Briefing Space Weather

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2023/04/05

This report refers to the weeks of March 20-27 and March 27 through April 2.

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1 Sun

1.1 Responsible: José Cecatto

03/20 - M1.2 flare; Fast wind stream (=< 450 km/s); 8 CME c.h.c. toward the Earth *,*;

03/21 – No flare; Fast wind stream (=< 500 km/s); 4 CME c.h.c. toward the Earth;

03/22 – No flare; Fast wind stream (=< 550 km/s); 9 CME c.h.c. toward the Earth;

03/23 – No flare; Fast wind stream (=< 500 km/s); 3 CME c.h.c. toward the Earth;

03/24 – No flare; Fast wind stream (=< 500 km/s); 2 CME c.h.c. toward the Earth *,*,**;

03/25 – No flare; Fast wind stream (=< 550 km/s); 7 CME c.h.c. toward the Earth *;

03/26 – No flare; Fast wind stream (=< 700 km/s); 2 CME c.h.c. toward the Earth *;

03/27 – No flare; Fast wind stream (=< 700 km/s, ~ 400 km/s at 06 UT); 3 CME c.h.c. toward the Earth;

Prev.: No fast wind stream for the next 01-02 days; for the next 2 days (10% M, 01% X) probability of M / X flares;

also, occasionally other CME can present component toward the Earth.

c.h.c. – can have a component; * partial halo; ** halo

Summary

03/27 – No flare; Fast wind stream (=< 650 km/s); 4 CME c.h.c. toward the Earth *,*;

03/28 – No flare; Fast wind stream (=< 550 km/s); 2 CME c.h.c. toward the Earth;

03/29 – X1.2, M1.2, M1.1 flares; No fast wind stream; 9 CME c.h.c. toward the Earth;

03/30 - M5.4 flare; Fast wind stream (=< 550 km/s); 3 CME c.h.c. toward the Earth;

03/31 – No flare; Fast wind stream (=< 650 km/s); 3 CME c.h.c. toward the Earth *,*,**;

04/01 – No flare; Fast wind stream (=< 600 km/s); 11 CME c.h.c. toward the Earth *;

04/02 – No flare; Fast wind stream (=< 600 km/s); 4 CME c.h.c. toward the Earth *;

04/03 – No flare; Fast wind stream (=< 550 km/s); 3 CME c.h.c. toward the Earth;

Prev.: Fast wind stream for the next 01-02 days; for the next 2 days (01% M, 01% X) probability of M / X flares; also,

occasionally other CME can present component toward the Earth. c.h.c. – can have a component; * partial halo; ** halo

2 Sun

2.1 Responsible: Douglas Silva

- WSA-ENLIL (CME 2023-03-30T21:12 UT)
 - The simulation results indicate that the flank of Coronal Mass Ejection will reach the DS-COVR mission between 2023-04-02T20:00 UT and 2023-04-03T11:00 UT.
- WSA-ENLIL (Prediction for CME: 2023-04-01T00:48 UT)
 - $-\,$ The simulation results indicate that the flank of CME will reach the DSCOVR mission between 2023-04-02T18:00 UT and 2023-04-03T09:00 UT







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3 ULF waves

3.1 Responsible: Graziela B. D. Silva



Figura 1: a) Timeseries of the geomagnetic field total component measured at ISLL station (Island Lake) of the CARISMA magnetometer network in magenta, along with the associated perturbation in the Pc5 band shown in blue. b-d) timeseries of the geomagnetic field total component measured at stations PVE (Porto Velho), ARA (Araguatins), and CXP (Cachoeira Paulista) of the EMBRACE network in magenta, along with the Pc5 perturbation in blue.



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Figura 2: a-d) Time evolution of the power spectral density obtained from the filtered timeseries of the geomagnetic field total component (δ Btotal) for a) the high latitude station (ISLL-CARISMA), and b-d) for the low latitude stations of EMBRACE (PVE, ARA, CXP).



