

Space Weather Highlights 19 - 25 April 2004

SWO PRF 1495
27 April 2004

Solar activity ranged from very low to moderate this summary period. The period began with very low to low activity on 19 - 21 April. Early on 22 April, Region 596 (S08, L=110, class/area, Eko/400 on 22 April) produced an M1.2/1n flare at 0219 UTC. Though the largest group on the disk, Region 596 was quiet and stable for the remainder of the period and exhibited weak decay. On 23 April, Region 597 (S08, L=193, class/area, Dso/090 on 23 April) produced two M-class and numerous C-class flares as it neared the west limb. The first M-class flare was an impulsive M1.5 at 23/1150 UTC while later in the day, an M1.1/Sf occurred at 23/2112 UTC. Weak radio emissions, including a 150 sfu 10cm burst, were observed in association with the later M-class flare. By 24 April, activity levels returned to low levels as numerous C-class flares were observed from Region 597 as it rotated beyond the west limb. Region 599 (N16, L=047, class/area, Dai/170 on 25 April) emerged on the disk on 24 April. The group produced frequent upper level B-class and lower level C-class flares on 24 April. Early on 25 April, Region 599 produced the largest flare of the summary period, an impulsive M2.2/1n at 0537 UTC. The group grew steadily and showed some magnetic complexity.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft during most of the summary period. The period began with solar wind speed near 350 km/s. At 20/2255 UTC, a shock passage was observed at ACE resulting in a sudden increase in wind speed to 400 km/s. At the same time, density decreased, temperature increased and Alfvén wave activity in the magnetic field components appeared to increase, all indications of the presence of a high-speed coronal hole stream. Wind speed peaked at near 475 km/s midday on 21 April, but fluctuations in the IMF were weak with the field not varying beyond +/- 5 nT. Solar wind speed remained slightly elevated on 23 - 24 April with values running between 420 and 475 km/s. During this period, Bz rotated between +/- 10 nT. By 25 April, solar wind data showed a continuation of a weak, high-speed stream with velocities ranging between 500 - 550 km/s, but fluctuations in the IMF returned to a weak state with the field not varying beyond +/- 5 nT.

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

The greater than 2 MeV electron flux at geosynchronous orbit was at normal to moderate levels the entire summary period.

The geomagnetic field ranged from quiet to active levels. The period began on 19 - 22 April with quiet to unsettled conditions. Early on 23 April, activity increased to active to isolated minor storm levels as a result of the coronal hole high-speed stream. The period ended on 24 - 25 April with predominately quiet to unsettled levels with a few periods of isolated active conditions.

Space Weather Outlook 28 April - 24 May 2004

Solar activity levels are expected to range from very low to moderate for the forecast period. Isolated moderate activity is possible from Regions 596 and 599 and from returning old Region 597.

No greater than 10 MeV proton events are expected during the period.

The greater than 2 MeV electron flux at geosynchronous orbit is expected to reach high levels from 03 - 07 May, 15 - 16 May and 21 - 24 May due to recurrent coronal hole high-speed streams.

The geomagnetic field is expected to range from quiet to minor storm levels. Active to isolated minor storm levels are expected on 02 - 05 May and 20 - 22 May due to returning coronal hole high-speed streams. A weaker coronal hole is due to return to a geo-effective position on 14 - 15 May with unsettled to active conditions expected. Otherwise, the geomagnetic field will be at mostly quiet to unsettled levels.



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
19 April	113	108	440	B1.7	2	0	0	2	0	0	0	0
20 April	111	96	560	B1.4	0	0	0	1	0	0	0	0
21 April	113	98	490	B1.2	2	0	0	5	0	0	0	0
22 April	117	90	520	B2.0	2	1	0	16	2	0	0	0
23 April	115	63	450	B4.4	17	2	0	12	0	0	0	0
24 April	112	64	370	B4.4	11	0	0	4	0	0	0	0
25 April	107	45	400	B2.0	5	1	0	6	1	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
	19 April	2.2E+5	1.4E+4	3.4E+3		2.0E+7
20 April	2.7E+5	1.4E+4	3.2E+3		1.9E+7	
21 April	3.0E+5	1.5E+4	3.4E+3		1.2E+7	
22 April	4.2E+5	1.3E+4	3.3E+3		1.6E+7	
23 April	3.1E+5	1.4E+4	3.2E+3		3.5E+6	
24 April	3.4E+5	1.3E+4	2.8E+3		2.4E+6	
25 April	2.5E+5	1.2E+4	2.8E+3		4.3E+6	

