

Space Weather Highlights
28 November - 04 December 2016

SWPC PRF 2153
05 December 2016

Solar activity ranged from very low to moderate levels over the period. Very low levels were observed on 01-03 December, low levels were observed on 28 and 30 November and again on 04 December while moderate levels were observed on 29 November. Region 2615 (S07, L=139, class/area Dai/170 on 04 December) was responsible for the majority of the solar activity over the period since its inception late on 28 November. This region was responsible for 11 C-class flares and two M-class flares; an M1/Sn at 29/1723 UTC and an M1/Sf at 29/2338 UTC. No Earth-directed coronal mass ejections were observed during the period.

No proton events were observed at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit was at high levels throughout the period with a maximum flux of 41,607 pfu observed at 28/1640 UTC.

Geomagnetic field activity ranged from quiet to unsettled levels during the period. The period began as solar wind parameters were slowly recovering from a positive polarity coronal hole high speed stream (CH HSS). Solar wind speeds slowly decreased from approximately 570 km/s early in the period to near 280 km/s by the end. Total field values ranged from 1 nT to 7 nT. The geomagnetic field was at quiet to unsettled levels on 28 November. Quiet levels were observed from 29 November through 04 December.

Space Weather Outlook
05 December - 31 December 2016

Solar activity is expected to be at very low levels with a chance for C-class flares and a slight chance for M-class (R1-Minor) flares on 05-10 December and again from 24-31 December due to potential solar activity from Region 2615. The rest of the forecast period is expected to be at very low levels.

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be normal to moderate levels with high levels likely on 05-06, 10-18, and 22-31 December due to recurrent CH HSS influence.

Geomagnetic field activity is expected to be at unsettled to active levels on 05, 07-11, and 19-25 December with G1 (Minor) geomagnetic storm levels likely on 08-09 and 21-22 December due to recurrent CH HSS activity.



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	4
28 November	85	44	230	B1.3	1	0	0	2	0	0	0	0
29 November	86	43	260	B1.6	4	2	0	11	0	0	0	0
30 November	84	75	230	B1.1	4	0	0	9	0	0	0	0
01 December	85	49	260	B1.0	0	0	0	0	0	0	0	0
02 December	84	59	230	B1.0	0	0	0	0	0	0	0	0
03 December	85	62	230	B1.1	0	0	0	0	0	0	0	0
04 December	82	37	190	B1.2	3	0	0	5	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
	28 November		2.3e+06	1.4e+04	3.3e+03	
29 November		1.4e+06	1.5e+04	3.5e+03		8.7e+08
30 November		1.6e+06	1.4e+04	3.4e+03		8.6e+08
01 December		2.5e+06	1.4e+04	3.5e+03		6.7e+08
02 December		1.3e+06	1.4e+04	3.4e+03		4.5e+08
03 December		1.5e+06	1.5e+04	3.6e+03		3.0e+08
04 December		2.2e+06	1.4e+04	3.6e+03		2.4e+08

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	28 November	7	1-2-2-2-2-2-2-2	10	1-1-3-2-4-2-2-2	8
29 November	4	1-2-1-1-1-1-1-1	5	1-2-1-3-3-0-0-0	5	2-2-1-1-1-1-1-2
30 November	2	1-1-2-0-1-0-0-0	1	0-0-2-0-0-0-0-0	3	1-1-2-1-0-1-0-0
01 December	3	1-2-2-1-1-0-0-0	1	0-0-1-1-0-0-0-0	3	1-2-1-1-0-0-0-0
02 December	2	0-1-0-0-1-1-1-0	2	0-0-0-2-2-1-0-0	4	1-2-1-1-1-1-1-1
03 December	1	0-1-1-0-0-1-0-0	0	0-0-1-0-0-0-0-0	3	1-1-1-0-0-1-1-0
04 December	1	0-1-0-0-0-0-1-0	0	0-0-0-0-0-0-0-0	2	0-1-0-0-0-0-0-1

