Space Weather Highlights **SWPC PRF 2099**
16 November - 22 November 2015 **23 November 2015**

Solar activity was at very low to low levels over the period. Low levels occurred on 17-18 November and 21-22 November with Regions 2454 (N13, L=121, class/area Dac/130 on 22 Nov) and 2457 (N11, L=032, class/area Dsi/130 on 21 Nov) responsible for the C-class flare activity. The largest flares of the period were a pair of C5/Sf flares at 22/0210 UTC and 22/0538 UTC originating from Region 2454 which was in a growth phase after 21 November.

Two filament eruptions were observed at the beginning of the period that resulted in coronal mass ejections (CMEs). The first was an approximate 21 degree long filament, centered near S11W17, that lifted off around 15/2114 UTC. The second was an approximate 19 degree filament, centered near S26W24 that lifted off around 16/0114 UTC. Two CMEs were observed lifting off the SW limb in SOHO/LASCO C2 imagery at 15/2336 UTC and 16/0312 UTC, respectively. Analysis of these CMEs indicated a likely glancing blow early on 19 November. Later in the period, another filament eruption, centered near S20E10, occurred around 22/0600 UTC. An associated CME, observed in C2 imagery beginning at 22/0836 UTC, was mostly directed off the east limb. Subsequent analysis of this CME indicated a very low chance for a glancing blow.

No proton events were observed at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit was at high levels on 16 November with a maximum flux of 3,129 pfu at 16/1525 UTC. Normal to moderate levels were observed from 17-22 November.

Geomagnetic field activity ranged from quiet to minor storm periods over the period. Solar wind conditions began the period near nominal levels with prolonged periods of southward Bz near -6 nT on 16 November. Subsequently, the geomagnetic field responded with unsettled to active periods. Quiet to unsettled levels were observed on 17 November. At approximately 17/1941 UTC, a solar sector boundary crossing to a mostly negative (towards) sector occurred followed by an increase in solar wind speed from 370 km/s to around 530 km/s by early on 19 November. An abrupt increase in total field from 6 nT to 12 nT occurred at 18/1925 UTC with a maximum southward deflection of the Bz component to -11 nT indicating the likely arrival of the CMEs from 15-16 November coupled with influences from a negative polarity coronal hole high speed stream (CH HSS). A geomagnetic sudden impulse (70 nT at the Wingst magnetometer) was observed at 18/2010 UTC. The geomagnetic field responded with (G1) minor storming late in the period on 18 November with quiet to active conditions on 19 November. Solar wind speed continued a slow decay over the rest of the period to background levels resulting in quiet to unsettled levels on 20-21 November and quiet conditions on 22 November.

Space Weather Outlook
23 November - 19 December 2015

Solar activity is expected to be low with a chance for M-class (R1-R2, Minor-Moderate) flares from 23-25 November due to flare potential from Region 2454. Very low to low levels are expected from 26 November through 07 December. There is also a chance for M-class flare activity from 08-19 December with the return of old Region 2454 (N13, L=121).

No proton events are expected at geosynchronous orbit.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at normal to moderate levels with high levels likely from 26-28 November and again from 06-13 December due to CH HSS influence.

Geomagnetic field activity is expected to be at unsettled to active levels from 25-26 November and 05-12 December with (G1) minor storming likely on 06-07 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
16 November	106	44	40	B2.3	0	0	0	0	0	0	0	0
17 November	107	33	40	B2.5	1	0	0	1	0	0	0	0
18 November	108	36	60	B3.5	1	0	0	0	0	0	0	0
19 November	108	51	80	B3.5	0	0	0	0	0	0	0	0
20 November	111	52	150	B3.2	0	0	0	3	0	0	0	0
21 November	122	59	250	B4.0	6	0	0	2	0	0	0	0
22 November	123	76	330	B4.5	9	0	0	18	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
16 November		3.0e+05	1.2e+04	2.8e+03	5.6e+07	
17 November		4.5e+05	1.2e+04	3.0e+03	1.2e+07	
18 November		4.6e+05	1.2e+04	2.8e+03	2.0e+07	
19 November		3.0e+05	1.2e+04	2.8e+03	1.2e+07	
20 November		3.9e+05	1.2e+04	2.8e+03	8.2e+06	
21 November		2.4e+05	1.1e+04	2.8e+03	9.6e+06	
22 November		2.1e+05	1.2e+04	2.9e+03	9.5e+06	