Daily Geomagnetic Data

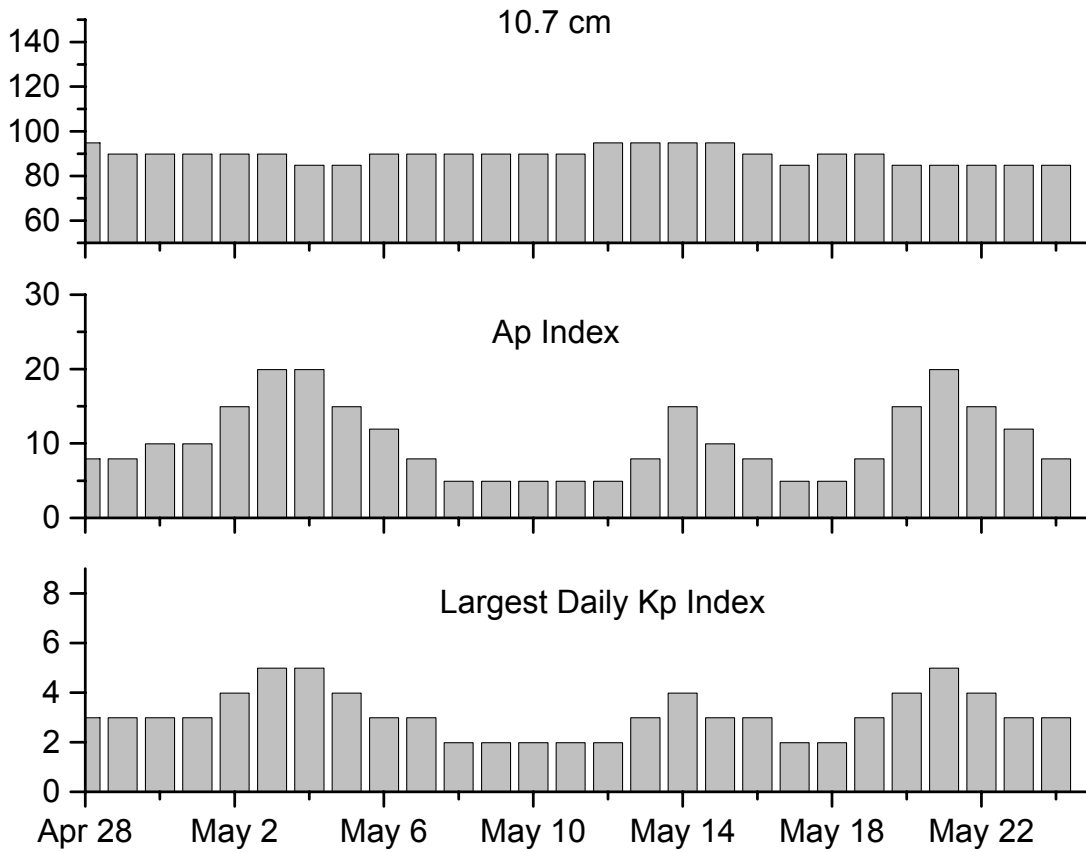
Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	19 April	4	2-2-1-1-1-1-1-1	8	1-2-3-4-2-1-0-0	6
20 April	4	1-1-1-1-2-0-1-2	2	1-0-2-1-0-0-0-1	4	1-1-1-2-2-2-1-2
21 April	6	1-3-1-1-2-1-2-1	4	0-2-1-1-1-2-1-1	5	1-3-1-2-2-2-2-1
22 April	2	0-0-1-1-1-1-1-1	5	1-1-1-1-3-1-2-1	4	0-0-2-1-2-2-1-1
23 April	16	2-2-4-4-3-3-3-3	34	2-3-4-5-6-6-2-2	20	2-3-4-4-5-4-2-3
24 April	7	1-2-2-3-2-2-2-1	17	1-2-3-4-5-4-1-1	11	1-2-3-4-3-3-1-2
25 April	7	1-2-3-2-2-1-1-2	17	2-3-5-4-4-2-1-1	12	1-3-4-3-3-3-2-2

