Space Weather Highlights
14 March - 20 March 2016

SWPC PRF 2116
21 March 2016

Solar activity ranged from very low to low levels during the period. Low levels were observed on 15, 16 and 19 March due to isolated, weak C-class flares from Regions 2521 (N19, L=029, class/area Dao/080 on 14 Mar) and 2522 (N14, L=078, class/area Cao/040 on 15 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 moderate levels on 14, 15 and 19 March and high levels on 16-18 and 20 March.

Geomagnetic field activity ranged from quiet to minor storm levels (G1-minor). The period began with quiet conditions, but increased to unsettled to minor storm levels late on 14 March due to the onset of a co-rotating interaction region (CIR) in advance of a coronal hole high speed stream (CH HSS) that originated from a negative extension off of the southern crown. With the CIR, wind speeds rapidly increased from about 360 km/s to near 565 km/s by late on the 14th. The interplanetary magnetic field (IMF) responded with total field (Bt) readings of 23 nT while the Bz component rotated between +18 nT to - 19 nT.

Geomagnetic field conditions remained elevated through 18 March with quiet to minor storm levels. Solar wind conditions also remained enhanced with wind speeds that approached 600 km/s midday on the 17th. Bt and Bz relaxed by early on 15 March with Bt fairly steady at 10 nT with Bz varying between +/- 8 nT. 18 and 19 March saw quiet to active levels due to prolonged periods of southward Bz. During this time frame, wind speeds averaged about 425 km/s.

Space Weather Outlook
21 March - 16 April 2016

Solar activity is expected to be at very low levels with a chance for C-class activity throughout 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 high levels on 21-22 March, 04-06 April and 12-16 April. Normal to moderate levels are expected for the remainder of the outlook period.

Geomagnetic field activity is expected to reach G2-moderate storm levels on 02 April with G1-minor storm levels expected on 03, 11-13 April due to the influence of recurrent, negative polarity CH HSSs. Quiet to unsettled conditions are expected for the remainder of the outlook period under a nominal solar wind regime.

Daily Solar Data

Date	Radio Flux 10.7cm	Sun spot No.	Sunspot Area (10^{-6} hemi.)	X-ray Background		Flares						
						X-ray			Optical			
						C	M	X	S	1	2	3	4
14 March	93	57	220	B1.5	0	0	3	0	0	0	0	0
15 March	94	44	170	B1.9	2	0	3	0	0	0	0	0
16 March	91	53	190	B1.8	1	0	0	0	0	0	0	0
17 March	92	66	320	B1.6	0	0	0	0	0	0	0	0
18 March	90	29	300	B1.2	0	0	2	0	0	0	0	0
19 March	89	26	410	B1.2	0	0	1	0	0	0	0	0
20 March	88	25	310	A9.3	2	0	1	0	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
14 March	2.5e+05	1.3e+04	2.9e+03	3.9e+06		
15 March	2.9e+05	1.3e+04	2.9e+03	4.6e+06		
16 March	1.4e+06	3.5e+04	3.2e+03	7.7e+07		
17 March	1.5e+06	1.4e+04	2.9e+03	8.7e+07		
18 March	3.6e+05	1.3e+04	3.1e+03	1.9e+08		
19 March	2.7e+05	1.3e+04	3.1e+03	2.9e+07		
20 March	2.6e+05	1.3e+04	3.1e+03	3.4e+07		

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
14 March	11	1-2-2-2-2-3-3-4	8	0-0-3-3-1-1-3-3	14	2-2-2-2-1-3-4-5
15 March	17	3-4-4-3-1-3-3-3	33	3-4-6-6-3-3-3-3	24	4-4-4-4-2-3-5-4
16 March	13	4-2-3-2-2-2-2-4	26	4-3-4-5-5-2-2-4	22	5-2-3-3-3-1-3-5
17 March	16	4-4-4-3-2-2-2-2	40	5-5-3-6-6-4-3-2	21	5-5-3-4-2-3-3-3
18 March	6	1-1-3-2-2-1-1-2	23	1-1-3-6-5-4-2-1	8	2-2-3-2-2-2-2-3
19 March	12	2-3-3-3-3-3-3-0	38	2-3-5-7-5-4-3-0	18	2-3-4-4-3-4-2-1
20 March	6	1-3-1-1-2-2-2-1	21	1-2-1-3-4-6-4-2	6	2-3-2-2-2-3-4-2

