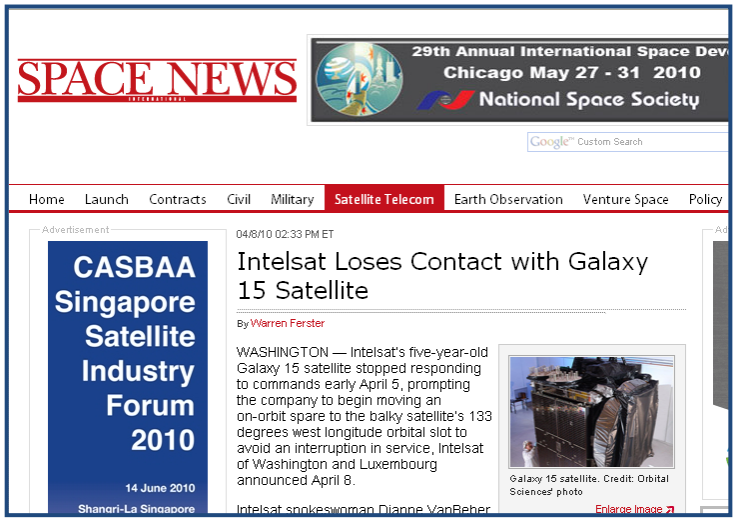
El entorno espacial y Meteorología espacial

Consuelo Cid

EL ENTORNO ESPECIAL: UN ENTORNO HOSTIL

Galaxy 15 (órbita GEO 35.786 km)


SPACE NEWS

29th Annual International Space Dev
Chicago May 27 - 31 2010
National Space Society

Home Launch Contracts Civil Military Satellite Telecom Earth Observation Venture Space Policy

CASBAA Singapore Satellite Industry Forum 2010
14 June 2010

04/8/10 02:33 PM ET

Intelsat Loses Contact with Galaxy 15 Satellite

By Warren Ferster

WASHINGTON — Intelsat's five-year-old Galaxy 15 satellite stopped responding to commands early April 5, prompting the company to begin moving an on-orbit spare to the balky satellite's 133 degrees west longitude orbital slot to avoid an interruption in service, Intelsat of Washington and Luxembourg announced April 8.

Galaxy 15 satellite. Credit: Orbital Sciences' photo

Enlarge Image

Intelsat spokeswoman Dianne VanBeber


SPACE NEWS

29th Annual International Space Dev
Chicago May 27 - 31 2010
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Home Launch Contracts Civil Military Satellite Telecom Earth Observation Venture Space Policy

CASBAA Singapore Satellite Industry Forum 2010
14 June 2010

04/20/10 02:05 PM ET

Orbital Blames Galaxy 15 Failure on Solar Storm

By Peter B. de Selding

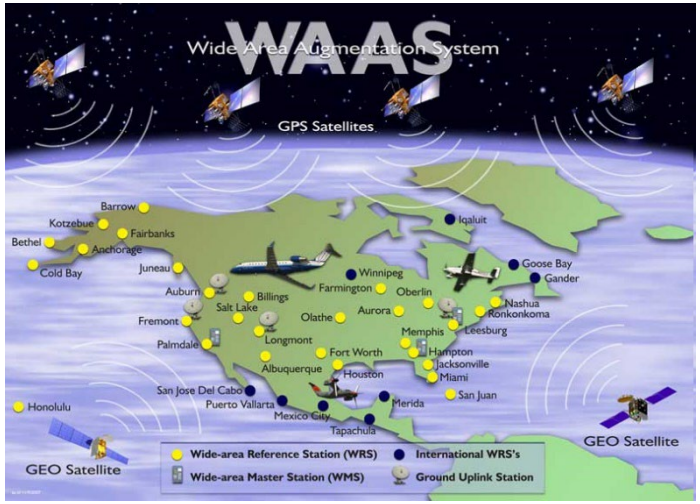
PARIS — The in-orbit failure of the Orbital Sciences-built Intelsat Galaxy 15 telecommunications satellite April 5 was likely caused by unusually violent solar activity that week that damaged the spacecraft's ability to communicate with ground controllers, Orbital officials said April 20.

Galaxy 15 satellite. Credit: Orbital Sciences' photo

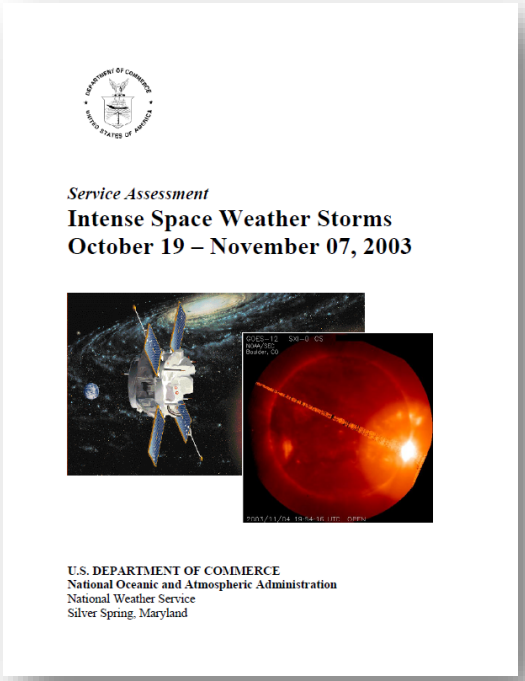
Enlarge Image

Similar events have occurred, if less

- 08/04/2010: Intelsat informa que el Galaxy 15 no responde a los comandos desde Tierra (anomalía: 5 abril @09:48 UTC)
- 10/04/2010: FAA predicen una degradación del sistema WAAS debido al fallo del Galaxy 12
- 20/04/2010: Orbital atribuye la pérdida del Galaxy 15 a la meteorología espacial



Octubre 2003

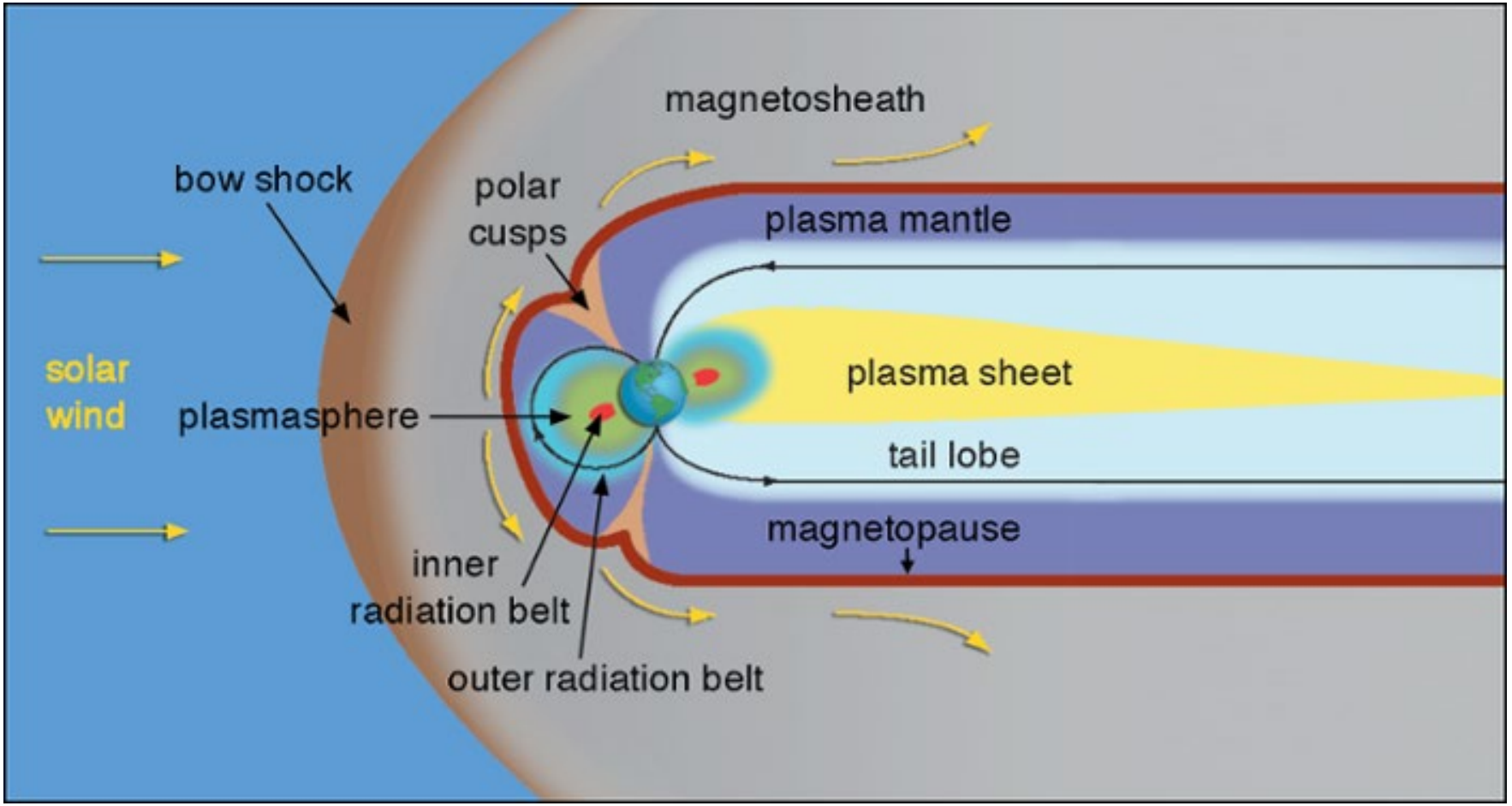


- Los astronautas de la ISS pasaron a la parte trasera del Zvezda Service Module
- Aproximadamente el 59% de las misiones de observación de la Tierra y científicas informaron de problemas, algunos no recuperables. Pérdida de operaciones durante 3 - 4 días
  - Mars Odyssey: Error de memoria (recuperable), pérdida del instrumento Martian Radiation Environment Experiment
- Departamento de Defensa (USA): operaciones satelitales en regiones de interés no disponibles durante 29 h
- Servicios de TV y radio por satélite: problemas para mantener operaciones rutinarias, periodos cortos de pérdida de señal
- Vuelos desviados de órbita polar por problemas con las comunicaciones y por exceso de radiación

