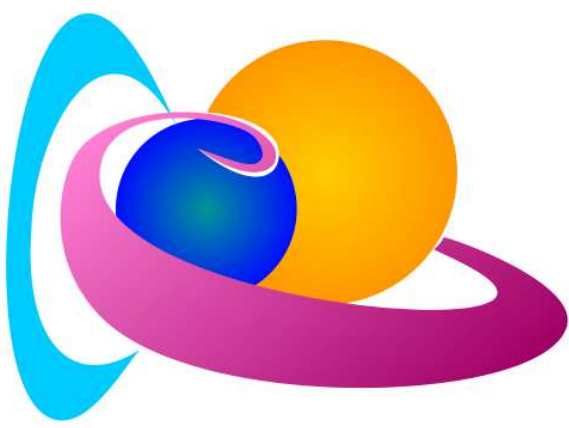


PART 2: Operational Space Weather Service

What is needed for operational service provision?



- Service definition

- Data, models, tools

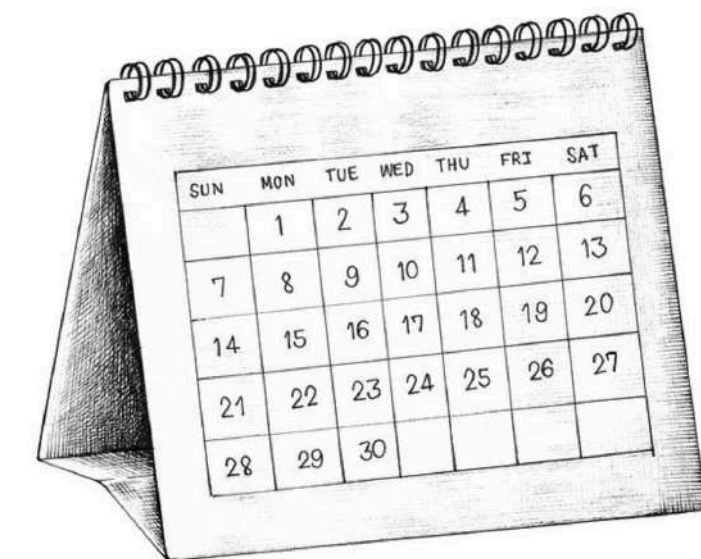
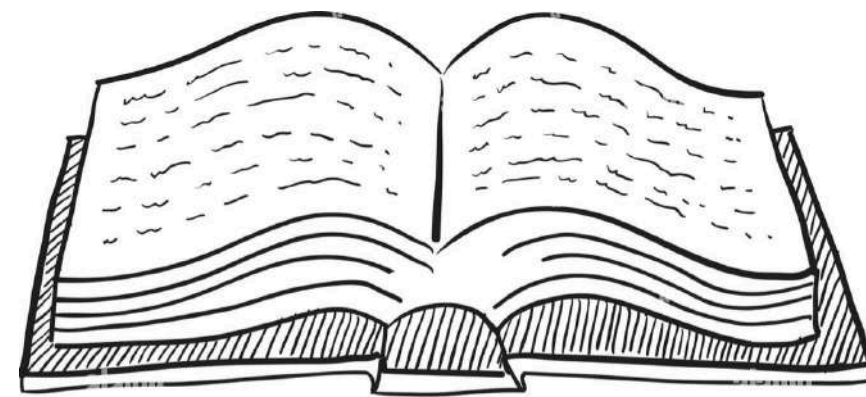
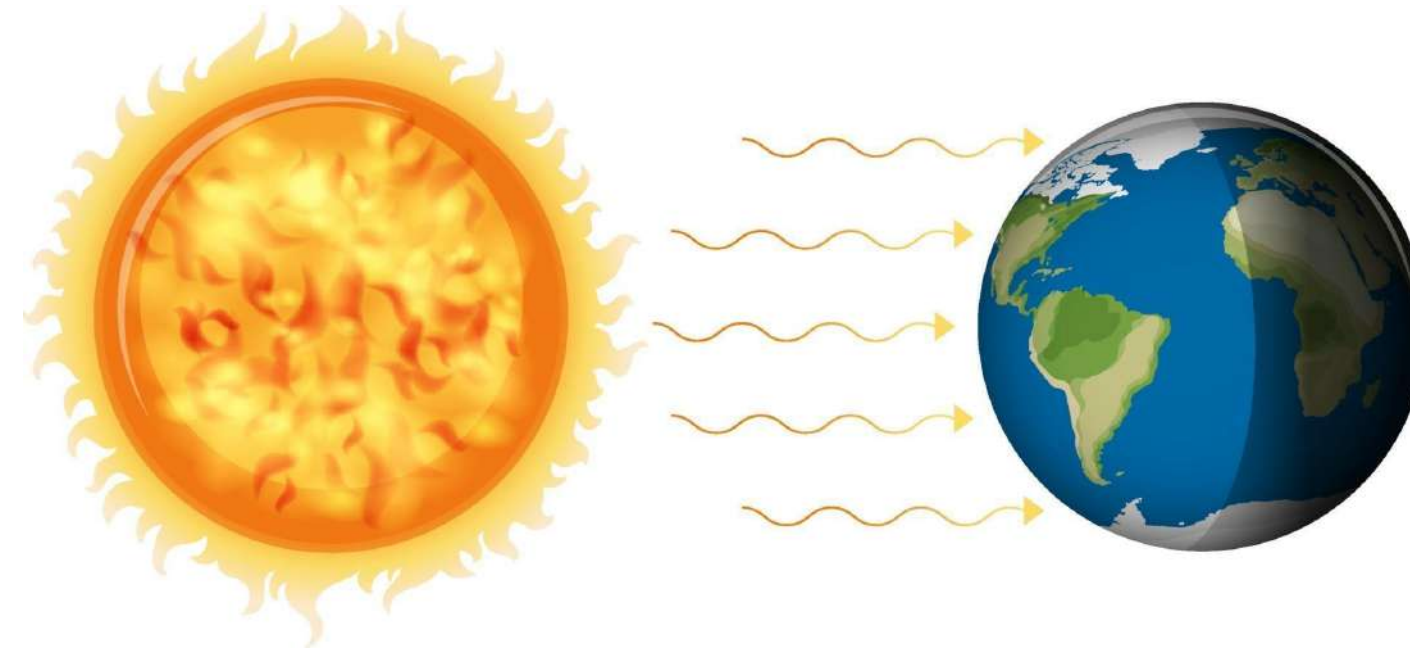
- Operators

- Procedures

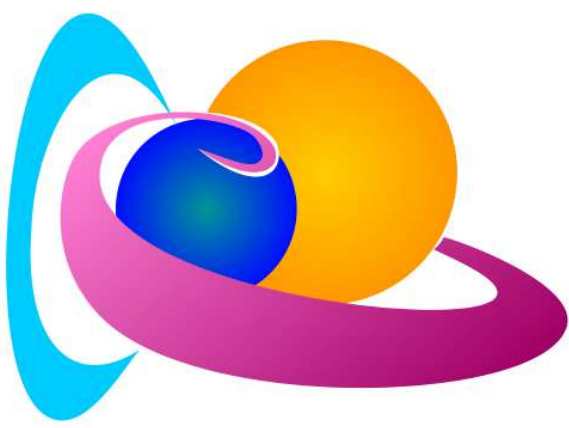
- Shifts

- Supporting Personnel

- Robust IT infrastructure

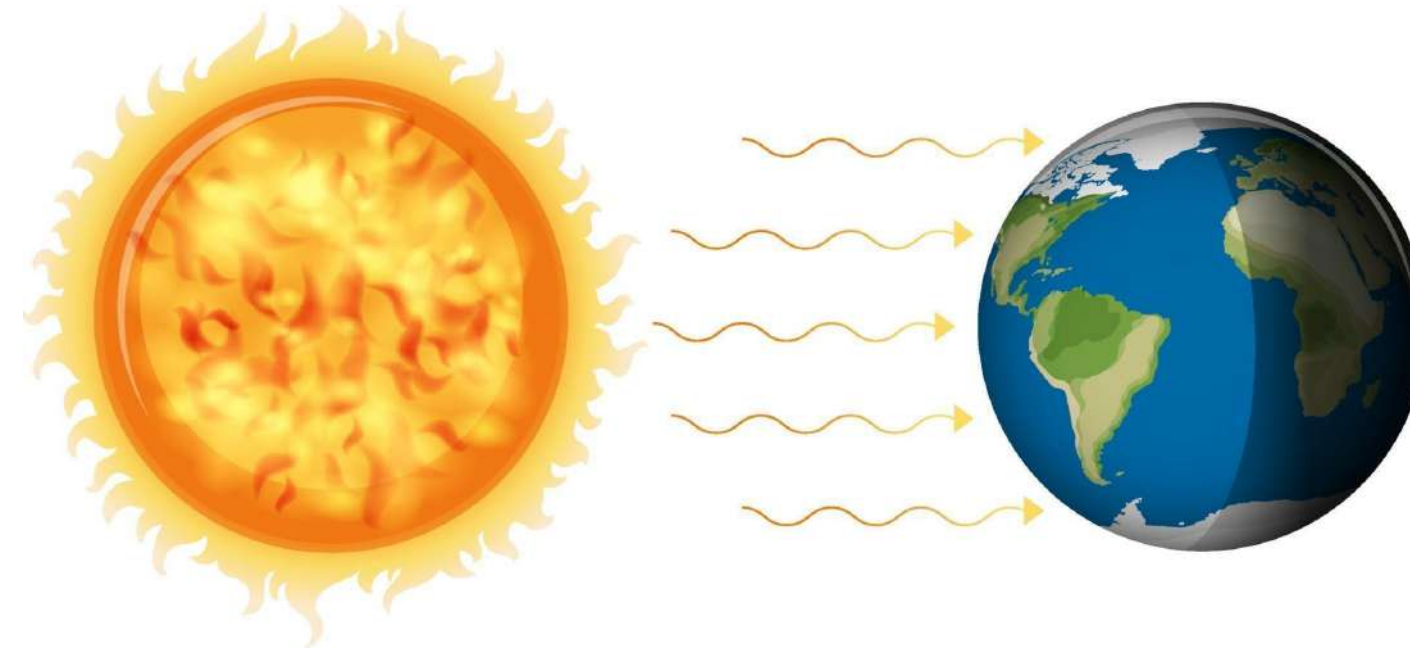


What is needed for operational service provision?



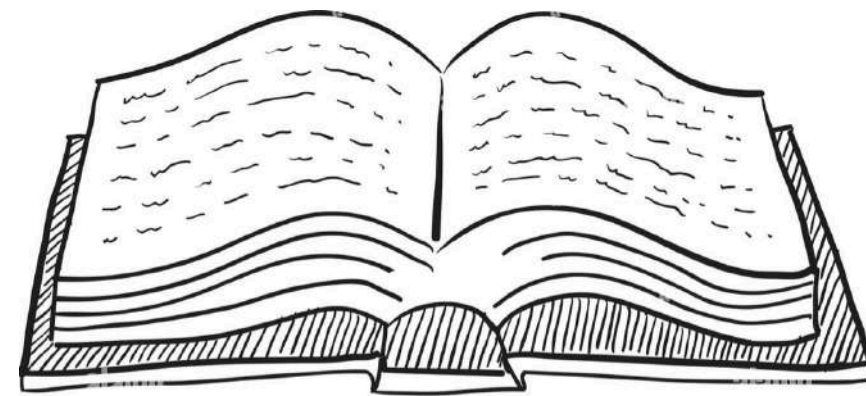
- Service definition

- Data, models, tools



- Operators

- Procedures

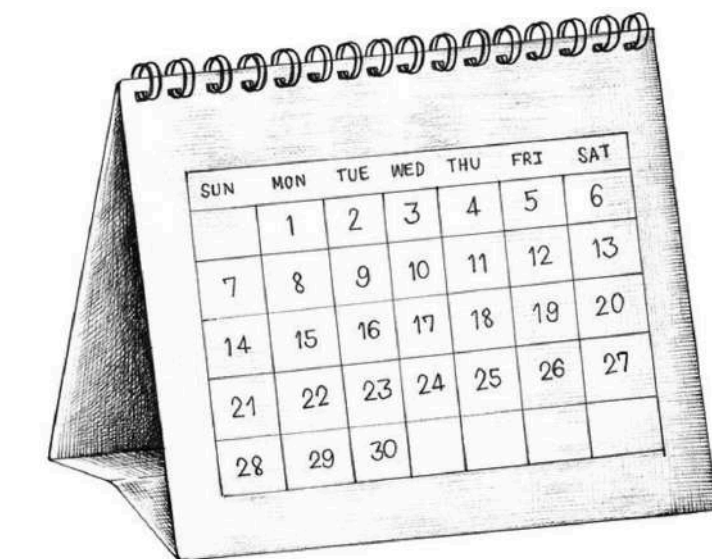


- Shifts

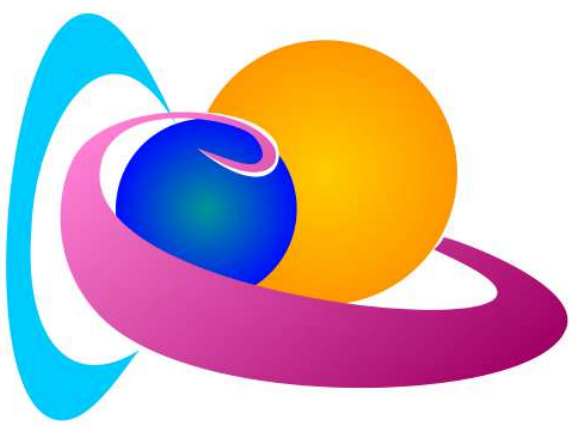
- Supporting Personnel



- Robust IT infrastructure



WHERE TO FIND SW DATA/TOOLS?