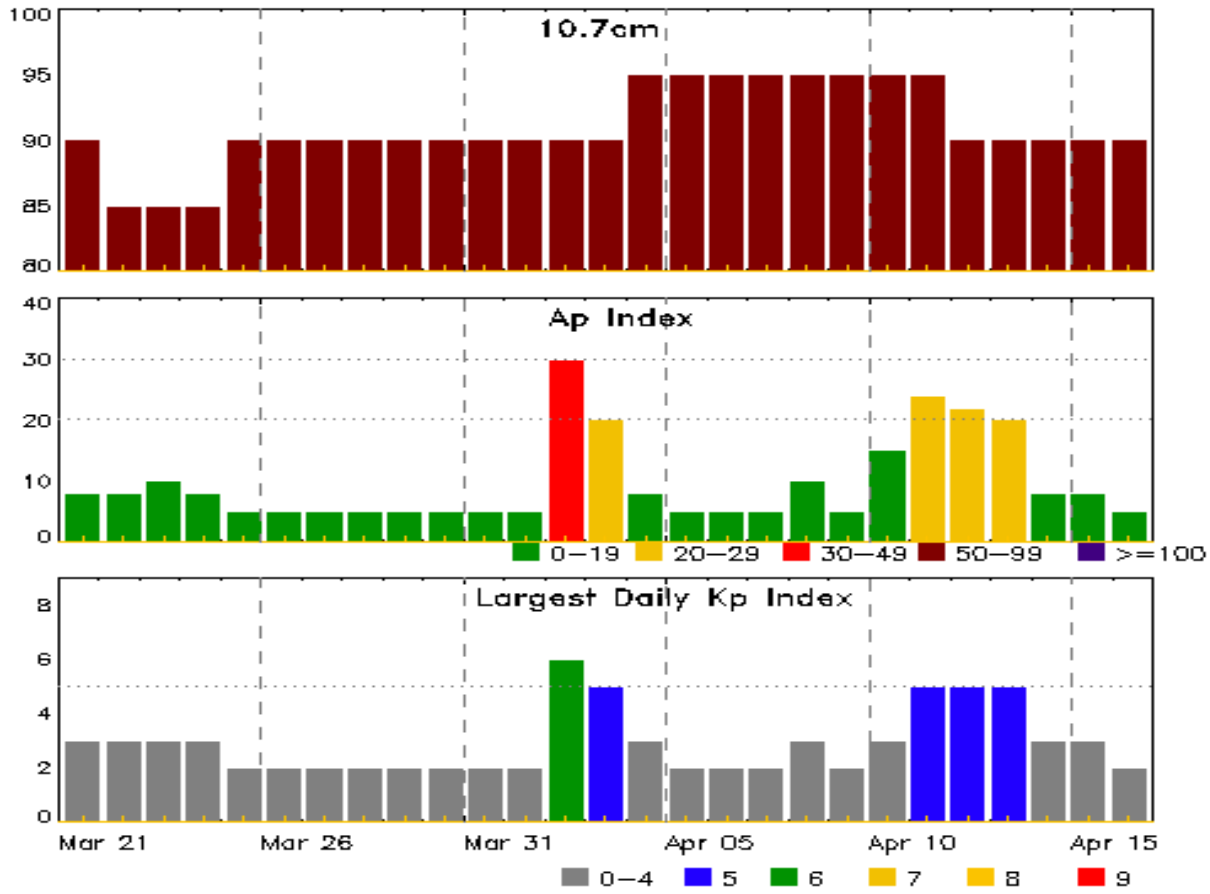
Alerts and Warnings Issued

Date & Time of Issue UTC	Type of Alert or Warning	Date & Time of Event UTC
14 Mar 1847	WARNING: Geomagnetic K = 4	14/1848 - 15/1300
14 Mar 1851	WARNING: Geomagnetic K = 5	14/1855 - 15/0700
14 Mar 2105	ALERT: Geomagnetic K = 4	14/2059
14 Mar 2236	ALERT: Geomagnetic K = 5	14/2235
15 Mar 0613	EXTENDED WARNING: Geomagnetic K = 4	14/1848 - 15/2359
15 Mar 0613	EXTENDED WARNING: Geomagnetic K = 5	14/1855 - 15/1600
15 Mar 2026	WARNING: Geomagnetic K = 5	15/2025 - 16/0600
15 Mar 2026	EXTENDED WARNING: Geomagnetic K = 4	14/1848 - 16/1200
15 Mar 2051	ALERT: Geomagnetic K = 5	15/2050
16 Mar 0055	ALERT: Geomagnetic K = 5	16/0055
16 Mar 0545	EXTENDED WARNING: Geomagnetic K = 5	15/2025 - 16/1200
16 Mar 0545	EXTENDED WARNING: Geomagnetic K = 4	14/1848 - 16/1500
16 Mar 0846	ALERT: Type II Radio Emission	16/0645
16 Mar 1322	ALERT: Electron 2MeV Integral Flux >= 1000pfu	16/1300
16 Mar 1434	EXTENDED WARNING: Geomagnetic K = 4	14/1848 - 17/0300
16 Mar 2241	WARNING: Geomagnetic K = 5	16/2235 - 17/0300
16 Mar 2241	WATCH: Geomagnetic Storm Category G1 predicted	
16 Mar 2248	ALERT: Geomagnetic K = 5	16/2246
17 Mar 0223	ALERT: Geomagnetic K = 5	17/0222
17 Mar 0223	EXTENDED WARNING: Geomagnetic K = 4	14/1848 - 17/1500