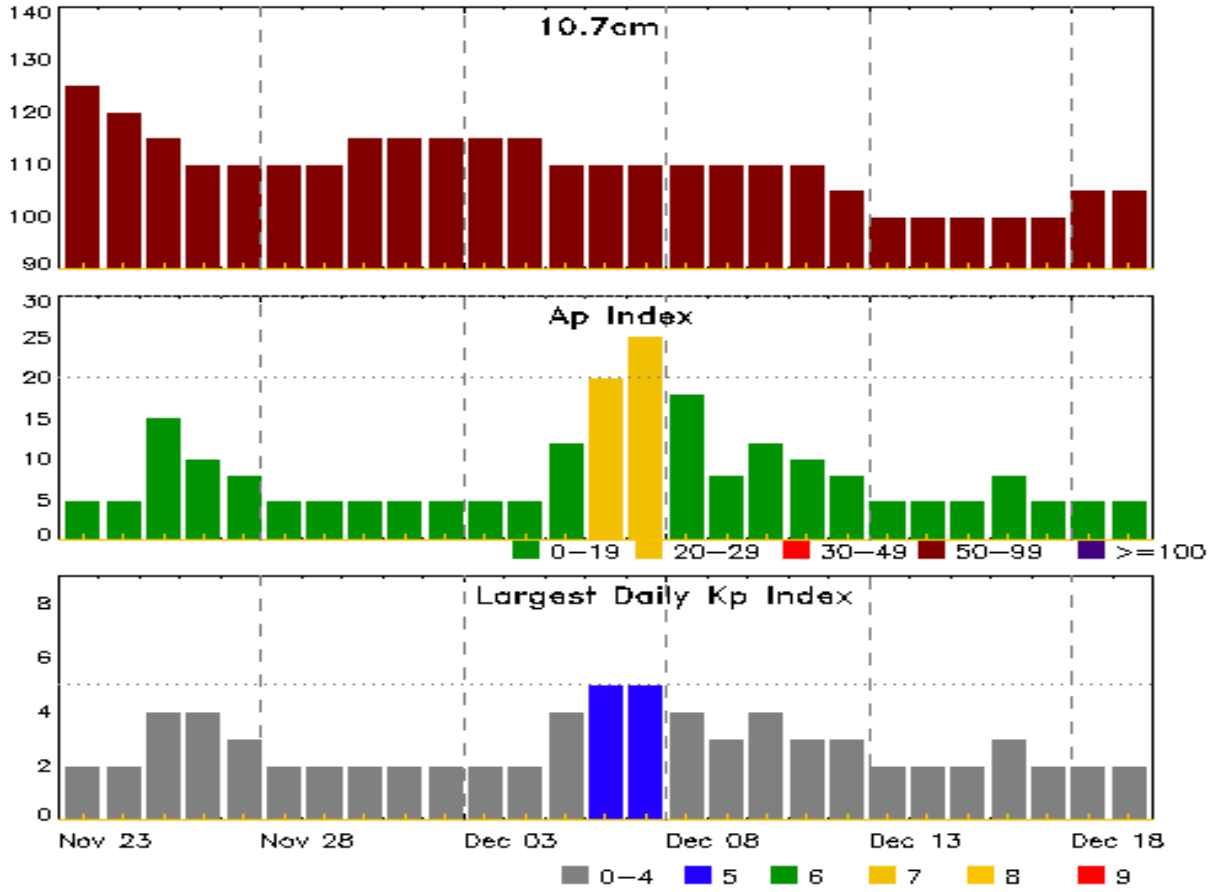
Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
16 November	9	3-2-2-2-3-2-2-2	41	2-3-6-5-6-6-3-1	14	4-3-3-3-3-3-3-3
17 November	7	2-2-1-1-1-2-2-3	10	1-1-3-3-3-2-3-1	8	2-3-1-2-1-2-3-2
18 November	14	1-3-1-3-2-2-3-5	16	0-1-3-5-3-4-2-3	17	1-3-2-3-2-3-3-5
19 November	6	3-1-1-3-2-1-1-0	13	3-1-2-5-4-1-1-0	9	4-2-2-3-1-0-1-1
20 November	6	1-2-2-3-1-1-1-1	3	0-1-2-3-0-0-0-0	6	1-2-3-3-1-0-1-1
21 November	3	2-1-0-0-1-2-1-0	0	0-0-0-0-0-0-0-0	4	3-1-1-1-0-1-1-1
22 November	3	1-1-1-0-0-2-1-1	0	0-0-0-0-0-0-0-0	4	1-1-1-0-0-0-1-1

