

Space Weather Highlights 16 - 22 Aug 2004

SWO PRF 1512
24 Aug 2004

Solar activity levels ranged from very low to high. Region 656 (S13, L=082, class/area, Fkc/1360 on 13 August) produced most of the activity this period with 29 C-class, 6 M-class, and 1 X-class flares. The summary period began with moderate levels on 16 and 17 August as Region 656 produced several low-level M-class flares. Early on the 17th, a large filament eruption in the southeast quadrant of the disk was observed at 0500 UTC. Shortly thereafter, a CME was observed emerging from the southeast limb at about 0630 UTC, but was not Earth-directed. Activity levels rose to high by 18 August. As Region 656 began to rotate around the west limb, it produced an X1.8/Sf at 1740 UTC with an associated non-Earth directed CME. Moderate levels occurred on 19 August as Region 656 produced two more M-class flares, an M3.0 (0701 UTC) and an M2.1 (1351 UTC). Activity levels decreased to low by the 20th. Even though Region 656 was well beyond the west limb, it produced a long duration C2.8 X-ray flare at 20/0107 UTC. The summary period ended with very low levels on 20 and 21 August. The only other region of interest was Region 661 (N09, L=347, class/area, Eko/510 on 19 August). Since quietly rotating onto the disk on 12 August, Region 661 has produced only low-level B and C-class activity.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft during most of the summary period. The period began on 16 August with solar wind speed near 350 km/s and the IMF Bz in a weak, northward configuration. Early on 17 August, the IMF Bz began rotating north and south +/- 7 nT and continued this trend for about 24 hours as effects from the weak full-halo CMEs observed on 14 August were felt. During this period, speed jumped slightly to 400 km/s. By midday on 19 August, and through to the end of the forecast period, the IMF Bz trended mostly southward 5 to 10 nT as a weak, recurrent coronal hole rotated into a geoeffective position. Wind speed gradually increased to near 500 km/s by the end of 21 August and finished the summary period at 400 km/s.

There were no greater than 10 MeV proton events at geosynchronous orbit during the summary period.

The greater than 2 MeV electron flux at geosynchronous orbit was at high levels on 16 and 22 August.

The geomagnetic field ranged from quiet to minor storm levels. From 16 – 19 August, the field was mostly quiet to unsettled with brief periods of active conditions observed at high latitudes. By 20 August, and through to the end of the summary period, the field became predominately unsettled to active with isolated high latitude minor storm periods as a recurrent coronal hole high speed stream influenced the geomagnetic field.

Space Weather Outlook 25 August - 20 September 2004

Solar activity is expected to range from very low to moderate. Solar activity is expected to be at very low to low through late August. From early to mid-September, activity levels are expected to increase to low to moderate when old Region 656 (L=085) is due to return.

A greater than 10 MeV proton event is possible after 01 September upon the return of old Region 656.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to be at high levels on 25 – 26 August, 04 – 06 September, and 14 – 19 September.

The geomagnetic field is expected to range from quiet to unsettled levels for most of the forecast period. From 24 – 25 August, 03 – 05 September, and 13 – 18 September, levels are expected to increase to unsettled to active due to a series of weak, recurrent coronal hole high speed streams that are expected to be in a geoeffective position.



Daily Solar Data

Date	Radio Flux 10.7 cm	Sun spot No.	Sunspot Area (10 ⁻⁶ hemi.)	X-ray Background	Flares							
					X-ray Flux			Optical				
					C	M	X	S	1	2	3	4
16 August	134	68	1810	B5.6	11	2	0	13	2	0	0	0
17 August	135	63	1410	B8.7	10	4	0	8	0	0	0	0
18 August	140	53	750	B9.2	12	0	1	1	1	0	0	0
19 August	121	60	660	B9.7	5	2	0	1	0	0	0	0
20 August	121	85	840	B3.2	1	0	0	0	0	0	0	0
21 August	120	88	850	B2.3	0	0	0	0	0	0	0	0
22 August	115	102	770	B1.9	0	0	0	0	0	0	0	0