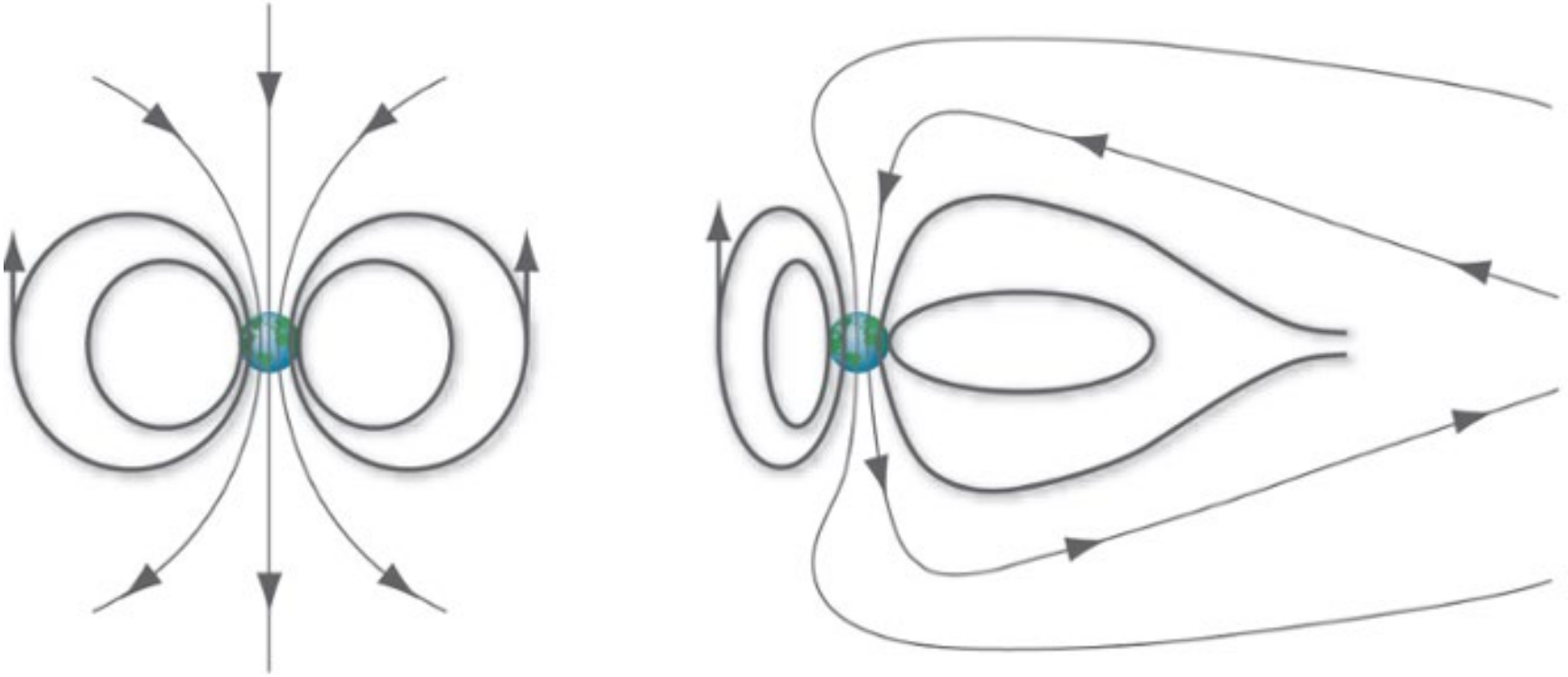
QUÉ ENTENDEMOS POR EL ENTORNO ESPACIAL

El entorno espacial

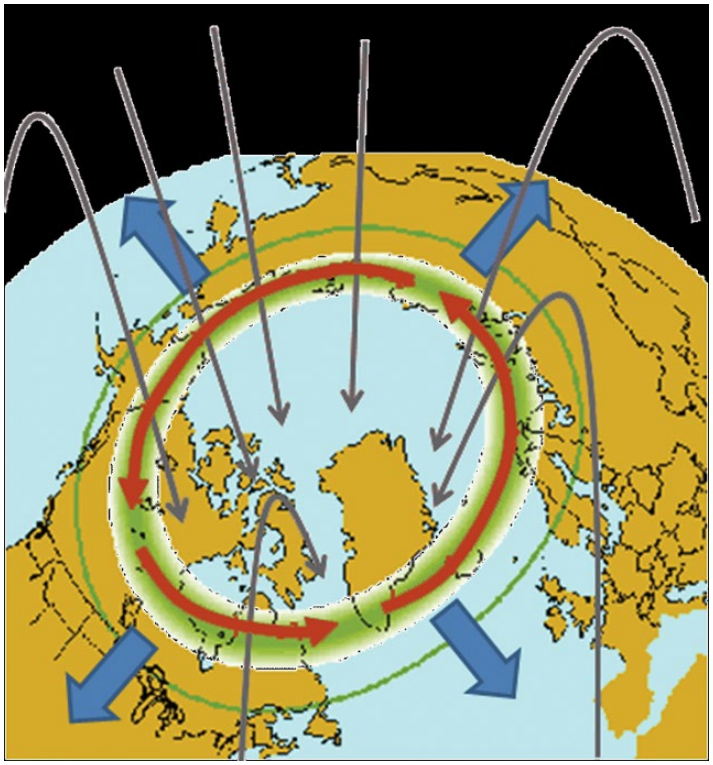
Las “esferas” no son esferas



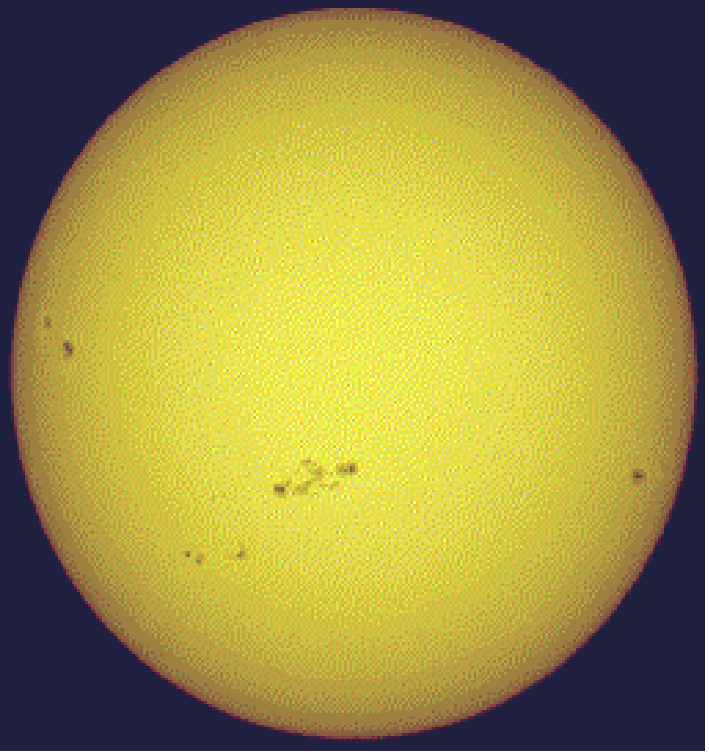
El campo dipolar terrestre se ve distorsionado por el viento solar