Alerts and Warnings Issued

Date & Time of Issue UTC	Type of Alert or Warning	Date & Time of Event UTC
16 Nov 0310	ALERT: Geomagnetic K = 4	16/0259
16 Nov 1145	CONTINUED ALERT: Electron 2MeV Integral Flux >= 1000pfu	04/1405
17 Nov 0017	WATCH: Geomagnetic Storm Category G1 predicted	
17 Nov 1930	WATCH: Geomagnetic Storm Category G1 predicted	
18 Nov 2038	SUMMARY: Geomagnetic Sudden Impulse	18/2010
18 Nov 2100	WARNING: Geomagnetic K = 4	18/2100 - 19/1000
18 Nov 2207	ALERT: Geomagnetic K = 4	18/2207
18 Nov 2252	WARNING: Geomagnetic K = 5	18/2300 - 19/0700
18 Nov 2309	ALERT: Geomagnetic K = 5	18/2308
19 Nov 0954	EXTENDED WARNING: Geomagnetic K = 4	18/2100 - 19/1600
19 Nov 0958	EXTENDED WARNING: Geomagnetic K = 4	18/2100 - 19/1600
19 Nov 1731	CANCELLATION: Geomagnetic Storm Category G1 predicted	

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
23 Nov	125	5	2	07 Dec	110	25	5
24	120	5	2	08	110	18	4
25	115	15	4	09	110	8	3
26	110	10	4	10	110	12	4
27	110	8	3	11	110	10	3
28	110	5	2	12	105	8	3
29	110	5	2	13	100	5	2
30	115	5	2	14	100	5	2
01 Dec	115	5	2	15	100	5	2
02	115	5	2	16	100	8	3
03	115	5	2	17	100	5	2
04	115	5	2	18	105	5	2
05	110	12	4	19	105	5	2
06	110	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 #
17 Nov	1326	1329	1331	B5.8	SF	N05E20	2454
17 Nov	1438	1450	1454	B5.3			2454
17 Nov	1516	1519	1522	B5.1			2454
17 Nov	1551	1554	1558	C1.1			2454
18 Nov	0834	0852	0902	B7.0			
18 Nov	1943	2009	2015	C1.1			2457
19 Nov	0744	0748	0753	B8.0			2457
20 Nov	0609	0612	0616	B5.2			2457
20 Nov	1104	1104	1107		SF	N14E71	2457
20 Nov	1121	1125	1127	B5.5			2457
20 Nov	1215	1215	1221		SF	N14E71	2457
20 Nov	1226	1258	1302	B7.3			2455
20 Nov	1231	1232	1234		SF	N14E71	2457
21 Nov	0210	0214	0217	C1.6	SF	N09E65	2457
21 Nov	0332	0341	0353	B7.3			2457
21 Nov	1311	1324	1329	C2.0			2454
21 Nov	1336	1353	1405	C3.3			2454
21 Nov	1707	1711	1714	B8.7			2454
21 Nov	1733	1744	1758	C1.6			2454
21 Nov	1938	1942	1948	C1.0			2454
21 Nov	2215	2221	2229	C1.1	SF	N11E51	2457
22 Nov	B0013	0013	0024		SF	N13E55	2457
22 Nov	0100	0128	0257		SF	N13E53	2457
22 Nov	0137	0210	0227	C5.1	SF	N14W39	2454
22 Nov	0317	0321	0325	C1.2			2454
22 Nov	0412	0413	0417		SF	N13E52	2457
22 Nov	0531	0538	0541	C5.6	SF	N15W40	2454
22 Nov	B0638	U0647	A0655		SF	N13W43	2454
22 Nov	B0639	U0639	A0656		SF	N15E50	2457
22 Nov	0658	0659	0714		SF	N13E49	2457
22 Nov	0748	0749	0755		SF	N13E49	2457

