

Space Weather Highlights
21 March - 27 March 2016

SWPC PRF 2117
28 March 2016

Solar activity was at predominately very low levels with an isolated C1 x-ray event observed on 23/0354 UTC from Region 2524 (N15, L=277, class/area Eho/340 on 19 Mar). No Earth-directed coronal mass ejections were observed in coronagraph imagery.

No proton events were observed at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit was at normal levels on 23 March, high levels on 22 March and moderate levels on 21 and 24-27 March.

Geomagnetic field activity ranged from quiet to unsettled levels with an isolated active interval observed early on 23 March. The period began with quiet conditions, but increased to quiet to unsettled levels late on 21 March due to the onset of a weak, positive polarity coronal hole high speed stream (CH HSS). Predominately quiet to unsettled conditions persisted through early on 24 March under the influence of the positive polarity CH HSS. Wind speeds averaged about 425 km/s through midday on 23 March. A gradual increase was then observed to a peak of near 565 km/s early on 25 March before decreasing to about 350 km/s late on 26 March. From 21-25 March, total field (Bt) ranged between 1-10 nT while the Bz component varied between +9 nT to -5 nT.

Quiet conditions persisted from late on the 25th through 26 March. Predominately unsettled levels were observed on 27 March due to the onset of a co-rotating interaction region in advance of another positive polarity CH HSS. On 27 March, wind speeds increased to near 440 km/s, Bt reached a maximum value of 12 nT while the Bz component rotated between +8 nT to -9 nT.

Space Weather Outlook
28 March - 23 April 2016

Solar activity is expected to be at very low levels with a slight chance for C-class flares through the outlook period.

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at moderate levels on 28 March and on 01-03, 07-11 and 17-23 April. High levels are expected on 29-31 March, 04-06 and 12-16 April.

Geomagnetic field activity is expected to be reach G1 (Minor) storm levels on 02-03 and 11-13 April with G2 (Moderate) storm levels expected on 02 and 11 April due to the influence of recurrent, negative polarity CH HSSs. Quiet to unsettled levels are expected on 28-29 March, 04, 08, 14 and 23 April, with isolated active levels expected on 28 March and 23 April, all due to various CH HSSs. Mostly quiet conditions are expected for the remainder of the outlook period.



Daily Solar Data

Date	Radio Flux 10.7cm	Sun spot No.	Sunspot Area (10 ⁻⁶ hemi.)	X-ray Background Flux		Flares						
						X-ray			Optical			
						C	M	X	S	1	2	3
21 March	89	25	220	A8.3	0	0	0	0	0	0	0	0
22 March	87	13	240	B1.3	0	0	0	0	0	0	0	0
23 March	87	14	210	B1.3	1	0	0	0	0	0	0	0
24 March	87	25	310	A8.6	0	0	0	0	0	0	0	0
25 March	86	24	280	A7.5	0	0	0	1	0	0	0	0
26 March	86	23	270	A6.4	0	0	0	1	0	0	0	0
27 March	88	23	270	A7.6	0	0	0	1	0	0	0	0

Daily Particle Data

Date	Proton Fluence (protons/cm ² -day-sr)			Electron Fluence (electrons/cm ² -day-sr)		
	>1 MeV	>10 MeV	>100 MeV	>0.6 MeV	>2MeV	>4 MeV
	21 March		3.3e+05	1.3e+04	3.2e+03	
22 March		2.5e+05	1.3e+04	3.1e+03		5.3e+07
23 March		1.2e+05	1.3e+04	2.9e+03		7.6e+06
24 March		1.6e+05	1.2e+04	2.8e+03		4.5e+06
25 March		1.0e+05	1.2e+04	2.8e+03		8.4e+06
26 March		2.9e+05	1.2e+04	2.8e+03		1.5e+07
27 March		2.9e+05	1.2e+04	3.0e+03		5.0e+06