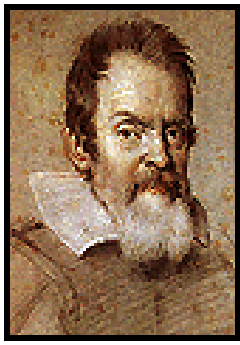
Las regiones polares

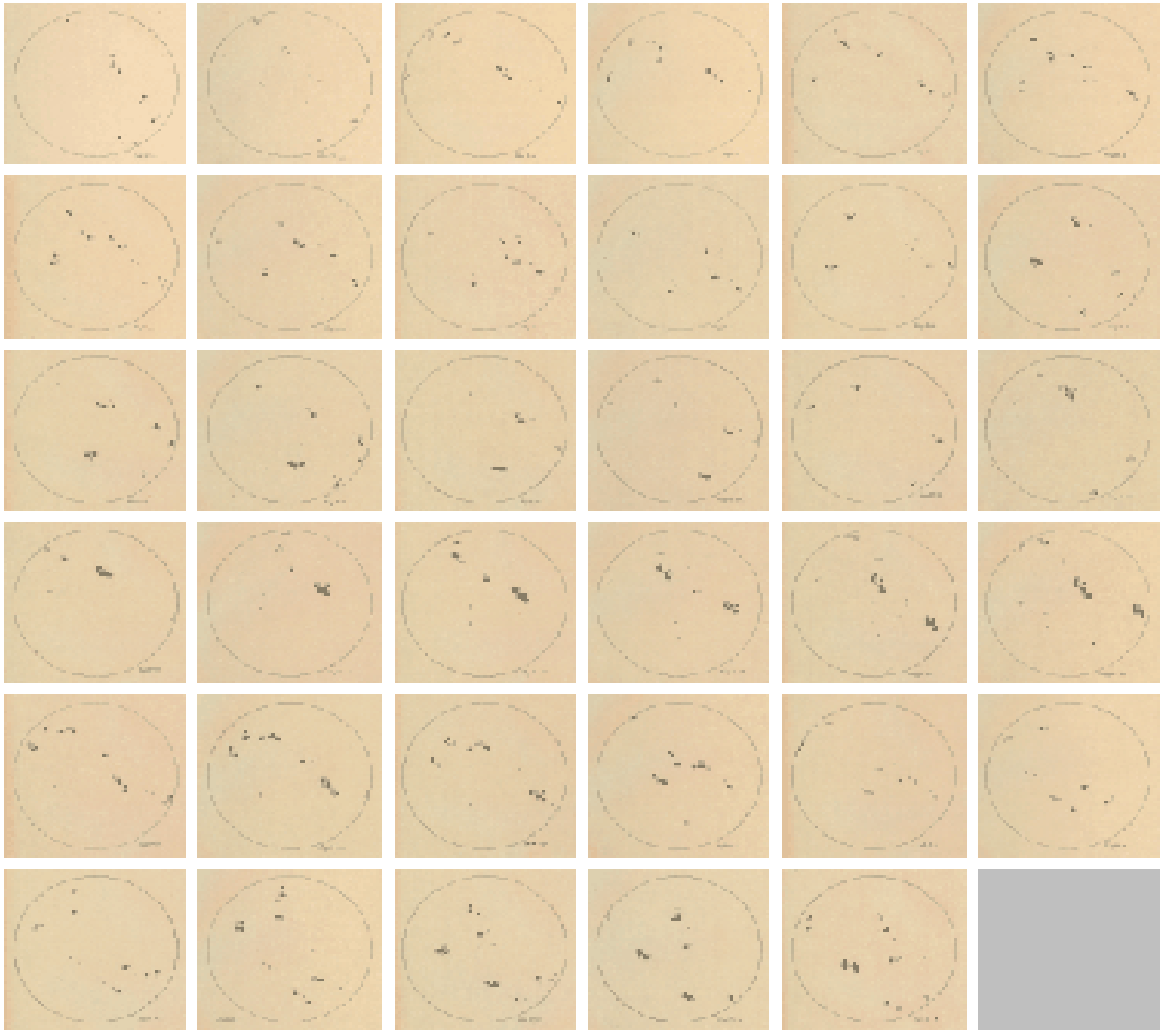


EL SOL: UNA ESTRELLA ACTIVA



El Sol y su dinámica de rotación



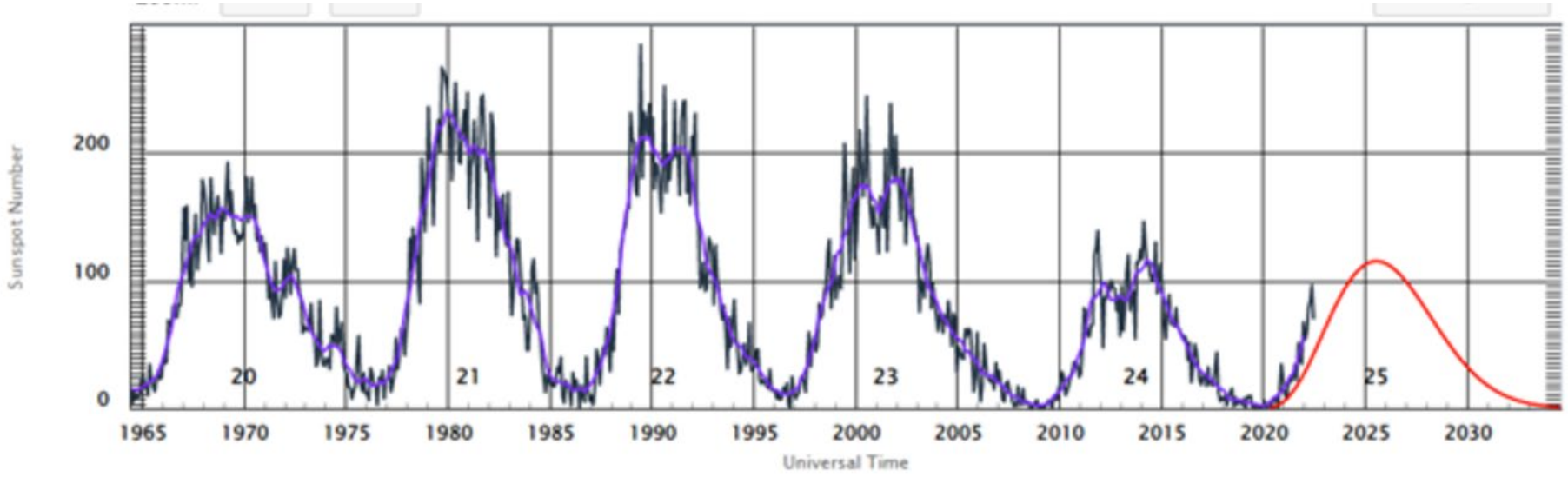


El Sol rota con un periodo de unos 27 días

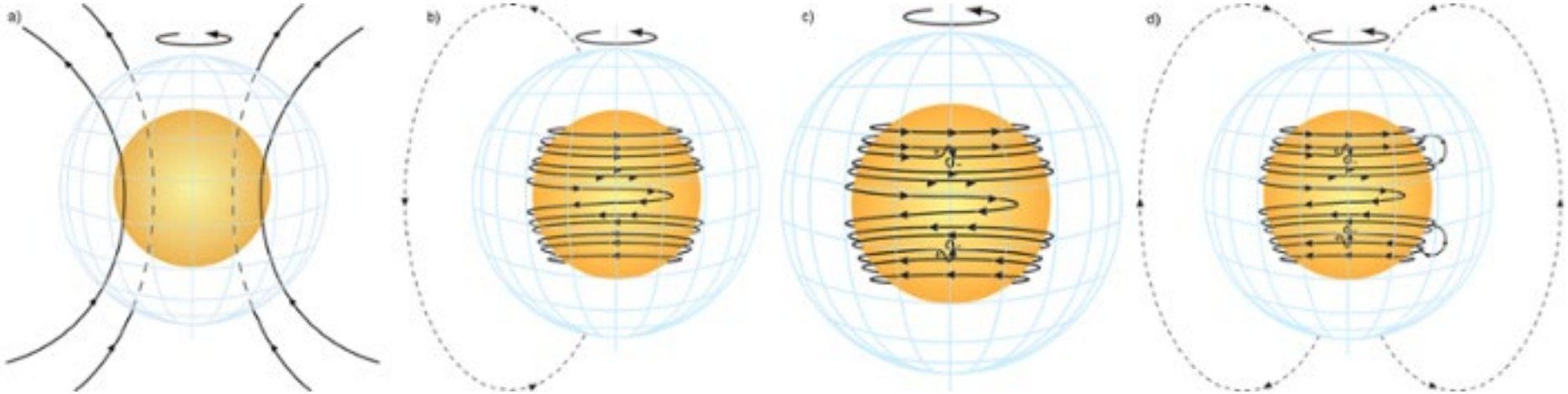
La rotación es más rápida en el ecuador que en los polos

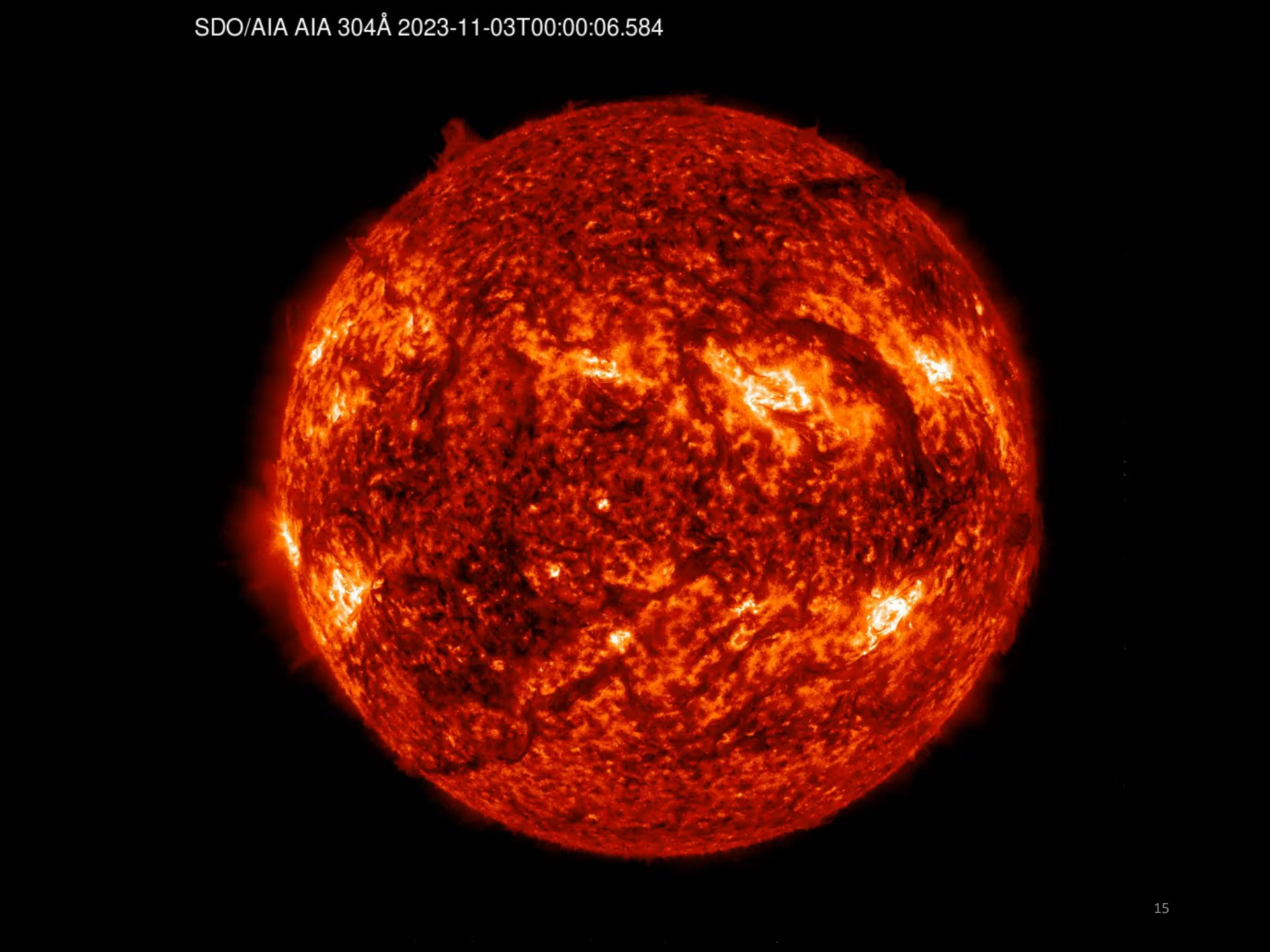
Ciclo Solar

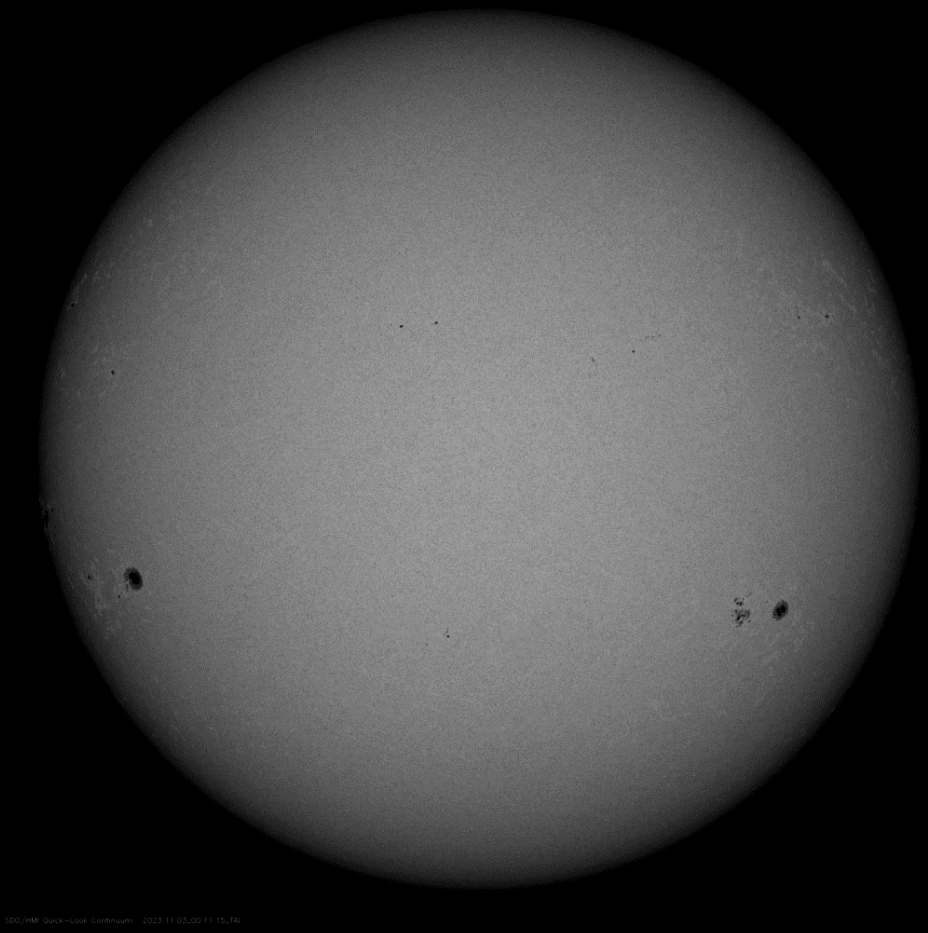

apagón

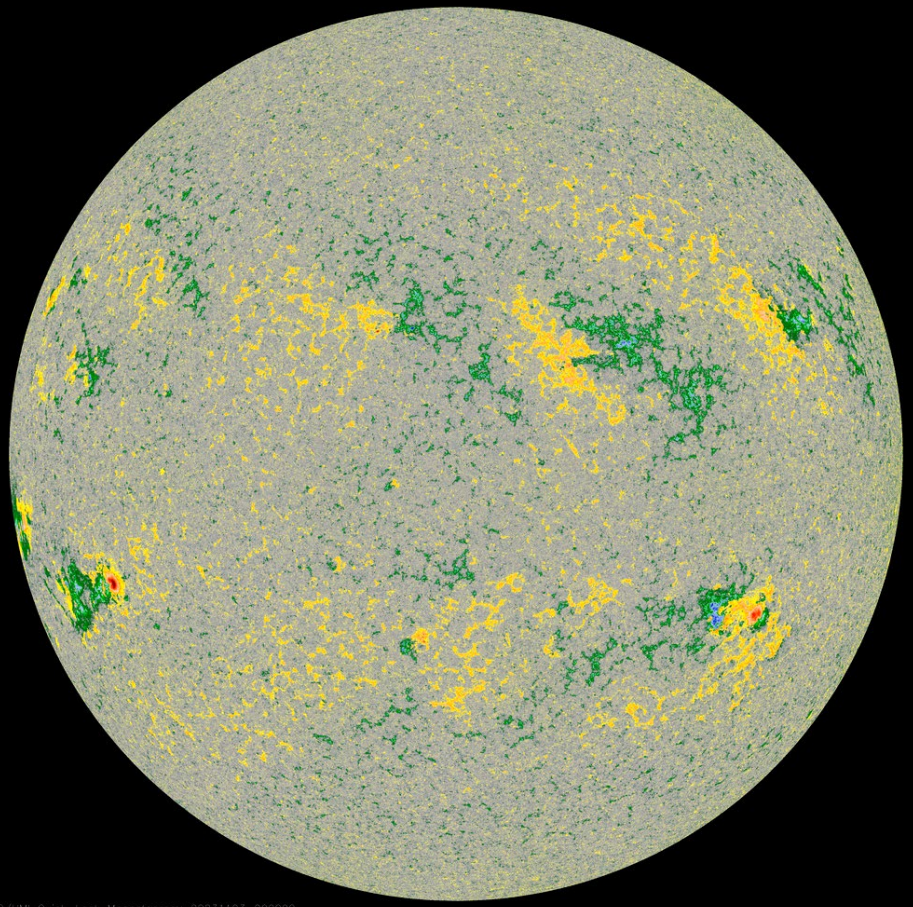

Sunspot Number
200
100
0
20
21
22
23
24
25
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
Universal Time