Daily Particle Data

Date	Proton Fluence (protons/cm ² -day-sr)			Electron Fluence (electrons/cm ² -day-sr)		
	>1MeV	>10MeV	>100MeV	>.6MeV	>2MeV	>4MeV
	16 August	9.9E+5	1.5E+4	3.7E+3		4.9E+7
17 August	7.6E+5	1.4E+4	3.2E+3		8.4E+6	
18 August	2.0E+5	1.4E+4	3.3E+3		1.4E+6	
19 August	3.0E+5	1.6E+4	3.6E+3		2.1E+6	
20 August	3.9E+5	1.6E+4	3.8E+3		1.7E+6	
21 August	4.7E+5	1.4E+4	3.5E+3		4.6E+6	
22 August	5.8E+5	1.3E+4	2.9E+3		4.4E+7	

Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	16 August	5	0-1-0-1-2-1-2-3	3	0-1-0-1-2-1-1-2	8
17 August	9	3-1-1-1-3-2-2-3	7	2-1-1-1-2-3-2-2	11	3-1-1-2-3-3-4-3
18 August	10	2-2-3-2-2-3-2-3	*	2-2-*-*-*-*-*0	13	3-2-4-3-3-3-3-3
19 August	3	2-1-0-1-1-1-1-1	2	1-0-0-0-0-1-1-1	7	3-1-0-2-2-3-2-2
20 August	9	2-2-2-3-3-2-2-1	26	2-2-4-5-5-5-3-2	14	3-3-3-4-3-3-3-3
21 August	14	4-3-4-2-1-2-2-3	27	3-4-6-5-4-2-2-2	17	3-4-4-3-3-3-3-3
22 August	8	2-2-3-2-2-2-2-2	28	3-3-6-5-4-4-1-2	13	3-3-4-4-3-3-2-2

