Impact of Space Weather on the Security of Earth & Space Assets.

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Solar-Terrestrial Centre of Excellence (STCE), Royal Observatory of Belgium (ROB)

High Level Course on Aerospace, Defense & Security. Module 2 Lecture 6. 2023-09-08 09:15-10:00

STCE ROB

Overview of the lecture

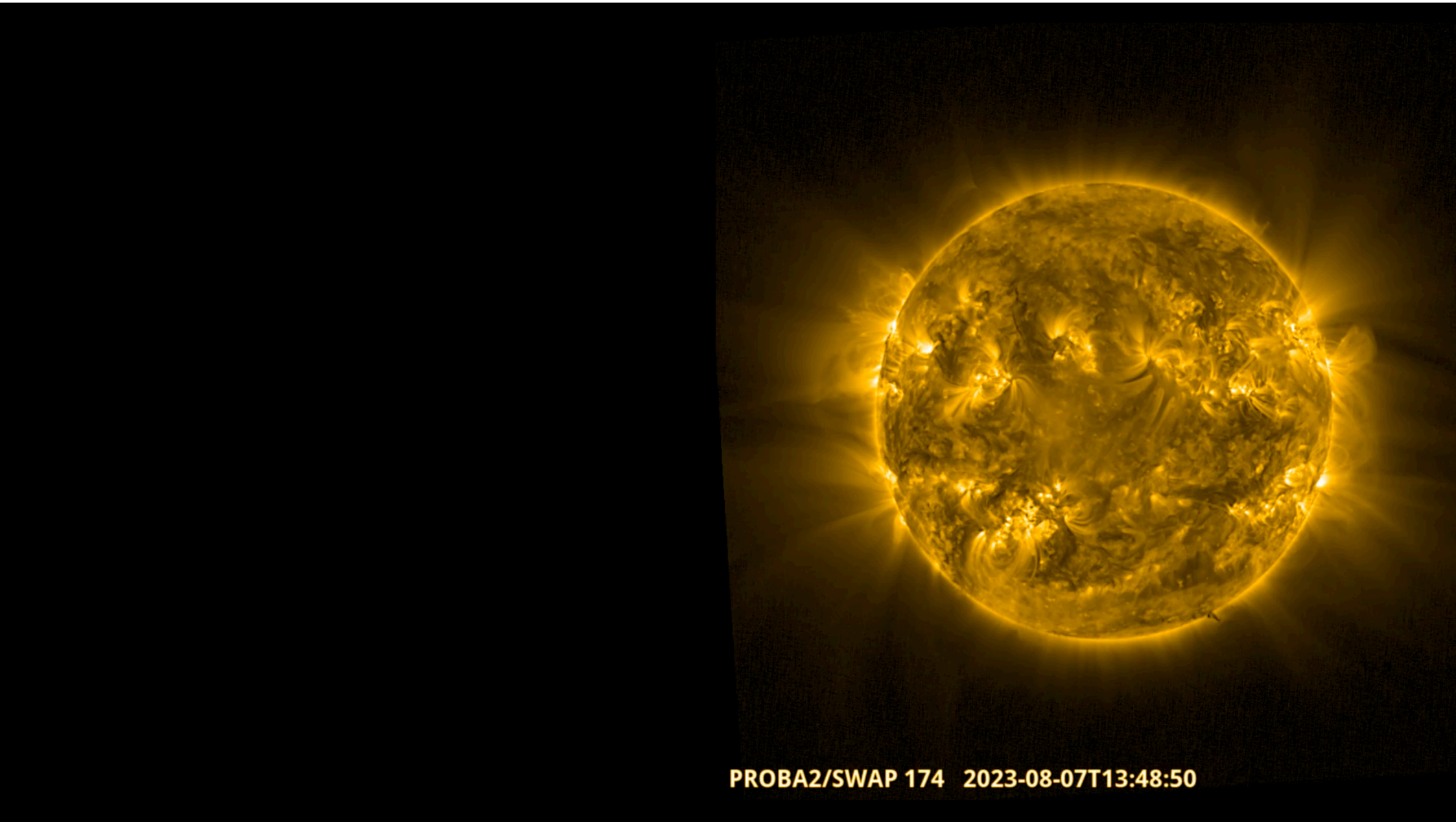
1. What is space weather and where does it come from?
   Physics of space weather, from the Sun to the Earth

2. Why should you care about space weather?
   Space weather impacts

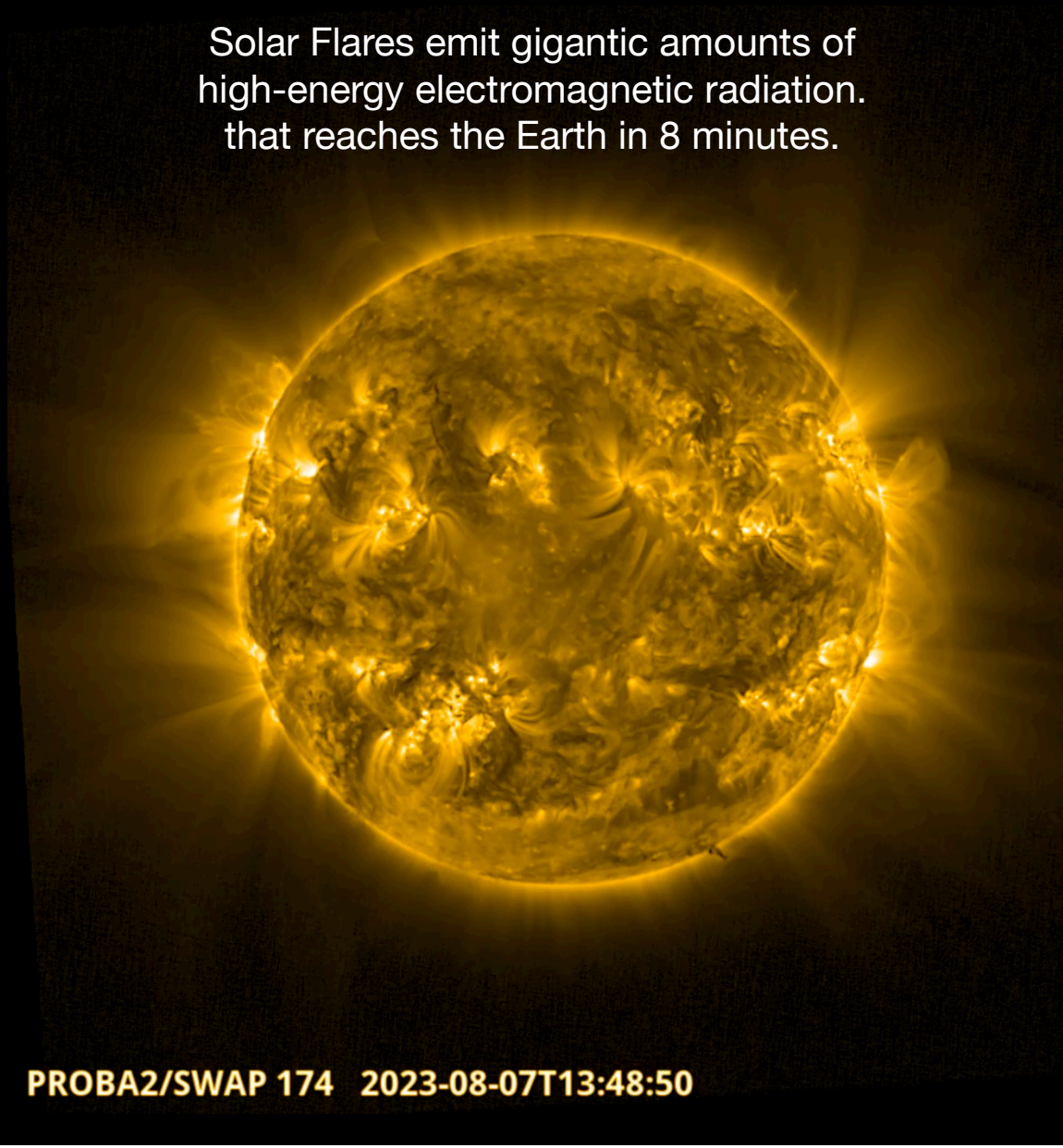
3. How can we deal with space weather?
   Efforts to mitigate space weather impacts

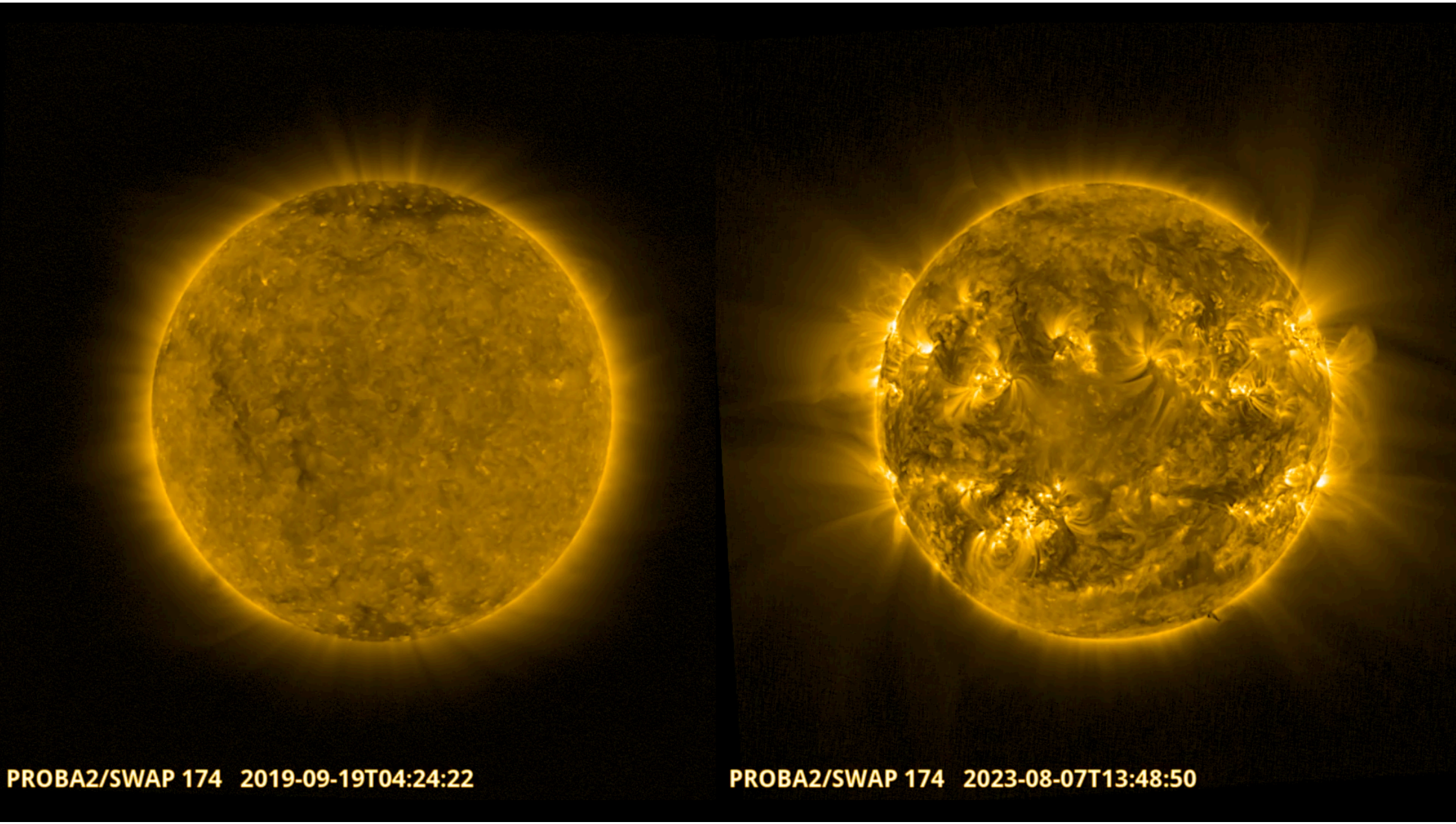
What is space weather and where does it come from?

Physics of space weather, from the Sun to the Earth


PROBA2/SWAP 174 2023-08-07T13:48:50

Solar Flares emit gigantic amounts of
high-energy electromagnetic radiation.
that reaches the Earth in 8 minutes.

