

**Space Weather Highlights**  
**12 - 18 April 2004**

**SWO PRF 1494**  
**20 April 2004**

Solar activity ranged from very low to moderate this summary period. The largest flare of the period occurred in new Region 591 (S16, L=245, class/area, Dso/090 on 15 April) where an impulsive M1.2/Sf was observed at 15/1644 UTC. Since forming on the disk on 12 April, Region 591 displayed reverse polarity characteristics. No other significant activity occurred in this region. The only other activity observed this period was from Region 588 (S165 L=316, class/area, Cao/100 on 12 April). Region 588 produced three low-level C-class flares on 12 April, and rotated off the disk on 14 April.

Solar wind data were available from the ACE spacecraft during most of the summary period. The period began with solar wind velocity at speeds near 425 km/s. Shortly thereafter, a shock passage was observed at ACE at 12/1730 UTC, which was believed to be in response to the partial halo CME associated with the C2.8 flare that occurred on 09 April. Solar wind speed peaked at near 540 km/s while the IMF Bz remained predominately northward. Wind speed decayed to about 350 km/s by the end of the 14th, but by midday on 16 April had trended upward to near 450 km/s in response to a weak coronal hole high-speed stream. From midday on the 15th through the end of the summary period, fluctuations in the IMF were weak, not varying much beyond +/- 5 nT.

As the period began, a greater than 10 MeV proton event was in progress due to the C9.6 flare on 11 April. This event reached a peak value of 35 pfu at 11/1135 UTC and decayed to below event levels at 12/0405 UTC.

The greater than 2 MeV electron flux at geosynchronous orbit was at high levels on 12 - 15 April.

The geomagnetic field was at predominately quiet to unsettled levels with a few periods of isolated active conditions. Unsettled to active levels were recorded on 12 April as a result of the partial-halo CME from 09 April. Unsettled to active levels were observed on 16 April due to the influence of a weak coronal hole high-speed stream.

**Space Weather Outlook**  
**21 April - 17 May 2004**

Solar activity levels are expected to range from very low to moderate for the forecast period. Isolated moderate activity is possible after 26 April from returning old Regions 582 and 588.

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 24 - 26 April, 03 - 07 May and 15 - 16 May 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 expected on 23 - 25 April and 14 - 15 May due to weak coronal hole high-speed streams while active to minor storm levels are possible from 02 - 05 May due to a vigorous, recurrent coronal hole high-speed stream.



### 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
12 April	91	37	140	A8.9	3	0	0	1	0	0	0	0
13 April	93	41	130	A8.6	0	0	0	0	0	0	0	0
14 April	95	69	230	B1.0	0	0	0	1	0	0	0	0
15 April	97	60	180	B1.1	0	1	0	2	0	0	0	0
16 April	97	53	200	B1.0	0	0	0	0	0	0	0	0
17 April	98	55	130	B1.0	1	0	0	0	0	0	0	0
18 April	109	92	310	B1.3	0	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
12 April	4.4E+7	4.3E+5	3.0E+3		7.8E+7	
13 April	2.0E+6	1.9E+4	3.0E+3		1.1E+8	
14 April	6.3E+5	1.6E+4	3.5E+3		1.4E+8	
15 April	5.6E+5	1.4E+4	3.2E+3		1.5E+8	
16 April	5.0E+5	1.5E+4	3.4E+3		5.9E+6	
17 April	4.7E+5	1.4E+4	3.5E+3		2.3E+7	
18 April	3.1E+5	1.5E+4	3.4E+3		1.2E+7	

### Daily Geomagnetic Data

Date	Middle Latitude Fredericksburg		High Latitude College		Estimated Planetary	
	A	K-indices	A	K-indices	A	K-indices
	12 April	7	3-2-2-1-1-1-3-1	19	4-3-5-4-2-2-3-1	11
13 April	5	2-1-1-1-2-1-2-1	7	1-1-2-3-3-1-1-1	6	2-2-2-2-2-2-2-2
14 April	2	1-1-0-0-1-0-0-2	2	1-0-0-0-2-0-0-1	5	2-1-1-0-3-2-2-1
15 April	3	1-1-0-1-1-0-2-2	4	0-0-0-1-2-2-1-3	6	1-1-1-1-2-2-2-3
16 April	10	2-3-2-2-2-3-3-2	27	2-3-5-5-4-4-2-2	12	2-3-4-3-2-3-3-2
17 April	6	1-3-1-1-1-1-2-2	8	2-2-2-2-3-3-1-1	9	2-3-2-1-2-3-3-2
18 April	6	1-2-3-2-1-0-2-2	18	1-3-4-4-5-3-1-1	11	1-2-4-2-3-3-3-2

