

**Space Weather Highlights**  
**17 May – 23 May 2004**

**SWO PRF 1499**  
**25 May 2004**

Solar activity ranged from low to moderate. New Region 618 (S10, L=039, class/area, Fki/330 on 23 May) produced the most activity this period with 13 low-level C-class flares and one M-class flare, an M2.6 at 21/2352 UTC with an associated 220 sfu Tenflare. Since first rotating onto the disk on 20 May, Region 618 has grown from a simple 8-spot bipolar group to a complex 46-spot beta-gamma-delta configuration. Region 618 heralds the return of old Region 601 which produced occasional high C-class flare activity on its

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 at 350 km/s. This depressed velocity was maintained through late on 19 May when speed showed a steady increase and reached 500 km/s late on 20 May. Elevated solar wind temperature and wave patterns in the magnetic field suggest that the enhancement originated from a coronal hole high speed stream. Through to the end of the summary period, solar wind speed persisted between 450 – 500 km/s. The IMF Bz did not vary much beyond +/- 5 nT through late on 19 May. From late on 19 May though 20 May, the Bz component of the IMF was on average southward with the characteristic north-south oscillation associated with coronal hole high speed streams. Bz reached peak values during this period near -12 nT. From 21 May through the end of summary period, the IMF Bz did not vary much 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 was at quiet to active levels with one isolated period of minor storming midday on 20 May. From 20 – 23 May, the geomagnetic field was under the influence of a favorably positioned, low-latitude solar coronal hole high speed stream.

**Space Weather Outlook**  
**26 May - 21 June 2004**

Solar activity is expected to be at low levels with isolated moderate activity possible from Region 618 through 01 June.

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 30 May - 04 June, and 16 – 18 June due to coronal hole high speed streams.

The geomagnetic field is expected to range from quiet to active. Unsettled to active conditions are possible from 29 May – 03 June, and 15 - 17 June as coronal hole high speed streams rotate into a geoeffective position.

Note: The ACE spacecraft orbit will bring ACE nearly in line with the Sun from about 30 May – 02 June. During that time, solar radio noise may interfere with spacecraft telemetry resulting in the loss of solar wind plasma, magnetic field, and particle data.



### Daily Solar Data

Date	Radio Flux 10.7 cm	Sun spot No.	Sunspot Area (10 <sup>-6</sup> hemi.)	X-ray Background	Flares							
					X-ray Flux			Optical				
					C	M	X	S	1	2	3	4
17 May	111	147	850	B2.3	1	0	0	2	0	0	0	0
18 May	108	91	710	B1.9	3	0	0	2	1	0	0	0
19 May	109	87	530	B1.7	2	0	0	3	0	0	0	0
20 May	105	109	520	B2.1	3	0	0	0	0	0	0	0
21 May	107	82	470	B2.0	3	1	0	2	0	0	0	0
22 May	102	79	570	B2.0	6	0	0	2	0	0	0	0
23 May	104	127	520	B2.3	4	0	0	3	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)		
	>1MeV	>10MeV	>100MeV	>.6MeV	>2MeV	>4MeV
17 May	1.2E+5	1.4E+4	3.1E+3		1.2E+6	
18 May	1.3E+5	1.4E+4	3.0E+3		1.8E+6	
19 May	1.3E+5	1.4E+4	3.0E+3		2.2E+6	
20 May	2.0E+5	1.3E+4	2.8E+3		1.1E+6	
21 May	2.0E+5	1.3E+4	3.0E+3		1.4E+6	
22 May	2.1E+5	1.4E+4	2.9E+3		3.3E+6	
23 May	2.6E+5	1.3E+4	2.8E+3		3.4E+6	

### Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	17 May	3	1-1-0-1-1-0-1-2	2	1-1-0-0-0-1-2-1	5
18 May	4	2-1-1-1-2-2-1-0	4	2-1-2-2-1-1-0-1	4	1-1-1-2-2-1-1-1
19 May	6	0-1-1-1-2-3-2-2	11	1-1-0-2-3-5-2-2	6	1-2-1-1-3-2-2-2
20 May	11	2-2-3-3-2-2-3-3	21	2-2-4-6-3-2-3-2	13	2-2-3-5-2-2-3-3
21 May	6	3-2-2-1-1-1-1-1	11	3-3-2-3-3-2-2-1	10	3-3-3-2-3-3-2-2
22 May	7	1-3-3-2-1-1-1-2	10	1-3-4-3-2-2-1-1	11	2-3-4-3-3-2-2-2
23 May	9	3-3-2-3-2-2-2-2	15	3-3-2-3-4-3-3-2	12	3-3-2-3-3-2-3-3

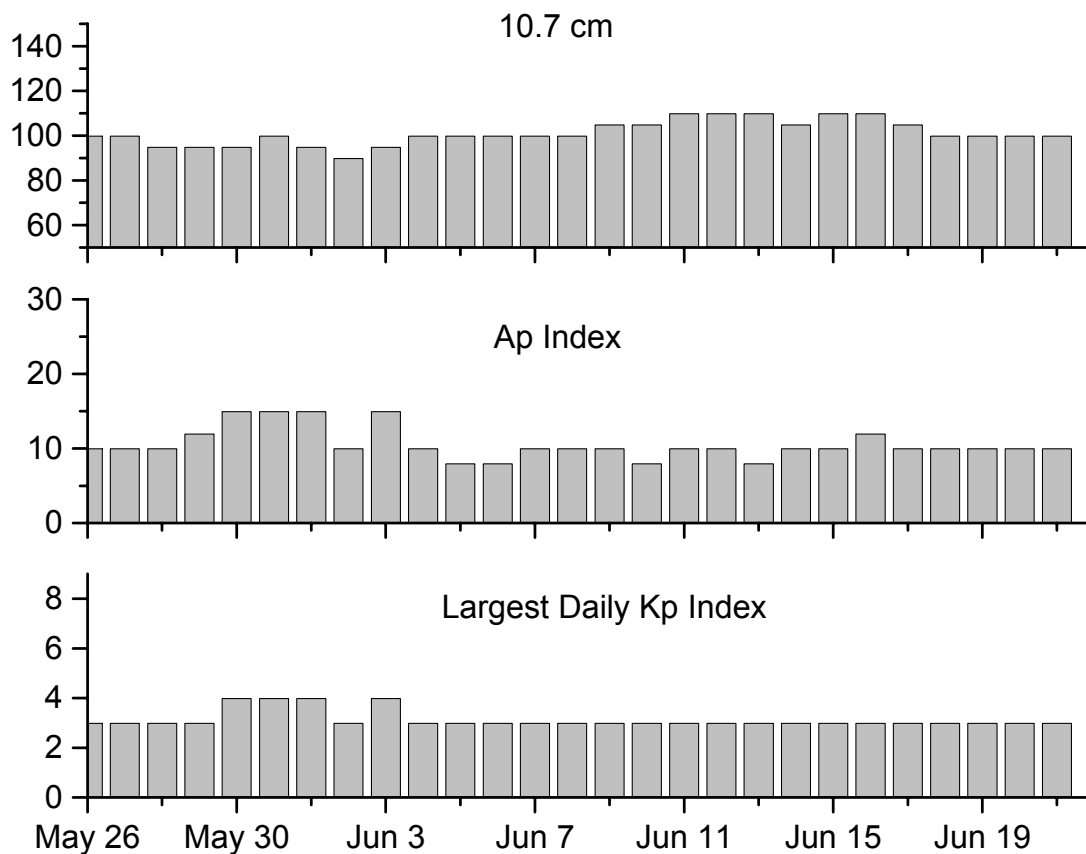


### *Alerts and Warnings Issued*

<u>Date &amp; Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date &amp; Time of Event UT</u>
17 May 0010	1 – 245 MHz Radio Burst	16 May
19 May 1012	ALERT: Geomagnetic K= 4	19 May 1010
19 May 1422	CANCEL ALERT: Geomagnetic K=4	19 May 1012
19 May 1737	ALERT: Geomagnetic K= 4	19 May 1730
20 May 948	ALERT: Geomagnetic K= 4	20 May 0947
20 May 1204	ALERT: Geomagnetic K= 5	20 May 1126
22 May 017	SUMMARY: 10cm Radio Burst	22 May 2349
22 May 844	ALERT: Geomagnetic K= 4	22 May 0843
23 May 0008	1 – 245 MHz Radio Noise Storm	22 May
23 May 1703	WARNING: Geomagnetic K= 4 expected	23 May 1705 - 2359
23 May 1711	ALERT: Geomagnetic K= 4	23 May 1711



