

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

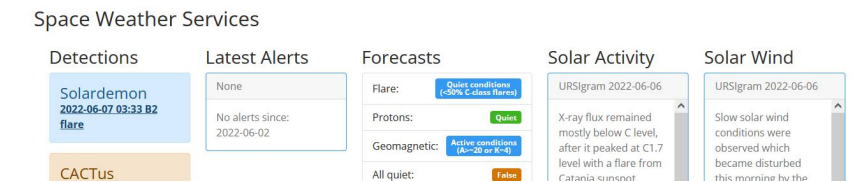
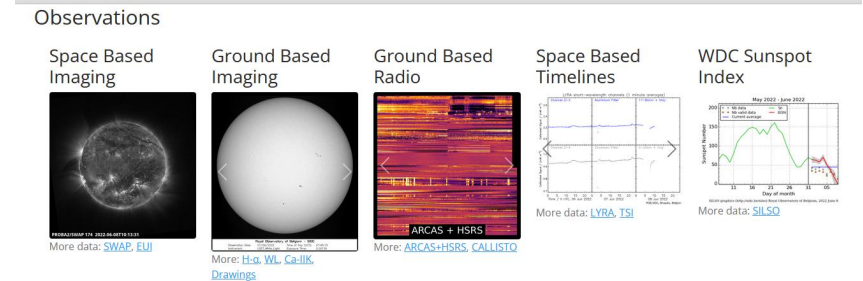
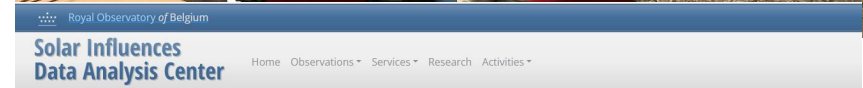
SIDC/RWC & URSIgram - Contents

- **SIDC/RWC**
- SWx alerts
- Exercises

The SIDC / RWC

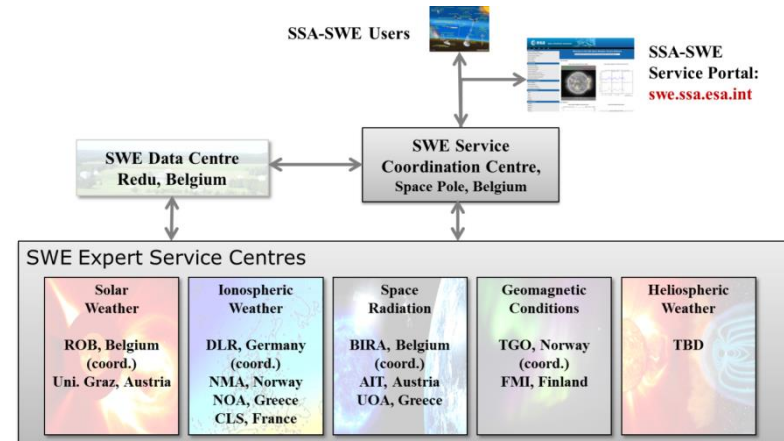
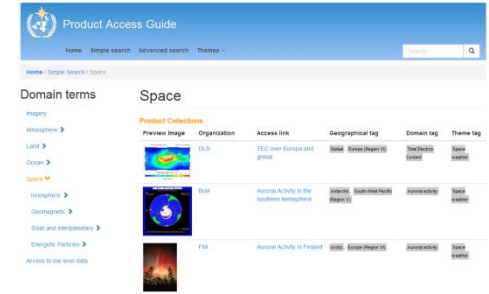
Regional Warning Centre Brussels

- 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



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/>

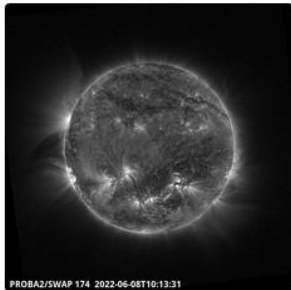
Royal Observatory of Belgium

Solar Influences Data Analysis Center

Home Observations Services Research Activities

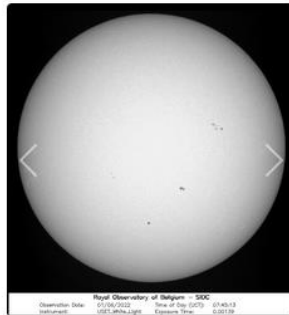
Observations

Space Based Imaging



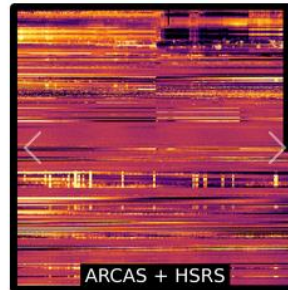
More data: [SWAP](#), [EUI](#)

Ground Based Imaging



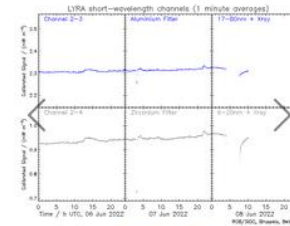
More: [H- \$\alpha\$](#) , [WL](#), [Ca-IIK](#), [Drawings](#)

Ground Based Radio



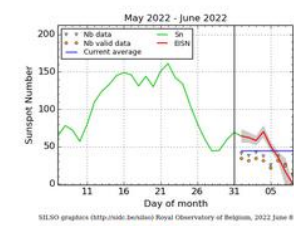
More: [ARCAS+HSRS](#), [CALLISTO](#)

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**
($A_{\phi} > 20$ 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