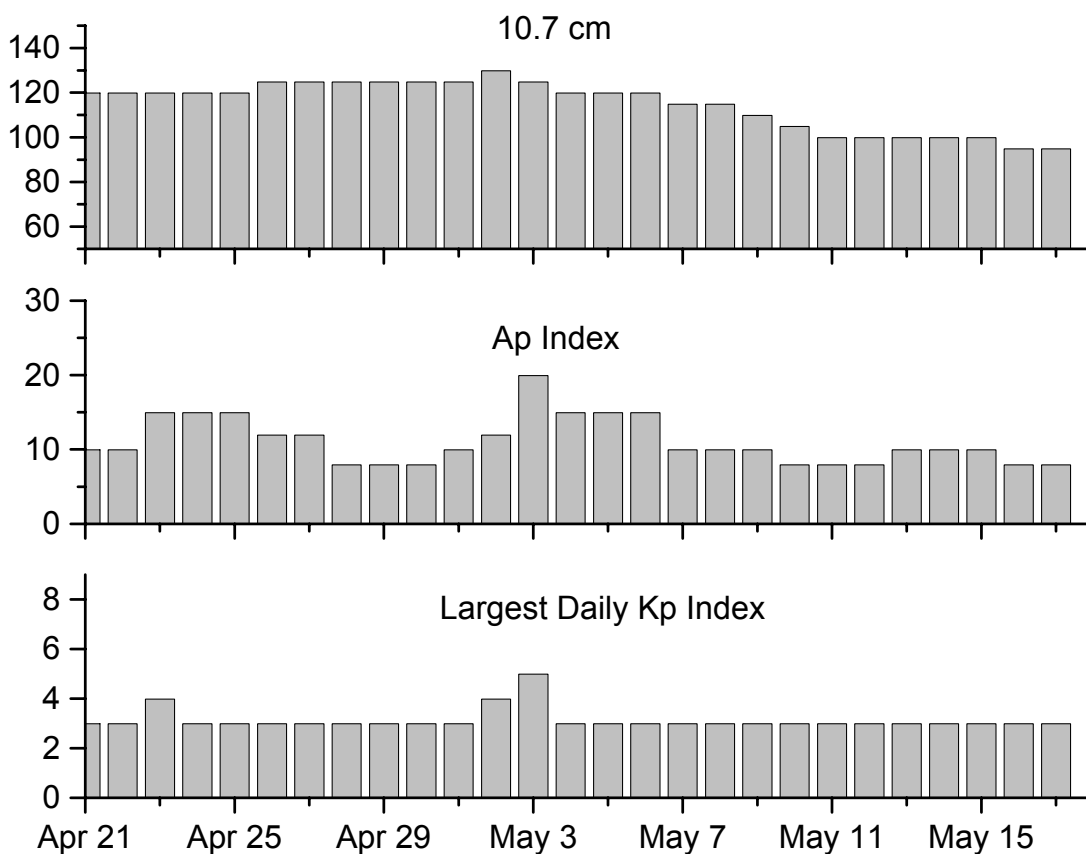


### *Alerts and Warnings Issued*

<u>Date &amp; Time of Issue</u>	<u>Type of Alert or Warning</u>	<u>Date &amp; Time of Event UT</u>
12 Apr 0008	EXT WARNING: Proton 10MeV Integral Flux > 10pfu	11Apr 1110 – 12 Apr 0600
12 Apr 0024	3 – 245 MHz Radio Bursts	11 Apr
12 Apr 0100	CONT ALERT: Proton Event 10MeV Integral Flux > 10pfu	11 Apr 1135
12 Apr 0144	WARNING: Geomagnetic K= 4	12 Apr 0144 - 1500
12 Apr 0151	ALERT: Geomagnetic K= 4	12 Apr 0150
12 Apr 0158	ALERT: Electron 2MeV Integral Flux > 1000pfu	12 Apr 12 0140
12 Apr 1156	ALERT: Electron 2MeV Integral Flux > 1000pfu	12 Apr 12 1140
12 Apr 1233	SUMMARY: Proton Event 10MeV Integral Flux > 10pfu	11 Apr 11 1135
12 Apr 1455	EXT WARNING: Geomagnetic K=4	12 Apr 0144 -2359
13 Apr 0011	1 – 245 MHz Radio Burst	12 Apr
13 Apr 0928	ALERT: Electron 2MeV Integral Flux > 1000pfu	13 Apr 0910
14 Apr 0808	ALERT: Electron 2MeV Integral Flux > 1000pfu	14 Apr 0750
15 Apr 0851	ALERT: Electron 2MeV Integral Flux > 1000pfu	15 Apr 0835
16 Apr 0026	4 – 245 MHz Radio Bursts	15 Apr
16 Apr 0026	1 – 245 MHz Radio Noise Storm	15 Apr
16 Apr 0439	WARNING: Geomagnetic K= 4	16 Apr 0440 -1600
16 Apr 0442	ALERT: Geomagnetic K= 4	16 Apr 0441
17 Apr 0421	ALERT: Geomagnetic K= 4	17 Apr 0420
18 Apr 0753	WARNING: Geomagnetic K= 4	18 Apr 0753 - 1600
18 Apr 0758	ALERT: Geomagnetic K= 4	18 Apr 0758



### 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
21 Apr	120	10	3	05 May	120	15	3
22	120	10	3	06	120	15	3
23	120	15	4	07	115	10	3
24	120	15	3	08	115	10	3
25	120	12	3	09	110	10	3
26	125	12	3	10	105	8	3
27	125	8	3	11	100	8	3