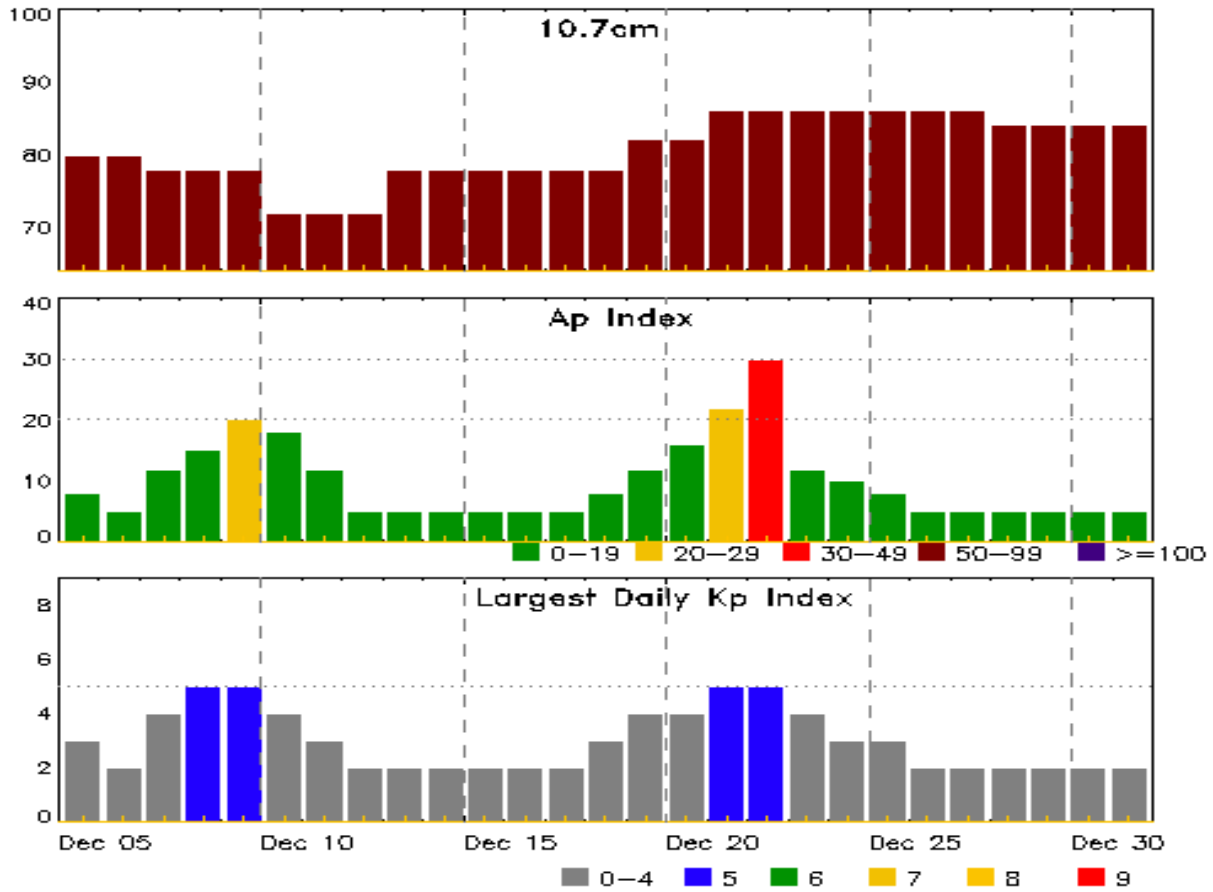


Alerts and Warnings Issued

Date & Time of Issue UTC	Type of Alert or Warning	Date & Time of Event UTC
28 Nov 0501	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955
28 Nov 0501	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955
29 Nov 0501	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955
30 Nov 0500	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955
01 Dec 0502	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955
02 Dec 0501	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955
03 Dec 0501	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955
04 Dec 0501	CONTINUED ALERT: Electron 2MeV Integral Flux \geq 1000pfu	25/0955



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
05 Dec	80	8	3	19 Dec	82	12	4
06	80	5	2	20	82	16	4
07	78	12	4	21	86	22	5
08	78	15	5	22	86	30	5
09	78	20	5	23	86	12	4
10	72	18	4	24	86	10	3
11	72	12	3	25	86	8	3
12	72	5	2	26	86	5	2
13	78	5	2	27	86	5	2
14	78	5	2	28	84	5	2
15	78	5	2	29	84	5	2
16	78	5	2	30	84	5	2
17	78	5	2	31	84	5	2
18	78	8	3				



Energetic Events

Date	Time		Half Max	X-ray		Optical Information			Peak		Sweep Freq	
	Begin	Max		Class	Integ Flux	Imp/ Brtns	Location Lat CMD	Rgn #	Radio Flux 245 2695	Intensity II IV		
29 Nov	1719	1723	1726	M1.0	0.002	SN	S07E55	2615				
29 Nov	2329	2338	2340	M1.2	0.004	SF	S08E52	2615				