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	21 March	7	1-1-2-3-2-2-1-2	9	2-1-3-4-2-2-1-1	8
22 March	6	2-2-1-2-2-1-1-2	9	2-1-4-4-2-0-0-0	8	3-2-2-3-2-0-1-2
23 March	7	1-2-3-2-2-2-1-2	15	1-4-5-4-2-0-2-1	10	2-3-4-2-2-1-2-3
24 March	7	3-2-2-1-2-2-1-2	3	2-0-2-1-1-0-1-1	7	3-2-2-2-1-1-1-2
25 March	6	3-1-1-1-2-2-1-1	4	3-1-0-2-2-0-0-0	6	3-2-1-1-1-1-1-0
26 March	2	0-0-1-0-1-2-1-1	0	0-0-0-0-1-0-0-0	3	0-1-1-0-1-1-1-1
27 March	10	2-2-3-3-2-3-2-2	12	2-2-3-3-4-3-2-1	15	3-2-3-3-2-3-3-2

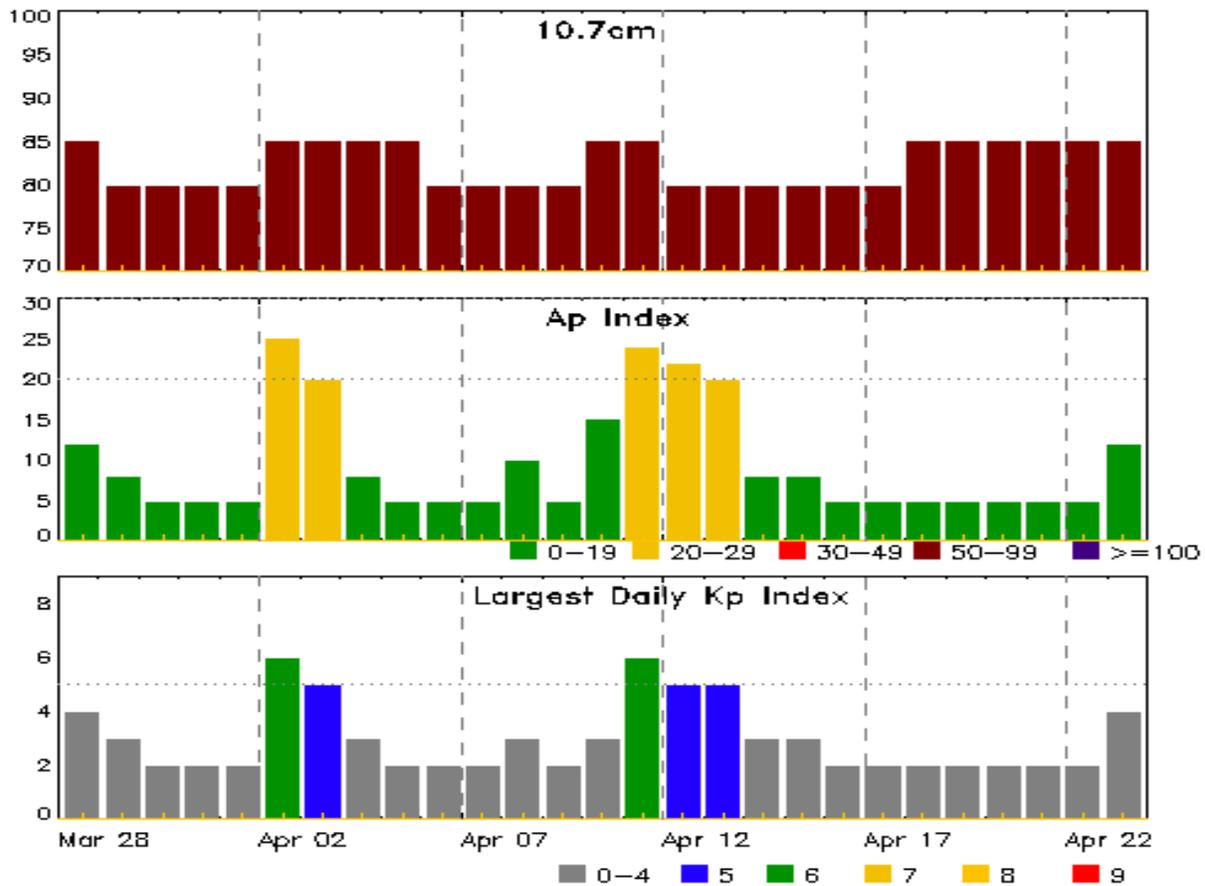


Alerts and Warnings Issued

Date & Time of Issue UTC	Type of Alert or Warning	Date & Time of Event UTC
22 Mar 1424	ALERT: Electron 2MeV Integral Flux \geq 1000pfu	22/1355
23 Mar 0546	WARNING: Geomagnetic K = 4	23/0546 - 1000
23 Mar 0902	ALERT: Geomagnetic K = 4	23/0900
27 Mar 1716	WARNING: Geomagnetic K = 4	27/1716 - 2300
27 Mar 2208	EXTENDED WARNING: Geomagnetic K = 4	27/1716 - 28/0900



Twenty-seven Day Outlook



Date	Radio Flux 10.7cm	Planetary A Index	Largest Kp Index	Date	Radio Flux 10.7cm	Planetary A Index	Largest Kp Index
28 Mar	85	12	4	11 Apr	85	24	6
29	80	8	3	12	80	22	5
30	80	5	2	13	80	20	5
31	80	5	2	14	80	8	3
01 Apr	80	5	2	15	80	8	3
02	85	25	6	16	80	5	2
03	85	20	5	17	80	5	2
04	85	8	3	18	85	5	2
05	85	5	2	19	85	5	2
06	80	5	2	20	85	5	2
07	80	5	2	21	85	5	2
08	80	10	3	22	85	5	2
09	80	5	2	23	85	12	4
10	85	15	3				



Energetic Events

Date	Time			X-ray	Optical Information			Peak		Sweep Freq	
	Begin	Max	Half Max	Class	Integ Flux	Imp/ Brtns	Location Lat CMD	Rgn #	Radio Flux 245	2695	Intensity II