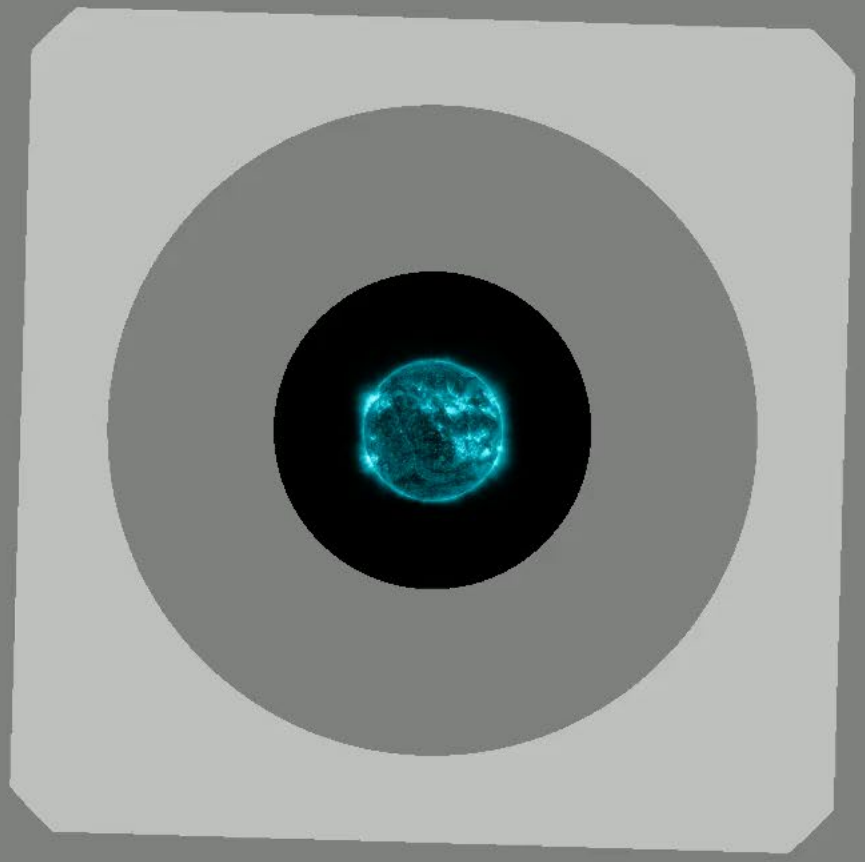
Dinamo Solar



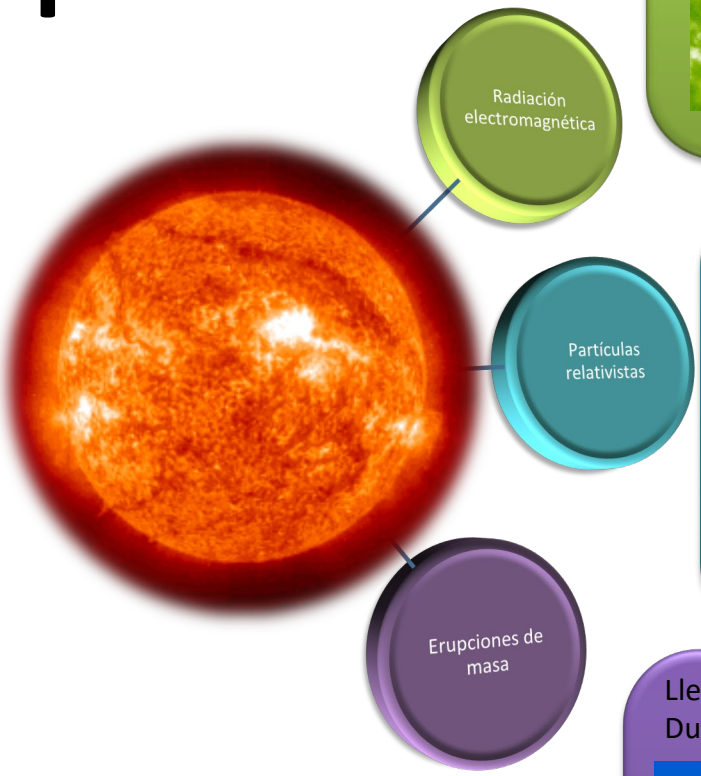

SDO/AIA AIA 304Å 2023-11-03T00:00:06.584


SDO/HMI Quick-Look Continuum: 2023.11.03_00:11:15_TAI


SDO/HMI Quick-Look Magnetogram: 20231103_000000

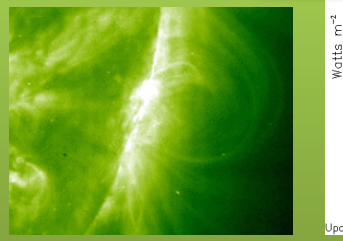

2023-02-17T18:33:45.630

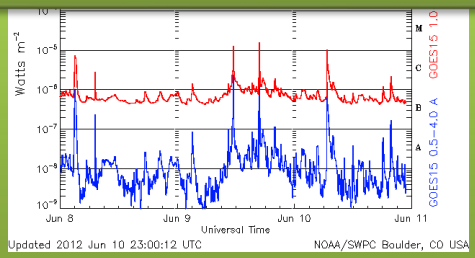
Meteorología espacial



Llegada: 8 min
Duración: 1-2 h

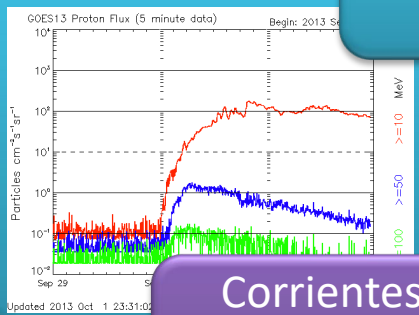
Bloqueos radio HF, interferencias satcom y radar, y cambio órbita satélites





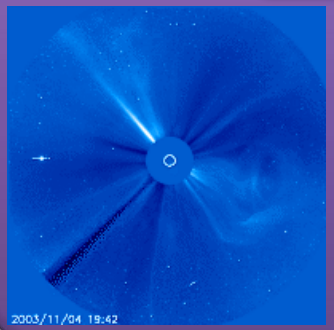
Llegada: 15 min – horas
Duración: horas-días

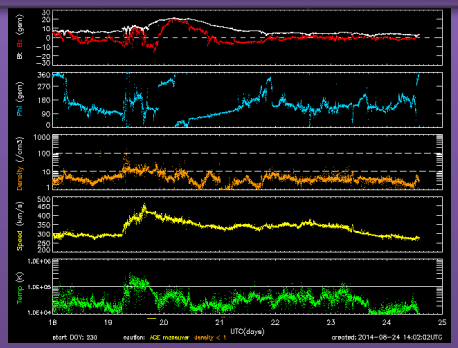
Daño directo a los satélites e instrumentos y sobredosis de radiación en vuelos



Llegada: 2-3 días
Duración: días

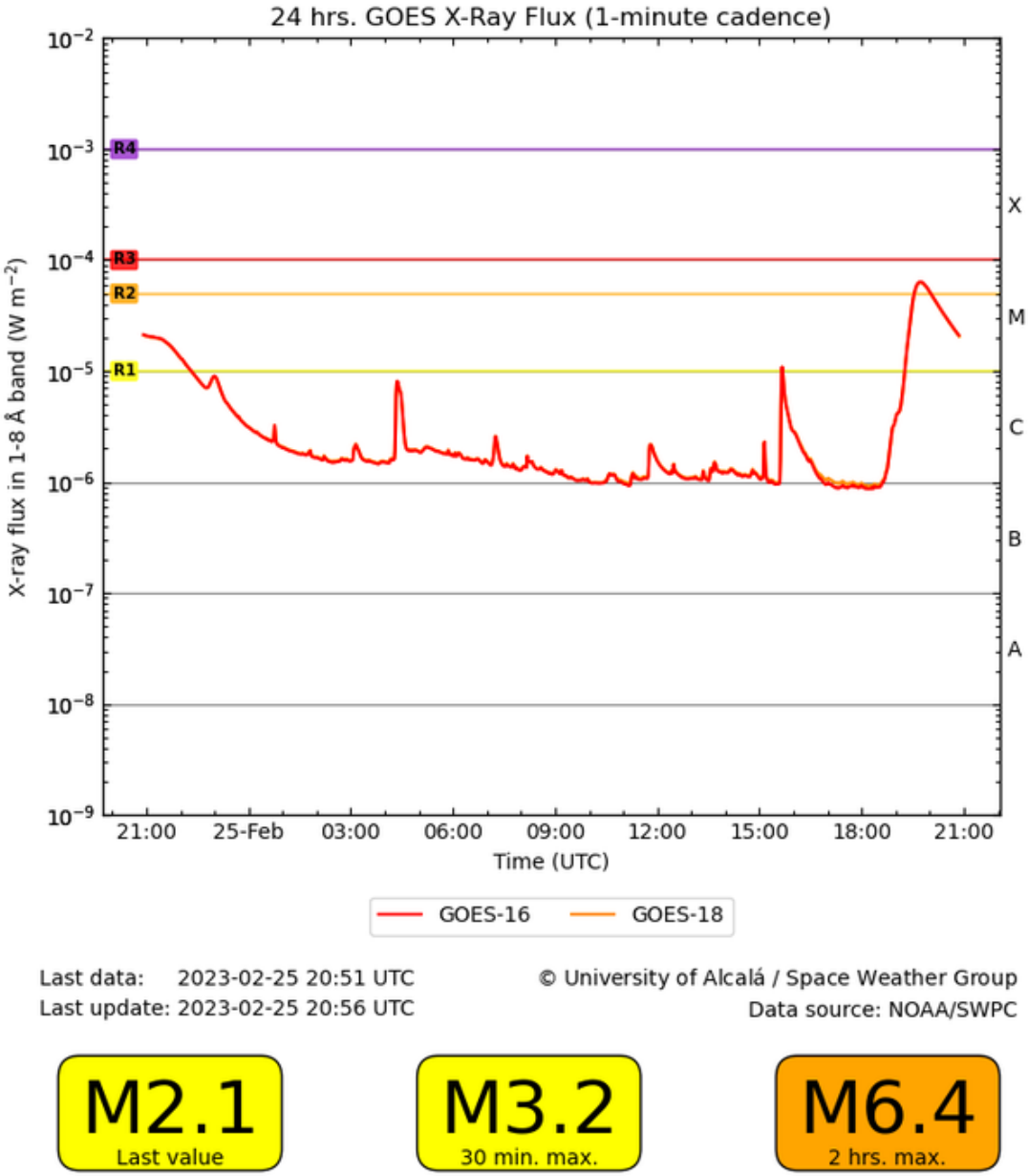
Corrientes inducidas, bloqueos radio HF, interferencias satcom y radar, falso posicionamiento, cambio órbita satélites …





www.senmes.es

@sweuah



EL IMPACTO DE LA METEOROLOGÍA ESPACIAL A LO LARGO DE LA HISTORIA

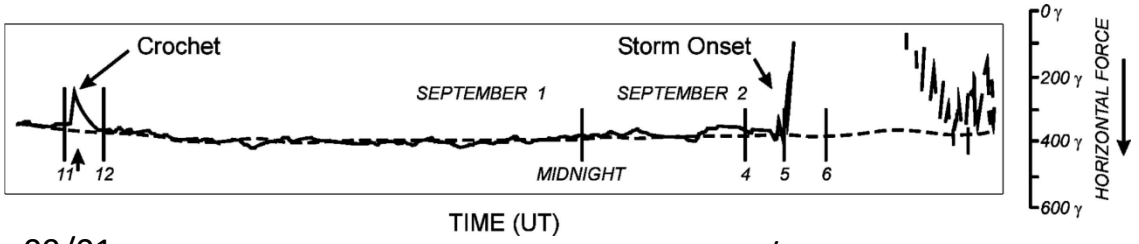
El suceso de Carrington (1859)

From the evening of Aug. 28th until the morning of the 29th the needles of the magnetic telegraph at Paris were almost constantly in motion, as if a permanent current was passing through the telegraph wires. Business was therefore entirely interrupted and could not be resumed until 11 A.M. Aug. 29th. The same effect was noticed on the telegraph lines from 4h to 8h on the morning of Sept. 2d, although no aurora was noticed on that day. Business was again interrupted, the needles were disturbed, and the bells were rung.