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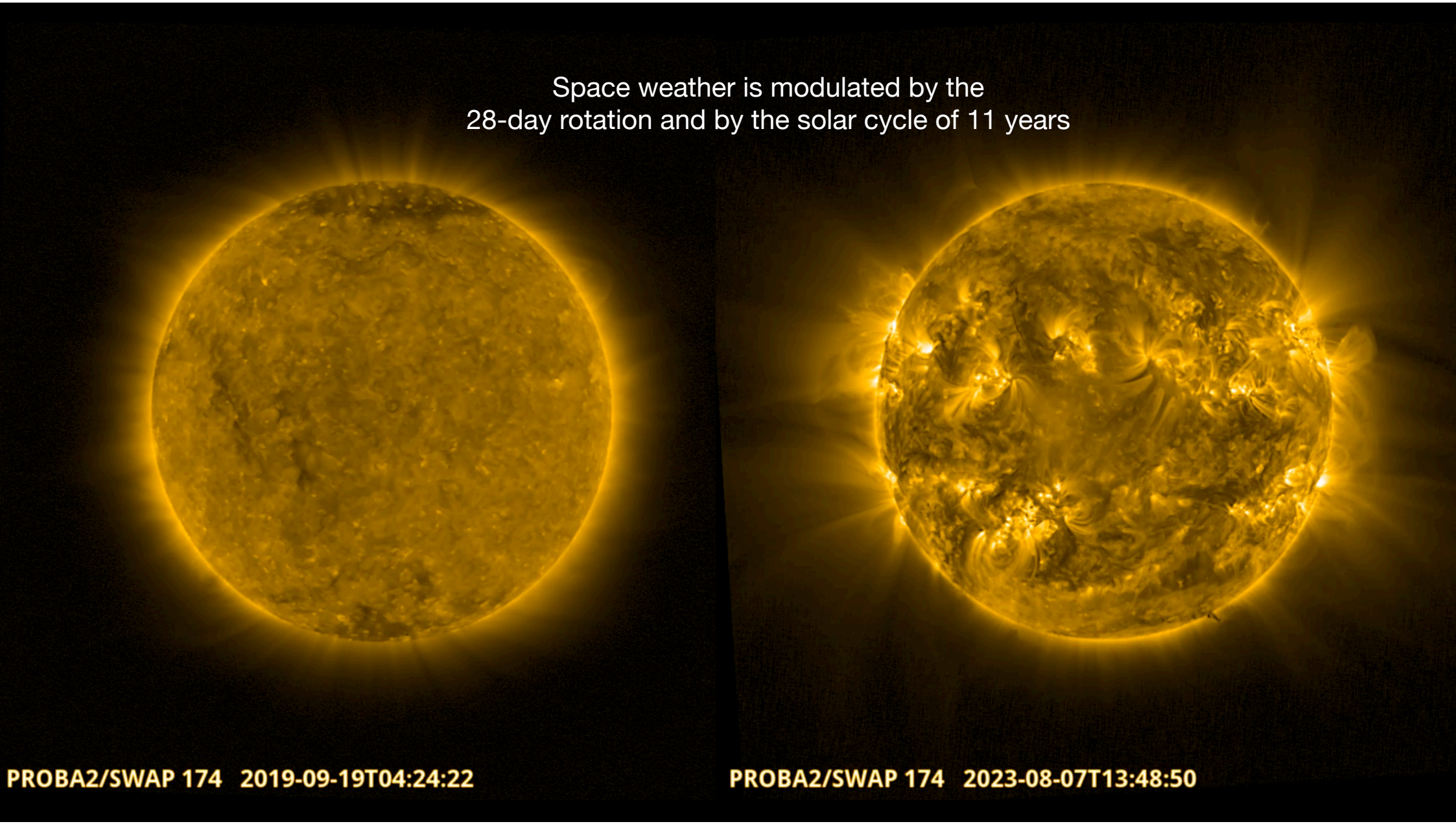
Space weather is modulated by the
28-day rotation and by the solar cycle of 11 years
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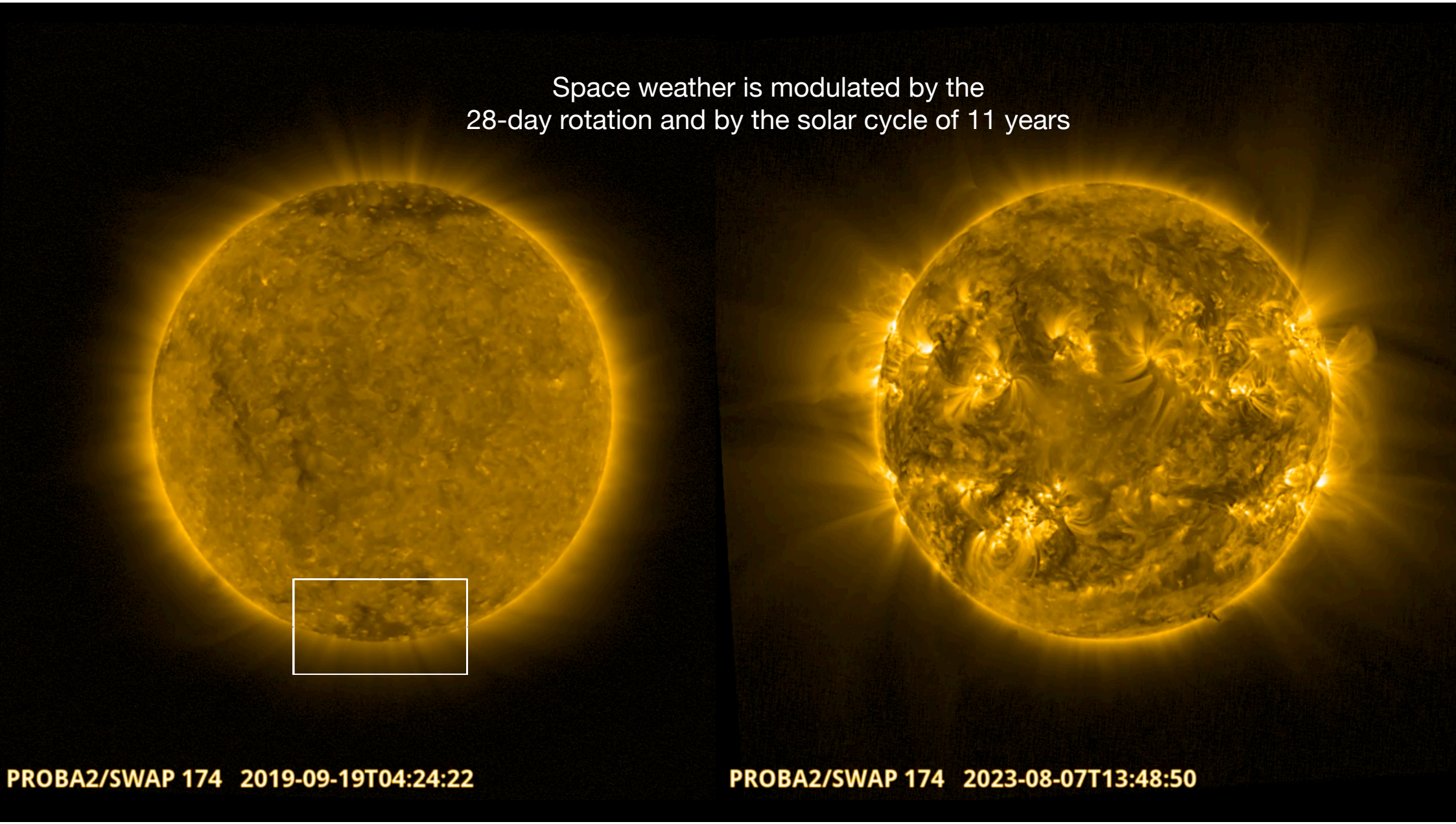
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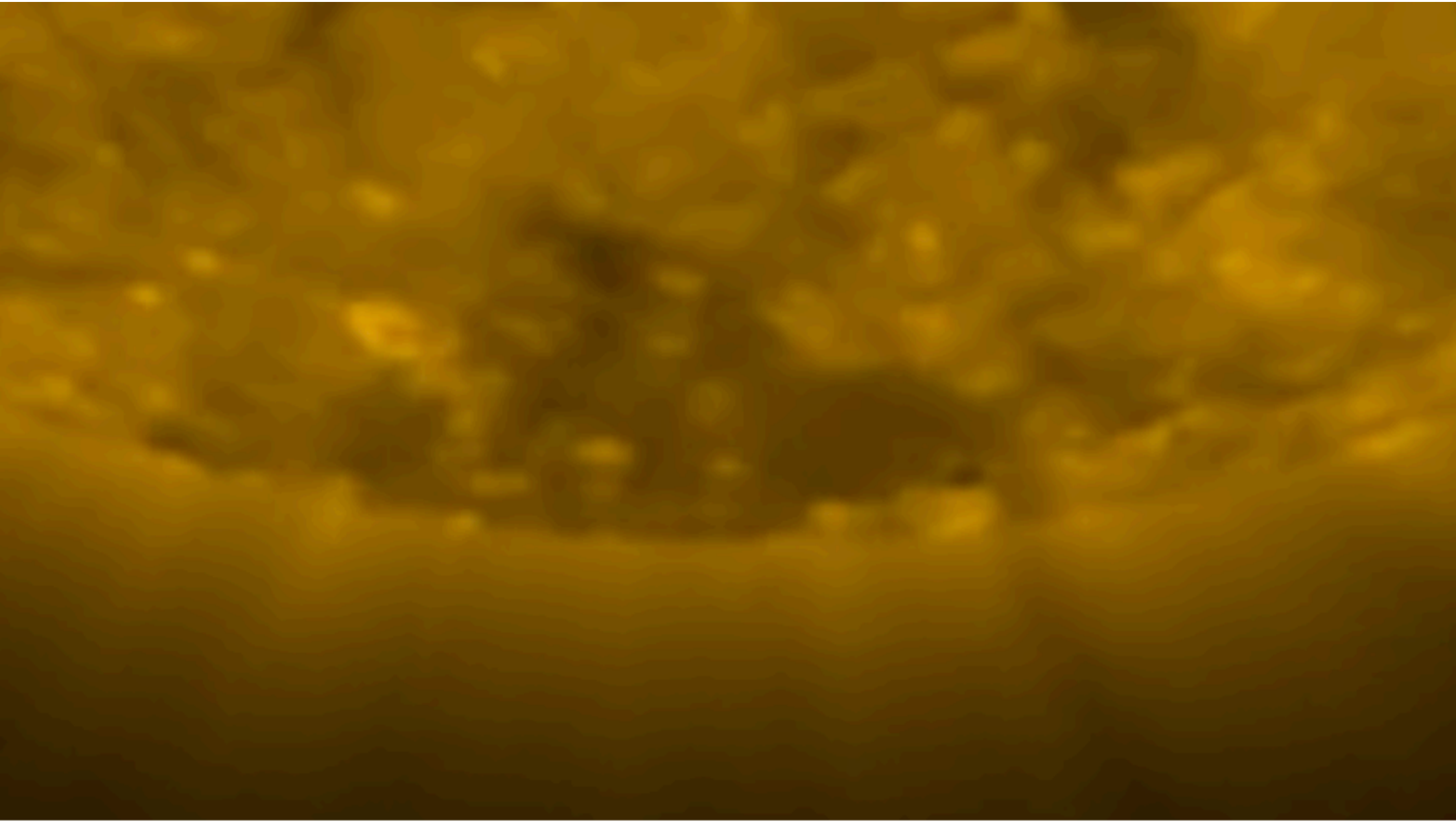
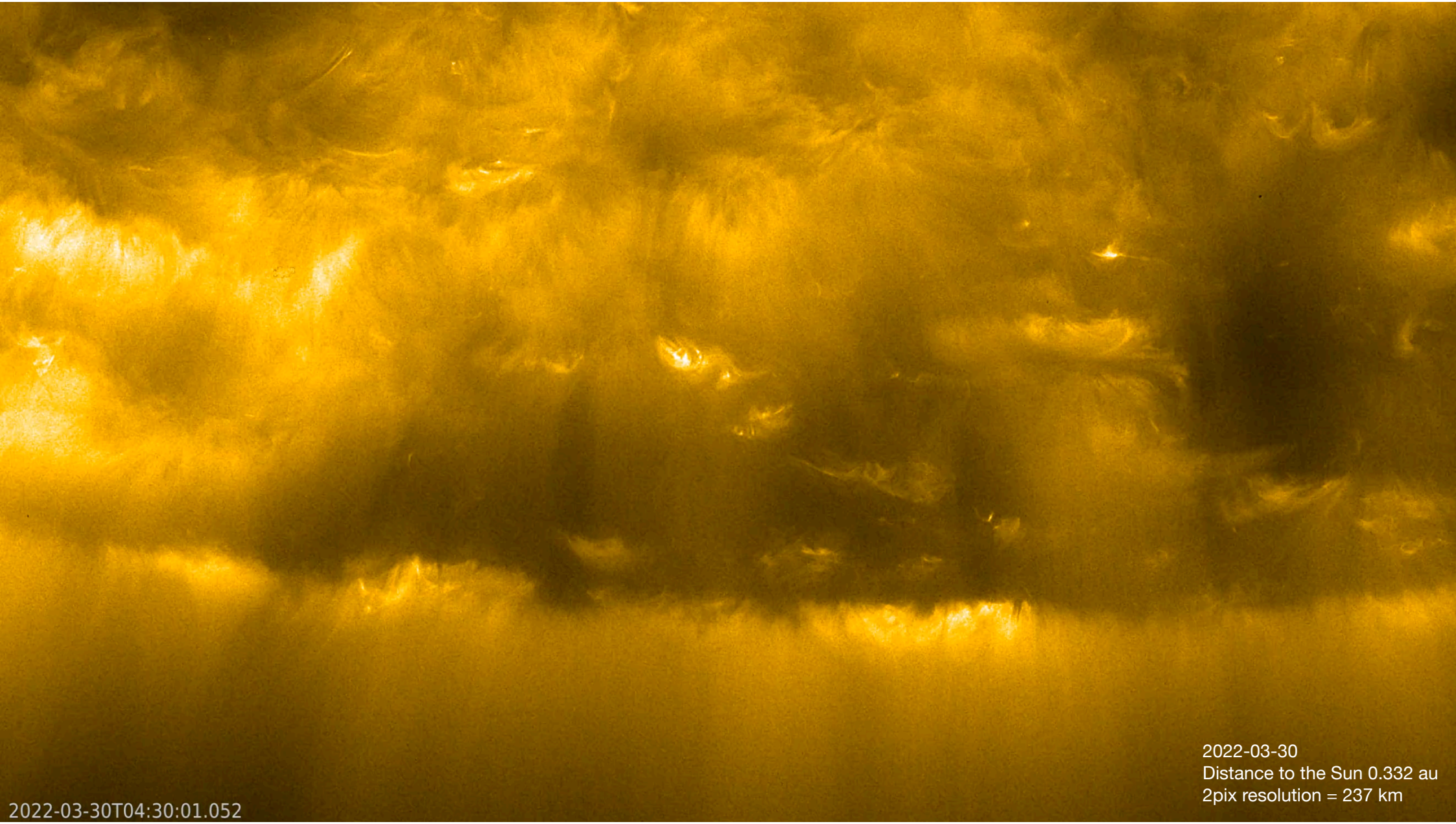
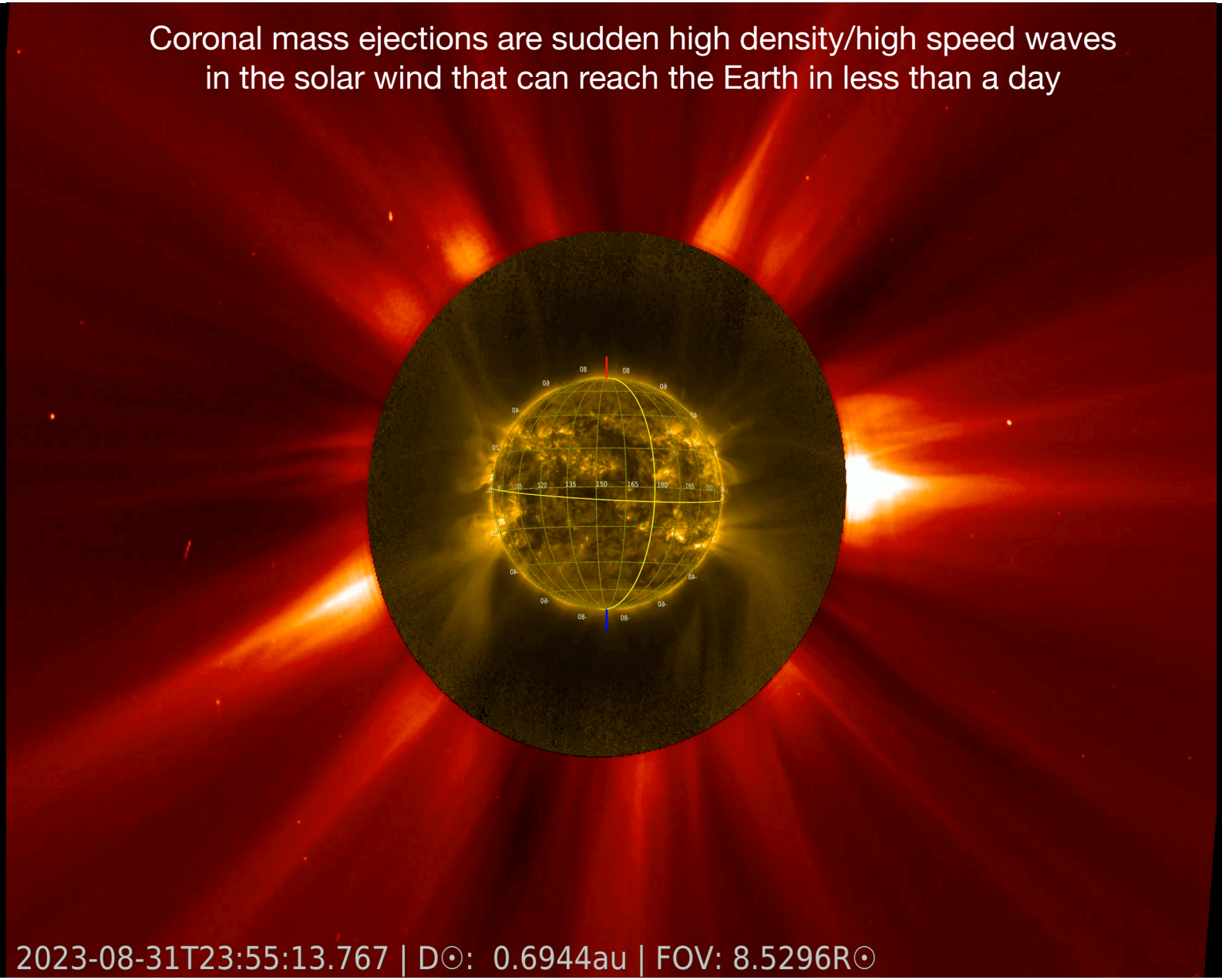
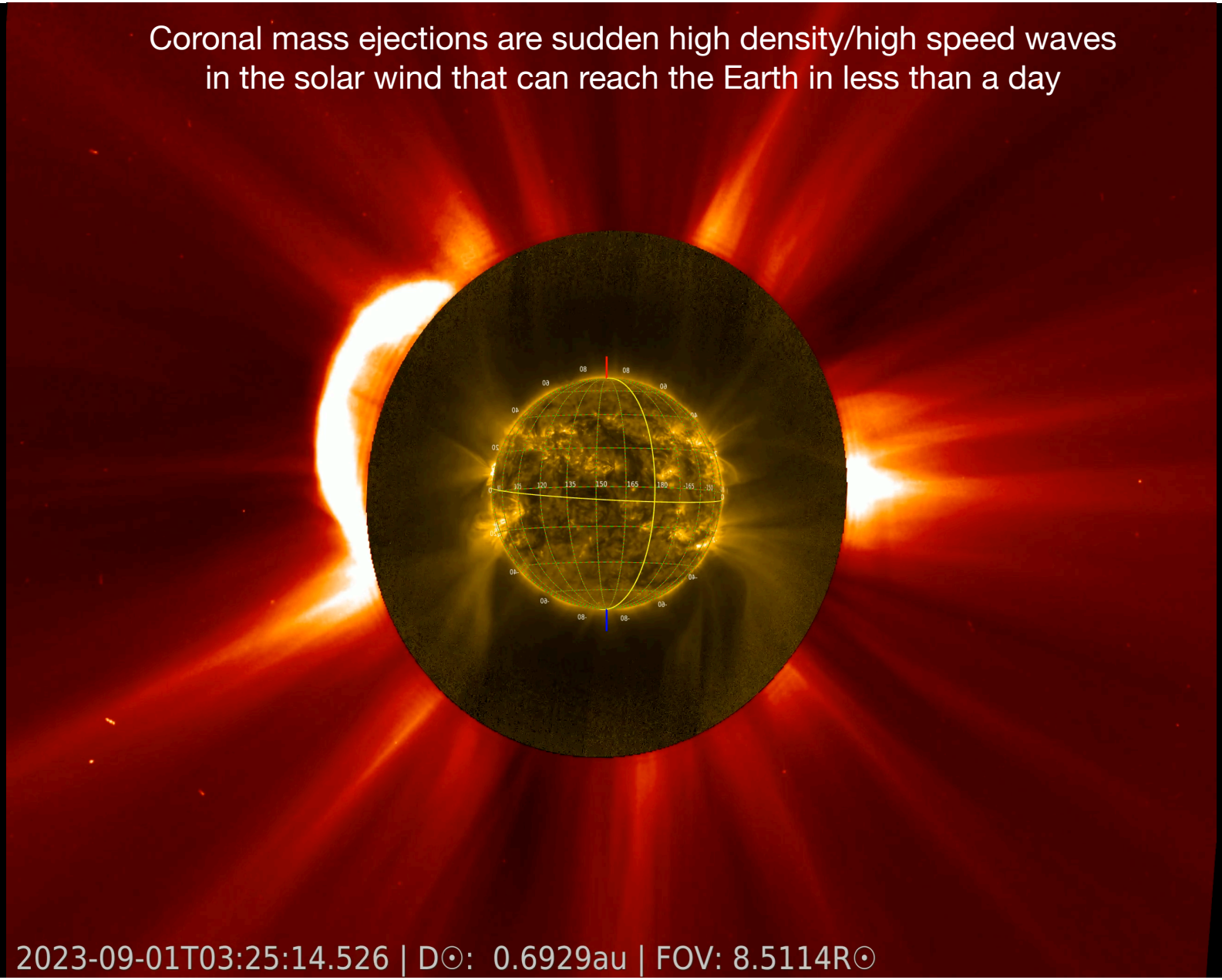



