

**Space Weather Highlights**  
**24 May – 30 May 2004**

**SWO PRF 1500**  
**01 June 2004**

Solar activity ranged from very low to low. Region 618 (S10, L=039, class/area, Fki/410 on 24 May) was the largest and most complex sunspot group of the period, and produced most of the C-class activity over the past two weeks. A magnetic delta configuration persisted in this region through 28 May, but activity levels remained low. The region was in a decay phase as it approached the west limb at the end of the period. A large filament erupted from north center of the disk on 24 May. An associated CME was observed on LASCO imagery, but the ejecta did not appear Earth directed. New Region 621 (S15, L=282, class/area, Dac/140 on 30 May) exhibited minor magnetic complexity as it rotated into view late this period.

Solar wind data were available from the NASA Advanced Composition Explorer (ACE) spacecraft during most of the summary period. The period began with elevated solar wind speed near 500 km/s due to a coronal hole. The elevated solar wind speed gradually declined to near 350 km/s by late on 27 May. A larger coronal hole rotated into a geoeffective position late on the 30th and solar wind speed increased to over 500 km/s. The IMF Bz did not vary much beyond +/- 7 nT through the entire period.

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 normal to moderate levels the entire summary period.

The geomagnetic field was at quiet to active levels. The period began under the influence of a weak high speed coronal hole stream. Occasional active periods were observed on 24 May but were confined to the high latitudes. Predominantly quiet to unsettled conditions persisted 25 through 28 May before the onset of another high speed coronal hole stream. Occasional active periods were observed on 29 and 30 May in response to the elevated solar wind speed.

**Space Weather Outlook**  
**02 June - 28 June 2004**

Solar activity is expected to be at low levels with isolated moderate activity possible during the first half of the period from Region 621.

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 02 - 05 June, 09 – 10 June, 17 – 19 June, and 28 June due to recurrent coronal hole high speed streams.

The geomagnetic field is expected to range from quiet to minor storm levels. Unsettled to active conditions are possible from 02– 04 June, 08 – 09 June, 16 - 18 June, and 26 - 28 June, as generally weak, recurrent coronal hole high speed streams rotate into a geoeffective position. Occasional minor storm periods are also possible on 02 - 04 June and again on 26 – 28 June as the larger of these coronal holes becomes geoeffective.



### 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
24 May	105	118	600	B2.3	2	0	0	2	0	0	0	0
25 May	102	101	520	B1.5	0	0	0	0	0	0	0	0
26 May	103	89	470	B1.8	0	0	0	2	0	0	0	0
27 May	102	62	400	B1.7	2	0	0	1	0	0	0	0
28 May	102	52	370	B2.5	3	0	0	3	0	0	0	0
29 May	101	57	630	B2.1	0	0	0	0	0	0	0	0
30 May	100	64	580	B1.9	1	0	0	0	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
	24 May	4.7E+5	1.3E+4	2.8E+3		8.9E+6
25 May	2.0E+5	1.3E+4	2.8E+3		1.2E+7	
26 May	2.3E+5	1.4E+4	2.9E+3		1.7E+7	
27 May	3.1E+5	1.3E+4	2.9E+3		1.9E+7	
28 May	2.4E+5	1.3E+4	3.0E+3		1.2E+7	
29 May	2.0E+5	1.3E+4	2.9E+3		3.1E+6	
30 May	1.9E+5	1.2E+4	2.9E+3		5.9E+6	

