Assessment of Geosynchronous Orbit Surface Charging Conditions using GOES-16 / 17 MPS-Lo data

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Space Weather Research

& Spacecraft Survivability Services

LANL MPA SURFACE CHARGING SIGNATURE

THOMSEN ET AL.: SURFACE CHARGING AT GEOSYNCHRONOUS ORBIT

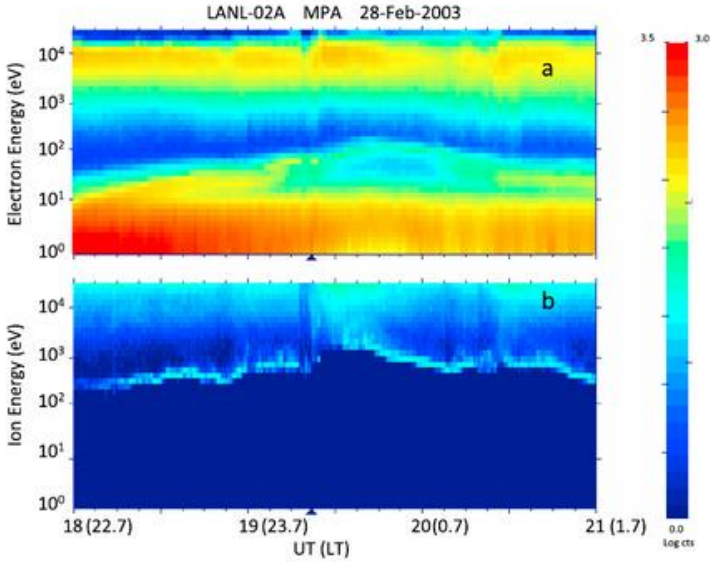
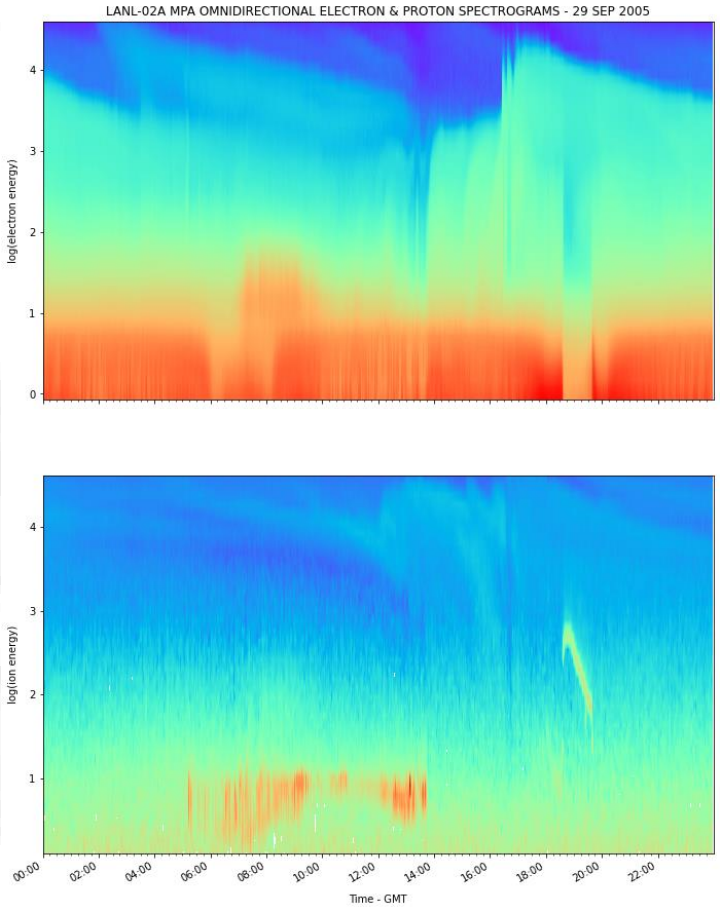
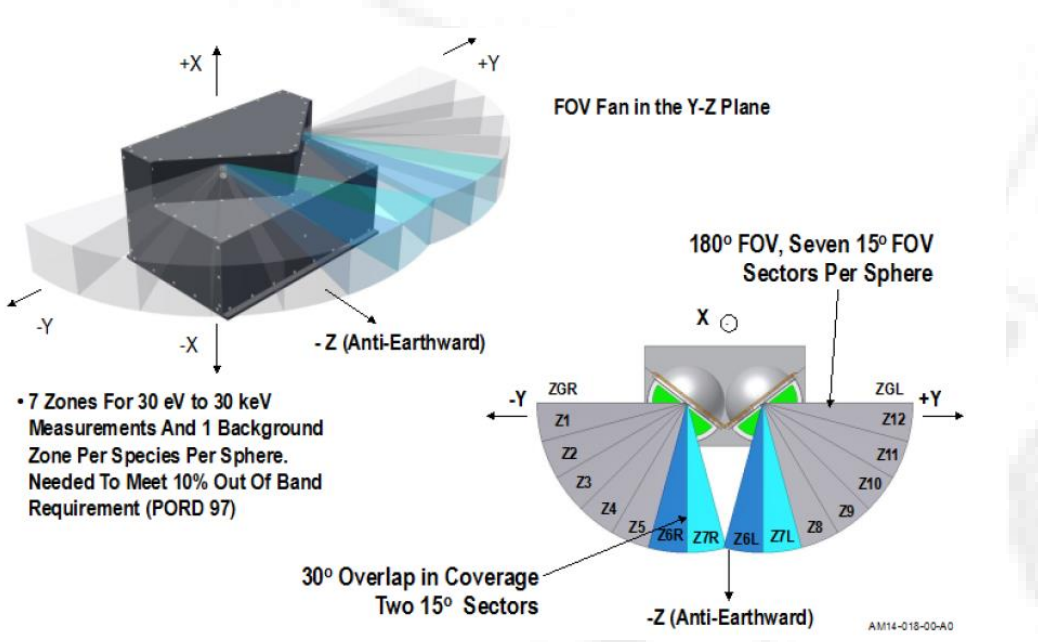


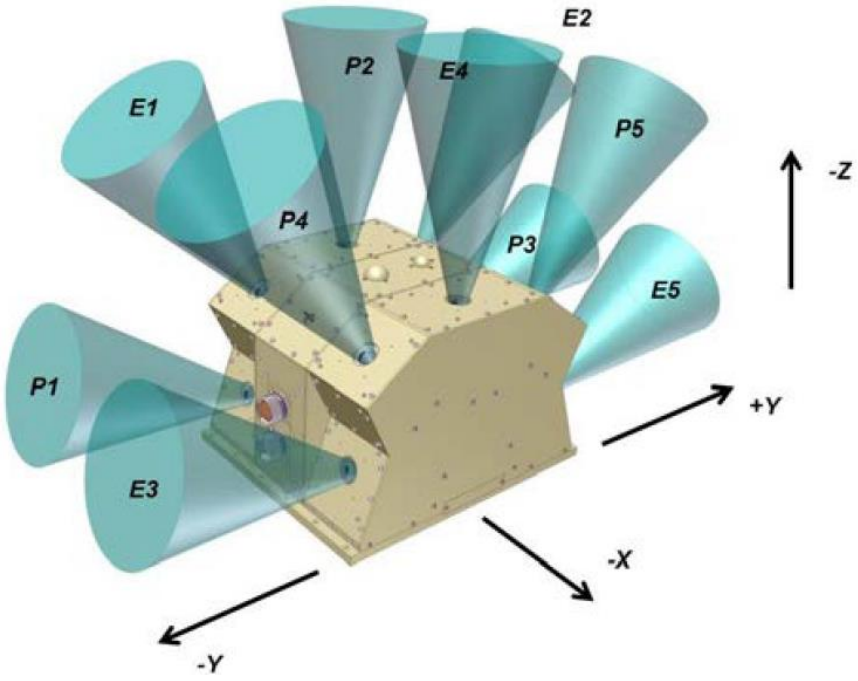
Figure 1. Color-coded count rate (proportional to energy flux) of (a) electrons and (b) ions measured as a function of energy and time by the MPA instrument on satellite LANL-02A for a 3 hour interval on 28 February 2003, as it moved from a local time of 22.7 to 1.7 LT. The sharp lower cutoff in the ion distribution is caused by charging of the surface of the vehicle to a negative potential relative to the ambient environment; ambient ions crossing the spacecraft sheath are accelerated by the spacecraft potential, so the low-energy population gets swept up into the "ion line" just above the sharp lower cutoff. The surface charging is caused by the intense fluxes of electrons above ~3 keV, as seen in Figure 1a. The intense low-energy electron population in Figure 1a, including the peak that rises to near 100 eV near 1945 UT, is photo- and secondary electrons produced on the spacecraft and trapped locally by differential charging.



