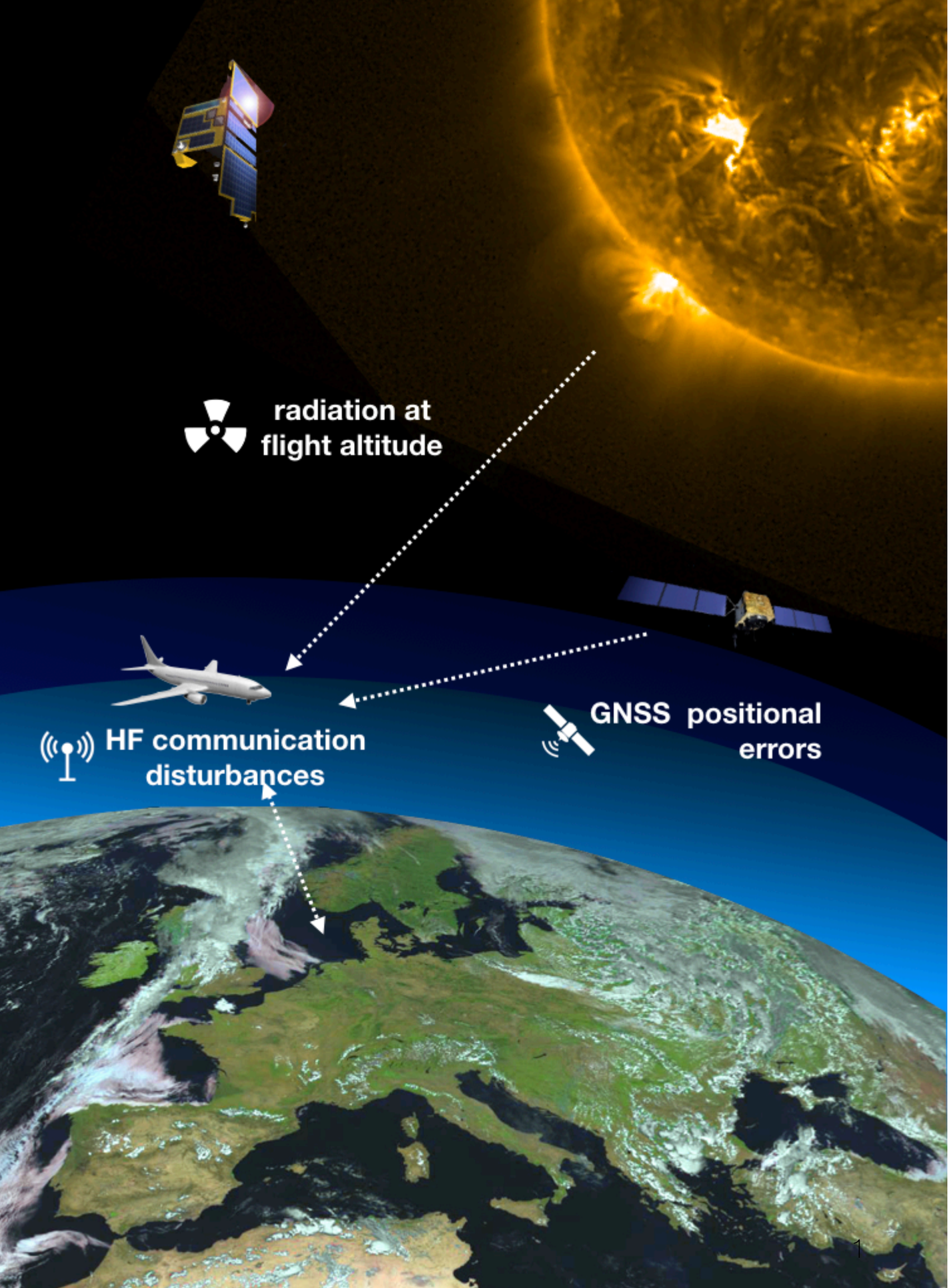
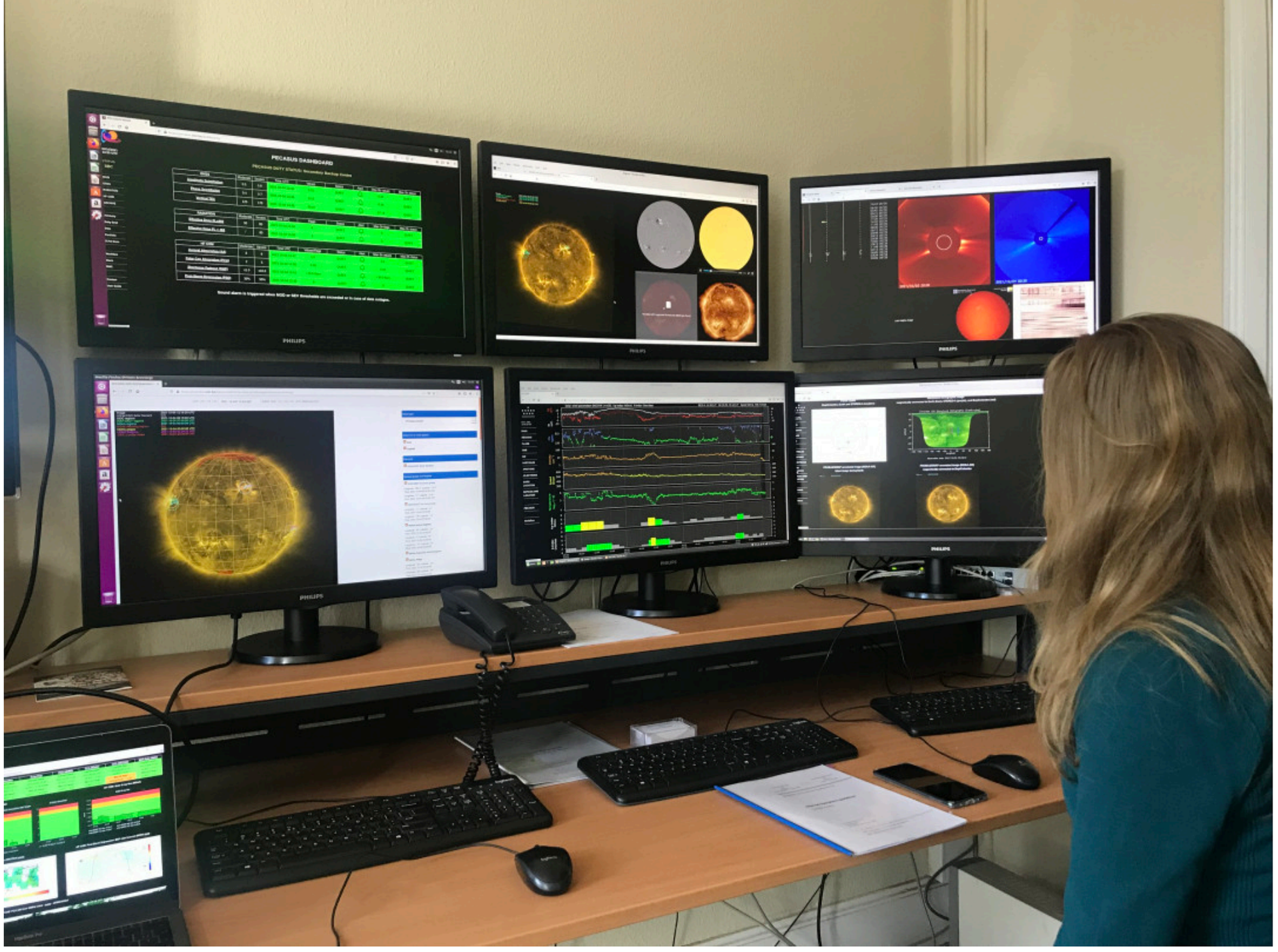


Space Weather impacts on Aviation

PECASUS advisories for ICAO

Course by the
Solar-Terrestrial Centre of Excellence

March 2024



Space Weather Forecasting at the STCE Products and Tools

Elke D'Huys

SIDC Webpage

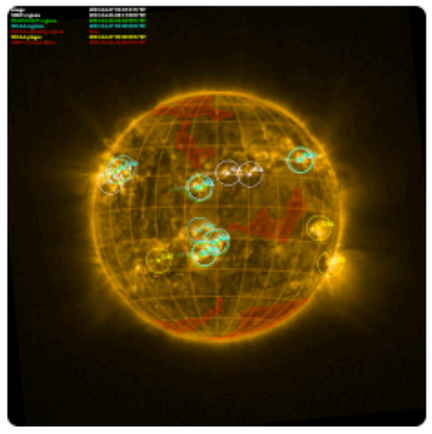
Space Weather Services

Detections

Solardemon
2023-04-27 02:51 B8 flare

CACTus
2023-04-21 18:12
844km/s

Solar Map



Latest Alerts

Presto 2023-04-24

The Corona Mass Ejection (CME) arrival first reported yesterday continues to cause a major geomagnetic storm. Although the solar wind velocity has now dropped to 500 km/s and the North-South component of the interplanetary magnetic field (Bz) has now increased to -10 nT, the Kp index has reach the severe level (Kp=8, G4). The geomagnetic conditions are expected

Forecasts

Flare:	Quiet conditions (<50% C-class flares)
Protons:	Quiet
Geomagnetic:	Quiet (A<20 and K<4)
All quiet:	False
Provisional SSN:	127

Solar Activity

URSIgram 2023-04-26

Solar flaring activity was low and infrequent with two C1 flares detected during the past 24 hours. NOAA Active Region (AR) 3285 (Catania group 65) produced one of them, while a yet unnamed AR turning into Earth's view produced the second flare. More C-class flare activity is expected in the next 24 hours, most probably from the unnamed AR mentioned above. No Earth-directed Coronal Mass Ejections

Solar Wind

URSIgram 2023-04-26

The Solar Wind (SW) conditions were stable during the last 24 hours. The SW speed ranged between 490 and 570 km/s in the last 24 hours. The total interplanetary magnetic field (Bt) varied between 2 and 6 nT and its North-South component (Bz) ranged between -5 and 5 nT. The interplanetary magnetic field phi angle was directed away from the Sun until yesterday 19:00 UT and has turned

Forecaster and Pecasus operator Tasks

Forecaster

- One week duty cycle
- Daily ursigram
- Alerts when needed
- Briefing/handover on Monday
- 24/7 with automated alerts
- PECASUS operator during day (9-17h)
- Tailored bulletins (BepiColombo, Mars Express)

PECASUS Operator

- 17h-9h (except weekends)
- Night shifts
- On call with support from MeteoWing
- ICAO Advisories when needed + follow-up

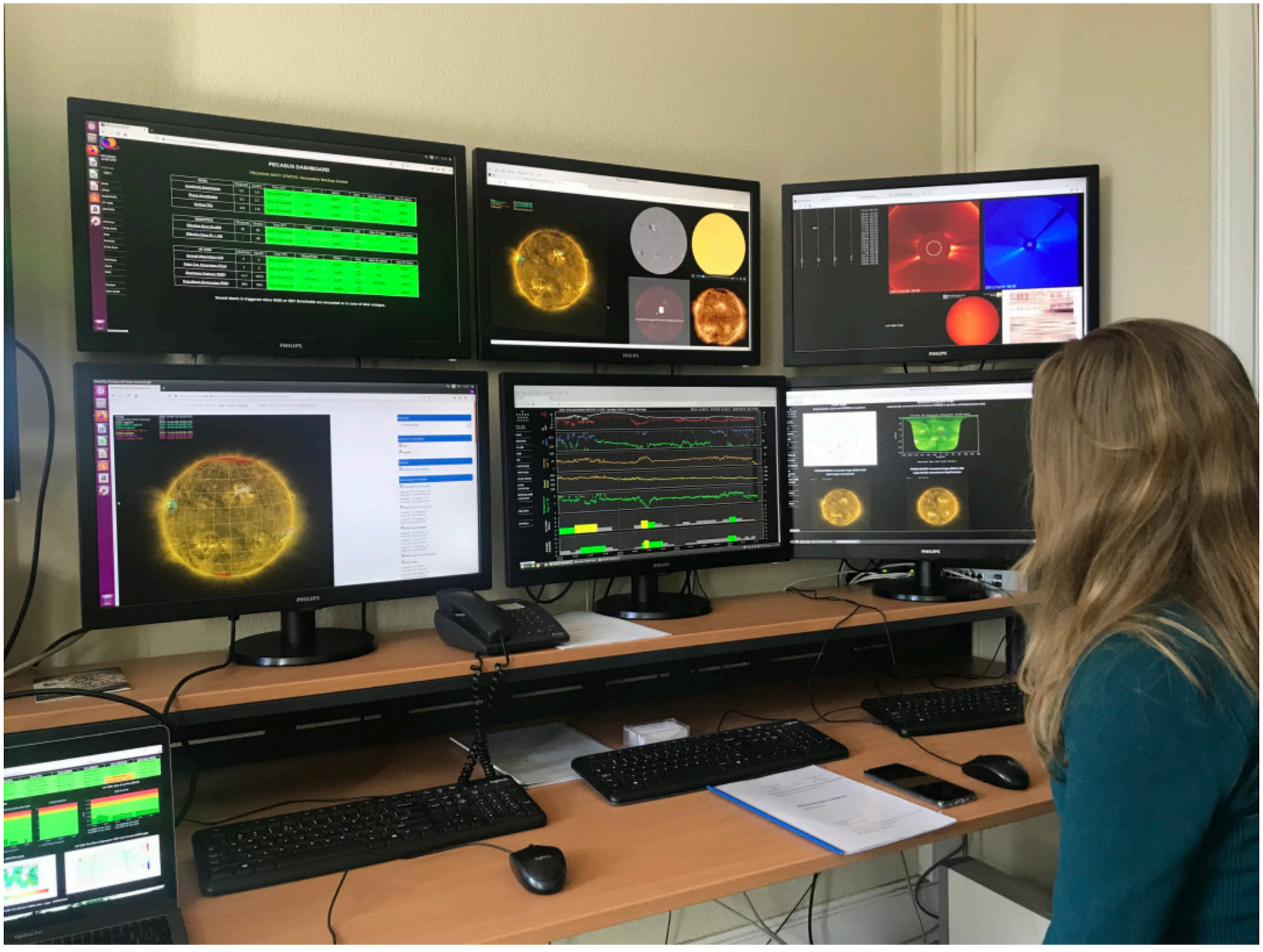
SWIC

ISES

PECASUS
PAN-EUROPEAN CONSORTIUM FOR AVIATION SPACE WEATHER USER SERVICES

Meteo Wing
Belgian Air Component

Monitoring



Previweb - Forecaster page

UTC time: 10:02:16 Date: 2023-05-05 Forecast status : Busy Forecaster: de Patoul Judith

Login : elked Warning : you are not the forecaster : Make me forecaster Logout

Catania needs update Click here

Forecast regions | Forecast 10cm flux | Forecast K | Forecast helio | Finish forecast

Solar Flares - Regions

Forecast regions | Forecast 10cm flux | Forecast K | Forecast helio | Finish forecast