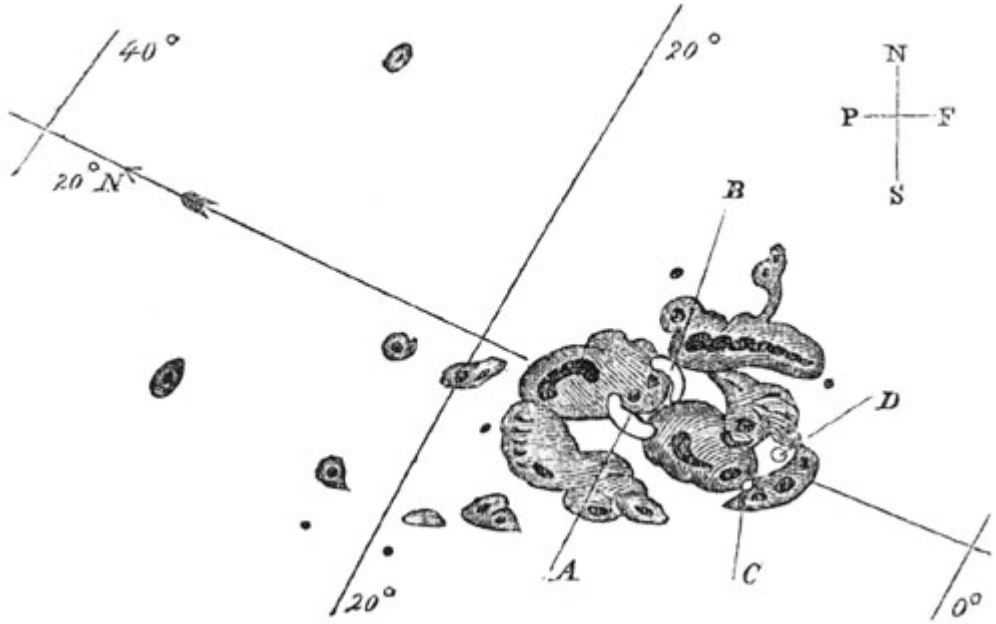
Effect on the telegraph Wires, from the Comptes Rendus, T. XLIX, p. 365

El suceso de Carrington (1859)

Cliver and Svalgaard (2005)



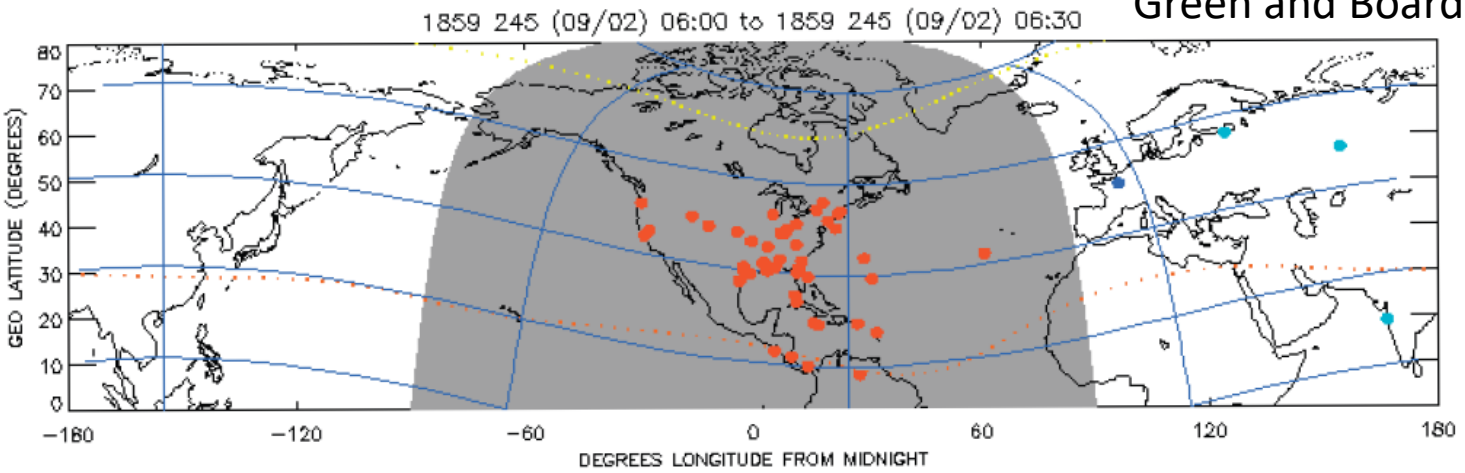
09/01 09/02



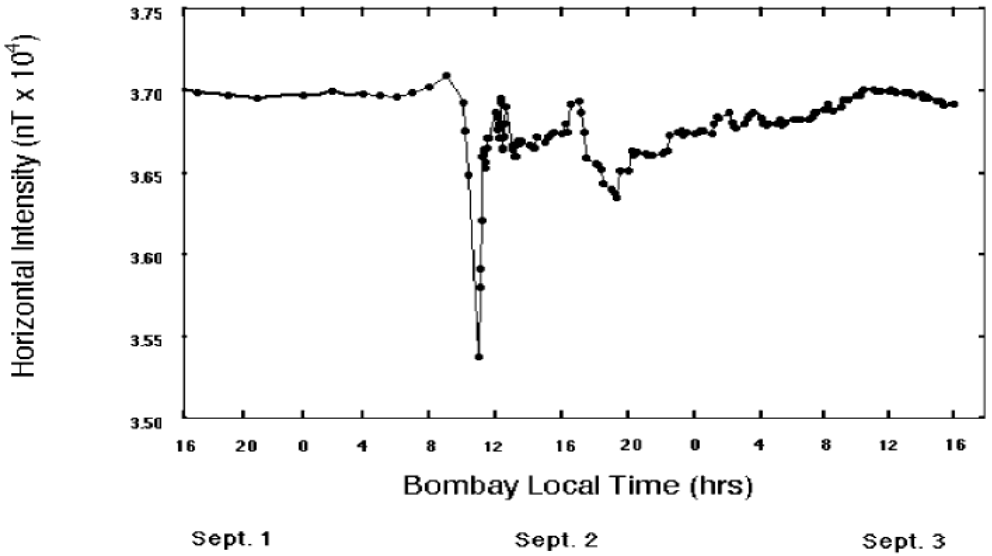
Carrington relacionó por primera lo ocurrido en la Tierra vez con lo ocurrido en el Sol

El suceso de Carrington (1859)

Green and Boardsen (2006)



Tsurutani et al. (2003)



Celsius (siglo XVIII)

La tecnología en 1859

Thomas Alva Edison
(1847 -1931)

The First Documented Space Weather Event That Perturbed the Communication Networks in Iberia

P. Ribeiro, J. M. Vaquero, M. C. Gallego, and R. M. Trigo

Abstract In this work, we review the first space weather event that affected significantly a number of communication networks in the Iberian Peninsula (Southw
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THE EDITOR.

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mous communications.]

Hittites.

28 there appeared, under the
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and John Garstang, a letter
al subject, entitled "Etruscan
e." The object of this letter
we a culture-connection in the
reen the Etruscans in Italy, the
ia Minor and northern Syria,
r "Shepherd Kings" who in-
its government between the
nasties.
, one of considerable interest,
stive one, but readers of the
om the tenor of this letter that
has been well known to all
rteen years at least! In fact,
by several workers in the field
re it was finally thrown into
efore scholars by Father A. C.
As expounded by this learned
repeated by the three writers
ned; hardly any original addi-
re not of a character to com-
tudents. For example, it is
itely said, that the well-known
m Asia depicted on the walls
p at Beni Hasan was a party
, however, these people are
ame of their chief, Abesha, is,
itic. Now we are quite certain
ta, and their names also, were
besha, the writers of the letter
of a foreign (mountainous)
t has been conjectured, to the
south of Hebron, where Hittite and Semite had intercourse and intermarriage in the age of the Patriarchs." Here an unwarrantable assumption, and even this is not original, has been made, for there is no proof that the "children of Heth," who in the Bible are said to have lived near Hebron, are of the same race or nation as the Hittim of northern Syria, who are certainly to be identified with the Khatti of the Assyrian records and the Kheta of the Egyptian monuments, who were undoubtedly the builders of the great sanctuaries of Boghaz Köi and Eyuk, and to whom the inscriptions commonly called "Hittite" be-

three writers who thought fit to send a communication to the *Times* on an important archæological matter should have been, as it appears, totally unaware of the long priority of another writer in the whole field of which their letter treats. X.

Telegraphic Disturbances in Spain on October 31.

On Saturday, October 31, the telegraphic communication was interrupted almost from morning until late at night. The first sign of the perturbation was observed at 9h. 30m. in the morning (W.E.T.) in the form of continuous currents along nearly all the lines that start from Madrid. At first it was thought that some leakage from a cable in the vicinity of the Central Office was the cause of the phenomenon, but on making inquiries it was ascertained that the same occurrence was observed in Cordoba, in the line to Málaga. At the same time the cable from Vigo to Emden was rendered useless, and at Lisbon the phenomenon was observed at some moments in which the situation was normal at Madrid. The maximum intensity took place between 12h. 30m. and 15h.; at 21h. the phenomenon had nearly ceased.

During the first hours of the evening the currents were continuous for periods of twenty to thirty minutes in some of the wires, for instance, in those of Vigo; at 22h. the current in the Coruña wire was continuous during 3m.; at 1h. 45m. of November 1 the current was also continuous in the Bilbao wire. At 3h. 20m. the cable from Cadiz to Tenerife in the Canary Islands remained perturbed so strongly that the clerks made the contact with the earth to avoid the discharges.

At 19h. communication between Madrid and Burdeos was re-established; information received at the Central Office stated that the cable from Senegal to Noronha was disturbed. In Spain, in some lines running approximately east and west, the phenomenon was not observed, namely, in the coast of Andalusia, from Málaga to Almeria, but in the line from Málaga to Granada, which runs roughly to the north, the perturbation was very marked, also in the more north-easterly line from Granada to Murcia. These three lines are approximately of the same length. In the centre of Old Castile, in the transversal line from Aranda to Ariza and to Valladolid, nothing abnormal was observed; meanwhile, in the general line that runs north-south, the disturbance prevented all communication. In the provinces of Cuenca and Extremadura, the lines of which run approximately east and west, the communications remained undisturbed.

The night was clouded, so that nothing could be seen of an aurora borealis, even if a display occurred.

Augusto Arcimis.
Instituto Central Meteorológico, Madrid, November 3.

