

**Space Weather Highlights**  
**29 February - 06 March 2016**

**SWPC PRF 2114**  
**07 March 2016**

Solar activity reached low levels on 04 March due to a C1 flare from Region 2506 (S06, L=223, class/area=Dai/130 on 29 Feb) at 0900 UTC. Very low levels were observed for the remainder of the period. No Earth-directed coronal mass ejections (CMEs) were observed in coronagraph imagery.

No proton events were observed at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit reached moderate levels throughout the period.

Geomagnetic field activity was at quiet or quiet to unsettled levels until 06 March, when a negative polarity coronal hole high-speed stream (CH HSS) became geoeffective. During the onset of the co-rotating interaction region (CIR) total field (Bt) to a maximum of 22 nT at 06/1646 UTC while the Bz component reached a maximum southward deflection of -18 nT at 06/1834 UTC. Solar wind speeds increased to a peak of around 580 km/s at the end of the period. The geomagnetic field reached G1 (Minor) during the 1500-1800 synoptic period, G2 (Moderate) during the 1800-2100 synoptic period, and G3 (Strong) Geomagnetic Storm levels during the 2100-2400 UTC synoptic period.

**Space Weather Outlook**  
**07 March - 02 April 2016**

Solar activity is expected to be at very low levels, with a chance for C-class flares, throughout the forecast period.

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at high levels from 07-10 March and 17-22 March due to CH HSS effects. Moderate levels are expected from 11-16 March and 23 March - 02 April.

Geomagnetic field activity is likely to reach G1 (Minor) geomagnetic storm levels on 07 March, 17-19 March, and 02 Apr in response to effects from multiple coronal holes. Quiet to quiet to unsettled conditions are anticipated for rest of the forecast period under nominal solar wind conditions.



### *Daily Solar Data*

Date	Radio Flux 10.7cm	Sun spot No.	Sunspot Area (10 <sup>-6</sup> hemi.)	X-ray Background Flux	Flares							
					X-ray			Optical				
					C	M	X	S	1	2	3	4
29 February	91	44	160	B1.5	0	0	0	1	0	0	0	0
01 March	97	39	140	B1.6	0	0	0	0	0	0	0	0
02 March	98	65	220	B1.7	0	0	0	0	0	0	0	0
03 March	99	50	150	B1.2	0	0	0	0	0	0	0	0
04 March	101	95	190	B1.5	1	0	0	1	0	0	0	0
05 March	96	68	180	B1.2	0	0	0	1	0	0	0	0
06 March	96	68	140	B1.4	0	0	0	2	0	0	0	0

### *Daily Particle Data*

Date	Proton Fluence (protons/cm <sup>2</sup> -day -sr)			Electron Fluence (electrons/cm <sup>2</sup> -day -sr)		
	>1 MeV	>10 MeV	>100 MeV	>0.6 MeV	>2MeV	>4 MeV
	29 February	3.2e+05	1.3e+04	2.9e+03	2.9e+03	2.3e+07
01 March	3.6e+05	1.3e+04	3.2e+03	3.2e+03	5.2e+06	
02 March	2.7e+05	1.4e+04	3.5e+03	3.5e+03	2.8e+06	
03 March	1.9e+05	1.4e+04	3.7e+03	3.7e+03	6.5e+06	
04 March	1.4e+05	1.3e+04	3.4e+03	3.4e+03	1.0e+07	
05 March	2.7e+05	1.3e+04	3.0e+03	3.0e+03	8.9e+06	
06 March	3.7e+05	1.2e+04	2.9e+03	2.9e+03	5.4e+06	

### *Daily Geomagnetic Data*

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	29 February	4	2-1-1-1-1-1-1-2	3	1-0-1-2-2-0-0-1	5
01 March	8	3-2-2-1-2-2-1-3	7	1-1-2-3-3-1-1-1	9	3-2-2-2-2-2-1-3
02 March	7	3-1-1-2-3-2-1-0	6	1-0-0-3-3-3-1-0	7	3-1-1-2-2-3-1-1
03 March	7	1-3-2-3-2-1-1-1	11	1-1-2-5-3-2-0-2	8	2-3-2-3-2-1-1-2
04 March	2	2-1-0-1-1-1-0-0	2	1-1-0-2-0-1-0-0	4	3-1-0-1-0-1-1-0
05 March	3	0-0-2-1-2-1-1-0	8	0-0-2-4-4-1-0-0	4	0-0-2-2-2-1-1-1
06 March	19	1-1-2-2-2-4-5-5	28	0-0-1-1-1-7-4-5	3	1-1-2-2-2-5-6-7