Catania info (Last update: 2023-Apr-26)						NOAA info (Last update: 2023-Apr-27)					Probabilities for			
Number	area	nspots	Zurich	Longitude	Latitude	Number	Macintosh	Mag. type	Longitude	Latitude	C flare	M flare	X flare	Proton
65	20	6	C	-14.0	-17.0	3285	Cso	Beta	-5.0	-17.0	10	1	1	1
						3286	Axx	Alpha	-12.0	-11.0	5	1	1	1
67	15	10	D	-21.0	-23.0	3288	Dso	Beta	-10.0	-22.0	40	1	1	1
69	7	4	D	-74.0	19.0	3289	Dso	Beta	-58.0	20.0	90	10	1	1
66	4	4	D	34.0	24.0	3290	Dro	Beta	45.0	24.0	30	1	1	1
68	1	3	B	-23.0	8.0	3291	Bxo	Beta	-12.0	9.0	15	1	1	1

Total flare forecast (computed range of probabilities, depending on the above filled out info)

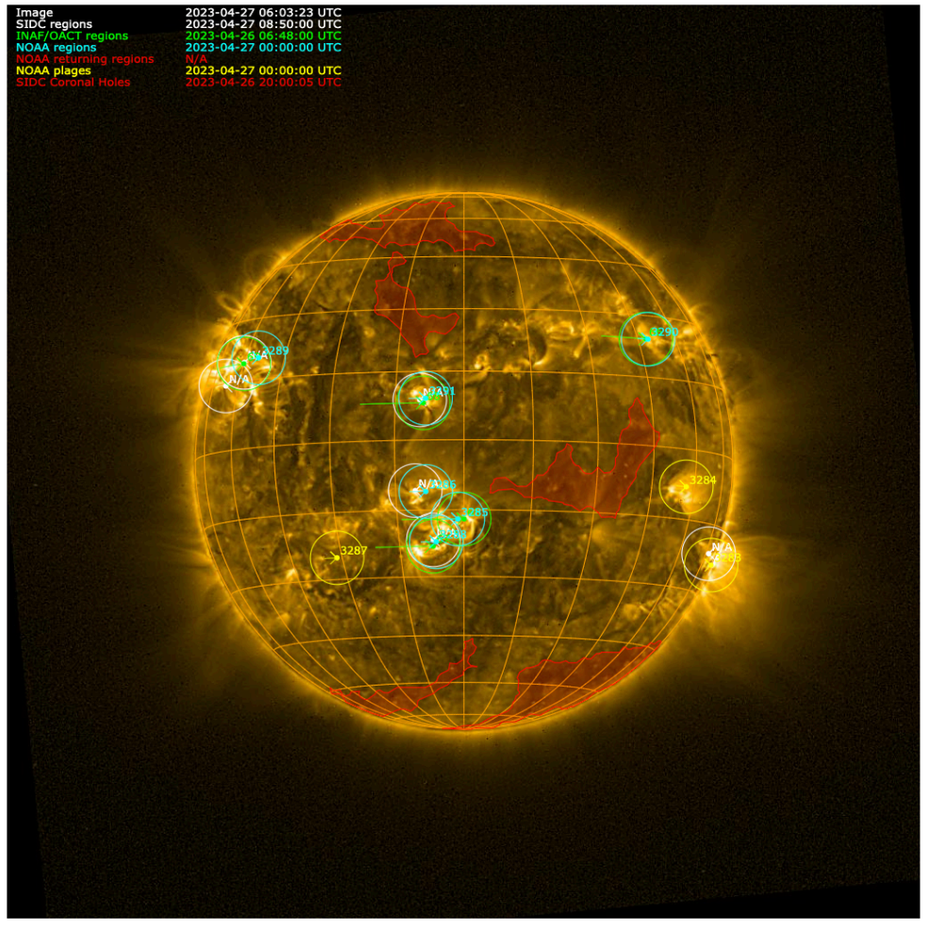
Flare level	Total flares Catania (Last update: 2023-Apr-26)	Total flares NOAA (Last update: 2023-Apr-27)	Predictions
C	96	96	
M	13	14	
X	4	5	

Flare forecast (computed range of probabilities, depending on the above filled out info)

Proton forecast

Total protons:

Solar activity info



Links

Solar images and features

- Solar map
- USET regions
- Solar Monitor Regions
- Latest NOAA synoptic map
- Raben Maps
- STEREO Stonyhurst heliographic maps
- PROBA2 LYRA data and SWAP images
- SDO movies
- SDO movies (ROB page)
- SOHO movietheater (defunct)
- SOHO data
- STEREO movies
- Realtime GONG H-alpha movies (backup)

Flares

- NOAA SWPC event lists: today, yesterday, archive, ROB-hosted
- Kanzelhoehe flare list
- Solar Demon
- SolarSoft Latest Events
- GOES X-ray, proton & electron flux, estimated Kp (assembled fro
- GOES X-ray plots
- LYRA Quick Look viewer
- Solar monitor Flare Forecast
- Bradford university Flare monitor (ASAP)
- SIDC flare forecast archive

Radio

- Latest 10.7cm measurement, Archive of 10.7cm measurement
- SWPC radio flux measurements
- 10.7cm forecasts by CLS
- Radio bursts Humain
- NOAA SWPC event lists: today, yesterday, archive, ROB-hosted searchable flare archive
- Culgoora spectrographs
- Culgoora Latest Radio burst
- Learmonth spectrographs

Solar Flares - Forecast

Forecast regions | Forecast 10cm flux | Forecast K | Forecast helio | Finish forecast

Catania info (Last update: 2023-Apr-26)						NOAA info (Last update: 2023-A					Probabilities for			
Number	area	nspots	Zurich	Longitude	Latitude	Number	Macintosh	Ma typ	ongitude	Latitude	C flare	M flare	X flare	Proton
65	20	6	C	-14.0	-17.0	3285	Cso	Be	-5.0	-17.0	10	1	1	1
						3286	Axx	Alp	-12.0	-11.0	5	1	1	1
67	15	10	D	-21.0	-23.0	3288	Cso	Beta	-10.0	-22.0	40	1	1	1
69	7	4	D	-74.0	19.0	3289	Cso	Beta	-58.0	20.0	90	10	1	1
66	4	4	D	34.0	24.0	3290	Dro	Beta	45.0	24.0	30	1	1	1
68	1	3	B	-23.0	8.0	3291	Bxo	Beta	-12.0	9.0	15	1	1	1

Total flare forecast (computed range of probabilities, depending on the above filled out info)

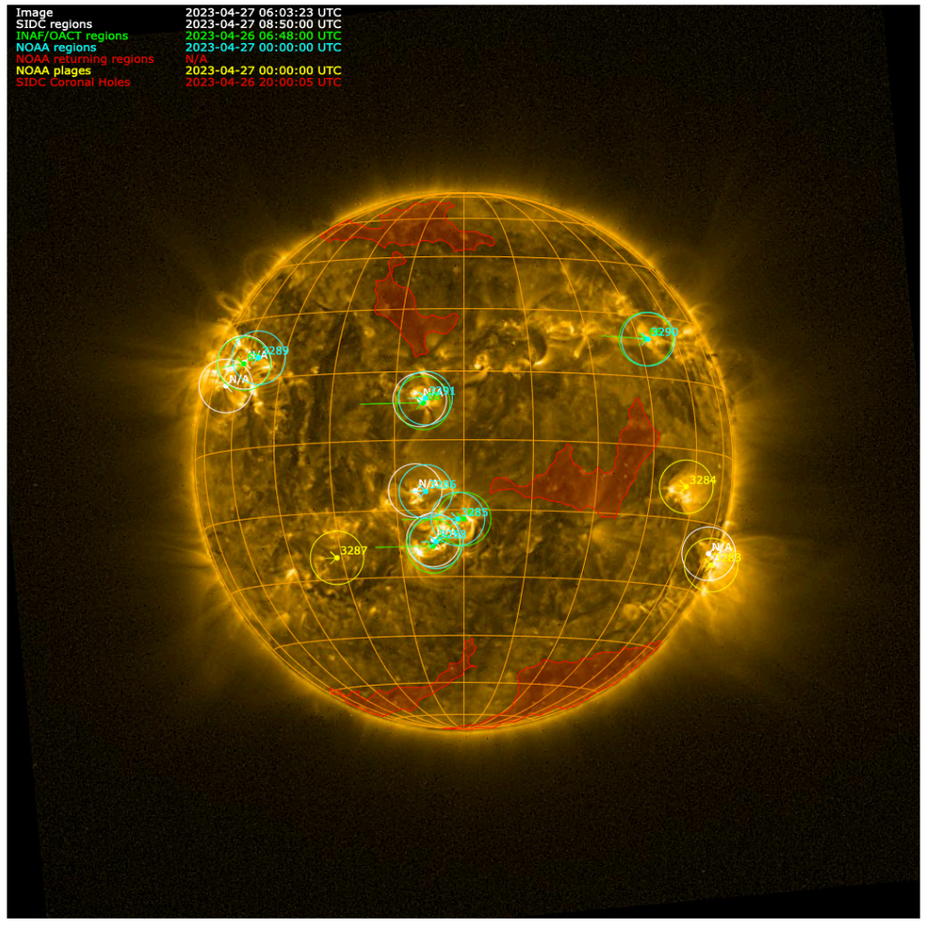
Flare level	Total flares Catania (Last update: 2023-Apr-26)	Total flares NOAA (Last update: 2023-Apr-27)	Predictions
C	96	96	
M	13	14	
X	4	5	

Flare forecast (computed range of probabilities, depending on the above filled out info)

Proton forecast

Total protons:

Solar activity info



Links

Solar images and features

- Solar map
- USET regions
- Solar Monitor Regions
- Latest NOAA synoptic map
- Raben Maps
- STEREO Stonyhurst heliographic maps
- PROBA2 LYRA data and SWAP images
- SDO movies
- SDO movies (ROB page)
- SOHO movietheater (defunct)
- SOHO data
- STEREO movies
- Realtime GONG H-alpha movies (backup)

Flares

- NOAA SWPC event lists: today, yesterday, archive, ROB-hosted
- Kanzelhoehe flare list
- Solar Demon
- SolarSoft Latest Events
- GOES X-ray, proton & electron flux, estimated Kp (assembled fro
- GOES X-ray plots
- LYRA Quick Look viewer
- Solar monitor Flare Forecast
- Bradford university Flare monitor (ASAP)
- SIDC flare forecast archive

Radio

- Latest 10.7cm measurement, Archive of 10.7cm measurement
- SWPC radio flux measurements
- 10.7cm forecasts by CLS
- Radio bursts Humain
- NOAA SWPC event lists: today, yesterday, archive, ROB-hosted searchable flare archive
- Culgoora spectrographs
- Culgoora Latest Radio burst
- Learmonth spectrographs

Solar Flares - Forecast Disk

Forecast regions | Forecast 10cm flux | Forecast K | Forecast helio | Finish forecast

Catania info (Last update: 2023-Apr-26)						NOAA info (Last update: 2023-Apr-27)					Probabilities for			
Number	area	nspots	Zurich	Longitude	Latitude	Number	Macintosh	Mag. type	Longitude	Latitude	C flare	M flare	X flare	Proton
65	20	6	C	-14.0	-17.0	3285	Cso	Beta	-5.0	-17.0	10	1	1	1
						3286	Axx	Alpha	-12.0	-11.0	5	1	1	1
67	15	10	D	-21.0	-23.0	3288	Dso	Beta	-10.0	-22.0	40	1	1	1
69	7	4	D	-74.0	19.0	3289	Dso	Beta	-58.0	20.0	90	10	1	1
66	4	4	D	34.0	24.0	3290	Dro	Beta	45.0	24.0	30	1	1	1
68	1	3	B	-23.0	8.0	3291	Bxo	Beta	-12.0	9.0	15	1	1	1

Total flare forecast (computed range of probabilities, depending on the above filled out info)

Flare level	Total flares Catania (Last update: 2023-Apr-26)	Total flares NOAA (Last update: 2023-Apr-27)	Predictions
C	96	96	
M	13	14	
X	4	5	

Flare forecast (computed range of probabilities, depending on the above filled out info)

Proton forecast

Total protons:

Solar activity info

Flare forecast (computed range of probabilities, depending on the above filled out info)

- ✓ ---------
- No forecast
- Quiet conditions (<50% probability of C-class flares)
- C-class flares expected, (probability >=50%)
- M-class flares expected (probability >=50%)
- X-class flares expected (probability >=50%)
- Proton flares expected (proton flares expected, probability >=50%)
- Warning condition (activity levels expected to increase, but no numeric forecast given)

Links

Solar images and features

- Solar map
- USET regions
- Solar Monitor Regions
- Latest NOAA synoptic map
- Raben Maps
- STEREO Stonyhurst heliographic maps
- PROBA2 LYRA data and SWAP images
- SDO movies
- SDO movies (ROB page)
- SOHO movietheater (defunct)
- STEREO movies
- Realtime GONG H-alpha movies (backup)

Flares

- NOAA SWPC event lists: today, yesterday, archive, ROB-hosted searchable flare archive
- Kanzelhoehe flare list
- Solar Demon
- SolarSoft Latest Events
- GOES X-ray, proton & electron flux, estimated Kp (assembled from NOAA by N3KL)
- GOES X-ray plots
- LYRA Quick Look viewer
- Solar monitor Flare Forecast
- Bradford university Flare monitor (ASAP)
- SIDC flare forecast archive

Radio

- Latest 10.7cm measurement, Archive of 10.7cm measurement
- SWPC radio flux measurements
- 10.7cm forecasts by CLS
- Radio bursts Humain
- NOAA SWPC event lists: today, yesterday, archive, ROB-hosted searchable flare archive
- Culgoora spectrographs
- Culgoora Latest Radio burst
- Learmonth spectrographs

Flares -> Short Wave fade-out

PECASUS DASHBOARD

PECASUS DUTY STATUS: Secondary Backup Centre

GNSS	Moderate	Severe	Time UTC	Values	Status	Alert	Max-3h values	Max-3h status
Amplitude Scintillation	0.5	0.8	2024-03-04 14:45	0.33	QUIET		0.98	SEVERE
Phase Scintillation	0.4	0.7	2024-03-04 14:45	0.17	QUIET		0.30	QUIET
Vertical TEC	125	175	2024-03-04 14:40	95.92	QUIET		98.57	QUIET

RADIATION	Moderate	Severe	Time UTC	Flags	Status	Alert	Max-3h flags	Max-3h status
Effective Dose FL ≤ 460	30	80	2024-03-04 14:45	0	QUIET		0	QUIET
Effective Dose FL > 460	/	80	2024-03-04 14:45	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	2024-03-04 14:48	2.0	QUIET		2.0	QUIET
Polar Cap Absorption (PCA)	2	5	2024-03-04 14:47	0.11	QUIET		0.23	QUIET
Shortwave Fadeout (SWF)	x1.0	x10.0	2024-03-04 14:45	< M5 flare	QUIET		< M5 flare	QUIET
Post-Storm Depression (PSD)	30%	50%	2024-03-04 14:45	2	SEVERE		2	SEVERE

Sound alarm is triggered when MOD or SEV thresholds are exceeded or in case of data outages.