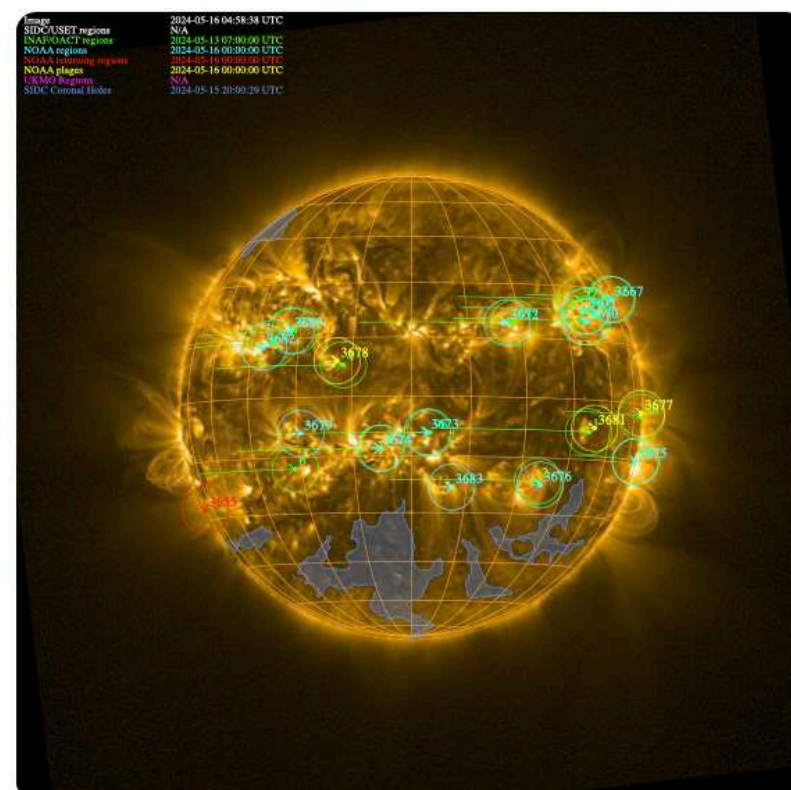
Space Weather Services

Detections

Solardemon
2024-05-16 07:54 B2
flare

CACTus
2024-05-15 16:24
436km/s

Solar Map



Latest Alerts

Presto 2024-05-15

An X3.0 flare was registered by GOES-16 as peaked today at 14:38 UTC. The source was an

Flaremail 2024-05-15

A class X2.9 solar X-ray flare occurred on 2024/05/15 with peak time 14:38UT

CACTus Halo 2024-05-16

A halo or partial-halo CME was detected with the following characteristics: t0 | dt0|

Forecasts

Flare: **M-class flares (≥50%)**

Protons: **Event in progress (>10 MeV)**

Geomagnetic: **Active conditions (A≥20 or K=4)**

All quiet: **False**

Provisional SSN: **212**

Solar Activity

URSIgram 2024-05-15

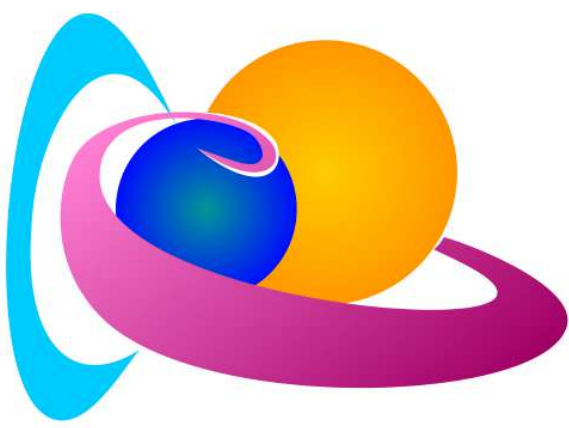
Solar flaring activity was high during the last 24 hours with three X-class flares detected during the last 24 hours. The brightest flare was a long-lasting X8.7 emitted from NOAA Active Region (AR) 3664 (magnetic configuration Beta-Gamma-Delta, Catania sunspot group 86) yesterday at 16:51 UTC. The same AR produced the rest of the X-class flare activity, namely an X3.4 that peaked today at


Solar Wind

URSIgram 2024-05-15

Geomagnetic conditions were both globally and locally unsettled to quiet (NOAA Kp 3- to 1 and K BEL 3 to 2) during the past 24 hours. In the next 24 hours they are expected to reach active levels as a result of the expected arrival of a Coronal Mass Ejection (CME). The Solar Wind (SW) conditions are gradually returning to the slow SW regime during the past 24 hours. The SW speed dropped from

WHERE TO FIND SW DATA/TOOLS?





SIDC - Solar Influences Data Analysis Center

SIDC/RWC-Belgium visit us at <https://www.sidc.be> SIDC/RW

Home

Ground-based images (USET)

Human Solar Radioastronomy

Sunspots (SILSO)

Space Weather services

Image Processing

Hardware characterisation

Space Instruments

Visualisation

Dissemination

General info

LEGAL NOTICES

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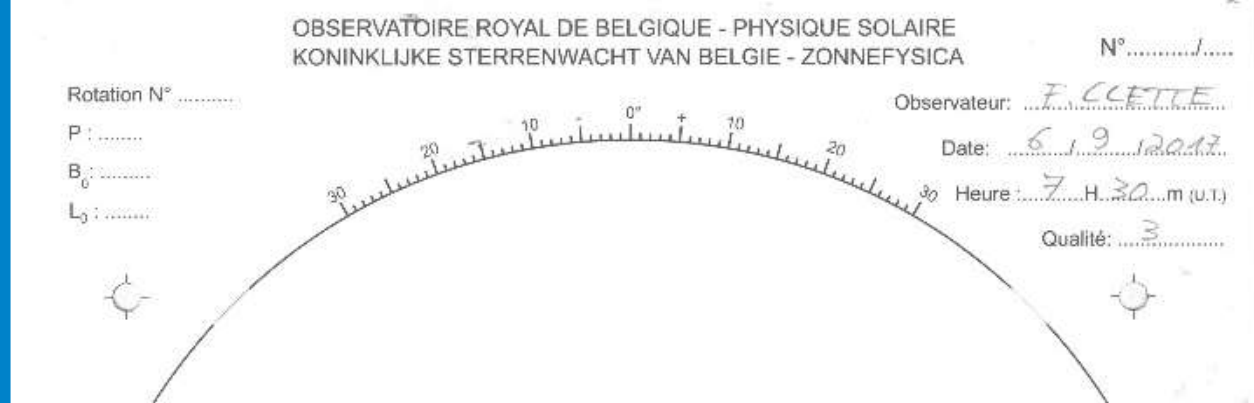
Mail header	SIDC code	Description	format	Frequency	Source
Boumeuss	bms	Sunspot data.	Encoded data (ISES)	daily	SEC (RWC-Boulder,US)
COMESep SEP forecast	comesep_sep	Automated Solar Energetic Particle (SEP) radiation storm forecast for >10 MeV protons when a medium or stronger SEP storm risk is expected 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)
Halo CME detection alert	cactus	This message is of the fast alert type. It is sent out when the CACTus software detects in image sequences from LASCO a halo CME with an angular width of more than 180°.	Plain text	ASAP, when CME has been reliably detected	SIDC (RWC-Belgium)
INDAA message	ind	Preliminary aa indices, based on k indices from Hartland (UK) and Canberra (Australia).	Encoded data (ISES)	weekly	SIDC (RWC-Belgium)
Indices K Canberra	kcan	K indices from Canberra.	Encoded data (ISES)	weekly	Canberra (Australia)
Indices K Hartland	khar	K indices from Hartland.	Encoded data (ISES)	weekly	Hartland (UK)

Issued: 2022 Mar 07 1248 UTC
 Product: documentation at <http://www.sidc.be/products/meu>

-----#
 # DAILY BULLETIN ON SOLAR AND GEOMAGNETIC ACTIVITY from the SIDC #
 # (RWC Belgium) #
 # -----#

SIDC URSIGRAM 20307
 SIDC SOLAR BULLETIN 07 Mar 2022, 1246UT
 SIDC FORECAST (valid from 1230UT, 07 Mar 2022 until 09 Mar 2022)
 SOLAR FLARES : C-class flares expected, (probability >=50%)
 GEOMAGNETISM : Quiet (A<20 and K<4)
 SOLAR PROTONS : Quiet

PREDICTIONS FOR 07 Mar 2022 10CM FLUX: 113 / AP: 008
 PREDICTIONS FOR 08 Mar 2022 10CM FLUX: 110 / AP: 007
 PREDICTIONS FOR 09 Mar 2022 10CM FLUX: 112 / AP: 004
 COMMENT: Solar activity over the past 24 hours was at very low to low



CACTUS
 A software package for 'Computer Aided C'

Details and graphs for CME001

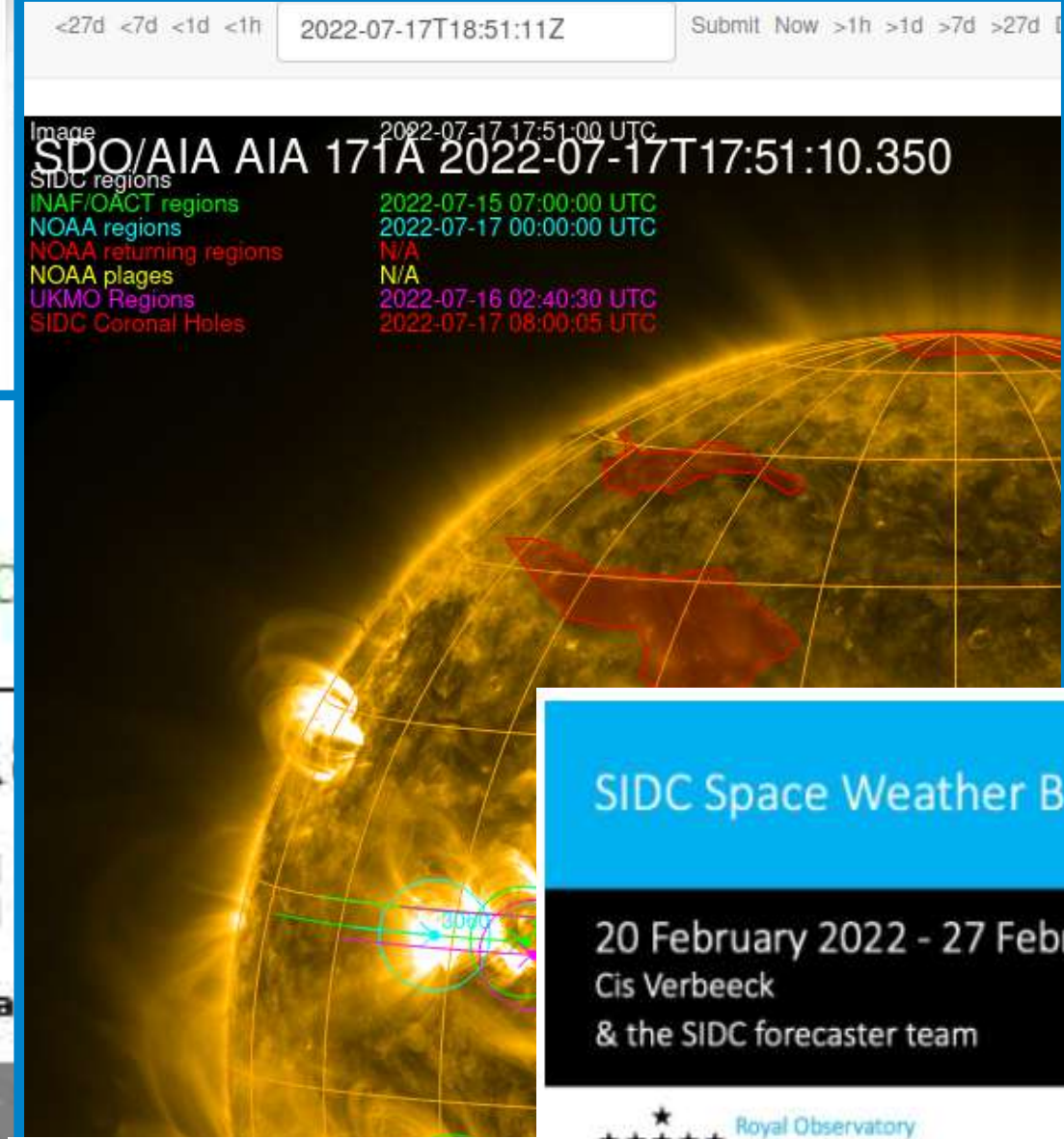
# CME	t0	dt0	pa	da	v	dv
0018	2022/07/15 15:36	02	335	108	0260	0020

CME Movie :: Download :: **Sample Image**

-----#
 Product: documentation at <http://www.sidc.be/products/presto>
 # -----#
 # FAST WARNING 'PRESTO' MESSAGE from the SIDC (RWC-Belgium) #
 # -----#

SoHO LASCO C2 coronagraph data show a halo CME from Feb 15 22:12UT onwards. The CME is directed primarily to the North-East from Earth perspective. Combined with STEREO A cor2 coronagraph data (where the CME is seen as also primarily directed to the North-East from that perspective) the CME is analysed to be backward and will not influence Earth.

-----#
 # 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> #
 # -----#



- ROB/SIDC • S.101 Proba2/SWAP Images
- ROB/SIDC • S.101c SIDC Solarmap
- ROB/SIDC • S.102 Proba2/LYRA Data
- ROB/SIDC • S.103 SIDC/USSET Halpha Solar images
- ROB/SIDC • S.104 SIDC/USSET White light Solar images

SIDC Space Weather Briefing

20 February 2022 - 27 February 2022
 Cis Verbeeck & the SIDC forecaster team

Summary Report

Solar activity from 2022-02-20 12:00 to 2022-02-27 23:59

Active regions	NOAA 2948, 2952, 2953, 2954, 2955, 2956, 2957
Flares	# C-class flare: 3 # M-class flare: 0 # X-class flare: 0
Coronal Holes	presence of 1 southern polar coronal hole, equatorial (1) coronal hole
CMEs	No Earth-directed CMEs
Proton Flux	Nominal
Electron Flux	Exceeded the 1000 pps threshold several times
Solar wind and geomagnetic conditions	
ICMEs	None
SW Conditions	[Bz: 0.4 - 13.73 nT // Bx: -13.45 nT // Vw: 348.0 - 590.7 km/s]
A-indices	max Kp-index (Kp _{max}): 4 max Kp-index (NOAA): 5
All Quiet Alert: Never on	

Solar-Terrestrial Centre of Excellence

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- ACTIVITIES
- NEWSLETTER
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- SPACE WEATHER EDUCATION CENTER
- PROJECTS



Quick-look! running in real time on SDO/AIA 211 QLK data
 3 minute cadence, typical delay 15 minutes (detection version 1.00)
[\(view all Solar Demon detection tools\)](#)

Overview of dimming 3950

Detector 24h operating status:
 Last processed image: 0 hours and 54 minutes ago (2022-07-17 17:51 UTC)
 Last detected dimming: 0 hours and 54 minutes ago (2022-07-17 17:51 UTC)

Overview for dimming #:
 3950 [back to overview](#)

Animations and graphs
[derotated original images \(non-derotated \)](#)
[dimming intensity \(overlaid on HMI \)](#)
[dimming mask](#)

[base difference \(percentage \)](#)
[running difference \(percentage \)](#)

Details for dimming #: 3950

time	seq #
2022-07-15 11:54:11	1
2022-07-15 11:57:11	2
2022-07-15 12:00:11	3
2022-07-15 12:03:11	4
2022-07-15 12:06:11	5
2022-07-15 12:09:11	6
2022-07-15 12:12:11	7
2022-07-15 12:15:11	8

NOAA 3599's spectacular eruption

Active region NOAA 3599 had already rotated over the Sun's west limb when it produced a spectacular, long duration C-class flare

Slowly but surely

The polar field reversal on the Sun is ongoing, but it is not completed yet as testified by observations.

Colourful curtains

A moderate geomagnetic storm was observed on 3 March. Polar lights were photographed as far south as mid-England and Lower Saxony in Germany.

Wuthering Heights

So far this solar cycle, NOAA 13590 is the largest sunspot group and it has produced the strongest solar flare. Some perspective

More X-class flares

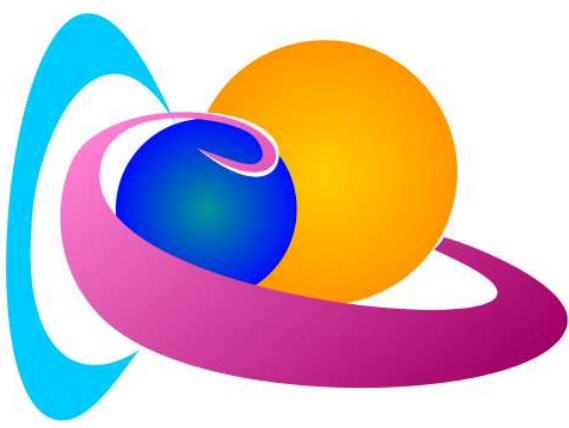
NOAA 3590 produced 3 X-class flares in 24 hours: an X1.8 flare peaking late on 21 February, an X1.7 flare peaking early on 22 February, and an X6.3 event that peaked on 22 February at 22:34UTC. The latter is the strongest flare so far this solar cycle.

UPDATED.

SWEC
 Space Weather Education Center



WHERE TO FIND SW DATA/TOOLS?



swe.ssa.esa.int/current-space-weather

→ THE EUROPEAN SPACE AGENCY

Welcome to the ESA Space Weather Service Network
Please note that all ESA-SWE Services are under review/construction

Current Space Weather /

Welcome to the ESA Space Weather Service Network

This dashboard provides a snapshot of the current space weather conditions based on the latest products from the SWE Network.