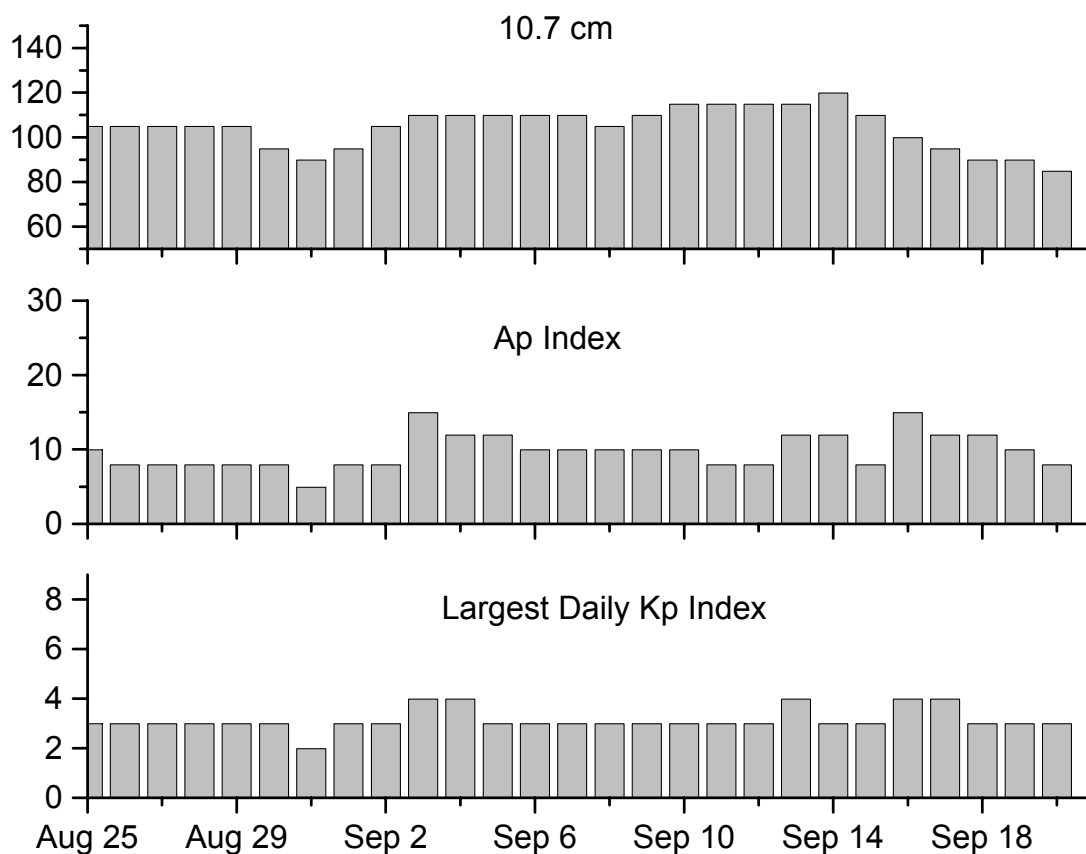


Alerts and Warnings Issued

<u>Date & Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date & Time of Event UT</u>
16 Aug 0013	16 – 245 MHz Radio Bursts	15 Aug
16 Aug 0013	1 – 245 MHz Radio Noise Storm	15 Aug
16 Aug 1320	ALERT: Electron 2MeV Integral Flux exceeded 1000pfu	16 Aug 1300
17 Aug 0009	4 – 245 MHz Radio Bursts	16 Aug
16 Aug 0013	16 – 245 MHz Radio Bursts	15 Aug
18 Aug 0012	5 – 245 MHz Radio Bursts	17 Aug
18 Aug 1157	ALERT: Type II Radio Emission	16 Aug 1044
18 Aug 1737	ALERT: X-Ray Flux \geq M5	18 Aug 1735
18 Aug 1746	SUMMARY: 10cm Radio Burst	18 Aug 1732
18 Aug 1756	SUMMARY: X-ray Event \geq X1	18 Aug 1729
18 Aug 1825	ALERT: Type II Radio Emission	18 Aug 1742
18 Aug 1826	ALERT: Type IV Radio Emission	18 Aug 1809
19 Aug 0026	1 – 245 MHz Radio Bursts	17 Aug
20 Aug 1439	WARNING: Geomagnetic K = 4	18 Aug 1440 - 20 Aug 2359
20 Aug 1628	ALERT: Geomagnetic K = 4	20 Aug 1625
20 Aug 1757	WARNING: Geomagnetic K = 5	20 Aug 1757 -20 Aug 2359
21 Aug 0045	1 - 245 MHz Radio Burst	20 Aug
20 Aug 2355	EXTENDED WARNING: Geomagnetic K= 4	20 Aug 1440 - 21 Aug 1500
21 Aug 0812	WARNING: Geomagnetic K = 5	21 Aug 0811 - 1500
21 Aug 0814	ALERT: Geomagnetic K= 5	21 Aug 0813
21 Aug 1444	EXTENDED WARNING: Geomagnetic K= 4	20 Aug 1440 - 21 Aug 2359