Protons - Forecast

Forecast regions | Forecast 10cm flux | Forecast K | Forecast helio | Finish forecast

Catania info (Last update: 2023-Apr-26)						NOAA info (Last update: 2023-Apr-27)					Probabilities for			
Number	area	nspots	Zurich	Longitude	Latitude	Number	Macintosh	Mag. type	Longitude	Latitude	C flare	M flare	X flare	Proton
65	20	6	C	-14.0	-17.0	3285	Cso	Beta	-5.0	-17.0	10	1	1	1
						3286	Axx	Alpha	-12.0	-11.0	5	1	1	1
67	15	10	D	-21.0	-23.0	3288	Dso	Beta	-10.0	-22.0	40	1	1	1
69	7	4	D	-74.0	19.0	3289	Dso	Beta	-58.0	20.0	90	10	1	1
66	4	4	D	34.0	24.0	3290	Dro	Beta	45.0	24.0	30	1	1	1
68	1	3	B	-23.0	8.0	3291	Bxo	Beta	-12.0	9.0	15	1	1	1

Total flare forecast (computed range of probabilities, depending on the above filled out info)

Flare level	Total flares Catania (Last update: 2023-Apr-26)	Total flares NOAA (Last update: 2023-Apr-27)	Predictions
C	96	96	
M	13	14	
X	4	5	

Flare forecast (computed range of probabilities, depending on the above filled out info)

Proton forecast

Total protons:

Solar activity info

Links

Solar images and features

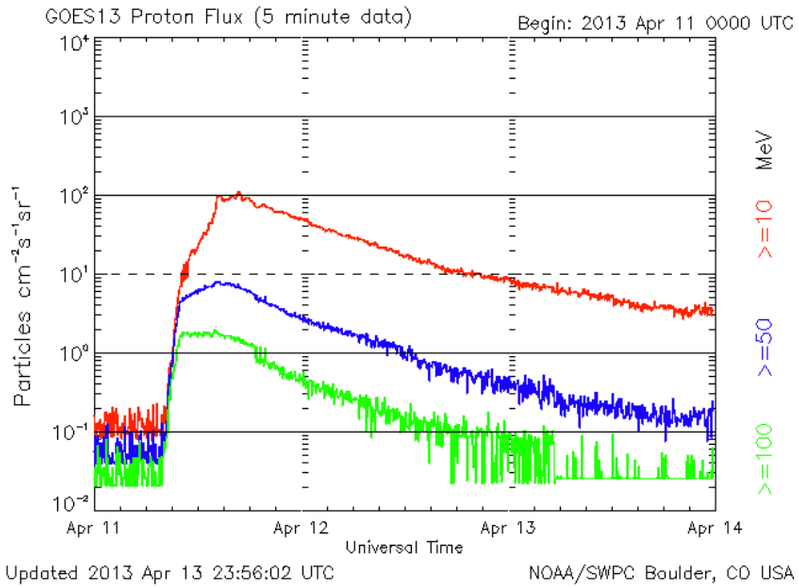
- Solar map
- USET regions
- Solar Monitor Regions
- Latest NOAA synoptic map
- Raben Maps
- STEREO Stonyhurst heliographic maps
- PROBA2 LYRA data and SWAP images
- SDO movies
- SDO movies (ROB page)
- SOHO movietheater (defunct)
- SOHO data
- STEREO movies
- Realtime GONG H-alpha movies (backup)

Flares

- Kanzelhoehe flare list
- Solar Demon
- SolarSoft Latest Events
- GOES X-ray, proton & electron flux, estimate
- GOES X-ray plots
- LYRA Quick Look viewer
- Solar monitor Flare Forecast
- Bradford university Flare monitor (ASAP)
- SIDC flare forecast archive

Radio

- Latest 10.7cm measurement, Archive of 10.7
- SWPC radio flux measurements
- 10.7cm forecasts by CLS
- Radio bursts Humain
- NOAA SWPC event lists: today, yesterday, a
- Culgoora spectrographs
- Culgoora Latest Radio burst
- Learmonth spectrographs



GOES

Proton forecast

Total protons:

- ✓ ---------
- No forecast
- Quiet
- Proton event expected (10 pfu at >10 MeV)
- Major proton event expected (100 pfu at >100 MeV)
- Proton event in progress (>10 MeV)
- Warning condition (activity levels expected to increase, but no numeric forecast given)

Proton event -> PCA

PECASUS DASHBOARD

PECASUS DUTY STATUS: Secondary Backup Centre

GNSS	Moderate	Severe	Time UTC	Values	Status	Alert	Max-3h values	Max-3h status
Amplitude Scintillation	0.5	0.8	2024-03-04 14:45	0.33	QUIET		0.98	SEVERE
Phase Scintillation	0.4	0.7	2024-03-04 14:45	0.17	QUIET		0.30	QUIET
Vertical TEC	125	175	2024-03-04 14:40	95.92	QUIET		98.57	QUIET

RADIATION	Moderate	Severe	Time UTC	Flags	Status	Alert	Max-3h flags	Max-3h status
Effective Dose FL ≤ 460	30	80	2024-03-04 14:45	0	QUIET		0	QUIET
Effective Dose FL > 460	/	80	2024-03-04 14:45	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	2024-03-04 14:48	2.0	QUIET		2.0	QUIET
Polar Cap Absorption (PCA)	2	5	2024-03-04 14:47	0.11	QUIET		0.23	QUIET
Shortwave Fadeout (SWF)	x1.0	x10.0	2024-03-04 14:45	< M5 flare	QUIET		< M5 flare	QUIET
Post-Storm Depression (PSD)	30%	50%	2024-03-04 14:45	2	SEVERE		2	SEVERE

Sound alarm is triggered when MOD or SEV thresholds are exceeded or in case of data outages.

Solar Activity - Forecast

Forecast regions | Forecast 10cm flux | Forecast K | Forecast helio | Finish forecast

Catania info (Last update: 2023-Apr-26)						NOAA info (Last update: 2023-Apr-27)					Probabilities for			
Number	area	nspots	Zurich	Longitude	Latitude	Number	Macintosh	Mag. type	Longitude	Latitude	C flare	M flare	X flare	Proton
65	20	6	C	-14.0	-17.0	3285	Cso	Beta	-5.0	-17.0	10	1	1	1
						3286	Axx	Alpha	-12.0	-11.0	5	1	1	1
67	15	10	D	-21.0	-23.0	3288	Dso	Beta	-10.0	-22.0	40	1	1	1
69	7	4	D	-74.0	19.0	3289	Dso	Beta	-58.0	20.0	90	10	1	1
66	4	4	D	34.0	24.0	3290	Dro	Beta	45.0	24.0	30	1	1	1
68	1	3	B	-23.0	8.0	3291	Bxo	Beta	-12.0	9.0	15	1	1	1

Total flare forecast (computed range of probabilities, depending on the above filled out info)

Flare level	Total flares Catania (Last update: 2023-Apr-26)	Total flares NOAA (Last update: 2023-Apr-27)	Predictions
C	96	96	
M	13	14	
X	4	5	

Flare forecast (computed range of probabilities, depending on the above filled out info)

Proton forecast

Total protons:

Solar activity info

Links

Solar images and features

- Solar map

- Past 24 hours general solar activity
- Past 24 hours [M,X]-class flares peak time and location (and optionally C-Flare).
- Forecast of new/decaying active regions
- Forecast of the flare activity level
- Filament observations and eruptions
- Proton flux and fluence

Previweb - Forecaster's Page

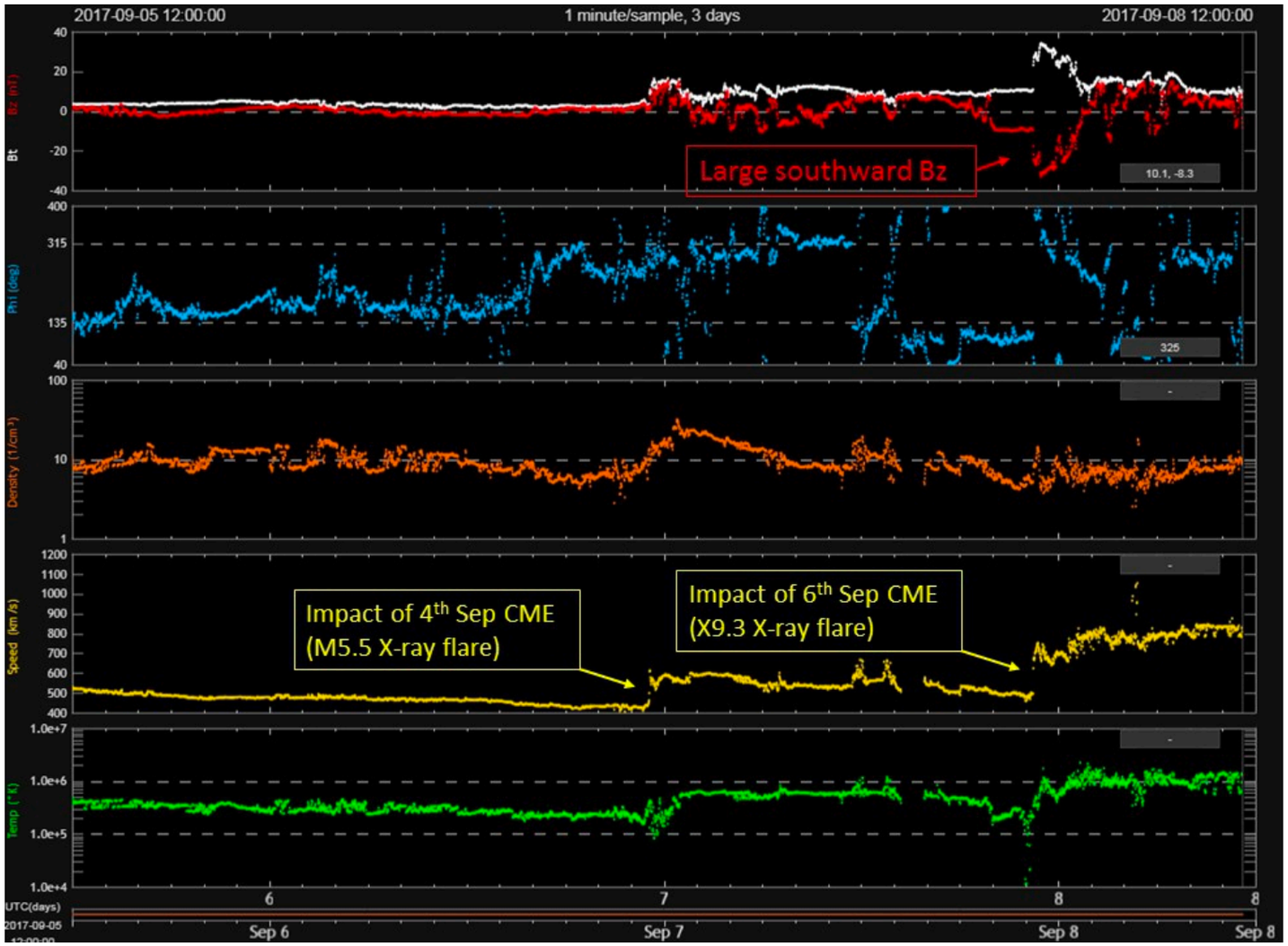
UTC time: 10:02:43 Date: 2023-05-05 Forecast status : Busy Forecaster: de Patoul Judith

Login : elked Warning : you are not the forecaster : Make me forecaster Logout

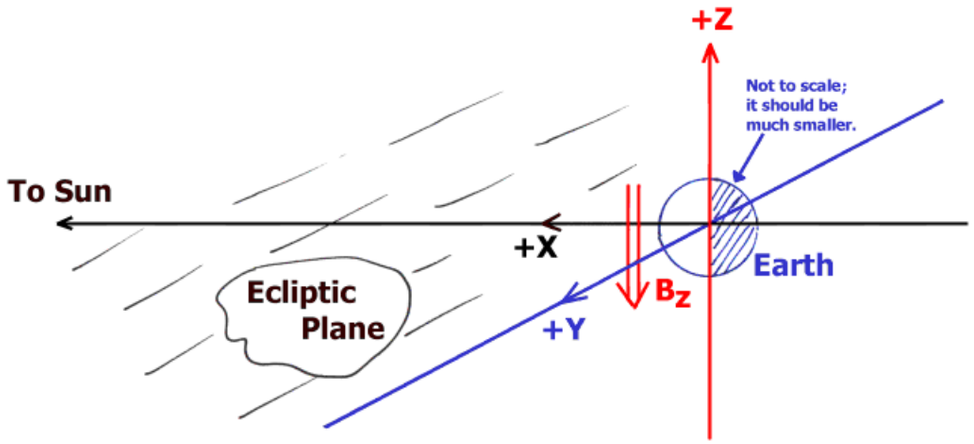
Catania needs update Click here

Forecast regions | Forecast 10cm flux | Forecast K | Forecast helio | Finish forecast