No Events Observed

Flare List

Date	Time			X-ray Class	Imp/ Brtns	Optical		Rgn #
	Begin	Max	End			Location Lat CMD		
23 Mar	0259	0354	0445	C1.1				2524
23 Mar	2205	2209	2212	B2.8				2526
23 Mar	2241	2251	2256	B4.2				2526
24 Mar	1255	1258	1301	B2.0				2526
24 Mar	1659	1702	1705	B3.3				2524
25 Mar	1455	1500	1502	B6.5	SF	S06E68		2526
26 Mar	0719	0722	0724	B1.6	SF	S04E57		2526
26 Mar	0734	0737	0741	B1.7				2526
26 Mar	2312	2317	2327	B1.9				2526
27 Mar	0600	0607	0611	B3.5				2524
27 Mar	B1023	U1033	1043	B1.7	SF	S05E41		2526
27 Mar	1102	1127	1133	B2.1				
27 Mar	1213	1219	1226	B4.2				2524
27 Mar	1633	1638	1642	B4.8				2524
27 Mar	1943	1948	1950	B4.8				2524



Region Summary

Date	Location		Sunspot Characteristics				Flares											
	Lat CMD	Lon	Area 10 ⁶ hemi.	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical							
								C	M	X	S	1	2	3	4			
Region 2519																		
09 Mar	N06E76	10	70	1	Hsx	1	A	2										
10 Mar	N06E61	11	50	2	Cao	2	B											
11 Mar	N06E48	11	50	5	Cao	3	B											
12 Mar	N05E39	7	80	7	Cso	4	B											
13 Mar	N05E26	7	80	11	Cso	5	B											
14 Mar	N05E08	12	80	2	Hsx	1	A											
15 Mar	N05W05	12	60	2	Hsx	1	A											
16 Mar	N05W17	10	90	5	Dso	4	B											
17 Mar	N04W33	13	80	3	Cso	3	B											
18 Mar	N04W48	15	70	2	Hsx	2	A					1						
19 Mar	N04W62	15	70	1	Hsx	1	A					1						
20 Mar	N03W74	14	70	1	Hsx	1	A											
21 Mar	N04W89	16	20	1	Hsx	1	A											
								2	0	0	2	0	0	0	0	0		

Crossed West Limb.