STCE Newsletter

23 Jan 2017 - 29 Jan 2017

: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



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

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SIDC Space Weather briefing

23 January – 29 January 2017

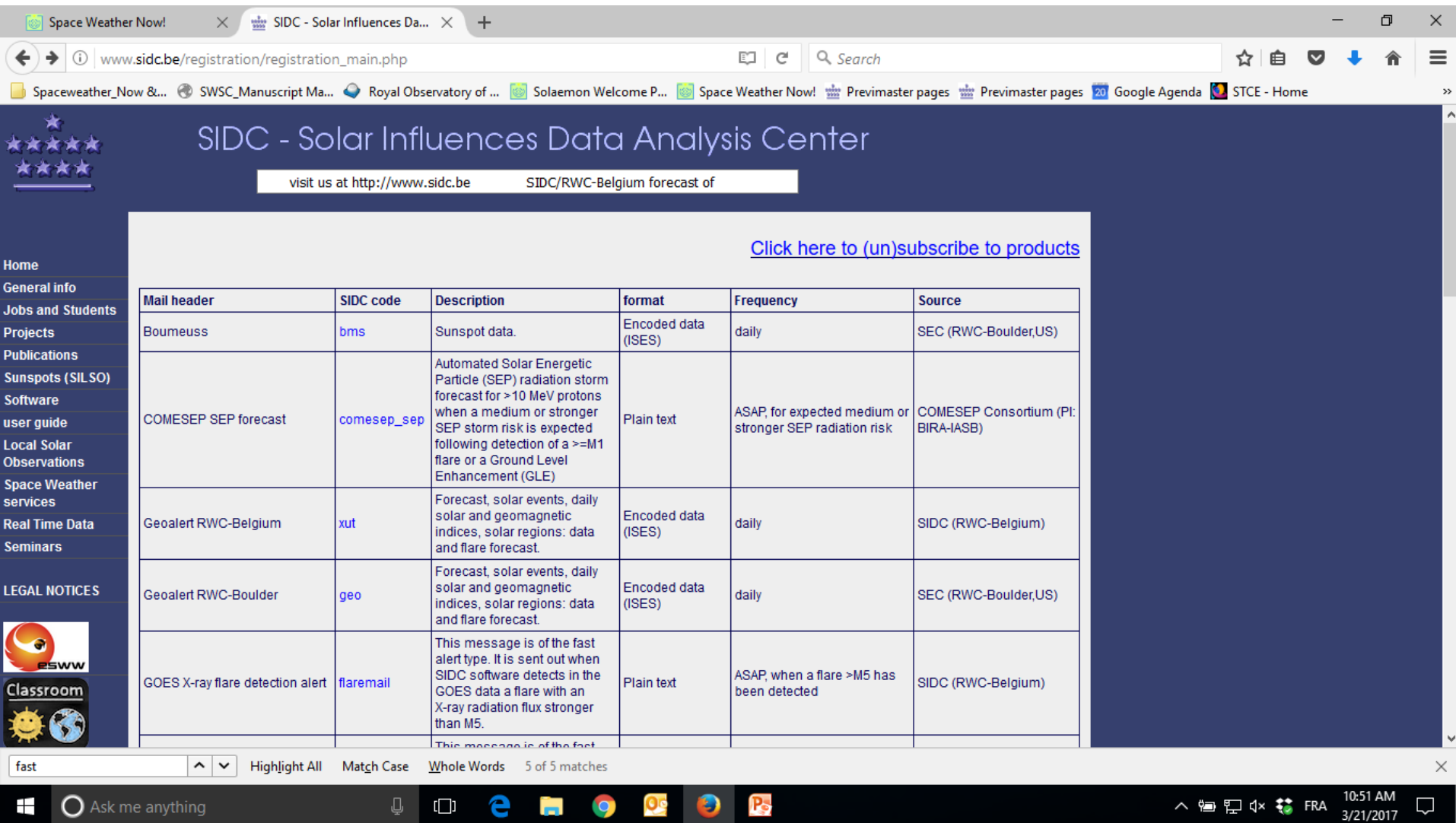
Jan Janssens
&
SIDC forecaster team

Solar Influences
Data analysis Centre
www.sidc.be

★ ★ ★ ★ ★
Royal Observatory
of Belgium

SIDC products – Free online

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



Space Weather Now! SIDC - Solar Influences Da... +

www.sidc.be/registration/registration_main.php

Spaceweather_Now &... SWSC_Manuscript Ma... Royal Observatory of ... Solaemon Welcome P... Space Weather Now! Previmaster pages Previmaster pages Google Agenda STCE - Home

SIDC - Solar Influences Data Analysis Center

visit us at <http://www.sidc.be> SIDC/RWC-Belgium forecast of

[Click here to \(un\)subscribe to products](#)

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)

fast Highlight All Match Case Whole Words 5 of 5 matches

10:51 AM 3/21/2017

SIDC/RWC & URSIgram - Contents

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- SWx alerts
- Exercises



Fast alerts: automatic detection by S IDC software

Flare > M5

S IDC in GOES X-ray

```
:Issued: 2016 Jul 24 0516 UTC
:Product: documentation at http://www.sidc.be/products/flaremail
#-----#
# Large flare alerts from the S IDC (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 S IDC (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.
#-----#
```

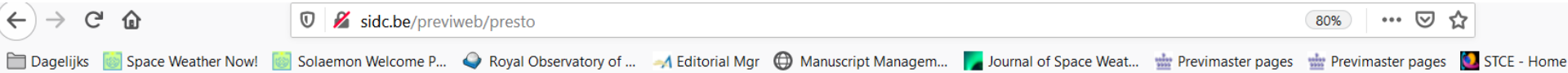
SOHO: Solar and Heiospheric Observatory

CACTus: Computer Aided CME Tracking

LASCO: Large Angle and Spectrometric Coronagraph



PRESTO alert: 1. Criteria



Presto alert



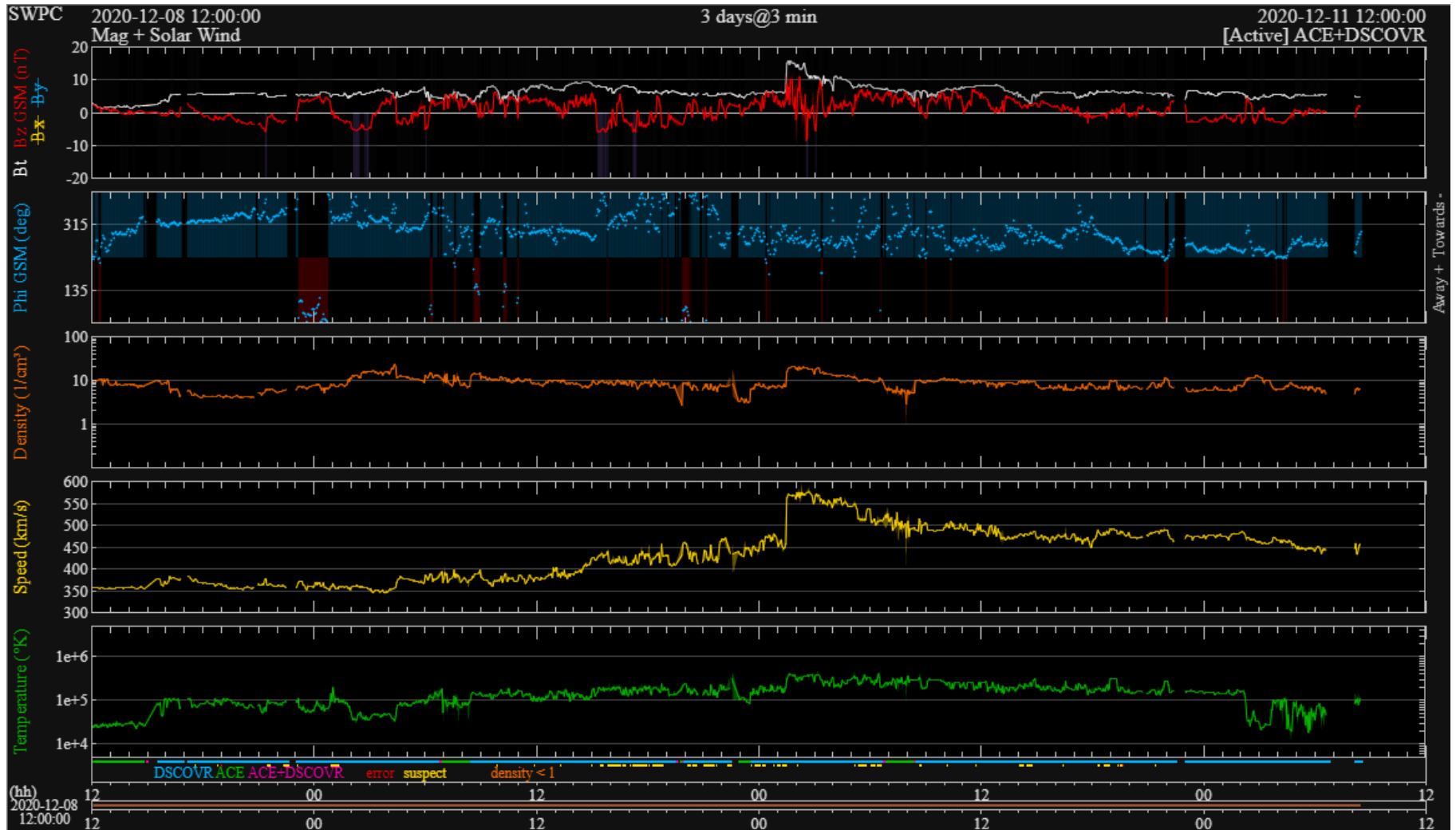
- L1 positive
- www
- mail

Send presto alert

When to send a presto immediately?

- During or just after an **X-flare** occurred.
- In case of a **proton event**.
- When **K > 5**.
- When a **halo CME** or a strong Westward directed CME occurred. Try to find out whether the halo CME is front-sided or not. Therefore look at the EIT images to find a related flare.
- In case you observe a **fast forward shock** in the solar wind speed.
- In case you observe enhanced solar wind conditions which will likely lead to geomagnetic storm conditions **K > 5**.

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





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 $\geq 50\%$)

GEOMAGNETISM : Active conditions expected ($A \geq 20$ 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 $A \geq 20$ while $A_p=17$?
- 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.