Solar Wind - Observations



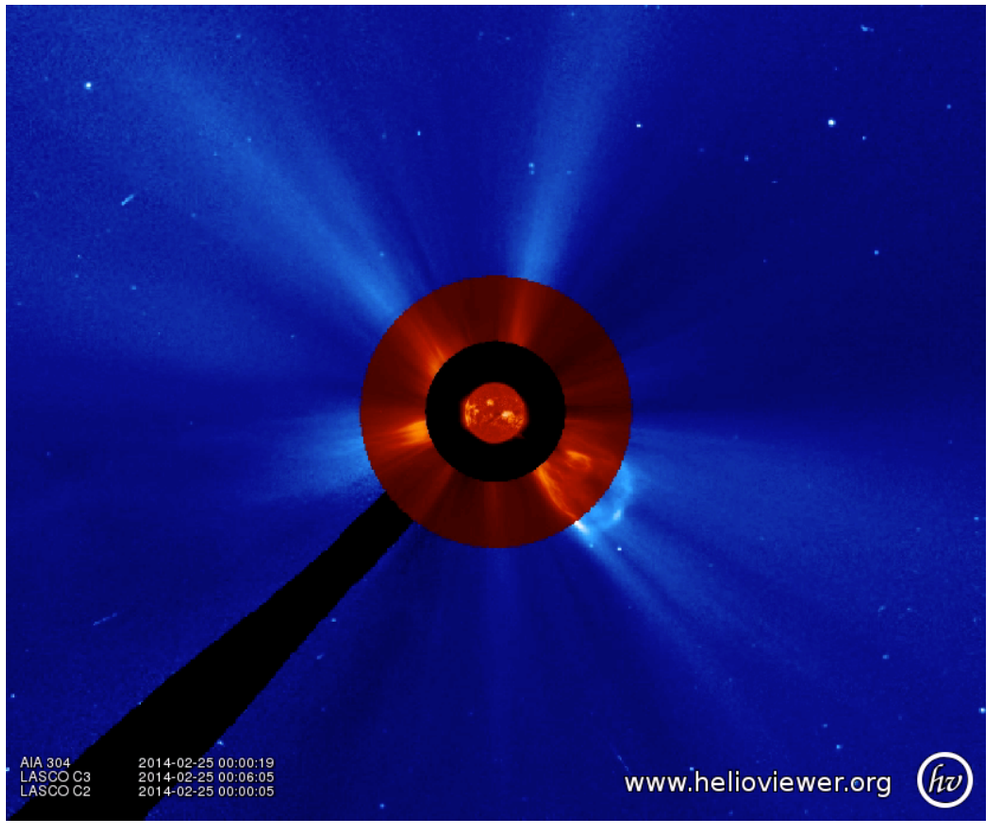
DSCOVR



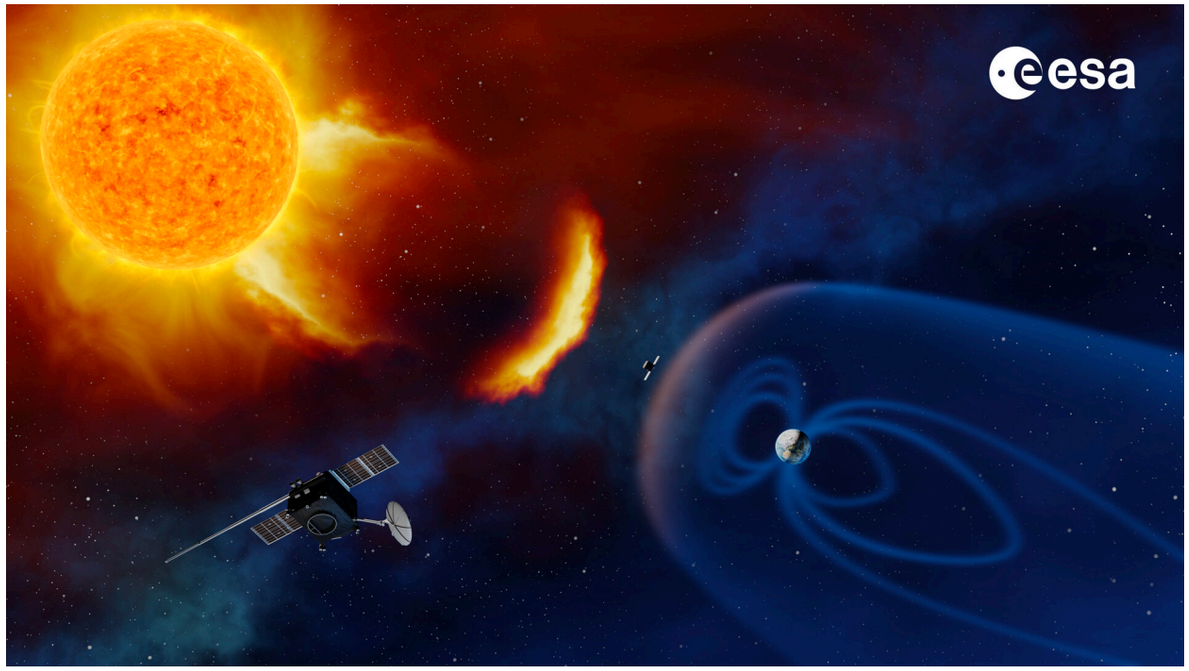
+Z is perpendicular to the Ecliptic Plane.

Solar wind observations DISCOVR

SW Disturbance - Coronal Mass Ejection

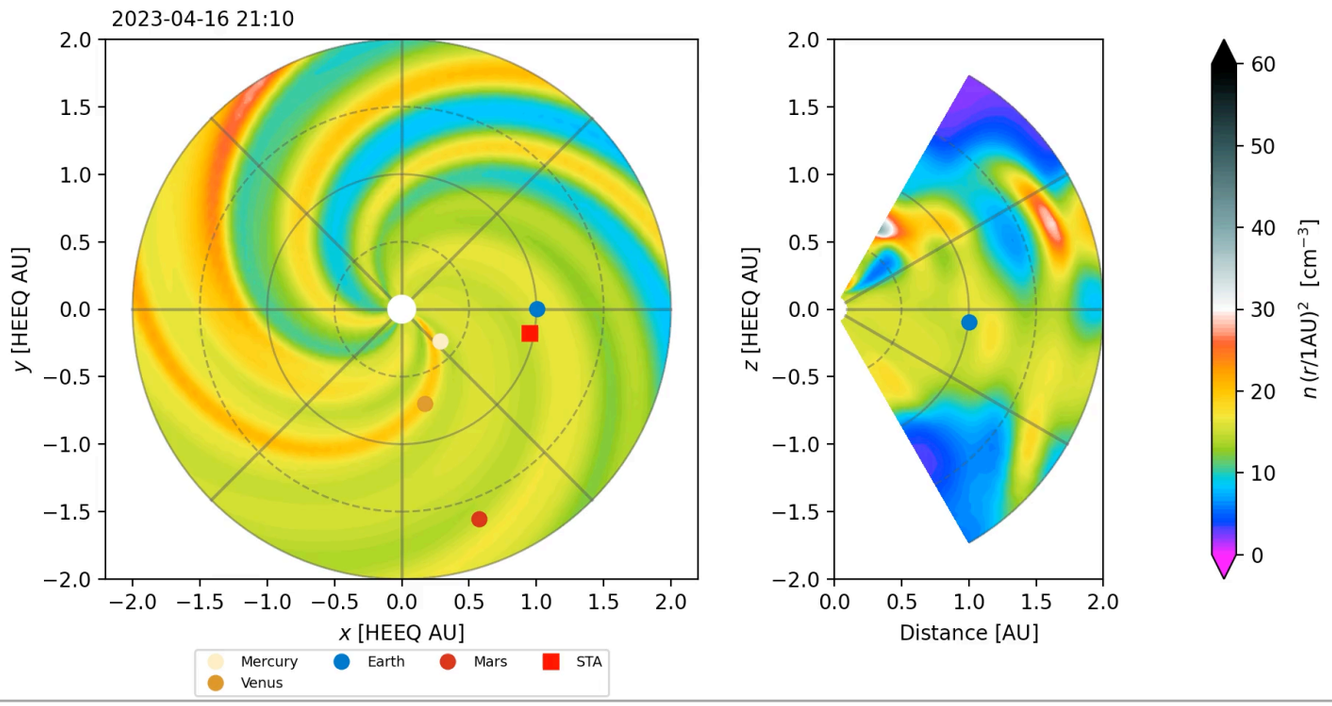


SDO/AIA and SOHO/LASCO

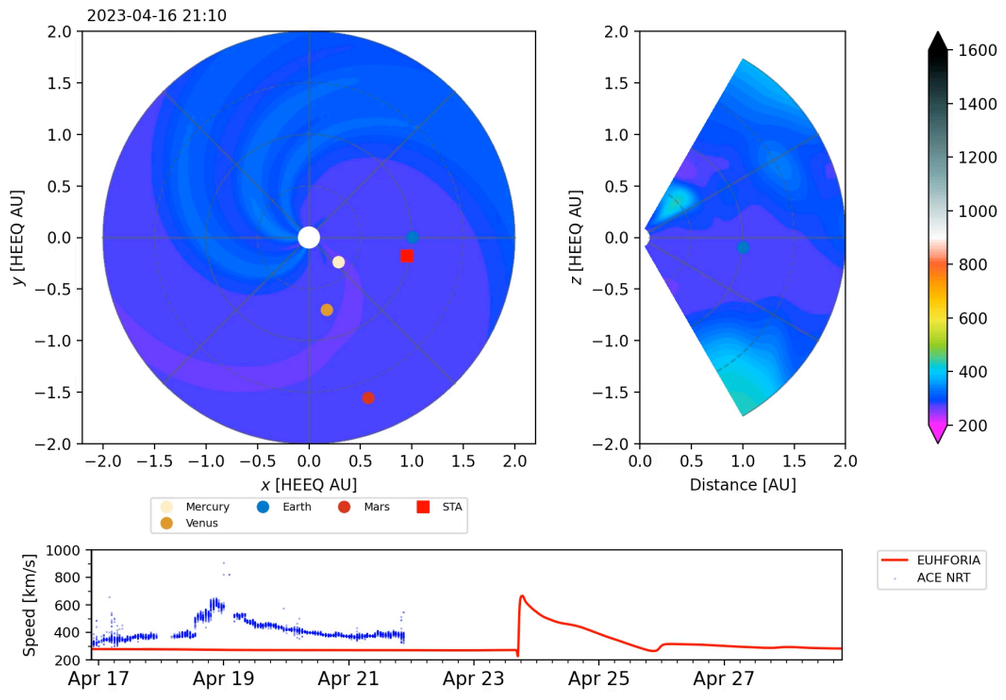


SW Disturbance - CME Arrival Prediction

Density



Velocity



euhforia

SW Disturbance - CME Arrival Prediction

Calculation of ICME arrival times

Main reference

This model is based on the article "Propagation of Interplanetary Coronal Mass Ejections: The Drag-Based Model" (Vrsnak et al. 2012).

Gamma drag parameter; usually between 0.2 and 2 (10^{-7} km^{-1}): 1

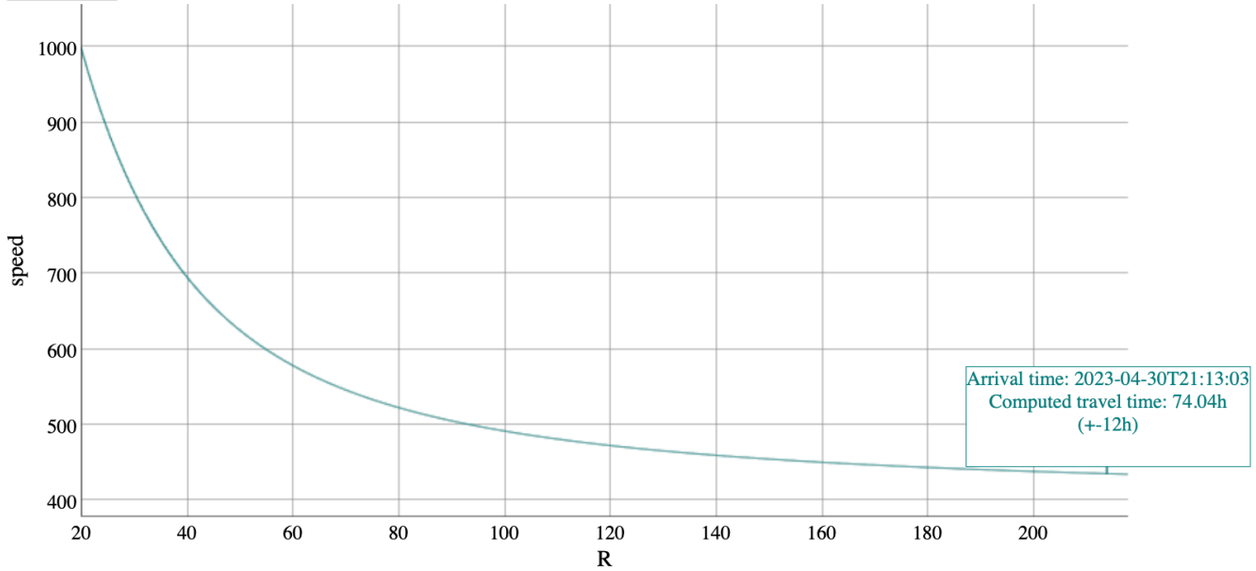
R_S: distance where the CME speed is measured (solar radii): 20.0 (Preferentially near 20 R_S.)