GOES-16 / 17 MPS-Lo & MPS-Hi

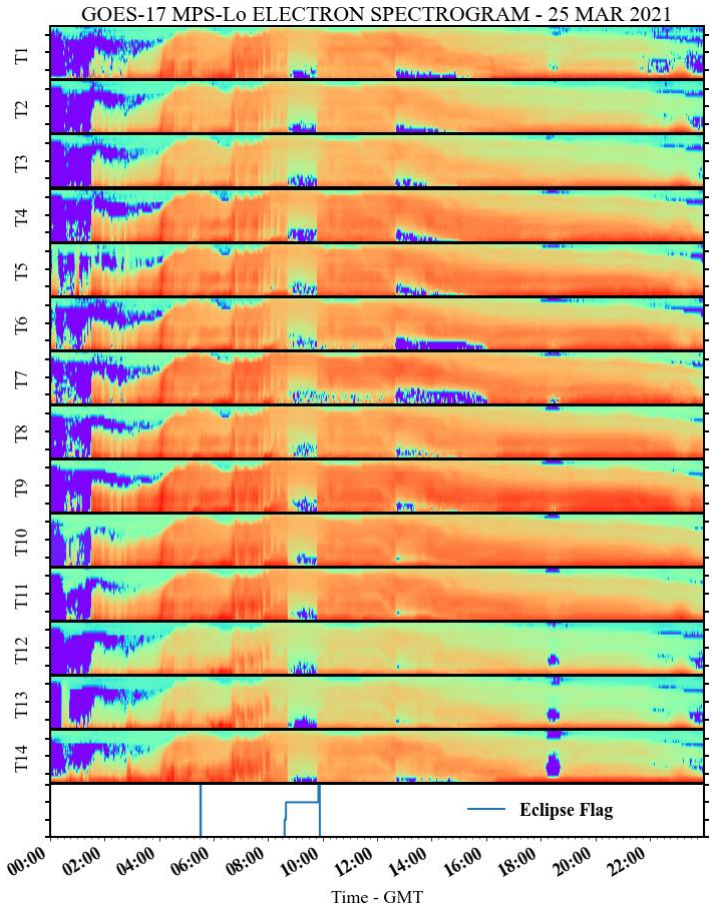


MPS-Lo

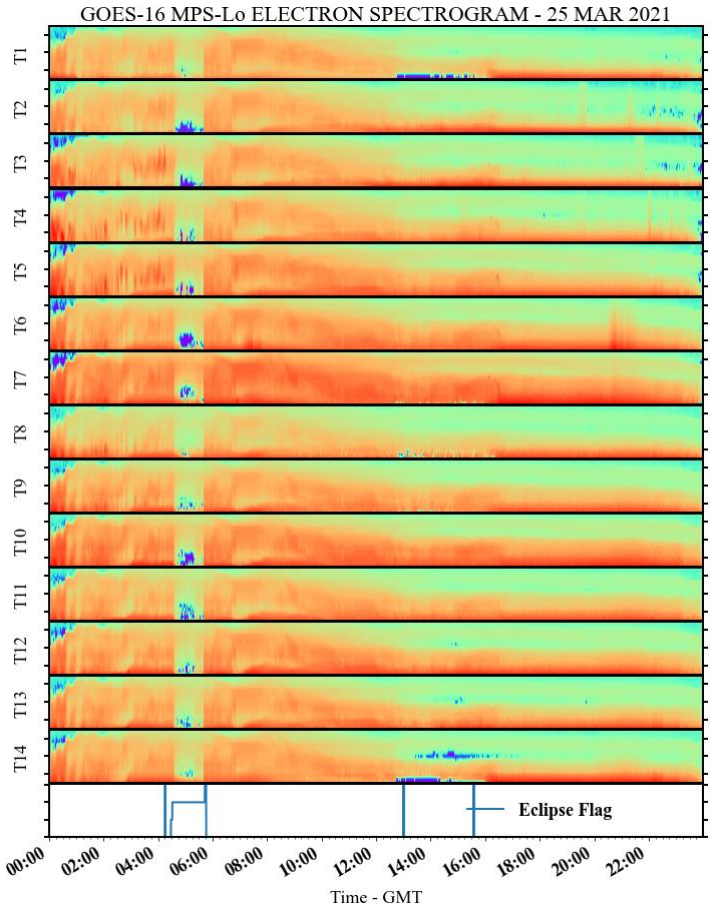


MPS-Hi

MPS-Lo ELECTRON SPECTROGRAMS – 25 MAR 2021

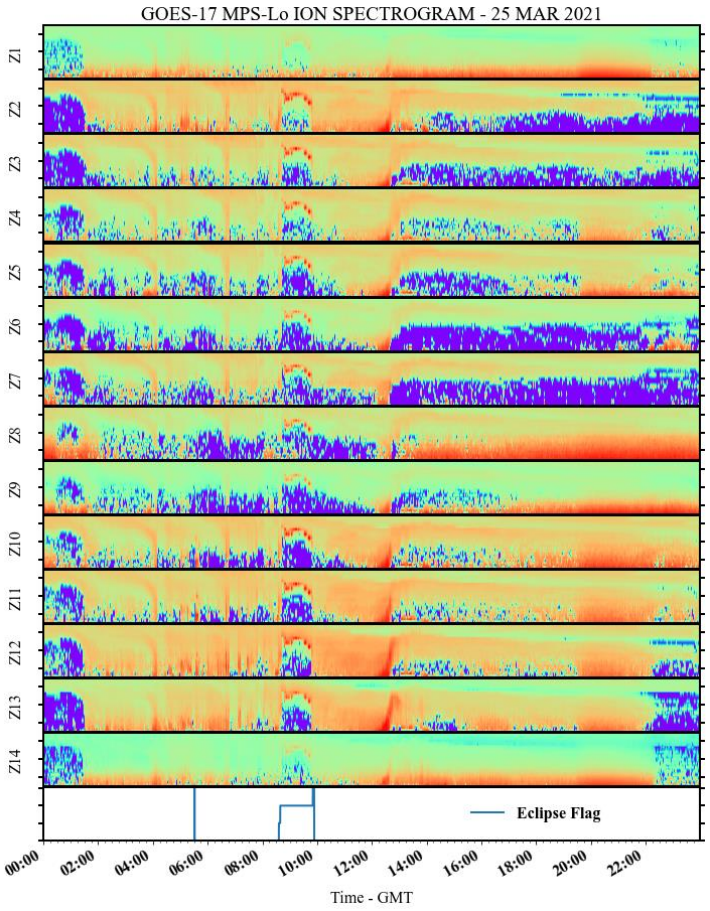


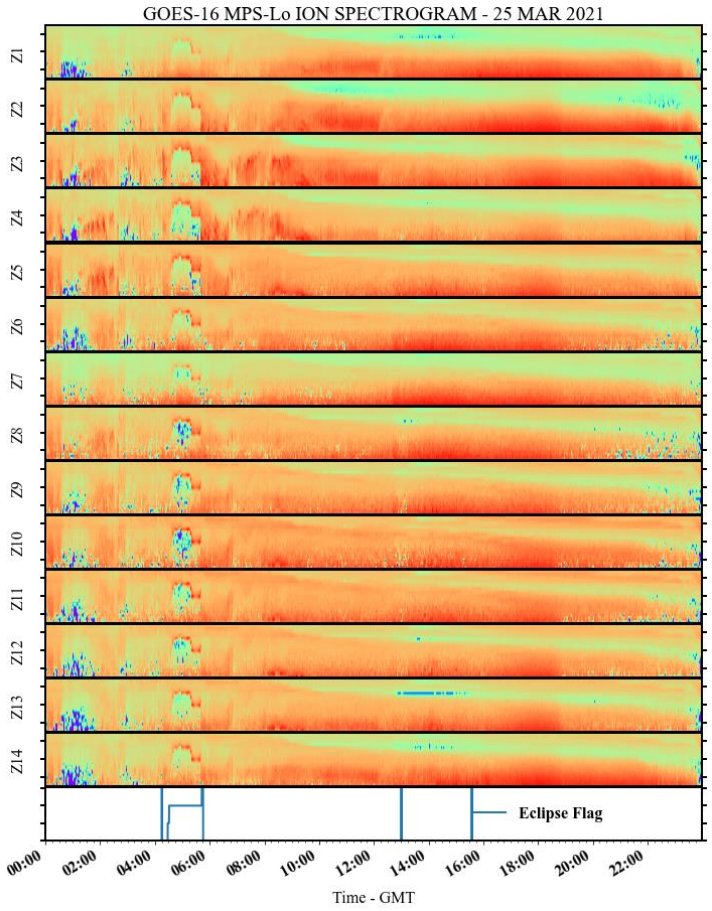
GOES-17: 137° W



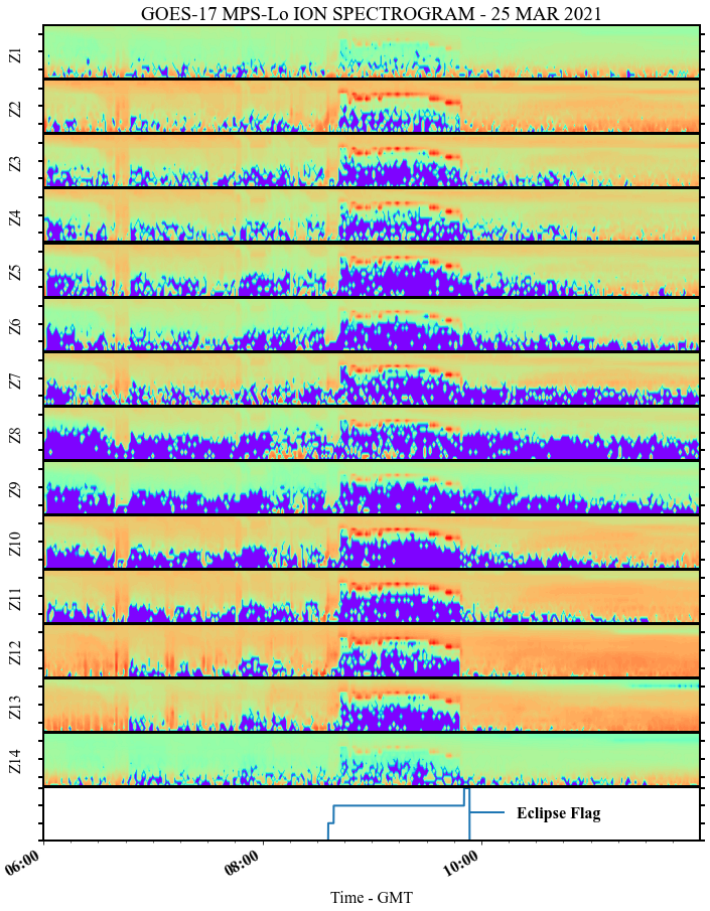
GOES-16: 75° W

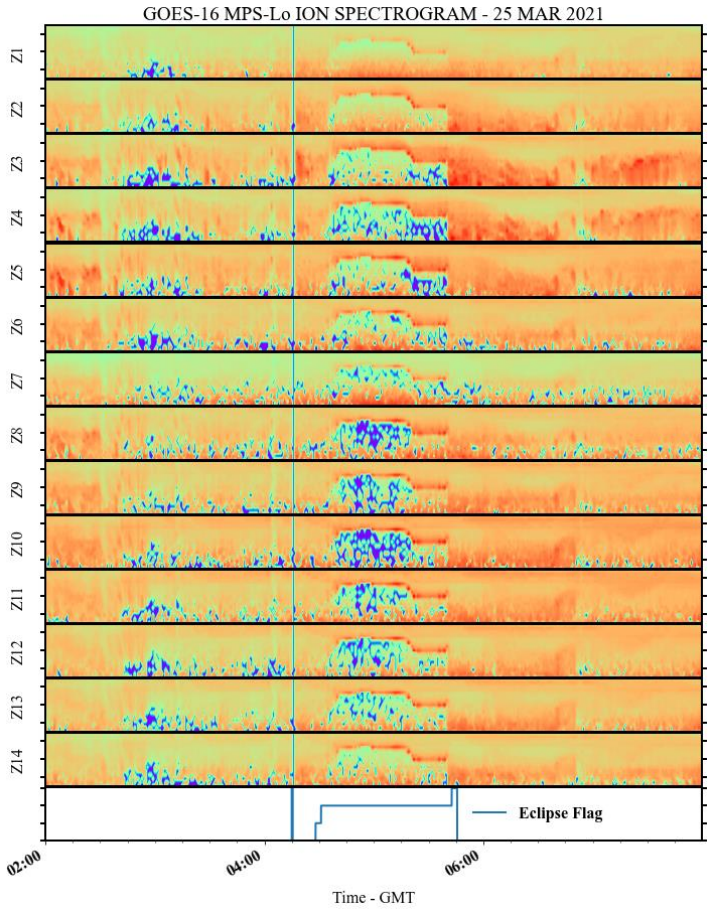
MPS-Lo ION SPECTROGRAMS – 25 MAR 2021



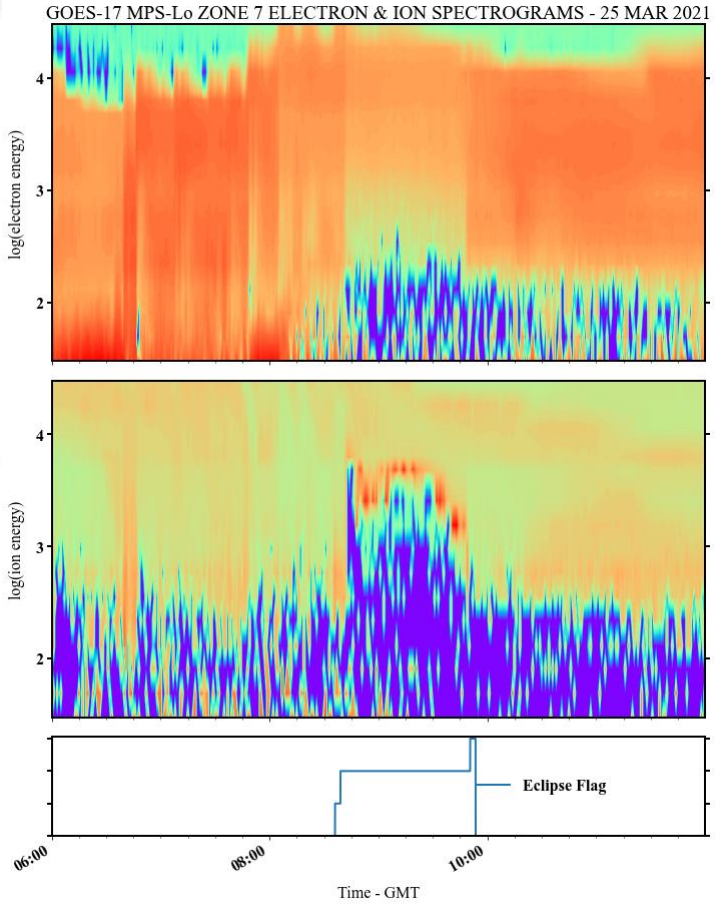


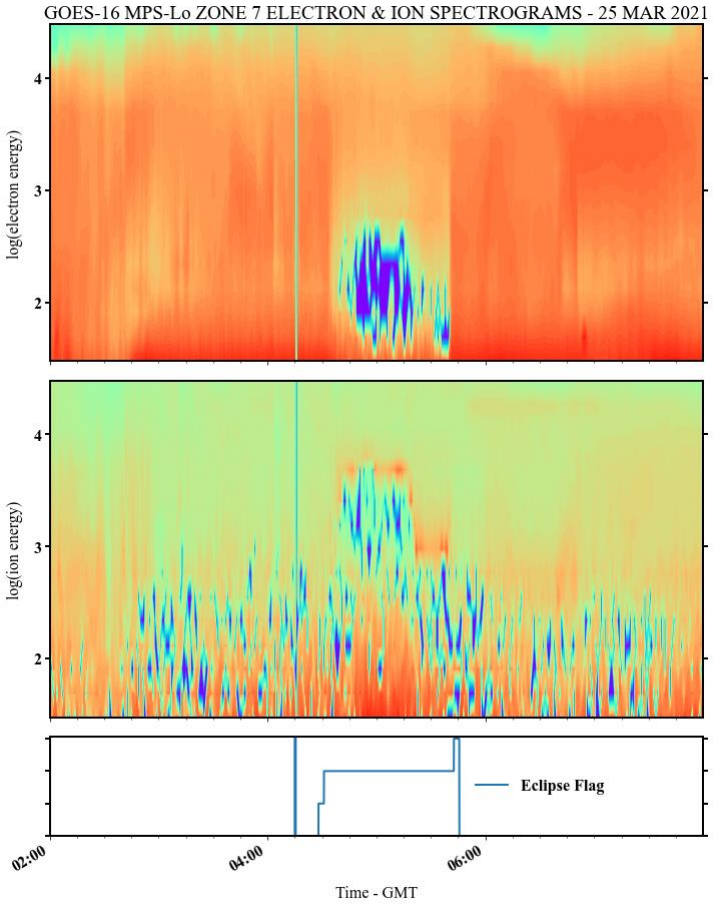
MPS-Lo ION SPECTROGRAMS – 25 MAR 2021



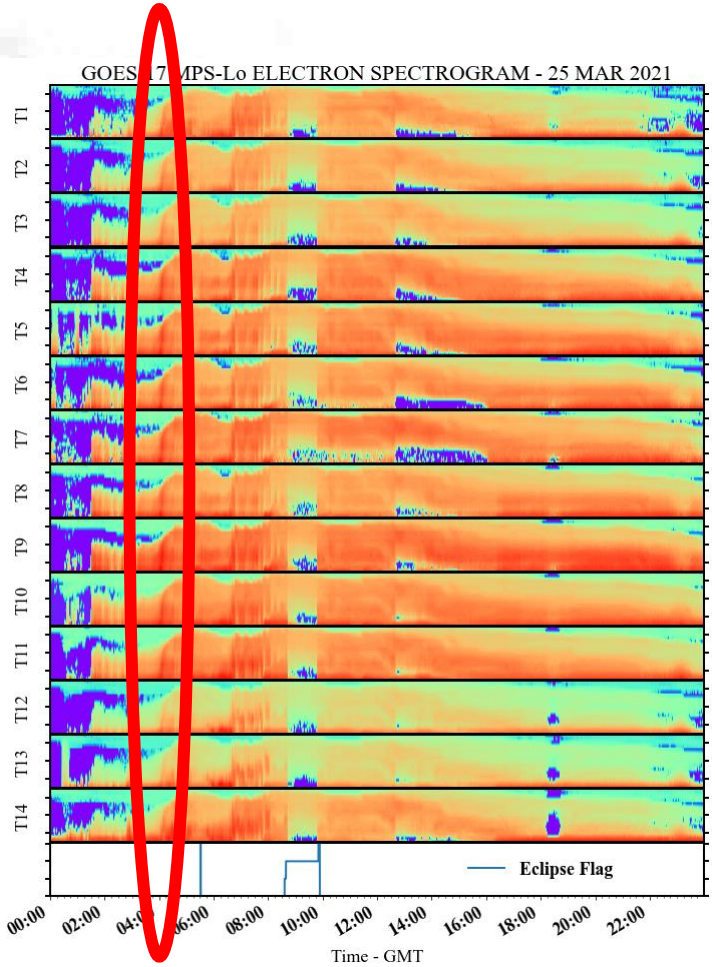