### Daily Geomagnetic Data

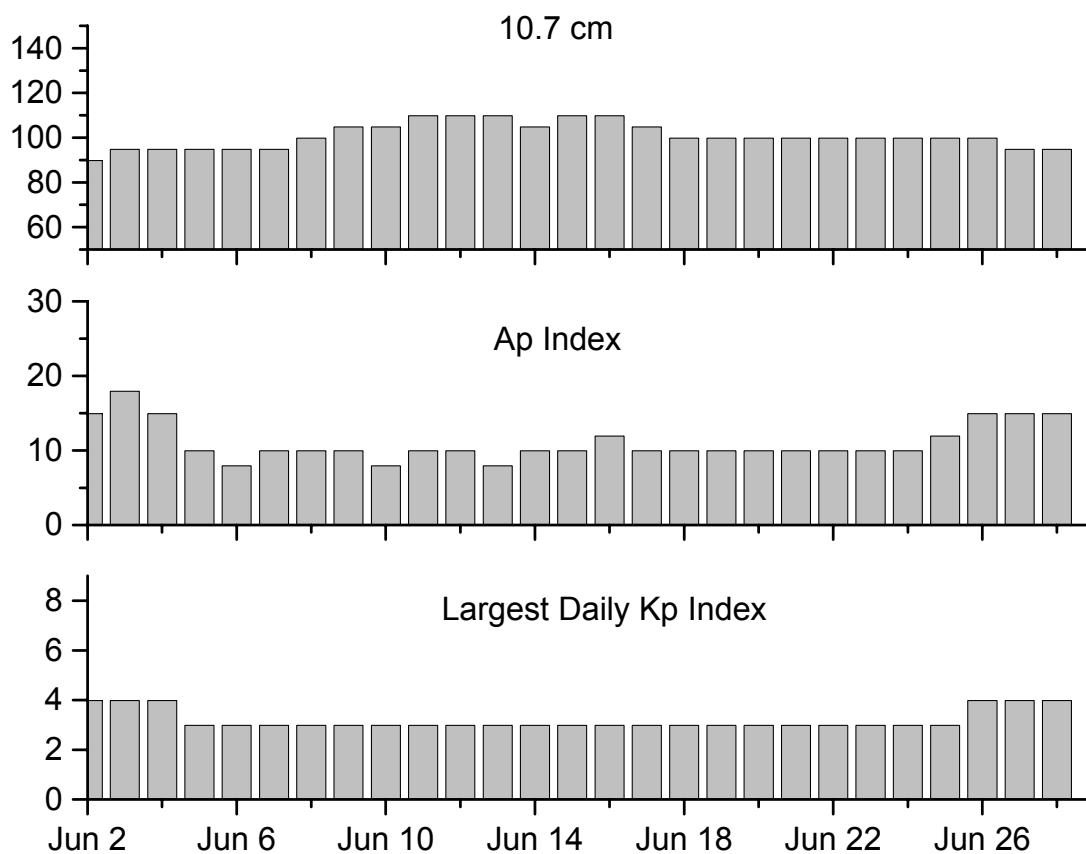
Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	24 May	8	2-2-3-2-3-2-1-1	22	3-2-4-5-5-3-2-2	11
25 May	5	2-1-2-1-1-1-1-2	6	2-1-2-3-2-1-1-1	8	2-1-3-3-3-2-2-2
26 May	3	1-1-1-0-1-1-1-2	2	1-1-0-1-1-0-0-0	6	1-1-2-1-3-3-2-2
27 May	5	3-1-2-1-1-1-1-1	6	2-2-3-3-0-0-1-1	6	1-1-3-2-2-2-2-1
28 May	6	1-0-1-1-2-2-2-3	11	2-0-2-2-4-4-2-2	9	2-0-1-2-3-3-3-3
29 May	12	3-2-2-3-3-2-3-3	19	3-3-3-5-4-2-2-3	14	3-3-3-4-3-3-2-3
30 May	11	2-2-2-3-2-1-3-4	17	2-2-2-5-4-3-2-3	13	3-2-1-4-3-3-3-4

### Alerts and Warnings Issued

Date & Time of Issue	Type of Alert or Warning	Date & Time of Event UT
24 May 0821	ALERT: Geomagnetic K-index of 4	24 May 0820
29 May 0035	1 – 245 MHz Radio Burst	28 May
29 May 0255	WARNING: Geomagnetic K= 4	29 May 0255 - 1500
29 May 0256	ALERT: Geomagnetic K-index of 4	29 May 0254
30 May 0457	1 – 245 MHz Radio Burst	29 May
30 May 2249	WARNING: Geomagnetic K= 4	30 May 2249 – 31 May 1500
30 May 2251	ALERT: Geomagnetic K= 4	30 May 2247



## 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
02 Jun	90	15	4	16 Jun	110	12	3
03	95	18	4	17	105	10	3
04	95	15	4	18	100	10	3
05	95	10	3	19	100	10	3
06	95	8	3	20	100	10	3
07	95	10	3	21	100	10	3
08	100	10	3	22	100	10	3
09	105	10	3	23	100	10	3
10	105	8	3	24	100	10	3
11	110	10	3	25	100	12	3
12	110	10	3	26	100	15	4
13	110	8	3	27	95	15	4
14	105	10	3	28	95	15	4
15	110	10	3				