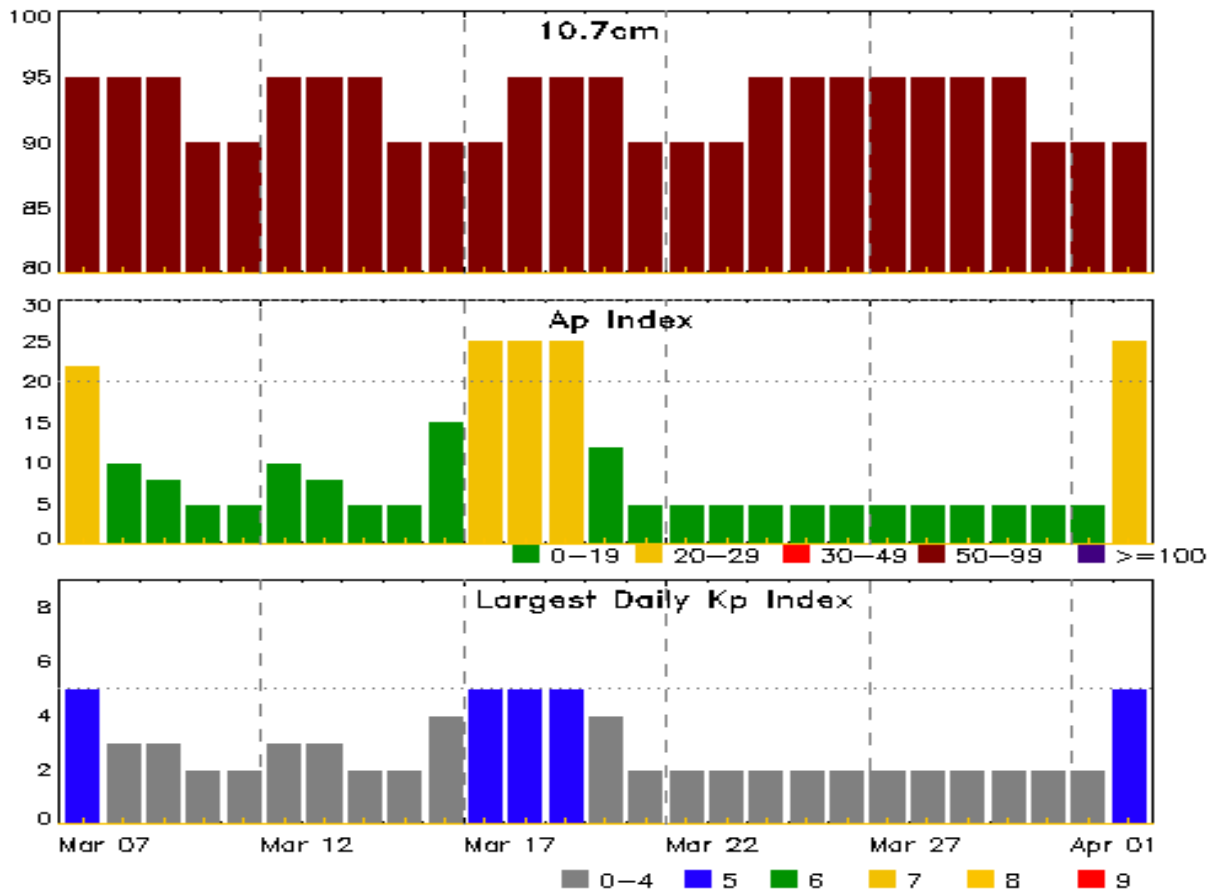


### *Alerts and Warnings Issued*

<b>Date &amp; Time of Issue UTC</b>	<b>Type of Alert or Warning</b>	<b>Date &amp; Time of Event UTC</b>
03 Mar 1836	WATCH: Geomagnetic Storm Category G1 predicted	
06 Mar 1445	WARNING: Geomagnetic K = 4	06/1444 - 07/1000
06 Mar 1646	WARNING: Geomagnetic K = 5	06/1645 - 2359
06 Mar 1646	ALERT: Geomagnetic K = 4	06/1644
06 Mar 1729	ALERT: Geomagnetic K = 5	06/1728
06 Mar 1949	WATCH: Geomagnetic Storm Category G1 predicted	
06 Mar 2009	ALERT: Geomagnetic K = 5	06/2005
06 Mar 2032	WARNING: Geomagnetic K = 6	06/2031 - 2359
06 Mar 2049	ALERT: Geomagnetic K = 6	06/2048
06 Mar 2139	ALERT: Geomagnetic K = 5	06/2137
06 Mar 2206	ALERT: Geomagnetic K = 6	06/2204
06 Mar 2225	EXTENDED WARNING: Geomagnetic K = 5	06/1645 - 07/1000
06 Mar 2225	EXTENDED WARNING: Geomagnetic K = 6	06/2031 - 07/1000
06 Mar 2245	WARNING: Geomagnetic K $\geq$ 7	06/2243 - 07/0500