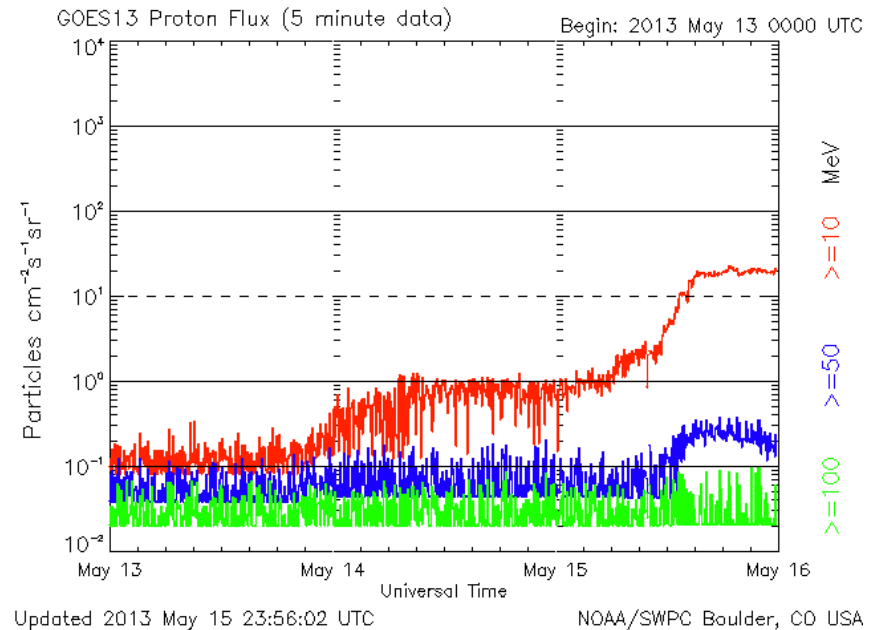
- **Questions – Part 2 of 2: SWx impact questions**

- 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

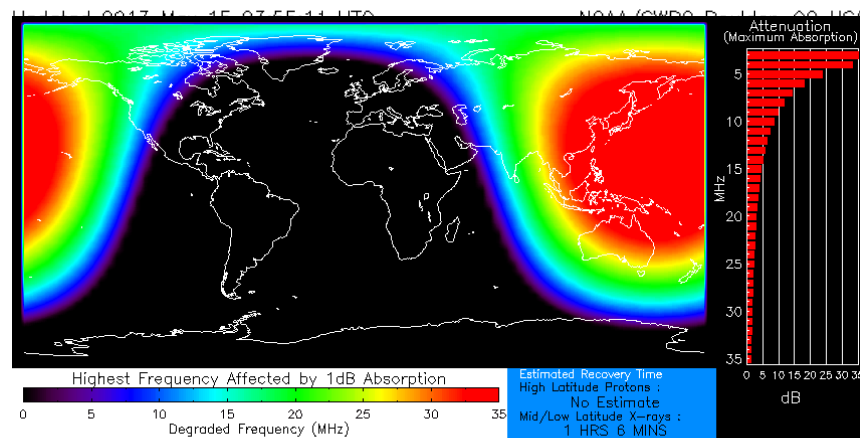
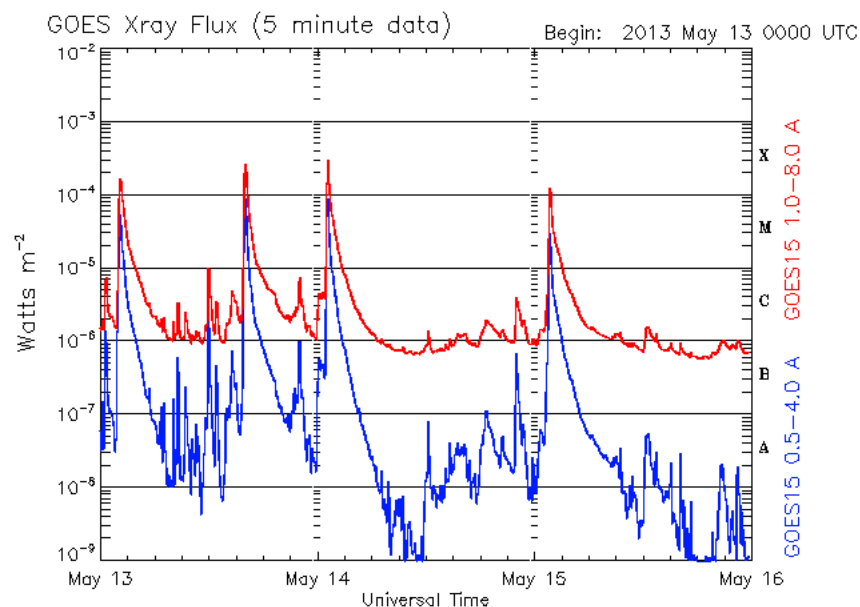
- Question 1:
 - Has the >10MeV proton event threshold been reached? If yes, what would be your communications advice concerning a Dutch submarine operating north of Iceland?



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

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?

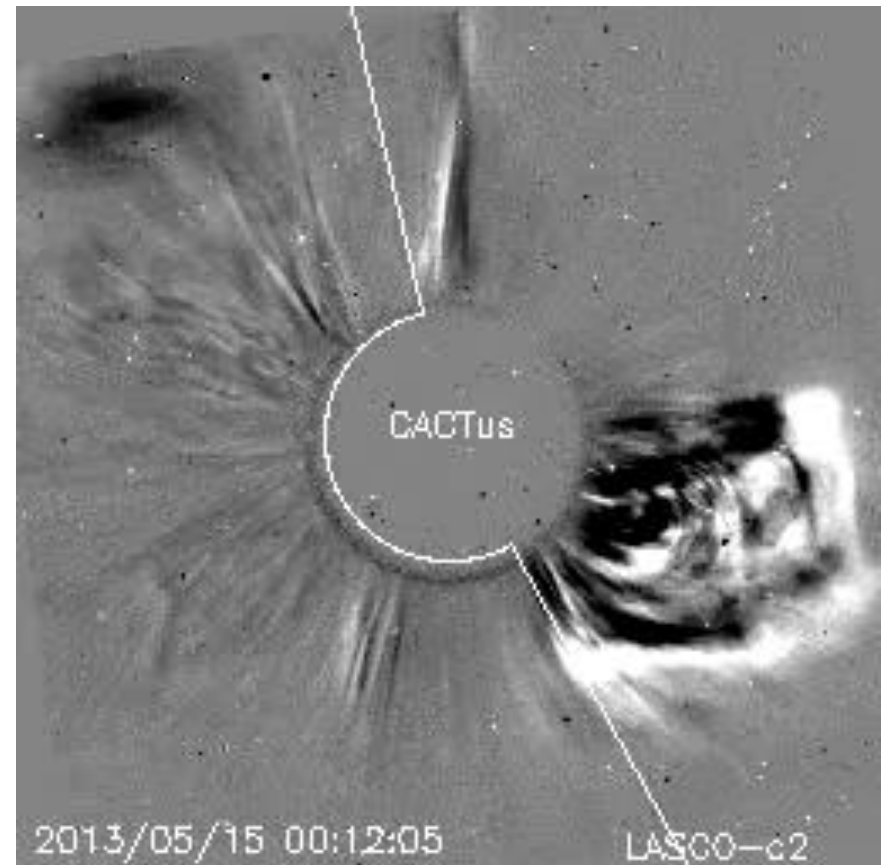


Strong X-ray flux
Product Valid At : 2013-05-15 01:49 UTC

Normal Proton Background
NOAA/SWPC Boulder, CO USA

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?