2022-03-30
Distance to the Sun 0.332 au
2pix resolution = 237 km
2022-03-30T04:30:01.052


The solar wind is a steady stream of particles from the sun
which reaches the Earth in about 3 days.
2022-03-30T04:30:01.052


Coronal mass ejections are sudden high density/high speed waves
in the solar wind that can reach the Earth in less than a day
2023-08-31T23:55:13.767 | D☉: 0.6944au | FOV: 8.5296R☉


Coronal mass ejections are sudden high density/high speed waves
in the solar wind that can reach the Earth in less than a day
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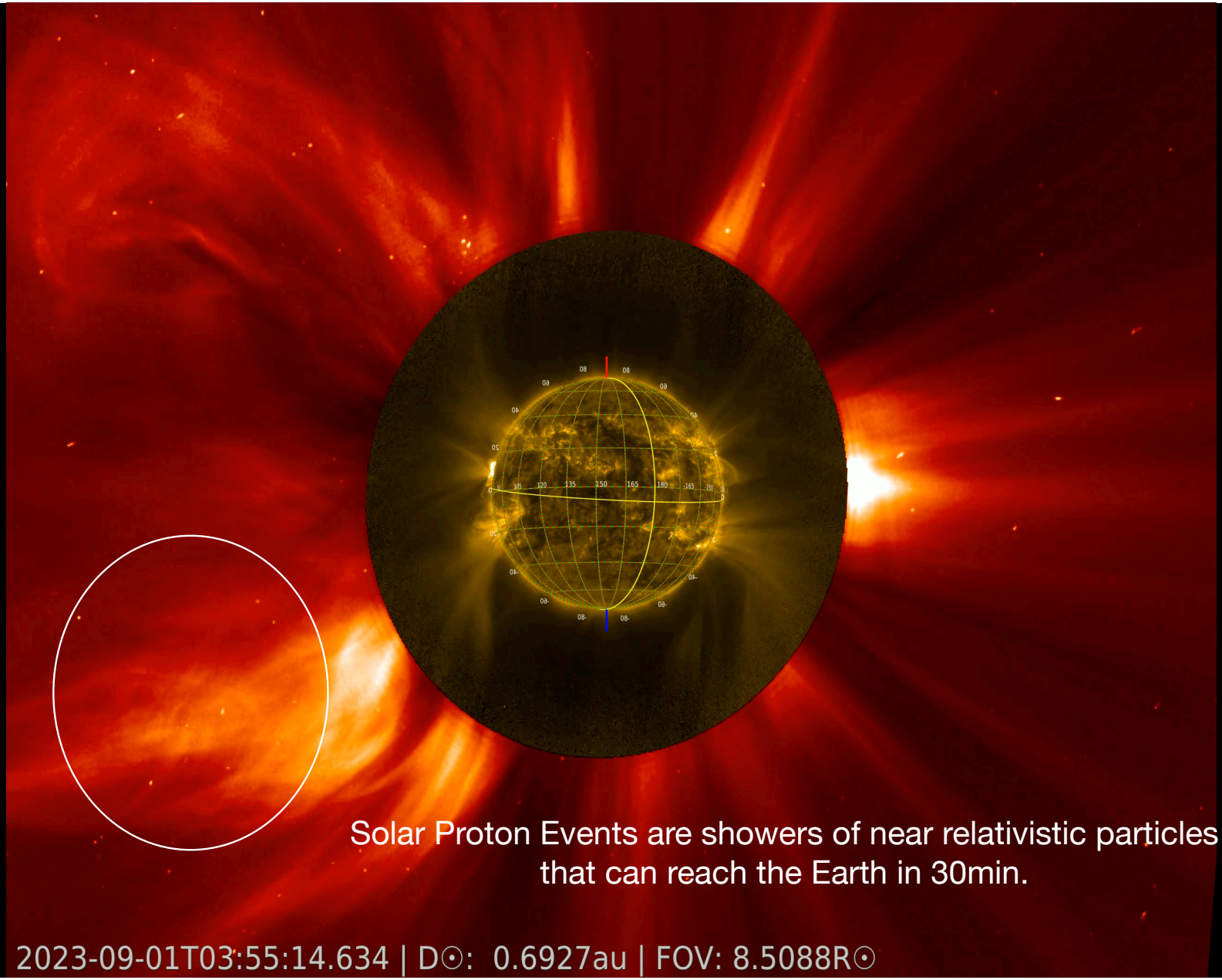
Solar Proton Events are showers of near relativistic particles
that can reach the Earth in 30min.
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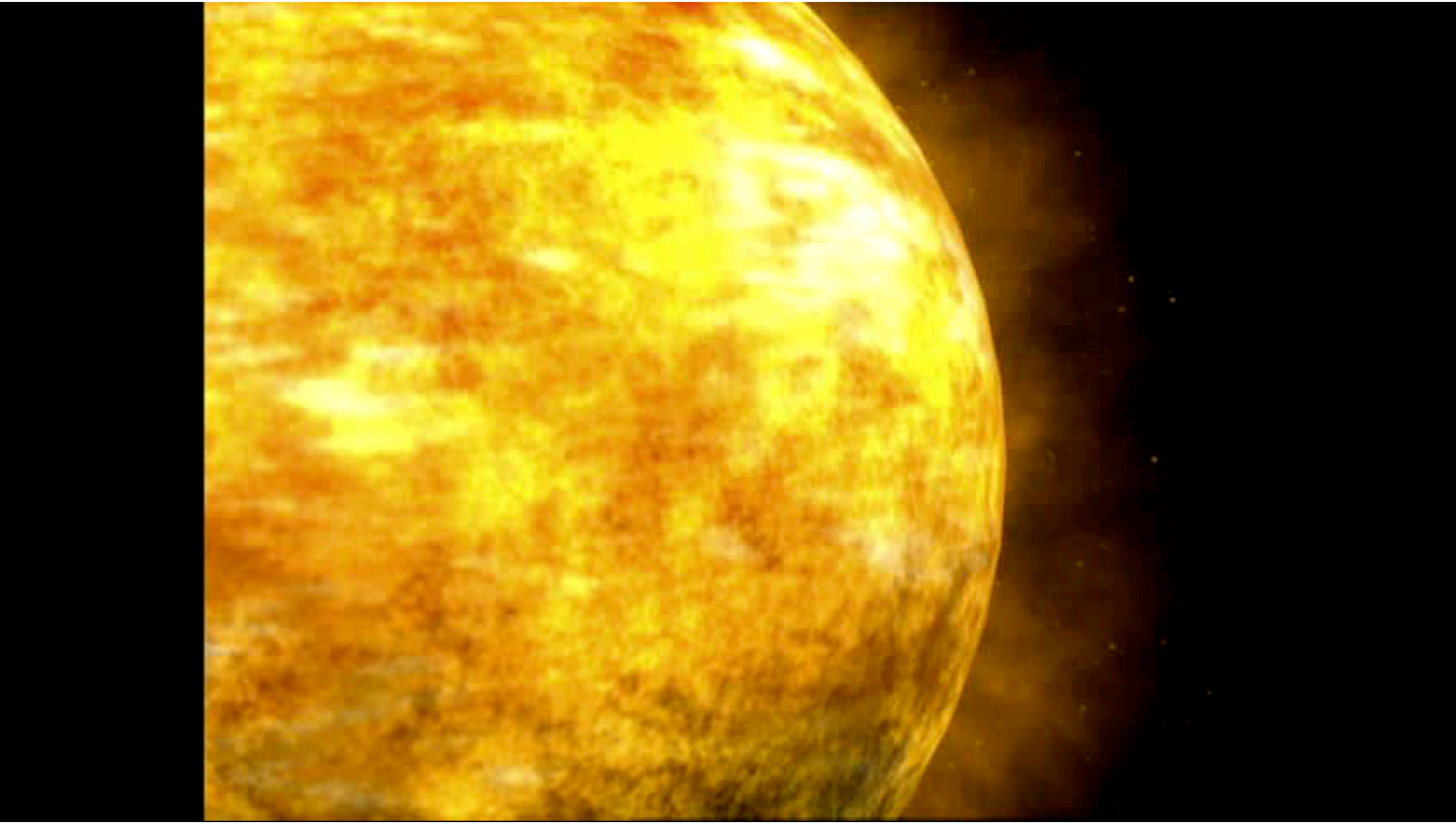
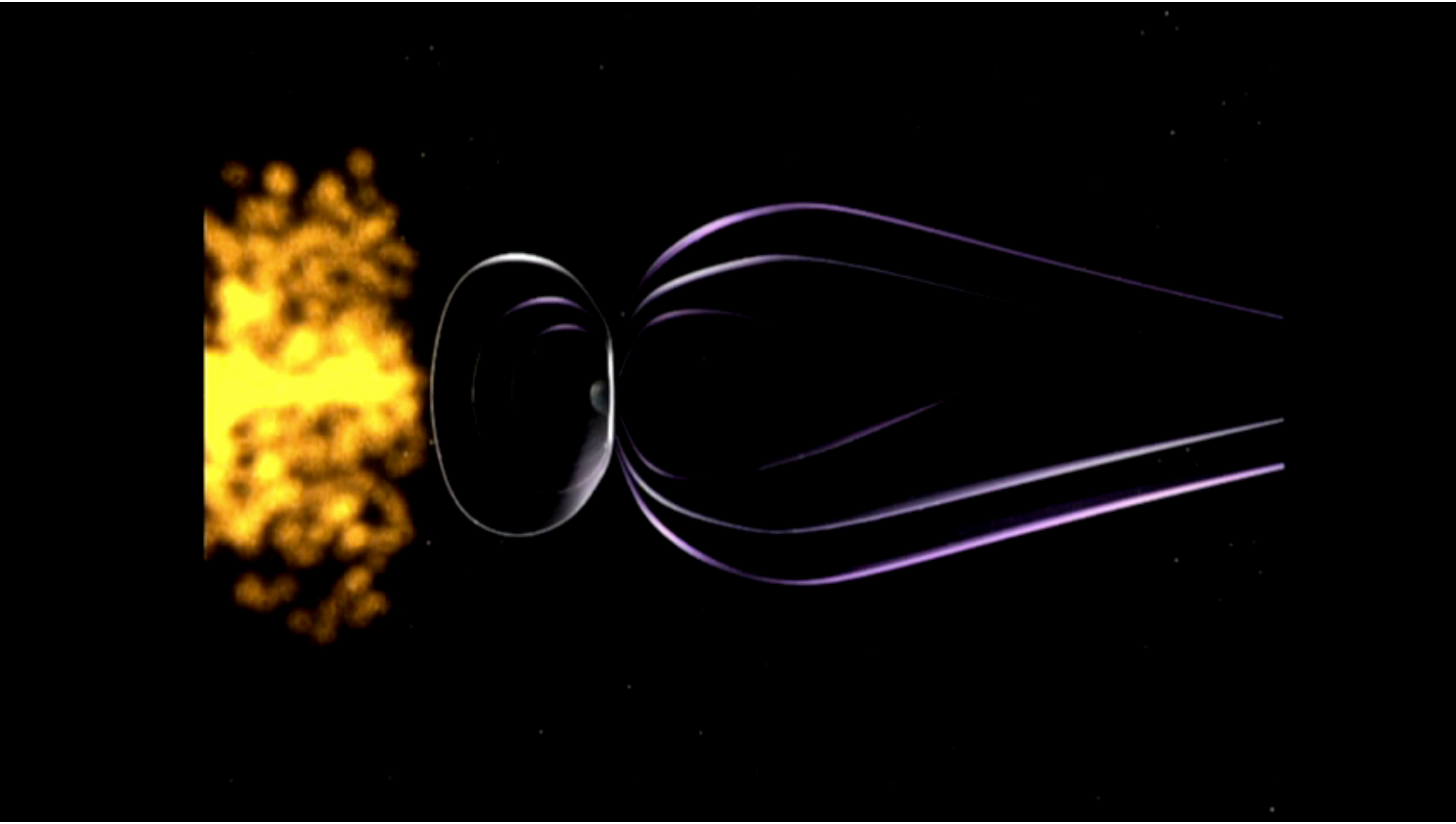
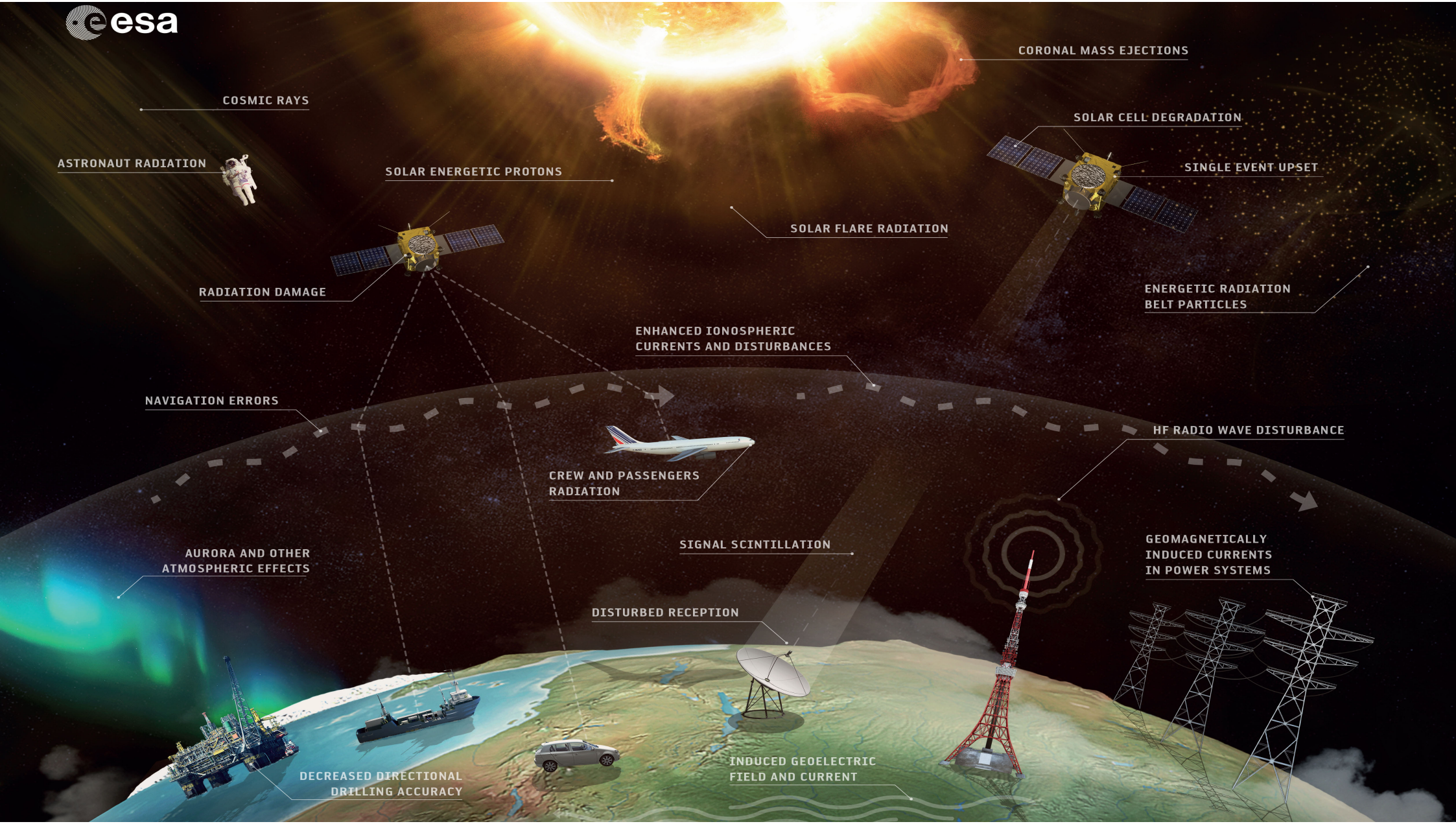
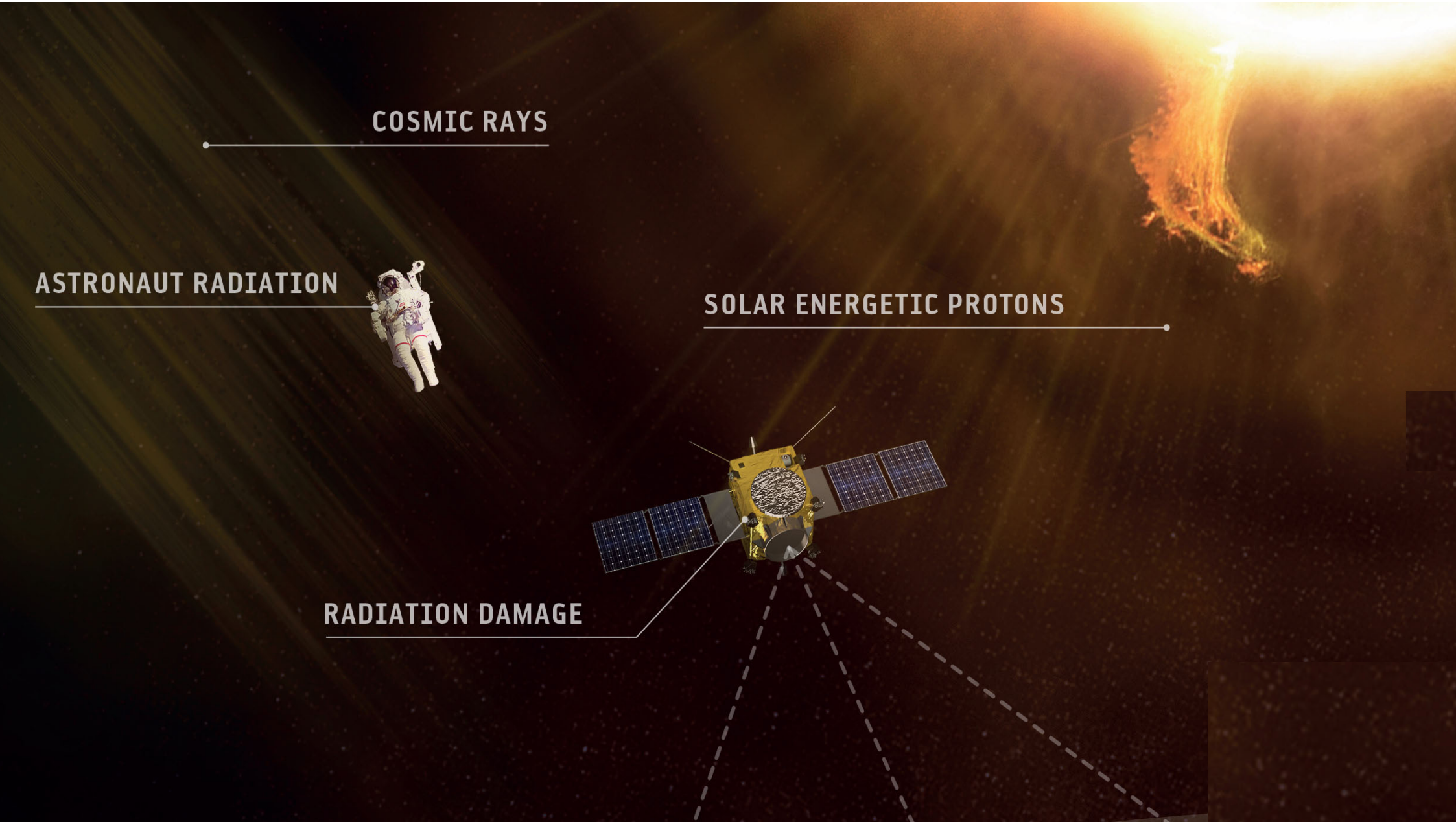