Alerts and Warnings Issued

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UT
20 Apr 2330	WARNING: Geomagnetic Sudden Impulse	20 Apr 2345 -21 Apr 0030
23 Apr 0858	WARNING: Geomagnetic K = 4	23 Apr 0858 - 1500
23 Apr 0900	ALERT: Geomagnetic K=4	23 Apr 0900



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
28 Apr	95	8	3	12 May	95	5	2
29	90	8	3	13	95	8	3
30	90	10	3	14	95	15	4
01 May	90	10	3	15	95	10	3
02	90	15	4	16	90	8	3
03	90	20	5	17	85	5	2
04	85	20	5	18	90	5	2
05	85	15	4	19	90	8	3
06	90	12	3	20	85	15	4
07	90	8	3	21	85	20	5
08	90	5	2	22	85	15	4
09	90	5	2	23	85	12	3
10	90	5	2	24	85	8	3
11	90	5	2				



Energetic Events

Date	Time		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	Max	Class	Flux	Imp/ Brtns	Location Lat CMD	Rgn #	Radio Flux		Intensity	
									245	2695	II	IV
22 Apr	0203	0219	0224	M1.2	.005	1n	S09E19	596				
23 Apr	1141	1150	1152	M1.5	.004			597				
23 Apr	2102	2112	2114	M1.1	.004	Sf	S08W83	597	150			
25 Apr	0502	0537	0542	M2.2	.011	1n	N13E38	599				

Flare List

Date	Time			X-ray Class.	Optical Imp / Brtns	Location Lat CMD	Rgn
	Begin	Max	End				
19 April	0037	0038	0042	C3.3	Sf	S08E60	596
	1820	1830	1840	C4.7			596
	2039	2043	2049	B4.1			595
	2225	2225	2230	B2.4	Sf	S10E47	596
	2339	2345	2349	B2.6			595
20 April	0251	0254	0300	B2.1			597
	0637	0641	0645	B2.9			594
	0940	0951	1007	B5.8			596
	1223	1235	1249	B4.2			
	1608	1619	1648	B5.8	Sf	S07E37	596
21 April	2028	2033	2042	B4.3			596
	0251	0257	0304	C2.1	Sf	S08E30	596
	1452	1455	1508	B9.4	Sf	S07E24	596
	1509	1515	1544		Sf	S09E25	596
	1605	1611	1637	C1.8	Sf	S08E24	596
22 April	2012	2012	2026	B8.8	Sf	S07E22	596
	0000	0000	0006		Sf	S06W73	597
	0010	0011	0018		Sf	S07E14	596
	0020	0023	0033		Sf	S04W03	595
	0038	0041	0043	B3.6			596
	0215	0218	0246	M1.2	1n	S09E19	596
	1004	1008	1011	B3.5			597
	1429	1430	1433		Sf	S09W75	597
	1434	1436	1439		Sf	S09W75	597
	1600	1601	1606	B5.1	Sf	S07E11	596
	1637	1638	1644		Sf	S05E07	596
	1645	1648	1659	B9.9	Sf	S06E09	596
	1746	1750	1753		Sf	S07E10	596
	1750	1910	2018		1f	S09W73	597
	1754	1756	1758		Sf	S09E10	596
1821	1822	1837	C1.1	Sf	S09E10	596	
1906	1909	1915	B9.8			597	



Flare List – continued.