### 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
26 May	100	10	3	09 Jun	105	10	3
27	100	10	3	10	105	5	3
28	95	10	3	11	110	10	3
29	95	12	3	12	110	10	3
30	95	15	4	13	110	8	3
31	100	15	4	14	105	10	3
01 Jun	95	15	4	15	110	10	3
02	90	10	3	16	110	10	3
03	95	15	4	17	105	10	3
04	100	10	3	18	100	10	3
05	100	8	3	19	100	10	3
06	100	8	3	20	100	10	3
07	100	10	3	21	100	10	3
08	100	10	3				



### *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
21 May	2335	2352	2359	M2.6	.016	Sf	S10E53	618		220		

### *Flare List*

Date	Time			X-ray Class.	Imp / Brtns	Optical		Rgn	
	Begin	Max	End			Location Lat CMD			
17 May	0047	0100	0107	B9.9	Sf	S04W26		609	
	0213	0219	0224	B6.5				612	
	0244	0247	0250	B4.0				607	
	18 May	0417	0418	0423	C7.0	Sf	S05W80		614
		0708	0712	0716	B8.1				614
		1412	1415	1421	B3.9				614
		1543	1548	1603	B4.7				614
2327		2346	2353	B3.1					
0205		0209	0227	C2.6	1f	N10W42		612	
0355		0400	0408	B3.6				617	
19 May	0534	0537	0540	B4.5	Sf	S09E06		617	
	0608	0612	0622	B4.1				614	
	0728	0732	0739	B3.0					
	0812	0827	0849	C3.2				615	
	1608	1610	1620	C1.6	Sf	N17E48		615	
	2018	2022	2027	B3.2					
	0057	0100	0104	B6.7	Sf	S10W66		606	
20 May	0123	0124	0127	B8.7	Sf	N09W61		612	
	0342	0346	0349	B3.4					
	0354	0358	0401	B4.5					
	0641	0641	0645	B4.6	Sf	N10W60		612	
	1841	1847	1901	C1.1					
	1929	1951	2028	C2.2					
	0104	0118	0128	C2.5				618	
21 May	0315	0320	0325	B7.7					
	0440	0504	0521	C1.1				618	
	0856	0859	0902	B3.5					
	1714	1719	1723	C3.7				618	
	0204	0214	0218	B5.7				618	
	0337	0341	0349	B6.1				618	
	0546	0551	0604	C2.0				618	
0825	0830	0833	B8.3				618		
1027	1034	1040	B7.0				618		
1320	1327	1336	B5.7				618		



*Flare List – continued.*

Date	Time			X-ray Class.	Optical		Rgn		
	Begin	Max	End		Imp / Brtns	Location Lat CMD			
21 May	1620	1621	1634	C2.0	Sf	S10W42	617		
	1850	1905	1908	B6.3			618		
	2032	2036	2040	B4.3			617		
	2213	2220	2229	C1.2			615		
	2343	2356	0016	M2.6			Sf	S10E53	618
22 May	0116	0119	0123	C1.7	Sf	S12E50			
	0710	0715	0730	C2.2			618		
	1145	1155	1206	C1.4			618		
	1223	1227	1232	C1.5			618		
	1255	1302	1308	C2.0			618		
	1608	1608	1613				Sf	S09E41	618
	1720	1734	1759	C1.0			618		
	2001	2006	2012	B2.9			618		
	2110	2115	2122	B3.8			618		
23 May	1130	1135	1143	B4.3	Sf	S10E30	618		
	1348	1353	1357	B3.6			618		
	1441	1452	1510	C2.9			Sf	S10E28	618
	1739	1741	1807	C2.0			Sf	S10E32	618
	1758	1801	1803	C1.6					618
	1948	1948	2005	C1.4			Sf		618
	2202	2209	2220	B7.4					618