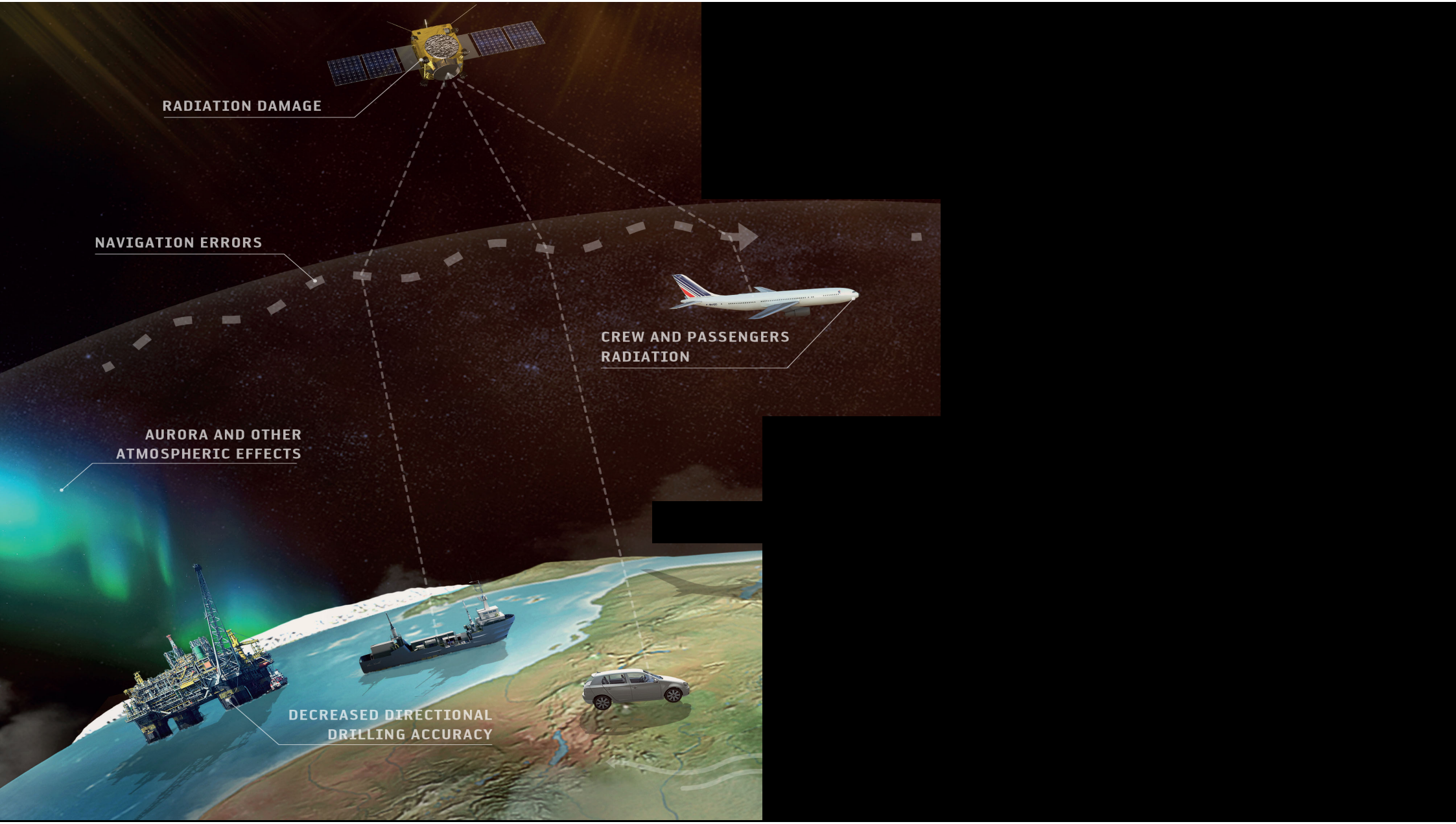


Why should you care about space weather?

Space weather impacts


esa
CORONAL MASS EJECTIONS
COSMIC RAYS
SOLAR CELL DEGRADATION
ASTRONAUT RADIATION
SOLAR ENERGETIC PROTONS
SINGLE EVENT UPSET
SOLAR FLARE RADIATION
RADIATION DAMAGE
ENERGETIC RADIATION
BELT PARTICLES
ENHANCED IONOSPHERIC
CURRENTS AND DISTURBANCES
NAVIGATION ERRORS
HF RADIO WAVE DISTURBANCE
CREW AND PASSENGERS
RADIATION
AURORA AND OTHER
ATMOSPHERIC EFFECTS
SIGNAL SCINTILLATION
GEOMAGNETICALLY
INDUCED CURRENTS
IN POWER SYSTEMS
DISTURBED RECEPTION
DECREASED DIRECTIONAL
DRILLING ACCURACY
INDUCED GEOELECTRIC
FIELD AND CURRENT


COSMIC RAYS
ASTRONAUT RADIATION
SOLAR ENERGETIC PROTONS
RADIATION DAMAGE


RADIATION DAMAGE
NAVIGATION ERRORS
CREW AND PASSENGERS
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AURORA AND OTHER
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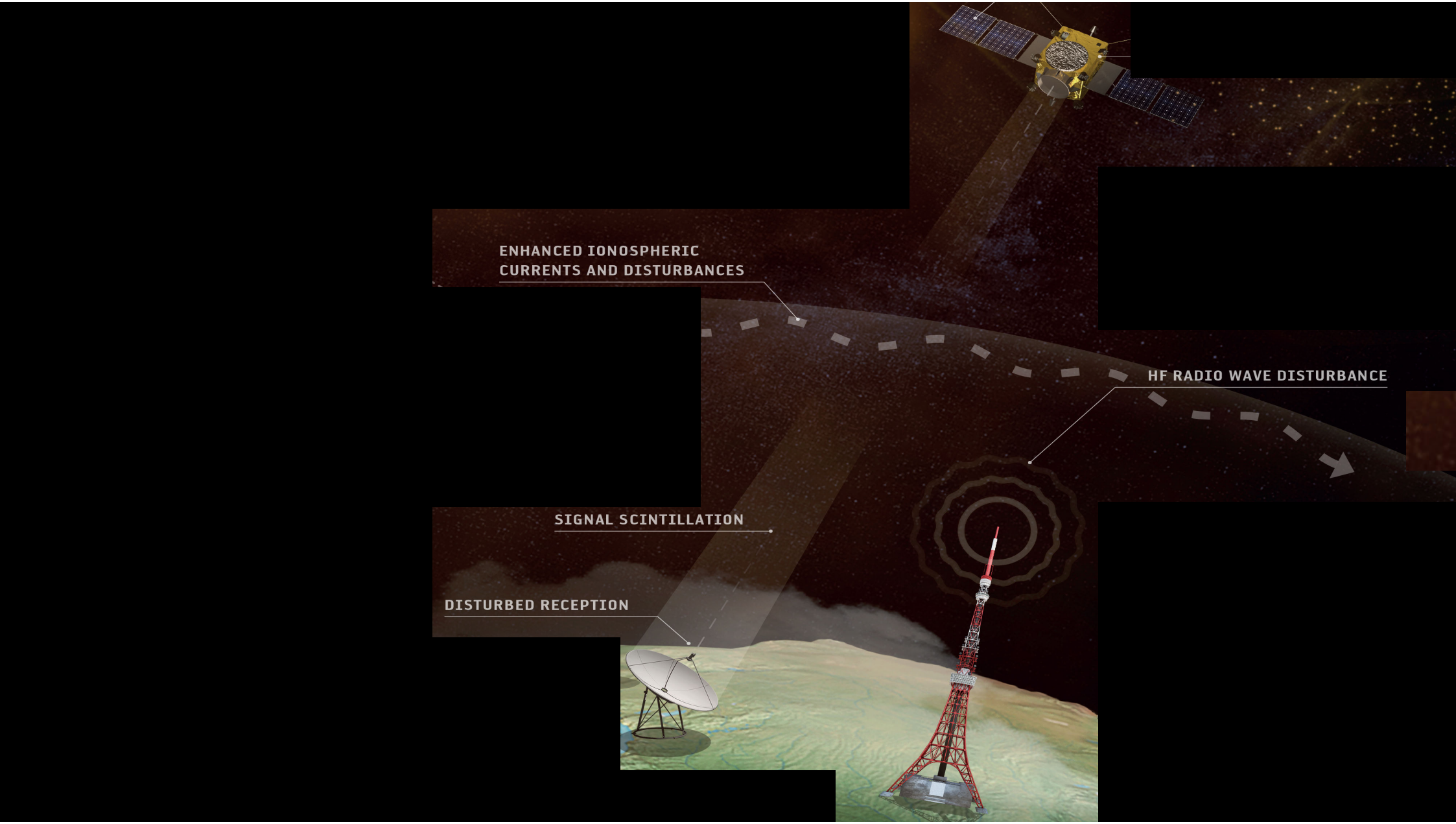
ENHANCED IONOSPHERIC
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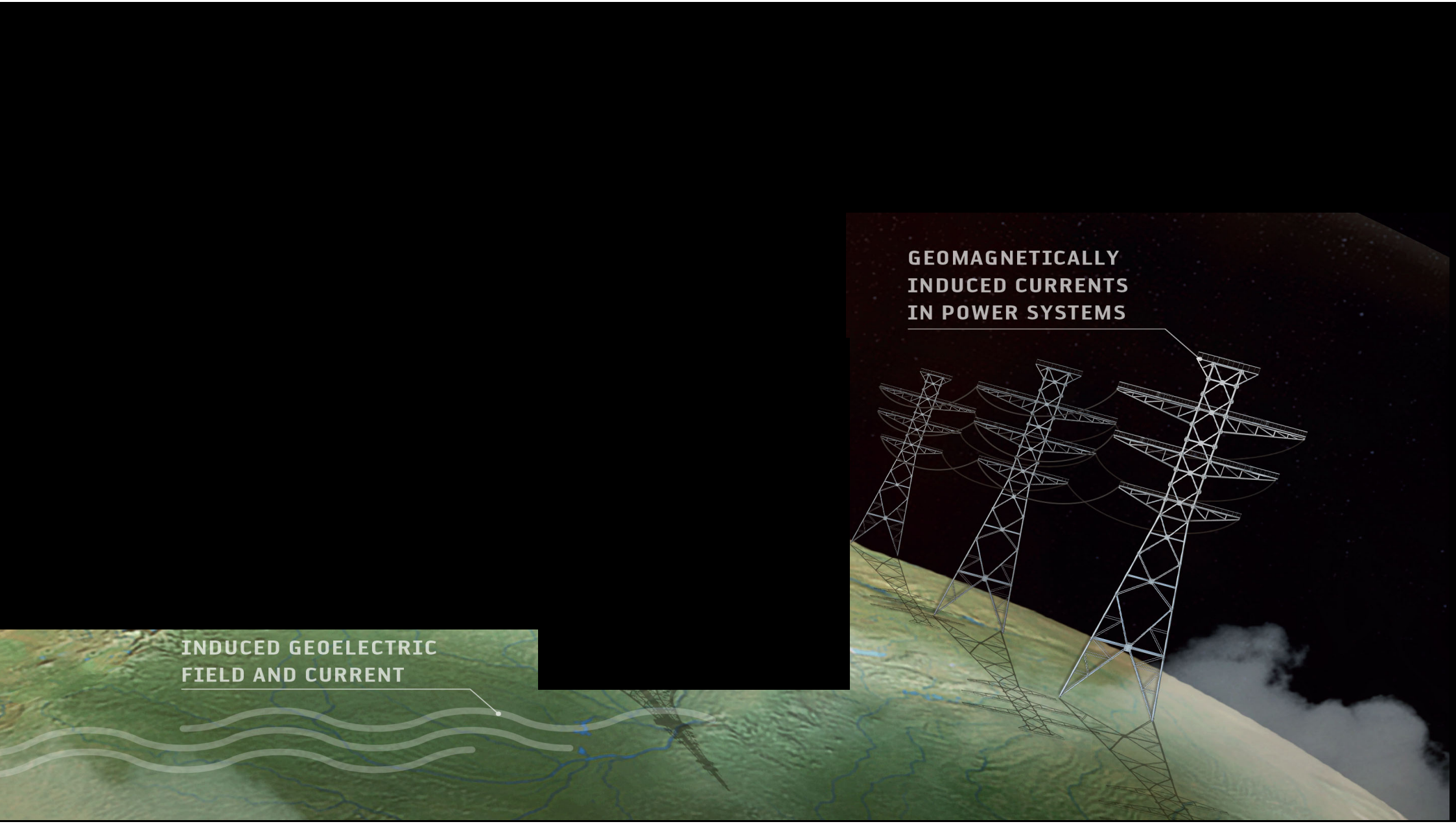
GEOMAGNETICALLY
INDUCED CURRENTS
IN POWER SYSTEMS
INDUCED GEOELECTRIC
FIELD AND CURRENT

SPACE WEATHER PREDICTION CENTER
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Solar Radiation Storm