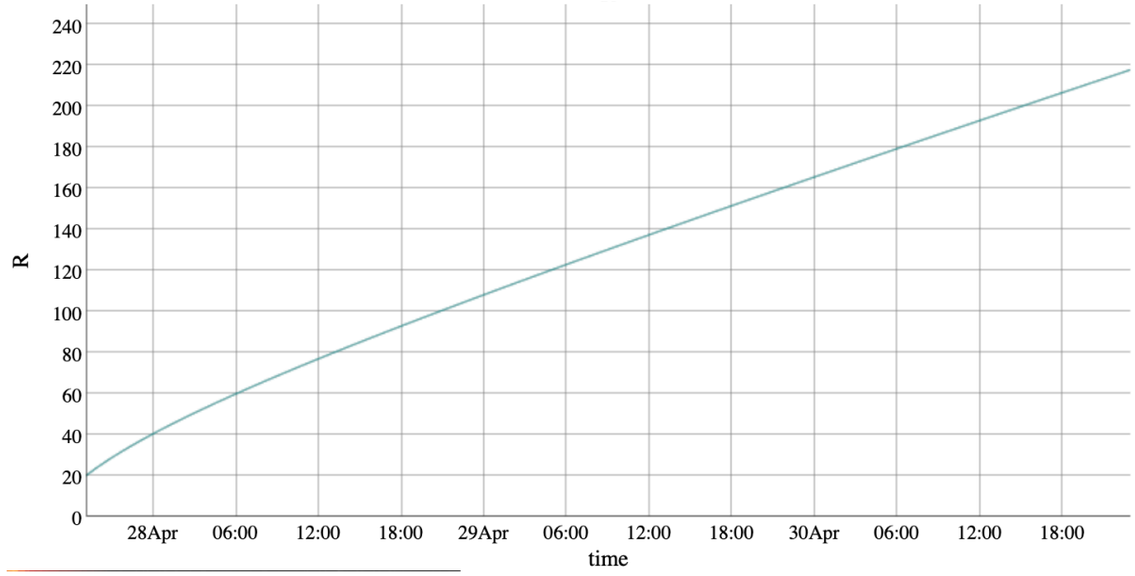
v_0; speed of CME R_s, (km/s): 1000.0

w; background solar wind speed (km/s): 400.0

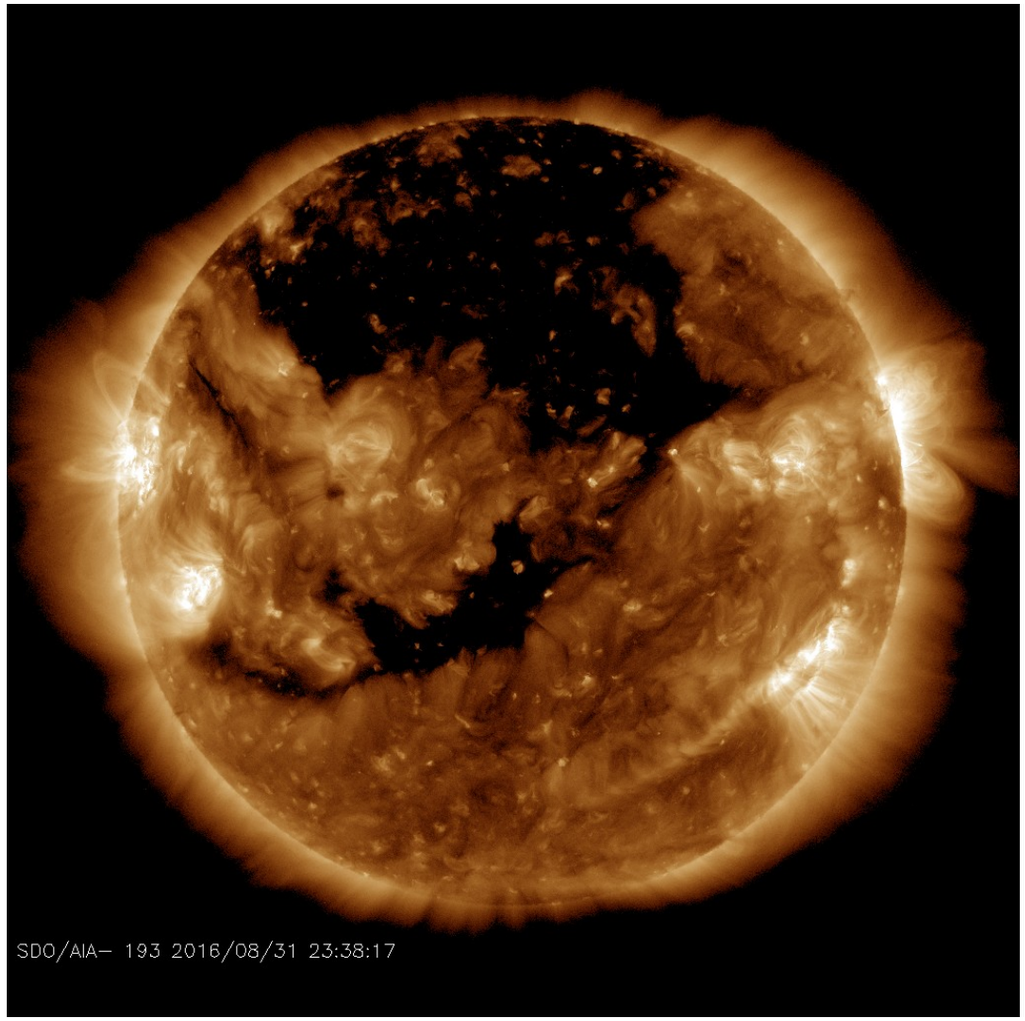
Date and time of CME at the given R_S: 2023-04-27T19:10:39

Run Model

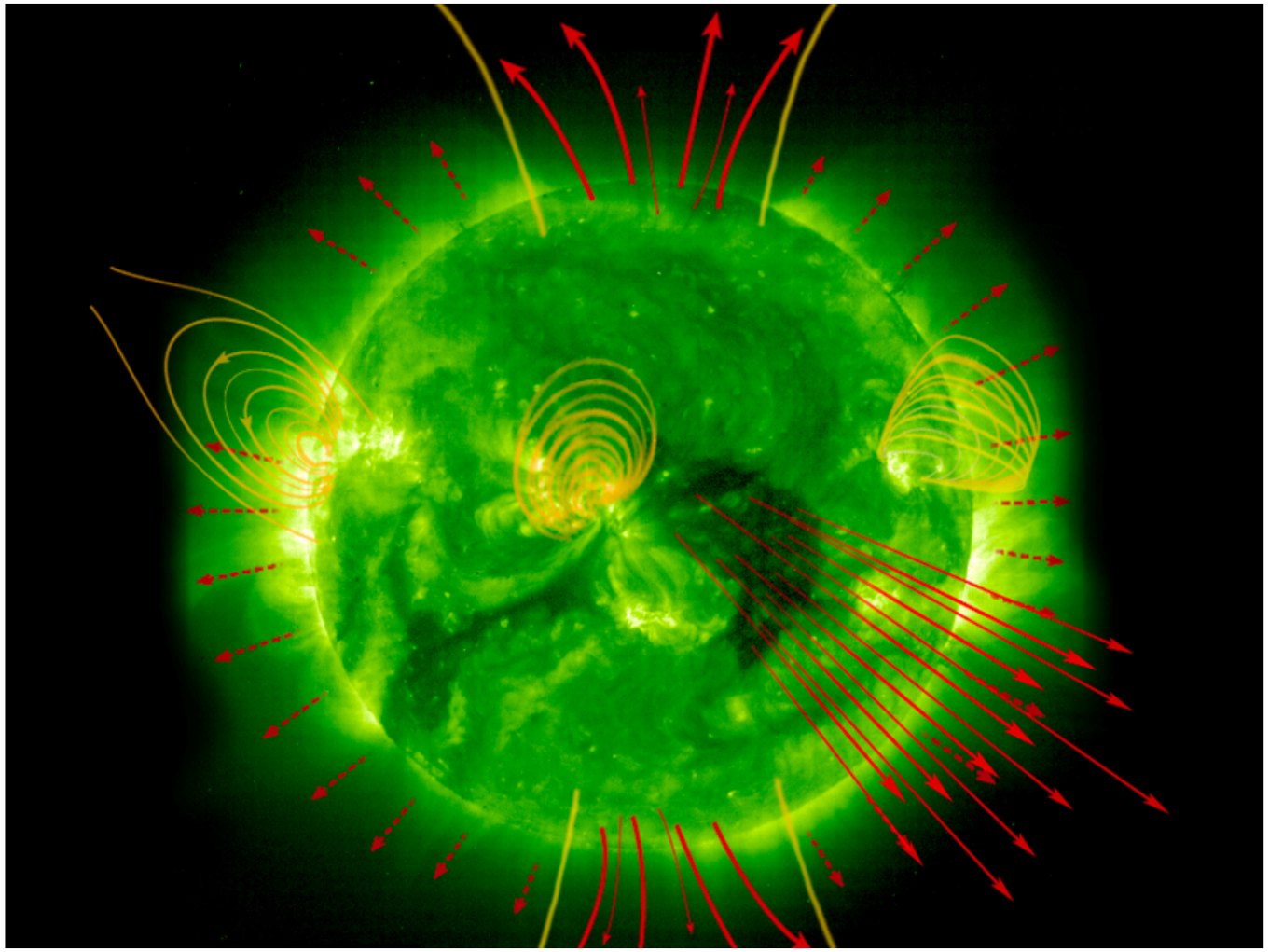




SW Disturbance - Coronal Hole



SDO/AIA



SOHO/EIT

K index - Forecast

Forecast regions | Forecast 10cm flux | **Forecast K** | Forecast helio | Finish forecast

Day/Hours	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24
Prediction local K-index for day 2023-04-27:	(2,2)	(1,1)	(2,2)	(1,1)	(2,2)	(1,1)	(2,2)	(1,1)
Prediction local K-index for day 2023-04-28:	(2,/)	(1,/)	(2,/)	(3,/)	(2,/)	(2,/)	(3,/)	(2,/)
Prediction local K-index for day 2023-04-29:	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)

Between brackets : (forecast from 1 day ago, forecast from 2 days ago); / means it is not available

Geomagnetic forecast: ---------

Extra geomagnetic information:

Hint: double click on a field to copy it in all empty fields!

K index - Forecast

Forecast regions | Forecast 10cm flux | **Forecast K** | Forecast helio | Finish forecast

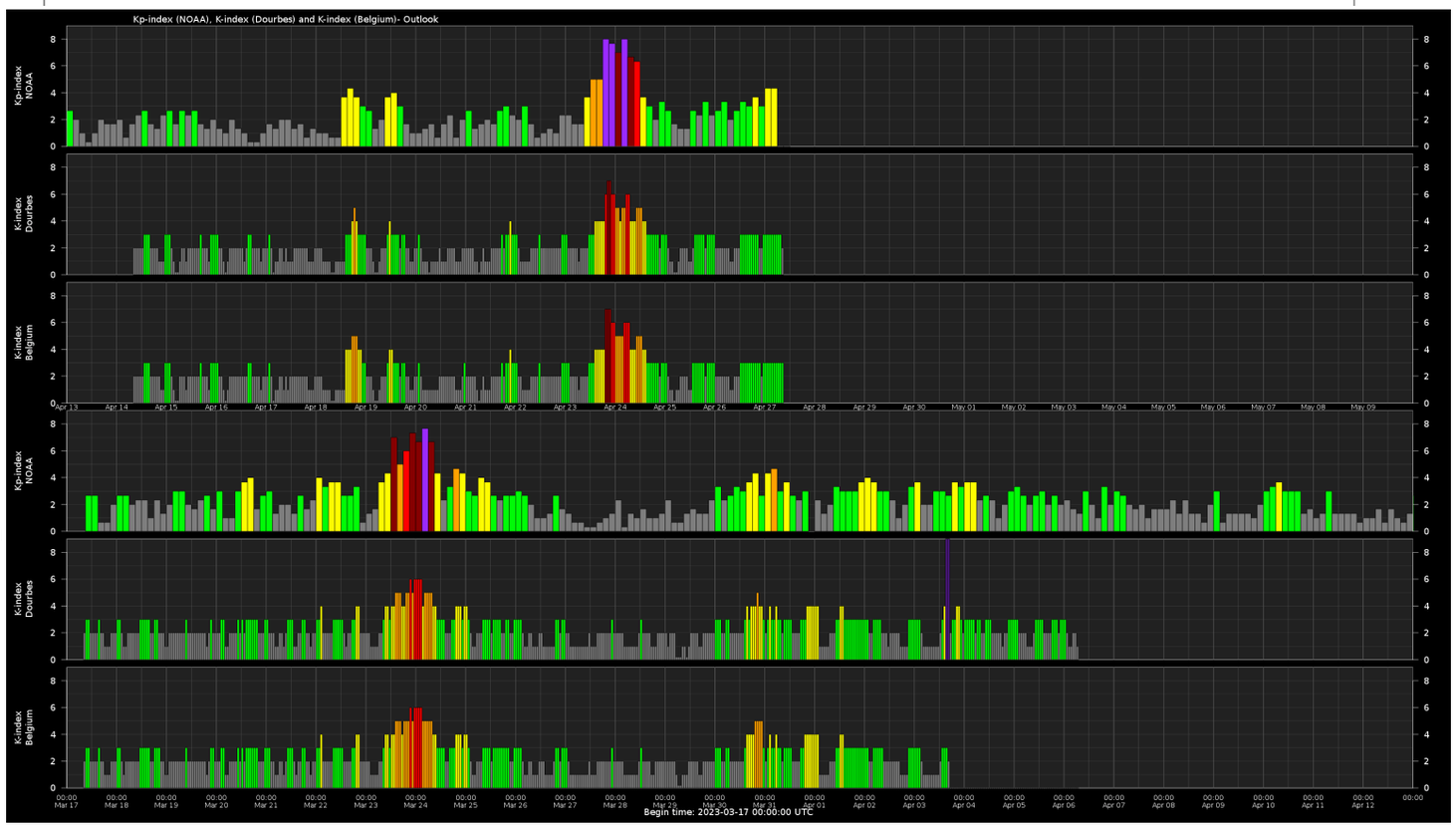
Day/Hours	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24
Prediction local K-index for day 2023-04-27:	(2,2)	(1,1)	(2,2)	(1,1)	(2,2)	(1,1)	(2,2)	(1,1)
Prediction local K-index for day 2023-04-28:	(2,/)	(1,/)	(2,/)	(3,/)	(2,/)	(2,/)	(3,/)	(2,/)
Prediction local K-index for day 2023-04-29:	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)

Between brackets : (forecast from 1 day ago, forecast from 2 days ago); / means it is not available

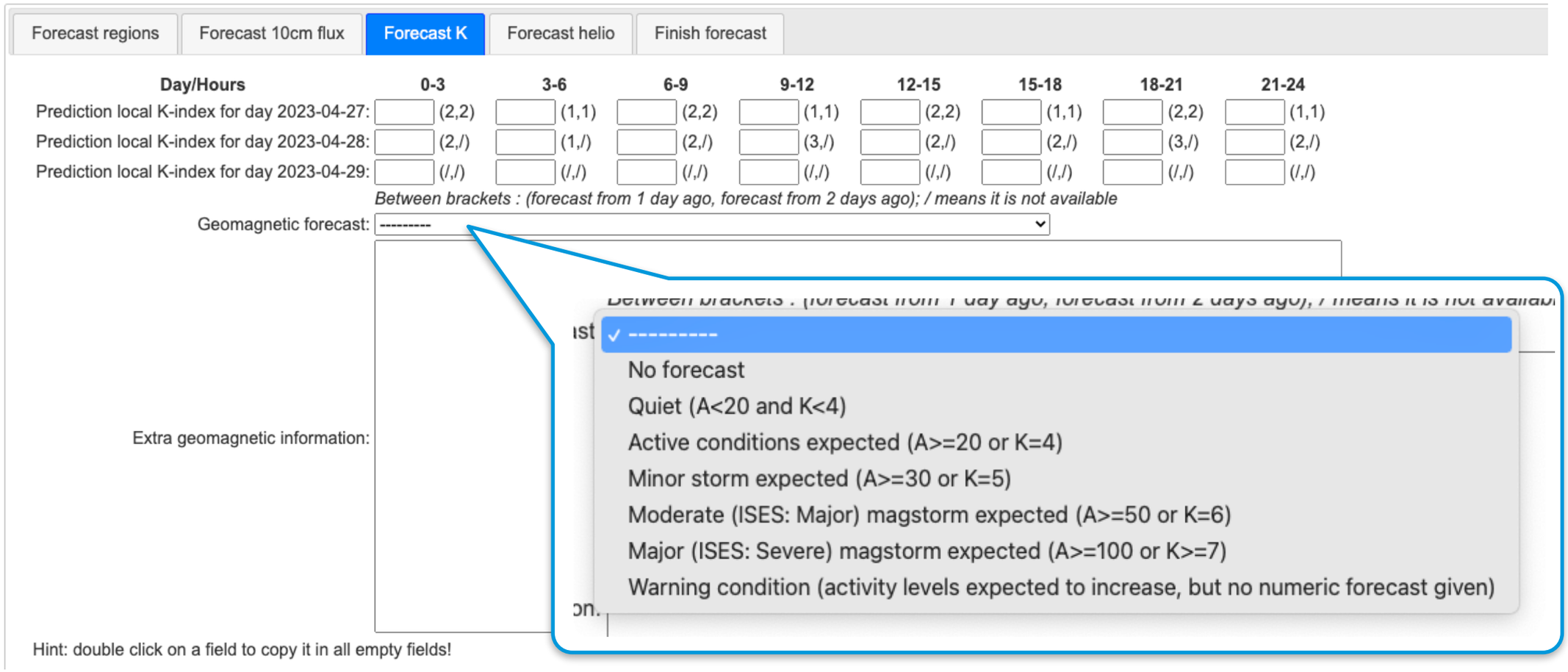
Geomagnetic forecast: ---------

Extra geomagnetic informat

Hint: double click on a field to copy it in a



K index - Forecast



Kp index -> AA and PSD

PECASUS DASHBOARD

PECASUS DUTY STATUS: Secondary Backup Centre

GNSS	Moderate	Severe	Time UTC	Values	Status	Alert	Max-3h values	Max-3h status
Amplitude Scintillation	0.5	0.8	2024-03-04 14:45	0.33	QUIET		0.98	SEVERE
Phase Scintillation	0.4	0.7	2024-03-04 14:45	0.17	QUIET		0.30	QUIET
Vertical TEC	125	175	2024-03-04 14:40	95.92	QUIET		98.57	QUIET

RADIATION	Moderate	Severe	Time UTC	Flags	Status	Alert	Max-3h flags	Max-3h status
Effective Dose FL ≤ 460	30	80	2024-03-04 14:45	0	QUIET		0	QUIET
Effective Dose FL > 460	/	80	2024-03-04 14:45	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	2024-03-04 14:48	2.0	QUIET		2.0	QUIET
Polar Cap Absorption (PCA)	2	5	2024-03-04 14:47	0.11	QUIET		0.23	QUIET
Shortwave Fadeout (SWF)	x1.0	x10.0	2024-03-04 14:45	< M5 flare	QUIET		< M5 flare	QUIET
Post-Storm Depression (PSD)	30%	50%	2024-03-04 14:45	2	SEVERE		2	SEVERE

Sound alarm is triggered when MOD or SEV thresholds are exceeded or in case of data outages.