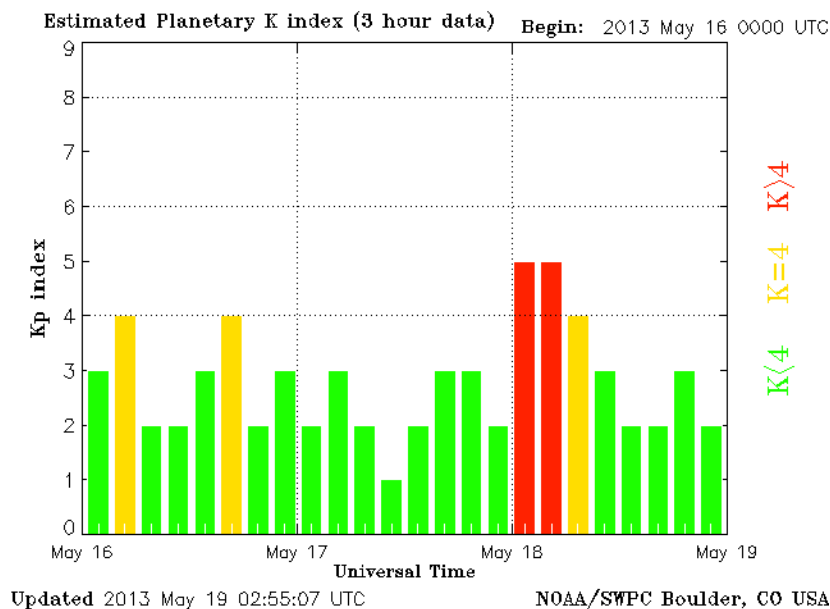
```
:Created: 2013 May 18 0332 UT
>Date: 2013 05 15
# Prepared by the U.S. Dept. of Commerce, NOAA, Space Weather Prediction Center
# Please send comments and suggestions to SWPC.Webmaster@noaa.gov
#
# Missing data: ////
# Updated every 30 minutes.
#
# Edited Events for 2013 May 15
#
#Event   Begin   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	<p>Power systems: Voltage corrections may be required, false alarms triggered on some protection devices.</p> <p>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.</p> <p>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.).</p>
G 2	Moderate	<p>Power systems: High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage.</p> <p>Spacecraft operations: Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions.</p> <p>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.).</p>
G 1	Minor	<p>Power systems: Weak power grid fluctuations can occur.</p> <p>Spacecraft operations: Minor impact on satellite operations possible.</p> <p>Other systems: Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).</p>



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 $\geq 50\%$)

GEOMAGNETISM : Major magstorm expected ($A \geq 50$ or $K \geq 6$)

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.

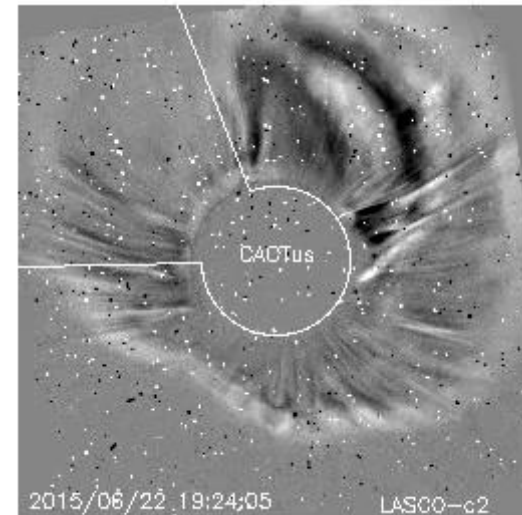
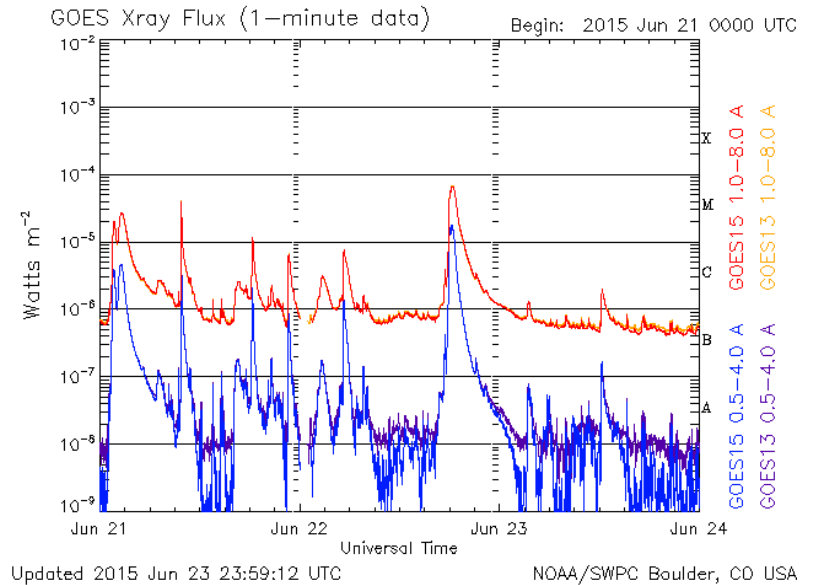
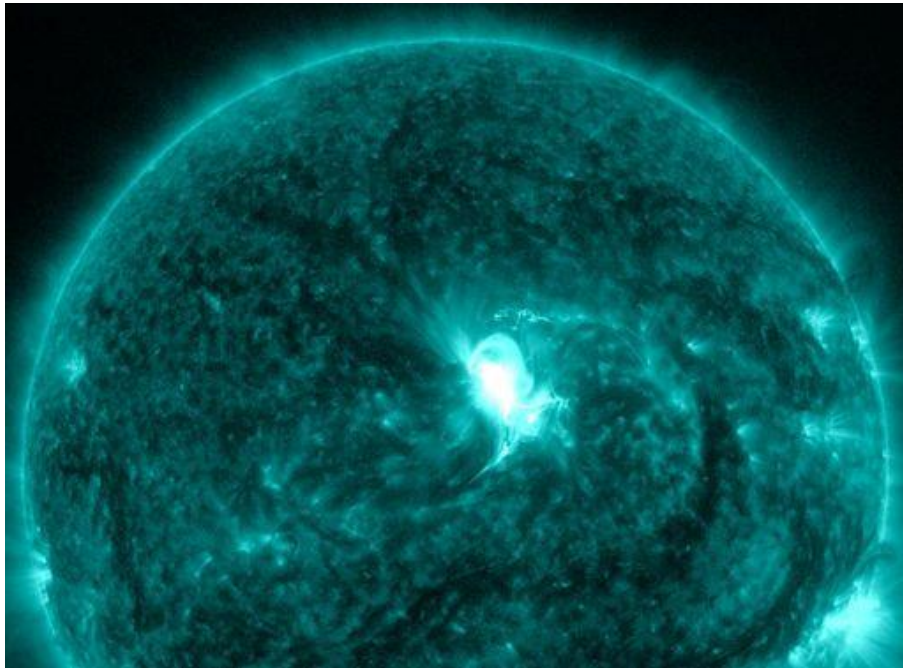
- **Questions**

- 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,...)?



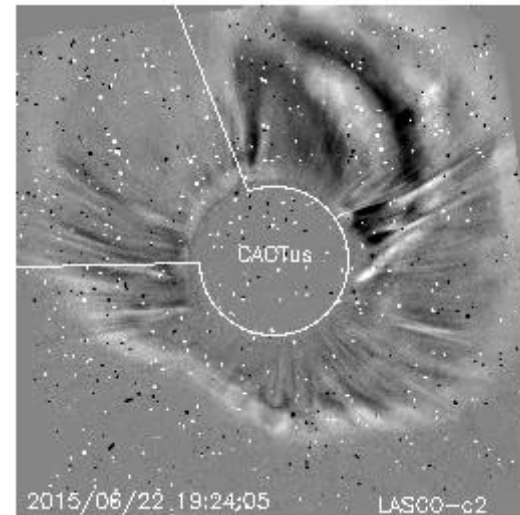
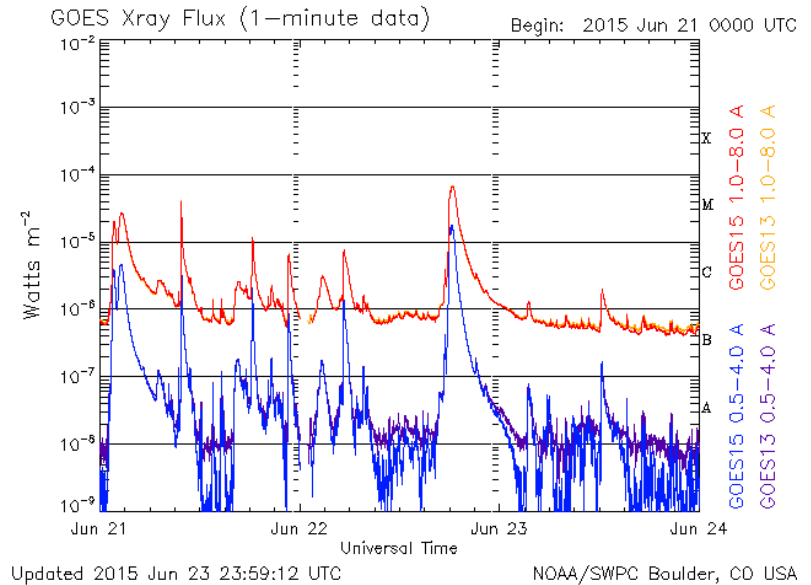
URSIgram – Exercise 2

- 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

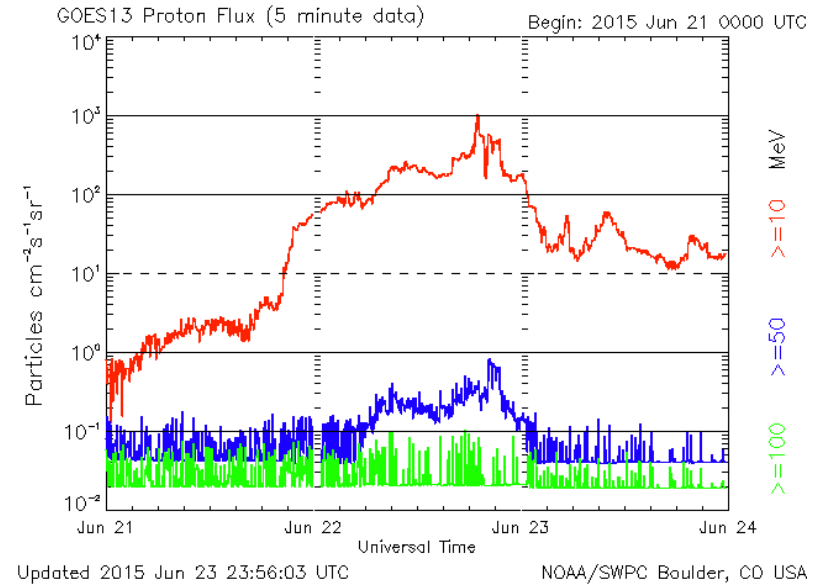
22 1739 1823 1851 N12W08 M6.5 2B 1000 92/2371 II/1

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

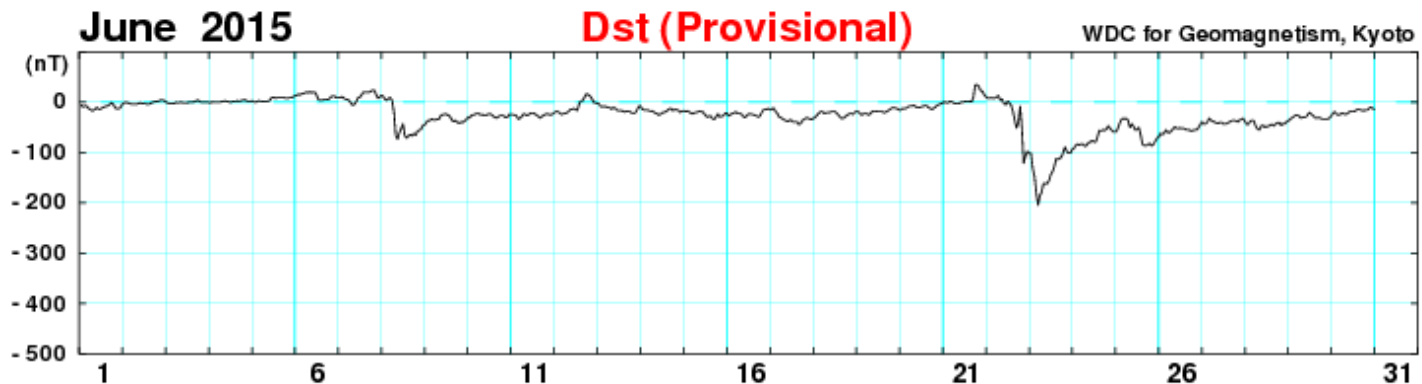
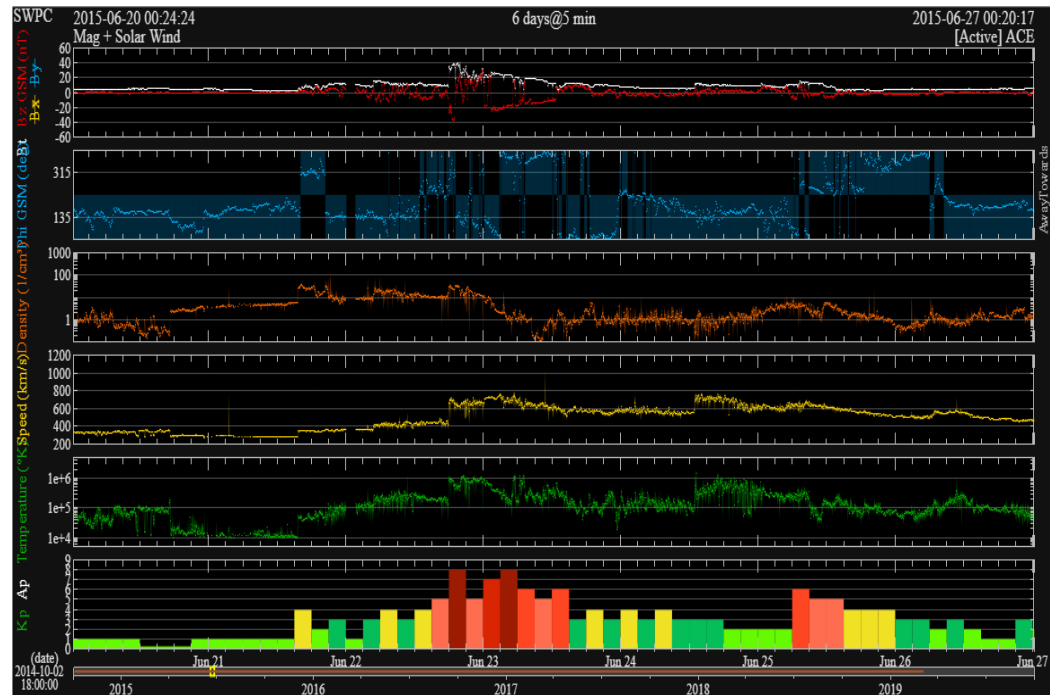