## 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
07 Mar	95	22	5	21 Mar	90	5	2
08	95	10	3	22	90	5	2
09	95	8	3	23	90	5	2
10	90	5	2	24	95	5	2
11	90	5	2	25	95	5	2
12	95	10	3	26	95	5	2
13	95	8	3	27	95	5	2
14	95	5	2	28	95	5	2
15	90	5	2	29	95	5	2
16	90	15	4	30	95	5	2
17	90	25	5	31	90	5	2
18	95	25	5	01 Apr	90	5	2
19	95	25	5	02	90	25	5
20	95	12	4				



### *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	Radio Flux 2695	Intensity II

**No Events Observed**

### *Flare List*

Date	Time			X-ray Class	Imp/ Brtns	Optical Location Lat CMD	Rgn #
	Begin	Max	End				
29 Feb	0419	0430	0441	B6.9	SF	S08W03	2506
29 Feb	1643	1706	1727	B5.2			2510
01 Mar	0046	0052	0056	B6.2			2510
01 Mar	1734	1757	1803	B3.4			2506
03 Mar	0136	0203	0257	B4.6			2510
03 Mar	1519	1550	1608	B5.2			2510
04 Mar	0615	0630	0649	B3.0			2510
04 Mar	0747	0751	0754	B3.2			2514
04 Mar	0828	0900	0921	C1.1			2506
04 Mar	0858	U0907	0921		SF	N14W02	2514
05 Mar	0035	0040	0047	B3.6			2506
05 Mar	0316	0322	0336	B4.4	SF	S03W16	2515
05 Mar	1048	1056	1104	B4.7			2506
06 Mar	0458	0512	0519	B7.2	SF	N11W19	2512
06 Mar	0623	0627	0630	B2.8			2514
06 Mar	B0631	0632	A0639		SF	N11W19	2512
06 Mar	0726	0730	0733	B3.1			2512
06 Mar	0734	0743	0745	B7.0			2512
06 Mar	0923	0927	0931	B5.1			2512
06 Mar	1233	1307	1314	B4.3			2512
06 Mar	1802	1805	1808	B2.7			2512





### *Region Summary - continued*

Date	Location		Sunspot Characteristics				Flares																
	Lat CMD	Lon	Helio 10 <sup>6</sup> hemi.	Area	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical											
									C	M	X	S	1	2	3	4							
<b>Region 2509</b>																							
29 Feb	N09E17	186	20	3	Bxo	4	B																
01 Mar	N08W00	189	20	10	Bxo	2	B																
02 Mar	N09W14	192	plage																				
03 Mar	N09W28	193	plage																				
04 Mar	N09W42	194	plage																				
05 Mar	N09W56	194	plage																				
06 Mar	N09W70	195	plage																				

Still on Disk.  
 Absolute heliographic longitude: 189

<b>Region 2510</b>																							
02 Mar	N05E51	127	30	10	Cro	3	B																
03 Mar	N05E43	124	30	1	Cro	3	B																
04 Mar	N05E30	122	30	4	Cro	3	B																
05 Mar	N05E18	120	30	4	Cao	4	B																
06 Mar	N06E03	122	20	4	Cro	4	B																

Still on Disk.  
 Absolute heliographic longitude: 122

<b>Region 2511</b>																							
02 Mar	N05E57	121	10	1	Bxo	3	B																
03 Mar	N06E32	131	plage																				
04 Mar	N06E19	133	plage																				
05 Mar	N06E04	134	plage																				
06 Mar	N06W11	136	plage																				

Still on Disk.  
 Absolute heliographic longitude: 134



**Region Summary - continued**

Date	Location		Sunspot Characteristics				Flares							
	Lat CMD	Helio Lon	Area 10 <sup>6</sup> hemi.	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical			
								C	M	X	S	1	2	3

**Region 2512**

02 Mar	N11E28	150	10	3	Bxo	3	B										
03 Mar	N12E13	152	20	4	Bxo	4	B										
04 Mar	N11W00	152	20	4	Cro	3	B										
05 Mar	N11W16	154	10	1	Hrx	1	A										
06 Mar	N11W30	155	30	2	Cao	7	B				2						
								0	0	0	2	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 152