21 Aug 2354	EXTENDED WARNING: Geomagnetic K= 4	20 Aug 1440 - 22 Aug 1500
22 Aug 0031	1 - 245 MHz Radio Bursts	21 Aug
22 Aug 0725	WARNING: Geomagnetic K = 5	22 Aug 0725 - 1500
22 Aug 0732	ALERT: Geomagnetic K = 5	22 Aug 0732
22 Aug 1526	ALERT: Electron 2MeV Integral Flux >1000pfu	22 Aug 1505



Twenty-seven Day Outlook



Date	Radio Flux 10.7 cm	Planetary A Index	Largest Kp Index	Date	Radio Flux 10.7 cm	Planetary A Index	Largest Kp Index
25 Aug	105	10	3	08 Sep	105	10	3
26	105	8	3	09	110	10	3
27	105	8	3	10	115	10	3
28	105	8	3	11	115	8	3
29	105	8	3	12	115	8	3
30	95	8	3	13	115	12	4
31	90	8	3	14	120	12	3
01 Sep	95	8	3	15	110	8	3
02	105	8	3	16	100	15	4
03	110	15	4	17	95	12	4
04	110	12	4	18	90	12	3
05	110	12	3	19	90	10	3
06	110	10	3	20	85	8	3
07	110	10	3				



Energetic Events

Date	Time		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	Max	Class	Flux	Imp/	Location	Rgn	Radio Flux		Intensity	
						Brtns	Lat CMD		245	2695	II	IV
16 Aug	0331	0347	0415	M1.1	.024	Sf	S12W54	656	85			
16 Aug	2229	2244	2252	M1.1	.008	1f	S12W62	656				
17 Aug	0459	0506	0514	M1.1	.006	Sf	S12W66	656				
17 Aug	1926	1937	1948	M2.4	.021			656				
17 Aug	2112	2121	2139	M1.8	.019			656				
17 Aug	2212	2228	2237	M1.3	.015			656				
18 Aug	1729	1740	1754	X1.8	.180	Sf	S12W83	656	79	150	2	
19 Aug	0635	0701	0718	M3.0	.040			656			26	
19 Aug	1329	1351	1416	M2.1	.041			656				

Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical Location Lat CMD	Rgn
	Begin	Max	End				
16 August	0258	0305	0314	C2.8			656
	0337	0341	0352	M1.1	Sf	S12W54	656
	0353	0357	0404		Sf	S12W54	656
	0448	0503	0520	C5.9	1f	S15W53	656
	B0516	0516	0522		Sf	S17W65	
	0528	0530	0534		Sf	S12W55	656
	0529	0537	0542	C9.4	Sf	S15W54	656
	0535	0539	0541		Sf	S12W55	656
	0545	0548	0551		Sf	S12W55	656
	0735	0749	0755	C1.9			656
	0739	0741	0746		Sf	S12W56	656
	0749	0750	0755		Sf	S12W56	656
	0829	0835	0841	C1.7			656
	1014	1016	1023	C8.0	Sf	S15W57	656
	1025	1032	1036		Sf	S14W58	656
	1336	1346	1356	C9.0	Sf	S15W59	656
	1505	1508	1510	C1.1			656
	1521	1525	1530	B8.5			656
	1629	1632	1635	B8.8			656
	1646	1651	1656	B8.0			656
	B1716	U1716	A1722	B8.4	Sf	S12W61	656
	1744	1751	1758	C1.9			656
	1949	2000	2006	C2.8			656
	2046	2055	2120	C6.2			656
	B2242	2244	2247	M1.1	1f	S12W62	656
17 August	0041	0050	0059	C2.9			656
	0201	0204	0207	C2.9	Sf	S12W66	656
	0340	0340	0347	C4.5	Sf	S12W67	656
	0458	0504	0513	M1.1	Sf	S12W66	656
	0519	0520	0524		Sf	S12W66	656



Flare List-continued

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
17 August	0545	0547	0549		Sf	S12W68	656
	0629	0630	0633		Sf	S15W66	656
	0737	0739	0742	C5.2	Sf	S14W67	656
	0832	0837	0842	C4.9			656
	0952	0958	1002	C4.1			656
	1047	1048	1051	C1.8	Sf	N06E26	661
	1319	1340	1351	C8.8			656
	1605	1648	1703	C1.6			656
	1800	1814	1828	C7.2			656
	1926	1937	1948	M2.4			656
	2112	2121	2139	M1.8			656
	2212	2228	2237	M1.3			656
	18 August	0106	0110	0115	C6.1		
0217		0223	0228	C3.3			656
0238		0242	0247	C1.8			656
0255		0319	0325	C2.5			656
0414		0417	0420	C1.6			
0506		0510	0514	C3.0			661
0714		0726	0735	C4.1			656
1042		1043	1053	C3.2	1f	N03E14	661
1312		1315	1322	C1.4			656
1348		1356	1403	C4.0			656
1621		1646	1701	C7.2			656
1736	1746	1754	X1.8	Sf	S12W83	656	
2253	2258	2302	C2.3			656	
19 August	0002	0006	0009	C2.6			656
	0115	0119	0126	C4.7			656
	0223	0224	0228		Sf	N09E07	661
	0635	0701	0718	M3.0			656
	1228	1239	1248	C3.0			656
	1250	1307	1325	C4.2			656
	1329	1351	1416	M2.1			656
2027	2105	2147	C2.1				
20 August	0031	0107	0136	C2.8			656
21 August	2358	0002	0004	B7.9			661
22 August	2129	2133	2137	B3.2			661
	2215	2219	2221	B3.4			664