- A proton event is in progress.
 - Do you (still) expect a GLE?
 - What would you recommend concerning arctic polar flights?



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

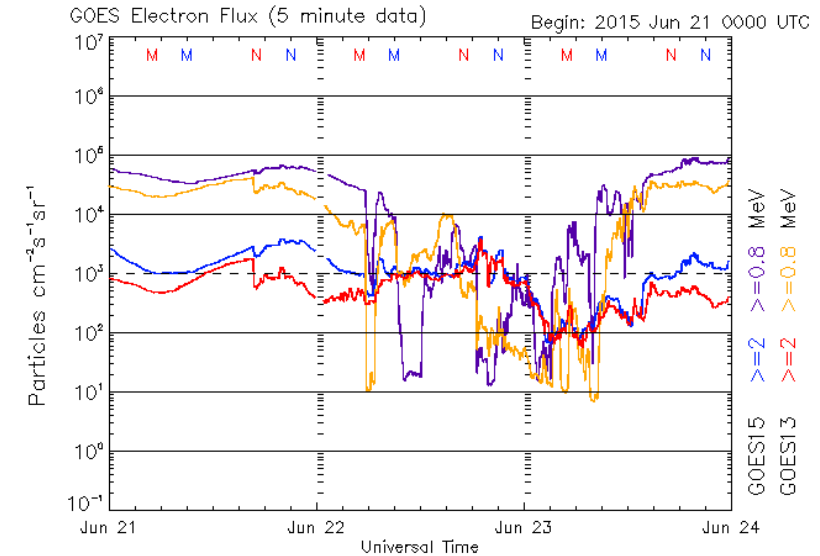
URSIgram – Exercise 2

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

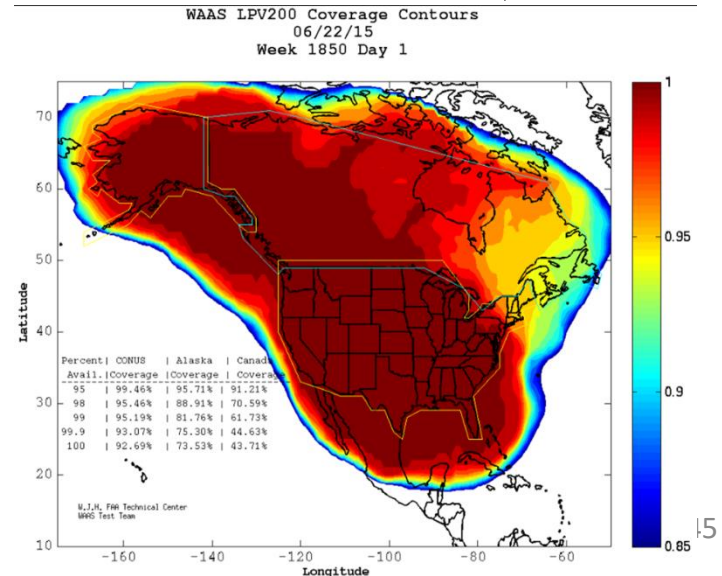


URSIgram – Exercise 2

- 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,...)?



Updated 2015 Jun 23 23:56:03 UTC NOAA/SWPC Boulder, CO USA



SIDC URSIGRAM 30424

SIDC SOLAR BULLETIN 24 Apr 2023, 1236UT

SIDC FORECAST (valid from 1230UT, 24 Apr 2023 until 26 Apr 2023)

SOLAR FLARES : C-class flares expected, (probability >=50%)

GEOMAGNETISM : Minor storm expected (A>=30 or K=5)

SOLAR PROTONS : Quiet

PREDICTIONS FOR 24 Apr 2023 10CM FLUX: 133 / AP: 051

PREDICTIONS FOR 25 Apr 2023 10CM FLUX: 140 / AP: 018

PREDICTIONS FOR 26 Apr 2023 10CM FLUX: 145 / AP: 010

COMMENT: Solar flaring activity was low and infrequent during the last 24 hours. Three C-class flares were detected, all from NOAA Active Region (AR) 3282 (magnetic type Beta-Gamma, Catania group 61). Further C-class activity is likely in the next 24 hours, either from NOAA AR 3282 or NOAA AR 3285 (magnetic type Beta, Catania group 65).

No Earth-directed Coronal Mass Ejections (CME) were observed in the last 24 hours.

The greater than 10 MeV proton flux exceeded the 10 pfu level yesterday between 18:15 and 18:40 UT and stayed at nominal levels for the rest of the past 24 hours. In the next 24 hours it is expected to remain below the 10 pfu level. The greater than 2 MeV electron flux remained below the 1000 pfu alert threshold and is expected to remain below this threshold during the next 24 hours. The 24h electron fluence was at nominal levels and is expected to remain so.