For a detailed overview of the current conditions, as well as access to forecasts, archives, alerts and interactive tools, we encourage you to register as a user and explore the full range of products and data available in our different Service Domains:

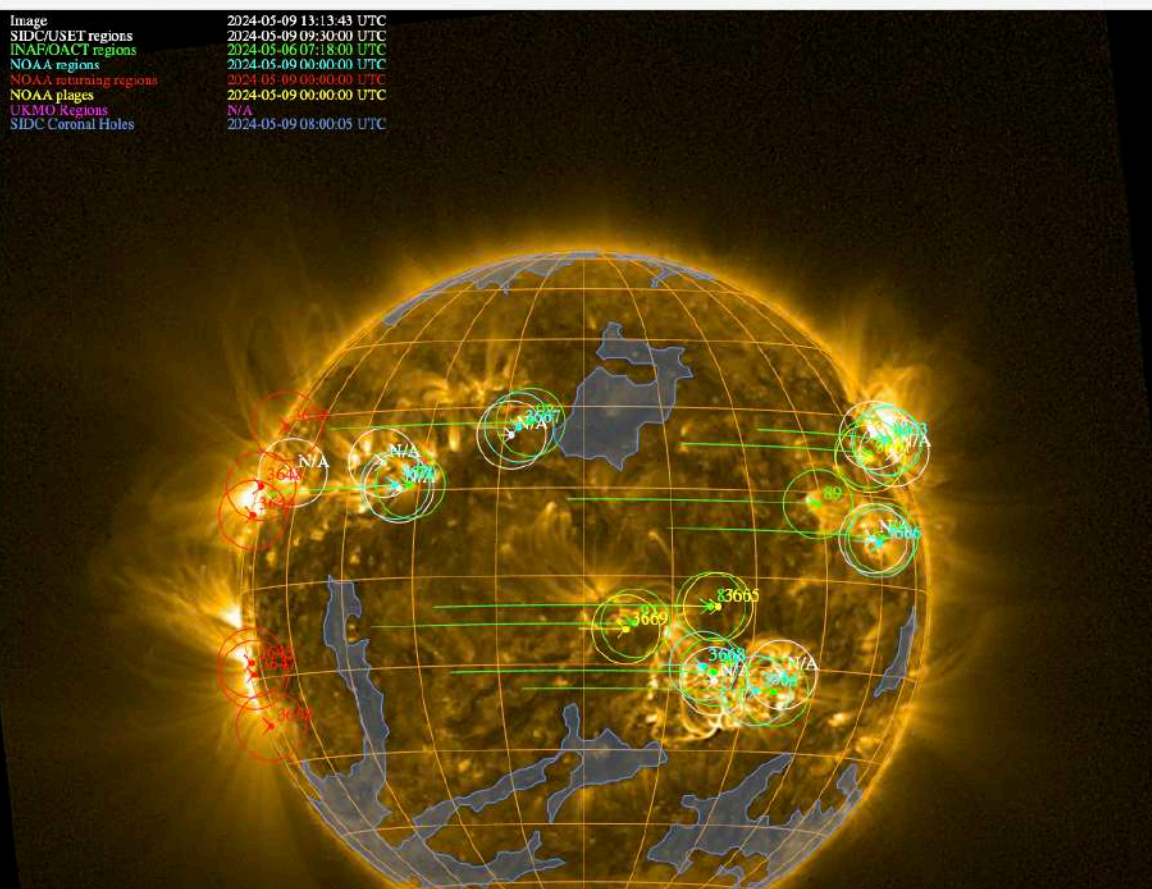
What is space weather?

Spacecraft Design	Spacecraft Operation
Human Spaceflight	Launch Operation
Transionospheric Radio Link	Space Surveillance and Tracking
Power Systems Operation	Aviation
Resource Exploitation System Operation	Pipeline Operation
Auroral Tourism	General Data Service

Solar Data

SIDC Solarmap

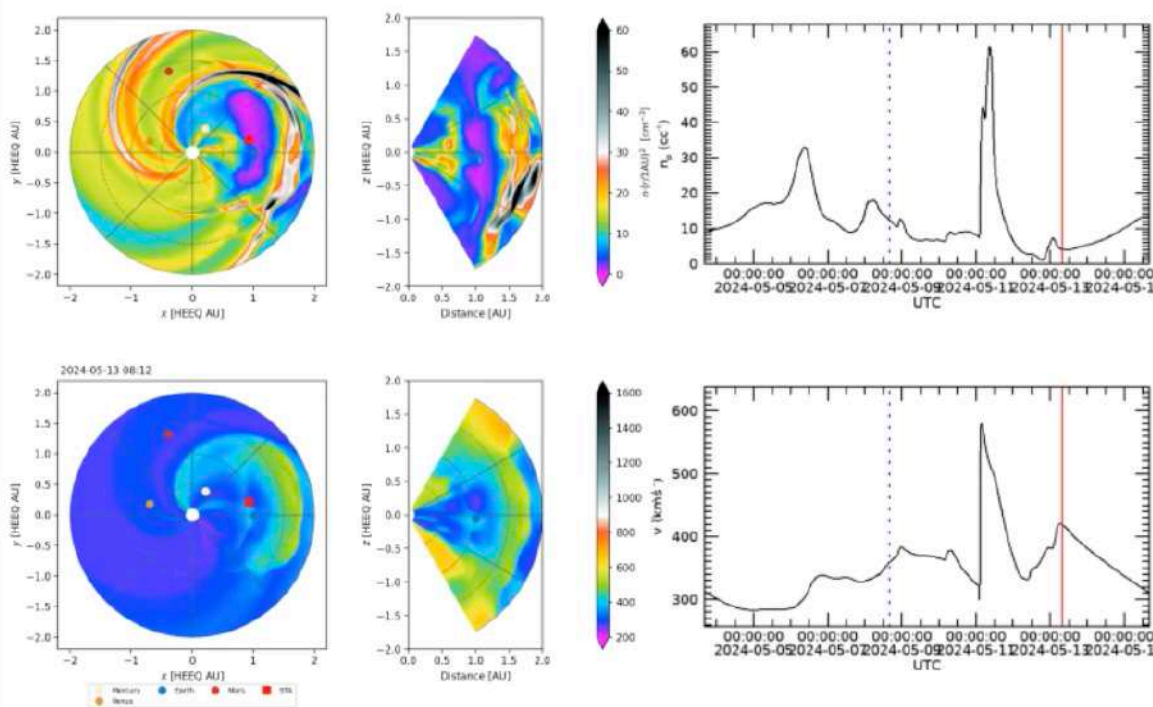
Image	2024-05-09 11:13:43 UTC
SIDC/SET regions	2024-05-09 09:30:00 UTC
INAF/OACT regions	2024-05-06 07:18:00 UTC
NOAA regions	2024-05-09 00:00:00 UTC
NOAA warning regions	2024-05-09 00:00:00 UTC
NOAA plots	2024-05-09 00:00:00 UTC
USNO Sunspot	N/A
SIDC Coronal Holes	2024-05-09 08:00:05 UTC



Interplanetary medium

Near-Earth solar wind forecasts (EUHFORIA)

EUHFORIA (Earth) - 2024-05-13T08:12:22

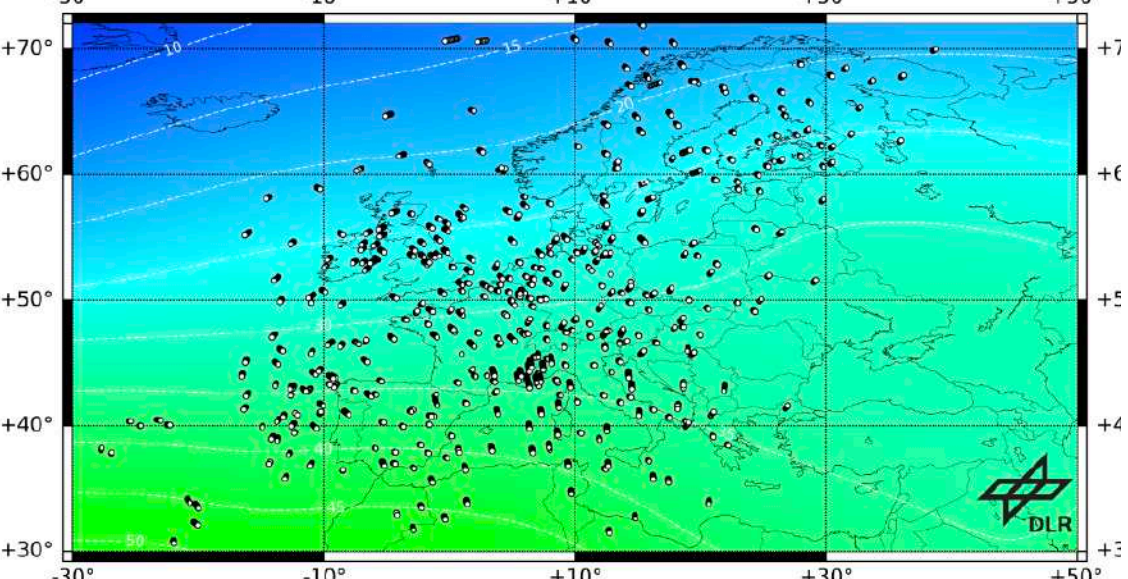


Full product | Provided by: STFC, RAL Space

Earth's Ionosphere and Thermosphere

TEC map (Europe), current

Total Electron Content (TEC) 2024-05-09T16:00:00 UT



Ionospheric Range Error (L1) / m

TEC/TECU

Full product | Provided by: German Aerospace Car

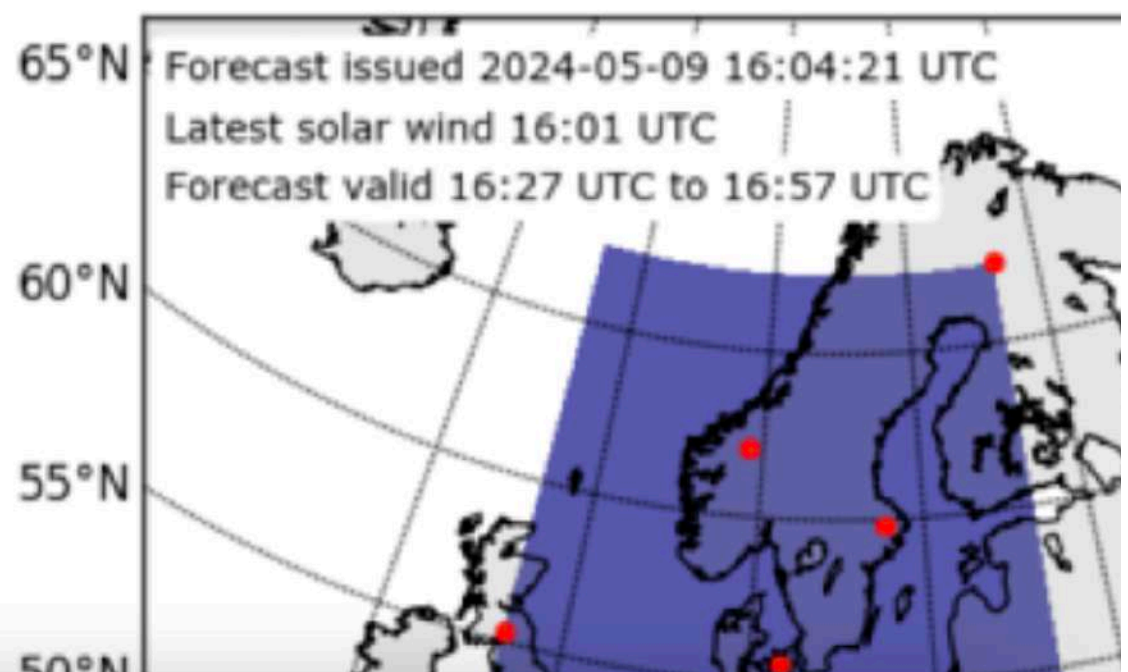
Earth's Atmosphere and Geomagnetic Environment

Forecasts of dB/dt

65°N Forecast issued 2024-05-09 16:04:21 UTC

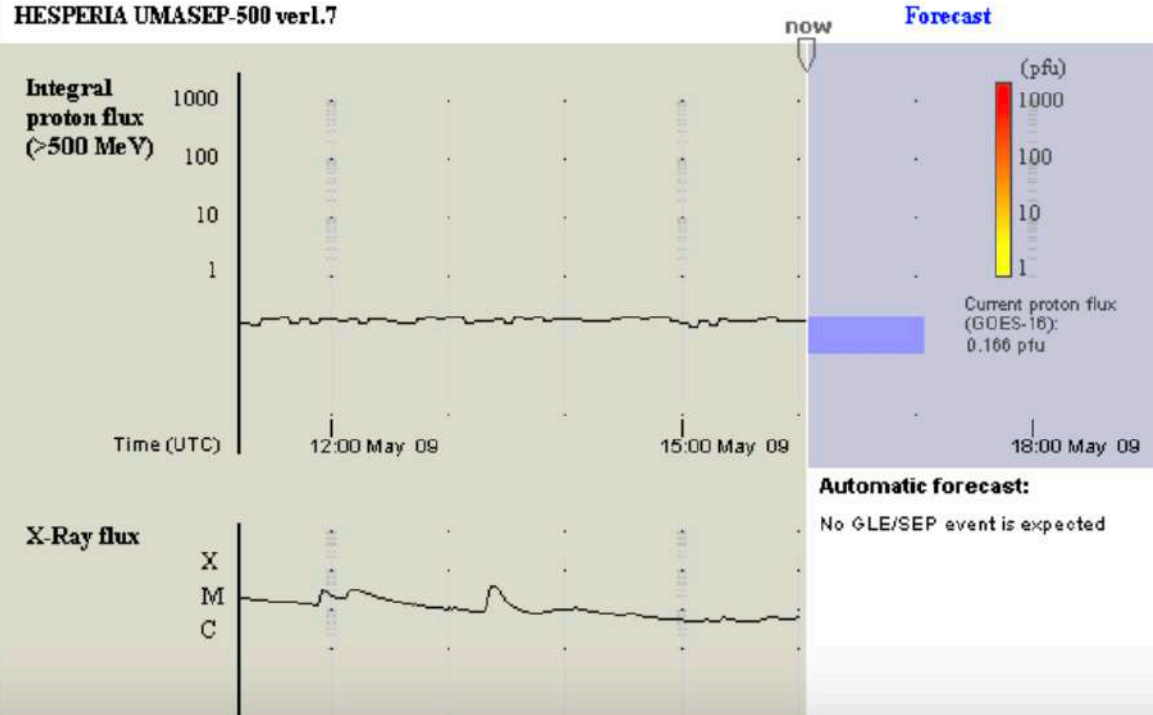
Latest solar wind 16:01 UTC

Forecast valid 16:27 UTC to 16:57 UTC



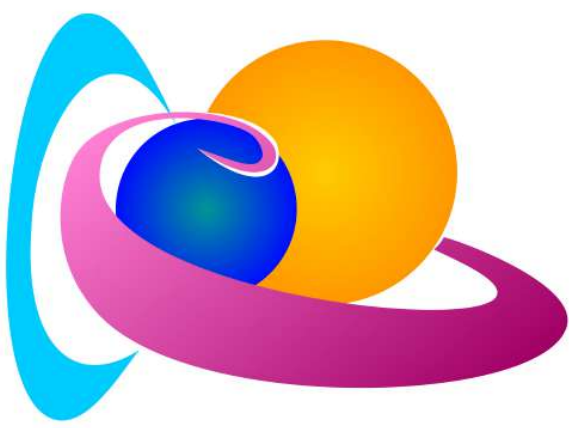
Latest HESPERIA UMASEP-500 forecast

HESPERIA UMASEP-500 ver1.7



Automatic forecast:
No GLE/SEP event is expected

WHERE TO FIND SW DATA/TOOLS?