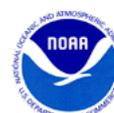
Absolute heliographic longitude: 12

Region 2523

16 Mar	S10W22	15	10	3	Bxo	3	B											
17 Mar	S09W35	15	10	2	Axx	3	A											
18 Mar	S07W50	17	plage															
19 Mar	S07W65	19	plage															
20 Mar	S07W80	21	plage															
								0	0	0	0	0	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 15



Region Summary - continued

Date	Location		Sunspot Characteristics				Flares											
	Lat CMD	Lon	Helio 10 ⁶ hemi.	Area	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical						
									C	M	X	S	1	2	3	4		
Region 2524																		
16 Mar	N14E69	284	70	2	Hsx	1	A											
17 Mar	N14E63	277	210	12	Eao	6	B											
18 Mar	N15E49	278	230	11	Eao	7	B						1					
19 Mar	N15E36	277	340	12	Eho	5	B											
20 Mar	N15E21	278	240	12	Eso	4	B						1					
21 Mar	N15E09	278	200	12	Eso	4	B											
22 Mar	N15W03	277	240	12	Eso	3	B											
23 Mar	N15W16	277	210	13	Eso	4	B	1										
24 Mar	N14W29	277	190	11	Eso	4	B											
25 Mar	N13W44	278	100	11	Eso	3	B											
26 Mar	N14W61	282	80	3	Hsx	1	A											
27 Mar	N14W75	283	80	3	Hsx	1	A											
								1	0	0	2	0	0	0	0	0		

Still on Disk.

Absolute heliographic longitude: 277

Region 2525																		
17 Mar	N12E13	327	10	3	Axx	2	A											
18 Mar	N13W01	328	plage															
19 Mar	N13W15	329	plage															
20 Mar	N13W29	330	plage															
21 Mar	N13W43	330	plage															
22 Mar	N13W57	331	plage															
23 Mar	N13W71	332	plage															
24 Mar	N13W85	333	plage															
								0	0	0	0	0	0	0	0	0	0	

Crossed West Limb.

Absolute heliographic longitude: 328

Region 2526																		
24 Mar	S05E72	176	120	2	Hsx	1	A											
25 Mar	S04E59	175	180	3	Hsx	1	A						1					
26 Mar	S04E45	176	190	3	Hsx	2	A						1					
27 Mar	S04E30	178	190	3	Hsx	2	A						1					
								0	0	0	3	0	0	0	0	0		

Still on Disk.