### Region Summary

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

#### Region 606

07 May	S09E81	195	0120	02	Hsx	001	A												
08 May	S09E66	197	0220	05	Hax	001	A												
09 May	S08E53	197	0160	02	Hsx	002	A												
10 May	S09E40	197	0140	03	Hkx	003	B												
11 May	S10E27	196	0230	04	Hkx	006	A												
12 May	S10E13	197	0190	05	Hax	006	A												
13 May	S09E01	196	0220	08	Cko	014	B												
14 May	S10W13	197	0220	07	Cko	009	B												
15 May	S09W26	197	0130	05	Cao	008	B												
16 May	S08W39	196	0070	06	Dao	004	B												
17 May	S08W53	197	0060	03	Dao	006	B												
18 May	S10W67	198	0080	03	Cao	003	B												
19 May	S09W80	198	0050	02	Hax	001	A												1
20 May	S10W89	194	0060	03	Cao	002	B												
																			0 0 0 1 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude:196

#### Region 608

09 May	S04E68	182	0040	08	Cso	006	B												
10 May	S04E52	185	0060	08	Dso	010	B												
11 May	S05E38	185	0050	08	Dao	005	B												
12 May	S04E27	183	0030	09	Cao	004	B												
13 May	S06E16	181	0020	02	Cro	003	B												
14 May	S06E03	181	0010	02	Bxo	002	B												
15 May	S06W13	184	0010	01	Bxo	002	B												
16 May	S04W26	183	0010	02	Axx	002	A												
17 May	S04W39	183																	
18 May	S04W52	183																	
19 May	S04W65	183																	
20 May	S04W78	183																	
																			0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude:181



**Region Summary - continued.**

Date	Location		Sunspot Characteristics				Flares										
	( ° Lat ° CMD)	Helio	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical						
		Lon						C	M	X	S	1	2	3	4		
<i>Region 609</i>																	
10 May	S03E63	174	0000	01	Axx	001	A										
11 May	S04E48	175	0020	03	Bxo	005	B										
12 May	S04E41	169	0040	05	Dro	015	B	1				1					
13 May	S03E24	173	0160	07	Dac	022	B	3				2					
14 May	S04E10	174	0230	09	Dac	028	B										
15 May	S03W05	176	0500	08	Dkc	039	Bg	2									
16 May	S03W19	176	0410	08	Dkc	035	Bg										
17 May	S03W31	175	0320	11	Eai	026	Bg					1					
18 May	S03W46	177	0270	08	Dai	013	Bg										
19 May	S04W58	176	0200	08	Dko	010	B										
20 May	S03W70	175	0160	09	Dao	008	B										
21 May	S02W88	180	0090	04	Cao	003	B										
								6	0	0	0	4	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 176

<i>Region 610</i>																	
12 May	S02E19	191	0020	02	Bxo	006	B										
13 May	S01E04	193	0010	01	Axx	001	A										
14 May	S01W11	193															
15 May	S01W24	193															
16 May	S01W37	193															
17 May	S01W50	193															
18 May	S01W63	193															
19 May	S01W76	193															
								0	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 193

<i>Region 611</i>																	
12 May	S12W14	224	0020	01	Cso	002	B										
13 May	S12W27	224															
14 May	S12W40	224															
15 May	S12W53	224															
16 May	S12W66	224															
17 May	S12W79	224															
								0	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 224





**Region Summary - continued.**

Date	Location		Sunspot Characteristics				Flares											
	( ° Lat ° CMD)	Helio	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical							
		Lon						C	M	X	S	1	2	3	4			
<i>Region 612</i>																		
13 May	N10E07	190	0010	03	Bxo	005	B											
14 May	N10W08	192	0040	05	Dao	008	B											
15 May	N10W21	192	0100	06	Dao	017	B											
16 May	N11W34	191	0150	07	Dai	016	B											
17 May	N10W46	190	0160	07	Dao	014	B											
18 May	N10W59	190	0100	02	Hax	001	A	1					1					
19 May	N11W70	188	0050	03	Cao	003	B						2					
20 May	N10W81	186	0010	03	Bxo	003	B											
								1	0	0	2	1	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 190