Expert Service Centres / ESC Solar Weather /

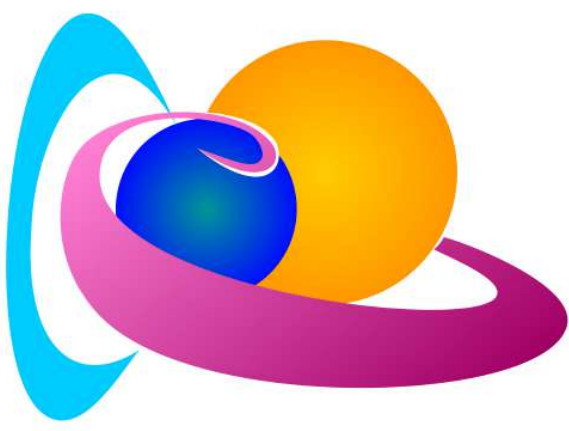
Solar Weather Expert Service Centre (S-ESC)



ESC Objectives Contributions Contributors

Current products provided by the S-ESC and available in SWE services:

- ▼ Catania Astrophysical Observatory (INAF/OACT)
 - INAF/OACT** • S.121 INAF/OACT White light Solar images
 - INAF/OACT** • S.122 INAF/OACT Halpha Solar images
 - INAF/OACT** • S.123a INAF/OACT Sunspot group characteristics
- ▶ Collecte Localisation Satellites (CNES/CLS)
- ▶ Institut de recherche sur les lois fondamentales de l'Univers (CEA/IRFU)
- ▶ Institute for Data Science (FHNW/I4DS)
- ▶ Kanzelhöhe Observatory for Solar and Environmental Research (UNIGRAZ/KSO)
- ▶ Multi Experiment Data & Operation Center (UPSaclay/MEDOC)
- ▶ Research Center for Astronomy and Applied Mathematics (AOA/RCAAM)
- ▶ Solar Influences Data analysis Center (ROB/SIDC)
- ▶ Solar Patrol Service (ASU CAS/SPS)
- ▶ UK Met Office (UKMO)

WHERE TO FIND SW DATA/TOOLS?





SPACE WEATHER PREDICTION CENTER
 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Thursday, May 09, 2024 16:08:11 UTC

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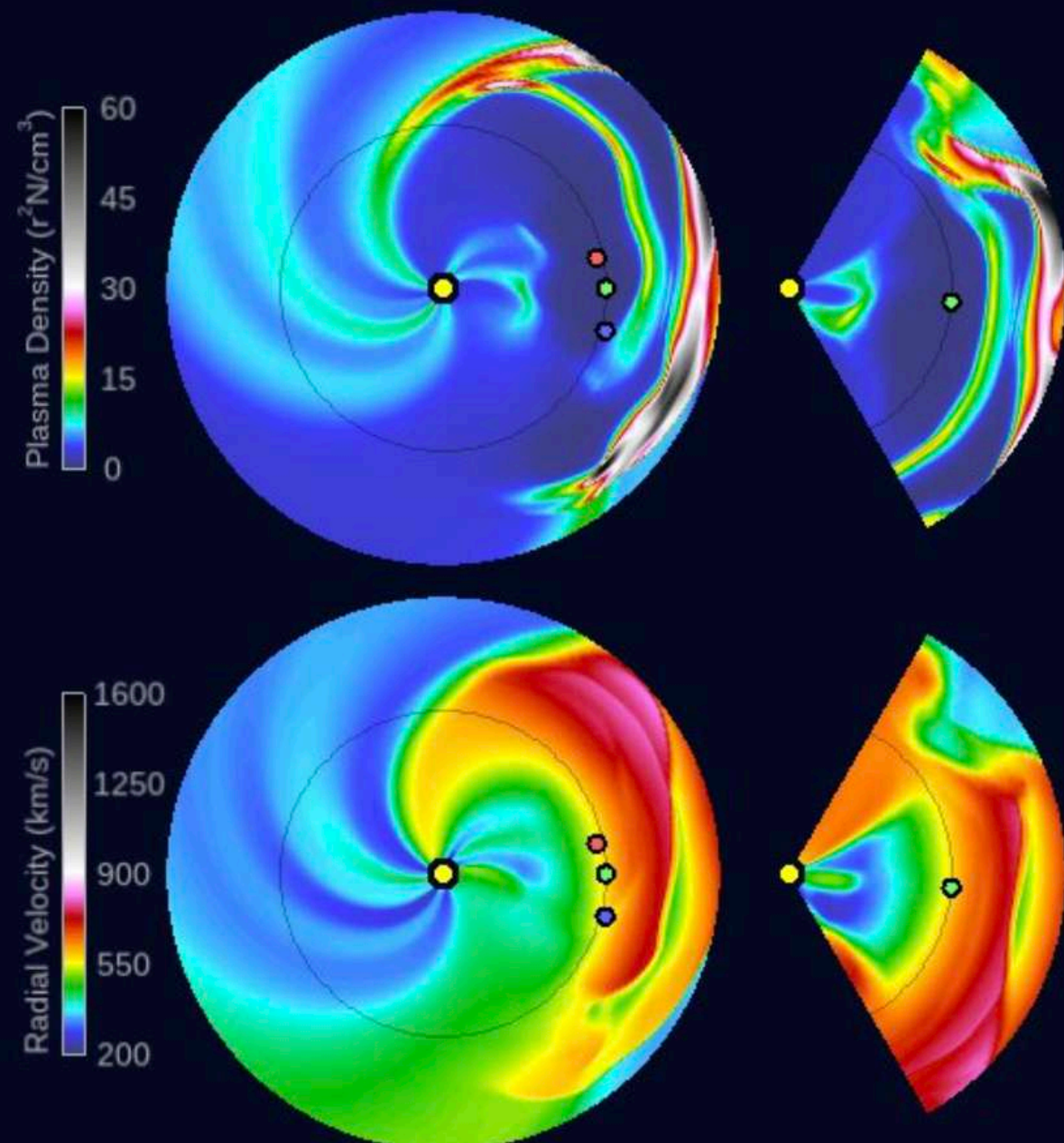
Home > Products and Data > Models > WSA-ENLIL Solar Wind Prediction

CURRENT SPACE WEATHER CONDITIONS on NOAA Scales
R S G

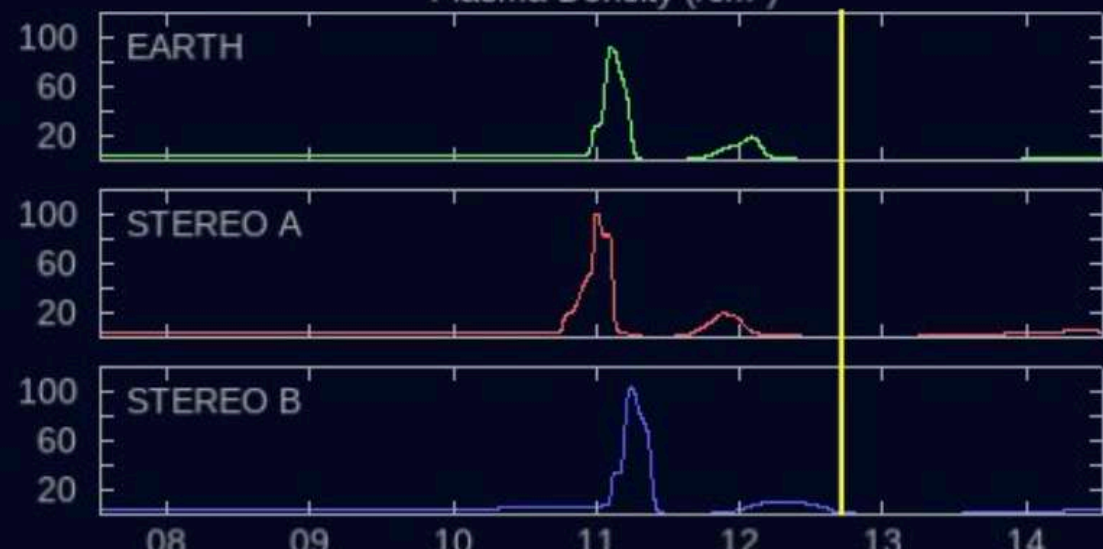
none none none

WSA-ENLIL SOLAR WIND PREDICTION

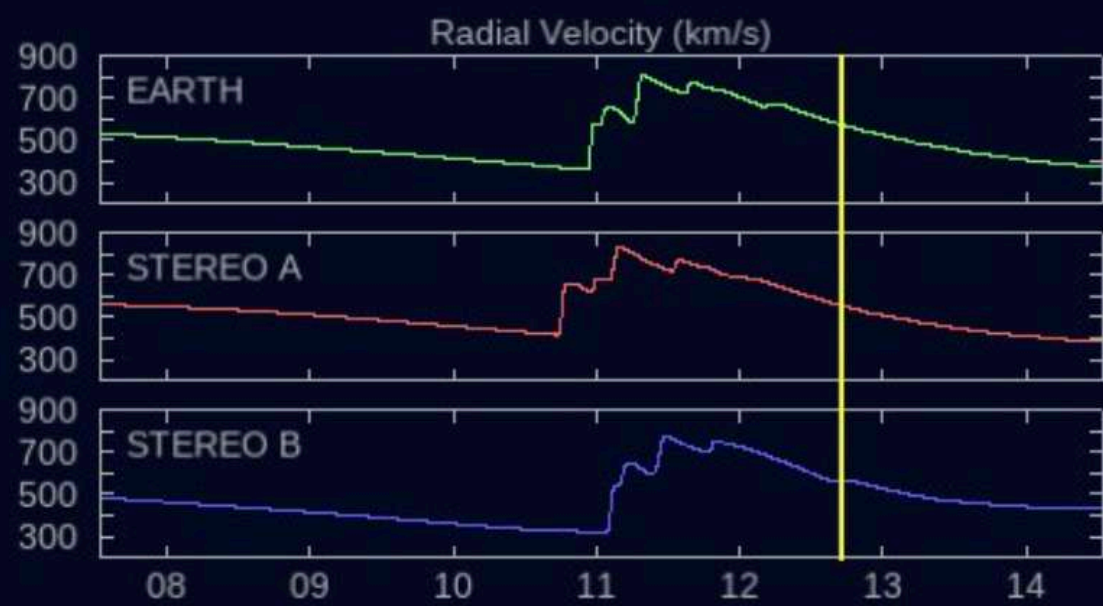
2024-05-12 17:00:00



Plasma Density ($/\text{cm}^3$)

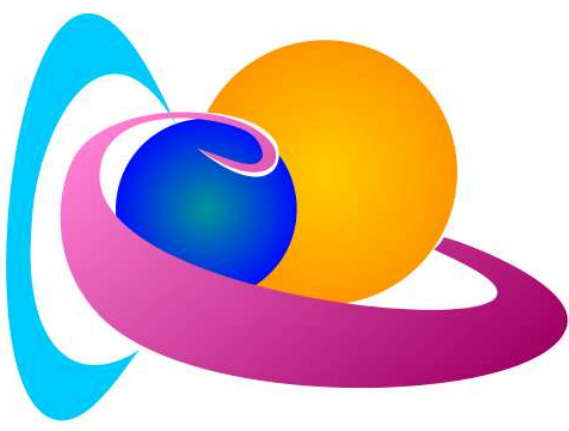


Radial Velocity (km/s)



Space Weather Prediction Center Run Time: 2024-05-09 13:00 UT Mode: CME Image Created: 2024-05-09 15:18 UT

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Space weather impacts

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What is space weather?

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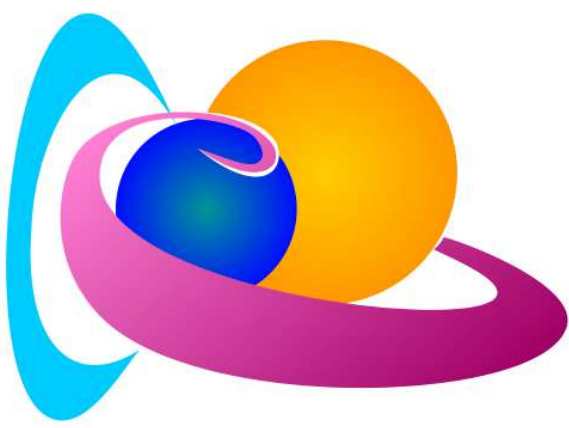


LEARN ABOUT

How to take photos of the auroras

 Explore

WHERE TO FIND SW DATA/TOOLS?



Space Weather Forecast
National Institute of Information and Communications Technology

JST
2024/05/10 02:23
UTC
2024/05/09 17:23

Home Report Current Status Forecast User guide Link

Solar Flare Bulletin
 Rapid increase of solar X-ray intensity (M class or above) was detected at 09/05 17:05 UT according to GOES-16

Alert

2024/05/09 12:20 Updated
 A full-halo coronal mass ejection (CME) was identified by SOHO/LASCO at about 9 UT on 9 May.

[Alert list](#)

Forecast

2024/05/09 06:00 UT ~ 2024/05/10 05:59 UT

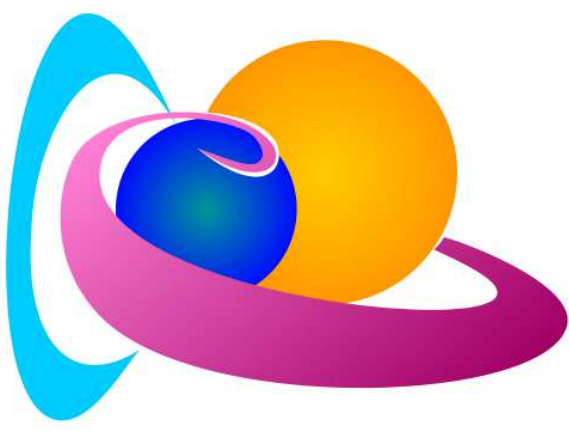
Solar flare	Solar proton	Geomagnetic disturbance	Radiation belt electron	Ionospheric storm	Dellinger phenomenon	Sporadic E layer
<div style="color: red; font-weight: bold;">⚠ Major flare</div> <div style="background-color: #f06292; padding: 2px;">Lv.4</div> <div style="background-color: #ffc107; padding: 2px;"></div> <div style="background-color: #28a745; padding: 2px;"></div>	<div style="color: green; font-weight: bold;">Quiet</div> <div style="background-color: #28a745; padding: 2px;">Lv.1</div>	<div style="color: green; font-weight: bold;">Quiet</div> <div style="background-color: #28a745; padding: 2px;">Lv.1</div>	<div style="color: green; font-weight: bold;">Low</div> <div style="background-color: #28a745; padding: 2px;">Lv.1</div>	<div style="color: green; font-weight: bold;">Quiet</div> <div style="background-color: #28a745; padding: 2px;">Lv.1</div>	<div style="color: red; font-weight: bold;">⚠ High</div> <div style="background-color: #f06292; padding: 2px;">Lv.3</div> <div style="background-color: #ffc107; padding: 2px;"></div> <div style="background-color: #28a745; padding: 2px;"></div>	<div style="color: red; font-weight: bold;">⚠ Active</div> <div style="background-color: #f06292; padding: 2px;">Lv.3</div> <div style="background-color: #ffc107; padding: 2px;"></div> <div style="background-color: #28a745; padding: 2px;"></div>

Today's space weather 2024/05/09 12:00 UT Update

Solar activity was high and it is expected to be high from 9 to 10 May. Geomagnetic activity in Japan was quiet level and it is expected to be quiet level until 9 May. Ionospheric condition over Japan was quiet level and it is expected to be quiet level from 9 to 10 May.

[More details >](#)

WHERE TO FIND SW DATA/TOOLS?



※ Click the image to enlarge.