**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										
								0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 102

**Region 2514**

04 Mar	N14W11	163	20	6	Cro	9	B				1						
05 Mar	N14W26	164	50	6	Cao	9	B										
06 Mar	N14W39	164	30	7	Cao	4	B										
								0	0	0	1	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 163

**Region 2515**

04 Mar	S03W14	166	10	3	Bxo	2	B										
05 Mar	S03W29	167	plage								1						
06 Mar	S03W44	169	plage														
								0	0	0	1	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 166





### *Region Summary - continued*

Date	Location		Sunspot Characteristics				Flares								
	Lat CMD	Lon	Helio 10 <sup>6</sup> hemi.	Area	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical			
									C	M	X	S	1	2	3

#### *Region 2516*

04 Mar	S04W05	157	10	3	Bxo	3	B										
05 Mar	S04W20	158	plage														
06 Mar	S04W35	160	plage														
									0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 157

#### *Region 2517*

06 Mar	N24W38	163	10	4	Bxo	2	B										
									0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 163

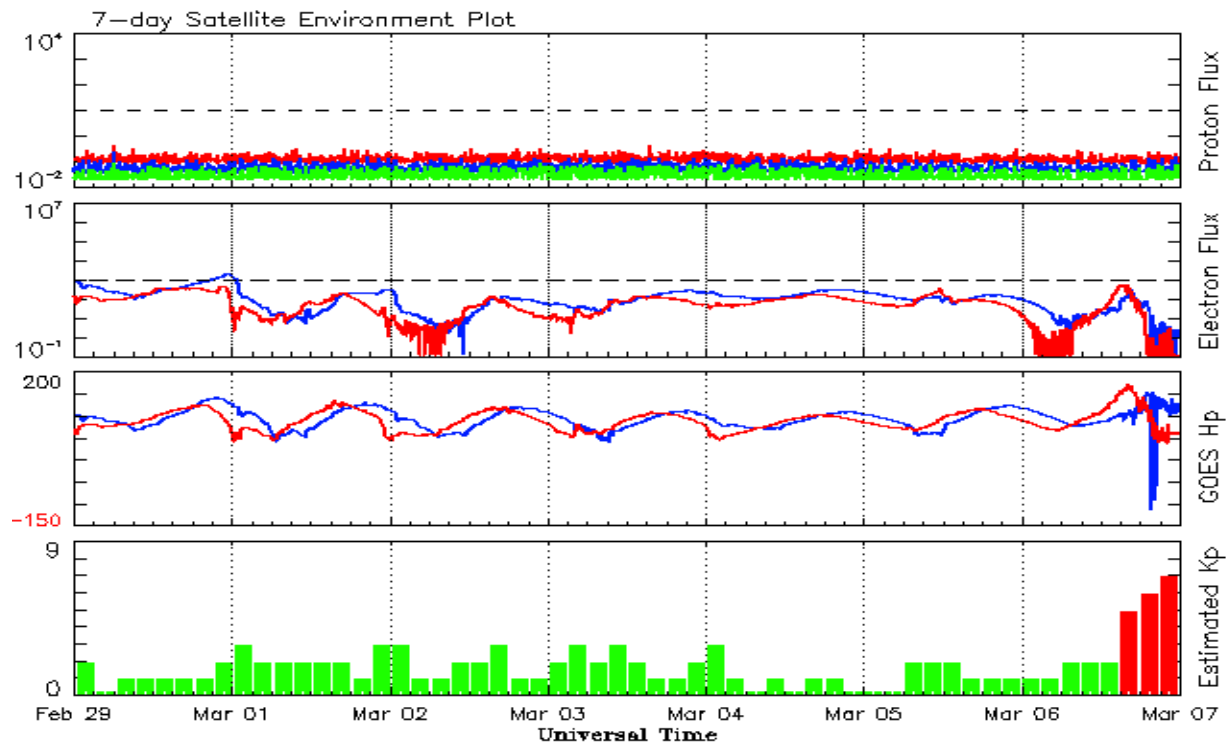


**Recent Solar Indices (preliminary)**  
**Observed monthly mean values**

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
<b>2014</b>									
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
<b>2015</b>									
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	
<b>2016</b>									
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 29 February 2016*

The proton flux plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-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.