Flare List

Date	Time			X-ray Class	Imp/ Brtns	Location Lat CMD	Rgn #
	Begin	Max	End				
28 Nov	0205	0212	0226	B3.6			2611
28 Nov	0335	0339	0344	B4.7			2611
28 Nov	0531	0534	0538	B2.2			2611
28 Nov	0755	0801	0803	C1.4			2611
28 Nov	0840	0846	0850	B3.8			2611
28 Nov	0937	0938	0949		SF	N07E15	2612
28 Nov	1145	1149	1153	B3.5			
28 Nov	1335	1335	A1459		SF	N07E41	
28 Nov	1731	1734	1736	B3.1			
29 Nov	0150	0155	0158	B9.3			
29 Nov	0333	0340	0344	B5.9			2615
29 Nov	0540	0545	0548	B5.5			2615
29 Nov	0703	0710	0712	C7.5	SF	S08E62	2615
29 Nov	0953	0957	1002	B3.8	SF	S05E60	2615
29 Nov	1008	1014	1024	B5.4			2615
29 Nov	1205	1213	1234	C2.6	SF	S07E63	2615
29 Nov	1547	1556	1606	B7.8	SF	S07E57	2615
29 Nov	1617	1621	1630	B7.5	SF	S07E55	2615
29 Nov	1636	1641	1648	C1.1	SF	S07E55	2615
29 Nov	1702	1702	1706		SF	S07E55	2615
29 Nov	1719	1723	1726	M1.0	SN	S07E55	2615
29 Nov	1858	1901	1903	B5.9	SF	S07E54	2615
29 Nov	2049	2054	2104	B3.5			2615
29 Nov	2234	2244	2251	B4.4			2615
29 Nov	2257	2317	2326	C1.9	SF	S07E50	2615
29 Nov	2329	2338	2340	M1.2	SF	S08E52	2615
30 Nov	0100	0104	0108	B3.4			2615
30 Nov	0114	0119	0123	C6.0	SF	S08E51	2615
30 Nov	0209	0222	0224	C3.1	SF	S08E51	2615



Flare List

Date	Time			X-ray Class	Imp/ Brtns	Optical		Rgn #
	Begin	Max	End			Location Lat CMD		
30 Nov	0248	0253	0257	B4.7	SF	S07E51		2615
30 Nov	0438	0445	0447	B3.7				2615
30 Nov	0506	0511	0518	B3.8	SF	S08E50		2615
30 Nov	0522	0526	0528	B3.9	SF	N05E18		2614
30 Nov	0709	0712	0714	B2.4				
30 Nov	1105	1111	1119	B1.7				2615
30 Nov	1145	1150	1153	B4.3				2615
30 Nov	1312	1318	1321	B4.0	SF	S06E45		2615
30 Nov	1500	1507	1511	C1.0	SF	S07E43		2615
30 Nov	1522	1525	1527	C2.3				2615
30 Nov	1533	1540	1541		SF	S07E43		2615
30 Nov	2013	2017	2022	B2.0	SF	S07E39		2615
01 Dec	1140	1147	1159	B3.7				2615
01 Dec	1612	1711	1718	B2.9				2612
01 Dec	1928	1931	1933	B2.7				2616
02 Dec	1817	1822	1838	B2.4				2612
03 Dec	1703	1716	1724	B2.1				2612
03 Dec	1733	1801	1813	B2.8				2615
03 Dec	2347	2350	2352	B1.7				2615
04 Dec	0122	0126	0129	B4.0				2615
04 Dec	0153	0157	0202	B5.3				2615
04 Dec	0247	0251	0254	C1.1	SF	S06W03		2615
04 Dec	0424	0427	0430	B4.2	SF	S06W04		2615
04 Dec	0715	0723	0725	C1.2	SF	S07W05		2615
04 Dec	0821	0825	0830	B2.8				2615
04 Dec	1022	1025	1027	B2.8				2615
04 Dec	1047	1050	1053	B2.5				2615
04 Dec	1218	1224	1229	B2.3				2615
04 Dec	1612	1615	1619	B2.7	SF	S06W15		2615
04 Dec	1735	1755	1814	C1.8	SF	S06W16		2615