MPS-Lo ZONE 7 SPECTROGRAMS – 25 MAR 2021

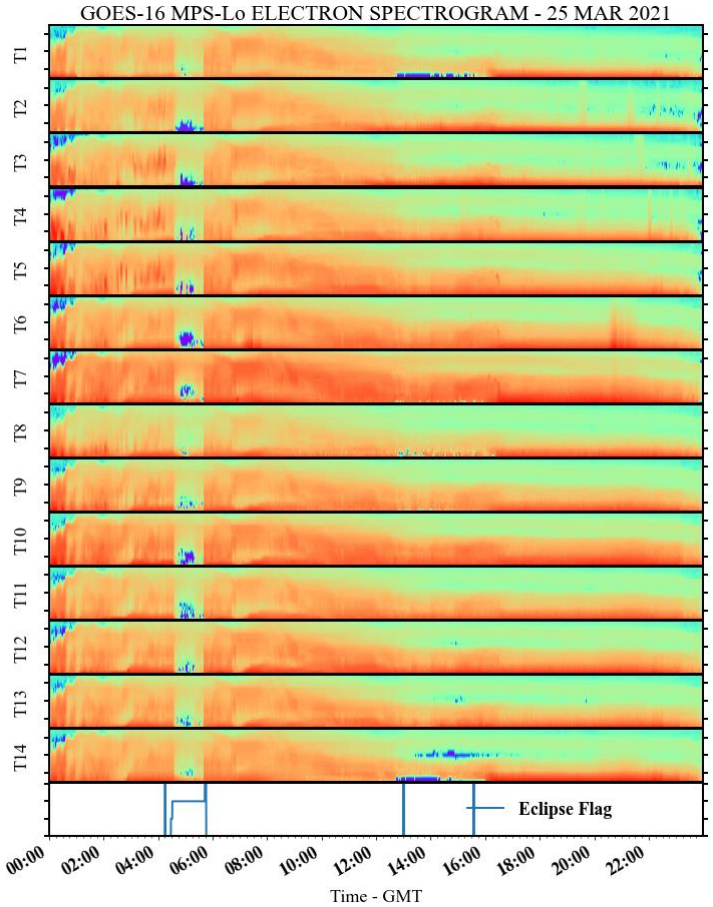




MPS-Lo ELECTRON SPECTROGRAMS – 25 MAR 2021

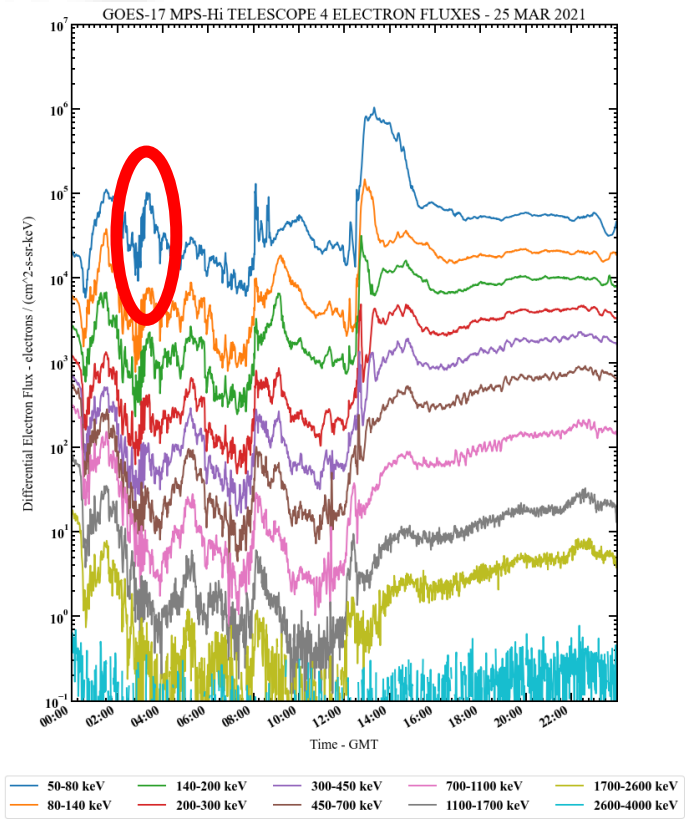


GOES-17: 137° W

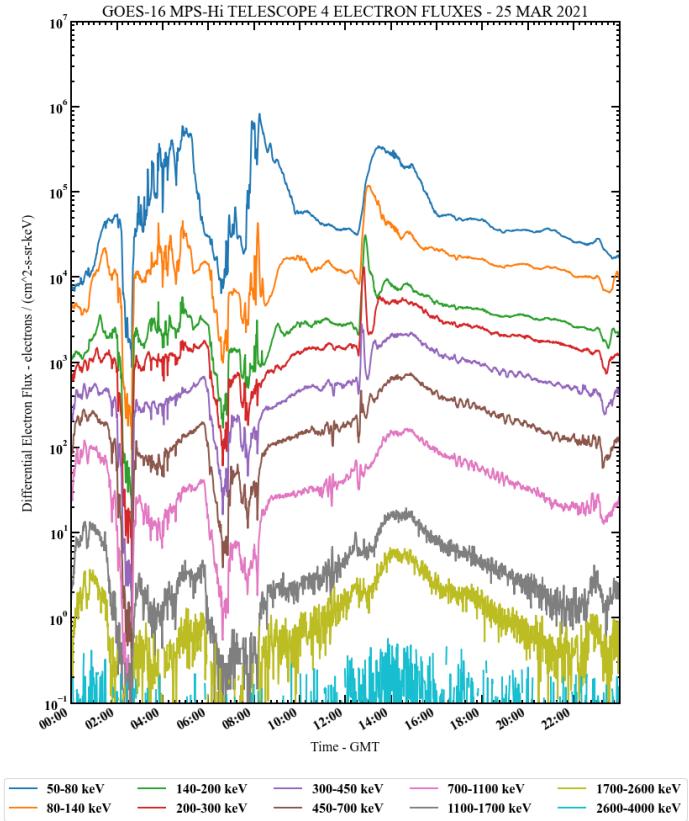


GOES-16: 75° W

MPS-Hi TELESCOPE 4 ELECTRON FLUXES – 25 MAR 2021

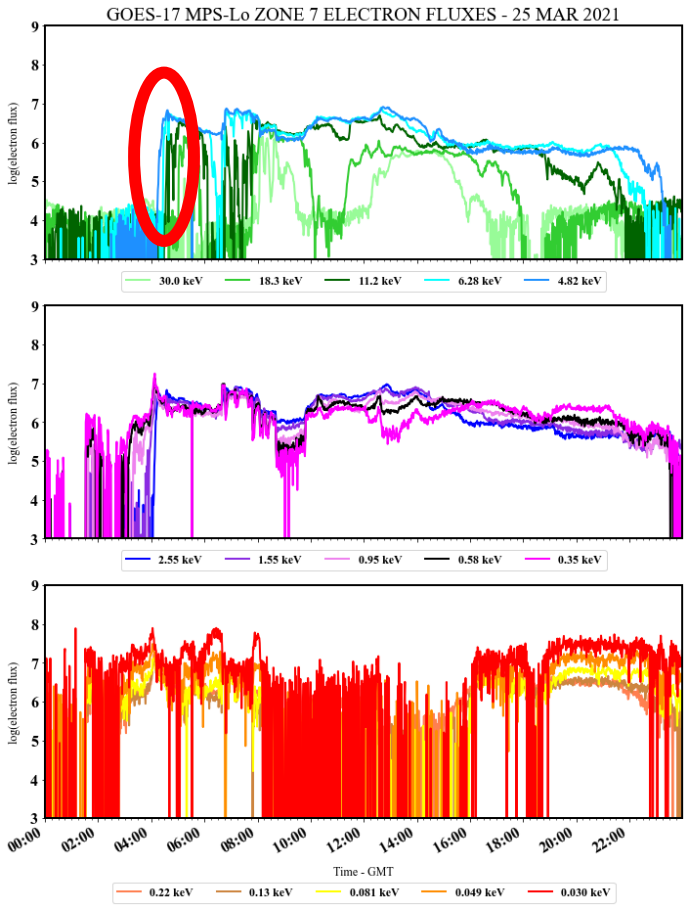


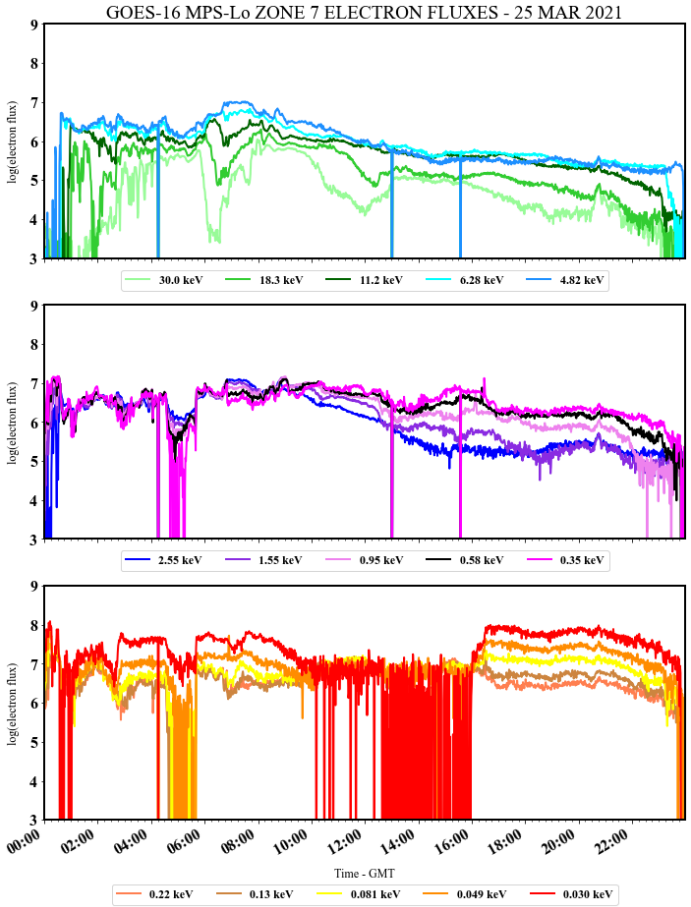
GOES-17: 137° W



GOES-16: 75° W

MPS-Lo ZONE 7 ELECTRON FLUXES – 25 MAR 2021





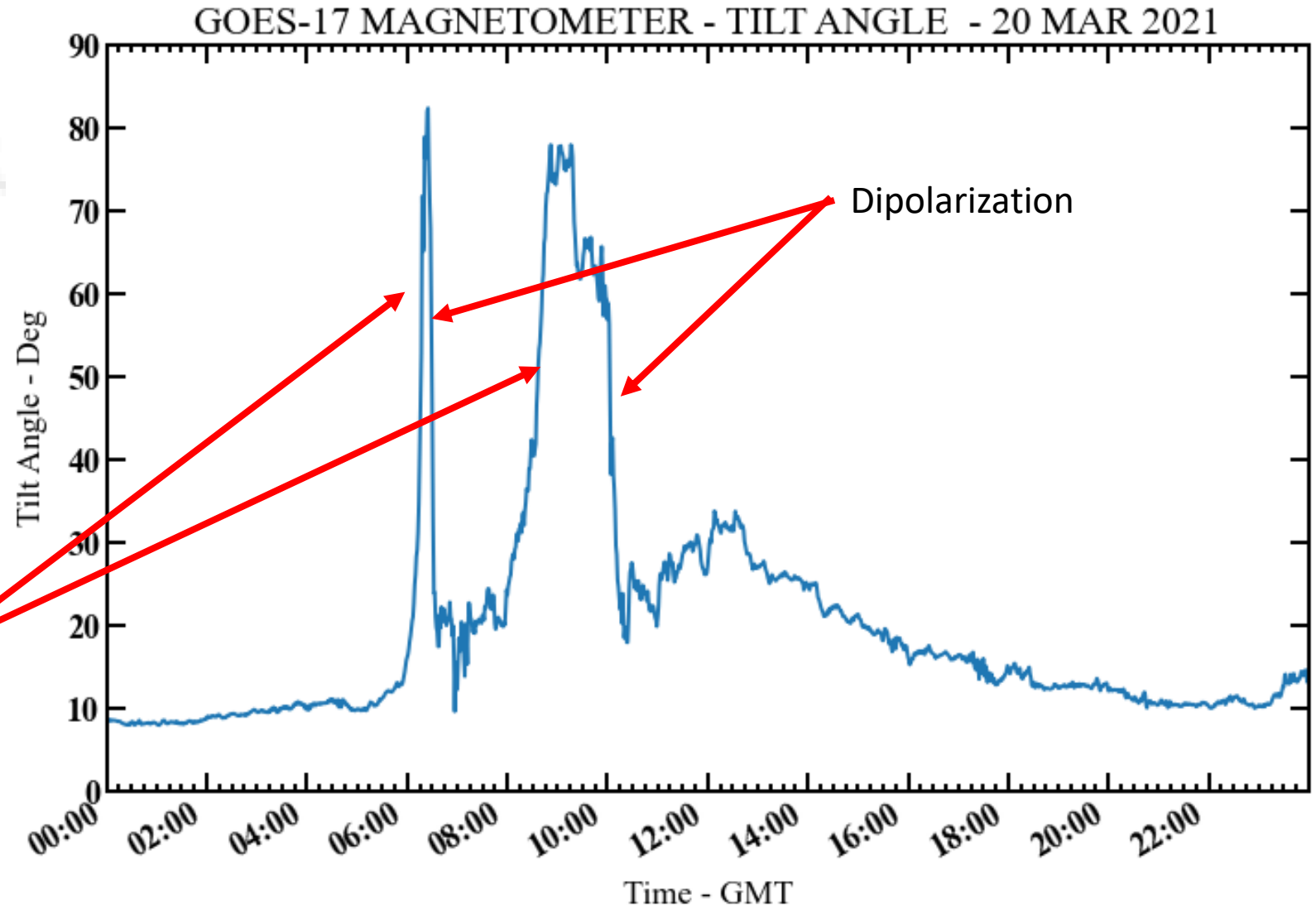
VERNAL EQUINOX 2021 SURFACE CHARGING SUMMARY