Flare List

	Time			Optical			
Date	Begin	Max	End	X-ray Class	Imp/ Brtns	Location Lat CMD	Rgn #
22 Nov	0853	0856	0905		SF	N13E49	2457
22 Nov	0935	0935	0939		SF	N13E47	2457
22 Nov	1017	1023	1029	C2.4			2457
22 Nov	1240	1245	1249	C1.4			2454
22 Nov	1348	1351	1356	B7.3			2457
22 Nov	1459	1514	1523		SF	N14E43	2457
22 Nov	1541	1542	1549		SF	N13E45	2457
22 Nov	1631	1657	1715	C2.0	SF	N11W44	2454
22 Nov	1639	1641	1642		SF	N13E44	2457
22 Nov	1747	1755	1855		SF	N12E34	2457
22 Nov	1841	1845	1848	C1.6	SF	N16W48	2454
22 Nov	1857	1900	1905	C1.3			2454
22 Nov	2239	2246	2249	C2.6	SF	N15W50	2454

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 2448												
04 Nov	N06E72	233	60	5	Dso	3	B	1							
05 Nov	N06E59	233	110	10	Dai	6	B								
06 Nov	N06E45	234	140	8	Dao	5	B	1							
07 Nov	N05E37	229	80	6	Cao	7	B	1			2				
08 Nov	N05E25	228	60	4	Cao	4	B								
09 Nov	N06E12	226	80	4	Cao	9	B								
10 Nov	N06W00	224	60	4	Cao	8	B				1				
11 Nov	N04W15	227	30	4	Cao	7	B				1				
12 Nov	N07W26	225	10	3	Bxo	3	B								
13 Nov	N06W41	228	10	1	Axx	2	A								
14 Nov	N06W56	230	plage												
15 Nov	N06W71	231	plage												
16 Nov	N06W86	233	plage												
								3	0	0	4	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 224

			Region 2449												
06 Nov	S12E72	207	30	4	Cro	4	B	3			3				
07 Nov	S12E57	209	150	8	Dao	6	B	2			3				
08 Nov	S12E46	207	150	8	Dao	8	B								
09 Nov	S11E32	206	140	9	Dai	13	B		1		1	1	1		
10 Nov	S13E18	206	120	9	Dai	14	B				4				
11 Nov	S12E05	206	60	10	Dai	14	B								
12 Nov	S13W09	208	30	9	Cao	6	B								
13 Nov	S11W23	210	20	5	Cro	2	B								
14 Nov	S11W36	210	10	4	Bxo	2	B				1				
15 Nov	S10W50	210	10	3	Bxo	2	B								
16 Nov	S10W64	211	plage												
17 Nov	S10W78	212	plage												
								5	1	0	12	1	1	0	0