17 Mar 0223	EXTENDED WARNING: Geomagnetic K = 5	16/2235 - 17/0900
17 Mar 0549	ALERT: Geomagnetic K = 5	17/0549
17 Mar 0851	EXTENDED WARNING: Geomagnetic K = 4	14/1848 - 17/1800
17 Mar 0851	EXTENDED WARNING: Geomagnetic K = 5	16/2235 - 17/1500
17 Mar 0851	CONTINUED ALERT: Electron 2MeV Integral Flux >= 1000pfu	16/1300
17 Mar 1743	EXTENDED WARNING: Geomagnetic K = 4	14/1848 - 18/0600
18 Mar 0653	CONTINUED ALERT: Electron 2MeV Integral Flux >= 1000pfu	16/1300
19 Mar 0634	WARNING: Geomagnetic K = 4	19/0650 - 1500

Alerts and Warnings Issued

Date & Time of Issue UTC	Type of Alert or Warning	Date & Time of Event UTC
19 Mar 0818	ALERT: Geomagnetic K = 4	19/0814
19 Mar 1427	EXTENDED WARNING: Geomagnetic K = 4	19/0650 - 2100
20 Mar 1545	ALERT: Electron 2MeV Integral Flux >= 1000pfu	20/1530
20 Mar 1800	WARNING: Geomagnetic K = 4	20/1800 - 2200
20 Mar 2102	ALERT: Geomagnetic K = 4	20/2059

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
21 Mar	90	8	3	04 Apr	95	8	3
22	85	8	3	05	95	5	2
23	85	10	3	06	95	5	2
24	85	8	3	07	95	5	2
25	90	5	2	08	95	10	3
26	90	5	2	09	95	5	2
27	90	5	2	10	95	15	3
28	90	5	2	11	95	24	5
29	90	5	2	12	90	22	5
30	90	5	2	13	90	20	5
31	90	5	2	14	90	8	3
01 Apr	90	5	2	15	90	8	3
02	90	30	6	16	90	5	2
03	90	20	5				