		NOAA ESTIMATED Kp								
	CHARGING SIGNATURE AT GOES-17?	00:00-02:59	03:00-05:59	06:00-08:59	09:00-11:59	12:00-14:59	15:00-17:59	18:00-20:59	21:00-23:59	CHARGING SIGNATURE AT GOES-16?
DATE			G16 ECLIPSE		G17 ECLIPSE					
27-Feb-21	NO	1	2	2	1	1	1	1	1	NO
28-Feb-21	NO	1	2	1	0	1	1	2	3	YES
1-Mar-21	YES	3	6	5	4	2	2	3	2	YES
2-Mar-21	YES	2	3	3	2	3	4	5	4	YES
3-Mar-21	YES	5	5	5	3	3	2	2	3	YES
4-Mar-21	NO	4	3	1	1	2	2	2	3	YES
5-Mar-21	YES	2	2	2	2	1	0	2	2	YES
6-Mar-21	YES	4	4	3	3	3	1	2	2	YES
7-Mar-21	NO	3	2	1	2	0	3	1	4	YES
8-Mar-21	NO	1	1	1	1	1	1	3	2	NO
9-Mar-21	NO	2	0	1	1	1	1	1	0	NO
10-Mar-21	NO	0	0	0	0	0	0	2	1	NO
11-Mar-21	NO	0	1	1	1	0	1	1	3	NO
12-Mar-21	YES	3	2	3	2	2	3	3	3	YES
13-Mar-21	YES	3	4	3	3	2	3	3	4	YES
14-Mar-21	YES	4	5	4	4	3	3	3	4	YES
15-Mar-21	YES	3	2	2	2	1	2	1	1	YES
16-Mar-21	NO	1	2	0	1	1	1	1	1	NO
17-Mar-21	NO	2	1	0	0	1	2	1	1	NO
18-Mar-21	NO	2	2	1	2	0	0	0	1	NO
19-Mar-21	YES	2	3	2	2	1	0	1	2	YES
20-Mar-21	YES	2	3	6	5	4	4	3	4	NO
21-Mar-21	NO	4	4	1	2	4	5	5	3	NO
22-Mar-21	YES	3	3	2	2	1	1	1	1	YES
23-Mar-21	YES	3	4	2	2	2	2	2	3	YES
24-Mar-21	YES	3	3	3	2	2	1	2	3	YES
25-Mar-21	YES	5	4	4	2	3	1	1	3	YES