Crossed West Limb.
Absolute heliographic longitude: 206

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 2450												
07 Nov	S23E66	200	10	5	Bxo	3	B	1			1				
08 Nov	S23E50	203	10	5	Bxo	3	B								
09 Nov	S23E36	204	plage												
10 Nov	S23E22	204	plage												
11 Nov	S22E03	207	10	3	Bxo	2	B								
12 Nov	S22W10	210	plage												
13 Nov	S22W24	211	plage												
14 Nov	S22W38	212	plage												
15 Nov	S22W52	212	plage												
16 Nov	S22W66	213	plage												
17 Nov	S22W80	214	plage												
								1	0	0	1	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 207

			Region 2452												
11 Nov	S08E42	169	10		Axx	1	A								
12 Nov	S08E28	172	plage												
13 Nov	S08E14	173	plage					1							
14 Nov	S08W00	174	plage												
15 Nov	S08W14	174	plage												
16 Nov	S08W28	175	plage												
17 Nov	S08W42	176	plage												
18 Nov	S08W56	177	plage												
19 Nov	S08W70	178	plage												
20 Nov	S08W84	179	plage												
								1	0	0	0	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 174

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 2453												
13 Nov	N06E05	182	10	3	Bxo	4	B								
14 Nov	N06W08	182	10	2	Bxo	2	B								
15 Nov	N06W21	181	20	4	Bxo	6	B								
16 Nov	N06W35	182	10	5	Bxo	4	B								
17 Nov	N06W50	184	plage												
18 Nov	N06W65	186	plage												
19 Nov	N06W80	188	plage												
								0	0	0	0	0	0	0	0

Crossed West Limb.
Absolute heliographic longitude: 182

			Region 2454												
13 Nov	N08E66	121	10	4	Bxo	2	B								
14 Nov	N08E52	122	20	3	Bxo	2	B								
15 Nov	N10E41	119	20	6	Bxo	8	B								
18 Nov	N11E01	120	10	3	Bxo	4	B								
19 Nov	N11W13	121	20	5	Cro	8	B								
20 Nov	N12W28	123	20	7	Cro	6	B								
21 Nov	N13W40	121	90	8	Dac	14	B	4							
22 Nov	N13W53	121	130	8	Dac	16	BG	8			6				
								12	0	0	6	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 120

			Region 2455												
14 Nov	N15E36	138	20	1	Bxo	2	B								
15 Nov	N15E22	138	30	5	Cro	7	B								
16 Nov	N15E09	137	20	5	Dro	5	B								
17 Nov	N15W04	137	10	4	Bxo	2	B								
18 Nov	N15W18	139	plage												
19 Nov	N15W32	140	plage												
20 Nov	N15W46	141	plage												
21 Nov	N15W60	141	plage												
22 Nov	N15W74	142	plage												
								0	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 137

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 2456												
16 Nov	N07E27	119	10	4	Bxo	5	B								
17 Nov	N05E12	121	30	5	Dro	11	B								
18 Nov	N06W00	120	50	9	Dai	12	B								
19 Nov	N06W14	122	40	7	Dai	10	B								
20 Nov	N06W29	124	20	6	Dro	8	B								
21 Nov	N06W42	123	30	5	Cao	5	B								
22 Nov	N06W53	121	20	3	Bxo	6	B								
								0	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 120

			Region 2457												
18 Nov	N12E84	38	plage					1							
19 Nov	N12E70	38	20	4	Bxo	3	B								
20 Nov	N11E63	32	110	7	Dso	8	B				3				
21 Nov	N11E49	32	130	8	Dsi	10	B	2			2				
22 Nov	N11E36	32	120	8	Dai	13	B	1			12				
								4	0	0	17	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 32