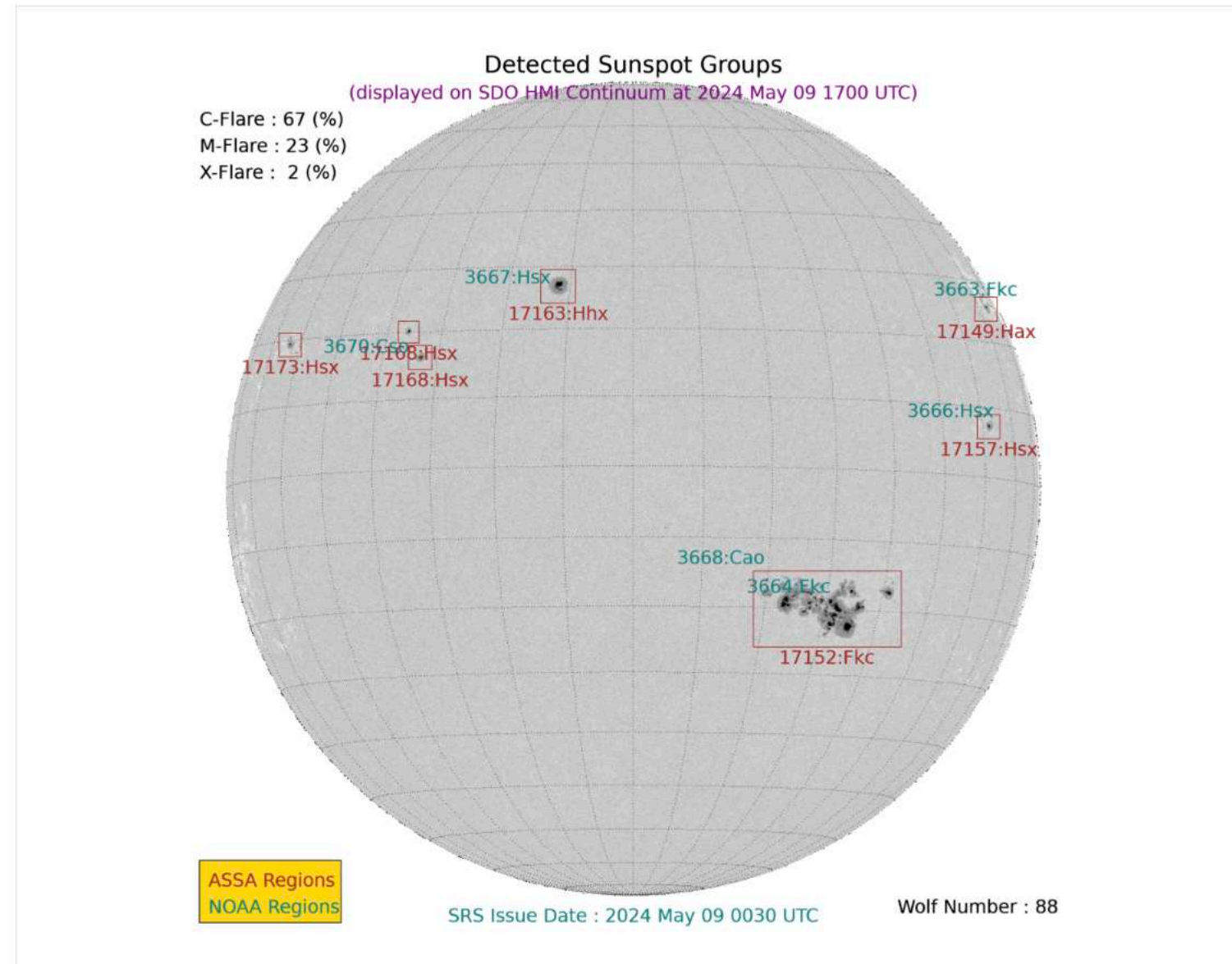


Fig1 Spot group detection and McIntosh classification result [TEXT INFO]

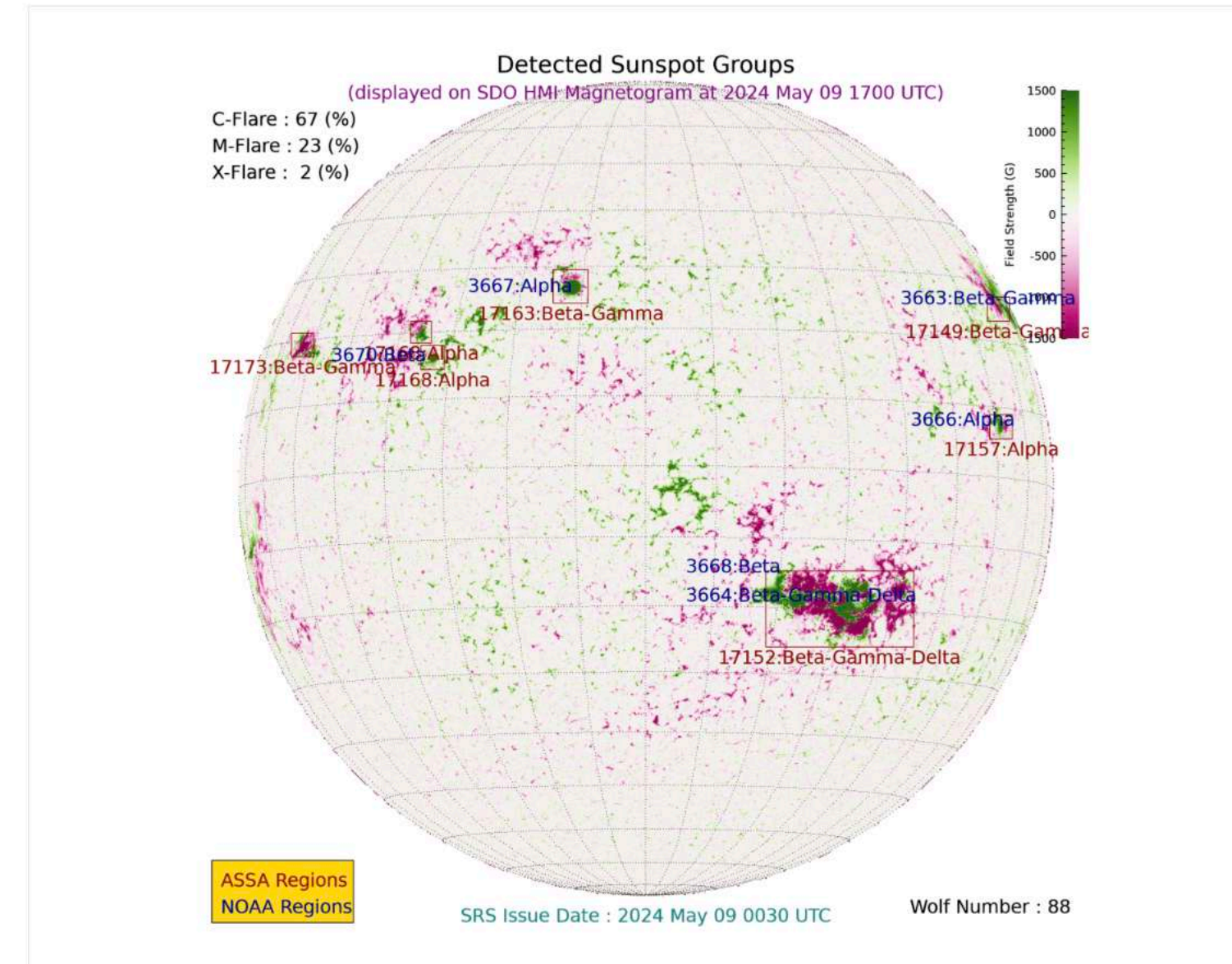
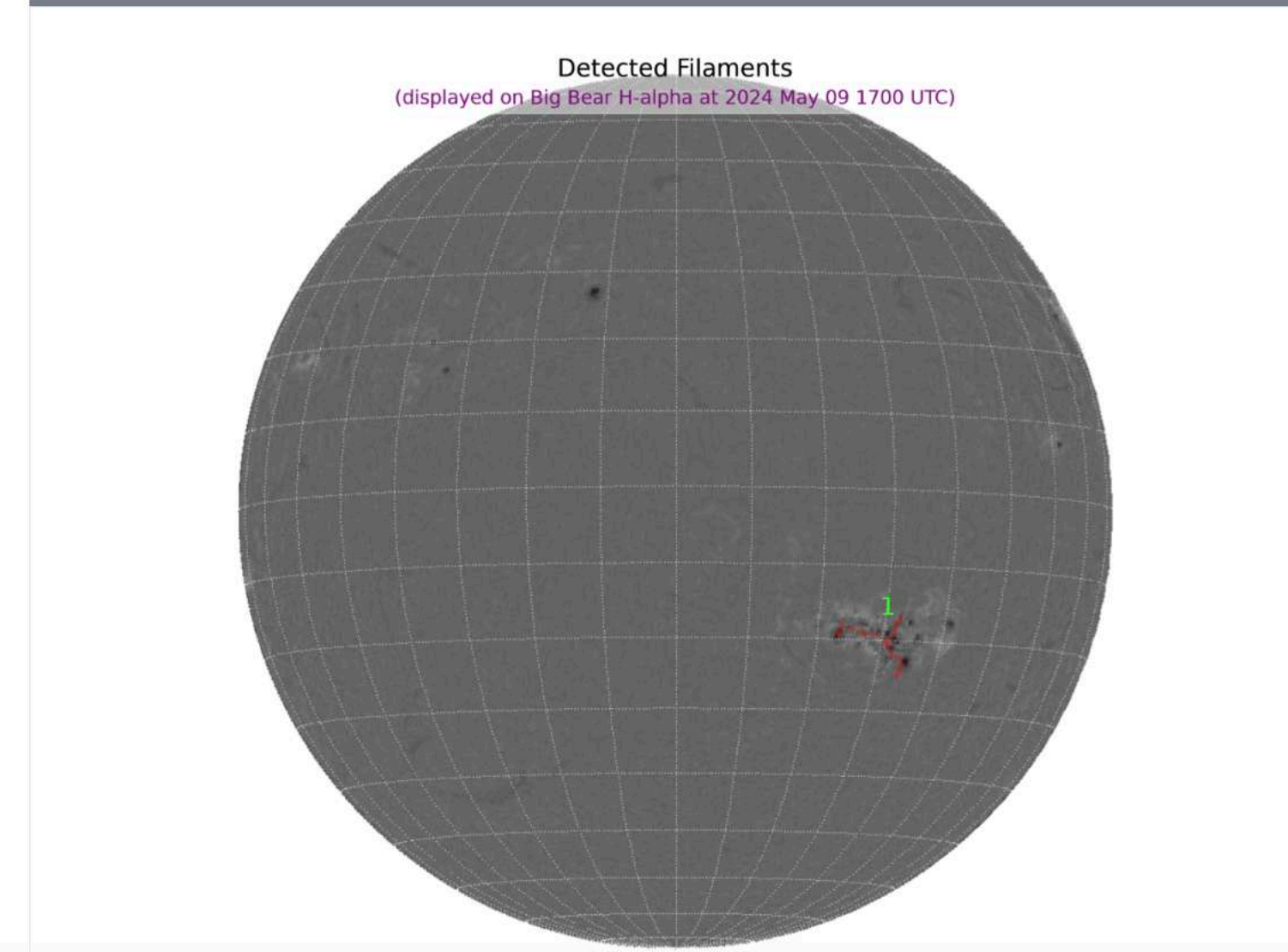
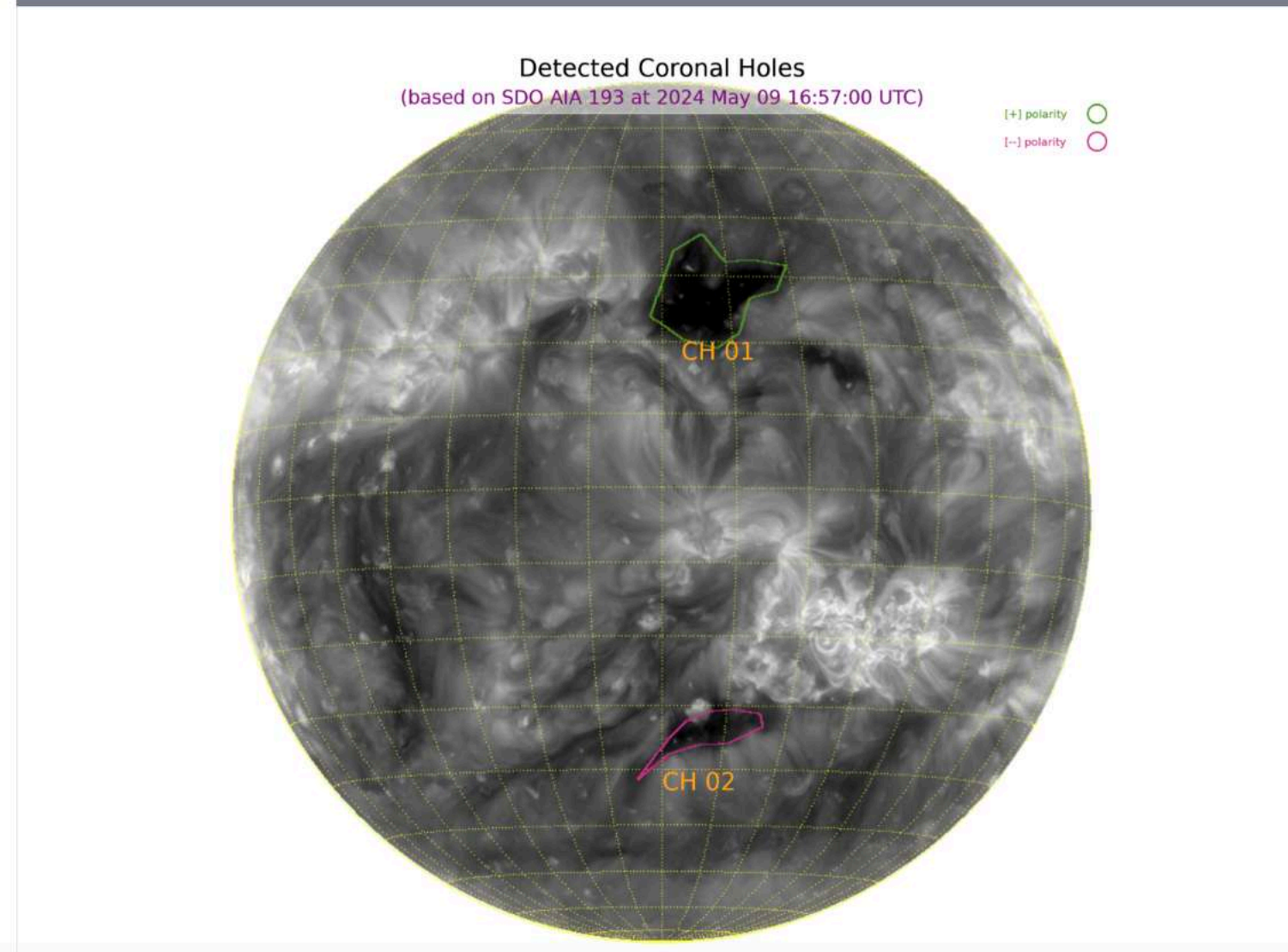
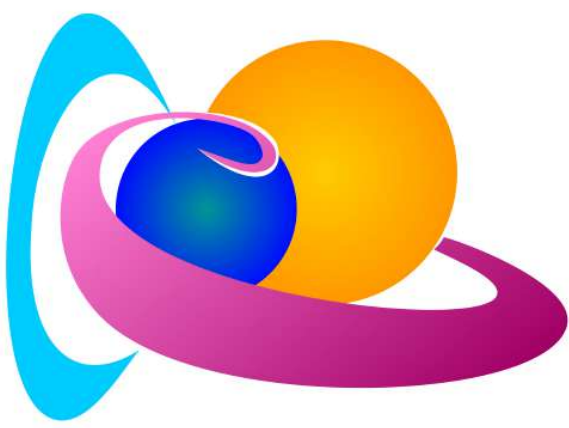


Fig1 Spot group detection and McIntosh classification result





WHERE TO FIND SW DATA/TOOLS?