Region Summary

Date	Location		Sunspot Characteristics				Flares												
	(° Lat ° CMD)	Helio	Area (10 ⁻⁶ hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical								
		Lon						C	M	X	S	1	2	3	4				
<i>Region 656</i>																			
06 Aug	S12E69	083	0040	02	Hsx	001	A												
07 Aug	S13E58	081	0250	09	Dko	007	B												
08 Aug	S12E45	081	0290	11	Eao	020	Bg	2				3							
09 Aug	S12E31	082	0660	11	Ekc	061	Bgd	14				12	1						
10 Aug	S12E18	082	0700	12	Ekc	043	Bgd	2				2							
11 Aug	S13E03	083	0990	14	Ekc	068	Bgd	18				11							
12 Aug	S13W09	082	1320	16	Fkc	083	Bgd	11	1			11	1						
13 Aug	S13W22	082	1360	16	Fkc	099	Bgd	6	4	1		7	4						
14 Aug	S13W35	082	1300	17	Fkc	066	Bgd	4	7			15	2	2					
15 Aug	S13W48	082	1310	22	Fhc	054	Bgd	8	5			6	1	1					
16 Aug	S13W61	082	1330	21	Fhc	033	Bgd	11	2			12	2						
17 Aug	S14W77	084	0930	21	Fkc	021	Bgd	9	4			7							
18 Aug	S13W91	085	0190	15	Eao	007	B	9			1	1							
								94	23	2	87	1	3	0	0				

Crossed West Limb.

Absolute heliographic longitude: 083

Region 657

06 Aug	N10E82	074	0080	02	Hax	001	A
07 Aug	N11E65	074	0060	02	Hax	001	A
08 Aug	N11E51	075	0040	02	Hax	001	A
09 Aug	N11E38	075	0040	02	Hax	001	A
10 Aug	N11E25	075	0030	02	Hsx	001	A
11 Aug	N10E12	074	0060	02	Hsx	001	A
12 Aug	N10W02	075	0030	02	Hsx	001	A
13 Aug	N10W15	075	0030	02	Hsx	001	A
14 Aug	N10W28	075	0020	02	Hsx	002	A
15 Aug	N10W41	075	0020	02	Hsx	001	A
16 Aug	N10W54	075					
17 Aug	N10W67	075					
18 Aug	N10W80	075					
19 Aug	N10W93	075					

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 075



Region Summary - continued.

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

Region 659

10 Aug N17E59	041	0030	06	Cro	005	B												
11 Aug N17E46	040	0040	02	Cso	002	B												
12 Aug N18E33	040	0030	02	Hax	001	A												
13 Aug N18E20	040	0010	06	Bxo	006	B												
14 Aug N17E05	042																	
15 Aug N17W08	042																	
16 Aug N17W21	042																	
17 Aug N17W34	042																	
18 Aug N17W47	042																	
19 Aug N17W60	042																	
20 Aug N17W73	042																	
21 Aug N17W86	042																	

0 0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude: 042

Region 660

11 Aug S08E62	024	0020	05	Cro	004	B												
12 Aug S07E48	025	0050	06	Dso	004	B												
13 Aug S07E35	025	0040	07	Cao	002	B												
14 Aug S07E17	030	0030	02	Hsx	001	A												
15 Aug S07E04	030	0010	01	Hsx	001	A												
16 Aug S07W10	030	0010	01	Hrx	001	A												
17 Aug S08W24	031	0010	01	Axx	001	A												
18 Aug S08W37	031																	
19 Aug S08W50	031																	
20 Aug S08W63	031																	
21 Aug S08W76	031																	
22 Aug S08W89	031																	

0 0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude: 030



Region Summary - continued.

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

Region 661

12 Aug	N08E84	349	0080	04	Hsx	001	A												
13 Aug	N07E73	347	0360	09	Dao	002	B												
14 Aug	N07E60	347	0340	07	Dao	002	B												
15 Aug	N07E47	348	0390	08	Dko	002	B												
16 Aug	N07E34	348	0470	11	Eko	004	Bd												
17 Aug	N09E20	347	0470	10	Dko	011	Bd	1			1								
18 Aug	N10E07	347	0540	10	Dko	013	Bg	2					1						
19 Aug	N09W06	347	0510	11	Eko	017	Bg					1							
20 Aug	N08W19	347	0470	11	Eko	016	B												
21 Aug	N07W33	348	0450	08	Dko	009	B												
22 Aug	N06W47	348	0430	07	Dko	007	B												
										3	0	0	0	2	1	0	0	0	0

Still on Disk.