26-Mar-21	YES	4	3	3	3	1	2	2	2	YES
27-Mar-21	YES	1	1	1	1	0	1	3	4	NO
28-Mar-21	NO	3	1	1	1	1	0	1	1	NO
29-Mar-21	NO	1	2	1	1	1	1	1	1	YES
30-Mar-21	NO	0	1	1	1	1	1	1	2	YES
31-Mar-21	YES	3	3	2	3	2	3	2	3	YES
1-Apr-21	YES	3	3	2	2	0	1	2	2	YES
2-Apr-21	NO	2	1	1	1	1	3	2	1	YES
3-Apr-21	NO	2	2	1	1	1	0	1	1	NO
4-Apr-21	NO	1	0	1	0	1	1	0	1	NO
5-Apr-21	NO	1	1	1	1	3	1	0	1	NO
6-Apr-21	NO	0	0	0	0	1	0	1	1	NO
7-Apr-21	YES	1	2	3	4	4	5	3	2	NO
8-Apr-21	NO	1	1	0	2	2	1	2	1	YES
9-Apr-21	NO	0	2	0	1	1	1	0	0	YES
10-Apr-21	NO	1	1	1	1	1	2	1	2	NO
11-Apr-21	NO	2	2	2	1	1	1	2	2	NO
12-Apr-21	NO	1	1	1	2	1	2	1	0	NO