<i>Region 613</i>																		
13 May	S08E83	114	0030	05	Hsx	002	A											
14 May	S08E64	120	0050	03	Hsx	001	A											
15 May	S08E52	119	0080	02	Hsx	001	A											
16 May	S08E38	119	0080	02	Hsx	002	A											
17 May	S09E25	119	0110	02	Hax	002	A											
18 May	S09E12	119	0110	03	Hkx	002	A											
19 May	S09W01	119	0090	03	Hkx	001	A											
20 May	S09W14	119	0120	02	Hsx	001	A											
21 May	S09W28	120	0100	03	Cso	003	B											
22 May	S09W42	120	0120	02	Hsx	002	A											
23 May	S09W55	120	0080	02	Hax	002	A											
								0	0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 119

<i>Region 614</i>																		
16 May	S05W76	233	0070	05	Cao	006	B											
17 May	S08W89	233	0030	03	Cao	003	B	1					1					
								1	0	0	1	0	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude: 233



**Region Summary - continued.**

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

*Region 615*

16 May	N17E64	093	0060	02	Hsx	002	A										
17 May	N16E51	093	0130	03	Hsx	006	A										
18 May	N17E38	093	0120	03	Hhx	003	A	2				1					
19 May	N16E26	092	0090	03	Hkx	002	A										
20 May	N18E14	091	0090	02	Hax	004	A										
21 May	N17W01	093	0100	03	Hsx	001	A	1									
22 May	N18W13	091	0100	02	Hsx	002	A										
23 May	N17W27	092	0070	03	Cao	007	B										
									3	0	0	1	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:93

*Region 616*

16 May	N08E71	086	0000	01	Axx	001	A										
17 May	N07E56	088	0010	01	Axx	001	A										
18 May	N07E43	088															
19 May	N07E30	088															
20 May	N07E17	088															
21 May	N07E04	088															
22 May	N07W09	088															
23 May	N07W22	088															
									0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 088

*Region 617*

17 May	S12E11	133	0030	03	Dso	009	B										
18 May	S11W04	135	0030	04	Dso	009	B					1					
19 May	S10W19	137	0050	06	Dao	010	B										
20 May	S10W32	137	0050	06	Dao	013	B										
21 May	S11W46	138	0030	06	Cro	006	B	1				1					
22 May	S10W60	138	0040	05	Cro	005	B										
23 May	S11W75	140	0010	02	Axx	002	A										
									1	0	0	2	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:135



***Region Summary - continued.***

Date	Location		Sunspot Characteristics				Flares											
	( ° Lat ° CMD)	Helio	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical							
		Lon						C	M	X	S	1	2	3	4			
<i>Region 618</i>																		
20 May	S10E69	036	0030	09	Cso	008	B	3										
21 May	S11E55	037	0150	12	Cai	019	B	1	1			1						
22 May	S10E41	037	0310	14	Eai	030	Bgd	5				2						
23 May	S10E26	039	0330	16	Fki	046	Bgd	4				3						
								13	1	0	6	0	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 039																		
<i>Region 619</i>																		
23 May	S09W37	102	0020	02	Dso	006	B											
								0	0	0	0	0	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 102																		
<i>Region 620</i>																		
23 May	S15E34	031	0010	03	Cso	004	B											
								0	0	0	0	0	0	0	0	0	0	0
Still on Disk.																		
Absolute heliographic longitude: 031																		