Energetic Events

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

No Events Observed

Flare List

	Time				Optical		
Date	Begin	Max	End	X-ray Class	Imp/ Brtns	Location Lat CMD	Rgn #
14 Mar	1103	1111	1120	B6.9			2522
14 Mar	1443	1447	1453		SF	N15W55	
14 Mar	1752	1758	1802	B6.4	SF	N15W56	2522
14 Mar	2233	2234	2237		SF	N15W56	2522
14 Mar	2241	2246	2253	B5.1			2522
15 Mar	0347	0421	0452	B4.3			
15 Mar	0923	0929	0934	C1.2	SF	N21W14	2521
15 Mar	1532	1538	1543	C1.0	SF	N20W15	2521
15 Mar	1647	1651	1654	B6.4			2521
15 Mar	1805	1811	1820	B8.6			2521
15 Mar	2037	2040	2048	B5.2	SF	N20W15	2521
16 Mar	0634	0646	0657	C2.2			2522
16 Mar	1952	1955	1957	B4.3			2519
17 Mar	1613	1616	1622	B3.5			2524
18 Mar	0011	0017	0024	B5.1			2523
18 Mar	1852	1856	1900	B3.4			2521
18 Mar	1922	1922	1929		SF	N13E55	2524
18 Mar	2303	2318	2331	B6.7	SF	N06W40	2519
19 Mar	0841	0843	0845		SF	N05W43	2519
19 Mar	1307	1311	1314	B2.1			2524
20 Mar	0040	0049	0105	C1.2			2521
20 Mar	0122	0133	0138	C3.7			2521
20 Mar	1133	1140	1144	B3.5			
20 Mar	1151	1151	1155		SF	N18E33	2524
20 Mar	1759	1802	1808	B2.1			

Region Summary

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
			Region 2513												
02 Mar	N11E84	94	60	1	Hsx	1	A								
03 Mar	N11E63	12	30	3	Hsx	1	A								
04 Mar	N12E49	103	40	2	Hsx	1	A								
05 Mar	N12E36	102	50	2	Hsx	1	A								
06 Mar	N12E23	102	50	2	Hsx	1	A								
07 Mar	N11E09	103	40	1	Hsx	1	A								
08 Mar	N10W03	102	40	2	Hsx	1	A								
09 Mar	N10W17	103	40	2	Hsx	1	A								
10 Mar	N10W31	103	40	2	Hsx	1	A								
11 Mar	N10W44	103	40	2	Hsx	1	A								
12 Mar	N10W57	103	50	2	Hsx	1	A	1			1				
13 Mar	N09W72	105	40	1	Hsx	1	A								
14 Mar	N08W83	103	20	1	Hsx	1	A								
								1	0	0	1	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 102

			Region 2518												
09 Mar	N04W29	115	30	3	Cao	5	B								
10 Mar	N04W41	113	20	4	Cro	5	B								
11 Mar	N04W54	113	10	2	Axx	2	A								
12 Mar	N04W69	115	plage												
13 Mar	N04W84	117	plage												
								0	0	0	0	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 115

Region Summary - continued

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	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								
								2	0	0	2	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 12

			Region 2520												
12 Mar	N04E17	29	10	3	Bxo	2	B								
13 Mar	N04E02	31	plage												
14 Mar	N04W13	33	plage												
15 Mar	N04W28	35	plage												
16 Mar	N04W43	36	plage												
17 Mar	N04W58	38	plage												
18 Mar	N04W73	40	plage												
19 Mar	N04W88	42	plage												
								0	0	0	0	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 31

Region Summary - continued

	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
			Region 2521												
12 Mar	N19E18	28	70	4	Cao	9	B				1				
13 Mar	N20E04	29	80	5	Dao	7	B				1				
14 Mar	N19W09	29	80	6	Dao	12	B								
15 Mar	N19W21	28	70	6	Dai	10	B	2			3				
16 Mar	N17W37	30	20	5	Cro	5	B								
17 Mar	N18W49	29	10	1	Axx	2	A								
18 Mar	N18W63	30	plage												
19 Mar	N18W77	31	plage												
								2	0	0	5	0	0	0	0

Died on Disk.
Absolute heliographic longitude: 29

			Region 2522												
14 Mar	N14W56	76	40	4	Cao	3	B				2				
15 Mar	N14W71	78	40	5	Cao	3	B								
16 Mar	N14W85	78	plage					1							
								1	0	0	2	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 76

			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

Still on Disk.
Absolute heliographic longitude: 15

			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				
								0	0	0	2	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 278

