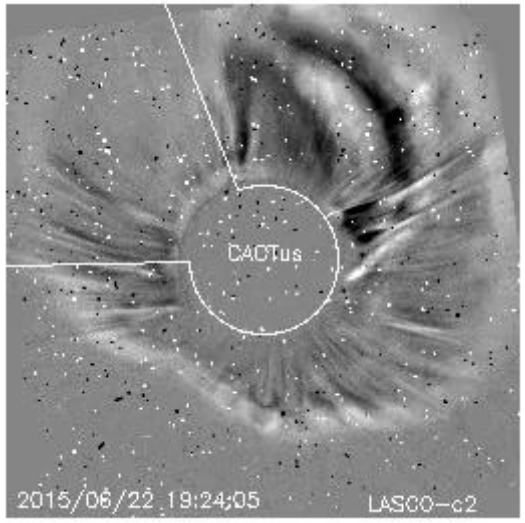




URSIgram – Exercise 2

- How would you characterize the solar activity level (very low, … , very high) over the last 24 hours?





URSIgram – Exercise 2

- Did the M6 flare affect the daily 10.7cm radio flux of 22 June?

TODAY'S ESTIMATED ISN : 042, BASED ON 14 STATIONS.

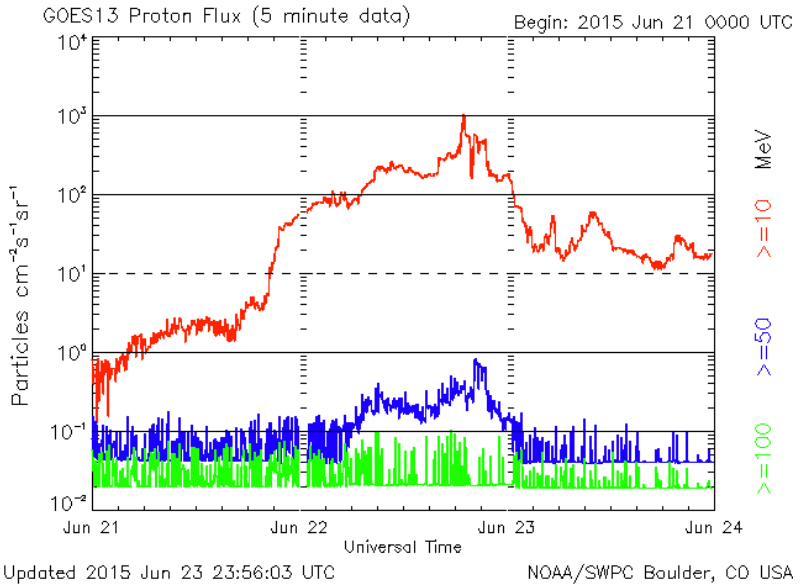
SOLAR INDICES FOR 22 Jun 2015
WOLF NUMBER CATANIA : 083
10CM SOLAR FLUX :
AK CHAMBON LA FORET : 108
AK WINGST : ///
ESTIMATED AP : 073
ESTIMATED ISN : 047, BASED ON 23 STATIONS.

NOTICEABLE EVENTS SUMMARY
DAY BEGIN MAX END LOC XRAY OP 10CM Catania/NOAA RADIO_BURST_TYPES
22 1739 1823 1851 N12W08 M6.5 2B 1000 92/2371 II/1

Date	Time	Julian day	Carrington rotation	Observed Flux	Adjusted Flux	URSI Flux
2015-06-20	17:00:00	2457194.197	2165.117	134.4	138.8	124.9
2015-06-20	20:00:00	2457194.322	2165.121	135.4	139.8	125.8
2015-06-20	23:00:00	2457194.447	2165.126	134.0	138.4	124.5
2015-06-21	17:00:00	2457195.197	2165.153	133.0	137.4	123.6
2015-06-21	20:00:00	2457195.322	2165.158	131.7	136.0	122.4
2015-06-21	23:00:00	2457195.447	2165.163	128.6	132.8	119.5
2015-06-22	17:00:00	2457196.197	2165.190	130.1	134.3	120.9
2015-06-22	20:00:00	2457196.322	2165.195	246.9	255.0	229.5
2015-06-22	23:00:00	2457196.447	2165.199	127.2	131.3	118.2
2015-06-23	17:00:00	2457197.197	2165.227	116.5	120.3	108.3
2015-06-23	20:00:00	2457197.322	2165.231	116.1	119.9	107.9
2015-06-23	23:00:00	2457197.447	2165.236	116.6	120.4	108.4

