

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

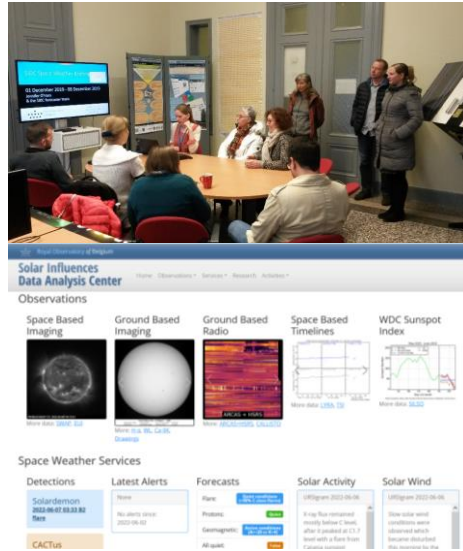
- SIDC/RWC
- SWx alerts
- Exercises

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, radiation, GNSS



SIDC: Solar Influences Data analysis Center – ICAO: International Civil Aviation Organization - HF: High Frequency – GNSS: Global Navigation Satellite System

International Space Environment Service

ISES (International Space Environment Services):
international network

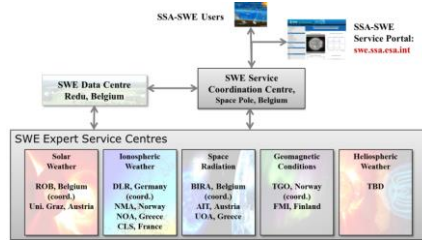
- ROB/SIDC is RWC (Regional Warning centre) since 2000
- endorsement by national government
- Services delivered to SWE network developed under ESA SSA (Space Situational Awareness) program (cfr. presentation by MK). Expert Group coordinating the Expert Service Centre “Solar Weather”

ICAO: International Civil Aviation Organization

PECASUS: Pan European Consortium for 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



International Space Environment Service
<http://www.spaceweather.org/>

ISES (International Space Environment Services):
international network

- ROB/SIDC is RWC (Regional Warning Centre) since 2000
- endorsement by national government
- Services delivered to SWE network developed under ESA SSA (Space Situational Awareness) program (cfr. presentation by MK). Expert Group coordinating the Expert Service Centre "Solar Weather"

WMO: WMO: ICTWS: 4-year → plan for consolidation of SWx services in WMO.

ICTSW: Interprogramme Coordination Team on Space Weather

WMO: World Meteorological Organization

URSIgram

<http://www.sidc.be/>

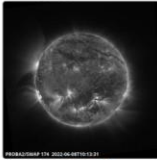
Royal Observatory of Belgium

Solar Influences Data Analysis Center

Home Observations Services Research Activities

Observations

Space Based Imaging



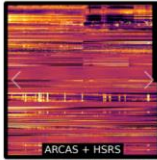
More data: [SWAP](#), [EUI](#)

Ground Based Imaging



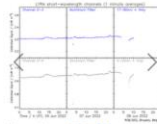
More: [H- \$\alpha\$](#) , [WL](#), [Ca-IIK](#), [Drawings](#)

Ground Based Radio



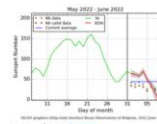
More: [ARCAS+HSRS](#), [CALLISTO](#)

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 \(E=0%, C-class flares\)](#)
Protons: [Quiet](#)
Geomagnetic: [Active conditions \(A \$\geq\$ 20 or K \$\geq\$ 4\)](#)
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 539 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	BWG	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)
BWG : 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	ORAY	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.sidc.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.

Content	Page
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7. Review of ionospheric activity (23 Jan 2017 - 29 Jan 2017)	14



Solar Influences
Data Analysis Centre
www.sidc.be

Royal Observatory
of Belgium

The space weather briefing as a pdf: http://www.sidc.be/news/SIDCSWbriefing2017-01-30_en.pdf

SIDC products – Free online

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

The screenshot shows the SIDC - Solar Influences Data Analysis Center website. The main content is a table listing various products available for registration. The table has columns for Mail header, SIDC code, Description, format, Frequency, and Source. A search bar at the bottom indicates 5 matches for the search term 'fast'.