Scale	Description	Effect	Physical measure (Flux level of >= 10 MeV particles)	Average Frequency (1 cycle = 11 years)
S 5	Extreme	**Biological:** Unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise panels possible. **Other systems:** C and position errors	10^5	Fewer than 1 per cycle
S 4	Severe	**Biological:** Unavoi high latitudes may **Satellite operatio** problems may caus **Other systems:** B errors over several		
S 3	Strong	**Biological:** Radiati flying aircraft at hig **Satellite operatio** panel are likely. **Other systems:** D		
S 2	Moderate	**Biological:** Passen risk. **Satellite operatio** **Other systems:** S locations possibly a		
S 1	Minor	**Biological:** None. **Satellite operatio** **Other systems:** M		

Geogmagnetic Storm

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
G 5	Extreme	**Power systems:** Widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle)
G 4	Severe	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** May experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation deg Alabama and n	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
G 3	Strong	**Power systen** **Spacecraft op** Earth-orbit sat **Other system** radio may be ir lat.).		
G 2	Moderate	**Power systen** cause transforr **Spacecraft op** in drag affect c **Other system** York and Idaho		
G 1	Minor	**Power systen** **Spacecraft op** **Other system** latitudes (north		

Radio black outs

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
R 5	Extreme	**HF Radio:** Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Less than 1 per cycle
R 4	Severe	**HF Radio:** HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. **Navigation:** Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	Strong	**HF Radio:** Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. **Navigation:** Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	**HF Radio:** Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. **Navigation:** Degradation of low-frequency navigation signals for tens of minutes.	M5 (5×10^{-5})	350 per cycle (300 days per cycle)
R 1	Minor	**HF Radio:** Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. **Navigation:** Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

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Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
		Geogmagnetic Storm		
G 5	**Extreme**	**Power systems:** Widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle)
G 4	**Severe**	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** May experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
G 3	**Strong**	**Power systems:** Voltage corrections may be required, false alarms triggered on some protection devices. **Spacecraft operations:** Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).	Kp = 7	200 per cycle (130 days per cycle)
G 2	**Moderate**	**Power systems:** High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. **Spacecraft operations:** Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).	Kp = 6	600 per cycle (360 days per cycle)
G 1	**Minor**	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations possible. **Other systems:** Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle)

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Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
		Geogmagnetic Storm		
G 5	**Extreme**	**Power systems:** Widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle) every few years
G 4	**Severe**	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** May experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
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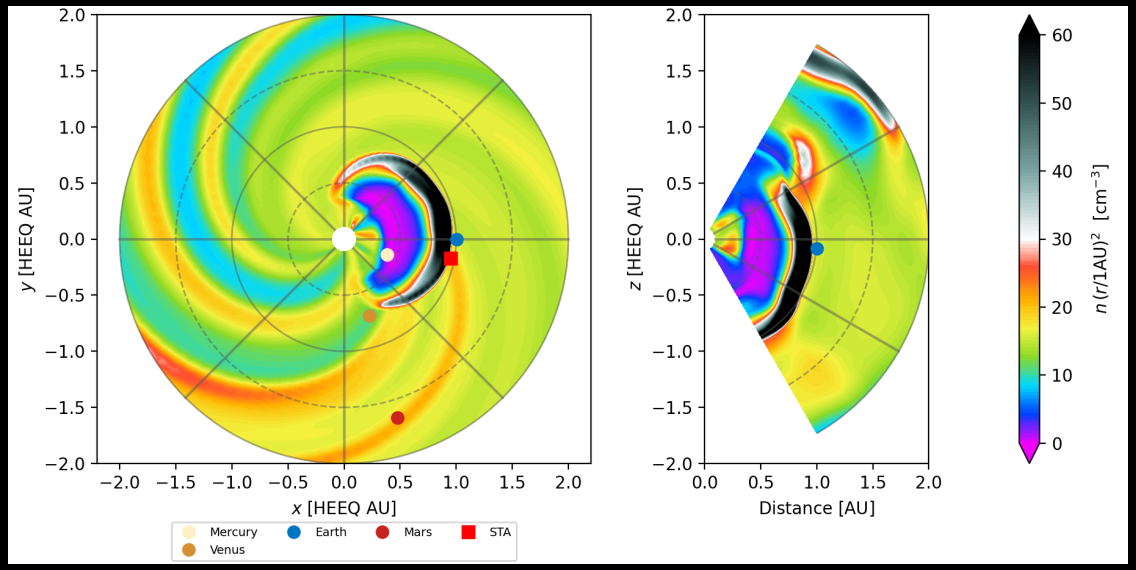
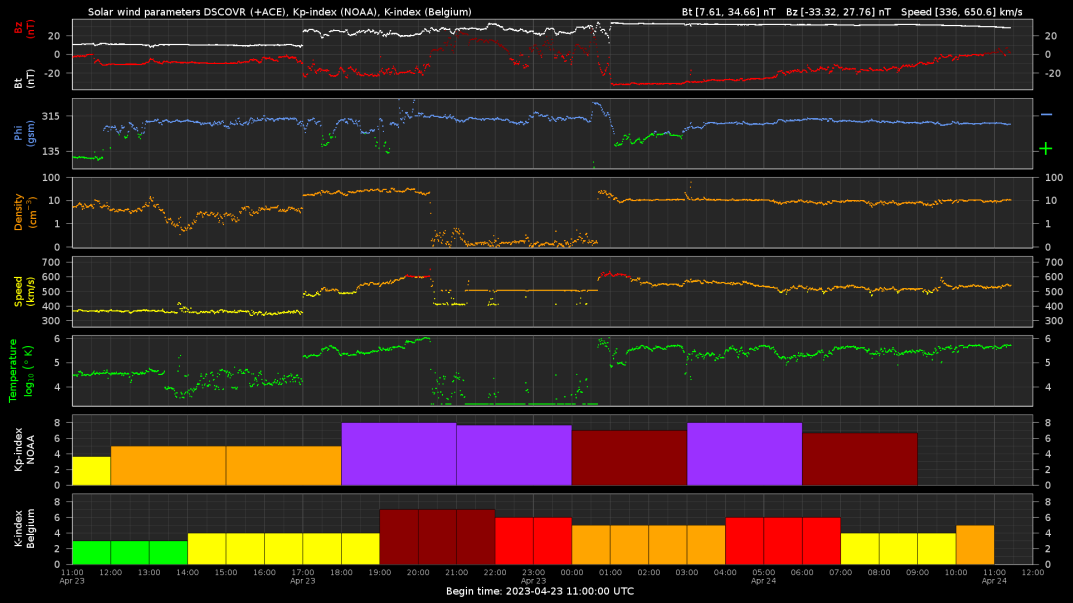
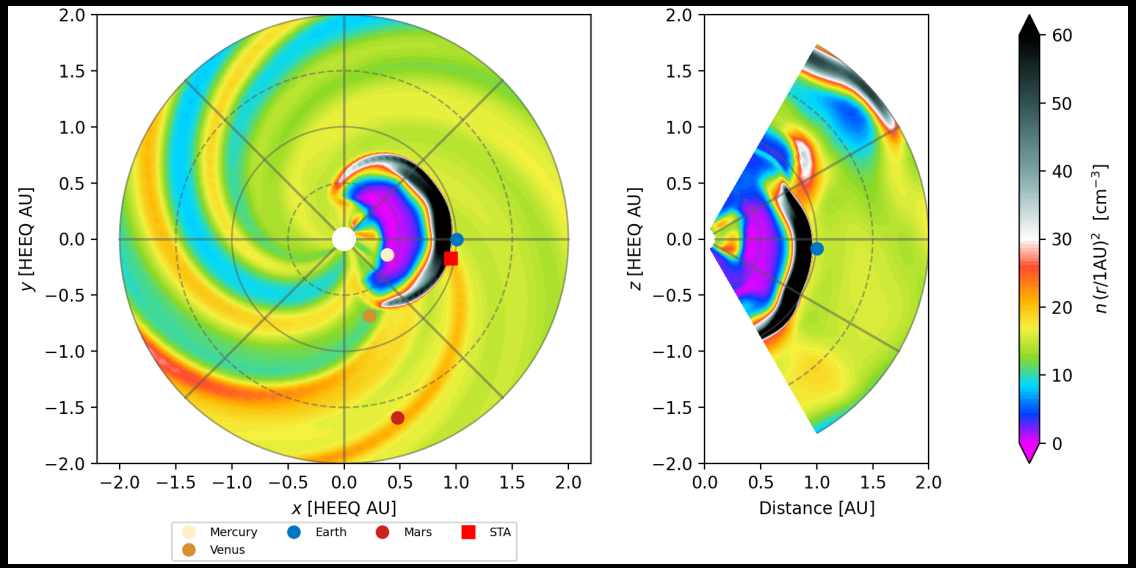
G 1	**Minor**	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations possible. **Other systems:** Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle) once per week

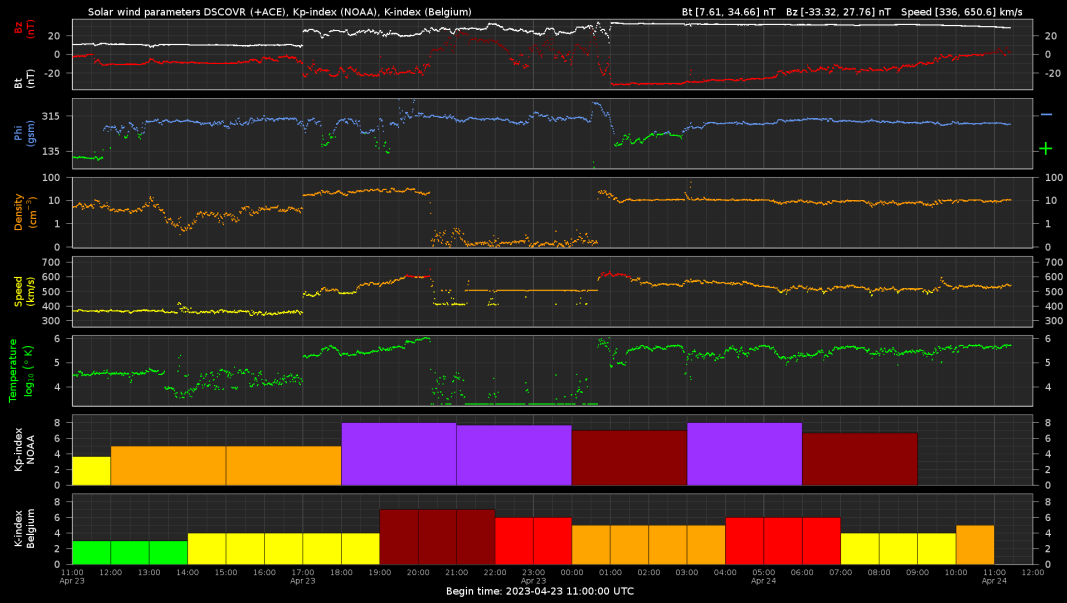
2023 04 23 G4 geomagnetic storm

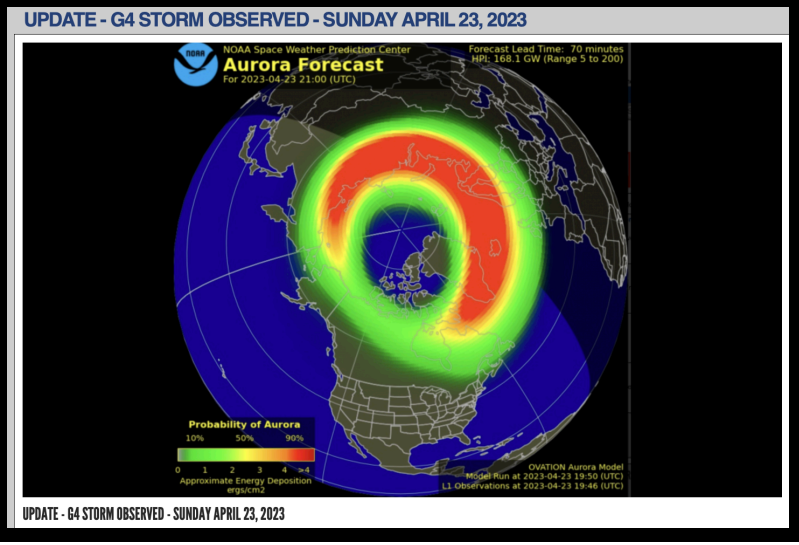


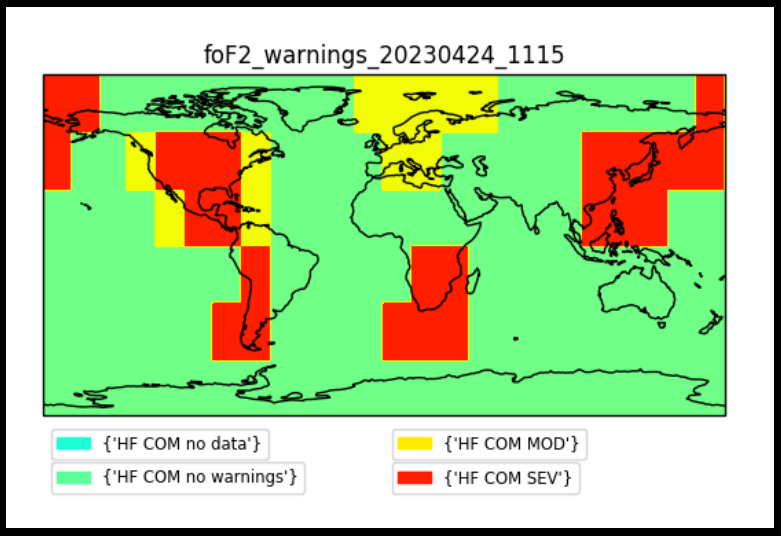


2023 04 23 G4 geomagnetic storm









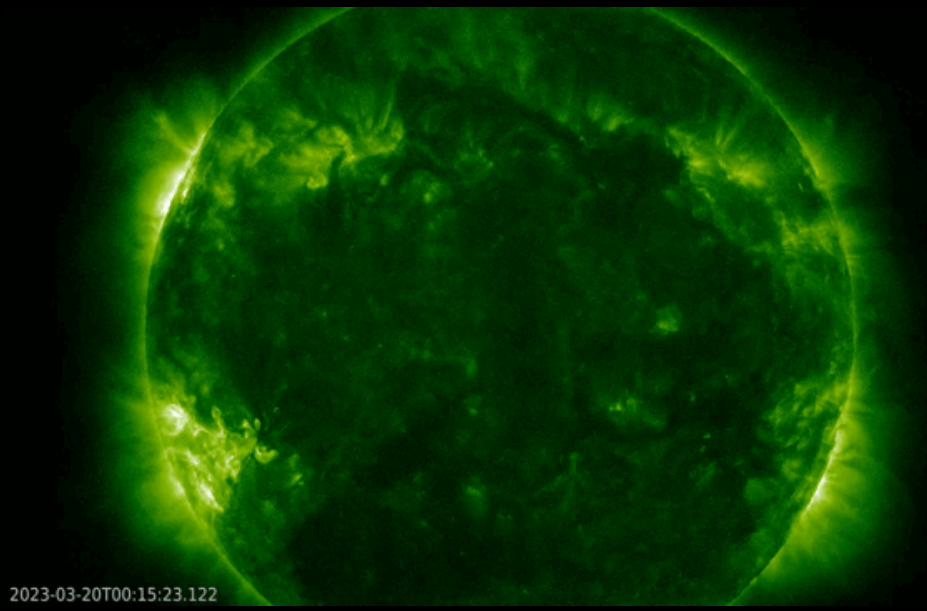
Impact on Global Navigation Satellite Systems, GNSS

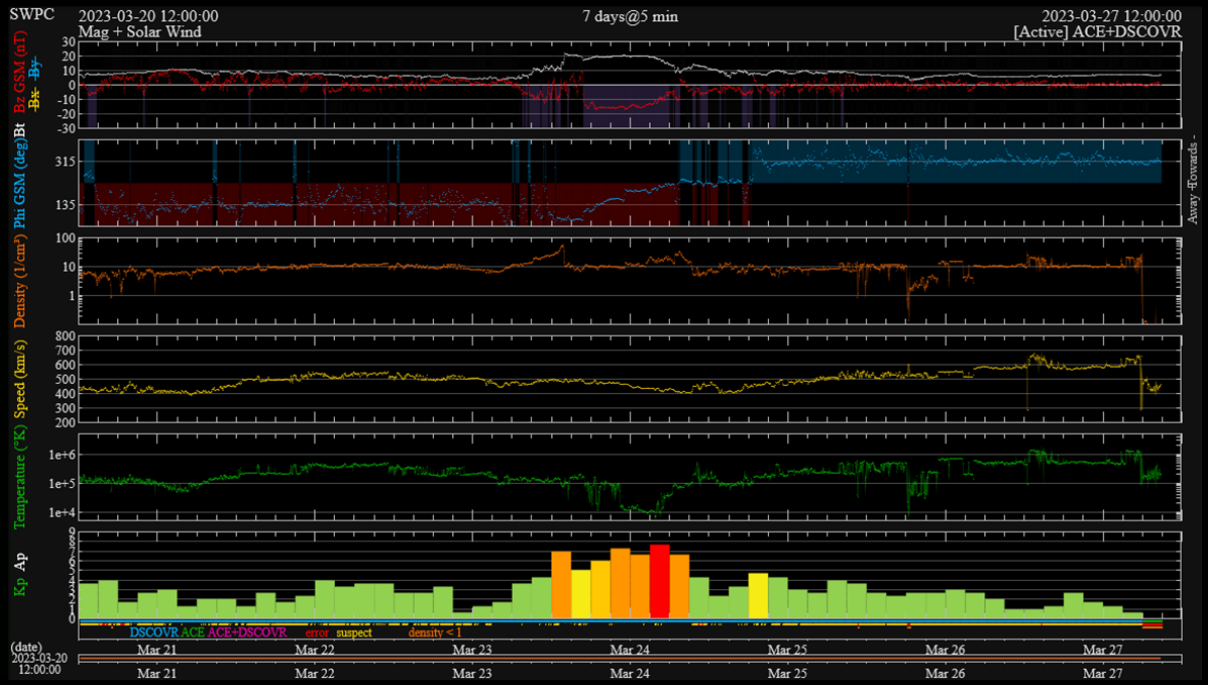
Simultaneously, global navigation satellite systems were also impacted. The signals sent out by the satellites were not well received anymore.