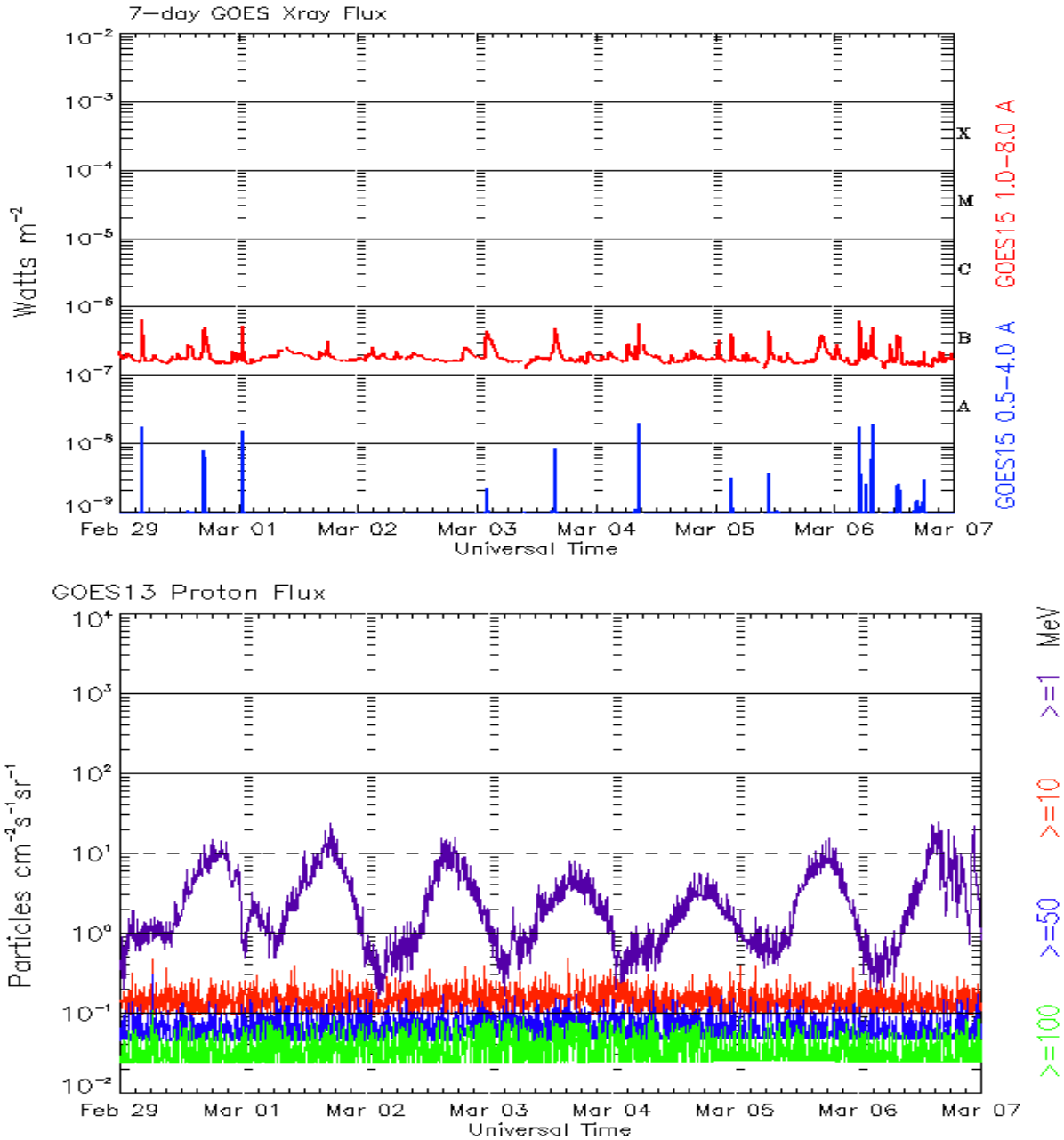
The electron flux plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV by the SWPC Primary GOES satellite.