Region Summary

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

Region 2611

17 Nov	N03E54	289	10	1	Hrx	1	A										
18 Nov	N03E39	291	20	3	Cao	3	B										
19 Nov	N03E29	288	10	1	Axx	1	A					1					
20 Nov	N04E17	287	10	1	Axx	1	A										
21 Nov	N04E02	289	plage														
22 Nov	N04W13	290	plage														
23 Nov	N04W28	292	plage														
24 Nov	N04W43	294	plage														
25 Nov	N04W58	296	plage														
26 Nov	N04W73	298	plage														
27 Nov	N04W88	300	plage														
										0	0	0	1	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 289

Region 2612

23 Nov	N07E68	196	120	3	Hsx	1	A										
24 Nov	N09E56	194	180	3	Hax	2	A										
25 Nov	N09E43	194	230	3	Hax	2	A										
26 Nov	N08E29	195	160	4	Hax	3	A										
27 Nov	N08E17	195	170	4	Cao	6	B										
28 Nov	N08E03	195	170	4	Cao	4	B					1					
29 Nov	N09W10	194	150	4	Cao	4	B										
30 Nov	N08W23	194	110	3	Dso	34	B										
01 Dec	N09W36	195	120	4	Dao	5	B										
02 Dec	N09W49	195	90	3	Dao	5	B										
03 Dec	N09W62	194	70	4	Dao	4	B										
04 Dec	N09W75	194	20	5	Cao	2	B										
										0	0	0	1	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 195

Region 2613

27 Nov	N12W51	263	30	4	Cao	5	B										
28 Nov	N12W64	262	50	3	Cao	3	B										
29 Nov	N12W78	263	plage														
										0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 263



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 2614																							
28 Nov	N06E35	162	10	4	Cro	7	B																
29 Nov	N05E21	163	80	5	Cro	7	B																
30 Nov	N05E06	164	60	5	Dao	3	B						1										
01 Dec	N06W06	165	30	5	Cao	4	B																
02 Dec	N06W21	167	10	1	Bxo	2	B																
03 Dec	N06W34	166	10	2	Bxo	2	B																
04 Dec	N06W49	168	plage																				
														0	0	0	1	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 164

Region 2615																							
29 Nov	S08E51	132	30	4	Dsi	2	B	4	2				10										
30 Nov	S07E37	134	60	7	Dai	8	B	4					8										
01 Dec	S07E22	137	110	7	Dai	10	B																
02 Dec	S07E08	138	110	8	Dao	9	B																
03 Dec	S07W07	139	140	8	Dai	14	B																
04 Dec	S07W20	139	170	10	Dai	15	B	3					5										
														11	2	0	23	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 139

Region 2616																							
02 Dec	N17W18	164	20	1	Bxo	3	B																
03 Dec	N18W33	165	10	1	Axx	2	A																
04 Dec	N18W47	166	plage																				
														0	0	0	0	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 164