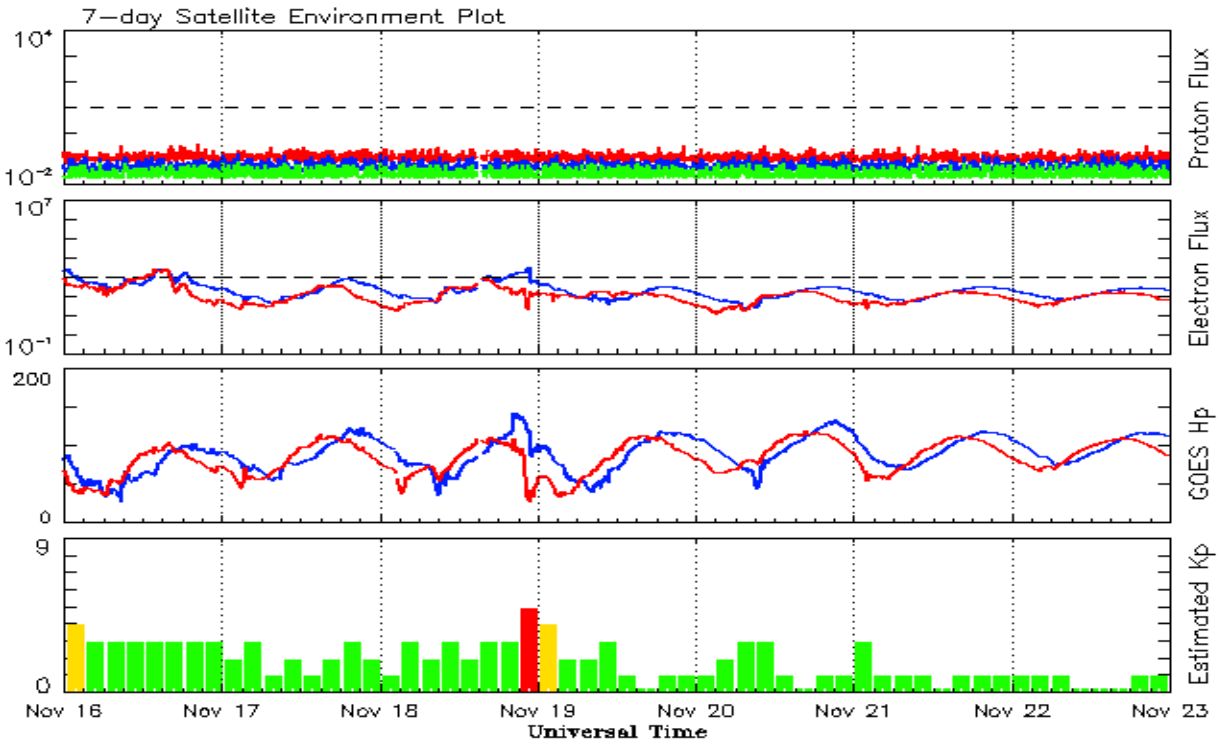
			Region 2458												
22 Nov	N09E72	356	60	2	Hax	1	A								
								0	0	0	0	0	0	0	0

Still on Disk.
Absolute heliographic longitude: 356

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
				2013					
November	125.7	77.6	0.62	114.6	75.3	148.4	135.4	5	7.9
December	118.2	90.3	0.76	115.4	75.9	147.7	135.9	5	7.5
				2014					
January	125.9	81.8	0.65	117.7	77.3	158.6	137.3	6	7.1
February	174.6	102.3	0.59	119.5	78.3	170.3	138.6	12	6.9
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			120.1		9	
June	77.3	39.9	0.53			123.2		14	
July	68.4	39.8	0.58			107.0		10	
August	61.6	38.8	0.63			106.2		16	
September	72.5	46.9	0.65			102.1		16	
October	59.5	37.0	0.62			104.1		15	