### *Energetic Events*

Date	Time		X-ray	Optical Information			Peak		Sweep Freq	
	Begin	Max	Integ	Imp/	Location	Rgn	Radio Flux		Intensity	
			Class	Flux	Lat	CMD	#	245	2695	II

*No Events Observed*

### *Flare List*

Date	Time			X-ray Class.	Imp / Brtns	Optical	Rgn
	Begin	Max	End			Location Lat CMD	
24 May	0208	0216	0226	B7.0			618
	0251	0300	0304	B6.7			618
	0314	0318	0320	B7.5			618
	1053	1104	1118	C4.6			618
	2247	2247	2249	C1.0	Sf	N20W36	615
	2254	2256	2257		Sf	N20W34	615
25 May	1022	1027	1037	B2.8			618
	1135	1141	1144	B9.0			618
	1152	1200	1203	B5.1			618
	1319	1323	1329	B3.0			618
	1501	1506	1508	B2.7			618
	1716	1722	1732	B3.8			618
	1843	1847	1850	B3.8			618
	2300	2303	2305	B2.7			618
26 May	2345	2348	2350	B3.1			618
	0039	0039	0044	B5.7	Sf	S11W03	618
	0323	0335	0350	B8.2	Sf	S11W02	618
	0556	0601	0603	B2.7			618
	1105	1109	1113	B3.9			618
27 May	1705	1744	1804	B7.3			619
	0025	0026	0041	C1.1	Sf	S08W12	618
	0225	0230	0235	B4.2			618
	0239	0242	0246	B7.0			618
	0256	0300	0306	B3.8			618
	0637	0645	0648	B4.2			618
	0755	0800	0804	B4.5			618
	0907	0913	0919	C1.0			619
28 May	1711	1714	1717	B3.2			
	1822	1826	1831	B2.3			
	0217	0223	0232	B6.9			618
	0613	0618	0622	B7.0			618
	0810	0814	0816	B4.0			
	1003	1011	1013	C4.1			618
	1112	1119	1124	B4.9			
	1209	1213	1215	C2.2			618



*Flare List – continued.*

Date	Time			X-ray Class.	Optical		Rgn
	Begin	Max	End		Imp / Brtns	Location Lat CMD	
28 May	1312	1316	1318	B5.1			
	1355	1355	1358		Sf	S11W46	618
	1834	1837	1839	B8.9			
	1906	1909	1912	B6.3			
	2044	2046	2050	C2.1	Sf	S10W39	618
	2105	2111	2121	B8.9			
	2304	2304	2307	B8.0	Sf	S11W51	618
29 May	0049	0056	0102	B8.0			618
	0246	0251	0256	B7.6			618
	0817	0823	0835	B3.4			
	1132	1135	1138	B7.4			
	1751	1755	1757	B7.5			618
30 May	0029	0035	0041	B5.9			618
	1915	1934	1956	C1.2			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	4								
<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																
24 May	S09W68	120	0060	02	Hax	001	A																
25 May	S09W81	120	0060	03	Hsx	001	A																
26 May	S09W94	120	0060	02	Hsx	002	A																
																					0 0 0 0 0 0 0 0		

Crossed West Limb.

Absolute heliographic longitude: 119

<i>Region 615</i>																							
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																
24 May	N17W40	092	0060	03	Hsx	002	A	1				2											
25 May	N17W53	092	0050	02	Hsx	001	A																
26 May	N17W66	092	0060	02	Hsx	001	A																
27 May	N17W80	092	0070	02	Hax	002	A																
28 May	N17W90	089	0060	02	Hax	001	A																
																					4 0 0 3 0 0 0 0		

Crossed West Limb.

Absolute heliographic longitude: 093



**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 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																
24 May	N07W35	088																
25 May	N07W48	088																
26 May	N07W61	088																
27 May	N07W74	088																
28 May	N07W87	088																
																		0 0 0 0 0 0 0 0

Crossed West Limb.

Absolute heliographic longitude:88

*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											
24 May	S11W88	140	0000	00		000												
																		1 0 0 2 0 0 0 0

Crossed West Limb.