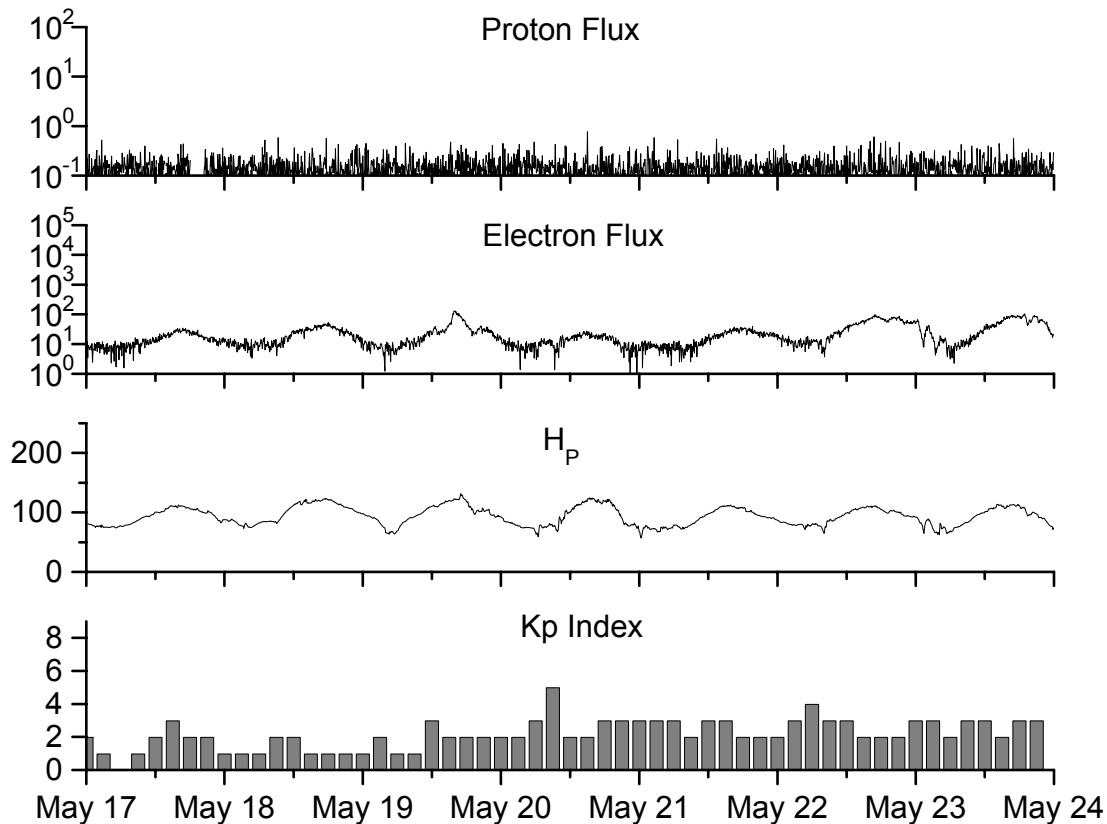


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

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
<b>2002</b>									
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
<b>2003</b>									
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			153.1		31	
December	75.4	47.0	0.62			115.1		18	
<b>2004</b>									
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	
April	59.3	39.3	0.66			101.3		10	

**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 17 May 2004*

*Protons* plot contains the five-minute averaged integral proton flux (protons/cm<sup>2</sup>-sec -sr) as measured by GOES-11 (W98) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