URSIgram – Exercise 2

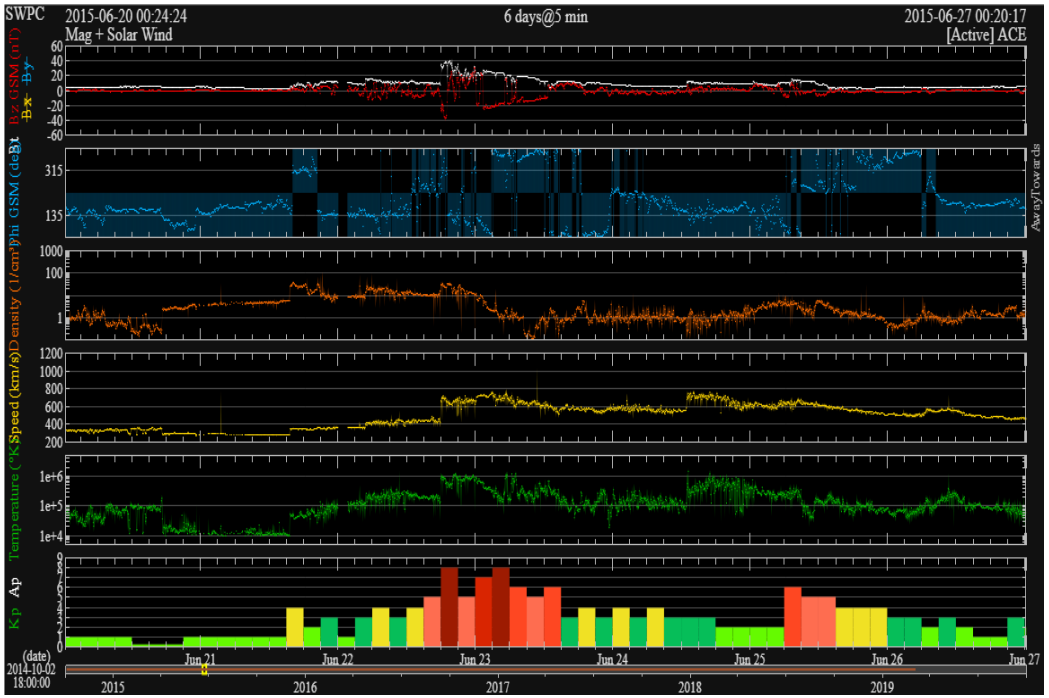
- A proton event is in progress.
  - Do you (still) expect a GLE?
  - What would you recommend concerning arctic polar flights?