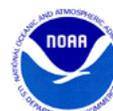
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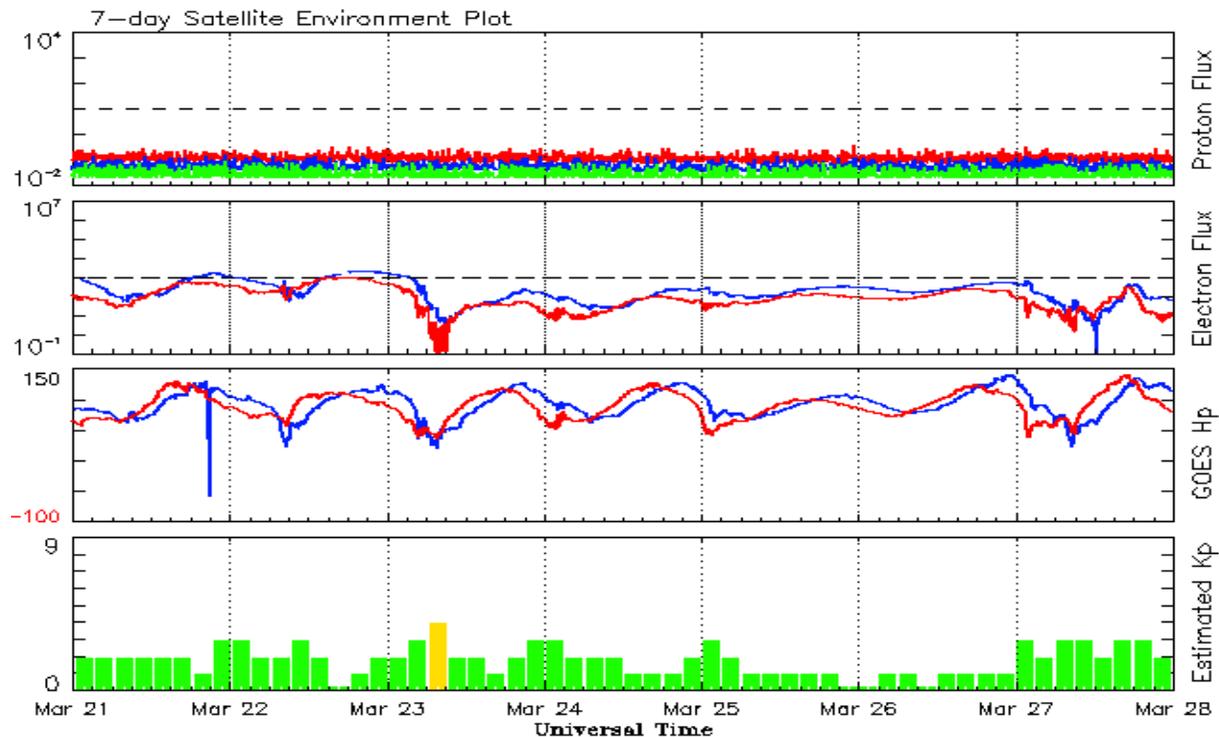


Recent Solar Indices (preliminary)
Observed monthly mean values

Month	Sunspot Numbers					Radio Flux		Geomagnetic	
	Observed values		Ratio	Smooth values		Penticton	Smooth	Planetary	Smooth
	SEC	RI	RI/SEC	SEC	RI	10.7 cm	Value	Ap	Value
2014									
March	141.1	91.9	0.65	123.2	80.8	149.9	140.8	6	7.2
April	130.5	67.5	0.65	124.8	69.8	144.3	143.5	9	7.5
May	116.8	67.5	0.64	122.3	69.0	130.0	144.7	7	7.9
June	107.7	61.7	0.66	121.4	68.5	122.2	145.5	7	8.4
July	113.6	60.1	0.64	120.4	67.6	137.3	145.2	5	8.8
August	106.2	64.1	0.70	115.1	65.0	124.7	142.8	9	8.9
September	127.4	78.0	0.69	107.4	61.1	146.1	140.1	11	9.3
October	92.0	54.0	0.66	101.7	58.4	153.7	138.4	10	9.9
November	101.8	62.2	0.69	97.9	56.8	155.3	137.4	10	10.1
December	120.0	67.7	0.65	95.2	55.3	158.7	137.0	12	10.5
2015									
January	101.2	55.8	0.66	92.1	53.6	141.7	135.8	10	11.0
February	70.6	40.0	0.63	88.3	51.7	128.8	133.8	10	11.5
March	61.7	32.7	0.62	84.2	49.3	126.0	131.2	17	12.0
April	72.5	45.2	0.75	80.5	47.3	129.2	127.3	12	12.4
May	83.0	53.3	0.71	77.5	45.6	120.1	123.3	9	12.7
June	77.3	39.9	0.53	73.1	43.2	123.2	119.5	14	13.0
July	68.4	39.5	0.58	68.2	40.9	107.0	116.0	10	13.1
August	61.6	38.6	0.63	65.5	39.8	106.2	113.3	16	13.1
September	72.5	47.2	0.65			102.1		16	
October	59.5	37.0	0.62			104.1		15	
November	61.8	37.9	0.61			109.6		13	
December	54.1	34.6	0.64			112.8		15	
2016									
January	50.4	34.0	0.67			103.5		10	
February	56.0	34.3	0.61			103.5		10	

Note: Values are final except for the most recent 6 months which are considered preliminary.
Cycle 24 started in Dec 2008 with an RI=1.7.