24 Marzo 1940

THE GREAT MAGNETIC STORM OF MARCH 24, 1940

By Seth B. Nicholson

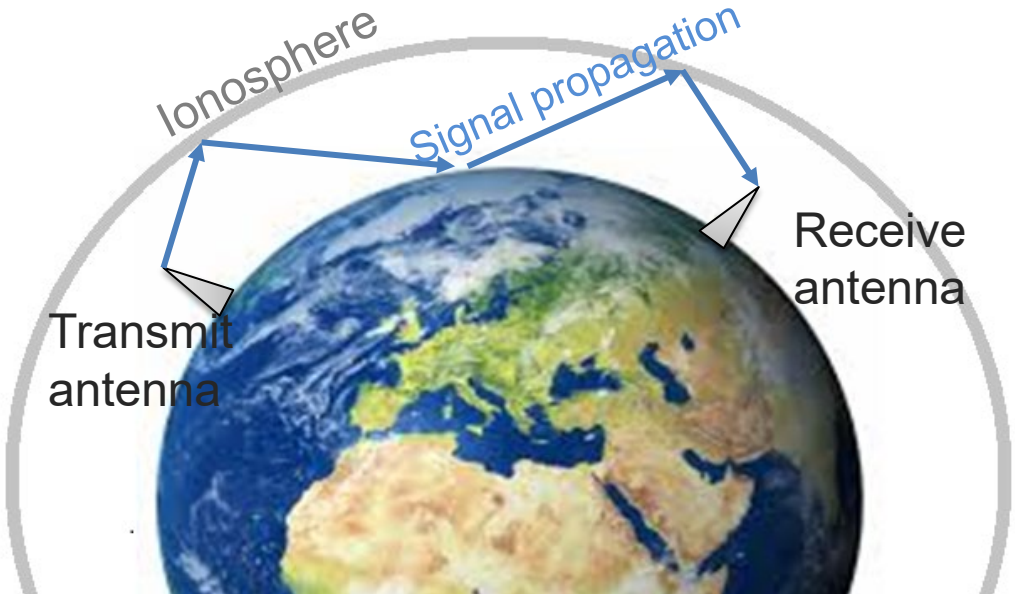
Sunday, March 24, 1940. For a few hours it completely interrupted all long-distance communication, war reports and Easter greetings alike. Had it occurred on a business day the financial loss would have been even greater with garbled stock reports adding to the confusion.

A magnetic storm interrupts communication by inducing, in long telegraph and cable circuits, electric currents strong enough to change regular messages beyond recognition. Radio communication suffered in much the same way. The static was very bad and the announcers talked a language no one could understand. Only far-distant stations were affected however. Local broadcasts, which are not reflected from the ionosphere, were just as distinct as ever.

about twenty minutes from at least 200 gammas above normal to 600 below. This was a decrease of more than 3 per cent of the normal horizontal intensity on Mount Wilson, which is about 26,000 gammas (0.26 C.G.S. units).

An aurora of moderate intensity was observed by Anthony Wausnock at the Mount Wilson Observatory on the night of March 24 just before moonrise (March 25, $3^h\ 30^m$ G.C.T.). The aurora was not visible in the light of the moon which was one day past full phase.

During March 25 the horizontal intensity was from 200 to 120 gammas below normal. On March 26 it began to recover



The May 1967 great storm and radio disruption event: Extreme space weather and extraordinary responses

D. J. Knipp[1,2], A. C. Ramsay[3], E. D. Beard[3], A. L. Boright[3], W. B. Cade[4], I. M. Hewins[5], R. H. McFadden[5], W. F. Denig[6], L. M. Kilcommons[1], M. A. Shea[7], and D. F. Smart[7]

[1]Department of Aerospace Engineering Sciences, University of Colorado Boulder, Boulder, Colorado, USA, [2]High Altitude Observatory, National Center for Atmospheric Research, Boulder, Colorado, USA, [3]Retired from U.S. Air Force, Air Weather Service, [4]Baylor Institute for Air Science, Baylor University, Waco, Texas, USA, [5]Institute for Scientific Research, Boston College, Boston, Massachusetts, USA, [6]National Centers for Environmental Information, NOAA, Boulder, Colorado, USA, [7]Retired from U.S. Air Force, Air Force Research Laboratory

'Yes, half the Sun has blown away'

5/18 East limb passage of one of the greatest activity complexes of Solar Cycle 19. Composed of three overlapped spot groups at time of first appearance, two of which were growing.

5/20 [illegible] spot group on southern border of complex. Eastward relative motion of this group, with respect to large spots to the north, may have contributed to conditions for great flare of 21 May in center of complex.

5/21 "Collision" between central and western members of the complex, as growth and expansion of central member moved its leader spot into the follower plage of the western member. Large flare occurred over the neutral line between the groups.

5/23 "Collision" and merger of leader of easternmost member with follower of central member, creating large "delta" magnetic configuration. Closest separation between the opposite-polarity spots coincided with great white-light, proton flare at 1840 UT (see *UAG Report 5*). These spots moved in a rotary pattern with respect to one another during 21-26 May.

5/28 Additional great flare over the "delta" configuration.

b

c

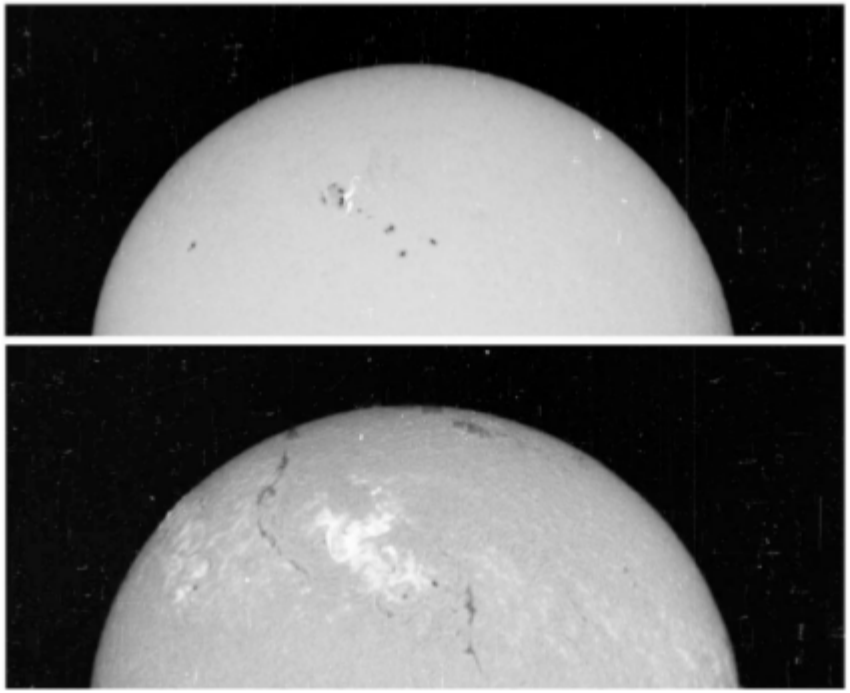
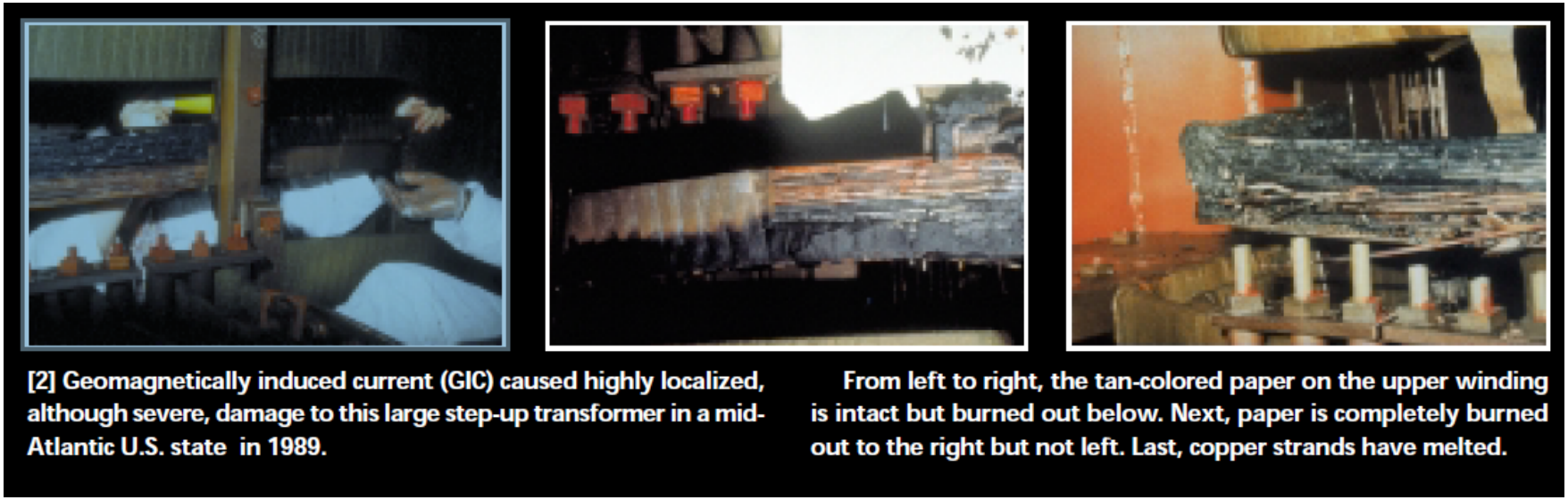


Figure 1. (a) Notes on the dynamics of McMath Region 8818, extracted from *McIntosh* [1979, p. 84]; (b) May 23 1967, 1840:50 UT, H α wing image, 656.28 nm, $\Delta\lambda = \pm 0.2$ nm; (c) 1844:00 UT, H α emission 656.28 nm, line center. North is at the top. West is to the right (Courtesy of National Solar Observatory).

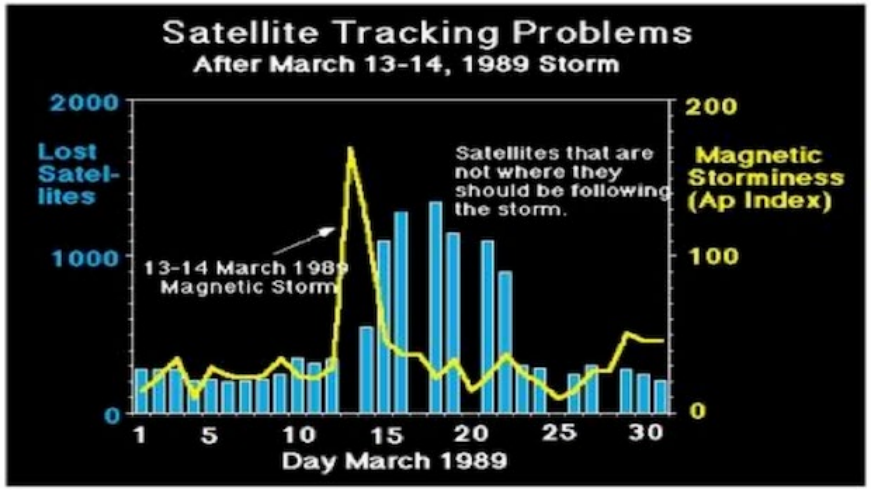
Marzo 1989, la tormenta de Quebec



[2] Geomagnetically induced current (GIC) caused highly localized, although severe, damage to this large step-up transformer in a mid-Atlantic U.S. state in 1989.

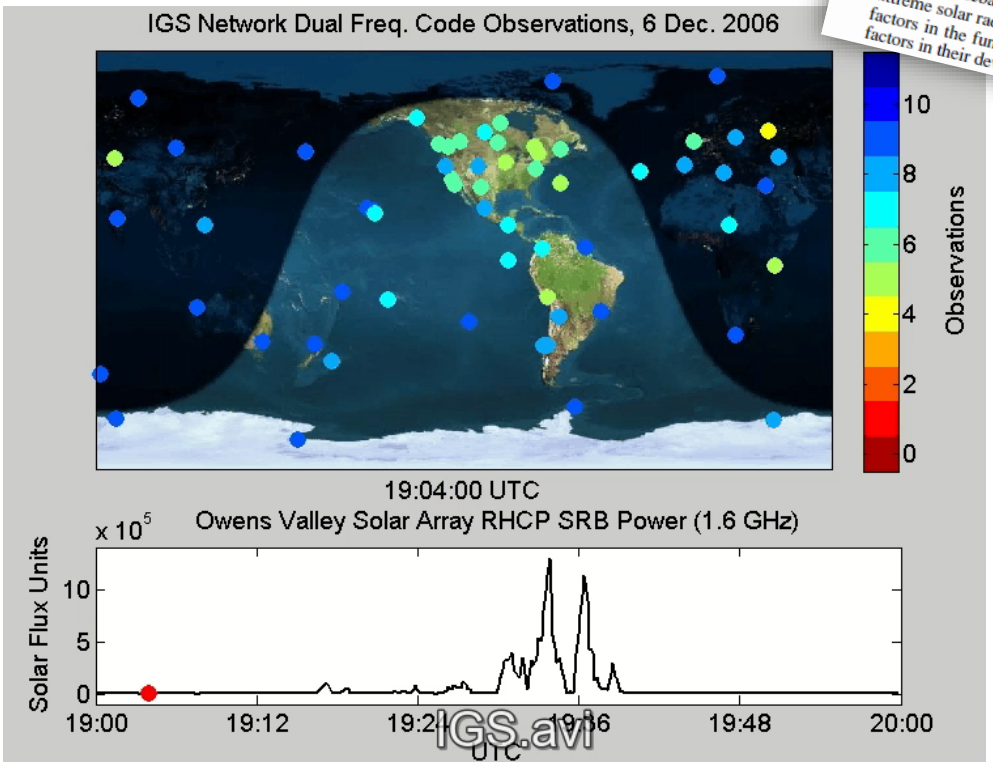
From left to right, the tan-colored paper on the upper winding is intact but burned out below. Next, paper is completely burned out to the right but not left. Last, copper strands have melted.