28	125	8	3	12	100	8	3
29	125	8	3	13	100	10	3
30	125	8	3	14	100	10	3
01 May	125	10	3	15	100	10	3
02	130	12	4	16	95	8	3
03	125	20	5	17	95	8	3
04	120	15	3				



### *Energetic Events*

Date	Time			X-ray		Optical Information			Peak		Sweep Freq	
	Begin	Max	½ Max	Class	Flux	Imp/ Brtns	Location Lat CMD	Rgn #	Radio Flux		Intensity	
									245	2695	II	IV
15 Apr	1637	1644	1648	M1.2	.004	Sf	S15W38	591	410	70		

### *Flare List*

Date	Time			X-ray Class.	Imp / Brtns	Optical		Rgn
	Begin	Max	End			Location Lat CMD		
12 April	B0224	0225	0235	C2.3	Sf	S17W54		588
	0622	0626	0629	B1.8				588
	0739	0749	0758	C1.0				588
	1011	1022	1028	B2.1				
	1222	1230	1239	C1.3				588
	1835	1840	1843	B2.6				588
	1857	1904	1913	B2.1				
	2109	2112	2114	B1.2				
13 April	0528	0532	0536	B1.5				
	1920	1944	1957	B2.1				
14 April	0231	0238	0244	B2.4			591	
	0512	0517	0523	B2.5				
	0744	0744	0747	B2.0	Sf	S16W20	591	
	0923	0928	0933	B3.9				
	1216	1225	1237	B3.9			591	
	1330	1337	1343	B3.5				
	1352	1417	1428	B9.1			591	
	1514	1517	1522	B3.0				
15 April	0051	0055	0106	B2.3			591	
	0938	0943	0947	B3.3			591	
	1120	1126	1131	B3.1			591	
	1642	1646	1659	M1.2	Sf	S15W38	591	
16 April	2204	2204	2208	B2.7	Sf	S15W42	591	
	0023	0027	0030	B2.4			591	
	0802	0808	0821	B2.3			591	
	1116	1119	1122	B1.6				
	1323	1326	1335	B1.4				
	1915	1923	1930	B8.6			595	
	2308	2317	2330	B2.7			595	
	0449	0501	0506	B3.7			595	
17 April	1134	1142	1151	C1.8				
	1833	1836	1838	B1.5				
	0933	0938	0945	B2.1				
18 April	1416	1419	1421	B2.9				
	1456	1459	1501	B2.7				
	1555	1559	1621	B9.1			596	
	1656	1659	1702	B3.2				