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
22 April	1925	1927	1933		Sf	S06E06	596
	2019	2024	2041	B8.0	Sf	S09W77	597
	2041	2045	2051		Sf	S09W74	597
	2218	2219	2227		Sf	S09E08	596
	2323	2325	2331		Sf	S04E02	596
	2346	0015	0020	C1.6			597
23 April	0114	0119	0124	C1.1			597
	0410	0413	0416	B7.6			597
	0450	0456	0501	C1.9			597
	0547	0550	0552	B9.1			597
	0633	0650	0701	C1.8			597
	0716	0719	0725	C1.2			597
	0743	0756	0801	C6.1			597
	0925	0930	0932	C4.4			597
	0944	0947	0952	C3.0			597
	1039	1044	1047	C4.0			597
	1141	1150	1152	M1.5			597
	1159	1203	1205	C5.1			597
	1415	1417	1437	C1.4	Sf	S06W76	597
	1452	1453	1457		Sf	S08W81	597
	1500	1503	1507		Sf	S08W80	597
	1602	1603	1608	C3.9	Sf	S08W79	597
	1726	1730	1736	C4.8	Sf	S07W83	597
	1903	1906	1909	C1.6	Sf	S08W83	597
	1942	1943	1947		Sf	S08W80	597
	1955	1959	2007		Sf	S07W80	597
	2021	2022	2034		Sf	S07W81	597
	2059	2124	2133	M1.1	Sf	S08W83	597
	2123	2126	2129	C2.8			597
2137	2139	2140		Sf	S08W78	597	
2211	2213	2217	C1.8	Sf	S08W79	597	
2250	2254	2300	C2.5			597	
2329	2337	2341	C2.9			597	
24 April	0006	0011	0023	C1.6			597
	0053	0100	0102	C2.9			597
	0202	0208	0213	C2.9			597
	0547	0549	0550	C1.5	Sf	S06W90	597
	0646	0657	0703	C1.2			597
	0901	0902	0904	C1.3	Sf	S06W90	597
	1251	1301	1313	C1.0			597
	1357	1403	1417	C1.2			597



Flare List – continued.

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
24 April	1522	1527	1529	C2.6			599
	1531	1534	1536	C1.4			599
	1625	1631	1634	B8.8			599
	1713	1719	1723	B9.9			599
	1731	1735	1743	B7.8			599
	1839	1848	1854	B8.3			599
	1922	1927	1931	C1.1			599
	2031	2047	2104		Sf	N16E41	599
	2121	2125	2129	B6.1			597
	2207	2210	2315	B7.9	Sf	N14E41	599
25 April	0140	0143	0217	C9.0	Sf	N13E42	599
	0350	0352	0400		Sf	N13E40	599
	0528	0537	0558	M2.2	ln	N13E38	599
	0712	0717	0722	B6.3			599
	0902	0909	0919	C1.2			599
	1006	1015	1023	C5.0			599
	1429	1439	1512	C1.4	Sf	N15E31	599
	1558	1609	1655	C2.6	Sf	N15E31	599
	1822	1829	1856		Sf	N17E30	599
	1925	1929	1934	B4.8			599
	2154	2154	2206		Sf	N13E32	599
	2315	2319	2323	B2.5			599

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

Region591

12 Apr	S15E01	247	0040	08	Cao	012	B										
13 Apr	S16W13	248	0050	07	Cao	009	B										
14 Apr	S16W25	245	0080	11	Eai	013	Bgd					1					
15 Apr	S16W38	245	0090	09	Dso	014	Bgd	1				2					
16 Apr	S16W52	246	0070	09	Dao	006	B										
17 Apr	S16W65	246	0060	07	Dao	007	B										
18 Apr	S17W79	247	0050	07	Bxo	004	B										
19 Apr	S17W92	247															
								0	1	0	3	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude:247



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 592

13 Apr	S12E59	176	0020	02	Hsx	001	A										
14 Apr	S12E46	174	0030	02	Hrx	003	A										
15 Apr	S12E33	174	0030	01	Hsx	003	A										
16 Apr	S11E19	175	0020	01	Hsx	001	A										
17 Apr	S11E06	175	0010	01	Hsx	001	A										
18 Apr	S10W08	176	0010	01	Axx	001	A										
19 Apr	S10W21	175	0010	01	Axx	001	A										
20 Apr	S10W34	175															
21 Apr	S10W47	175															
22 Apr	S10W60	175															
23 Apr	S10W73	175															
24 Apr	S10W86	175															