Planetary K-index NOAA

K index - Forecast

Forecast regions | Forecast 10cm flux | **Forecast K** | Forecast helio | Finish forecast

Day/Hours	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-24
Prediction local K-index for day 2023-04-27:	(2,2)	(1,1)	(2,2)	(1,1)	(2,2)	(1,1)	(2,2)	(1,1)
Prediction local K-index for day 2023-04-28:	(2,/)	(1,/)	(2,/)	(3,/)	(2,/)	(2,/)	(3,/)	(2,/)
Prediction local K-index for day 2023-04-29:	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)	(/,/)

Between brackets : (forecast from 1 day ago, forecast from 2 days ago); / means it is not available

Geomagnetic forecast: ---------

Extra geomagnetic information:

Hint: double click on a field to copy it in all empty fields!

- Solar wind observations
- CME predictions and (possible) arrival
- Coronal hole observations and (possible) arrival
- Geomagnetic conditions: K-index measurements and predictions

Daily Forecast - URSIgram

```
:Issued: 2022 Sep 07 1232 UTC
:Product: documentation at http://www.sidc.be/products/meu
#-----------------------------------------------------------------#
# DAILY BULLETIN ON SOLAR AND GEOMAGNETIC ACTIVITY from the SIDC  #
# (RWC Belgium)                                                   #
#-----------------------------------------------------------------#
SIDC URSIGRAM 20907
SIDC SOLAR BULLETIN 07 Sep 2022, 1230UT
SIDC FORECAST (valid from 1230UT, 07 Sep 2022 until 09 Sep 2022)
SOLAR FLARES  : C-class flares expected, (probability >=50%)
GEOMAGNETISM  : Active conditions expected (A>=20 or K=4)
SOLAR PROTONS : Quiet
PREDICTIONS FOR 07 Sep 2022  10CM FLUX: 123 / AP: 010
PREDICTIONS FOR 08 Sep 2022  10CM FLUX: 122 / AP: 010
PREDICTIONS FOR 09 Sep 2022  10CM FLUX: 120 / AP: 010
```

Forecast

```
COMMENT: Solar flaring activity was low during the last 24 hours, with six C-class flares detected, the brightest being an C3 at 18:42 UTC
yesterday. However, all but one of those flares originated from NOAA Active Region (AR) 3088 that is now invisible from Earth. NOAA AR 3092
produced a C1 flare in the previous 24 hours and it is likely to produce some more C-class activity in the next 24 hours.
```

Flaring Activity

```
No Earth directed CMEs observed in the last 24 hours.
```

CMEs

```
The greater than 10 MeV proton flux was at nominal levels over the past 24 hours and is expected to remain so for the next 24 hours. The greater
than 2 MeV electron flux was above the 1000 pfu alert threshold during the last 24 hours and is expected to remain above this level for the next
24 hours.
The 24h electron fluence was at moderate levels in the past 24 hours and is
expected to remain at these levels during the next 24 hours.
```

Particles

```
The Solar Wind (SW) conditions remained affected by the High Speed Stream (HSS) that arrived on 3 Sep. The SW speed ranged between 530 and 630
km/s over the last 24 hours. The total magnetic field (Bt) varied between 3 and 6 nT, while its Bz component ranged between -6 and 6 nT. The
interplanetary
magnetic field (phi) angle was directed away from the Sun during the last 24 hours. The SW conditions are expected to continue in the same
pattern in the next 24 hours.
```

Solar Wind

```
Geomagnetic conditions reached globally active (Kp 2-4) and locally unsettled (K-Belgium 2-3) levels over the last 24 hours. Unsettled conditions
are expected for the next 24 hours with intervals of active conditions.
```

Geomagnetic

```
TODAY'S ESTIMATED ISN  : 095, BASED ON 19 STATIONS.

SOLAR INDICES FOR 06 Sep 2022
WOLF NUMBER CATANIA    : ///
10CM SOLAR FLUX        : ///
AK CHAMBON LA FORET    : ///
AK WINGST              : 022
ESTIMATED AP           : 019
ESTIMATED ISN          : 078, BASED ON 28 STATIONS.
```

SIDC Webpage - Predictions

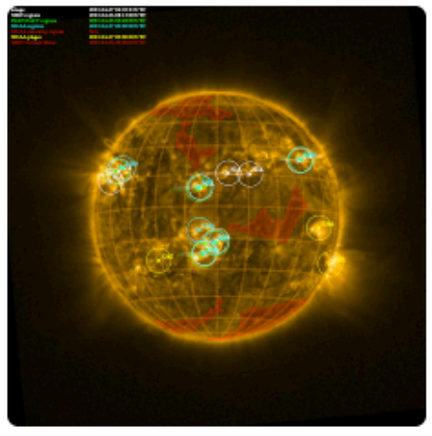
Space Weather Services

Detections

Solardemon
2023-04-27 02:51 B8 flare

CACTus
2023-04-21 18:12
844km/s

Solar Map



Latest Alerts

Presto 2023-04-24

The Corona Mass Ejection (CME) arrival first reported yesterday continues to cause a major geomagnetic storm. Although the solar wind velocity has now dropped to 500 km/s and the North-South component of the interplanetary magnetic field (Bz) has now increased to -10 nT, the Kp index has reach the severe level (Kp=8, G4). The geomagnetic conditions are expected

Forecasts

Flare:	Quiet conditions (<50% C-class flares)
Protons:	Quiet
Geomagnetic:	Quiet (A<20 and K<4)
All quiet:	False
Provisional SSN:	127

Solar Activity

URSIgram 2023-04-26

Solar flaring activity was low and infrequent with two C1 flares detected during the past 24 hours. NOAA Active Region (AR) 3285 (Catania group 65) produced one of them, while a yet unnamed AR turning into Earth's view produced the second flare. More C-class flare activity is expected in the next 24 hours, most probably from the unnamed AR mentioned above. No Earth-directed Coronal Mass Ejections

Solar Wind

URSIgram 2023-04-26

The Solar Wind (SW) conditions were stable during the last 24 hours. The SW speed ranged between 490 and 570 km/s in the last 24 hours. The total interplanetary magnetic field (Bt) varied between 2 and 6 nT and its North-South component (Bz) ranged between -5 and 5 nT. The interplanetary magnetic field phi angle was directed away from the Sun until yesterday 19:00 UT and has turned

SIDC Webpage - Detections

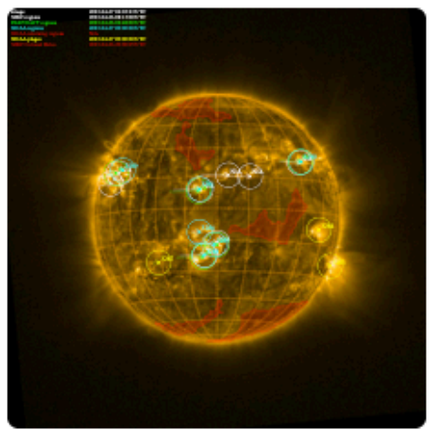
Space Weather Services

Detections

Solardemon
2023-04-27 02:51 B8 flare

CACTus
2023-04-21 18:12
844km/s

Solar Map



Latest Alerts

Presto 2023-04-24

The Corona Mass Ejection (CME) arrival first reported yesterday continues to cause a major geomagnetic storm. Although the solar wind velocity has now dropped to 500 km/s and the North-South component of the interplanetary magnetic field (Bz) has now increased to -10 nT, the Kp index has reach the severe level (Kp=8, G4). The geomagnetic conditions are expected

Forecasts

Flare:	Quiet conditions (<50% C-class flares)
Protons:	Quiet
Geomagnetic:	Quiet (A<20 and K<4)
All quiet:	False
Provisional SSN:	127

Solar Activity

URSIgram 2023-04-26

Solar flaring activity was low and infrequent with two C1 flares detected during the past 24 hours. NOAA Active Region (AR) 3285 (Catania group 65) produced one of them, while a yet unnamed AR turning into Earth's view produced the second flare. More C-class flare activity is expected in the next 24 hours, most probably from the unnamed AR mentioned above. No Earth-directed Coronal Mass Ejections

Solar Wind

URSIgram 2023-04-26

The Solar Wind (SW) conditions were stable during the last 24 hours. The SW speed ranged between 490 and 570 km/s in the last 24 hours. The total interplanetary magnetic field (Bt) varied between 2 and 6 nT and its North-South component (Bz) ranged between -5 and 5 nT. The interplanetary magnetic field phi angle was directed away from the Sun until yesterday 19:00 UT and has turned

SIDC Webpage - Alerts

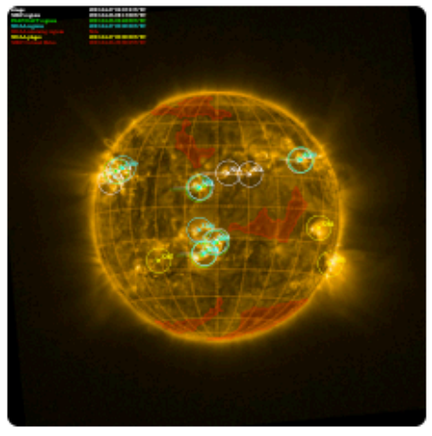
Space Weather Services

Detections

Solardemon
2023-04-27 02:51 B8 flare

CACTus
2023-04-21 18:12
844km/s

Solar Map



Latest Alerts

Presto 2023-04-24

The Corona Mass Ejection (CME) arrival first reported yesterday continues to cause a major geomagnetic storm. Although the solar wind velocity has now dropped to 500 km/s and the North-South component of the interplanetary magnetic field (Bz) has now increased to -10 nT, the Kp index has reach the severe level (Kp=8, G4). The geomagnetic conditions are expected

Forecasts

Flare:	Quiet conditions (<50% C-class flares)
Protons:	Quiet
Geomagnetic:	Quiet (A<20 and K<4)
All quiet:	False
Provisional SSN:	127

Solar Activity

URSIgram 2023-04-26

Solar flaring activity was low and infrequent with two C1 flares detected during the past 24 hours. NOAA Active Region (AR) 3285 (Catania group 65) produced one of them, while a yet unnamed AR turning into Earth's view produced the second flare. More C-class flare activity is expected in the next 24 hours, most probably from the unnamed AR mentioned above. No Earth-directed Coronal Mass Ejections

Solar Wind

URSIgram 2023-04-26

The Solar Wind (SW) conditions were stable during the last 24 hours. The SW speed ranged between 490 and 570 km/s in the last 24 hours. The total interplanetary magnetic field (Bt) varied between 2 and 6 nT and its North-South component (Bz) ranged between -5 and 5 nT. The interplanetary magnetic field phi angle was directed away from the Sun until yesterday 19:00 UT and has turned

SWIC

www.sidc.be

Types of Alerts

Automated

- Halo CME by CACTus
- Flaremail

Manual

- Presto
- ~~CACTus Correction~~
- ~~CME Arrival~~
- All quiet - End of all quiet

Automated Alerts

Automated: Halo CME

```
:Issued: 2023 Sep 24 2326 UTC
:Product: documentation at http://www.sidc.be/products/cactus
#-----------------------------------------------------------------#
# HALO CME ALERTS from the SIDC (RWC-Belgium), generated by CACTUS  #
#-----------------------------------------------------------------#

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

            t0       | dt0| pa | da |  v   |  dv  | minv| maxv|
2023-09-24T09:36:07.402 | 4.0 | 296 | 150 | 367 | 133 | 123 | 710


     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
#-----------------------------------------------------------------#
# Solar Influences Data analysis Center - RWC Belgium             #
# Royal Observatory of Belgium                                    #
```

Partial or full halo detected, i.e. da >180

Automated: flaremail

```
:Issued: 2014 Sep 10 1926 UTC
:Product: documentation at http://www.sidc.be/products/flaremail
#-----------------------------------------------------------------#
# Large flare alerts from the SIDC (RWC-Belgium), detected in GOES  #
# X-ray data                                                      #
#-----------------------------------------------------------------#
A class X1.6 solar X-ray flare occurred on 2014/09/10 with peak time 17:45 UT

#-----------------------------------------------------------------#
# 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     #
#-----------------------------------------------------------------#
```