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 16 November 2015

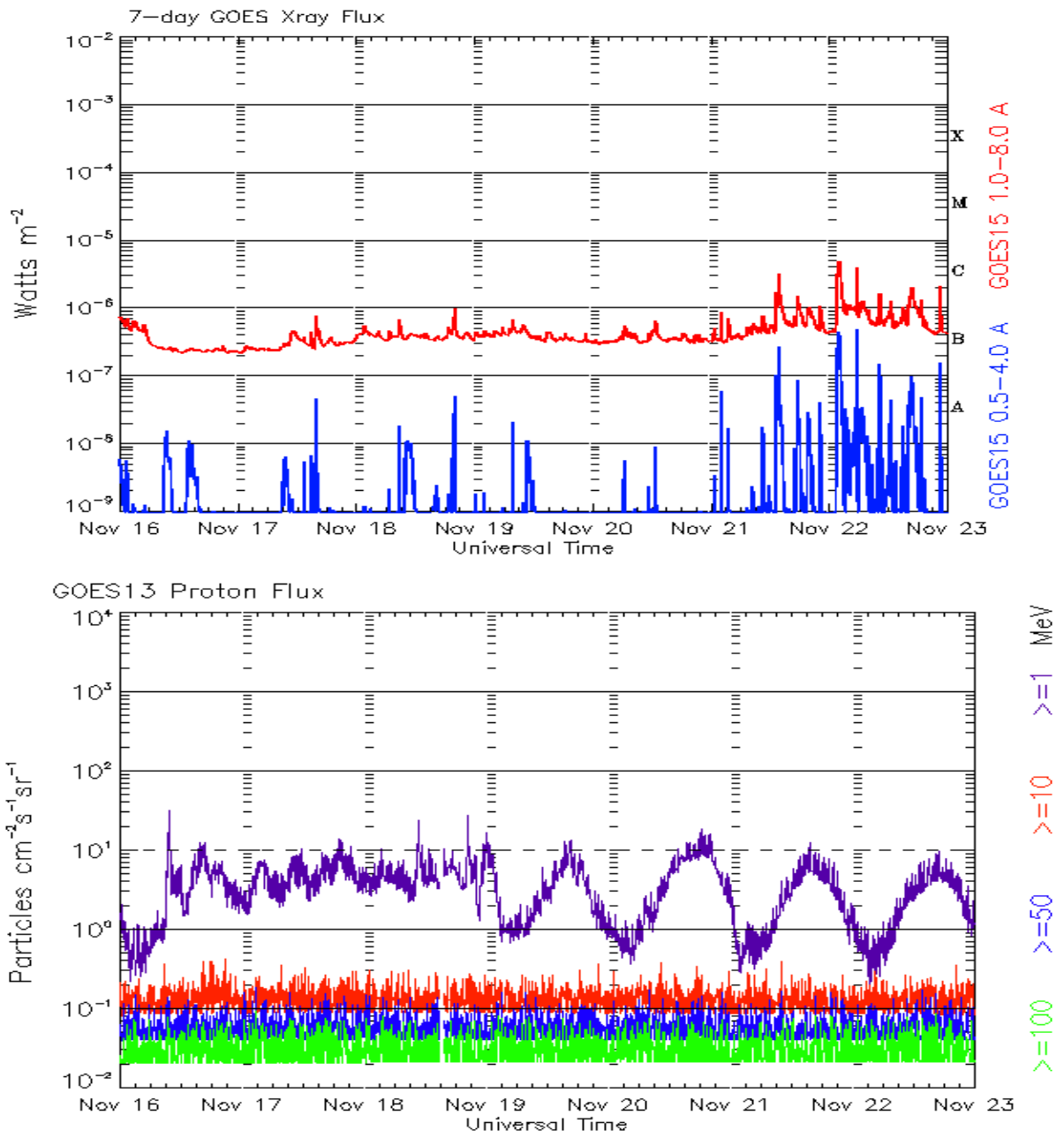
The proton flux plot contains the five-minute averaged integral proton flux (protons/cm^2-sec -sr) as measured by the SWPC Primary GOES satellite, near West 75, for each of three energy thresholds: greater than 10, 50, and 100 MeV.

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 16 November 2015

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.

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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

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

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http://spaceweather.gov/weekly/Usr_guide.pdf -- User Guide