SpaceWeatherLive.com
Real-time auroral and solar activity

10:08:56 UTC

Fatturare è solo l'inizio. Provalo Gratis Ora. Fatture in Cloud.it

Auroral activity

Kp-index *i*

Kp6
08:38 UTC
Threshold reached

More data ▾ *i* Help ▾ Kp-index forecast

Solar activity

Auroral oval *i*

More data ▾ Hemispheric Power

Disturbance Storm Time index *i*

50
25
0
-25
Now

G2 - Moderate geomagnetic storm *i*

Observed Kp: 6
Threshold reached: 08:38 UTC

The Disturbance Storm Time index predicts moderate storm conditions right now (-66nT) *i*

The maximum X-ray flux of the past two hours is:

M1.04 *i*

S1 - Minor solar radiation storm *?*

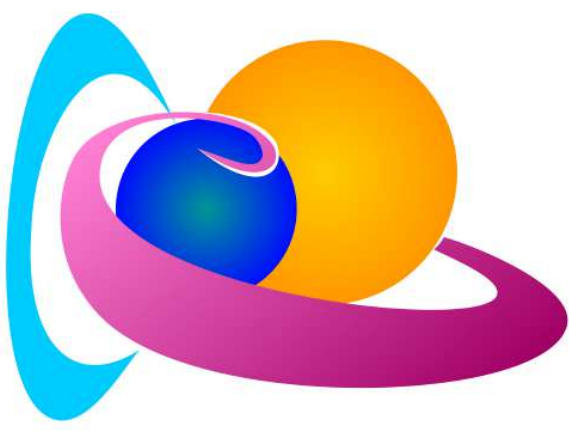
Minor impacts on HF radio through polar regions

Latest news

Tuesday, 14 May 2024
X8.7 solar flare

More news

WHERE TO FIND SW DATA/TOOLS?



Community Coordinated Modeling Center

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About ▾ Models ▾ Simulation Services ▾ Validation ▾ Community Support ▾ Space Weather ▾ Tools

News: MAGE updates

The MAGE version 0.75 model is available to the community through the CCMC Runs-On-Request (ROR) service.

[Read More](#)

z [R_E]

Max: 753.

B fieldlines

- IMF
- Polarcap
- closed

log(N) [cm⁻³]

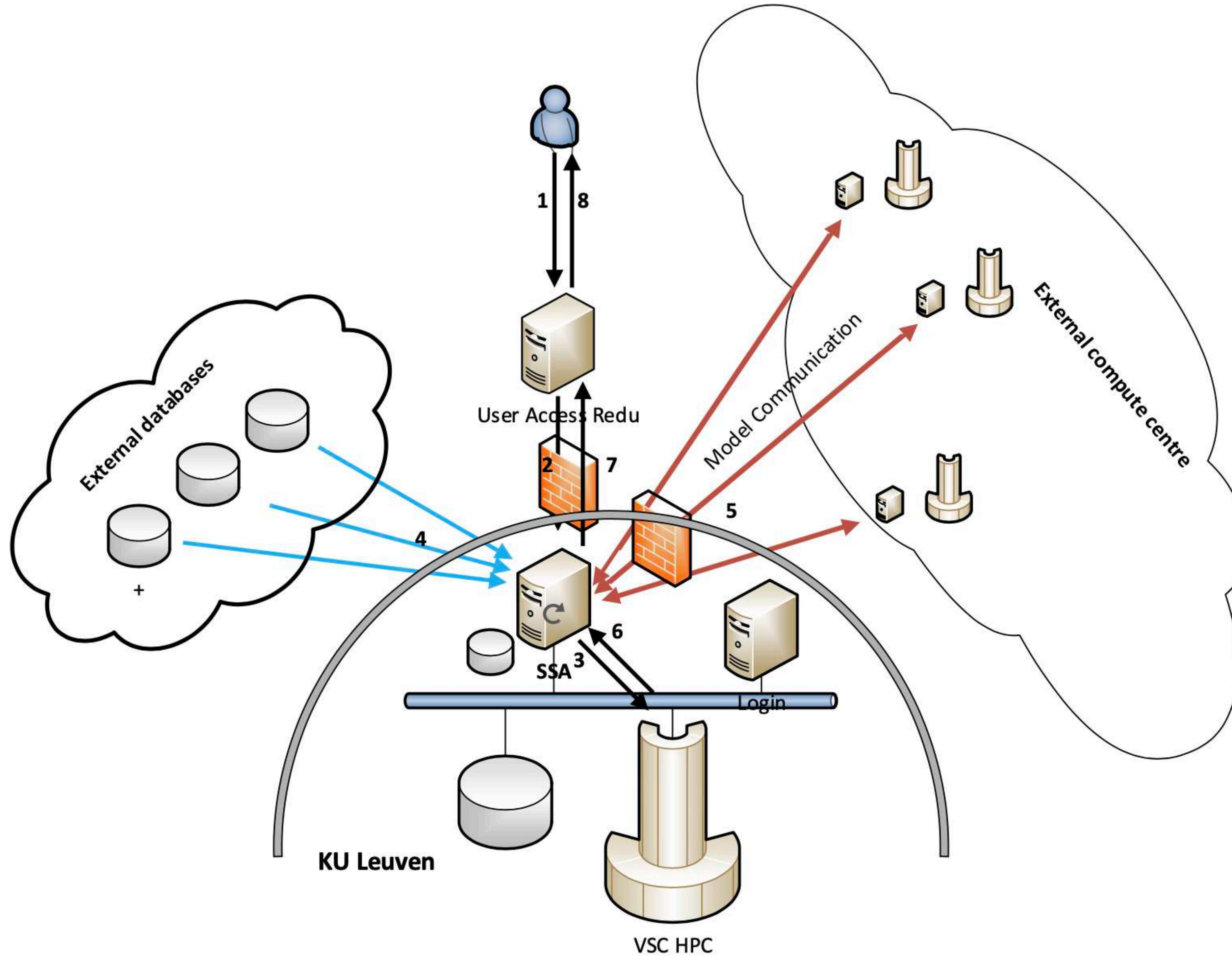
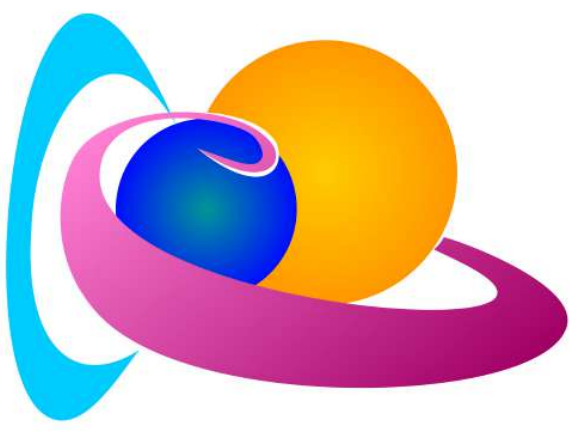
+2.96

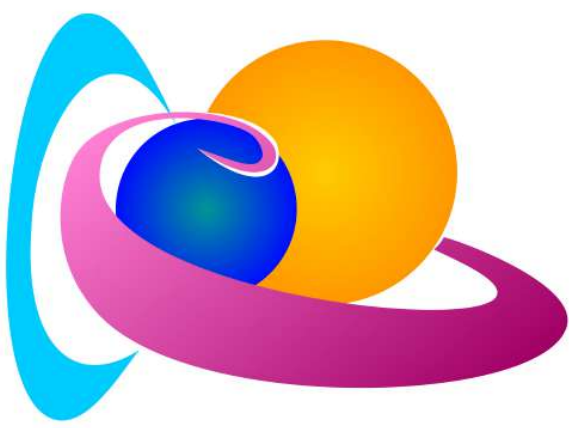
CCMC Workshop 2024 with tentative agenda

HWM14 updates Simulation Services

CORHEL-CME updates Simulation Services

Virtual Space Weather Modeling Center (VSWMC)





Heliospheric Weather Expert Service Centre (H-ESC)

ESC Objectives

Contributions

Product demonstration

Contributors

The H-ESC concept is to demonstrate state of the art products proposed for future integration in the SSA space weather services and assess their capabilities and functionality and user satisfaction. Therefore, H-ESC demonstrates products, which are currently in a prototype level. Each demonstration product is presented by the corresponding contributor on federated websites.

▼ Centre for mathematical Plasma-Astrophysics (KUL/CmPA)

VSWMC

- H.200a Virtual Space Weather Modelling Centre

Other Event Chain Catalogues: DONKI (M2M_CATALOG, CCMC)



Space Weather Database Of Notifications, Knowledge, Information

(DONKI)

Go to:

- [About DONKI](#)
- [DONKI Home](#)
- [Search Space Weather Activity](#)
- [Search Notification Archive](#)
- [Login](#)

Search Space Weather Activity Archive

Space Weather Activity Type :

Select Catalog :

Optional start date in format (e.g. 2013-01-31) :

Optional end date in format (e.g. 2013-06-30) :

Event Type	Start Time (UT)	Associated Instrument	Peak Time	End Time	Class	Source Location	Active Region Number	Directly Linked Event(s)
Solar Flare	2023-09-03 00:14	GOES-P: EXIS 1.0-8.0	2023-09-03T00:23Z	2023-09-03T00:33Z	M1.1	N12W90	13413	2023-09-03T00:36:00-CME-001
Solar Flare	2023-09-03 04:00	GOES-P: EXIS 1.0-8.0	2023-09-03T04:10Z	2023-09-03T04:14Z	C1.8	N10W90	13413	2023-09-03T04:36:00-CME-001

CME scoreboard (CCMC)



COMMUNITY
COORDINATED
MODELING
CENTER

CME Scoreboard

Active CMEs:

CME: 2024-05-14T10:09:00-CME-001

CME Note: Wide CME seen to the NE in all coronagraphs (STEREO A gets first visible frame). Source is an unnumbered region of the solar disk, centered around N23E35. Starting around 2024-05-14T09:07Z, field line movement is observed in SDO AIA 171/193/211 alongside a diagonal region of light dimming spanning approximately N40E60 -> N15E30 across that center point. A distinct post-eruptive arcade forms around 2024-05-14T10:47Z across SDO AIA 131/171/193/211.

<u>Predicted Shock Arrival Time</u>	<u>Difference (hrs)</u>	<u>Confidence (%)</u>	<u>Submitted On</u>	<u>Lead Time (hrs)</u>	<u>Predicted Geomagnetic Storm Parameter(s)</u>	<u>Method</u>	<u>Submitted By</u>	
2024-05-17T23:00Z (-7.0h, +7.0h)	----	----	2024-05-14T18:45Z	76.25	Max Kp Range: 2.0 - 3.0	WSA-ENLIL + Cone (NASA M2M)	Tony Iampietro (M2M)	Detail
2024-05-17T23:00Z	----	----	---	---	Max Kp Range: 2.0 - 3.0	Average of all Methods	Auto Generated (CCMC)	Detail

CME: 2024-05-11T01:36:00-CME-001

CME Note: Ear-shaped bright partial halo CME with a very complex shape brighter bulk and a fainter somewhat asymmetric full halo shock. The CME is associated with the X5.8 flare and a significant eruption (massive dimming) and EUV wave seen in SDO 193.

<u>Predicted Shock Arrival Time</u>	<u>Difference (hrs)</u>	<u>Confidence (%)</u>	<u>Submitted On</u>	<u>Lead Time (hrs)</u>	<u>Predicted Geomagnetic Storm Parameter(s)</u>	<u>Method</u>	<u>Submitted By</u>	
2024-05-12T11:13Z (-5.0h, +3.84h)	----	----	2024-05-11T05:24Z	29.82	----	CMEFM v.0.1	Garrett Imhoff (Other)	Detail
2024-05-13T13:00Z (-12.0h, +12.0h)	----	----	2024-05-11T06:38Z	54.37	Max Kp Range: 5.0 - 6.0	WSA-ENLIL + Cone (BoM)	Duty Forecaster (ASWFC)	Detail
2024-05-12T18:00Z (-6.0h, +12.0h)	----	70.0	2024-05-11T09:30Z	32.50	Max Kp Range: -- - 8.0	WSA-ENLIL + Cone (Met Office)	Met Office (Met Office)	Detail
2024-05-13T01:00Z	----	60.0	2024-05-11T10:20Z	38.67	Max Kp Range: 5.0 - 7.0	Cone + HAF (SEPC, NSSC, CAS)	Jingjing Wang (NSSC SEPC)	Detail
2024-05-13T04:59Z (-7.0h, +7.0h)	----	----	2024-05-11T14:23Z	38.60	Max Kp Range: 5.0 - 7.0	WSA-ENLIL + Cone (NASA M2M)	Carina Alden (M2M Office)	Detail

Flare scoreboard (CCMC/ISWA)

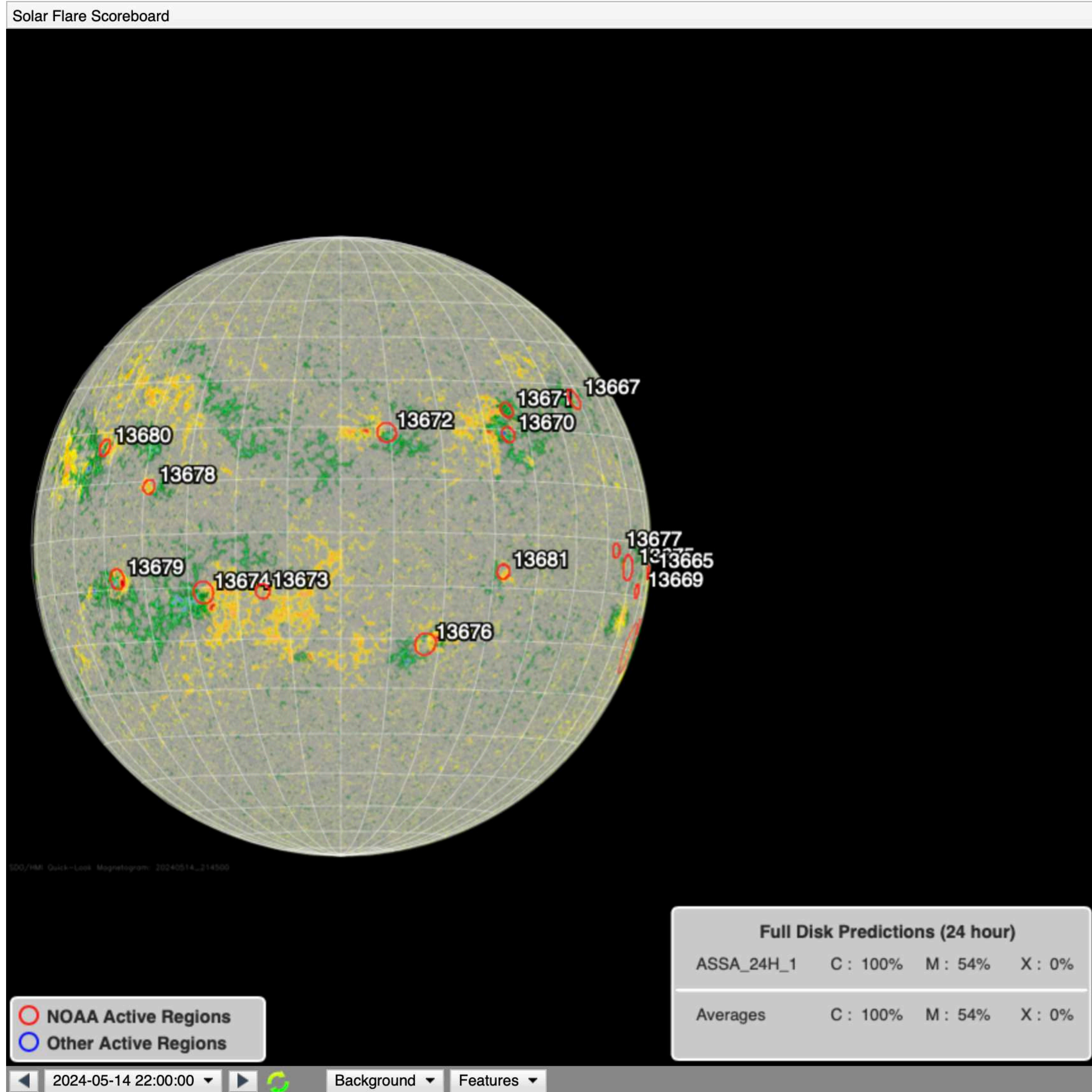
<https://ccmc.gsfc.nasa.gov/tools/iSWA/>