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

*Region 618*

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						
24 May	S10E13	039	0410	18	Fki	057	Bgd	1										
25 May	S10W00	039	0380	16	Fhc	046	Bgd											
26 May	S10W13	039	0330	17	Fsc	031	Bgd					2						
27 May	S10W27	039	0330	16	Fac	040	Bgd	1				1						
28 May	S10W44	043	0310	14	Eac	031	Bg	3				3						
29 May	S10W60	046	0520	15	Fkc	032	G											
30 May	S09W72	045	0360	19	Fac	017	Bg	1										
									19	1	0	12	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:39

*Region 619*

23 May	S09W37	102	0020	02	Dso	006	B											
24 May	S09W50	102	0030	05	Cso	003	B											
25 May	S09W63	102	0020	01	Hrx	001	A											
26 May	S09W76	102	0010	00	Axx	001	A											
27 May	S09W89	102										1						
									1	0	0	0	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude:102

*Region 620*

23 May	S15E34	031	0010	03	Cso	004	B											
24 May	S15E21	031	0040	04	Cso	005	B											
25 May	S15E08	031	0010	03	Cro	002	B											
26 May	S15W03	029	0010	03	Bxo	004	B											
27 May	S15W16	029																
28 May	S15W29	029																
29 May	S15W42	029																
30 May	S15W55	029																
									0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude: 029

*Region 621*

29 May	S14E62	284	0110	07	Dai	005	B											
30 May	S15E51	282	0140	06	Dac	014	B											
									0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:282





### *Region Summary - continued.*

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Location			Sunspot Characteristics				Flares								
Date	( ° Lat ° CMD)	Helio Lon	Area (10 <sup>-6</sup> hemi)	Extent (helio)	Spot Class	Spot Count	Mag Class	X-ray			Optical				
								C	M	X	S	1	2	3	4

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#### *Region 622*

30 May	S12E72	261	0080	02	Hax	003	A								
								0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:261

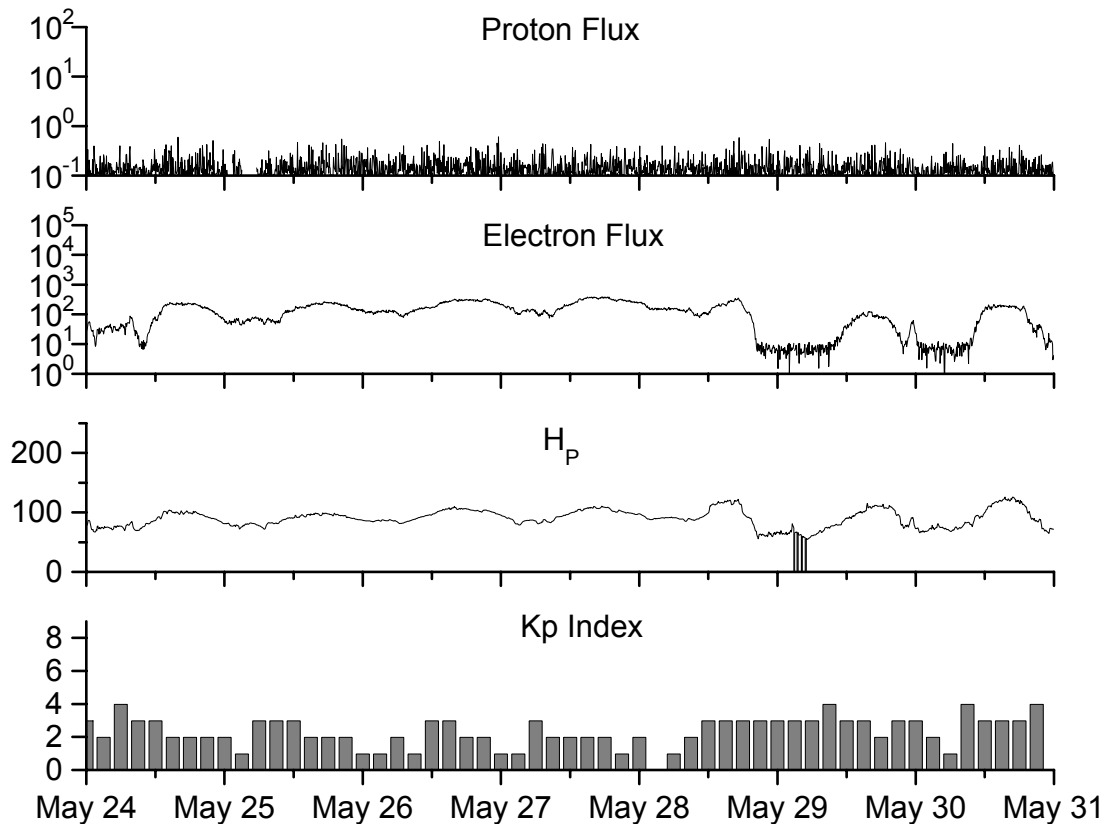


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

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 24 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.