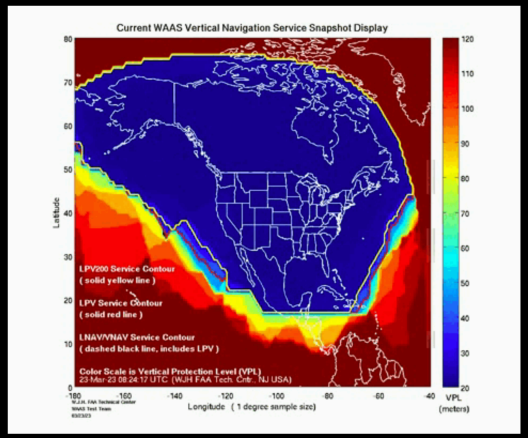
Alerting civil aviation

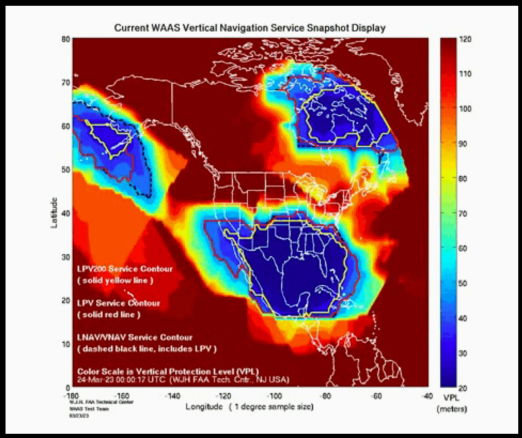
The first advisory on HF COM was sent at 17:06UT. It was the first of many.

2023 03 24 G4 geomagnetic storm









2022 02 03 G1 geomagnetic storm

Wed, Oct 12, 2022

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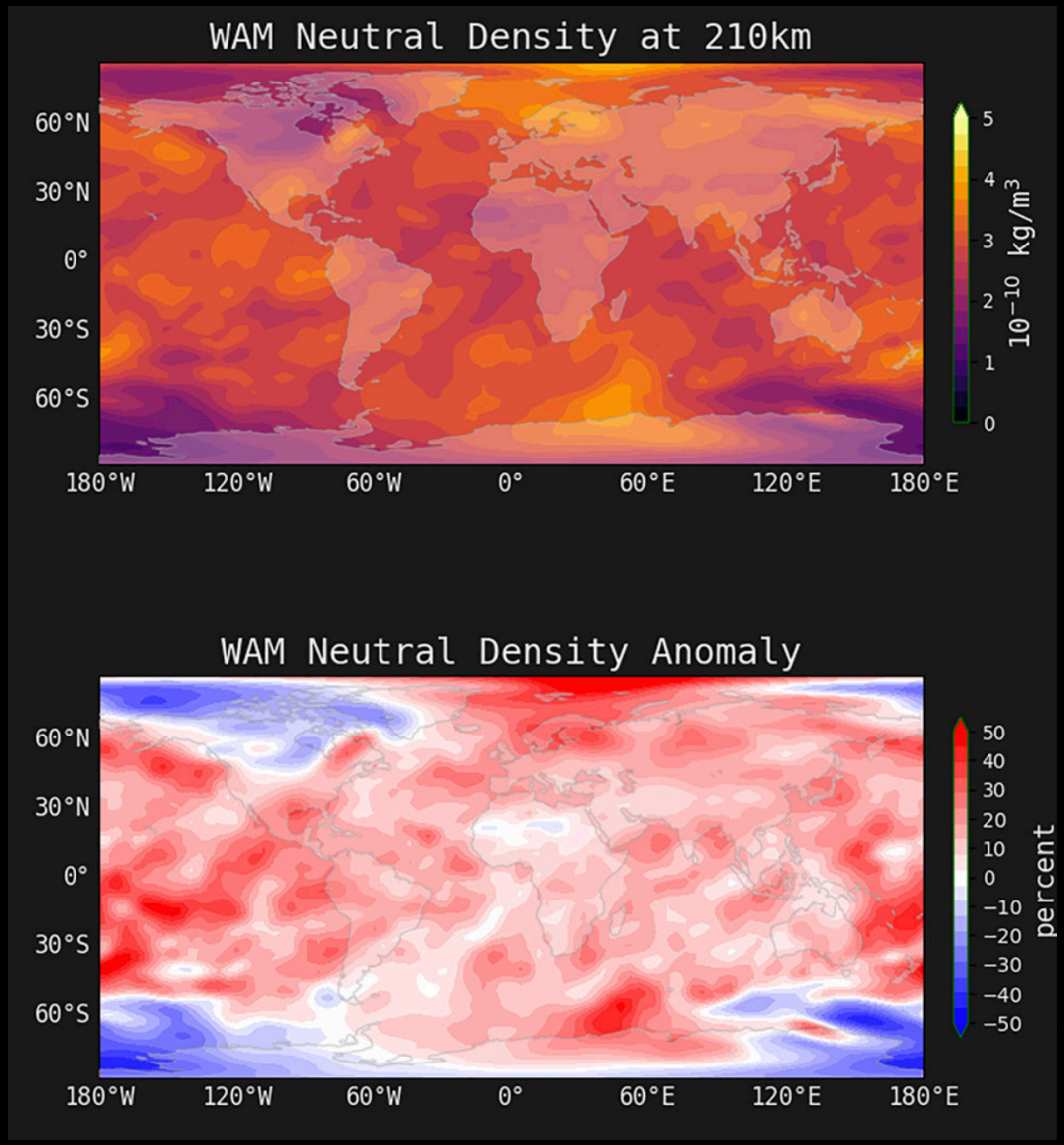
TECH & SCIENCE

'Destruction Event' From Sun Annihilated Dozens of SpaceX Satellites

BY ED BROWNE ON 9/16/22 AT 5:38 AM EDT

2022 02 03 G1 geomagnetic storm



Fang, T.-W., Kubaryk, A., Goldstein, D., Li, Z., Fuller-Rowell, T., Millward, G., et al. (2022). Space weather environment during the SpaceX Starlink satellite loss in February 2022. *Space Weather*, *20*, e2022SW003193. https://doi. org/10.1029/2022SW003193

How can we deal with space weather?

Efforts to mitigate space weather impacts

How can we deal with space weather?

Efforts to mitigate space weather impacts

1. understanding of the vulnerabilities, including impact and likelihood
2. preparedness through improved engineering of the affected systems
3. maintaining awareness of the current state of the space environment through observations and analysis in real time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Royal Meteorological Institute of Belgium (RMI)
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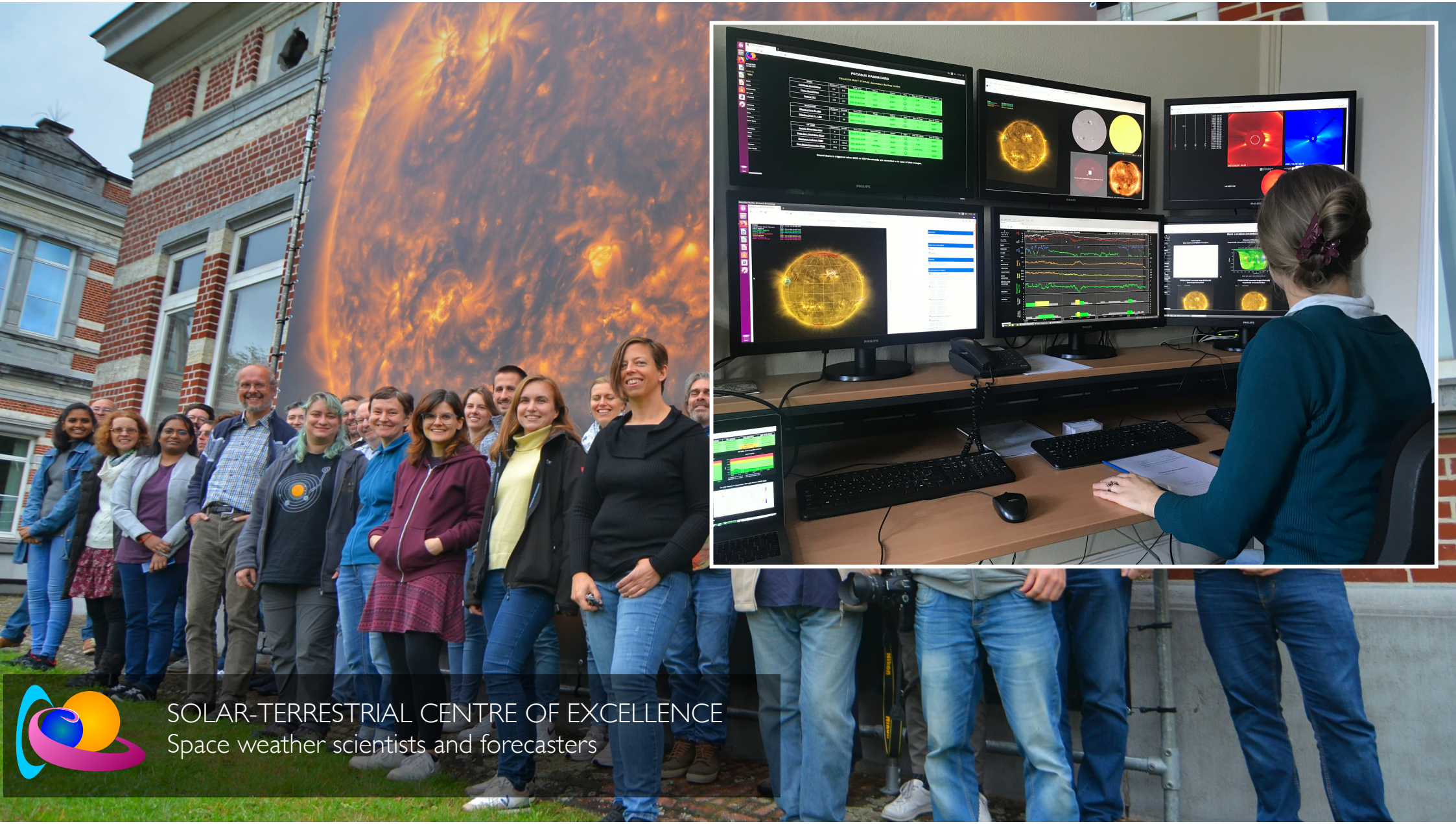
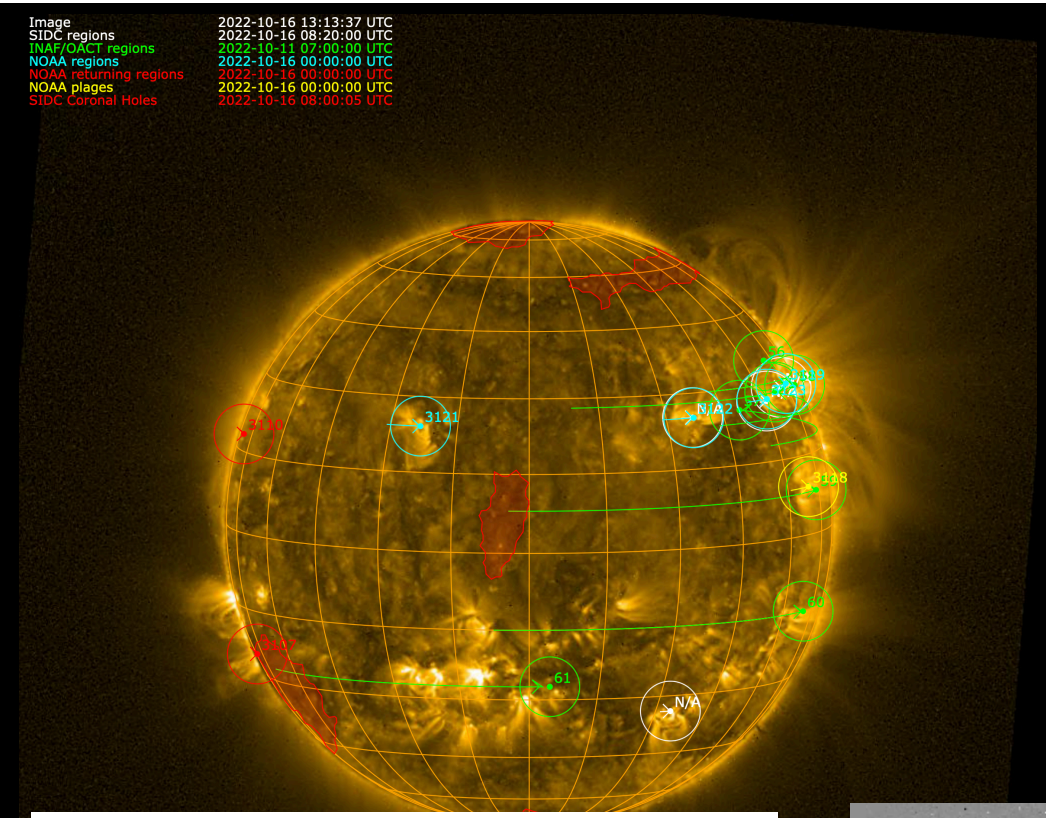


SOLAR-TERRESTRIAL CENTRE OF EXCELLENCE

Space weather scientists and forecasters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3136
3121
N/A2
3128
90
3127
61
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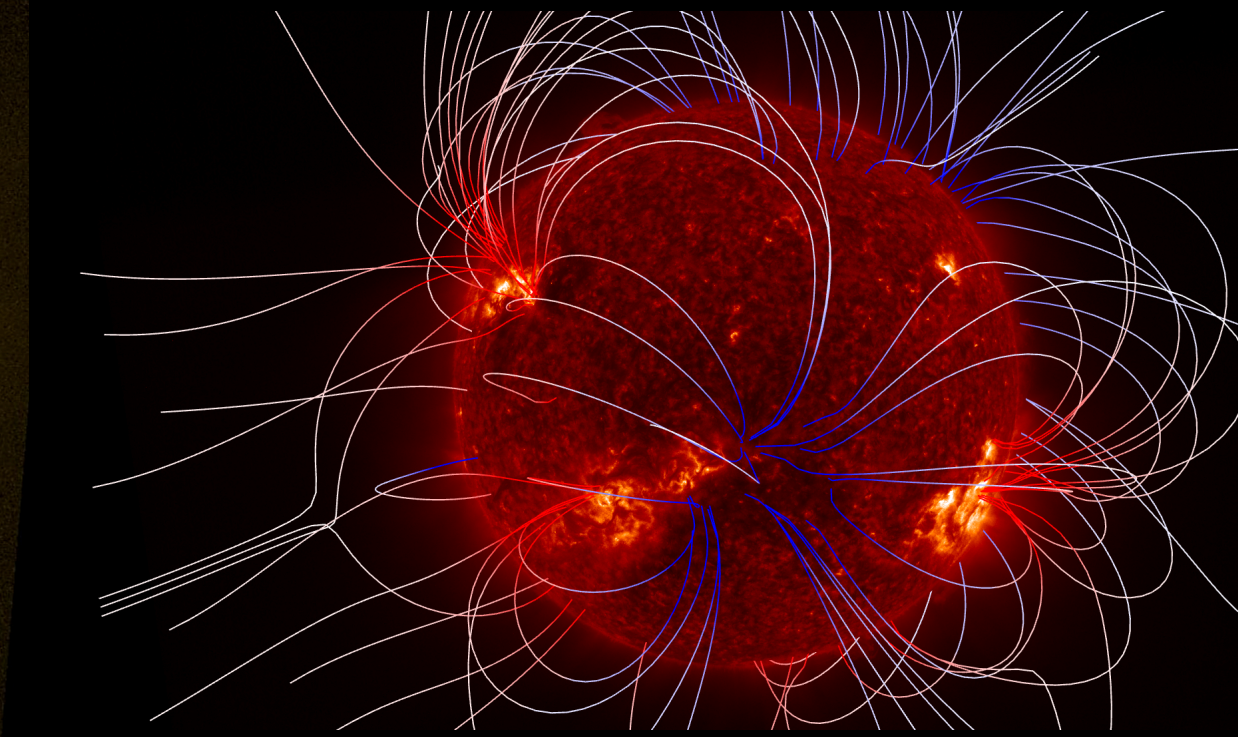