ISWA COMMUNITY COORDINATED MODELING CENTER

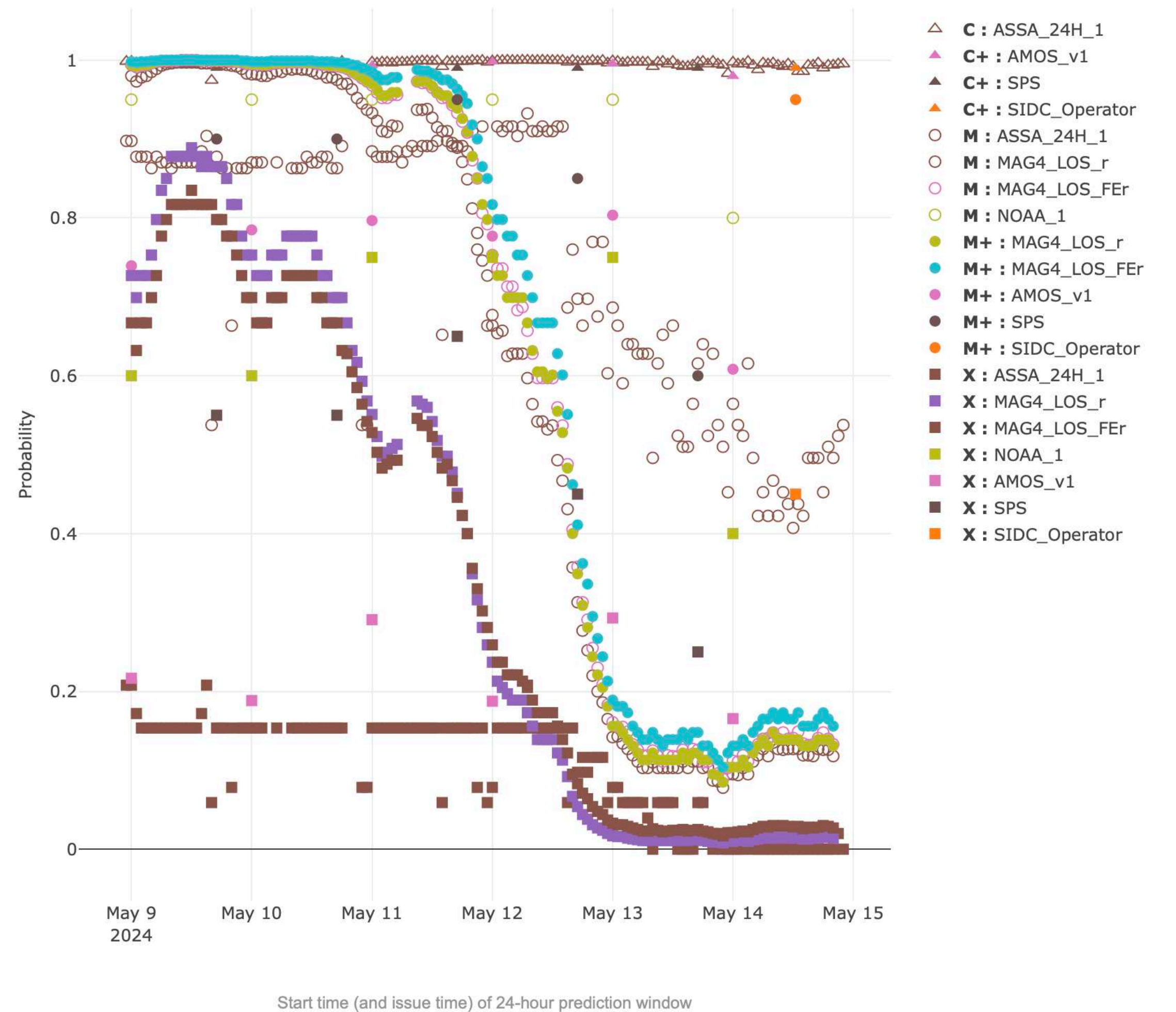
Help Save Layout Global Date/Time Clear Layout

Available Cygnets

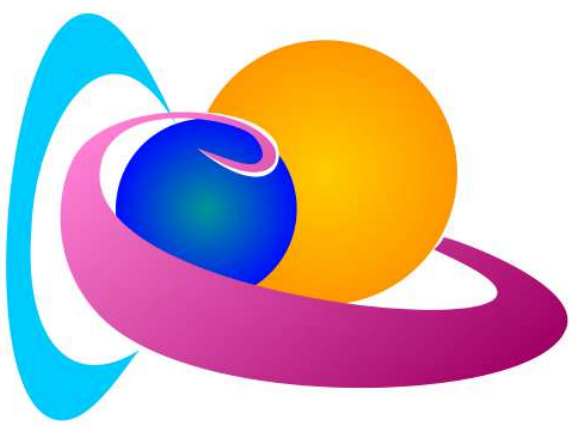
- Solar Heliosphere Magnetosphere Ionosphere Planetary Radiation Effects Events Time Periods ISEP Mars All Retired
- Solar Flare Scoreboard HAPI Timeline iSWA Super Timeline ASAP Flare Monitor ASSA SOHO



Full Disk 24 Hour Predictions

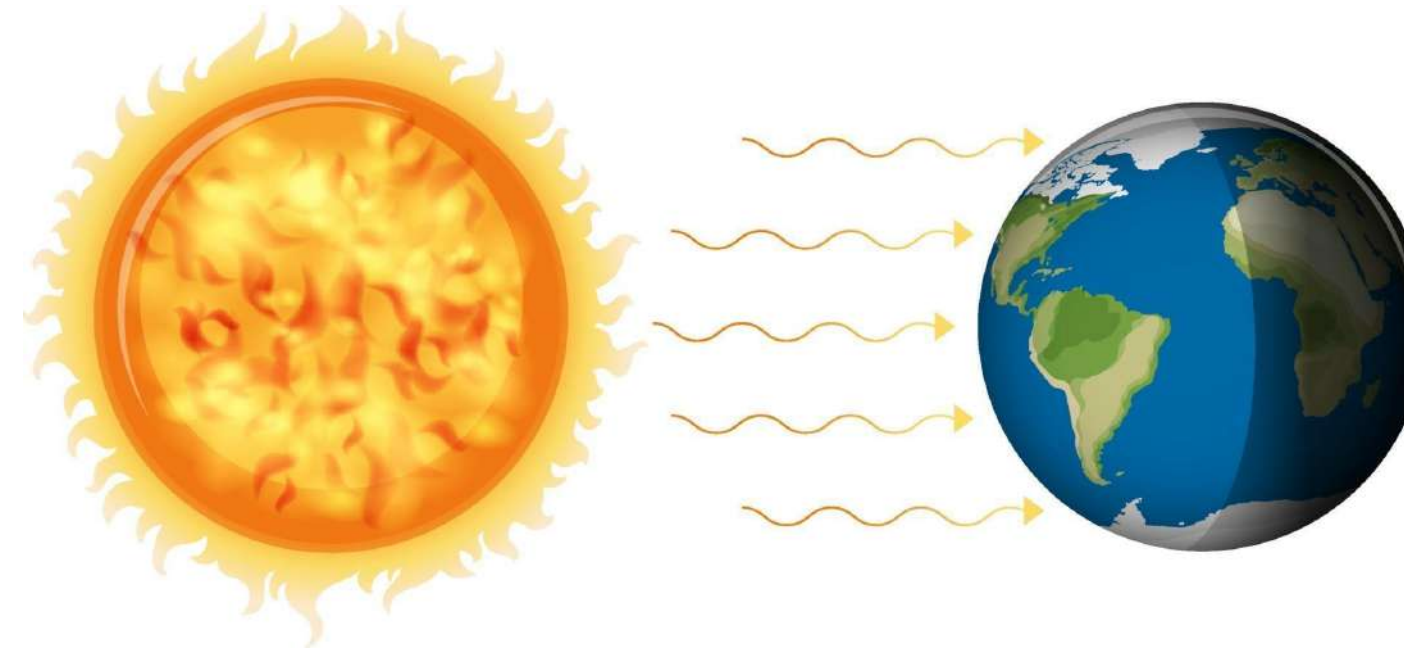


What is needed for operational service provision?



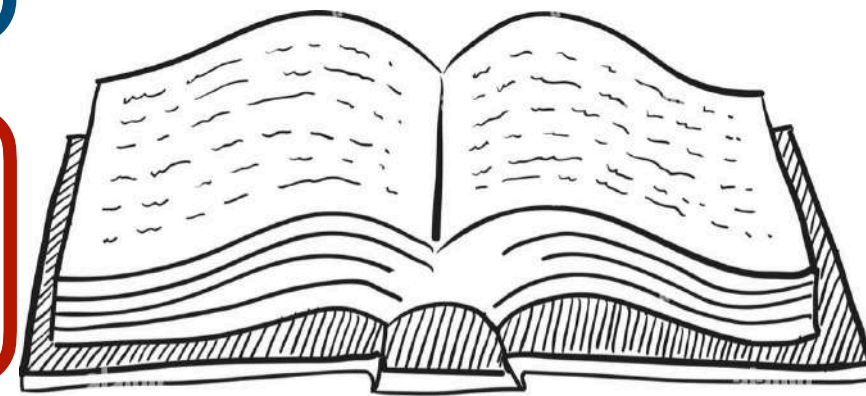
- Service definition

- Data, models, tools



- Operators

- Procedures

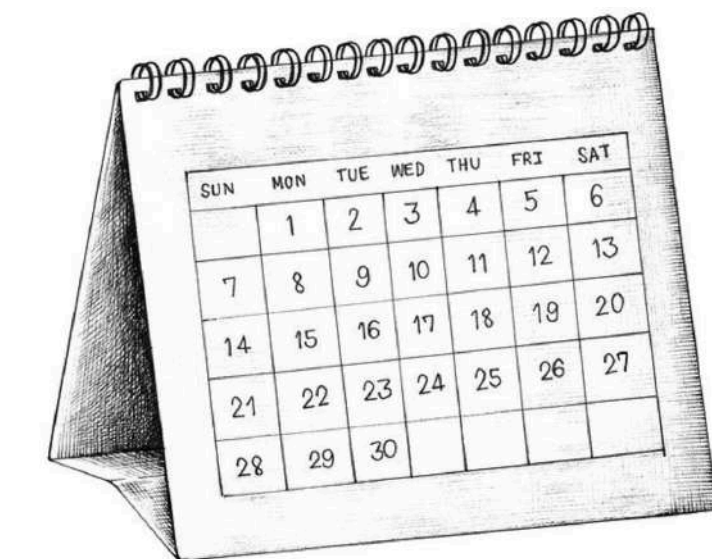


- Shifts

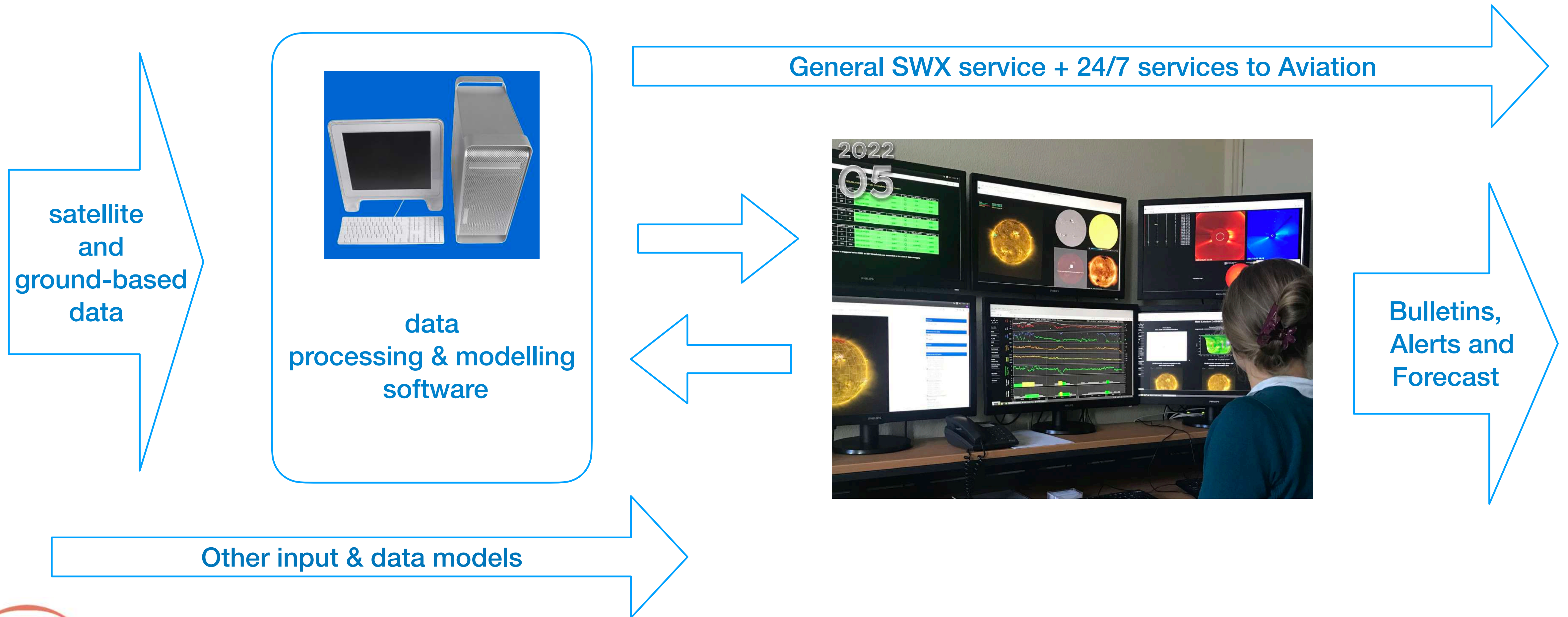
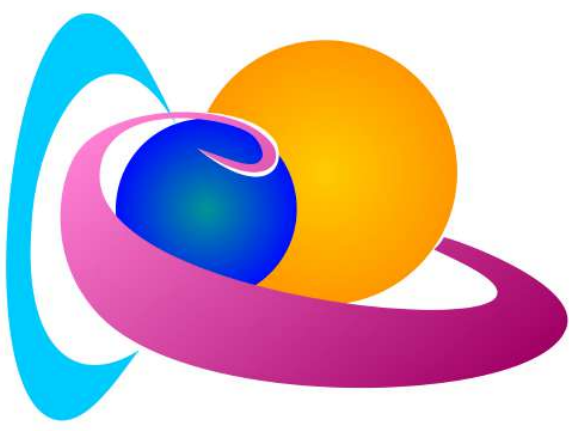
- Supporting Personnel