Absolute heliographic longitude:347

Region 662

18 Aug	N12E28	326	0020	03	Cro	003	B												
19 Aug	N13E13	328	0040	05	Cao	011	B												
20 Aug	N13E00	328	0110	06	Dao	013	B												
21 Aug	N13W13	328	0110	07	Dac	011	B												
22 Aug	N13W27	328	0050	05	Dao	006	B												
										0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:328

Region 663

19 Aug	N08E75	266	0110	04	Hax	002	A												
20 Aug	N10E67	261	0230	10	Dao	007	B												
21 Aug	N11E52	263	0200	13	Eao	009	B												
22 Aug	N11E39	262	0180	12	Eso	014	B												
										0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:262

Region 664

20 Aug	S11E40	288	0030	06	Dao	009	B												
21 Aug	S10E25	290	0090	09	Dac	019	B												
22 Aug	S10E12	289	0100	10	Dao	022	B												
										0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:289

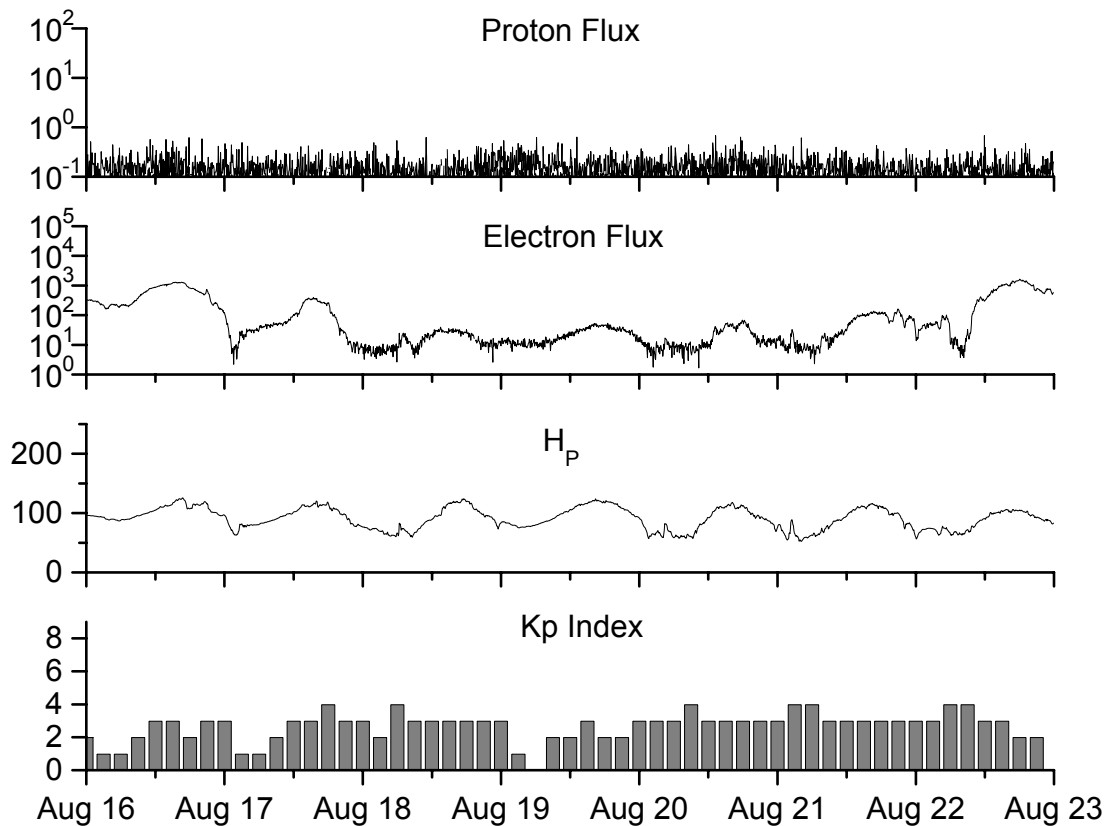


**Recent Solar Indices (preliminary)
of the observed monthly mean values**

Month	Sunspot Numbers			Radio Flux		Geomagnetic			
	Observed values SWO	Ratio RI	Ratio RI/SWO	Smooth values SWO	Smooth values RI	*Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
2002									
August	191.0	116.4	0.61	169.2	98.7	183.9	169.5	16	14.2
September	206.4	109.6	0.53	163.4	94.6	175.8	164.1	14	15.0
October	153.9	97.5	0.63	158.8	90.5	167.0	159.4	23	15.6
November	159.8	95.5	0.60	150.9	85.2	168.7	154.8	16	16.3
December	147.9	80.8	0.55	144.6	82.1	158.6	150.9	13	17.0
2003									
January	149.3	79.7	0.53	141.7	81.0	144.0	149.2	13	18.2
February	87.0	46.0	0.53	136.4	78.5	124.5	144.7	17	18.9
March	119.7	61.1	0.51	128.1	74.2	132.2	139.5	21	19.4
April	119.7	60.0	0.50	121.5	70.3	126.3	136.3	20	20.0
May	89.6	55.2	0.62	118.3	67.8	129.3	135.0	26	21.0
June	118.4	77.4	0.65	113.6	65.2	129.4	132.6	24	21.8
July	132.8	85.0	0.64	106.9	62.0	127.8	129.5	20	22.3
August	114.3	72.7	0.64	102.8	60.3	122.1	127.5	23	22.4
September	82.6	48.8	0.59	100.7	59.8	112.3	126.0	19	21.9
October	118.9	65.6	0.55	96.6	58.4	153.1	124.1	32	21.1
November	118.9	67.2	0.57	93.6	57.0	153.1	121.8	31	20.0
December	75.4	47.0	0.62	91.4	55.0	115.1	119.4	18	18.6
2004									
January	62.3	37.2	0.60	87.9	52.1	114.1	117.7	20	18.0
February	75.6	46.0	0.61			107.0		13	
March	81.0	48.9	0.60			112.2		12	
April	59.3	39.3	0.66			101.3		10	
May	77.3	41.5	0.54			99.7		9	
June	78.9	43.2	0.55			99.7		9	
July	87.8	51.0	0.58			118.6		21	

NOTE: All smoothed values after September 2002 and monthly values after March 2003 are preliminary estimates. The lowest smoothed sunspot index number for Cycle 22, RI = 8.0, occurred in May 1996. The highest smoothed sunspot number for Cycle 23, RI= 120.8, occurred April 2000. *After June 1991, the 10.7 cm radio flux data source is Penticton, B.C. Canada. Prior to that, it was Ottawa.





*Weekly Geosynchronous Satellite Environment Summary
Week Beginning 16 August 2004*

Protons plot contains the five-minute averaged integral proton flux (protons/cm²-sec -sr) as measured by GOES-11 (W98) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