Molinski (2000)



From http://www.swpc.noaa.gov/impacts/satellite-drag

Diciembre de 2006



LETTER

Earth Planets Space, 61, 637–641, 2009

The total failures of GPS functioning caused by the powerful solar radio burst on December 13, 2006

E. L. Afraimovich, V. V. Demyanov, and G. Ya. Smolkov

Institute of Solar-Terrestrial Physics, the Russian Academy of Sciences, the Siberian Branch, 664033, Irkutsk, Russia

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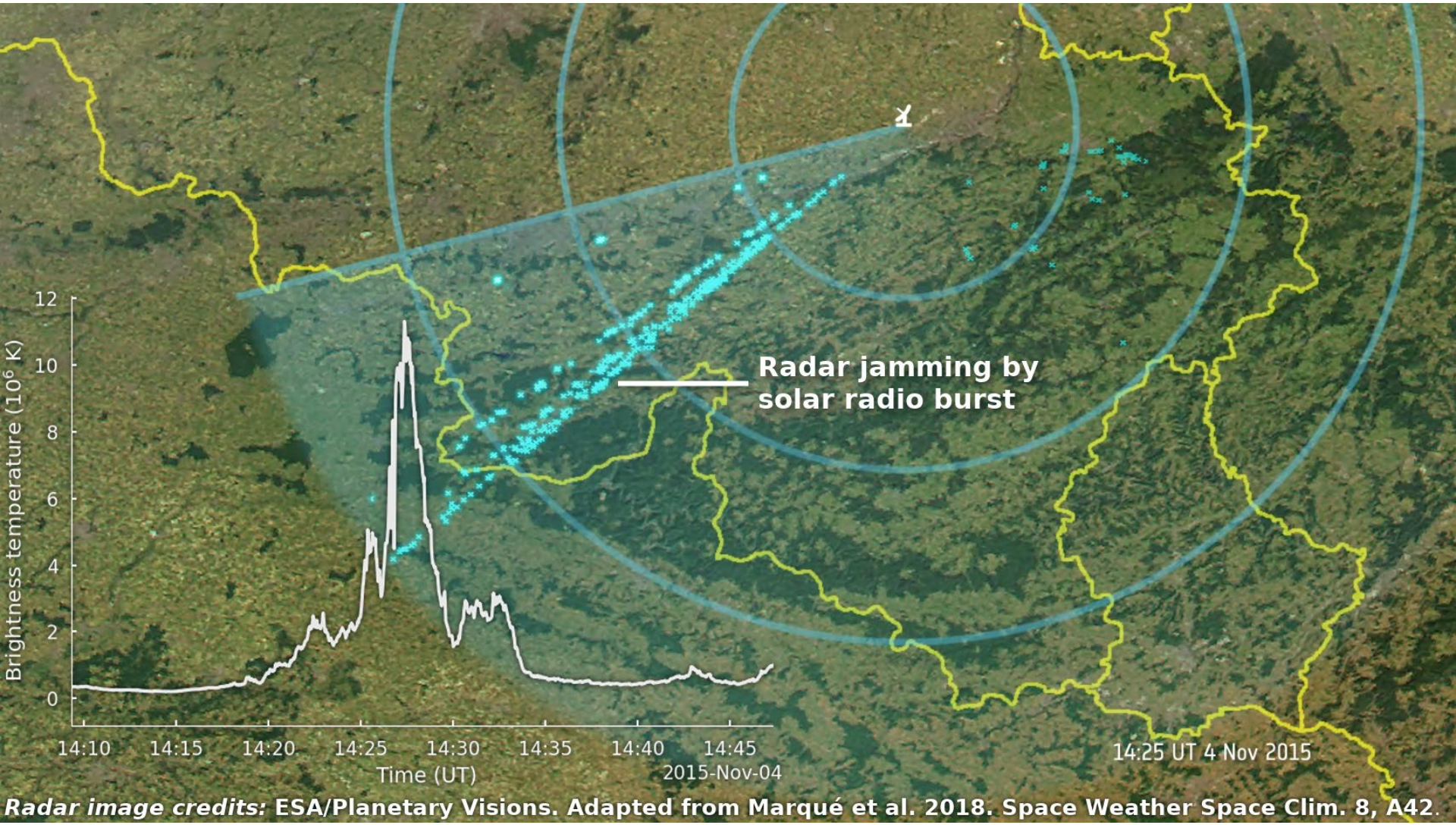
We investigated failures in the GPS performance produced by extremely dense solar radio burst fluxes associated with the intense (X3.4 in GOES classification) solar flare and Halo CME recorded by SOHO/LASCO on December 13, 2006. According to substantial experimental evidence, high-precision GPS positioning on the entire sunlit side of the Earth was partially disrupted for more than 12–15 min; the high level of GPS slips resulted from the wideband solar radio noise emission. Our results are in agreement with the data obtained recently for the extreme solar radio burst on December 6, 2006, and provide a sound basis for revising the role of space weather factors in the functioning of state-of-the-art satellite systems and for taking a more thorough account of these factors in their development and operation.

4 Noviembre 2015



Radar image credits: **ESA/Planetary Visions. Adapted from Marqué et al. 2018. Space Weather Space Clim. 8, A42.**

6 Septiembre 2017

Ionospheric Response to the X9.3 Flare on 6 September 2017 and Its Implication for Navigation Services Over Europe

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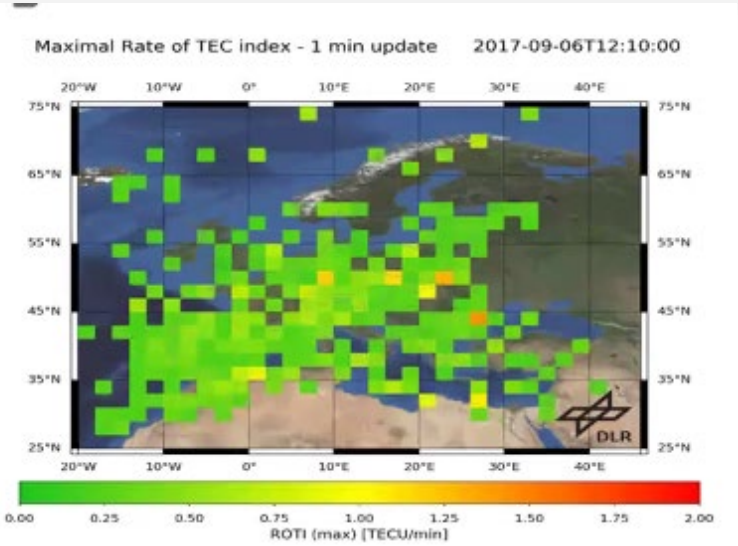


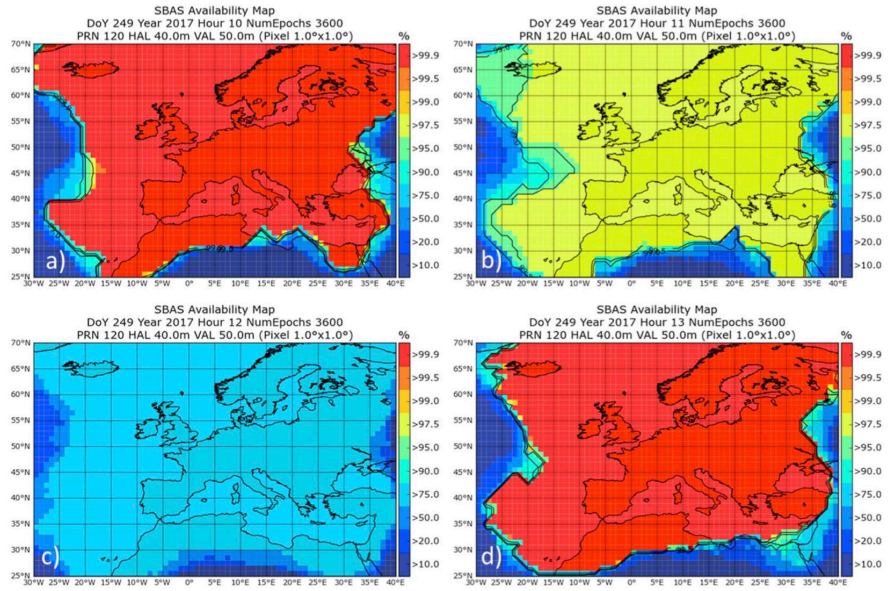
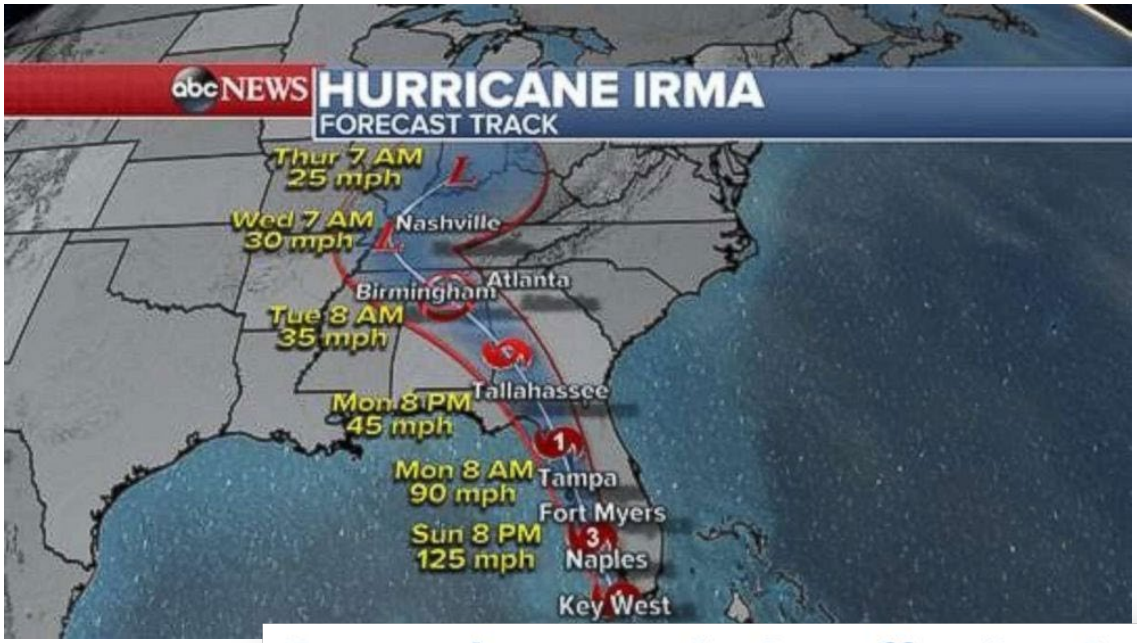


Figure 8. The hourly European Geostationary Navigation Overlay Service availability plots between 10:00 and 13:00 UT on 6 September are shown. The plots are generated with the ESA/UPC GNSS-Lab Tool (Sanz et al., 2012) and gracefully provided by ESA. Note in this figure red indicates high availability rates and blue indicates low availability rates. SBAS = satellite-based augmentation system.