*Weekly Geosynchronous Satellite Environment Summary
Week Beginning 21 March 2016*

The proton flux plot contains the five-minute averaged integral proton flux (protons/cm²-sec -sr) as measured by the SWPC Primary GOES satellite, near West 75, for each of three energy thresholds: greater than 10, 50, and 100 MeV.

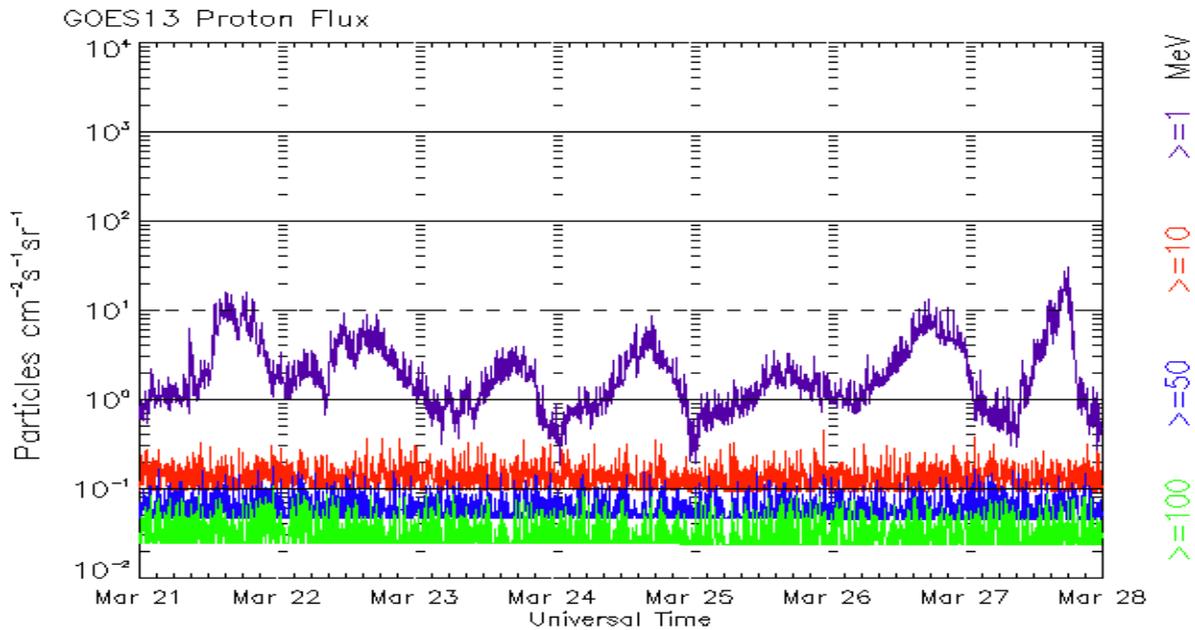
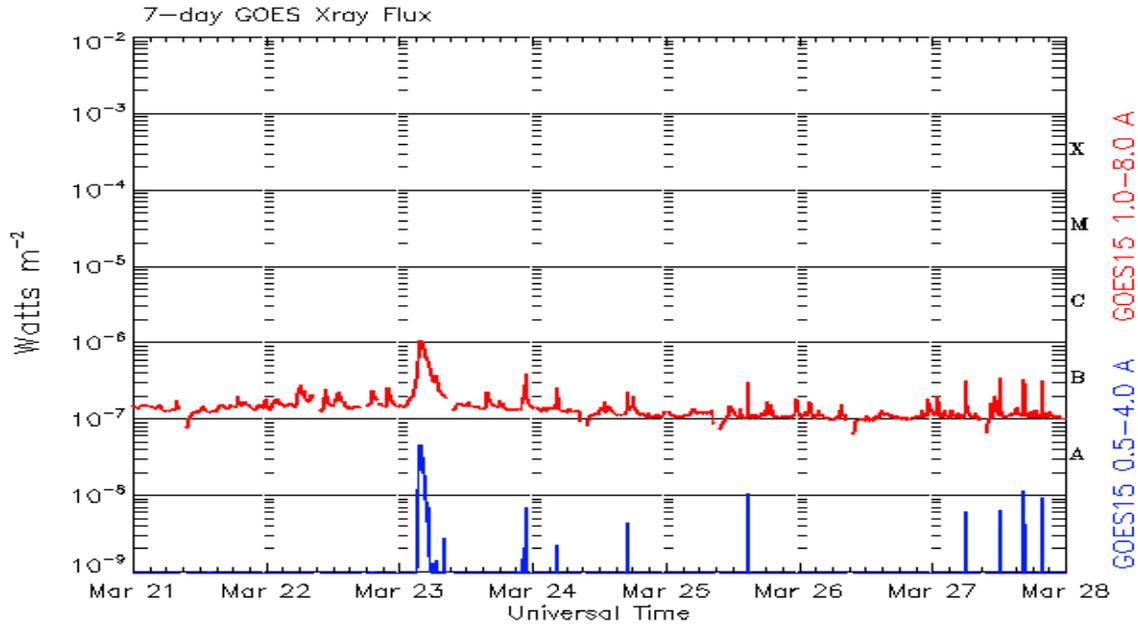
The electron flux plot contains the five-minute averaged integral electron flux (electrons/cm²-sec -sr) with energies greater than 2 MeV by the SWPC Primary GOES satellite.