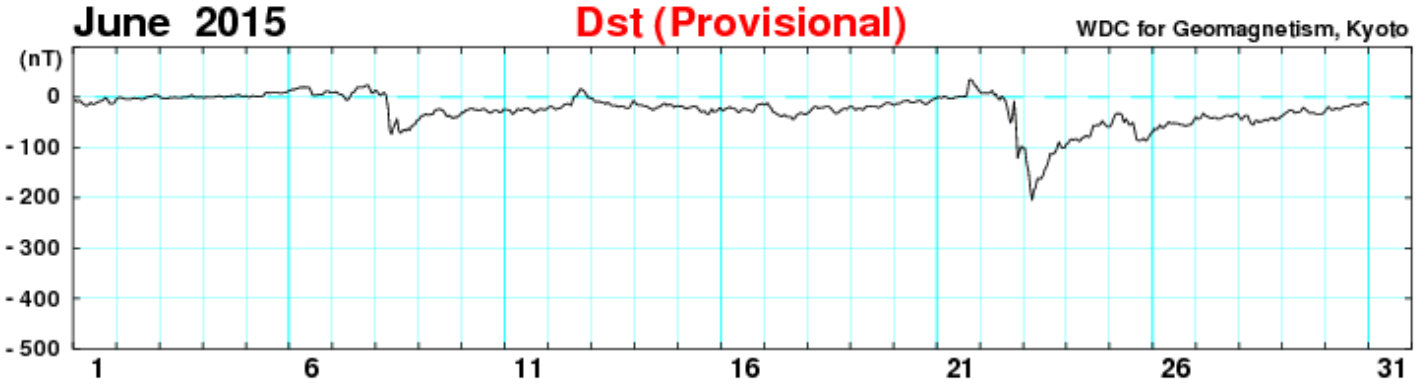


S 4	Severe	**Biological:** Unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** May experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** Blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.
S 3	Strong	**Biological:** Radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** Degraded HF radio propagation through the polar regions and navigation position errors likely.
S 2	Moderate	**Biological:** Passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk. **Satellite operations:** Infrequent single-event upsets possible. **Other systems:** Small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.
S 1	Minor	**Biological:** None. **Satellite operations:** None. **Other systems:** Minor impacts on HF radio in the polar regions.

URSIgram – Exercise 2

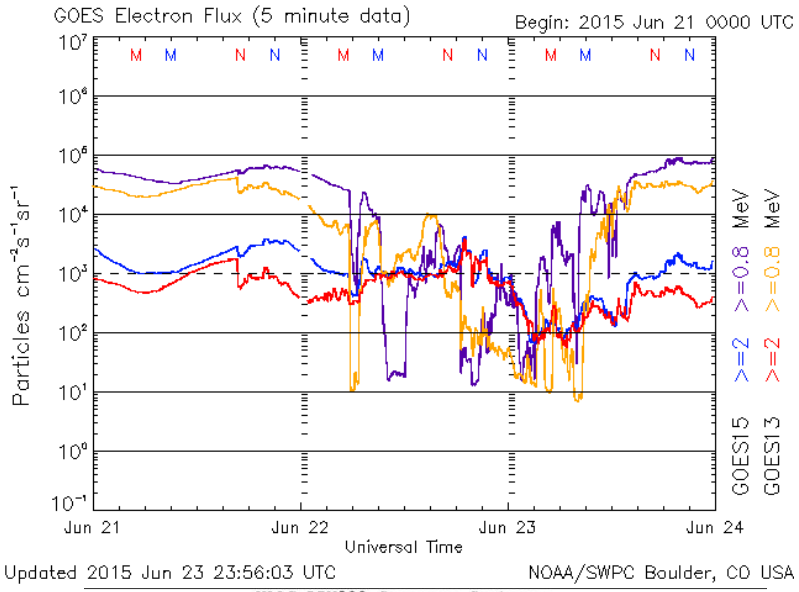
- In terms of Dst, how strong would you expect this event to be (Quiet, … , Extreme)?

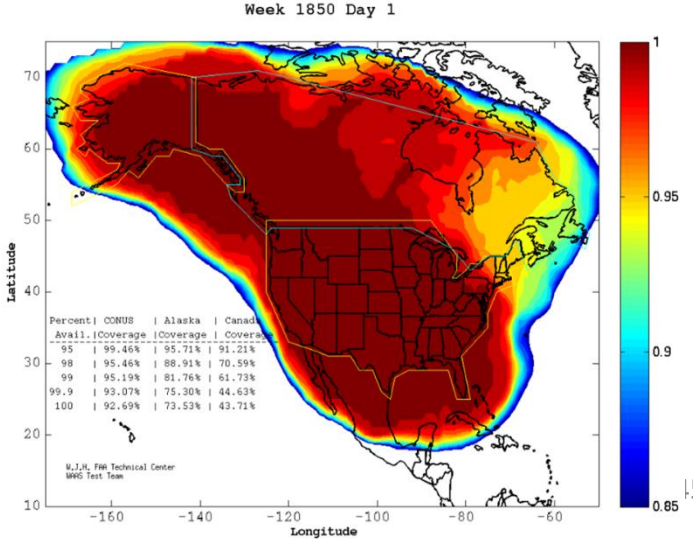




URSIgram – Exercise 2

- Based on the description of the geomagnetic storm:
  - Would you expect major satellite problems from deep di-electric charging?
  - Would you expect degradation of GNSS applications (WAAS,…)?





SIDC/RWC & URSIgram - Summary

- SIDC/RWC
- SWx alerts issued by the SIDC
- Exercises