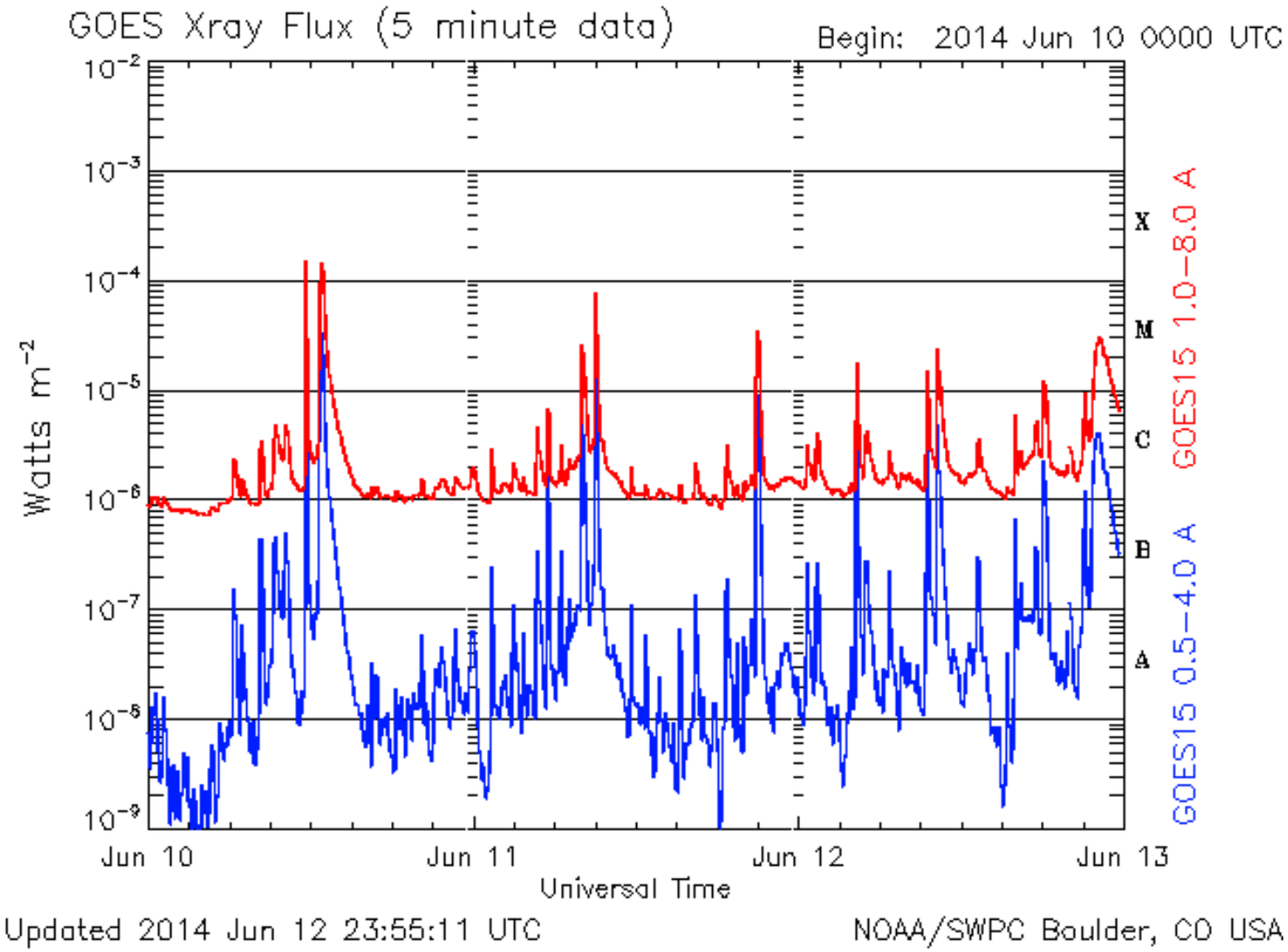
GOES X-ray > M5

Presto Alert

PRESTO

A presto alert needs to be sent ASAP:

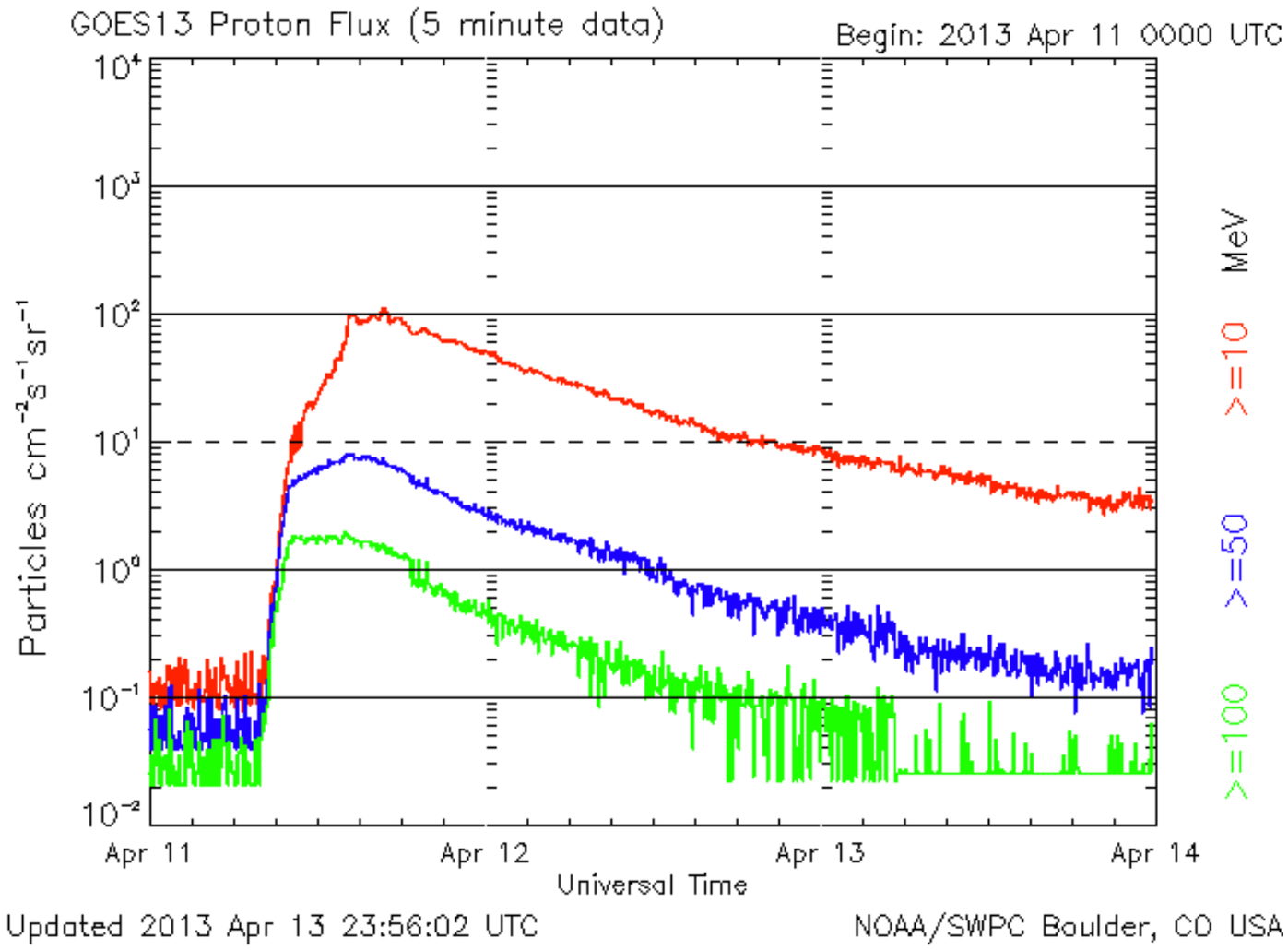
- During or just after an **X-flare**



PRESTO

A presto alert needs to be sent ASAP:

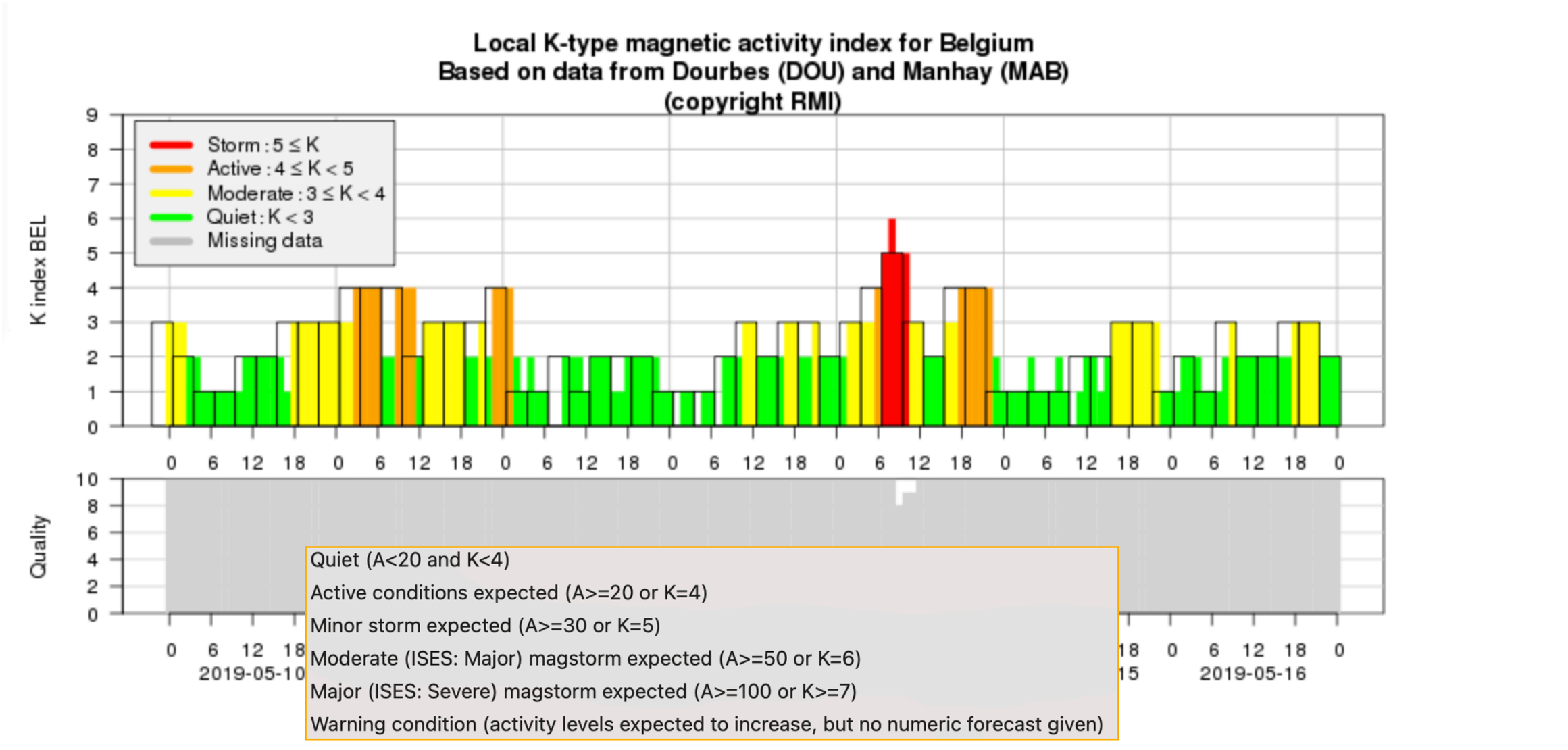
- In case of a **proton event**, i.e., proton flux >= 10 pfu (10 MeV particles)



PRESTO

A presto alert needs to be sent ASAP:

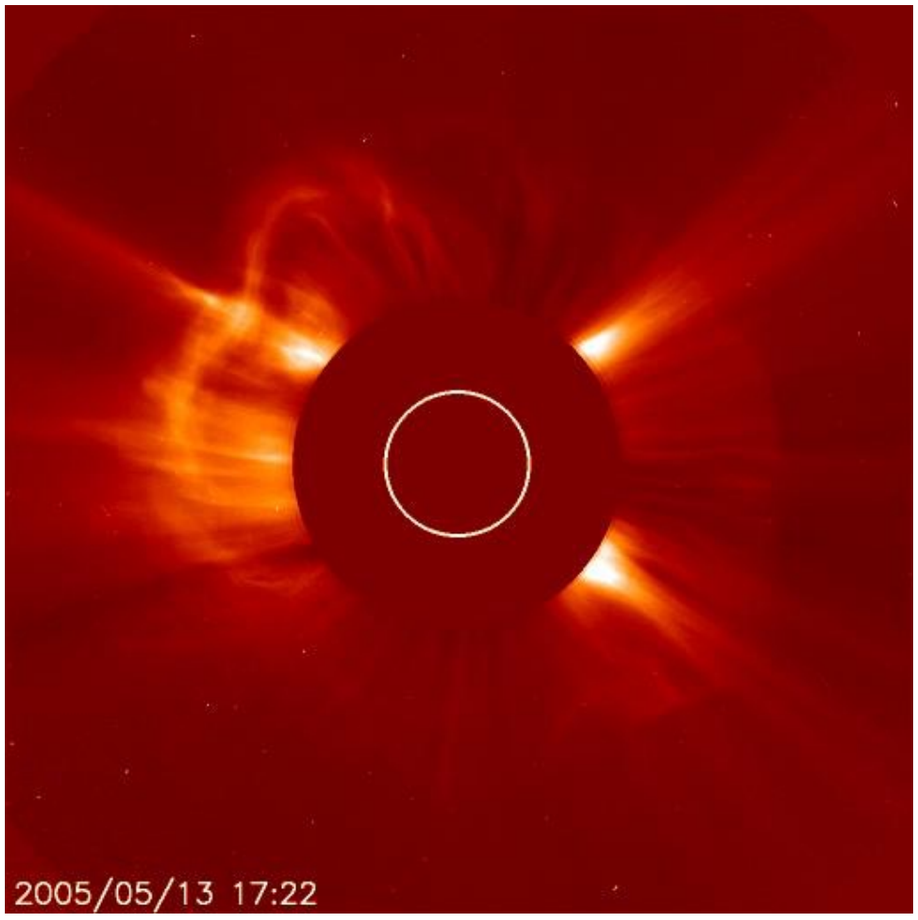
- When **Kp > 5** or K > 5.



PRESTO

A presto alert needs to be sent ASAP:

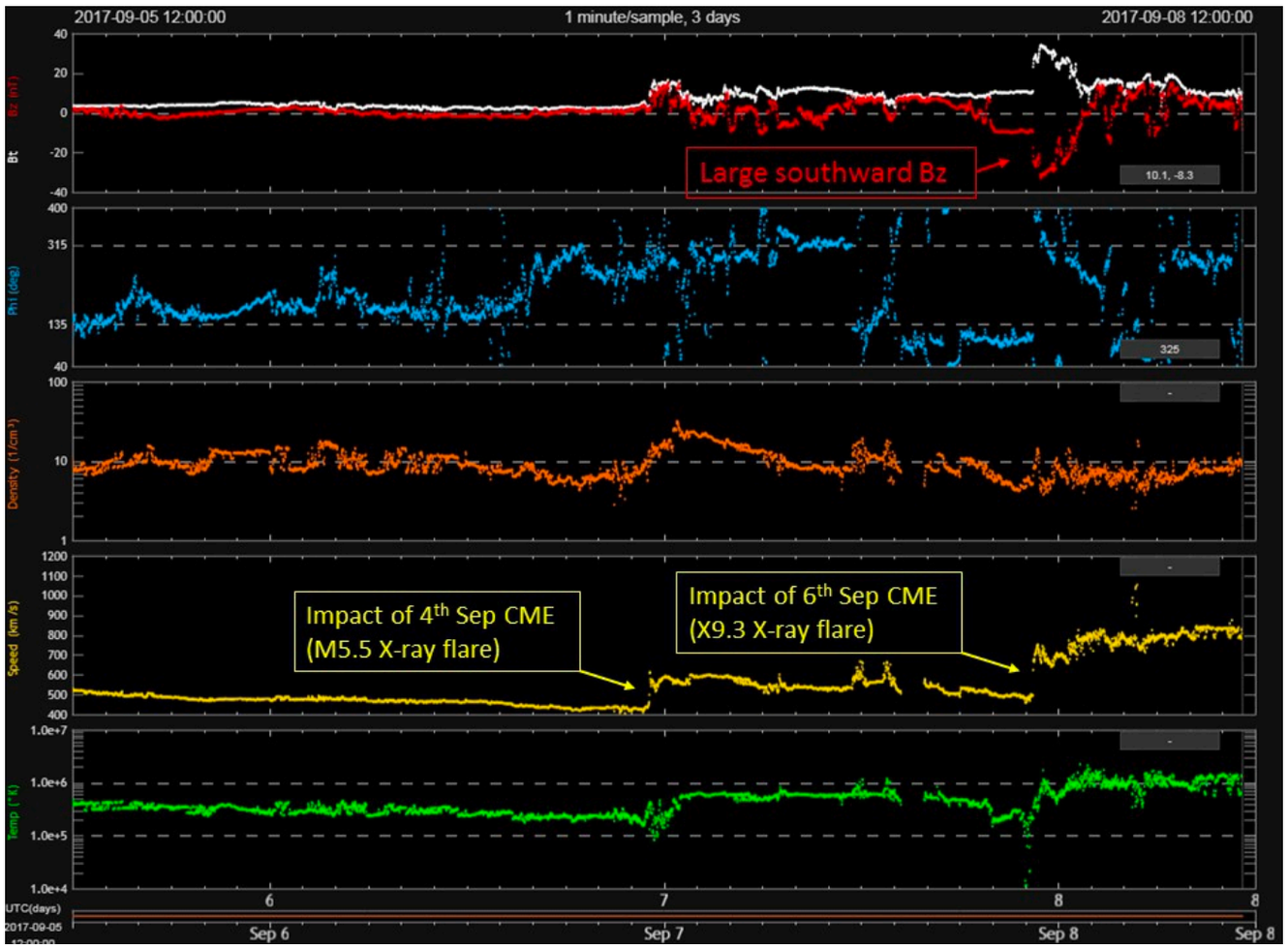
- When a (either front or back-side) (partial) **halo CME** or a strong westward directed CME occurred.
  Try to find out whether the halo CME is front-sided or not, by locating the source.