The Hp plot contains the five minute averaged Hp magnetic field component in nanoteslas (nT) as by the SWPC Primary GOES satellite. The Hp component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.

The Estimated 3-hour Planetary Kp-index is derived at the NOAA Space Weather Prediction Center using data from the following ground-based magnetometers: Boulder, Colorado; Chambon la Foret, France; Fredericksburg, Virginia; Fresno, California; Hartland, UK; Newport, Washington; Sitka, Alaska. These data are made available thanks to the cooperative efforts between SWPC and data providers around the world, which currently includes the U.S. Geological Survey, the British Geological Survey, and the Institut de Physique du Globe de Paris.

The data included here are those now available in real time at the SWPC and are incomplete in that they do not include the full set of parameters and energy ranges known to cause satellite operating anomalies. The proton and electron fluxes and Kp are 'global' parameters that are applicable to a first order approximation over large areas. H parallel is subject to more localized phenomena and the measurements generally are applicable to within a few degrees of longitude of the measuring satellite.





*Weekly GOES Satellite X-ray and Proton Plots
Week Beginning 21 March 2016*

The x-ray plots contains five-minute averages x-ray flux (Watt/ m^2) as measure by the SWPC primary GOES X-ray satellite, usually at West 105 longitude, in two wavelength bands, 0.05 - 0.4 and 0.1 - 0.8 nm. The letters A, B, C, M and X refer to x-ray event levels for the 0.1 - 0.8 nm band.

The proton plot contains the five-minute averaged integral flux units (pfu = protons/ cm^2 -sec -sr) as measured by the primary SWPC GOES Proton satellite for each of the energy thresholds: >1, >10, >30, and >100 MeV. The P10 event threshold is 10 pfu at greater than 10 MeV.



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Space Weather Prediction Center
325 Broadway, Boulder CO 80305

Notice: The 27-day Outlook, Satellite Environment, X-ray and Proton plots have been redesigned. Comments and suggestions are welcome SWPC.Webmaster@noaa.gov

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