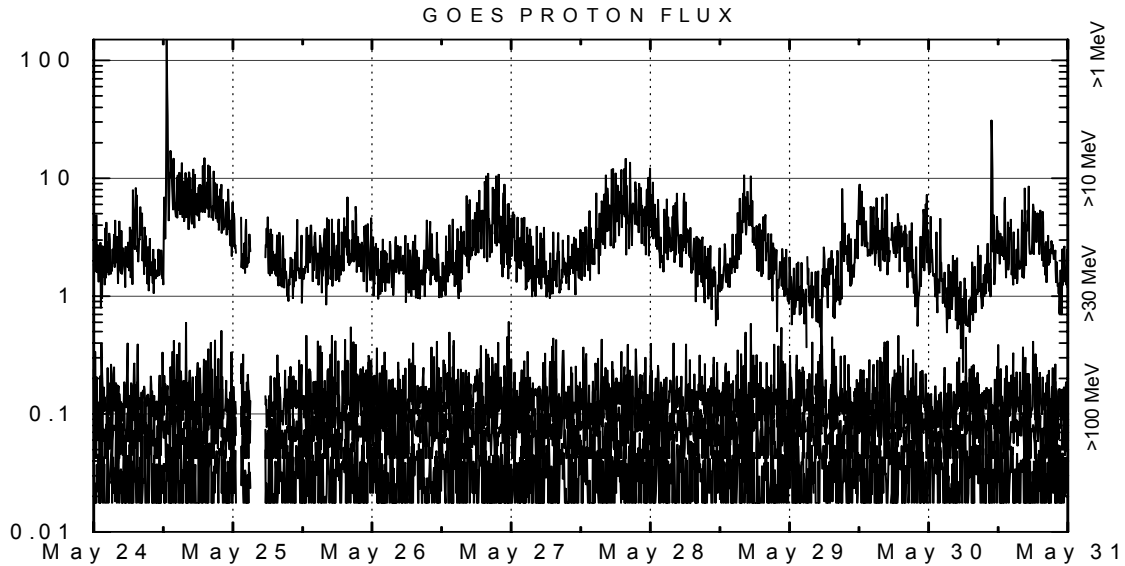
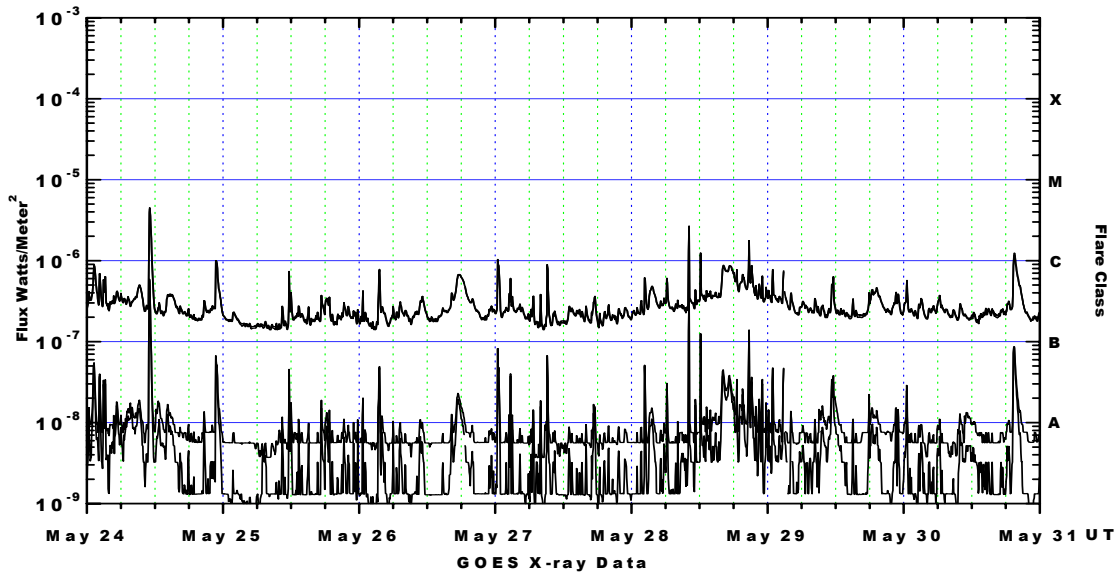
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV at GOES-12 (W75).

*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.