Mail header	SIDC code	Description	format	Frequency	Source
Boumeuss	bms	Sunspot data.	Encoded data (ISES)	daily	SEC (RWC-Boulder,US)
COMESSEP SEP forecast	comessep_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	COMESSEP 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. <small>This message is of the fast</small>	Plain text	ASAP, when a flare >M5 has been detected	SIDC (RWC-Belgium)

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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 #
# 'rvdliinden@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| 02 | 328| 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**.

A shock is considered to have the following criteria, calculated using a 10 min average before and after the shock:

- A 20+ % increase in B, N (density), and T
- A 20+ km/s increase in V (speed)

From: Interplanetary shock database (S. Nikbakhsh, PhD thesis)

<https://helda.helsinki.fi/bitstream/handle/10138/45227/Thesis.pdf>

PRESTO alert: 3. Send

PRESTO ALERT

Message 14 of 1168



From Solar Influences Data analysis Center [✉](mailto:jan.janssens@oma.be)
To jan.janssens@oma.be [✉](mailto:jan.janssens@oma.be)
Reply-To no-reply-sidc@oma.be [✉](mailto:no-reply-sidc@oma.be)
Date 10.12.2020 08:30

```
:Issued: 2020 Dec 10 07:27 UTC
:Product: documentation at http://www.sidc.be/products/presto
:-----
# FAST WARNING 'PRESTO' MESSAGE from the SIDC (RHO-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 Doubes =3) and active at planetary levels (Kp = 4).
#-----
# Solar Influences Data analysis Center - RHO 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:

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This message is of the fast alert type. It is sent when quiet Space Weather conditions are expected 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.

All quiet alerts are sent by the SWx forecaster, both to begin and to end the period.

The all quiet period is seldomly sent during the solar cycle maximum, as new groups may quickly develop on disk or may round the east limb, or there may be filaments on disk that may result in flare/proton events.

The all quiet alert is also seldomly sent during the ascending and declining phase as in view of the persistent high speed streams from coronal holes, as well as transients in the solar wind.

The criteria for the all quiet alerts are under debate.



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 »?

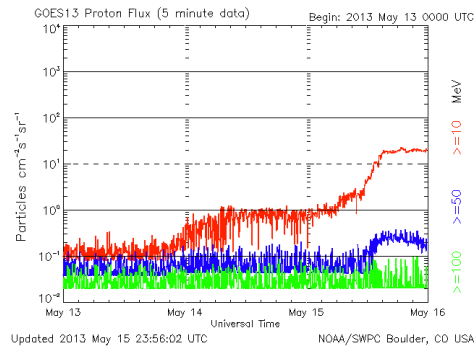