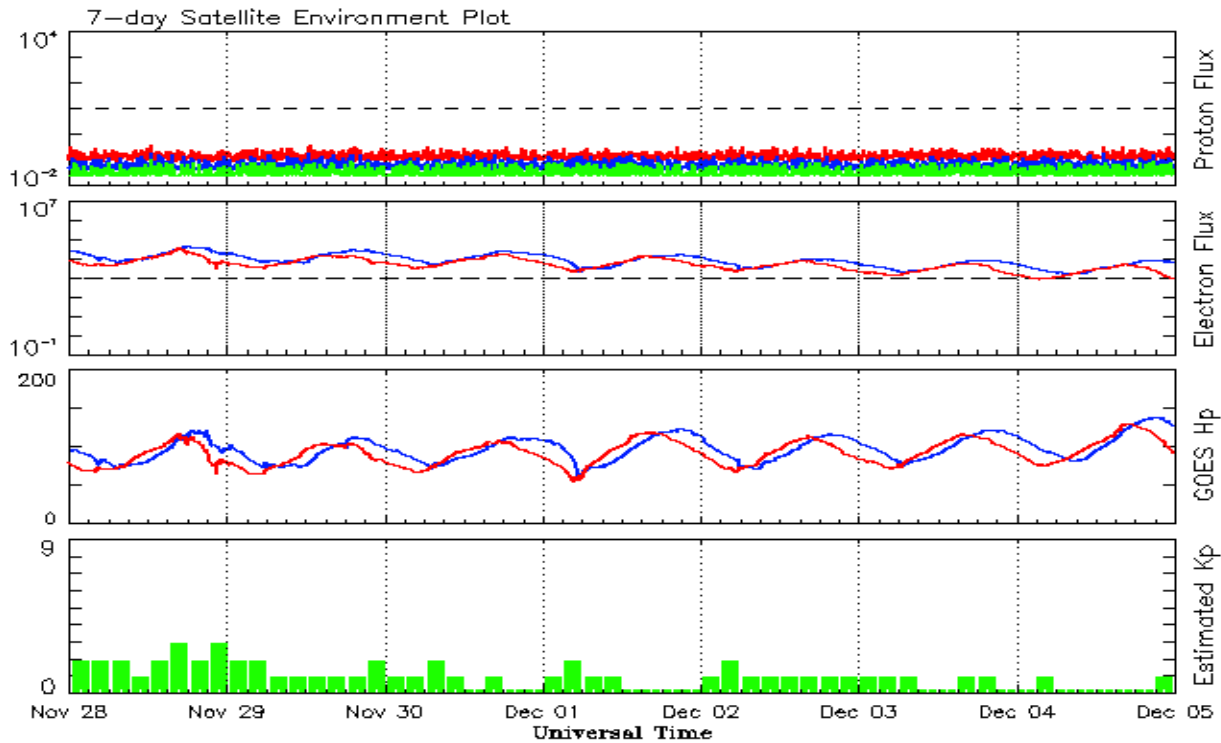


Recent Solar Indices (preliminary)
Observed monthly mean values

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									
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	45.7	120.1	123.3	9	12.7
June	77.3	39.9	0.53	73.1	43.3	123.2	119.5	14	13.0
July	68.4	39.5	0.58	68.2	41.0	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	64.0	39.5	102.1	110.8	16	12.8
October	59.5	38.2	0.62	61.8	38.6	104.1	107.9	15	12.5
November	61.8	37.3	0.61	59.0	36.7	109.6	105.3	13	12.5
December	54.1	34.8	0.64	55.1	34.7	112.8	102.5	15	12.5
2016									
January	50.4	34.2	0.67	51.4	32.6	103.5	99.9	10	12.3
February	56.0	33.8	0.61	49.6	31.5	103.5	98.1	10	12.0
March	40.9	32.5	0.80	47.7	30.3	91.6	96.6	11	11.8
April	39.2	22.7	0.58	45.0	28.7	93.4	95.3	10	11.8
May	48.9	30.9	0.64	42.1	26.9	93.1	93.2	12	11.7
June	19.3	12.3	0.65			81.9		9	
July	36.8	19.5	0.53			85.9		10	
August	50.4	30.4	0.60			85.0		10	
September	37.4	26.8	0.72			87.8		16	
October	30.0	20.2	0.67			86.1		16	
November	22.4	12.8	0.57			78.7		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 28 November 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.