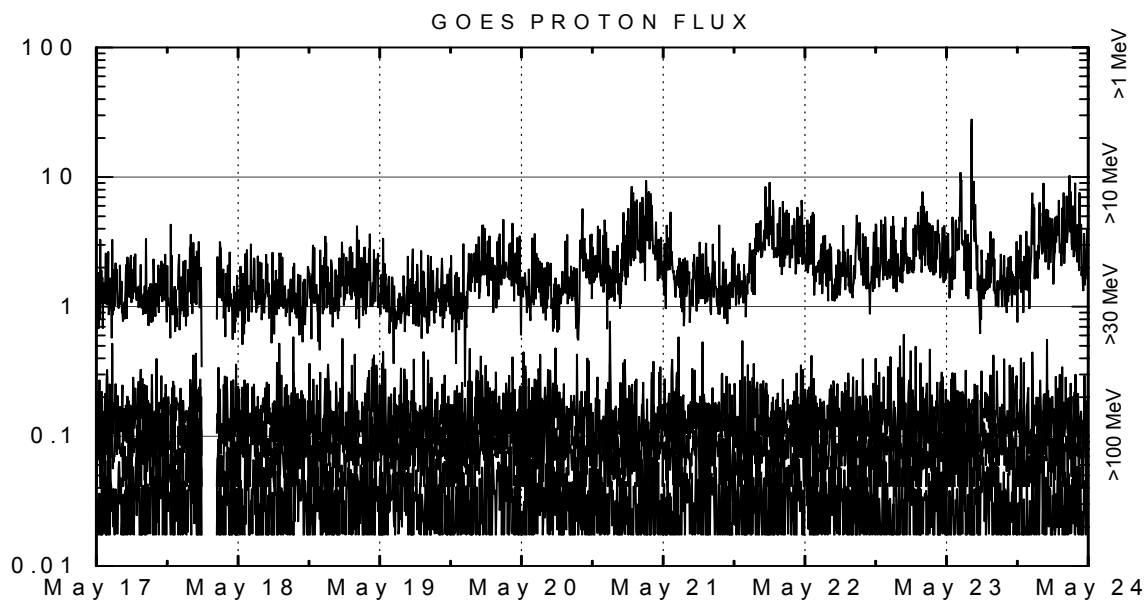
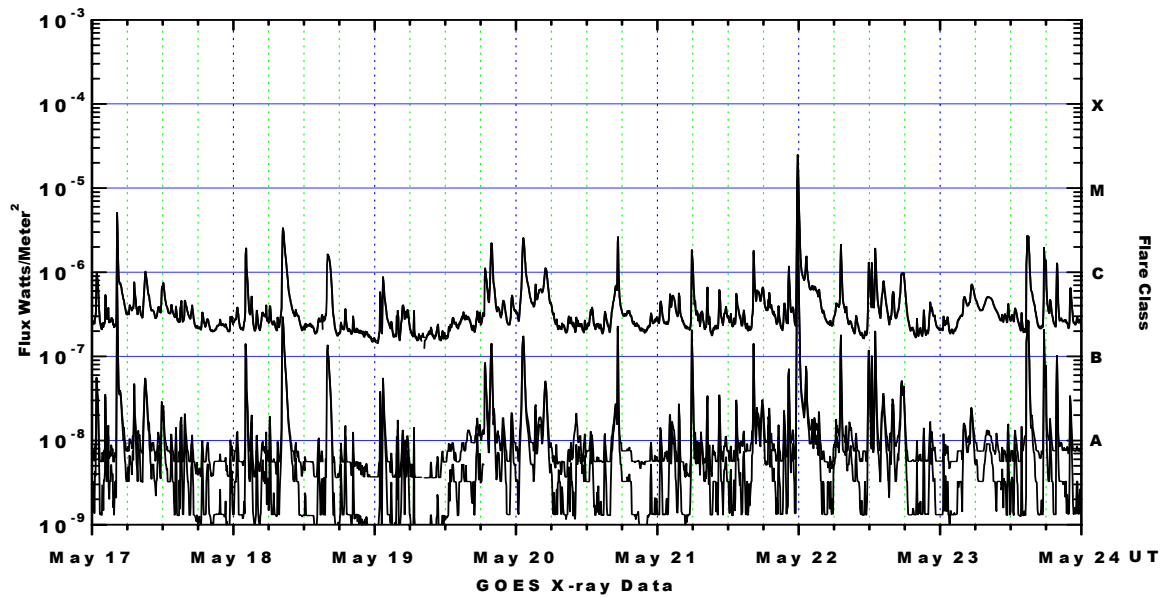
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV at GOES-12 (W75).

*H<sub>p</sub>* 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<sub>p</sub>* 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<sub>p</sub> 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<sub>p</sub> are "global" parameters that are applicable to a first order approximation over large areas. H<sub>p</sub> 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/m<sup>2</sup>) 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/cm<sup>2</sup>-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/cm<sup>2</sup>-sec-sr) at greater than 10 MeV.