September 2017's Geoeffective Space Weather and Impacts to Caribbean Radio Communications During Hurricane Response

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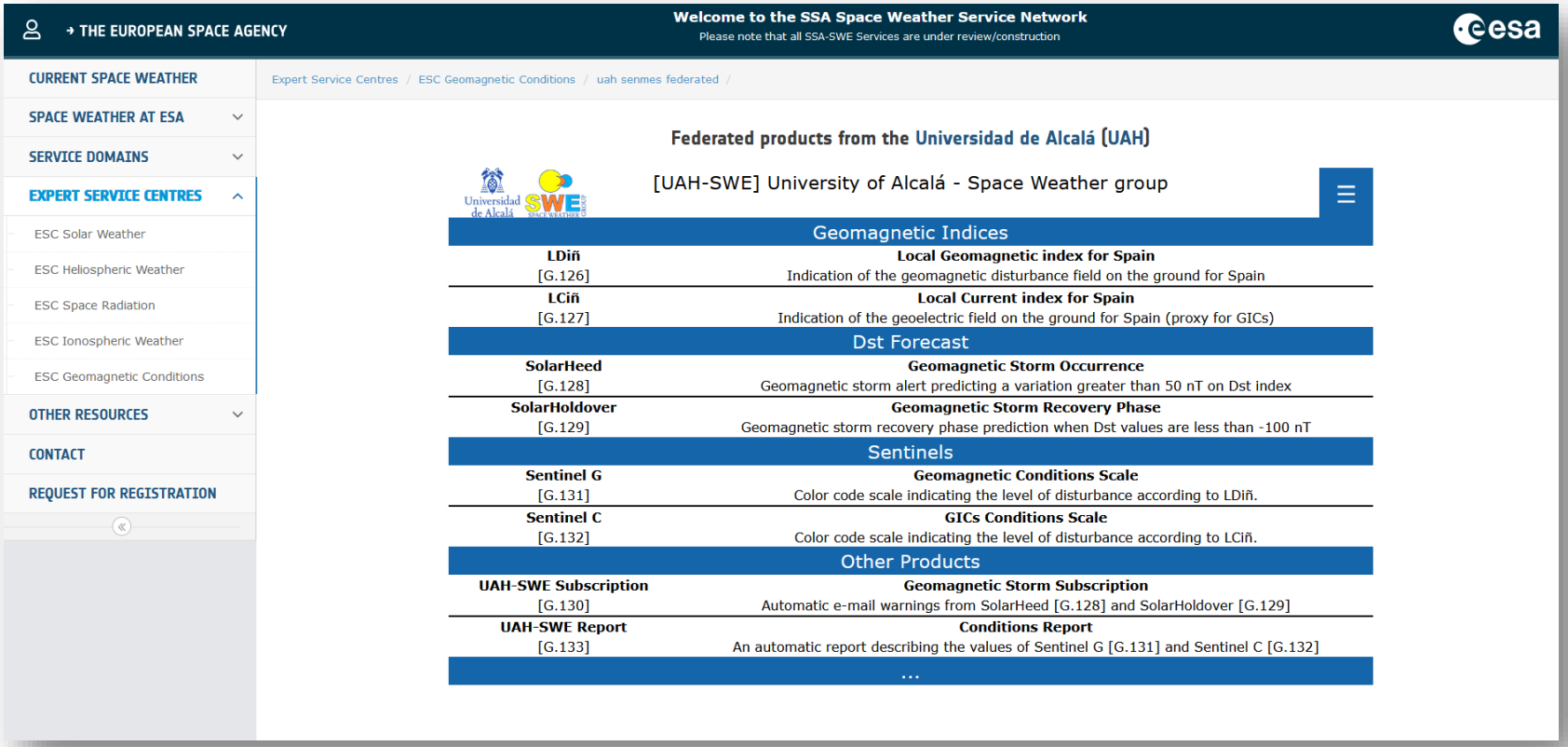

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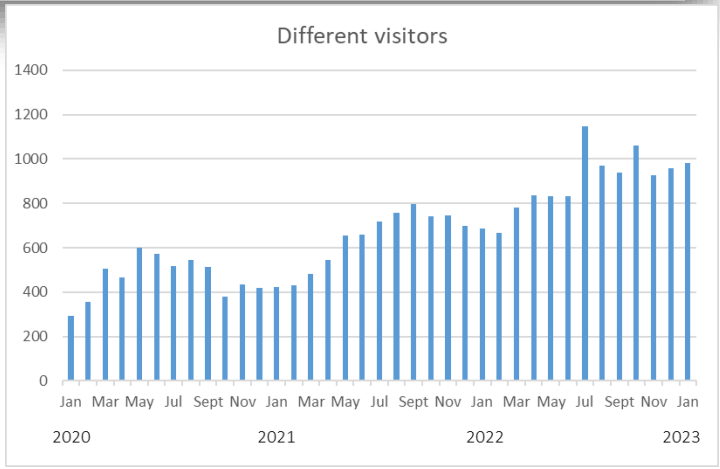
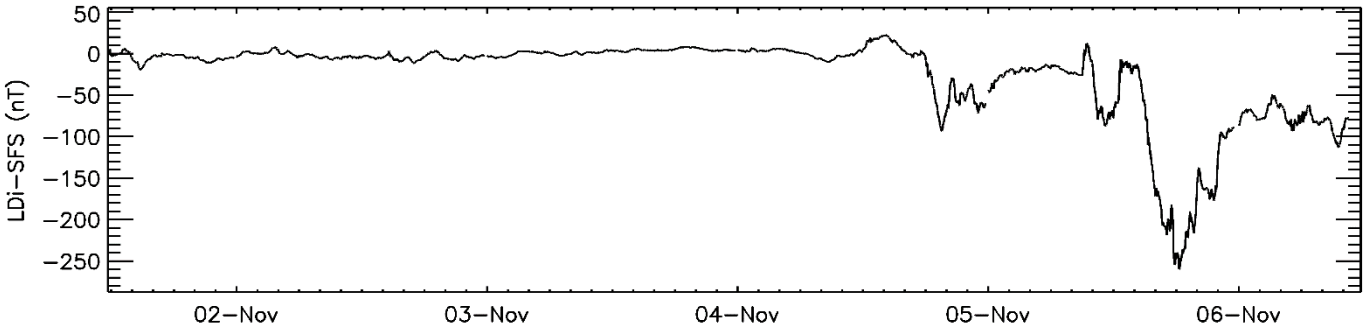
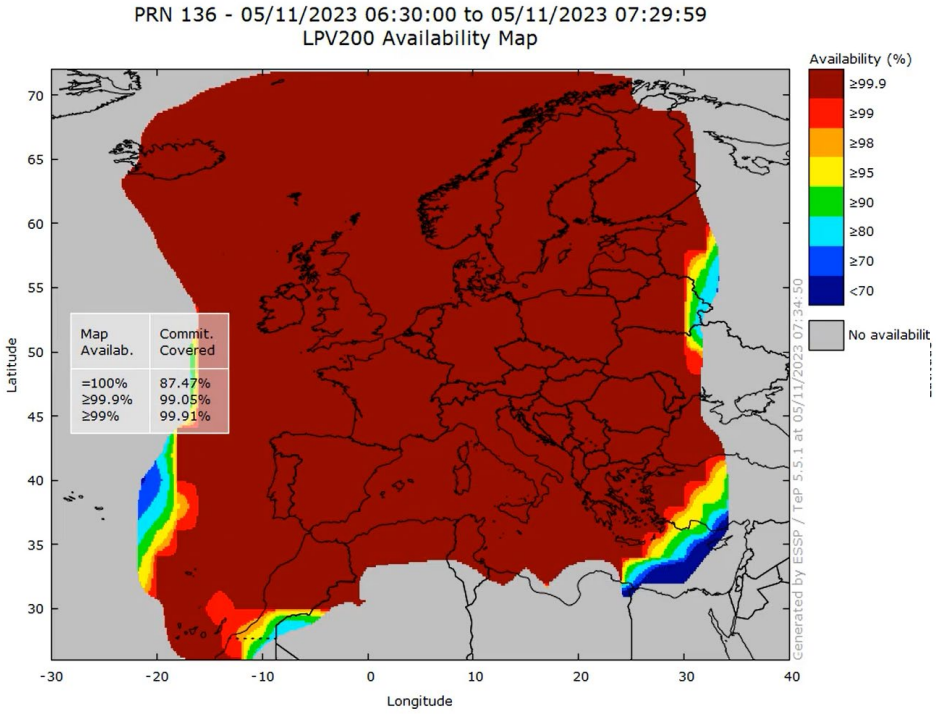
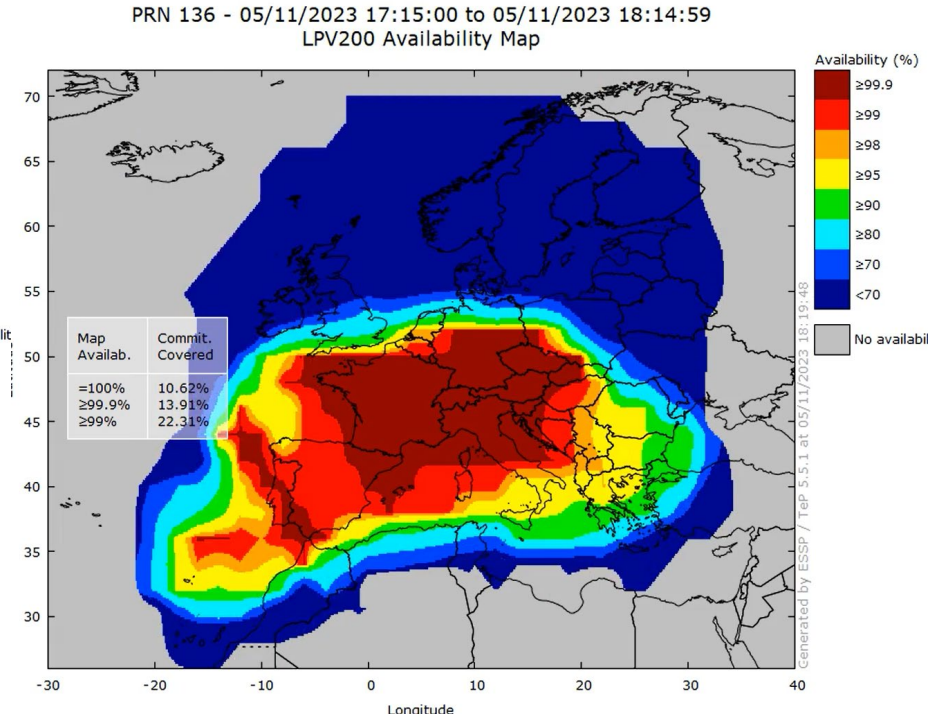


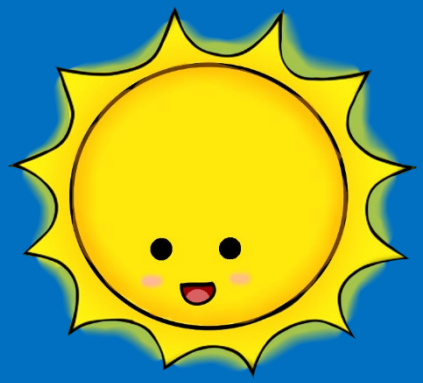


Last data: 2023−Nov−06 10:30 UT

Updated: 2023−Nov−06 11:40 UT







¡MUCHAS GRACIAS

POR

VUESTRA ATENCIÓN!

¿Alguna pregunta?