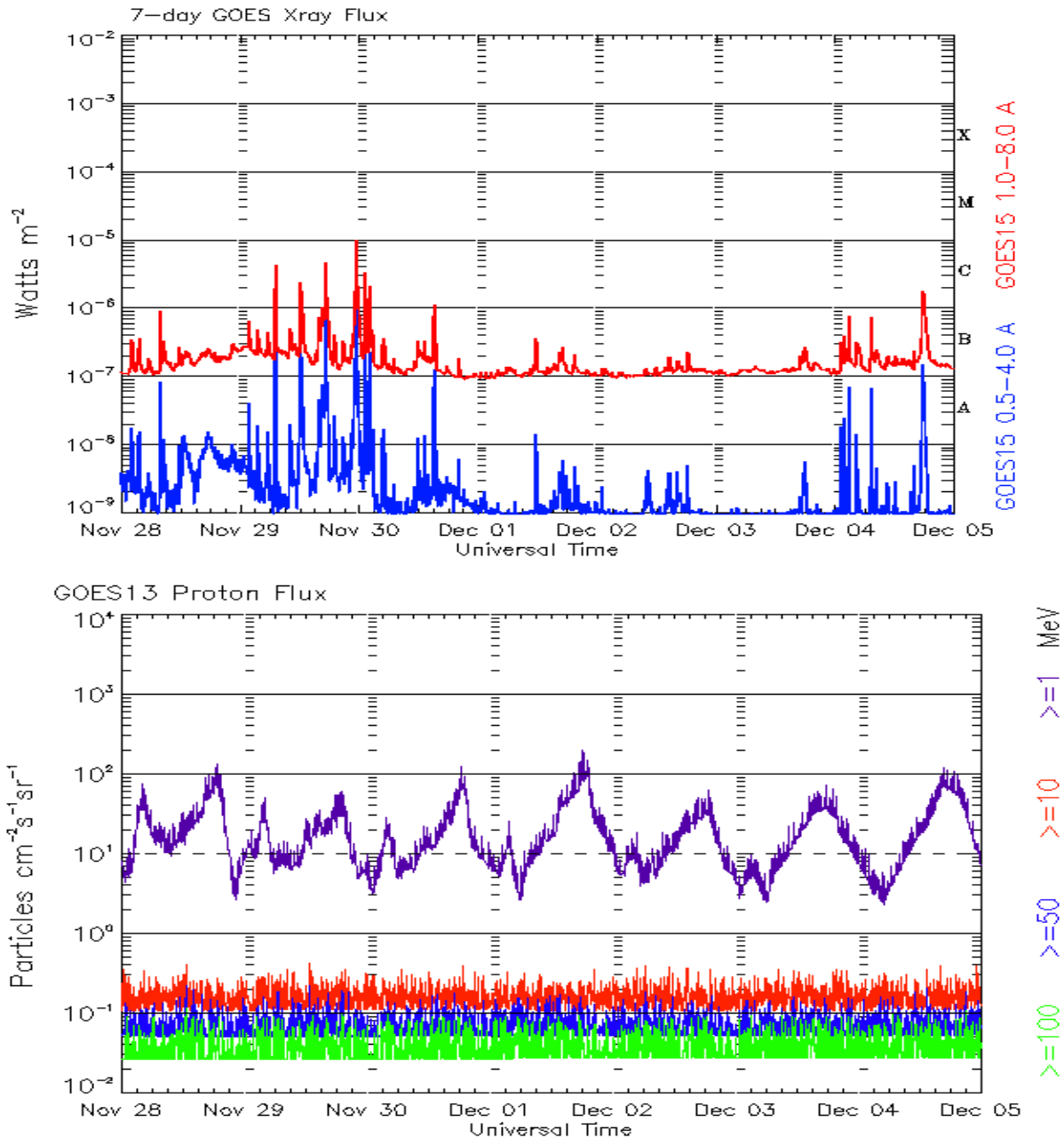
The electron flux plot contains the five-minute averaged integral electron flux (electrons/cm²-sec -sr) with energies greater than 2 MeV by the SWPC Primary GOES satellite.

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.