FOCUS ON A SECOND EVENT – 20 MARCH 2021

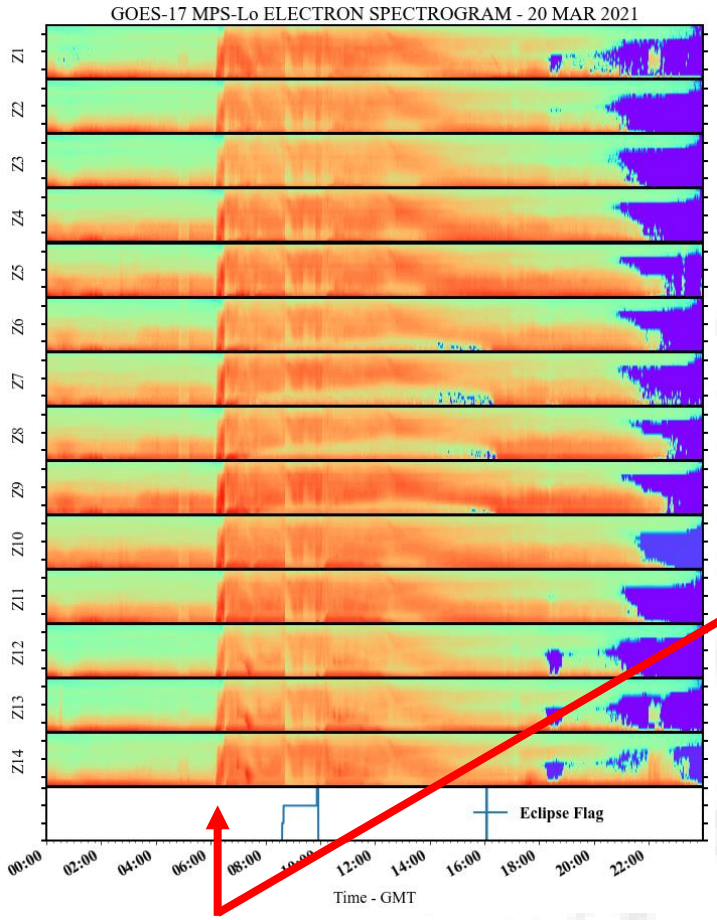
GOES-17 MAGNETOMETER

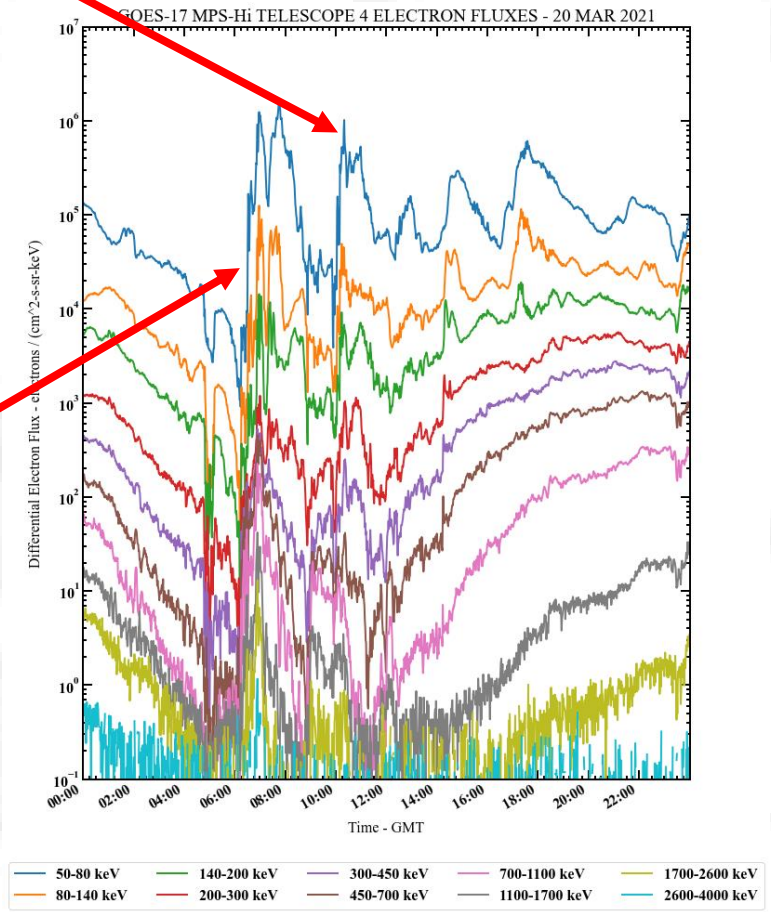
Tilt Angle =arctan($\sqrt{(E^2 + N^2)}$/P)



GOES-17 MPS-Lo & MPS-Hi ELECTRONS

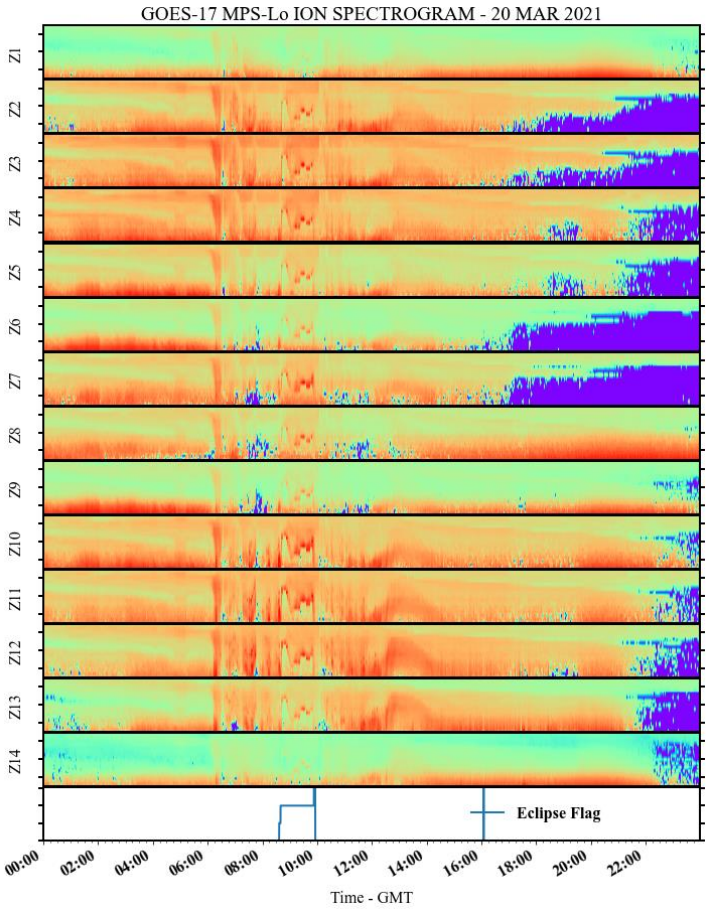
Injection related to second dipolarization

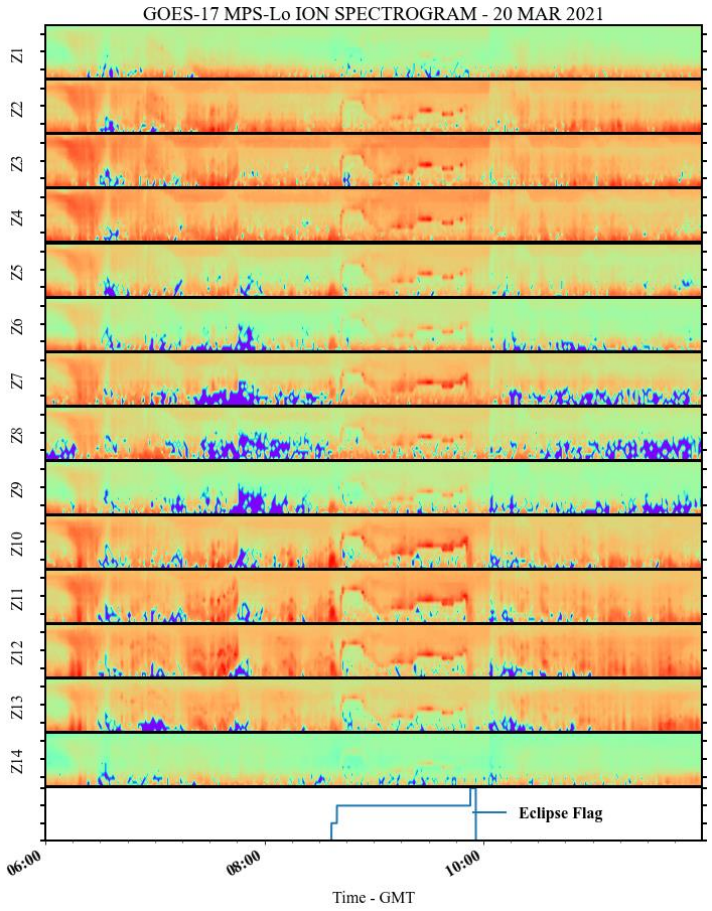




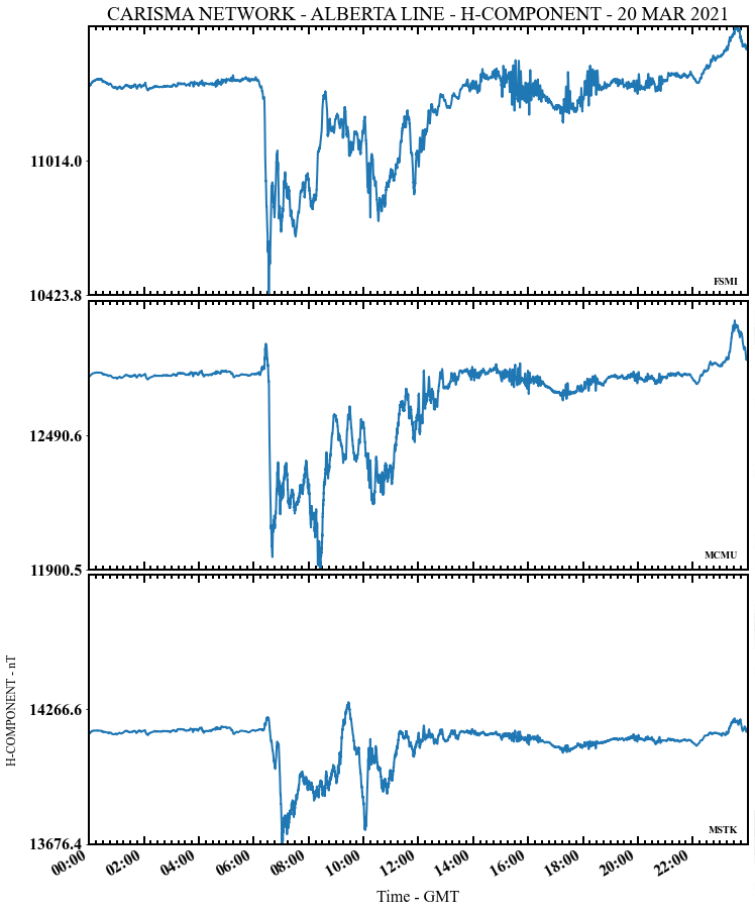
Injection related to first dipolarization