A small equatorial coronal hole of negative polarity started crossing the central meridian today. An associated high speed stream in in-situ solar wind measurements is expected for 28 April.

The Solar Wind (SW) conditions are strongly affected by the arrival of a Coronal Mass Ejection (CME) as previously forecasted. The SW speed increased from 340 km/s before the arrival of the CME to 650 km/s by today 01:00 UT. The total interplanetary magnetic field (Btot) increased to 35 nT yesterday at 17:00 UT, while its North-South component (Bz) dropped as low as -33 nT. The interplanetary magnetic field phi angle was predominantly directed towards the Sun over the last 24 hours. For the next 24 hours the SW speed and the Btot are expected to remain high, however the Bz has already increased above zero and is not expected to drop to such low values in the next 24 hours.

Geomagnetic conditions reached globally severe storm (Kp 8 between 18:00-21:00 UT yesterday and 03:00-06:00 UT today, Kp 8- between 21:00-00:00 yesterday) and strong storm (Kp 7 between 00:00-03:00 and Kp 7- between 06:00-09:00 today), while the rest of the time they were at minor to moderate storm levels. Locally the situation was rather similar, with K BEL at storm level (K BEL 5 or more) since yesterday 21:00 UT. Storm levels are expected for the next several hours and a significant decrease for the rest of the next 24 hours, both globally and locally.

TODAY'S ESTIMATED ISN : 077, BASED ON 09 STATIONS.

SOLAR INDICES FOR 23 Apr 2023

WOLF NUMBER CATANIA : ///

10CM SOLAR FLUX : 135

AK CHAMBON LA FORET : 103

AK WINGST : 062

ESTIMATED AP : 055

ESTIMATED ISN : 087, BASED ON 16 STATIONS.

NOTICEABLE EVENTS SUMMARY

DAY BEGIN MAX END LOC XRAY OP 10CM Catania/NOAA RADIO_BURST_TYPES

NONE

END



URSIgram – Exercise 3

- **Setting**

- You have received the above URSIgram (24 April 2023 – 12:36UT). You have to brief your SWx colleagues.