URSIgram – Exercise 1

- **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	<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>

Real-time: <https://www.swpc.noaa.gov/products/goes-proton-flux>

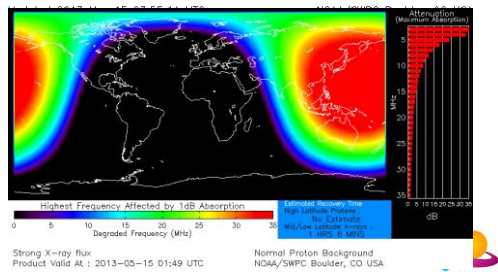
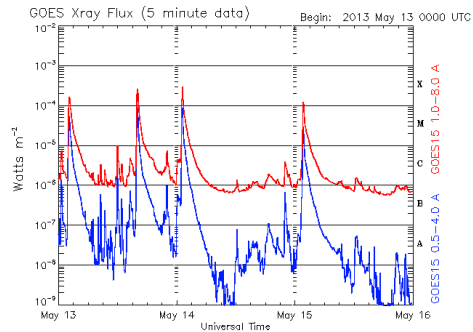
Nowcast e.g. COMESEP: <http://www.comesep.eu/alert/>

Nowcast e.g. D-RAP: <https://www.swpc.noaa.gov/products/d-region-absorption-predictions-d-rap>

Archive at <ftp://ftp.swpc.noaa.gov/pub/warehouse/>

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?



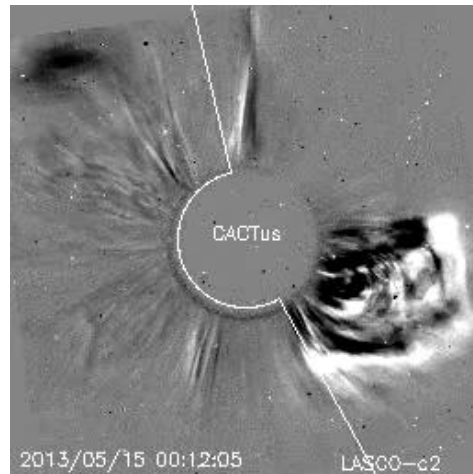
Real-time: <https://www.swpc.noaa.gov/products/goes-x-ray-flux>

Nowcast e.g. D-RAP: <https://www.swpc.noaa.gov/products/d-region-absorption-predictions-d-rap>

Archive at <ftp://ftp.swpc.noaa.gov/pub/warehouse/>

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)?



Real-time data at <http://www.sidc.oma.be/cactus/out/latestCMEs.html>

Archive at <http://sidc.oma.be/cactus/catalog.php>

Movie of this event at

http://sidc.oma.be/cactus/catalog/LASCO/2_5_0/2013/05/CME0079/CME.html

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#
#-----
S160     0124    0140    0230  LEA   3   FLA   N12E64   2N   ERU       1748
S160     0125    0148    0158  G15   5   XRA   1-8A     X1.2   1.2E-01  1748
S160 +   0127    ////    0148  CUL   C   RSP   400-00*  IV/2   1748
S160 +   0127    0130    0142  LEA   G   RBR   410     240     1748
S160 +   0129    0134    0146  LEA   G   RBR   1415    300     1748
S160 +   0130    0136    0142  LEA   G   RBR   610     250     1748
S160 +   0133    0133    0146  LEA   G   RBR   245     430     1748
S160 +   0133    0142    0150  LEA   G   RBR   2695    440     1748
S160 +   0133    0141    0153  LEA   G   RBR   8800    1400    1748
S160 +   0136    0141    0154  LEA   G   RBR   15400   920     1748
S160 +   0136    0143    0151  LEA   G   RBR   4995    1000    1748
S160 +   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.
    
```

Real-time at <https://www.swpc.noaa.gov/products/solar-and-geophysical-event-reports>

Summary at <https://www.swpc.noaa.gov/products/solar-and-geophysical-activity-summary>

Archive at <ftp://ftp.swpc.noaa.gov/pub/warehouse/>

The daily values for the 10.7cm radio flux can be found at

Penticton: <http://www.spaceweather.ca/solarflux/sx-4a-en.php>

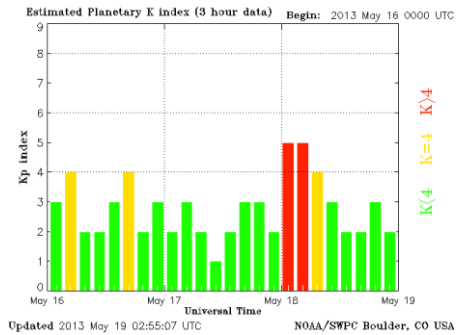
SWPC/NOAA: <ftp://ftp.swpc.noaa.gov/pub/lists/radio/rad.txt>

For 14 & 15 May, the Penticton values were as follows:

Date	Time	Julian day	Carr. Rot.	Observed Flux	Adjusted Flux	URSI Flux
2013-05-14	17:00:00	2456427.197	2136.996	148.1	151.4	136.2
2013-05-14	20:00:00	2456427.322	2137.001	147.9	151.1	136.0
2013-05-14	23:00:00	2456427.447	2137.005	147.8	151.0	135.9
2013-05-15	17:00:00	2456428.197	2137.033	141.8	144.9	130.4
2013-05-15	20:00:00	2456428.322	2137.037	145.6	148.8	133.9
2013-05-15	23:00:00	2456428.447	2137.042	148.7	152.0	136.8

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>



Real-time:

- NOAA Kp: <https://www.swpc.noaa.gov/products/planetary-k-index>
- Dourbes K: http://ionosphere.meteo.be/geomagnetism/ground_K_dourbes
- Dst: http://wdc.kugi.kyoto-u.ac.jp/dst_realtime/presentmonth/index.html
- DSCOVR: <https://www.swpc.noaa.gov/products/real-time-solar-wind>
- TEC: <http://swaciweb.dlr.de/data-and-products/public/tec/tec-eu/?L=1>

Archive at <ftp://ftp.swpc.noaa.gov/pub/warehouse/>

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**

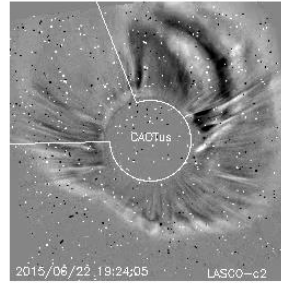
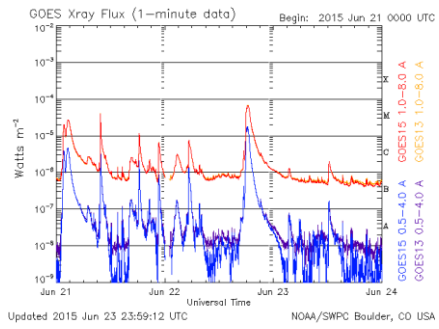
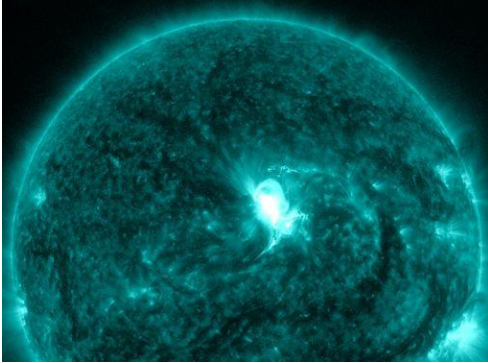
- Where on the solar surface did the M6 flare take place?
- How would you characterize the solar activity level (very low, ... , very high) over the last 24 hours?
- Did the M6 flare affect the daily 10.7cm radio flux of 22 June?
- A proton event is in progress.
 - Do you (still) expect a GLE?
 - What 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,...)?

38



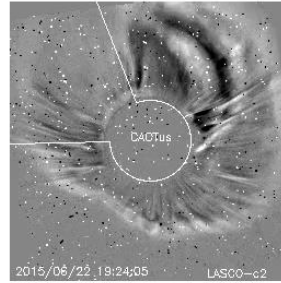
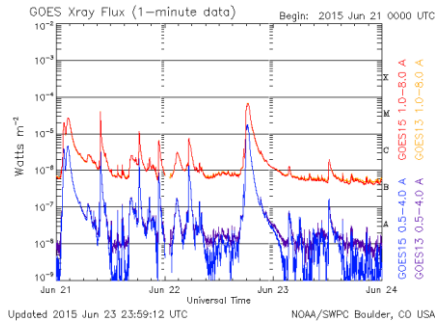
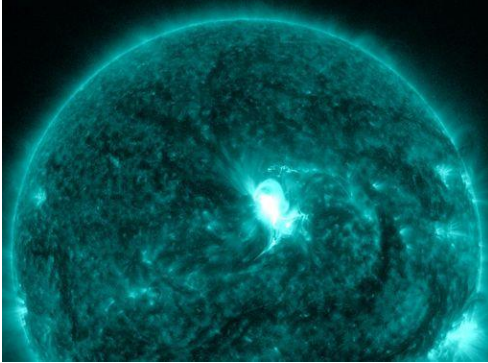
URSIgram – Exercise 2

- 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.