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude:175

Region 593

14 Apr	S20E43	177	0020	01	Hsx	001	A										
15 Apr	S20E30	177	0000	01	Axx	001	A										
16 Apr	S20E17	177															
17 Apr	S20E04	177															
18 Apr	S18W11	179	0040	06	Bxo	007	B										
19 Apr	S18W24	178	0050	06	Dai	010	B										
20 Apr	S19W37	178	0060	08	Dso	009	B										
21 Apr	S18W51	179	0030	09	Cso	005	B										
22 Apr	S19W64	179	0020	07	Cso	003	B										
23 Apr	S19W77	179															
24 Apr	S19W90	179															

0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude:177



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 594

14 Apr	N15E69	151	0060	02	Hsx	001	A										
15 Apr	N15E56	151	0060	02	Hsx	002	A										
16 Apr	N15E40	154	0070	02	Hax	002	A										
17 Apr	N15E27	154	0050	02	Hax	004	A										
18 Apr	N15E14	154	0020	06	Bxo	006	B										
19 Apr	N15E00	154	0010	01	Hsx	001	A										
20 Apr	N15W13	154	0020	01	Hsx	001	A										
21 Apr	N15W26	154															
22 Apr	N15W39	154															
23 Apr	N15W52	154															
24 Apr	N15W65	154															
25 Apr	N15W78	154															

0 0 0 0 0 0 0 0

Still on Disk.

Absolute heliographic longitude:154

Region 595

16 Apr	S09E68	126	0040	06	Cso	004	B										
17 Apr	S09E55	126	0010	06	Bxo	003	B										
18 Apr	S08E40	128	0030	11	Ero	006	B										
19 Apr	S07E27	127	0080	08	Dai	025	B										
20 Apr	S07E13	128	0070	07	Dao	010	B										
21 Apr	S06E00	128	0050	08	Cao	011	B										
22 Apr	S07W14	129	0030	06	Cso	006	B					1					
23 Apr	S07W26	128	0040	07	Cso	009	B										
24 Apr	S08W38	126	0010	04	Bxo	011	B										
25 Apr	S08W51	126															

0 0 0 1 0 0 0 0

Still on Disk.

Absolute heliographic longitude:128



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 596

18 Apr	S08E60	108	0160	09	Dso	008	B											
19 Apr	S09E44	110	0290	11	Eki	021	B	2				2						
20 Apr	S09E31	110	0340	10	Dko	020	B					1						
21 Apr	S07E19	109	0340	12	Eai	022	Bg	2				5						
22 Apr	S08E04	110	0400	13	Eko	024	Bg	1	1			10	1					
23 Apr	S08W09	111	0320	11	Eko	020	Bg											
24 Apr	S09W21	109	0240	11	Eso	015	B											
25 Apr	S08W36	111	0230	11	Eao	008	B											
								5	1	0	18	1	0	0	0	0		

Still on Disk.

Absolute heliographic longitude:110

Region 597

20 Apr	S06W60	201	0070	04	Dao	006	B											
21 Apr	S06W72	200	0050	05	Dso	004	B											
22 Apr	S07W84	199	0050	07	Cso	003	B	1				5	1					
23 Apr	S08W91	193	0090	08	Dso	004	B	17	2			12						
								18	2	0	17	1	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude:201

Region 598

21 Apr	S05W30	158	0020	05	Cso	006	B											
22 Apr	S07W45	160	0020	05	Bxo	004	B											
23 Apr	S07W58	160																
24 Apr	S07W71	160																
25 Apr	S07W84	160																
								0	0	0	0	0	0	0	0	0		

Still on Disk.

Absolute heliographic longitude:158

Region 599

24 Apr	N14E51	037	0120	06	Dai	008	B	3				2						
25 Apr	N16E28	047	0170	08	Dai	017	Bg	5	1			6	1					
								8	1	0	8	1	0	0	0	0		

Still on Disk.