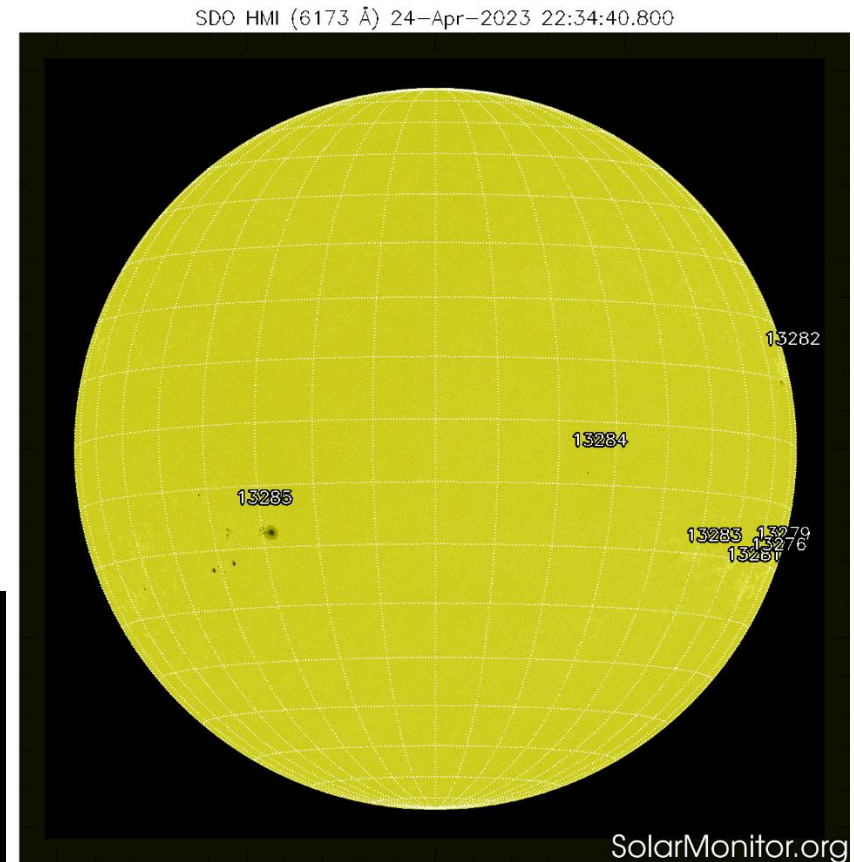
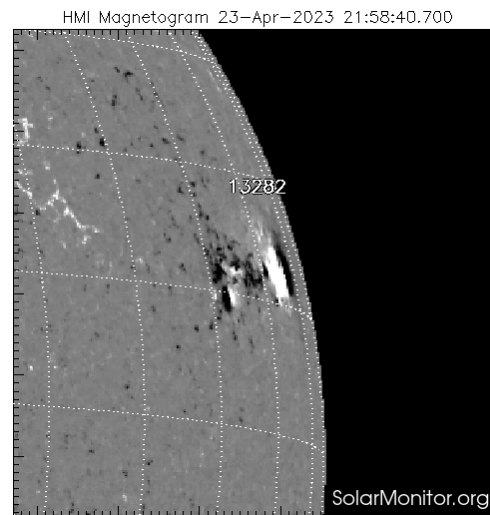
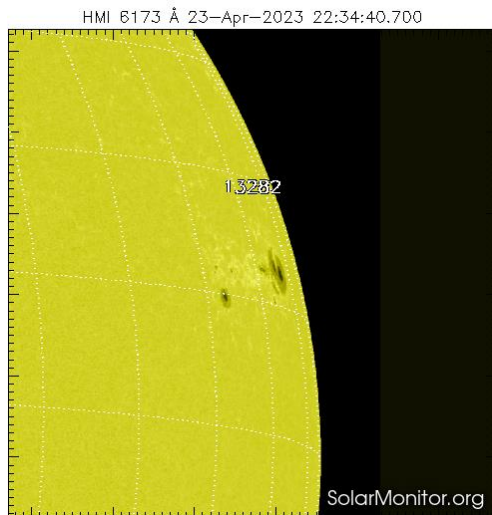
- **Questions**

- Do you agree with the SWx forecasters prognosis of solar flare activity (C-class flares expected)? Why (not)?
- Around 14:15UT, the Humaïn solar radio observatory detects a disturbance in the radio-spectrogram. What type of solar radio-burst is this?
- In terms of Dst, how strong would you expect this event to be (Quiet, ... , Extreme)? Do you expect any drag effects?
- Based on the description of the geomagnetic storm, would you expect degradation of GNSS applications (WAAS,...)?
- Do you still expect there will be advisories (warning messages) for the International civil aviation to be send? If yes, in which domains (GNSS, Radiation, HF Com)?



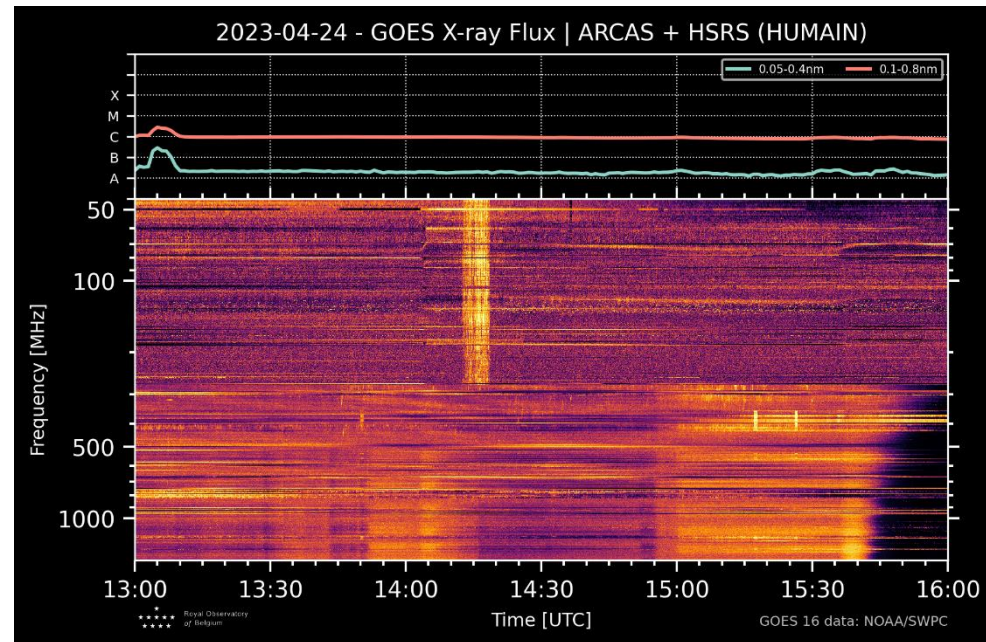
URSIgram – Exercise 3

- Do you agree with the SWx forecasters prognosis of solar flare activity (C-class flares expected)? Why (not)?



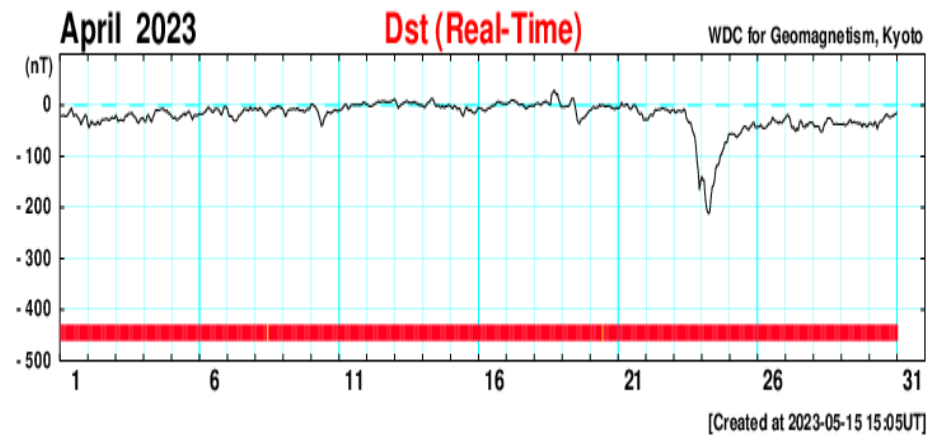
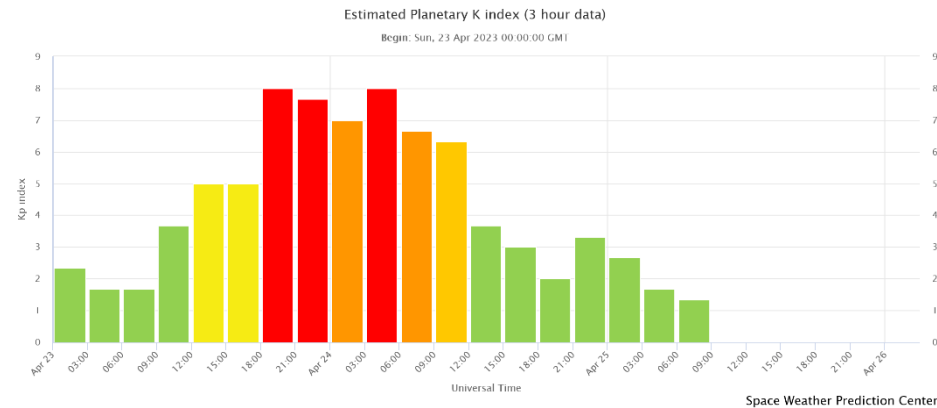
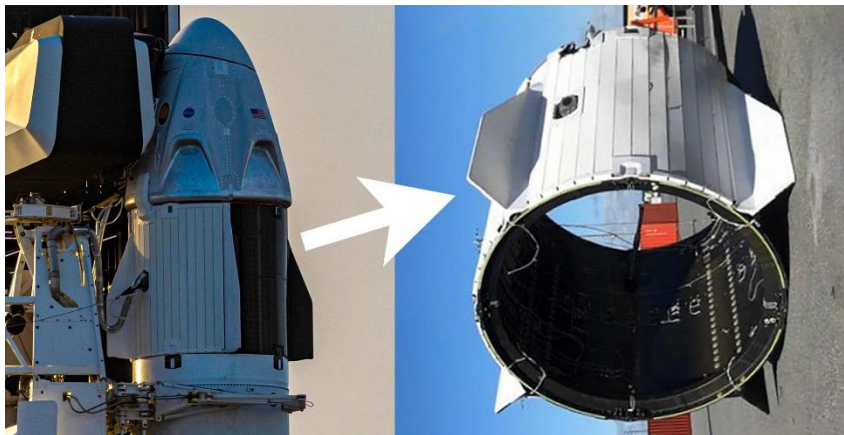
URSIgram – Exercise 3

- Around 14:15UT, the Humain solar radio observatory detects a disturbance in the radio-spectrogram. What type of solar radio-burst is this?



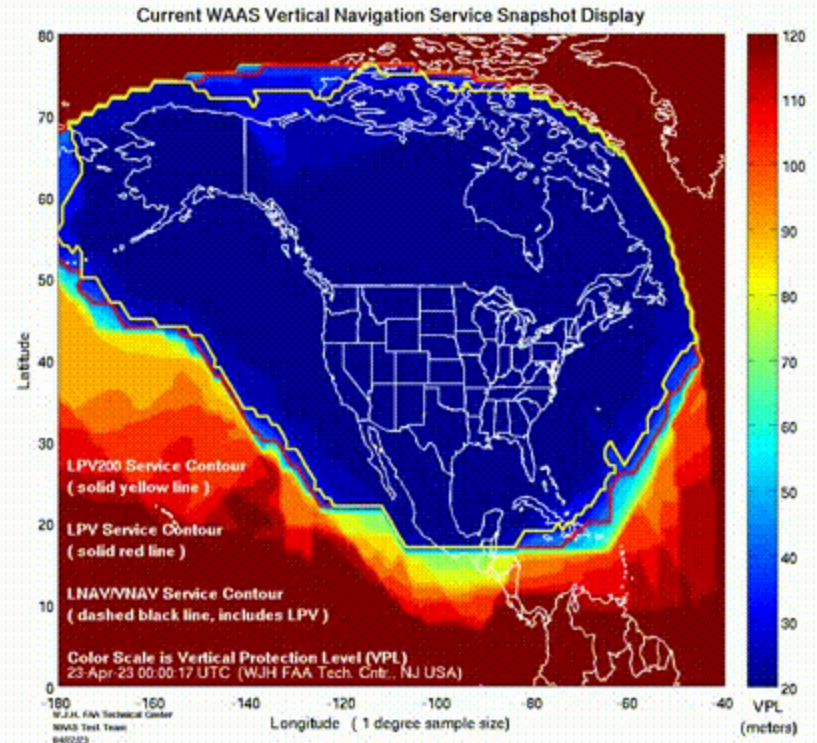
URSIgram – Exercise 3

- In terms of Dst, how strong would you expect this event to be (Quiet, ... , Extreme)?
- Do you expect any drag effects?



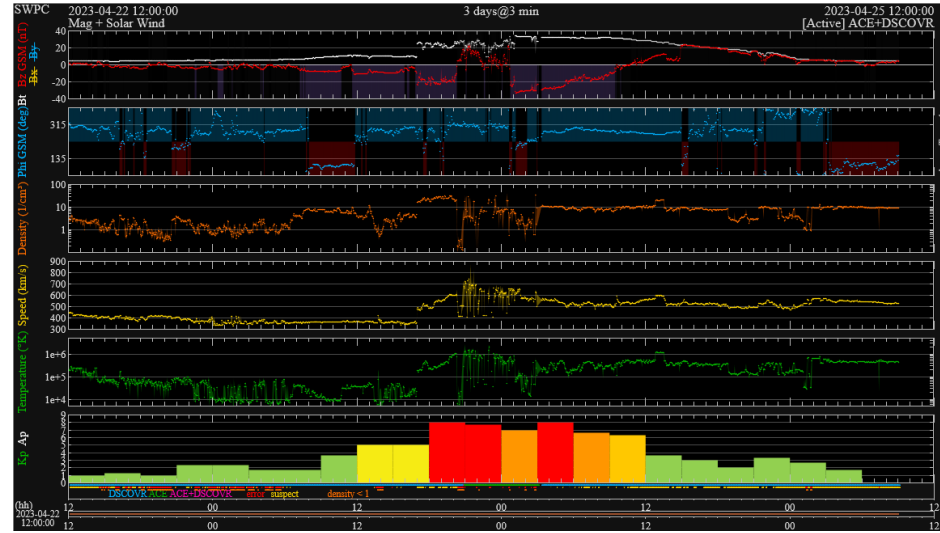
URSIgram – Exercise 3

- Based on the description of the geomagnetic storm, would you expect degradation of GNSS applications (WAAS,...)?



URSIgram – Exercise 3

- Do you still expect there will be advisories (warning messages) for the International civil aviation to be send? If yes, in which domains (GNSS, Radiation, HF Com)?



PECASUS DASHBOARD on 2023-04-24 12:00 UTC