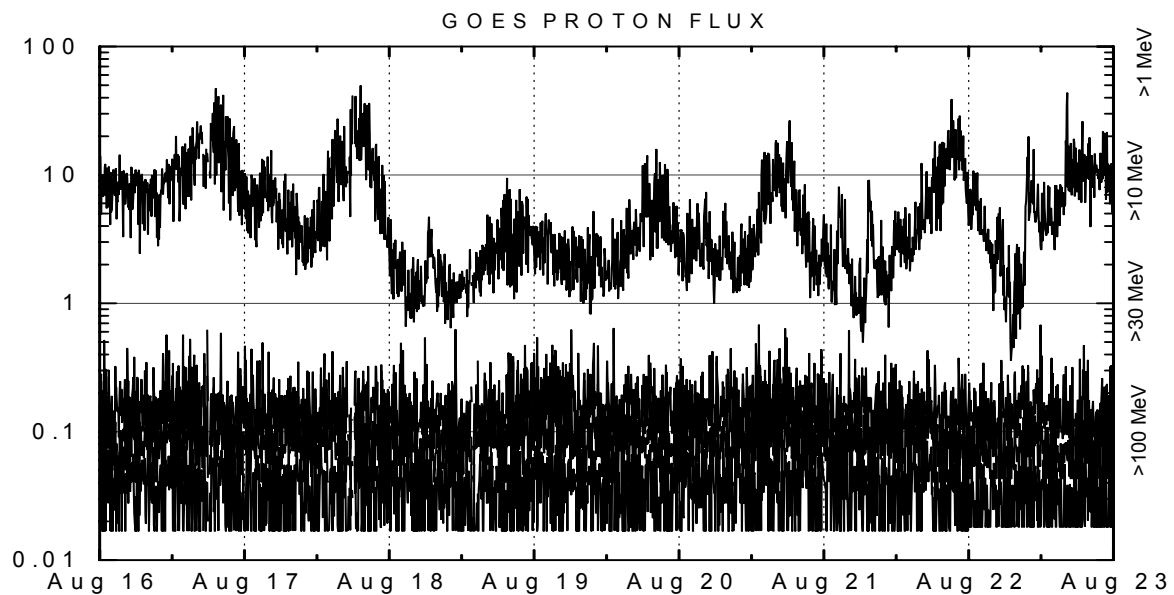
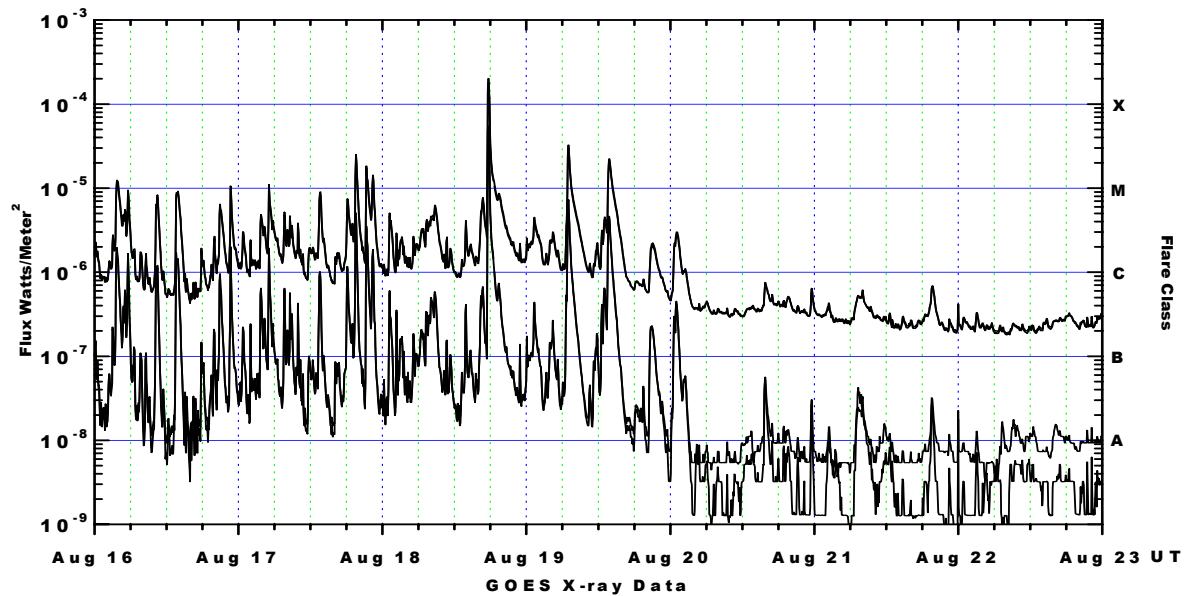
Electrons plot contains the five-minute averaged integral electron flux (electrons/cm²-sec -sr) with energies greater than 2 MeV at GOES-12 (W75).

H_p plot contains the five minute averaged magnetic field H - component in nanoteslas (nT) as measured by GOES-12. The H component is parallel to the spin axis of the satellite, which is nearly parallel to the Earth's rotation axis.

K_p plot contains the estimated planetary 3-hour K-index (derived by the Air Force Weather Agency) in real time from magnetometers at Meanook, Canada; Sitka, AK; Glenlea, Canada; St. Johns, Canada; Ottawa, Canada; Newport, WA; Fredericksburg, VA; Boulder, CO; Fresno, CA and Hartland, UK. These data are made available through cooperation from the Geological Survey of Canada (GSC), British Geological Survey (BGS) and the US Geological Survey. These may differ from the final K_p values derived from a more extensive network of magnetometers.

The data included here are those now available in real time at the SWO 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 K_p are "global" parameters that are applicable to a first order approximation over large areas. H_p 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

X-ray plot contains five-minute averaged x-ray flux (watts/m²) as measured by GOES 12 (W75) and GOES 10 (W135) in two wavelength bands, .05 - .4 and .1 - .8 nm. The letters A, B, C, M and X refer to x-ray event levels for the .1 - .8 nm band.

Proton plot contains the five-minute averaged integral proton flux (protons/cm²-sec-sr) as measured by GOES-11 (W98) for each of the energy thresholds: >1, >10, >30 and >100 MeV. P10 event threshold is 10 pfu (protons/cm²-sec-sr) at greater than 10 MeV.