### 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 588</i>																		
01 Apr	S12E74	319	0060	01	Hsx	001	A											
02 Apr	S12E64	316	0060	02	Hsx	001	A											
03 Apr	S12E51	316	0070	03	Dso	004	B											
04 Apr	S16E40	313	0120	08	Cso	011	B	1				1						
05 Apr	S15E25	315	0170	07	Dao	012	Bg		1					1				
06 Apr	S15E14	313	0130	09	Dai	015	B	1	1			3						
07 Apr	S17E01	313	0150	08	Dao	009	Bg											
08 Apr	S16W13	313	0140	09	Dao	011	B	2				1						
09 Apr	S15W26	313	0120	06	Cso	008	B	1				1						
10 Apr	S15W38	312	0150	08	Cso	010	B											
11 Apr	S15W55	316	0090	05	Cso	006	B	3						1				
12 Apr	S15W68	316	0100	05	Cao	005	B	3				1						
13 Apr	S13W80	315	0060	03	Hax	001	A											
14 Apr	S13W92	313	0040	02	Hrx	001	A											
								11	2	0	7	2	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude:313

<i>Region 589</i>																		
05 Apr	N10E54	286	0050	04	Bxo	004	B											
06 Apr	N10E43	284	0020	02	Axx	003	A											
07 Apr	N11E29	285	0010	01	Axx	001	A											
08 Apr	N11E16	285																
09 Apr	N11E03	285																
10 Apr	N11W10	285										1						
11 Apr	N11W23	285																
12 Apr	N11W36	285																
13 Apr	N11W49	285																
14 Apr	N11W62	285																
15 Apr	N11W75	285																
16 Apr	N11W88	285																
								0	0	0	1	0	0	0	0	0		

Crossed West Limb.

Absolute heliographic longitude:285



**Region Summary - continued.**

Date	Location		Sunspot Characteristics				Flares							
	( ° 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

*Region 591*

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											
								0	1	0	3	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:247

*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											
								0	0	0	0	0	0	0	0	0	0	0

Still on Disk.

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											
								0	0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:177

*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											
								0	0	0	0	0	0	0	0	0	0	0

Still on Disk.

Absolute heliographic longitude:154



***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>Region595</i>																	
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										
								0	0	0	0	0	0	0	0	0	0
Still on Disk.																	
Absolute heliographic longitude:128																	
<i>Region 596</i>																	
18 Apr	S08E60	108	0160	09	Dso	008	B										
								0	0	0	0	0	0	0	0	0	0
Still on Disk.																	
Absolute heliographic longitude:108																	