GNSS	Moderate	Severe	Time UTC	Values	Status	Alert	Max-3h values	Max-3h status
Amplitude Scintillation	0.5	0.8	2023-04-24 12:00	0.38	QUIET	🔔	0.38	QUIET
Phase Scintillation	0.4	0.7	2023-04-24 12:00	0.30	QUIET	🔔	0.33	QUIET
Vertical TEC	125	175	2023-04-24 12:00	162.59	QUIET	🔔	162.83	MODERATE

RADIATION	Moderate	Severe	Time UTC	Flags	Status	Alert	Max-3h flags	Max-3h status
Effective Dose FL ≤ 460	30	80	2023-04-24 12:00	0	QUIET	🔔	0	QUIET
Effective Dose FL > 460	/	80	2023-04-24 12:00	0	QUIET	🔔	0	QUIET

HF COM	Moderate	Severe	Time UTC	Values/Flags	Status	Alert	Max-3h values	Max-3h status
Auroral Absorption (AA)	8	9	2023-04-24 12:00	5.0	QUIET	🔔	6.3	WARNING
Polar Cap Absorption (PCA)	2	5	2023-04-24 12:00	0.06	QUIET	🔔	0.19	QUIET
Shortwave Fadeout (SWF)	x1.0	x10.0	2023-04-24 12:00	< M5 flare	QUIET	🔔	< M5 flare	QUIET
Post-Storm Depression (PSD)	30%	50%	2023-04-24 12:00	2	SEVERE	🔔	2	SEVERE

PECASUS DASHBOARD on 2023-04-25 00:00 UTC

GNSS	Moderate	Severe	Time UTC	Values	Status	Alert	Max-3h values	Max-3h status
Amplitude Scintillation	0.5	0.8	2023-04-25 00:00	0.38	QUIET	🔔	0.47	QUIET
Phase Scintillation	0.4	0.7	2023-04-25 00:00	0.22	QUIET	🔔	0.26	QUIET
Vertical TEC	125	175	2023-04-25 00:00	156.28	QUIET	🔔	157.32	MODERATE

RADIATION	Moderate	Severe	Time UTC	Flags	Status	Alert	Max-3h flags	Max-3h status
Effective Dose FL ≤ 460	30	80	2023-04-25 00:00	0	QUIET	🔔	0	QUIET
Effective Dose FL > 460	/	80	2023-04-25 00:00	0	QUIET	🔔	0	QUIET

HF COM	Moderate	Severe	Time UTC	Values/Flags	Status	Alert	Max-3h values	Max-3h status
Auroral Absorption (AA)	8	9	2023-04-25 00:00	3.0	QUIET	🔔	4.0	QUIET
Polar Cap Absorption (PCA)	2	5	2023-04-25 00:00	0.09	QUIET	🔔	0.12	QUIET
Shortwave Fadeout (SWF)	x1.0	x10.0	2023-04-25 00:00	< M5 flare	QUIET	🔔	< M5 flare	QUIET
Post-Storm Depression (PSD)	30%	50%	2023-04-25 00:00	2	SEVERE	🔔	2	SEVERE

SIDC/RWC & URSIgram - Summary

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