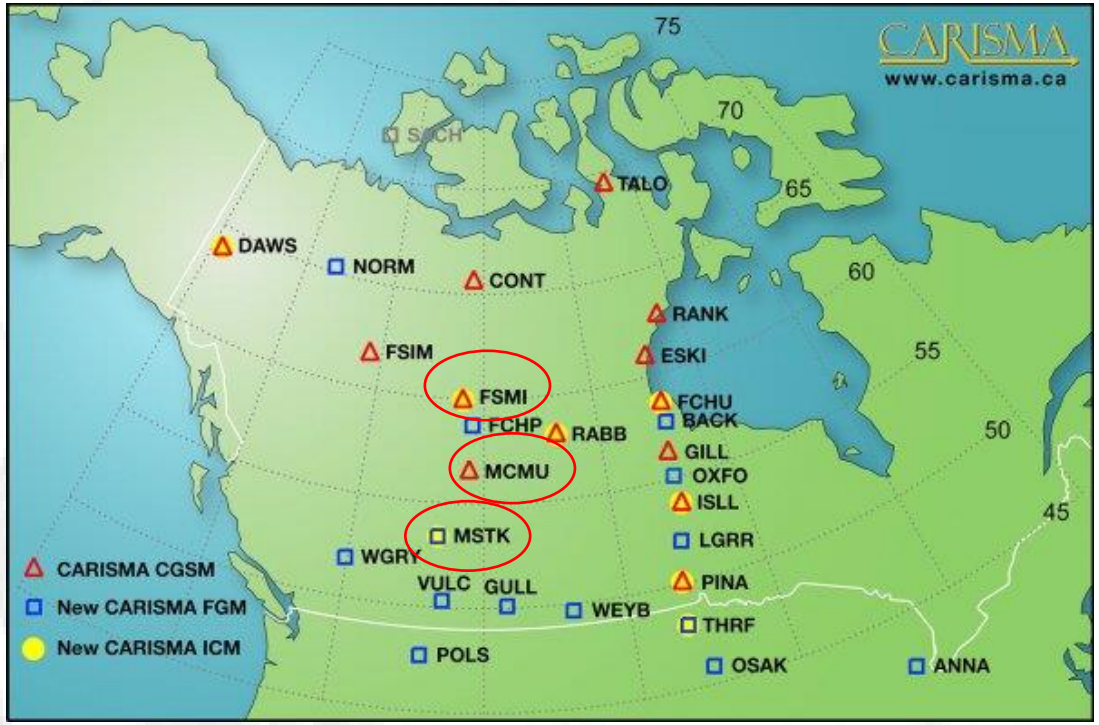
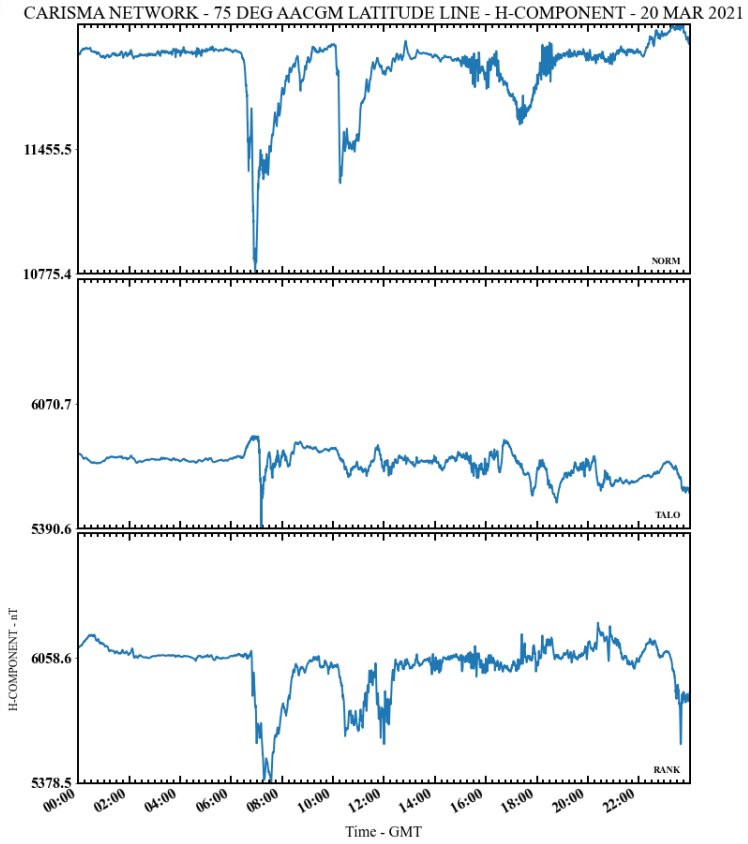
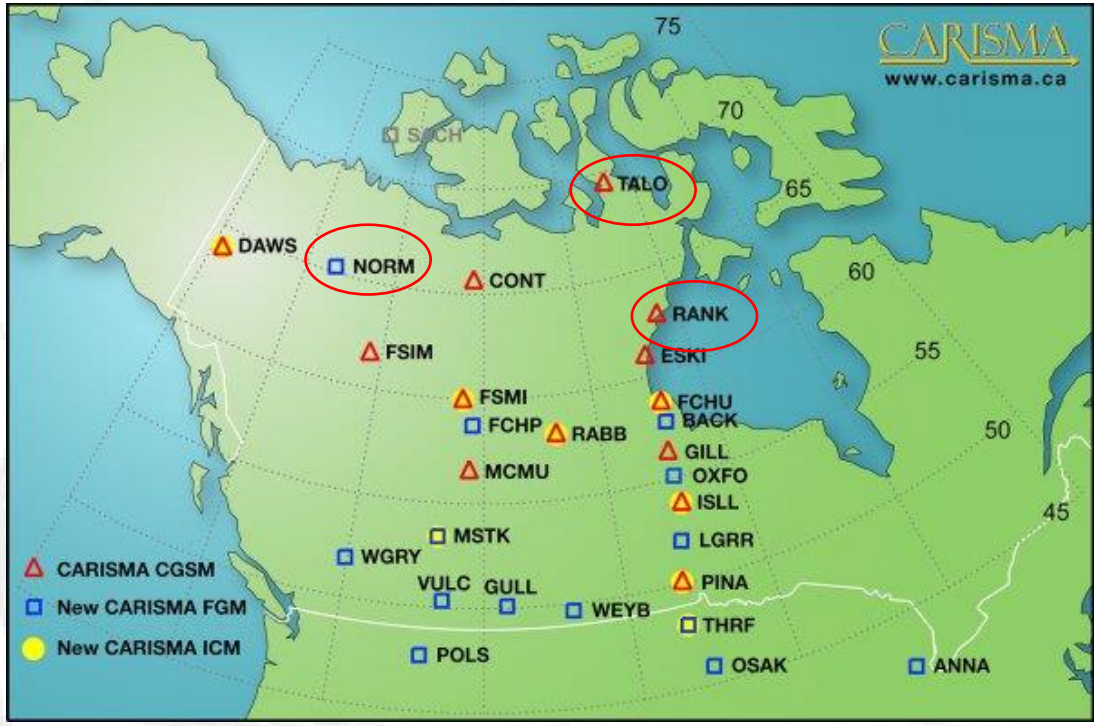
GOES-17 ION SPECTROGRAMS





CARISMA ALBERTA LINE H-COMPONENT





CARISMA 75° AACGM LATITUDE LINE H-COMPONENT