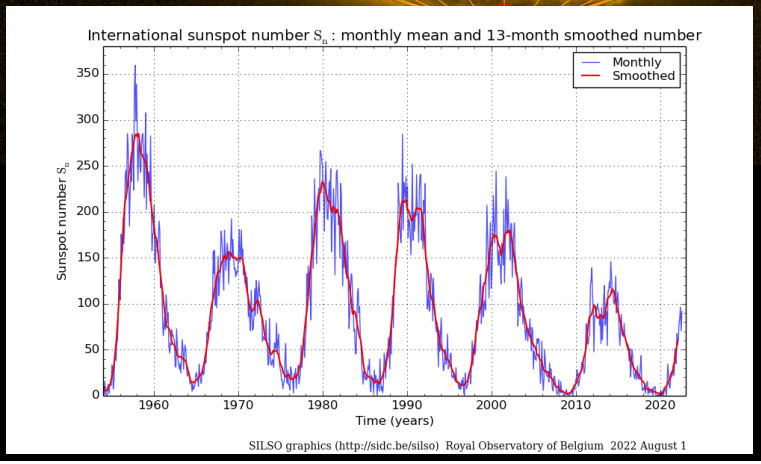
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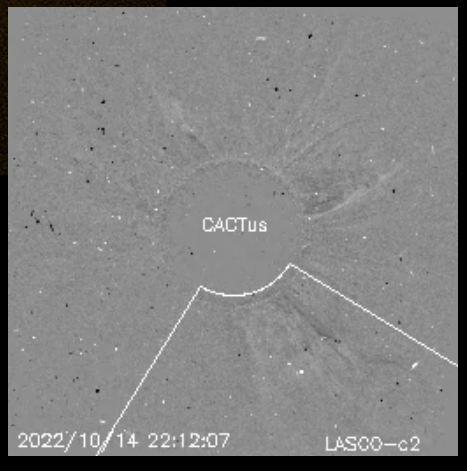
Monthly
Smoothed
Sunspot number S_n
Time (years)
SILSO graphics (http://sidc.be/silso) Royal Observatory of Belgium 2022 August 1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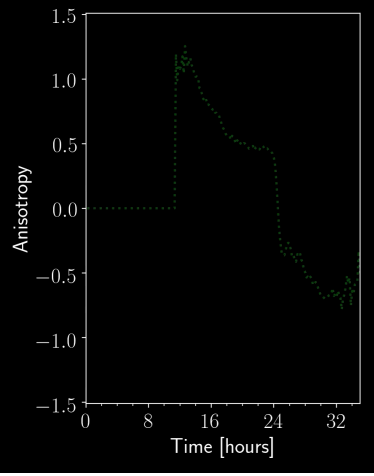
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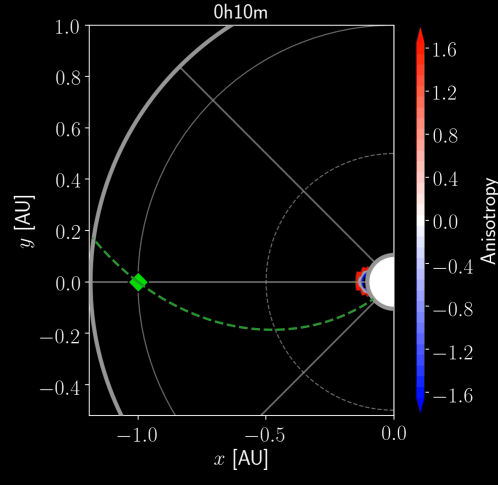
Time [hours]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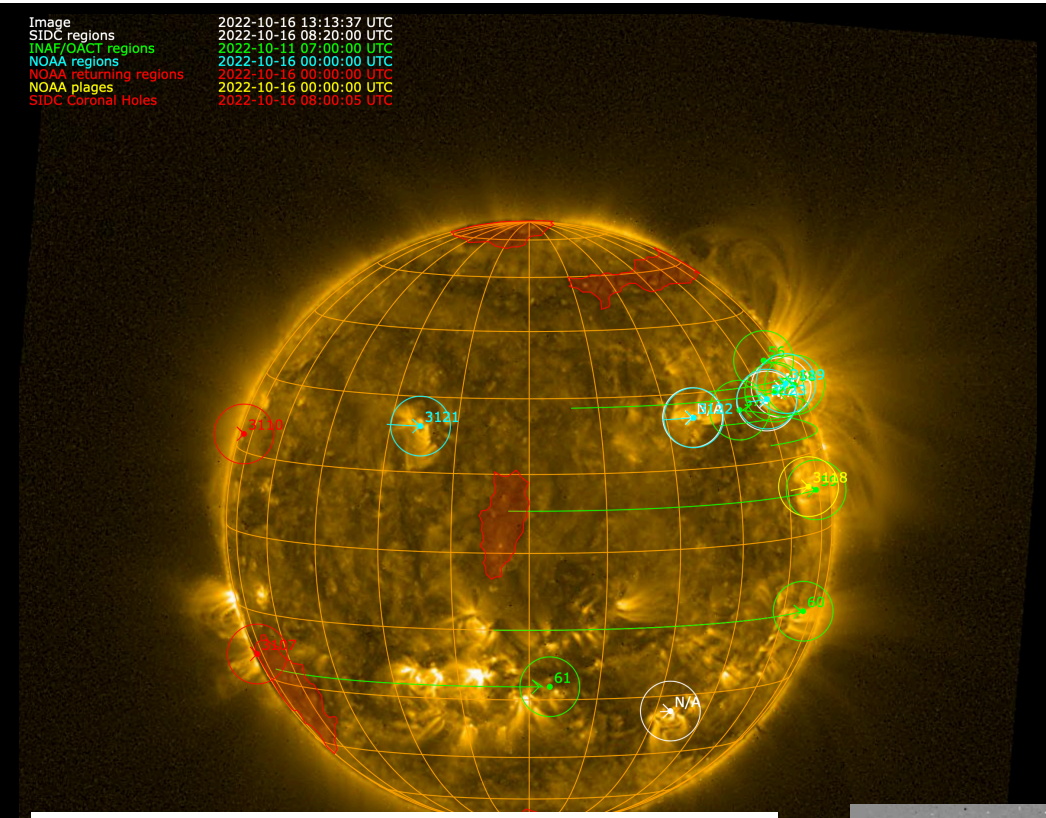
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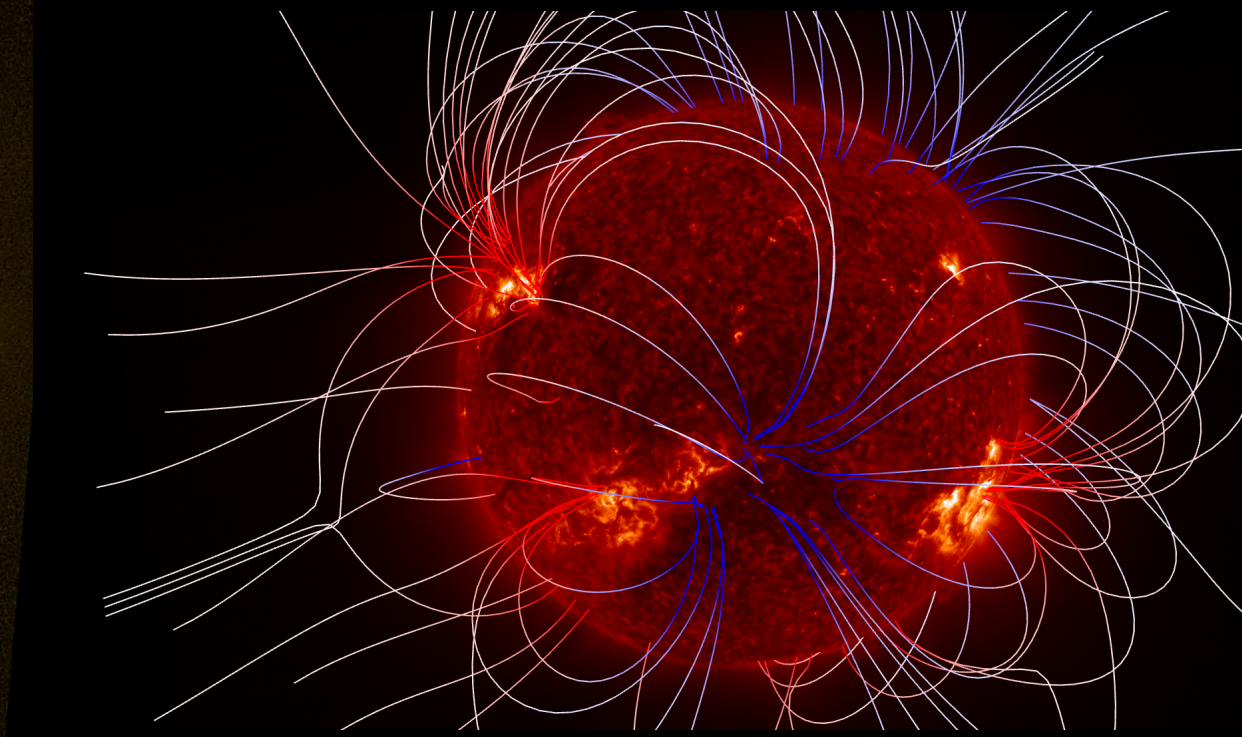

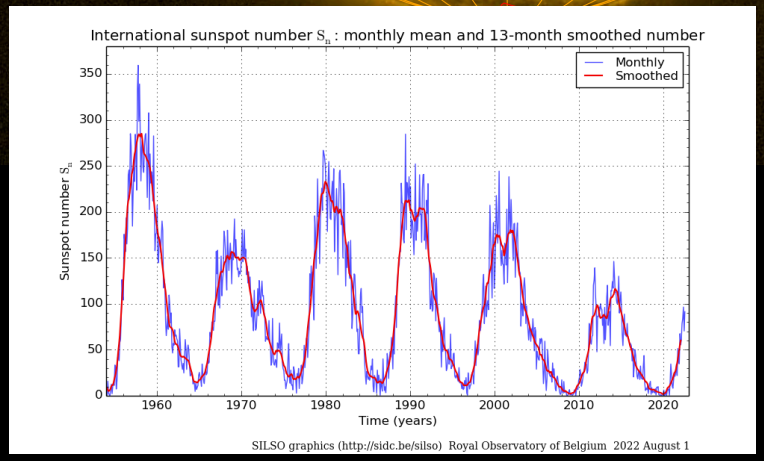
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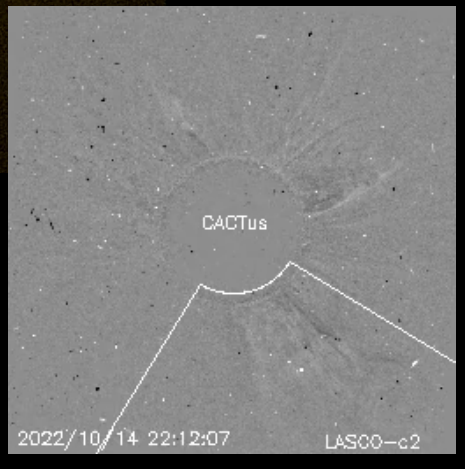
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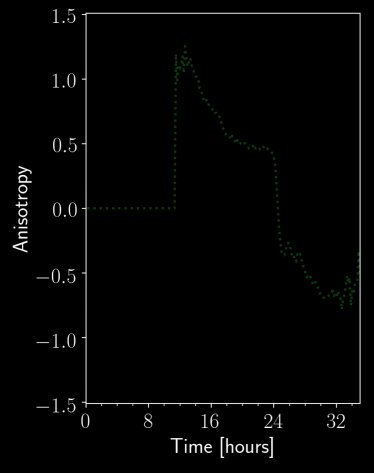
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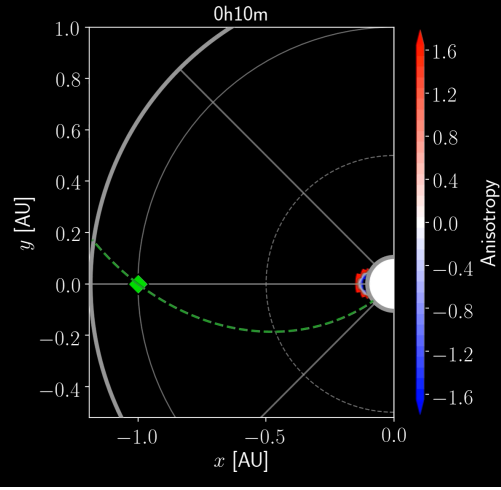
Time [hours]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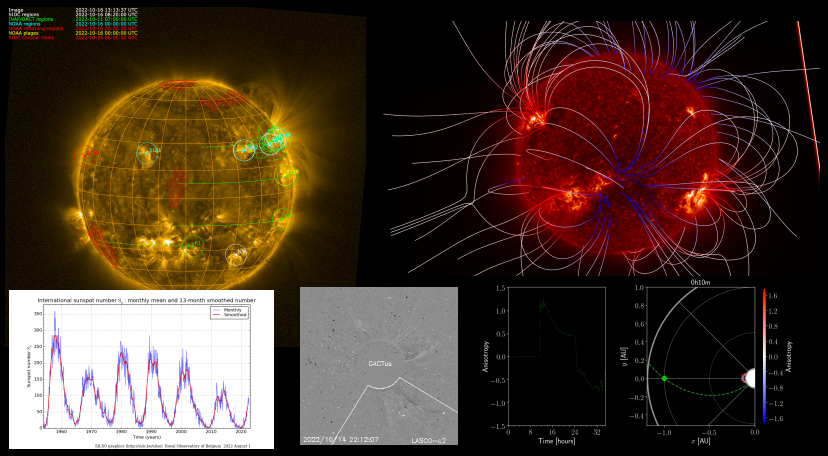
x [AU]
Anisotropy



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:Issued: 2022 Oct 20 1231 UTC
:Product: documentation at http://www.sidc.be/products/meu
#-----------------------------------------------------------------------#
# DAILY BULLETIN ON SOLAR AND GEOMAGNETIC ACTIVITY from the SIDC        #
# (RWC Belgium)                                                         #
#-----------------------------------------------------------------------#
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GEOMAGNETISM  : Quiet (A<20 and K<4)
SOLAR PROTONS : Quiet
PREDICTIONS FOR 20 Oct 2022  10CM FLUX: 113 / AP: 012
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From the Coronal Mass Ejections observed in the last 24 hours none is
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Geomagnetic conditions were at quiet levels (NOAA Kp and K Dourbes 0-2)
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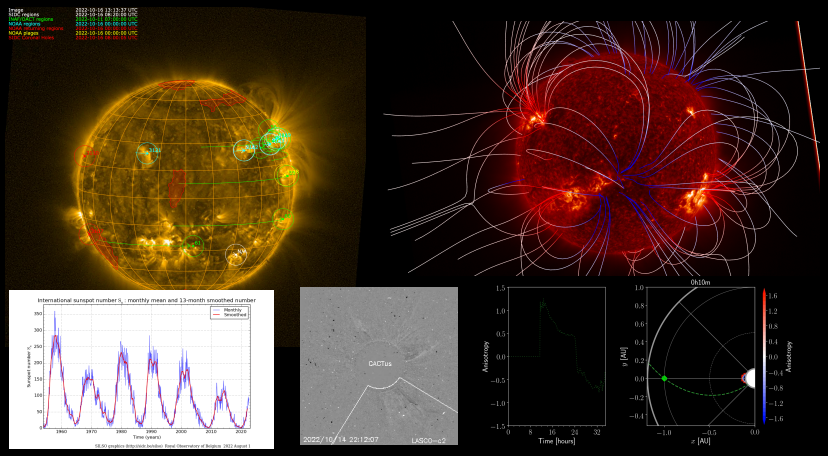

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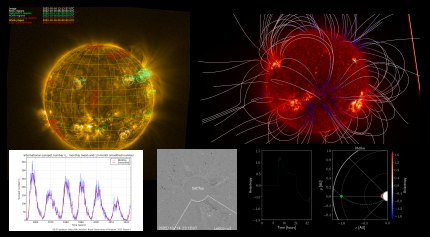

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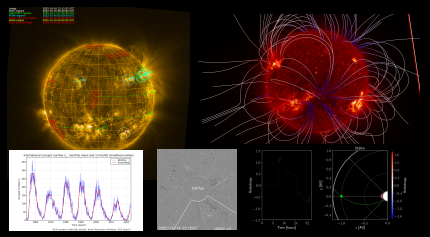
- affected industries