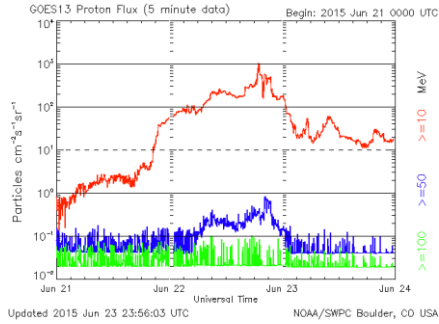
NOTICEABLE EVENTS SUMMARY
 DAY BEGIN MAX END LOC XRAY OP 10CM Catania/NOAA RADIO_BURST_TYPES
 22 1739 1823 1851 N12W08 M6.5 2B 1000 92/2371 II/1

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

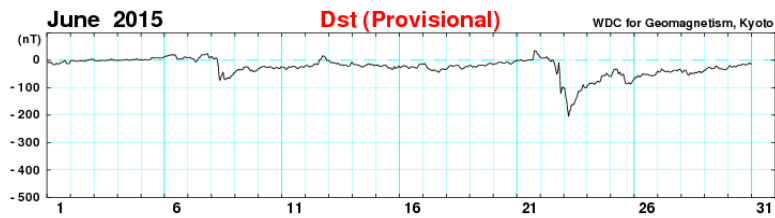
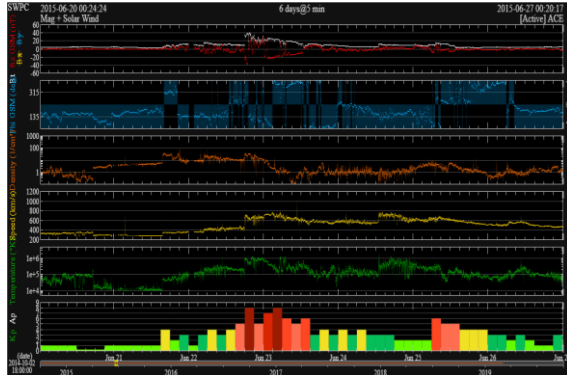
- A proton event is in progress.
 - Do you (still) expect a GLE?
 - What would you recommend concerning arctic polar flights?



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>

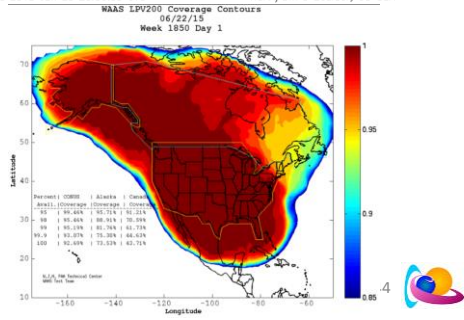
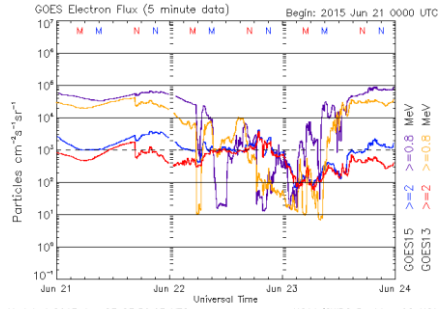
URSIgram – Exercise 2

- 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,...)?



<https://www.sciencedirect.com/topics/engineering/augmentation-system>

SIDC/RWC & URSIgram - Summary

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