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 29 February 2016*

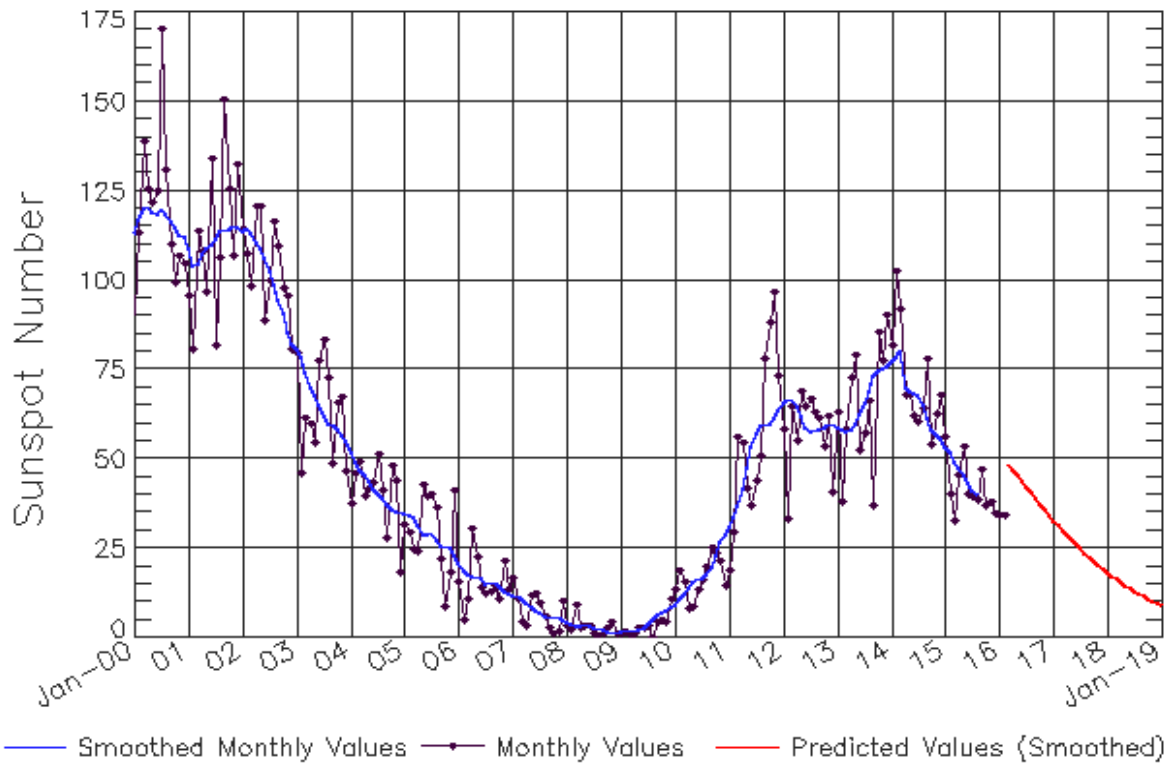
The x-ray plots contains five-minute averages x-ray flux (Watt/m<sup>2</sup>) as measure by the SWPC primary GOES X-ray satellite, usually at West 105 longitude, in two wavelength bands, 0.05 - 0.4 and 0.1 - 0.8 nm. The letters A, B, C, M and X refer to x-ray event levels for the 0.1 - 0.8 nm band.

The proton plot contains the five-minute averaged intergral flux units (pfu = protons/cm<sup>2</sup> -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.