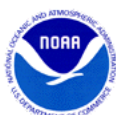




*Weekly GOES Satellite X-ray and Proton Plots
Week Beginning 28 November 2016*

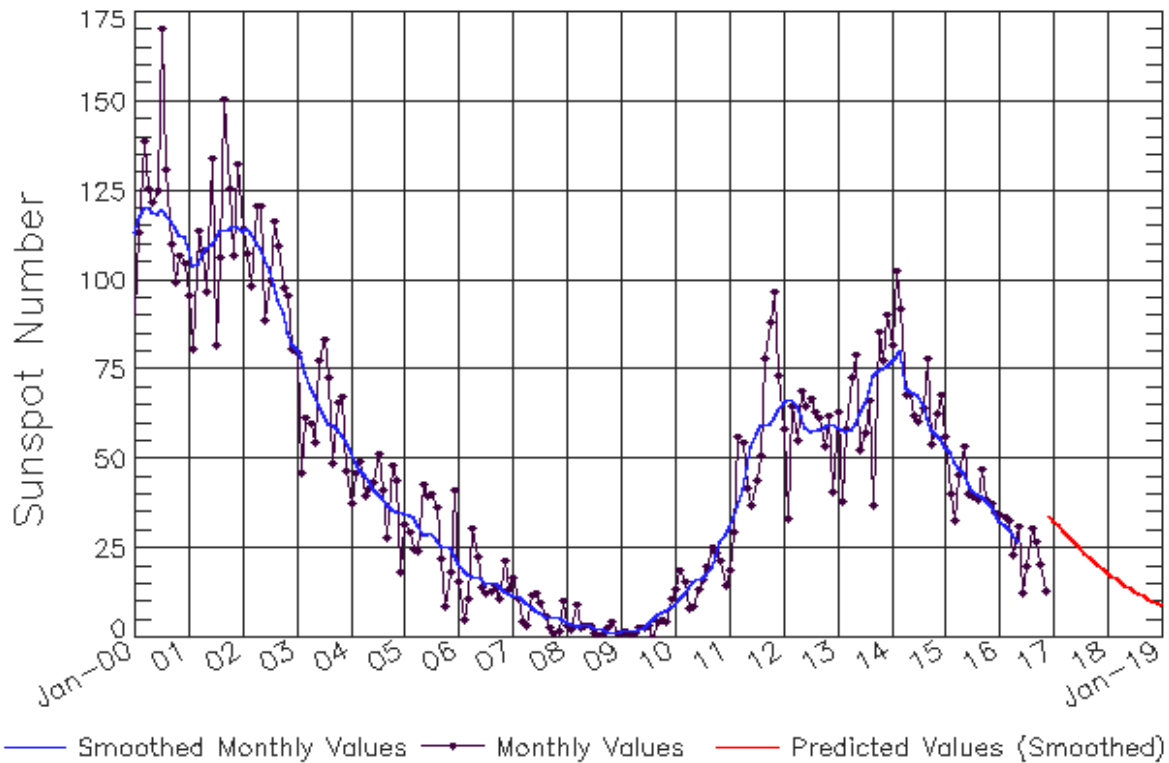
The x-ray plots contains five-minute averages x-ray flux (Watt/m²) as measure by the SWPC primary GOES X-ray satellite, usually at West 105 longitude, in two wavelength bands, 0.05 - 0.4 and 0.1 - 0.8 nm. The letters A, B, C, M and X refer to x-ray event levels for the 0.1 - 0.8 nm band.

The proton plot contains the five-minute averaged intergral flux units (pfu = protons/cm² -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 Nov 2016