ISES
International Space Environment Service

esa

International Civil Aviation Organization



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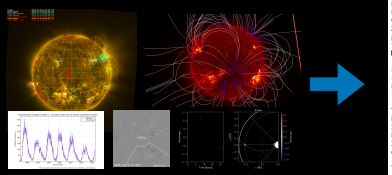

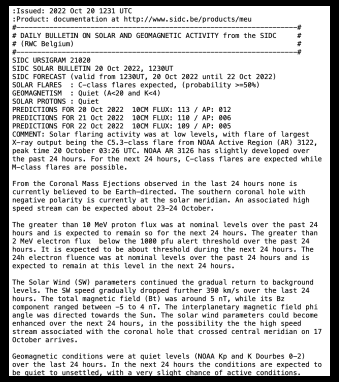

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ISES
International Space Environment Service

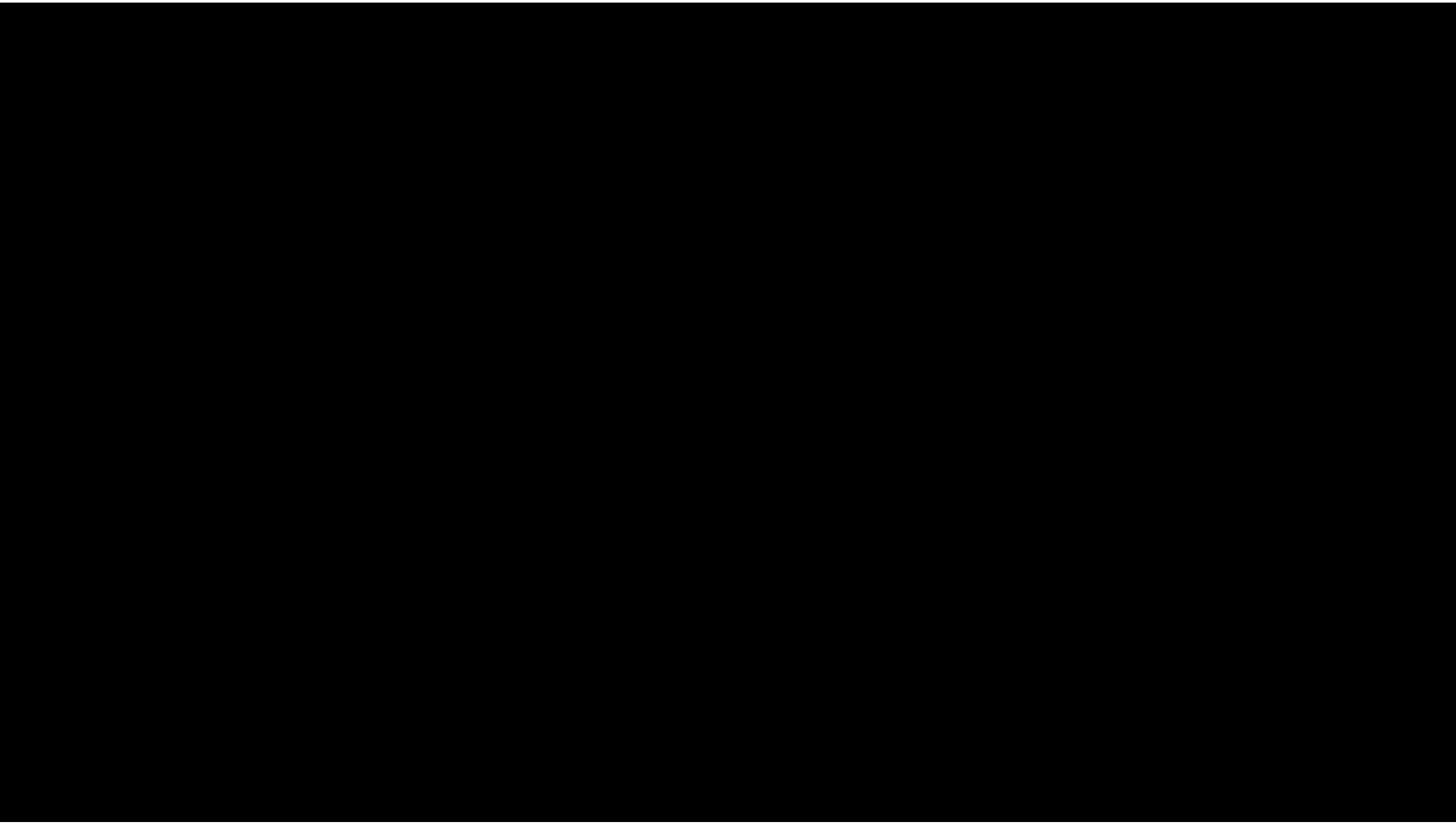
esa

International Civil Aviation Organization

other space weather forecast services

registered internal and external users

air traffic controllers, flight crew



Take home messages

1. The Sun is a variable star whose magnetic activity drives the space weather of the Earth environment.

2. The electromagnetic flashes of solar flares reach us in 8 min. High-energetic particles of solar proton events reach us in 30min. Plasma clouds of coronal mass ejections reach us in 1 day.

3. Life on Earth is protected by the Earth magnetosphere and the atmosphere. Life in space and at high-latitude flights can be affected during solar proton events.

4. Technology in space and on the ground can be seriously affected, in particular GNSS navigation, radio communication and power grid infrastructure.

5. Mitigating space weather impacts requires (1) awareness, (2) engineering, (3) monitoring & forecasting

6. The Royal Observatory of Belgium, through partnerships, is at the forefront of monitoring and forecasting space weather

Further information

- “Space Weather: The Impact on Security and Defense” In: Handbook of Space Security. Springer, Cham. https://doi.org/10.1007/978-3-030-22786-9_94-1 (2019). Janssens, J., Berghmans, D., Vanlommel, P. and Andries J.

Acknowledgements

- the Royal Observatory of Belgium (ROB, http://observatory.be) is a Belgian Federal Scientific Institute with a strong space weather group (http://sidc.be)
- the Solar-Terresterial Center of Excellence (http://stce.be) is a collaborative framework of ROB and the neighbouring institutes, the Belgian Institute of Space Aeronomy (BISA, http://aeronomie.be) and the Royal Meteorological Institute (RMI, http://meteo.be)
- ROB and BISA host together the “Space Weather Office” of the European Space Agency (ESA, https://www.esa.int/Space_Safety/Space_Weather_Office)
- ROB is a Regional Warning Center for space weather of the International Space Environment Service (ISES, http://www.spaceweather.org/)
- STCE is the scientific core of the PECASUS consortium (http://pecasus.eu) that provides space weather services to the civil aviation organization ICAO (https://www.icao.int/). STCE is supported for this 24h/7d by METEOWING of the Belgain Air Force.

Contacts

- Dr Ronald Van der Linden, Director General of the ROB and Manager of the STCE (ronald.vanderlinden@oma.be)
- Dr David Berghmans, senior scientist at ROB/STCE (david.berghmans@oma.be)
- operational support at ROB: sidc-support@oma.be

spare slides

1972 08 04 G5 geomagnetic storm, R5 radio black out, S5 radiation storm

In 1972 the United States were at war with Vietnam. In an attempt to isolate North Vietnam from the rest of the world, magnetic-influence sea mines ("Destructors") had been dropped into the coastal waters of North Vietnam just 3 months prior.

On 4 August, aircrews reported the sudden detonation of some two dozen of sea mines near Hon La in just 30 s. Aerial observations indicated evidence of some 4000 additional detonations along the North Vietnamese coast during the first weeks of August. The US Navy quickly concluded that the magnetic field variations were the cause of these detonations, in line with measurements from magnetometers in nearby locations such as Manila, the Philippines.

This conclusion led to the radical decision to replace all the magnetic-influence-only sea mines with magneto/seismic mines, meaning there were now two triggers needed before the sea mines could detonate.

https://en.wikipedia.org/wiki/August_1972_solar_storms

Mine explosion operation end sweep 1973 03 09

United States Navy photograph, Public domain, |via Wikimedia Commons

1956 02 23 Disappearance HMS Acheron submarine near Iceland, G5, S5, R5, largest solar radiation storm ever

Net Paid Circulation Over 13,350

Amsterdam Evening Recorder

AND DAILY DEMOCRAT

Weather Milder, Snow or Sleet

Vol. LXXVII, No. 158 — Recorder Established 1828—Democrat Established 1870 Consolidated 1893 — Amsterdam, N.Y., Friday, February 24, 1956 — Full Associated Press Report by Leased Wire Official City and County Paper — 7 CENTS — Per Single Copy 40c Weekly by Carrier

Critics Demand Dulles Explain Policies, Acts

Secretary Faces Questioning by Senators on Sale Of Tanks, 'Brink of War' Statement, Other Issues

WASHINGTON (AP)—Secretary of State Dulles confronts some of his most outspoken critics today at a public hearing that Sen. George (D-Ga.) said he hoped would get "bipartisanship back on the right track."

Dulles was invited before the Senate Foreign Relations Committee for questioning about administration policy toward the tension-ridden Middle East and on ways to counter new Russian economic, political and diplomatic moves.

George, chairman of the committee, said so many questions have been raised in the minds of committee members that Dulles may be asked to return Saturday or early next week for further questioning.

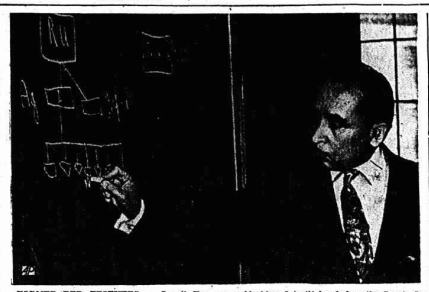
"I am glad Mr. Dulles is appearing at an open hearing," George told reporters. "I think it is advisable."

George said he thought the session "will help get a return of a greater measure of bipartisan consultation." He added, "I think it would tend in that direction."

Demands for an explanation from Dulles stemmed from the furore over shipment of 18 light tanks to Saudi Arabia. But Sen. Humphrey (D-Minn.) said he wanted to question Dulles on everything from his "brink of war" interview to policies in Korea and south Asia.

State Department sources said in advance Dulles would tell the committee that vital security interests in the Middle East dictated the decision to send the 18 tanks to Saudi Arabia.

One effect of the shipment has been to increase pressure on the State Department to accede to the Israeli government's request for authority to buy 50 million dollars



FORMER RED TESTIFIES — Ismail Ege uses a blackboard testifying before the Senate Internal Security subcommittee as a former Lieutenant Colonel in the Russian Army Intelligence. He said the "RU" stood for "Army Intelligence" and that from the top command it divided into the seven branches he points to here. At right are the letters "MVD" for Red secret police. In previous testimony Ege said he had broken with Communism in 1942. He resides in Silver Spring, Md. (AP Wirephoto.)

Missing Planes Found in Cuba; 16 Aboard Safe

MIAMI, Fla. (AP)—The Coast Guard said today six light planes that disappeared yesterday after taking off from Cuba for Jamaica had been found at Siquere, Cuba, and the 16 missionaries aboard were safe.

"We don't know whether they had trouble or just decided to land there for the night," said a Coast Guard spokesman.

Nine planes carrying the missionaries on a goodwill tour of the Caribbean Islands took off yesterday from Camaguey, Cuba, bound for Kingston, Jamaica. Only three of the planes reached Kingston.

The Coast Guard started a search at dawn. A twin-engine amphibious plane took off from Miami and arrived in the area at 7:30

Senate Leaders Planning Election Law With 'Teeth'

WASHINGTON (AP)—Senate Democratic and Republican leaders disclosed today they were working on a bill to put more teeth in the election laws for this year's presidential and congressional campaigns.

Sen. Lyndon B. Johnson of Texas, the Democratic leader, told reporters "we're going to have a strong elections bill this session."

Sen. Knowland of California, the GOP leader, said:

"I think some changes can be made to improve the election situation. I would like to see something accomplished before the 1956 elections."

Johnson said the leaders were not trying to bypass the new eight-member committee named by the Senate last night to investigate campaign contributions, lobbying and improper influence on sena-

State Agencies Oppose Moves To Curb Power

ALBANY (AP)—A dozen state agencies have assailed proposals by the state's "Little Hoover Commission" that their powers be brought under stricter control.

But an expected attack on the plan by Robert Moses, chairman of the State Power Authority, did not materialize at a hearing yesterday. Moses is vacationing in the Virgin Islands.

Thomas Moore, general counsel of the power authority, attacked

Ousted Soviet Premier Draws Fire of Leader

Deputy Prime Minister Denounces Malenkov's Administration of Power Ministry as Wasteful

MOSCOW (AP) — The Soviet press today published a direct attack on the ministry of electric power stations that former Premier Georgi Malenkov heads.

The ministry was accused of "procrastination" in a speech to the 20th Congress of the Soviet Communist Party delivered in the Kremlin yesterday by state planning boss and first deputy prime minister Maxim Z. Saburov.

When Malenkov resigned the premiership on Feb. 8, 1955, he publicly confessed he had been inefficient and not sufficiently experienced in administration.

Saburov did not mention Malenkov by name. But he left no doubt that the Soviet government was dissatisfied with the way Malenkov's ministry is being run.

"The ministry of electric power stations," Saburov said, "is procrastinating too much with the putting into operation of new equipment and electric stations. Due to this, one million tons extra in conventional terms of fuel are consumed annually at high pressure electric stations alone."

It was the first high-level criticism of this ministry since Malenkov took it over.

Before the party congress opened, there was considerable speculation in Western circles as to whether Malenkov would retain his place. This was allayed when he got up in the congress and endorsed the current line sponsored by party first secretary Nikita Khrushchev, which gives highest priority to the continued development of heavy industry. Malenkov during his time as premier put special emphasis on consumer goods.

Report Urges

Missing British Sub Feared Lost, Safe; Search Called Off

Acheron Sighted in Gale-Swept Arctic Sea by Minesweeper; Failure of Communications System Made Contact With Admiralty Impossible; Was Unreported Since Wednesday When It Made Trial Dive

LONDON (AP)—The Admiralty today called off a search for the British submarine Acheron, sighted safe in gale-swept seas after being feared lost for nearly six hours.

The British minesweeper Coquette radioed three hours after the Admiralty reported the Acheron overdue that she had made "visual contact" with the sub.

The Coquette also reported the Acheron, carrying 63 men, said her communications system was out of order. The Acheron then proceeded to Iceland.

The search started after the Acheron failed to make her routine radio report this morning.

Six hours later the Admiralty said: "The Acheron has now succeeded in passing her routine check signal and as a result the search for her has been canceled."

The 1,123-ton Acheron is a sister ship of the Affray, which sank in the English Channel in April 1951 with 75 dead.

Dived 2 Days Ago

The Acheron dived two days ago during arctic trials in the Denmark Stralt between Iceland and Greenland and should have reported by radio at 10:05 a.m. (5:05 a.m. EST) today. This message never came. The Admiralty said it was possible unusual sunspot activity over the past two days might have blacked it out. Gigantic explosions on the sun have bombarded the earth with cosmic rays, interfering with communications.

In Copenhagen, the Danish government's telegraph authority said no radio messages had been received from Greenland stations since yesterday morning.

"Frankly," a spokesman for the

3d Dixie Party Urged in Fight On Integration

SHREVEPORT, La. (AP)—Georgia Gov. Marvin Griffin called last night for an all-out war against both major political parties, charging they "are trying to see which can sink the knife deepest in the back" of the South.

The attempts of both Democrats and Republicans to aid the forces of integration will be successful, he said, "unless the people of the South unite and fight for our way of life."

"Let every white person in these Southern states unite and then we'll turpentine some of those timid souls in Washington," he added.

"It's about time we let some of our congressmen know that they are supposed to represent the South in Washington instead of representing Washington in their

5 Die, 100 Hurt In Derailment Of P.R.R. Train

Seven Coaches Jump Rails With Train Speeding at 80 Miles Per Hour; Cause Of Accident Unknown

ODENTON, Md. (AP) — Seven cars of a Pennsylvania Railroad passenger train, racing at 80 m.p.h. through the flat countryside between Washington and Baltimore, jumped the track last night and three overturned down an embankment. Five persons were killed and more than 100 injured.

Of 90 persons taken to six Maryland hospitals, 59 remained hospitalized today. Scores of others were treated at the scene by dozens of doctors and nurses.

By mid-morning, investigators still had not determined what caused the wreck of the New York-bound Embassy. A Pennsylvania Railroad spokesman said the possibility of faulty air brakes had been ruled out. The engineer said earlier the brakes had appeared to grab suddenly.

The worst mangled car was the diner. Apparently it tipped over just as it started to pass one of the heavy steel girders supporting the overhead electric cables that provide power to the engines.

Roof Torn Off

The force of the impact literally peeled back the roof of the diner like a sardine lid. The coach broke apart. Dining chairs were tossed 50 to 75 feet away. Scattered stacks of linen napkins were blackened by the tramping back and forth of rescue parties.

From 19-year-old Paul Sloane of Baltimore, making the trip from Washington alone, came this condensed description which more or less summarized the experiences of others:

"I felt a bumping and heard a big noise. Then I knew we were in a wreck. I was real scared. I got bumped around, but I didn't get hurt."