Figura 3: a) Timeseries of the geomagnetic field total component measured by GOES 16, together with the Pc5 fluctuation in black. b) Wavelet power spectrum of the filtered timeseries. c) Average ULF power in the period range from 2 to 10 minutes.



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Figura 4: a-d) The rate of change of the geomagnetic field total component (dB/dt) obtained for a) the high latitude station (ISLL-CARISMA), and b-d) for the low latitude stations of EMBRACE (PVE, ARA, CXP).



Figura 5: Same as the previous figure, but for the week of March 20 to 27 in following the intense magnetic storm on March 23.

• The GOES 16 satellite in geosynchronous orbit (L ~ 6.6) registered significant activity of Pc5 ULF waves during March 23-24, and as of March 30.

• As observed on the ground, the ISLL station at high latitude registered high intensity levels of ULF wave activity over 22-25 and in the period from March 30 to April 2.

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- In the same way, the PVE station from Embrace MagNet, located under the dip equator, registered significant levels of ULF wave activity over these days, however, with a strong diurnal influence by the equatorial electrojet.
- Also, the ARA and CXP stations at low latitudes of Brazil did register significant activity of the waves throughout these intervals.
- The dB/dt rates showed peaks of abolute values above 20 nT/min observed at the PVE station right after 12 UT on March 23. The rates surpassed 150 nT/min on March 23-24 at ISLL (Carisma network). Later, such rates remained at high levels of approximately 100 nT/min over March 31, while those rates well decreased to values below 6 nT/min at the low latitudes as monitored by the Embrace stations.

4 Geomagnetic activity

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4.1 Responsible: Lívia Alves

The figures below show that the week of March 20-27 registered very intense auroral activity (the AE index reached 2000 nT on March 24), which was associated with the development of an intense geomagnetic storm starting on March 23. In this storm, Dst reached a minimim of -180 nT. In the week of March 27 to April 2 there were two minor geomagnetic storms, and also minor auroral activity in which AE was below 1000 nT in this period.



Figura 6: Geomagnetic index AE during week 1.



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Figura 7: Geomagnetic index AE during week 2.



Figura 8: Geomagnetic index Dst during week 1.



Figura 9: Geomagnetic index Dst during week 2.

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$\mathbf{5}$ Ionosphere

Responsible: Laysa Resende 5.1

Boa Vista:

• There were spread F during all days in this week.

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• The Es layers reached scale 3 on March 21, 2023.



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Cachoeira Paulista:

- There were spread F during all days in this week.
- The Es layers reached scale 3 on March 30, 2023.





São Luís:

- There were spread F during all days in this week.
- The Es layers reached scale 4 on April 02, 2023.



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6 ROTI

6.1 Responsible: Name

In the week 2254 (March 19 to 25, 2023) there were ionospheric irregularities (plasma bubble), on all analyzed days, as shown in Figure 10 (high ROTI values). In addition, Figure 10 shows the ROTI time series for four stations in the Brazilian sector (Natal (RNNA), Bacabal (MABB), Cuiabá (CUIB) and São José dos Campos (SJSP)). Note that Figure 10 shows pre sunrise plasma bubbles, as indicating in the red rectangle.



Figura 10: ROTI time series for four stations in the Brazilian sector (Natal (RNNA), Bacabal (MABB), Cuiabá (CUIB) and São José dos Campos (SJSP)), from March 19 to 25, 2023.

Figure 11 shows the ROTI time series for four stations in the Brazilian sector (Natal (RNNA), Bacabal (MABB), Cuiabá (CUIB) and São José dos Campos (SJSP)). In the week 2255 (March 26 to Apr 01, 2023) there were ionospheric irregularities (plasma bubble), on all analyzed days, except the night of the 30th to the 31st, as shown in Figure 1 (high ROTI values. Note that ROTI values are already reduced compared to previous weeks, this is because the plasma bubbles seasonality is ending.



Figura 11: ROTI time series for four stations in the Brazilian sector (Natal (RNNA), Bacabal (MABB), Cuiabá (CUIB) and São José dos Campos (SJSP)), from March 26 to April 01, 2023.