Region Summary - continued

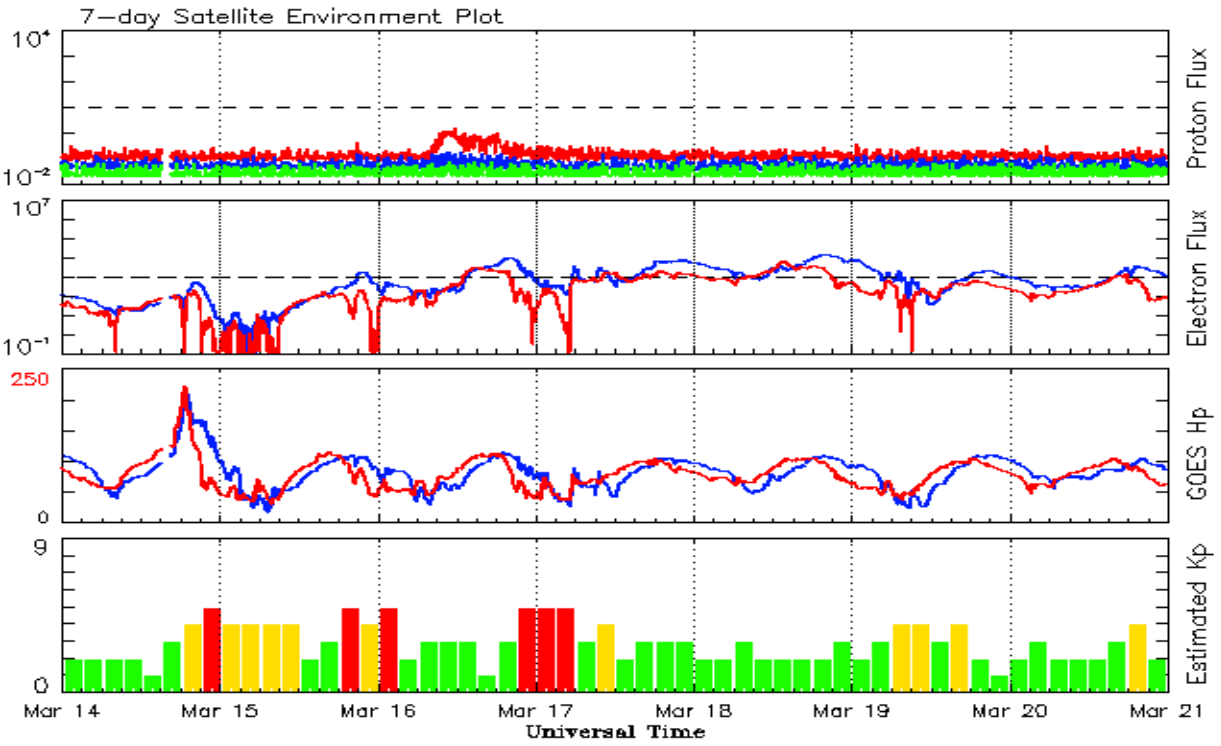
	Location		Sunspot Characteristics					Flares							
		Helio	Area	Extent	Spot	Spot	Mag	X-ray			Optical				
Date	Lat CMD	Lon	10^{-6} hemi.	(helio)	Class	Count	Class	C	M	X	S	1	2	3	4
		Region 2525													
17 Mar	N12E13	327	10	3	Axx	2	A								
18 Mar	N13W01	328	plage												
19 Mar	N13W15	329	plage												
20 Mar	N13W29	330	plage												
								0	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 328

Recent Solar Indices (preliminary)
Observed monthly mean values

	Sunspot Numbers					Radio Flux		Geomagnetic	
	Observed values		Ratio	Smooth values		Penticton	Smooth	Planetary	Smooth
Month	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 14 March 2016