PRESTO

A presto alert needs to be sent ASAP:

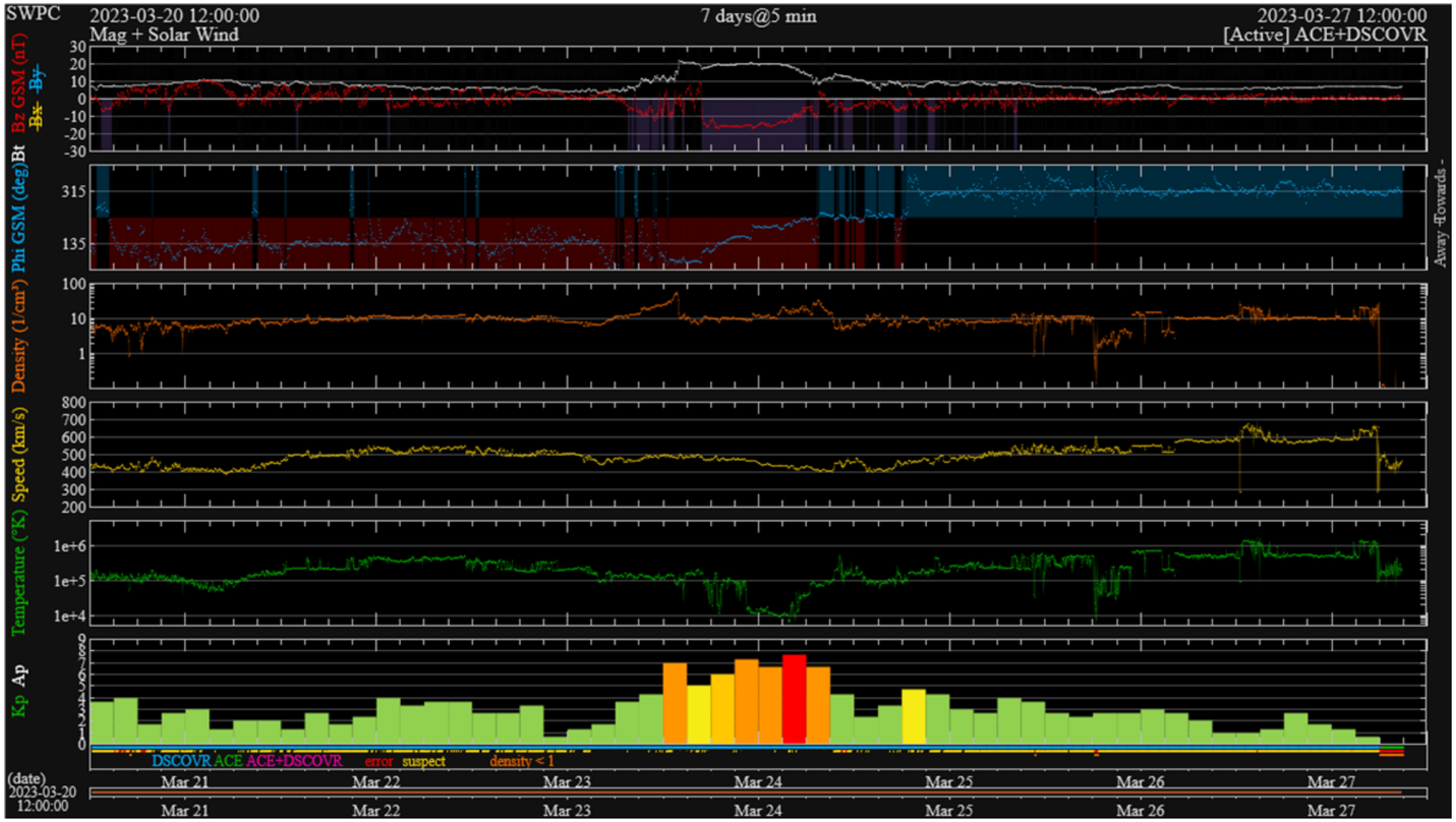
- In case you observe a **fast forward shock** in the solar wind speed. (delta_v>20km/s, ratio_n>1.2 and ratio_B>1.2)



PRESTO

A presto alert needs to be sent ASAP:

- In case you observe **enhanced solar wind conditions** which will likely lead to geomagnetic storm conditions K or Kp > 5.



PRESTO: example

:Issued: 2023 Mar 07 1343 UTC
:Product: documentation at http://www.sidc.be/products/presto
#---#
FAST WARNING 'PRESTO' MESSAGE from the SIDC (RWC-Belgium)
#---#
A halo Coronal Cass Ejection (CME) was observed in SOHO/LASCO-C2 from yesterday 03:12 UT. Although the bulk of the plasma is directed towards the West and South-West, a very faint asymmetric halo can be seen when the data are closely inspected. The speed of the CME is estimated to be 840 km/s and although the bulk of the CME is expected to miss Earth, a glancing blow is likely to arrive on the second half of 8 Mar or early on 9 Mar.

Another partial halo CME was automatically detected by the CACTUS software as launched yesterday 10:36 UT. However, close inspection revealed CACTUS took into account unrelated plasma ejecta and this is a marginally partial halo CME with only a weak component towards Earth's general direction. The speed of the CME is estimated to also be 840 km/s the bulk of the plasma is expected to miss Earth. A glancing blow might arrive on Earth's magnetosphere but if so it is expected to merge with the earlier CME mentioned above.
#---#
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

PRESTo: More examples

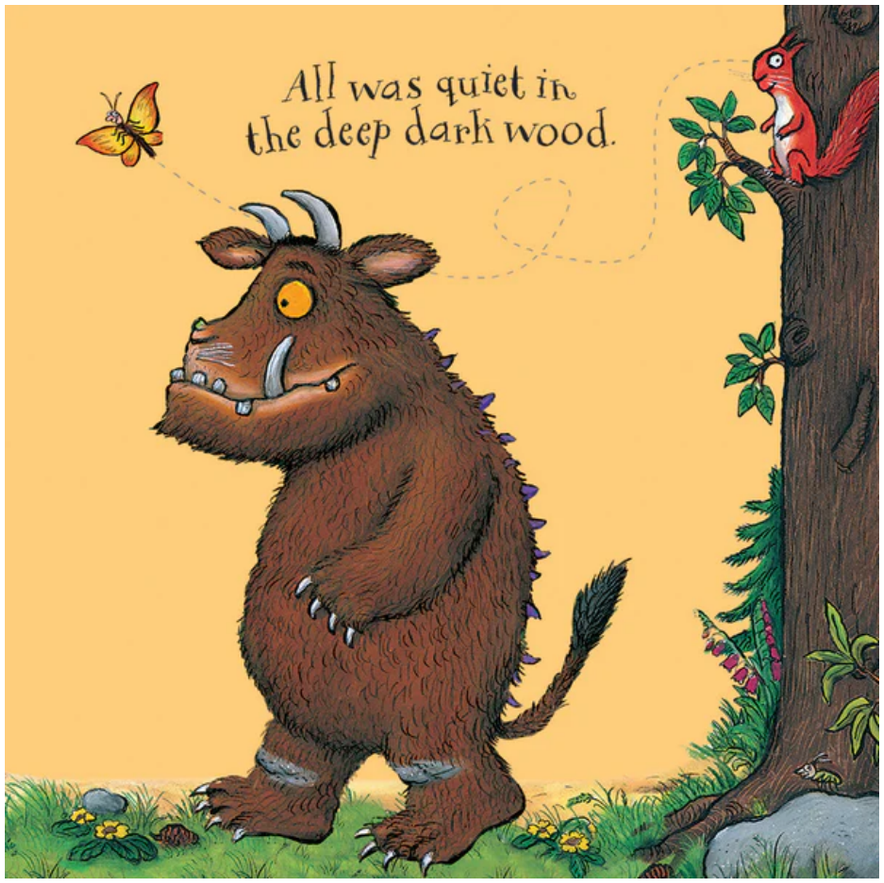
A **shock** in the solar wind at 19:54 UTC on 24 September marks the **arrival** of the ICME from 21 September (and probably that of the 22 September too). The **speed** jumped from 315 km/s to 440 km/s and the interplanetary **magnetic field** from 7 to 19 nT. The speed later reached 470 km/s and the magnetic field 28 nT with Bz down to -27 nT. This created moderate **geomagnetic storms** globally (Kp 6) and minor storms locally (K_Bel 5). The Earth is still inside the ICME (or ICMEs, to be confirmed as more data becomes available) and the corresponding geomagnetic storm is still ongoing.

Geomagnetic conditions have reached **moderate storm** levels globally (Kp 6) and minor storm levels locally (K_Bel 5), due to the ICME that arrived yesterday (**solar wind** speed up to 600 km/s and interplanetary magnetic field up to 22 nT and Bz down to -17 nT) and probably also some effects from a high speed solar wind stream. More disturbed conditions can be expected in the next 24 hours.

A **partial halo CME** with angular width around 150 degrees was first seen by LASCO-C2 at 13:36 UTC on 21 September. The CME was related to the M8.7 **flare** from NOAA **AR** 3435. The CME **speed** was estimated to be around 500 km/s, with the bulk of the material directed to the south. Since the source is located close to disk center, an **impact** at Earth can be expected on 25 September.

An **X1.5 class flare** was observed on August 07 peaking at 20:46 UTC. The flare was produced by the NOAA Active Region (**AR**) 3386 (Catania sunspot group 01), which was located at the west limb. Following this flare, the greater than 10 MeV **proton flux** started to rise at 21:46 UTC and crossed the 10 MeV warning **threshold** at 01:10 UTC on August 08 as measured by GOES. The 10 MeV proton flux remains currently above the threshold.

All Quiet Alert



All quiet

Send all quiet alert if **for the next 48 hours** you are forecasting that:

- the solar **X-ray** flux is expected to remain **below C-class level**
  (probability of C-flares on a daily basis should remain below 20% for the next two days),
- the **K** index is expected to remain **below 5**,
- **AND** the high-energy **proton** fluxes are expected to remain **below the event threshold**
  (10 pfu)

All conditions need to be met!

All quiet: example

:Issued: 2019 May 30 1214 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
# #
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
#---#

End of All quiet

```
:Issued: 2023 Jan 30 1608 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                                    #
#                                                                 #
# 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 #
#-----------------------------------------------------------------#
```

SIDC Webpage - Alerts

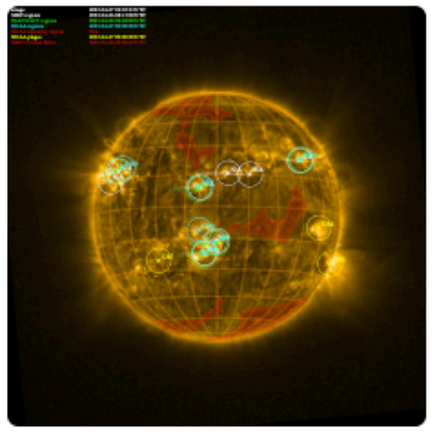
Space Weather Services

Detections

Solardemon
2023-04-27 02:51 B8 flare

CACTus
2023-04-21 18:12
844km/s

Solar Map



Latest Alerts

Presto 2023-04-24

The Corona Mass Ejection (CME) arrival first reported yesterday continues to cause a major geomagnetic storm. Although the solar wind velocity has now dropped to 500 km/s and the North-South component of the interplanetary magnetic field (Bz) has now increased to -10 nT, the Kp index has reach the severe level (Kp=8, G4). The geomagnetic conditions are expected

Forecasts

Flare:	Quiet conditions (<50% C-class flares)
Protons:	Quiet
Geomagnetic:	Quiet (A<20 and K<4)
All quiet:	False
Provisional SSN:	127

Solar Activity

URSIgram 2023-04-26

Solar flaring activity was low and infrequent with two C1 flares detected during the past 24 hours. NOAA Active Region (AR) 3285 (Catania group 65) produced one of them, while a yet unnamed AR turning into Earth's view produced the second flare. More C-class flare activity is expected in the next 24 hours, most probably from the unnamed AR mentioned above. No Earth-directed Coronal Mass Ejections

Solar Wind

URSIgram 2023-04-26

The Solar Wind (SW) conditions were stable during the last 24 hours. The SW speed ranged between 490 and 570 km/s in the last 24 hours. The total interplanetary magnetic field (Bt) varied between 2 and 6 nT and its North-South component (Bz) ranged between -5 and 5 nT. The interplanetary magnetic field phi angle was directed away from the Sun until yesterday 19:00 UT and has turned

STCE Newsletter

NEWSLETTER

STCE Newsletter

SOLAR-TERRESTRIAL CENTRE OF EXCELLENCE

STCE Newsletter

19 Feb 2024 - 25 Feb 2024

Published by the STCE - this issue : 1 Mar 2024.

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.

Archive of the newsletters

Subscribe to this newsletter by mail

Table of Content | 1.Wuthering Heig... | 2.Review of spac... | 3.PROBA2 Observa... | 4.Noticeable Sol... | 5.International ... | 6.Geomagnetic Ob... | 7.The SIDC space... | 8.Review of Iono... | 9.Courses, lectu...

Registration

E-mail lists - register!

https://www.sidc.be/