# ISES Solar Cycle Sunspot Number Progression

Observed data through Feb 2016



Updated 2016 Mar 7

NOAA/SWPC Boulder, CO USA

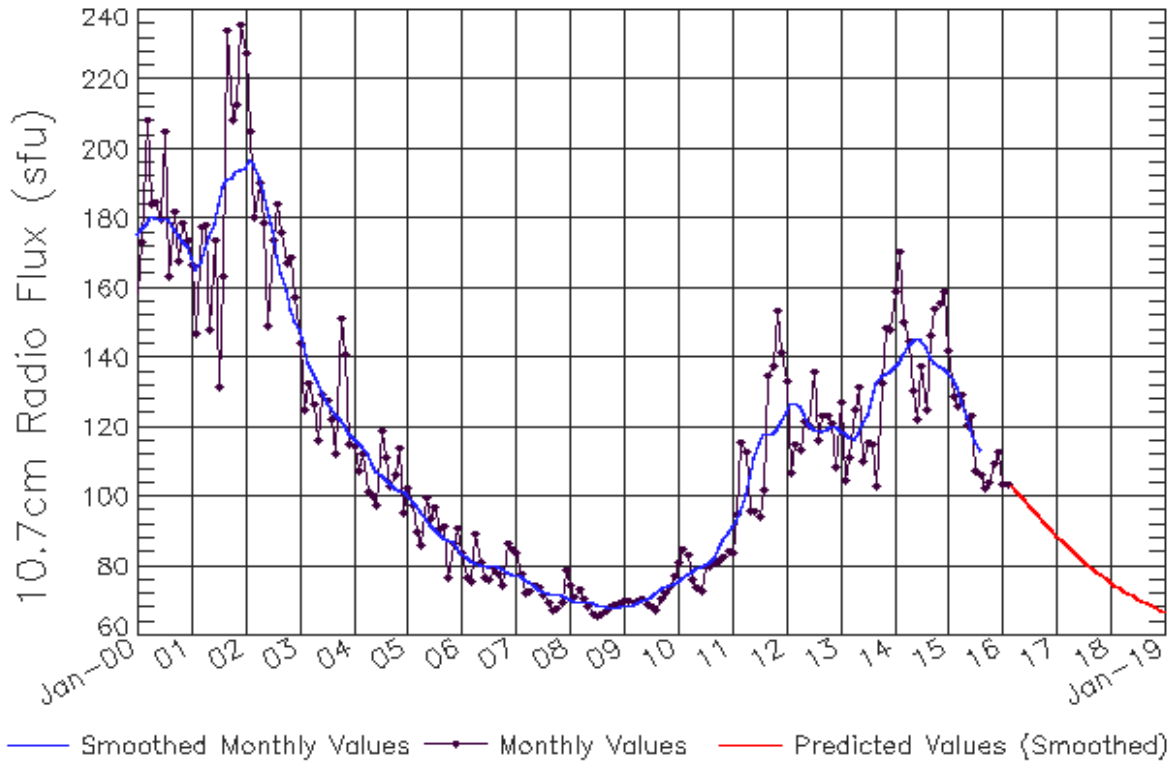
## Smoothed Sunspot Number Prediction

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	9 (1)	10 (2)	11 (3)	13 (5)	15 (5)	16 (6)	17 (7)	17 (7)	20 (8)	23 (9)	27 (9)	29 (10)
2011	19 (10)	30 (10)	56 (10)	54 (10)	42 (10)	37 (10)	44 (10)	51 (10)	78 (10)	88 (10)	97 (10)	73 (10)
2012	58 (10)	33 (10)	64 (10)	55 (10)	69 (10)	65 (10)	67 (10)	63 (10)	61 (10)	53 (10)	62 (10)	41 (10)
2013	63 (10)	38 (10)	58 (10)	72 (10)	79 (10)	53 (10)	57 (10)	66 (10)	37 (10)	86 (10)	78 (10)	90 (10)
2014	82 (10)	102 (10)	92 (10)	68 (10)	68 (10)	62 (10)	60 (10)	64 (10)	78 (10)	54 (10)	62 (10)	68 (10)
2015	56 (10)	40 (10)	33 (10)	45 (10)	53 (10)	40 (10)	40 (10)	39 (10)	47 (10)	37 (10)	38 (10)	35 (10)
2016	34 (10)	34 (10)	49 (10)	47 (10)	45 (10)	44 (10)	42 (10)	40 (10)	39 (10)	37 (10)	36 (10)	34 (10)
2017	33 (10)	31 (10)	30 (10)	29 (10)	27 (10)	26 (10)	25 (10)	24 (10)	23 (10)	21 (10)	20 (10)	19 (10)
2018	18 (10)	17 (10)	16 (10)	15 (10)	15 (10)	14 (10)	13 (10)	12 (10)	12 (10)	11 (10)	10 (10)	10 (10)
2019	9 (10)	8 (10)	8 (10)	7 (10)	7 (10)	6 (10)	6 (10)	6 (10)	5 (10)	5 (10)	4 (10)	4 (10)