Absolute heliographic longitude:047

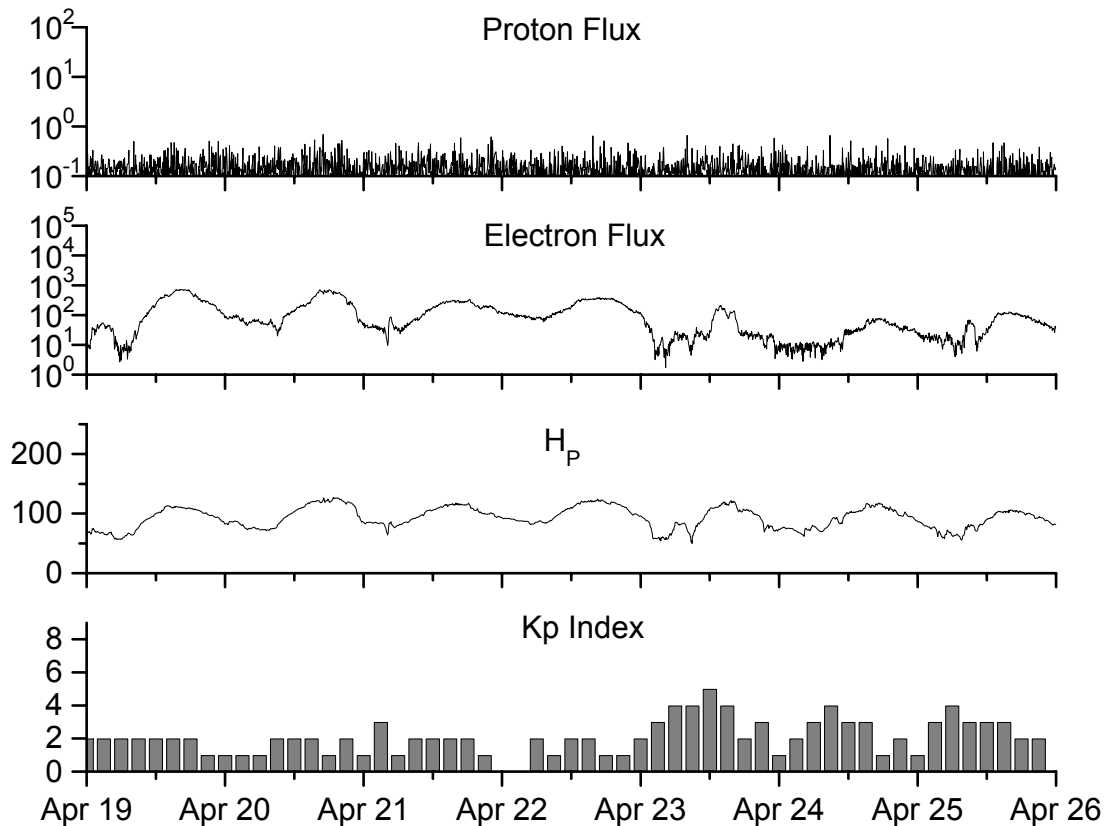


**Recent Solar Indices (preliminary)
of the observed monthly mean values**

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									
April	194.9	120.7	0.62	186.2	110.5	189.8	191.5	15	13.2
May	204.1	120.8	0.59	183.6	108.9	178.4	188.0	15	13.3
June	146.0	88.3	0.60	179.9	106.3	148.7	183.0	11	13.5
July	183.5	99.6	0.54	175.4	102.7	173.5	176.3	11	13.7
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			153.1		32	
November	118.9	67.2	0.57			153.1		31	
December	75.4	47.0	0.62			115.1		18	
2004									
January	62.3	37.2	0.60			114.1		20	
February	75.6	46.0	0.61			107.0		13	
March	81.0	48.9	0.60			112.2		12	

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 19 April 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.