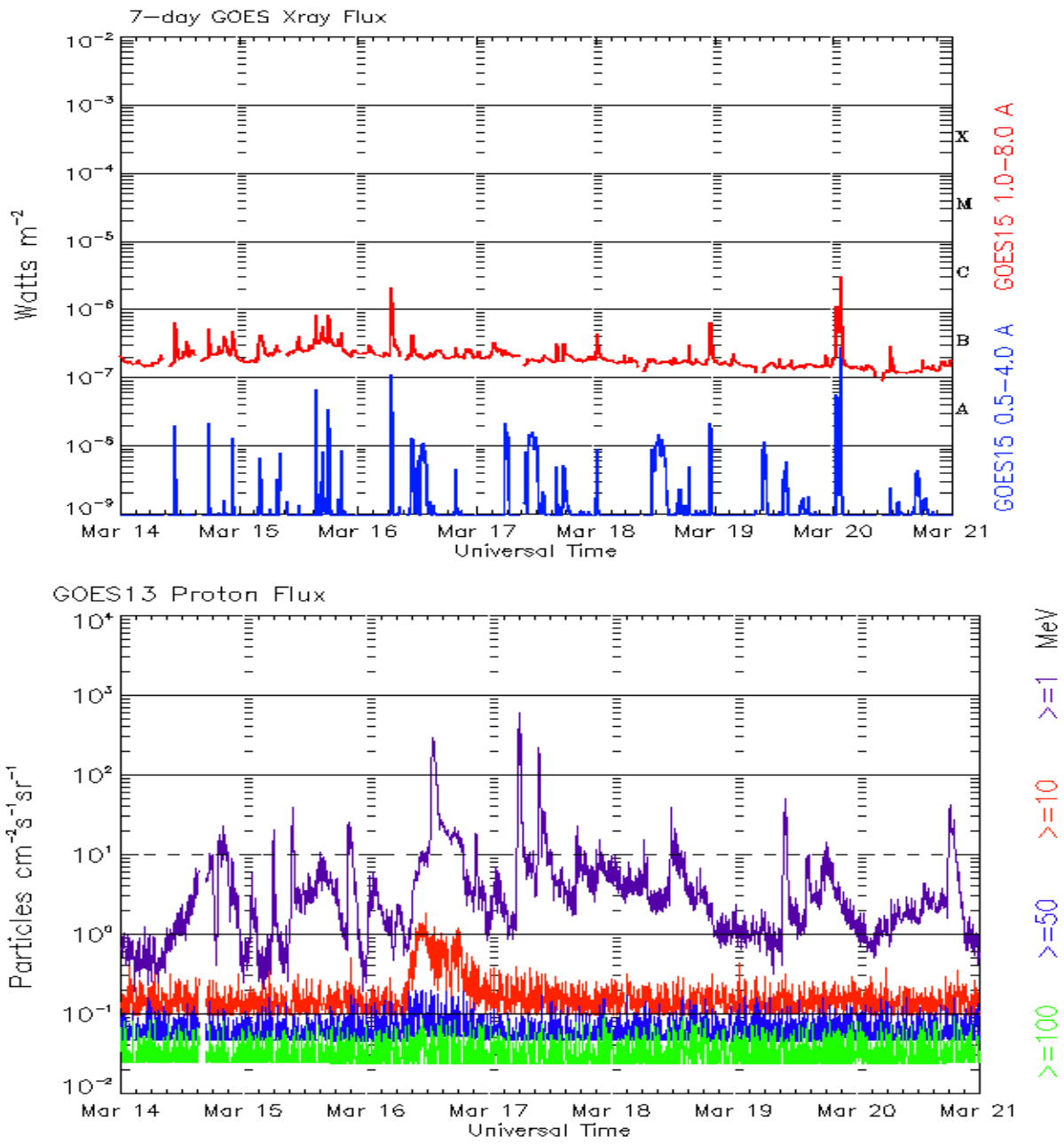
The proton flux plot contains the five-minute averaged integral proton flux (protons/cm^2-sec -sr) as measured by the SWPC Primary GOES satellite, near West 75, for each of three energy thresholds: greater than 10, 50, and 100 MeV.

The electron flux plot contains the five-minute averaged integral electron flux (electrons/cm^2-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 14 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 intergral 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.

Preliminary Report and Forecast of Solar Geophysical Data (The Weekly)

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

The Weekly has been published continuously since 1951 and is available online since 1997.

http://spaceweather.gov/weekly/ -- Current and previous year
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