# ISES Solar Cycle F10.7cm Radio Flux Progression

Observed data through Feb 2016



Updated 2016 Mar 7

NOAA/SWPC Boulder, CO USA

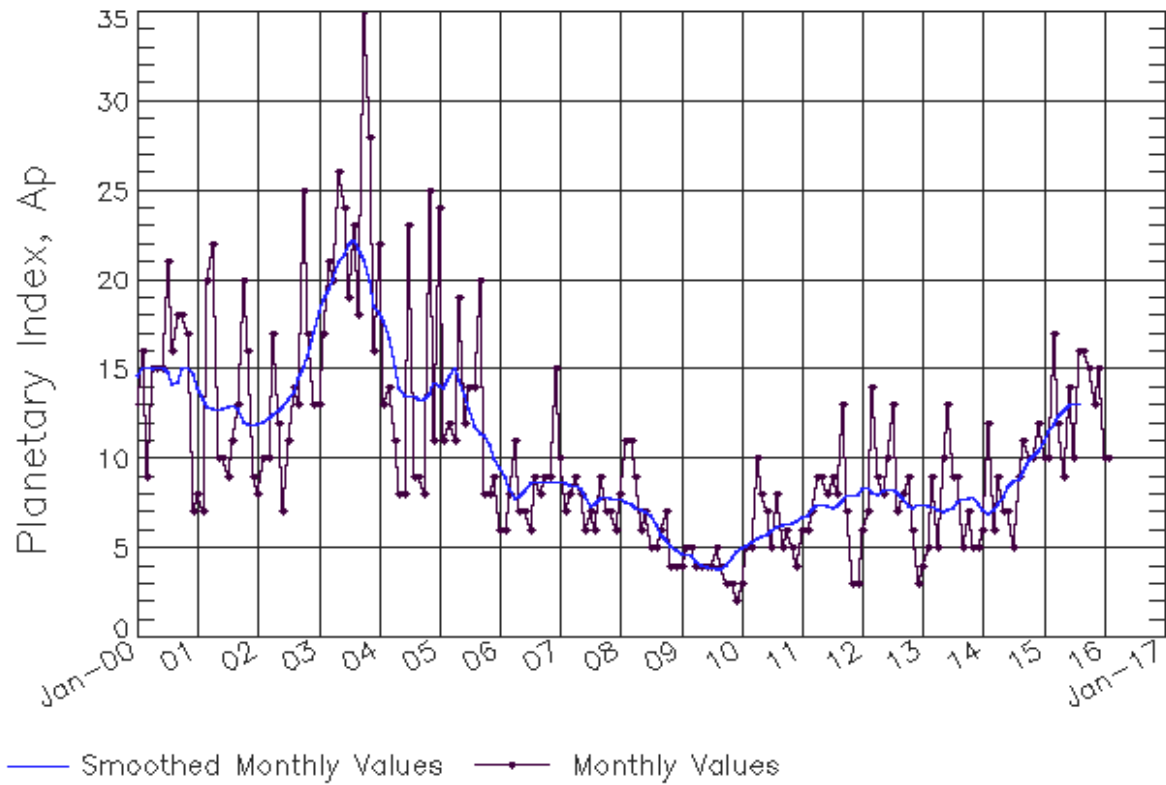
## Smoothed F10.7cm Radio Flux Prediction

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	76 (***)	77 (***)	78 (***)	78 (***)	79 (***)	80 (***)	80 (***)	81 (***)	82 (***)	85 (***)	88 (***)	90 (***)
2011	91 (***)	93 (***)	96 (***)	100 (***)	106 (***)	111 (***)	115 (***)	118 (***)	118 (***)	118 (***)	120 (***)	122 (***)
2012	124 (***)	127 (***)	127 (***)	126 (***)	124 (***)	121 (***)	120 (***)	119 (***)	119 (***)	119 (***)	120 (***)	120 (***)
2013	119 (***)	118 (***)	117 (***)	117 (***)	118 (***)	121 (***)	124 (***)	128 (***)	132 (***)	135 (***)	135 (***)	136 (***)
2014	137 (***)	139 (***)	141 (***)	144 (***)	145 (***)	146 (***)	145 (***)	143 (***)	140 (***)	138 (***)	137 (***)	137 (***)
2015	136 (***)	134 (***)	131 (***)	127 (***)	123 (***)	120 (***)	116 (***)	113 (***)	111 (1)	109 (1)	107 (2)	105 (3)
2016	104 (4)	103 (4)	102 (5)	102 (6)	100 (7)	99 (8)	97 (8)	96 (9)	94 (9)	93 (9)	92 (9)	90 (9)
2017	89 (9)	88 (9)	86 (9)	85 (9)	84 (9)	83 (9)	82 (9)	80 (9)	79 (9)	78 (9)	77 (9)	76 (9)
2018	75 (9)	75 (9)	74 (9)	73 (9)	72 (9)	71 (9)	71 (9)	70 (9)	69 (9)	69 (9)	68 (9)	67 (9)
2019	67 (9)	66 (9)	66 (9)	65 (9)	65 (9)	65 (9)	64 (9)	64 (9)	63 (9)	63 (9)	63 (9)	63 (9)



# ISES Solar Cycle Ap Progression

Observed data through Feb 2016



Updated 2016 Mar 7

NOAA/SWPC Boulder, CO USA

*Solar Cycle Comparison charts are temporarily unavailable.*



## ***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

<http://spaceweather.gov/ftpmenu/warehouse.html> -- Online archive from 1997

<http://spaceweather.gov/ftpmenu/> -- Some content as ascii text

<http://spaceweather.gov/SolarCycle/> -- Solar Cycle Progression web site

<http://spaceweather.gov/contacts.html> -- Contact and Copyright information

[http://spaceweather.gov/weekly/Usr\\_guide.pdf](http://spaceweather.gov/weekly/Usr_guide.pdf) -- User Guide