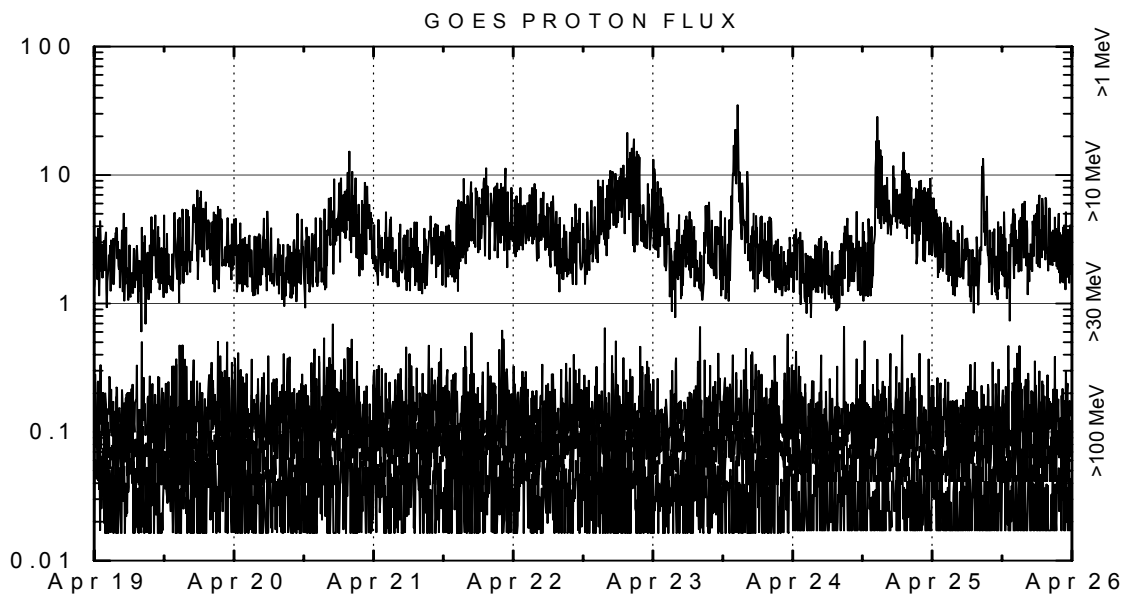
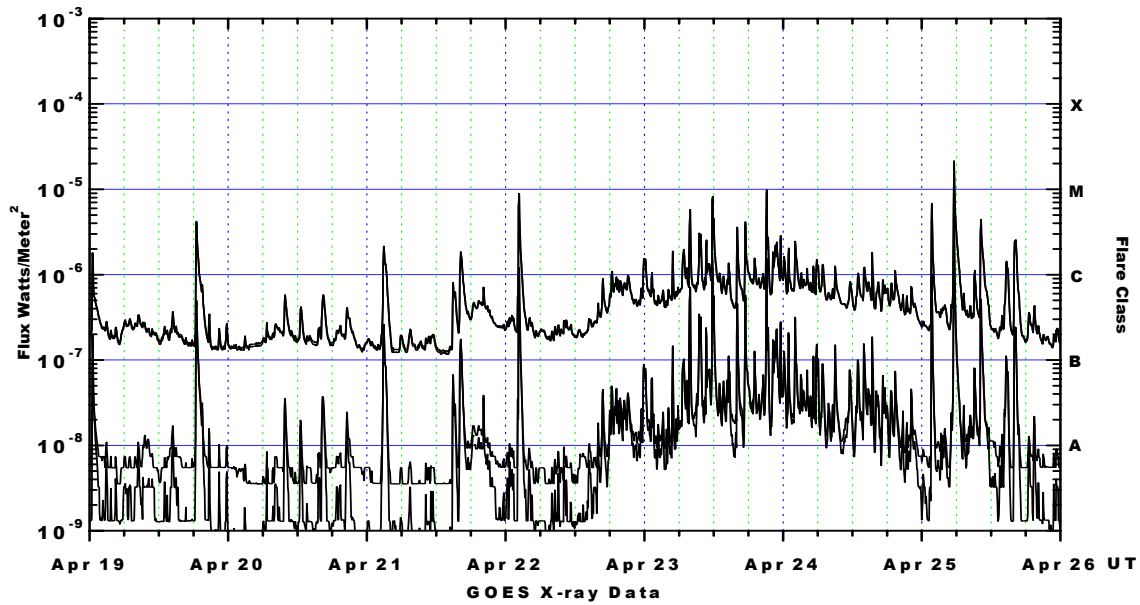
Electrons plot contains the five-minute averaged integral electron flux (electrons/cm²-sec -sr) with energies greater than 2 MeV at GOES-12 (W75).

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 Heartland, UK. These data are made available through cooperation from the Geological Survey of Canada (GSC) 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.