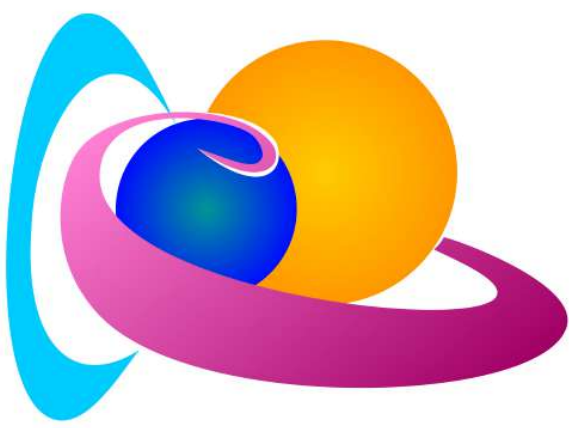


- Robust IT infrastructure



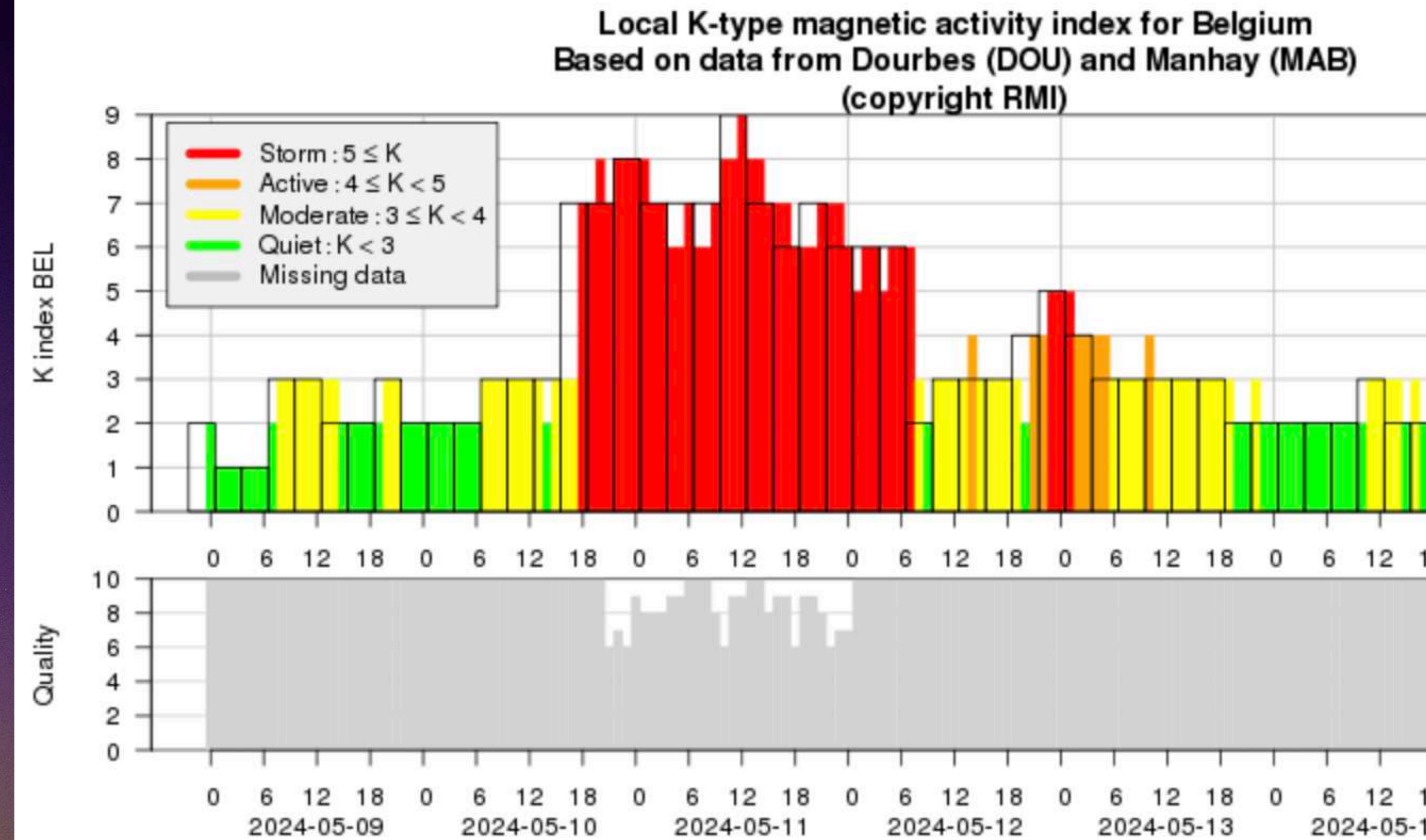
Space weather (SWX) monitoring and forecasting services at ROB/STCE

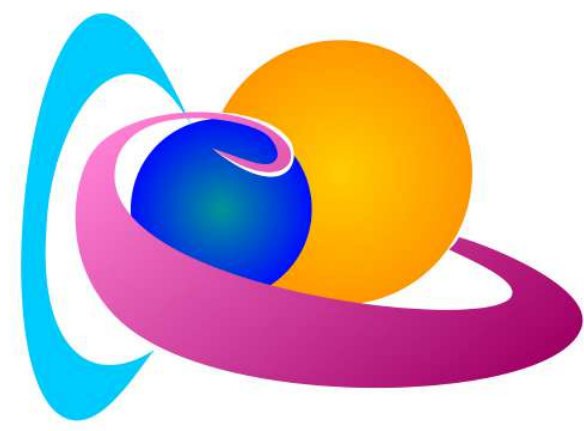




EXERCISE 2: connect solar drivers to SWX impacts

Extreme geomagnetic storms (G5) on May 10th, May 11th



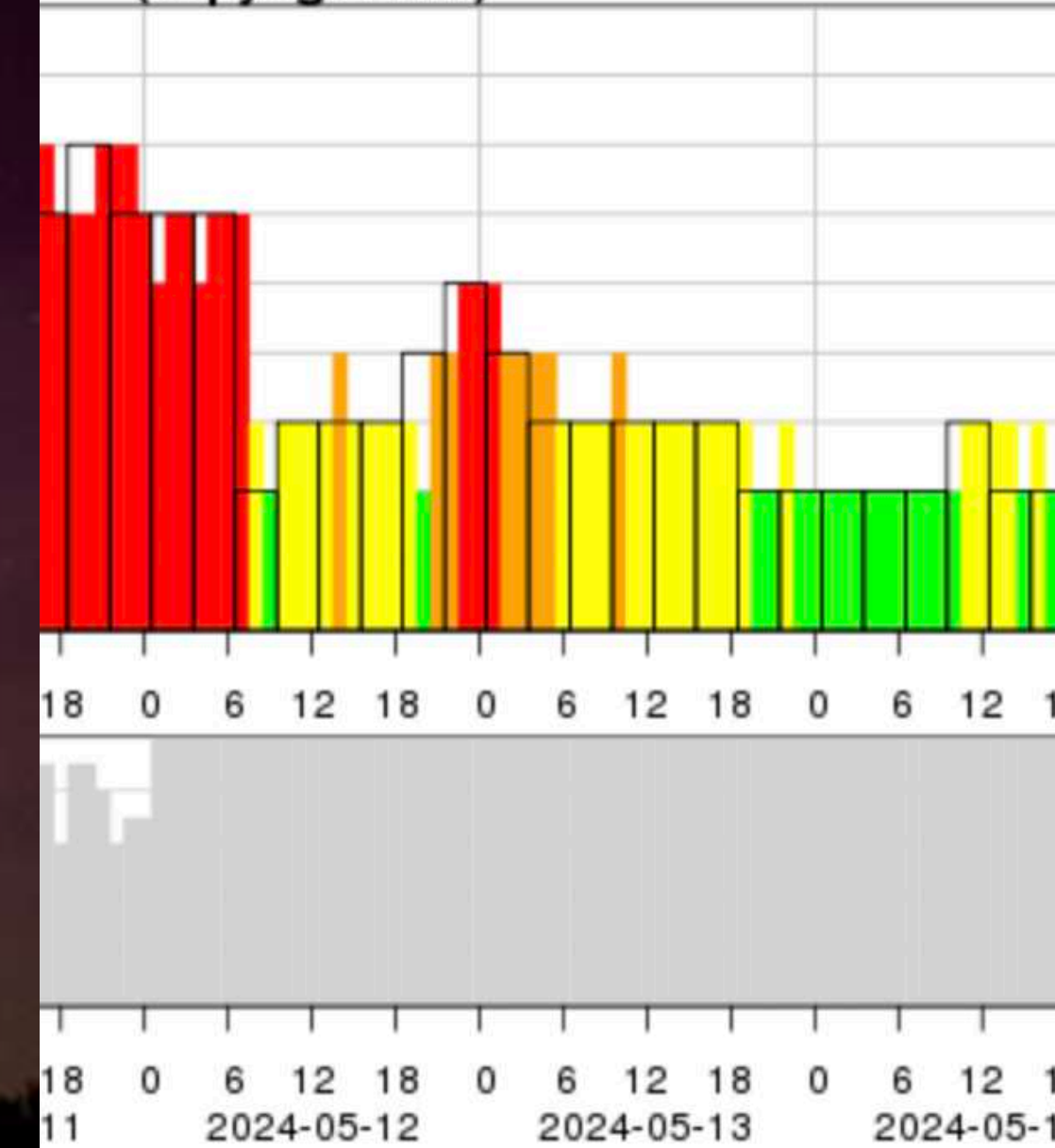


EXERCISE 2: connect solar drivers to SWX impacts

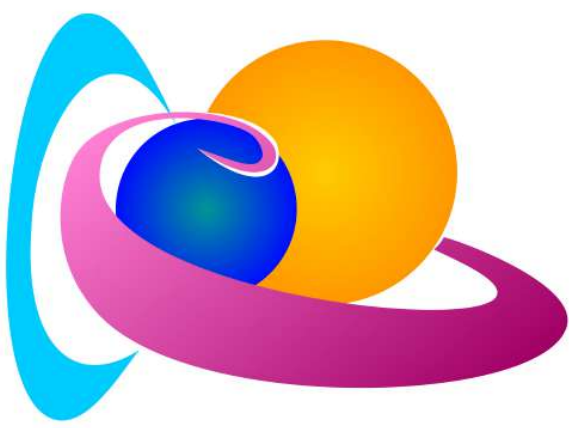
Extreme geo



magnetic activity index for Belgium
from Dourbes (DOU) and Manhay (MAB)
(copyright RMI)



EXERCISE 2: connect solar drivers to SWX impacts

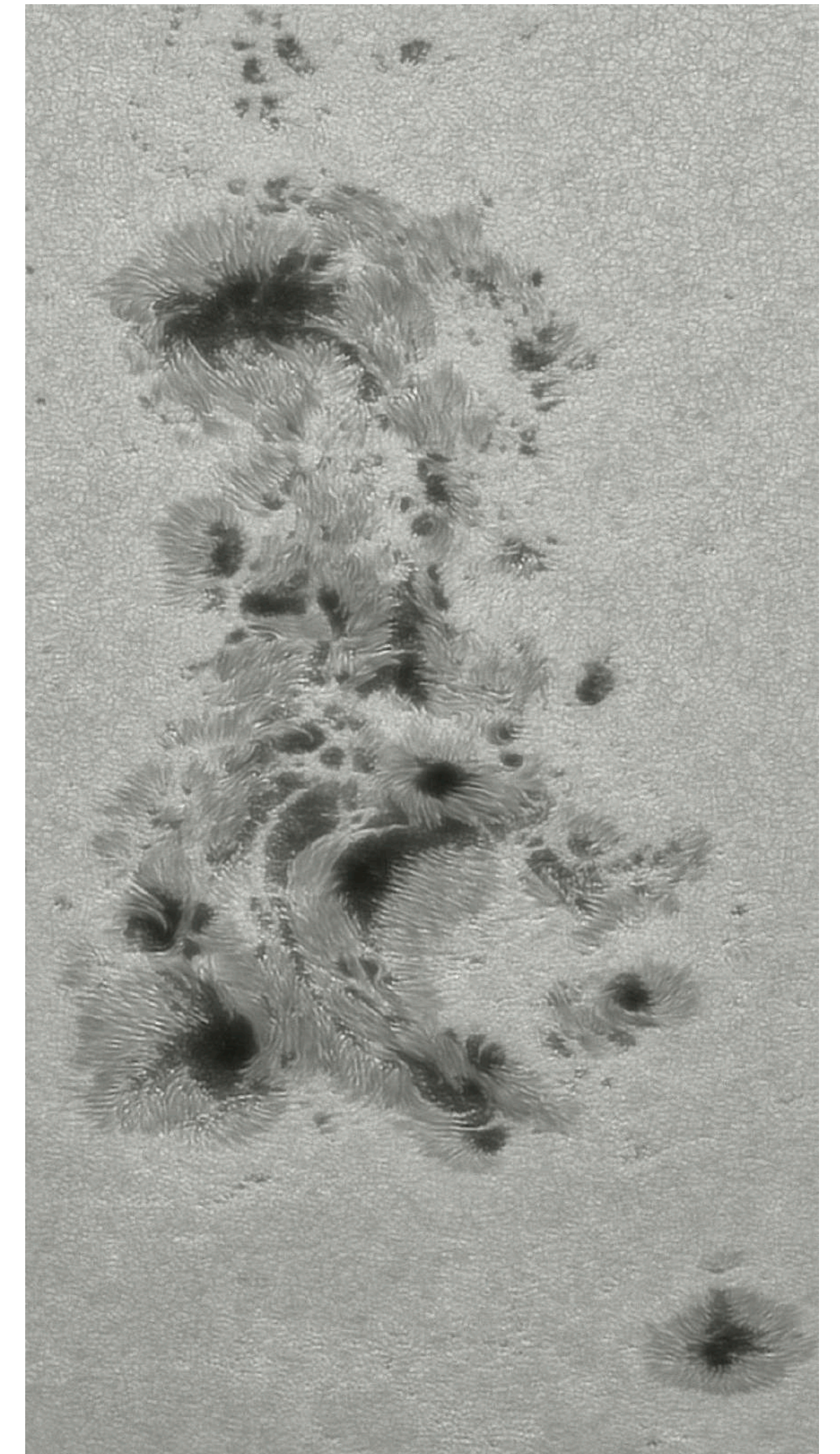


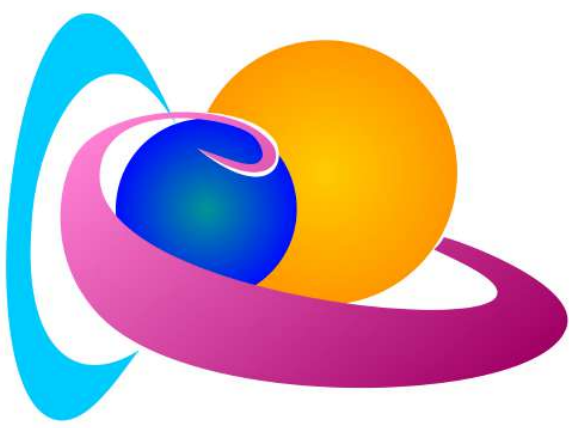
Go to <https://tinyurl.com/SWXImpacts>

Connect the solar drivers & model predictions with expected and observed SWX impacts

1. Check the data in Exercises/Data
2. Fill in Impact Table in Exercises/testImpacts
3. Bonus: try to understand the time flow

Hint: Possible answers: “Yes”, “No”, “No data”, “Possible”, ...





EXERCISE 2: Solution

Extreme geomagnetic storms (G5) on May 10th, May 11th

Domain	Possible Impact	Observed	Expected
Satellite Operators	Single Event Effects	No data	Possible intermittent SEUs, nothing serious
	Satellite charging	No data	No
	GNSS degradation	Yes	Yes
GNSS users	Satellite drag	Probably Yes	YES!
	Loss of lock (LOL) on GNSS signals	Yes	Yes
	GNSS degradation	Yes	Yes
Power systems operators	Geomagnetically induced currents (GIC) (based on electric field of on rate of change of the geomagnetic field [dB/dt])	Yes, but data not provided here	Yes
	Blackout	No data	Possible
	Transformer damages	No data	Possible
Airlines	Transformer saturation	No data	Possible
	Radiation level increase	No data	Slight increase over the poles
	VHF and HF radio communication degradation	No data	Yes
Service to pipeline operators	GNSS degradation	No data	Yes
	Geomagnetically induced currents (GIC) (based on electric field of on rate of change of the geomagnetic field [dB/dt])	Yes, but data not provided here	Yes
	Corrosion of the pipeline steel	No data	Possible
Auroral tourism sector	Aurora at lower latitudes	YES!!	Yes
Astronaut/Human Space Flight Safety	Radiation level increase	Yes	Yes
General Public Impacts	GPS, mobile networks, satellite TV/internet, power outage	No data	Yes
Geological Survey Interference	Errors in magnetic survey measurements	Probably, no data	Yes
Animal Migration	Disorientation of animals	Possible, No data	Yes

END OF PART 2