Updated 2016 Dec 5

NOAA/SWPC Boulder, CO USA

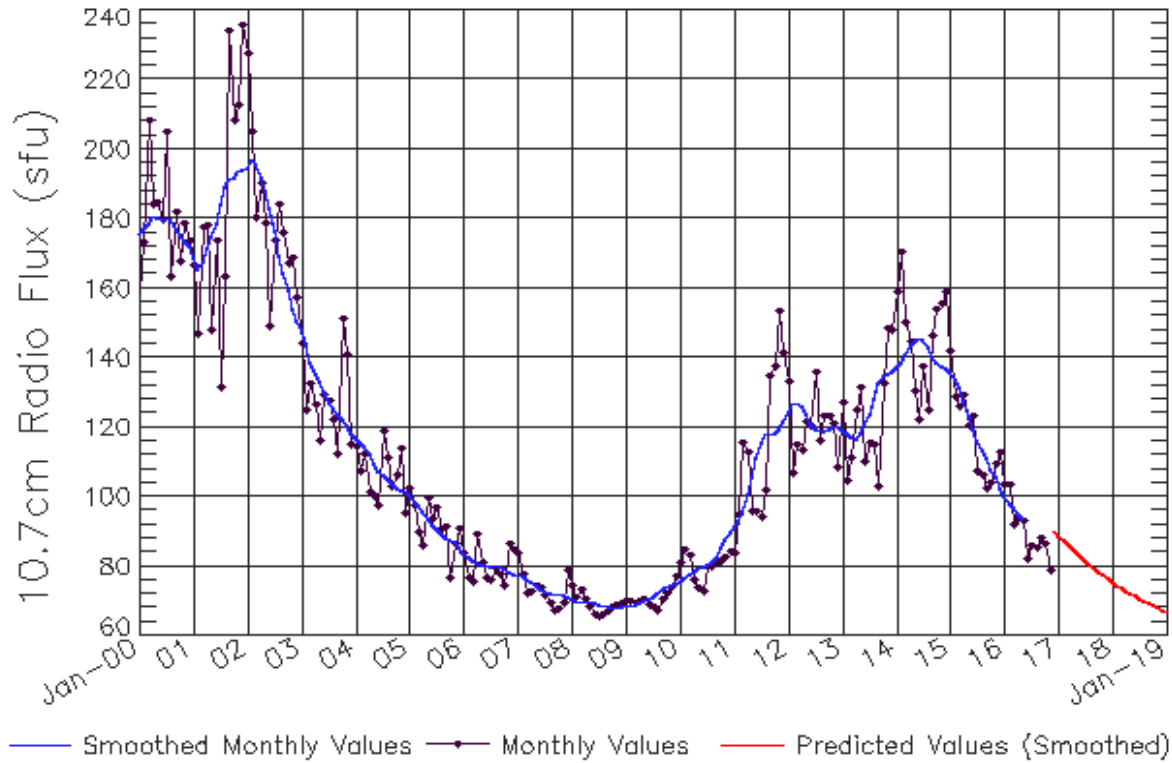
Smoothed Sunspot Number Prediction

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



ISES Solar Cycle F10.7cm Radio Flux Progression

Observed data through Nov 2016



Updated 2016 Dec 5

NOAA/SWPC Boulder, CO USA

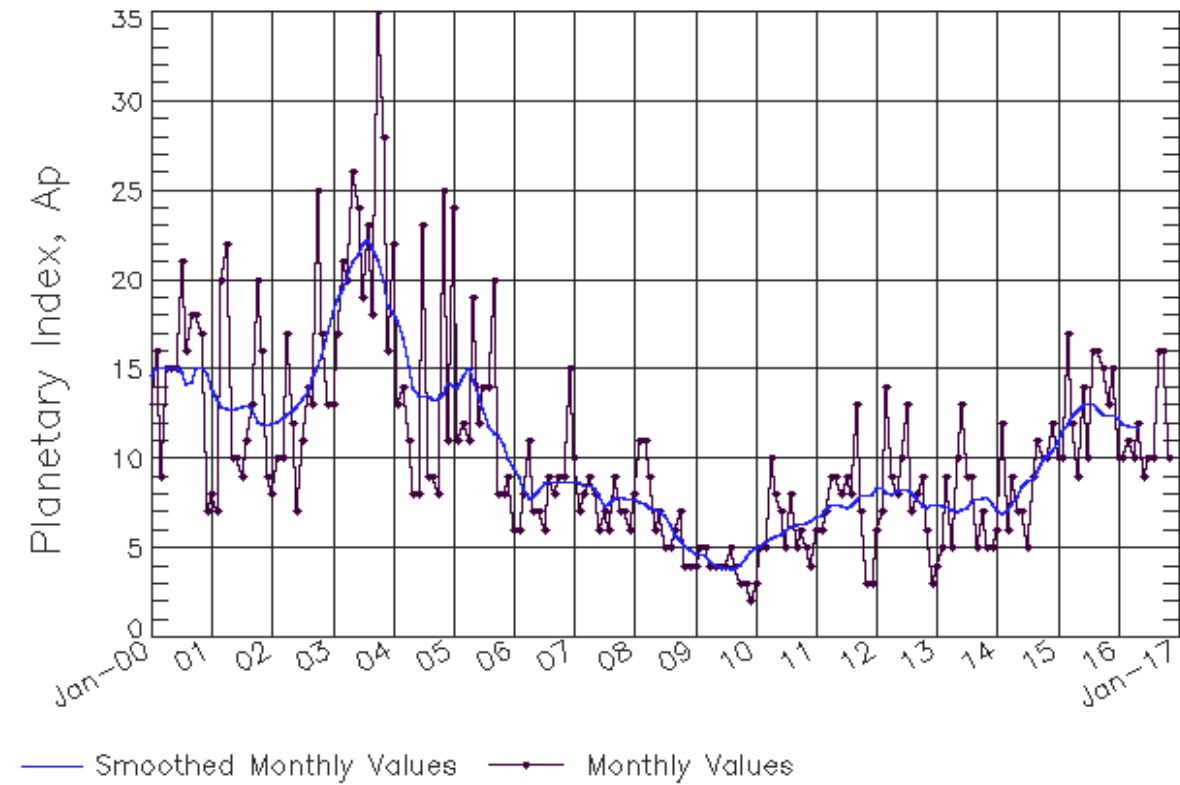
Smoothed F10.7cm Radio Flux Prediction

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 (***)	108 (***)	105 (***)	103 (***)
2016	100 (***)	98 (***)	97 (***)	95 (***)	93 (***)	91 (1)	89 (1)	88 (2)	87 (3)	87 (4)	86 (4)	86 (5)
2017	86 (6)	85 (7)	85 (8)	84 (8)	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

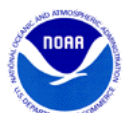
Observed data through Nov 2016



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Solar Cycle Comparison charts are temporarily unavailable.



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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 -- User Guide