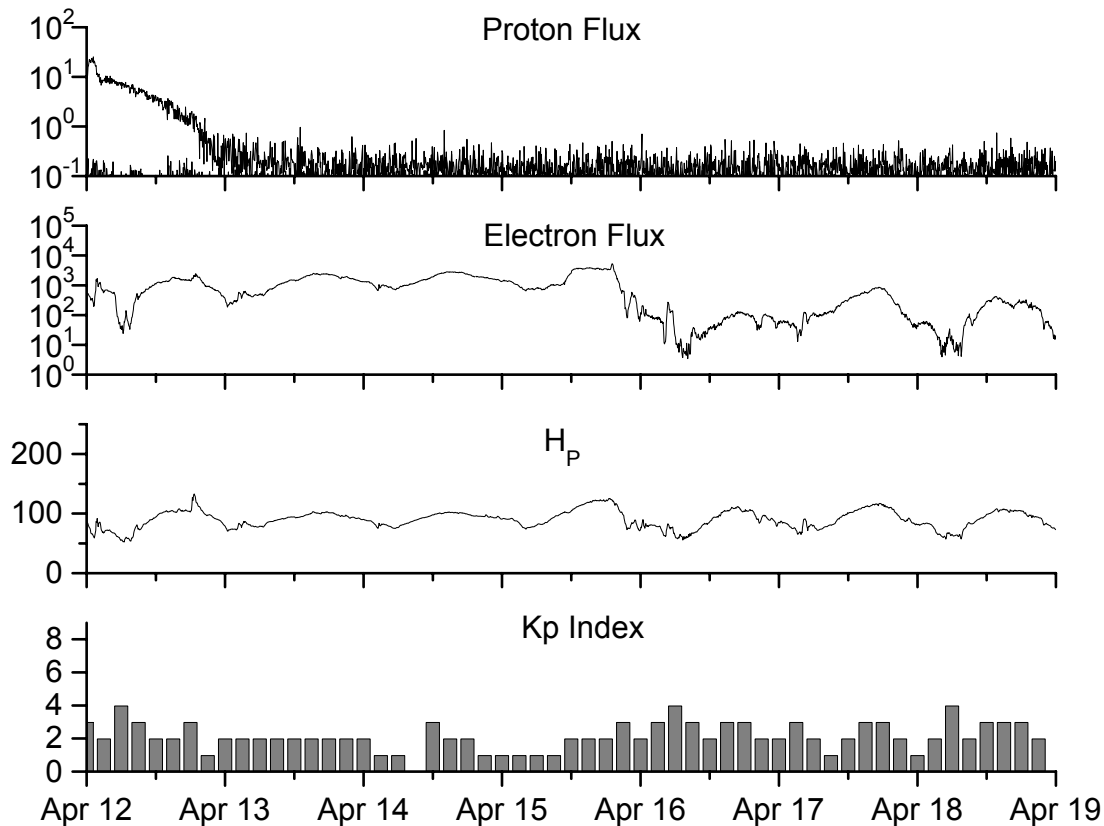


**Recent Solar Indices (preliminary)  
of the observed monthly mean values**

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>									
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
<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			153.1		32	
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	

**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 12 April 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.

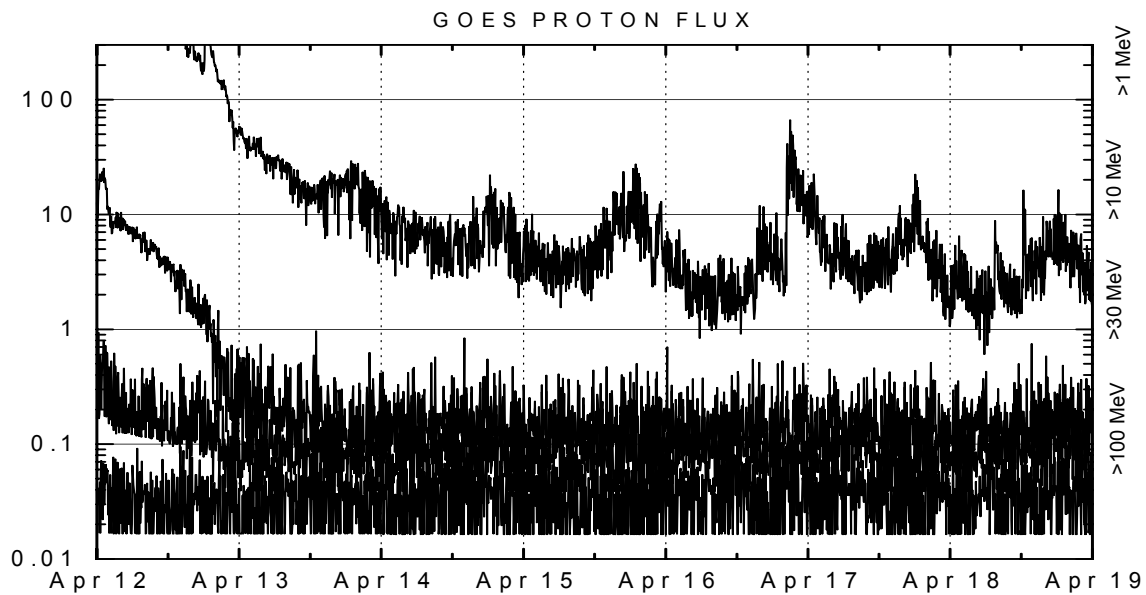
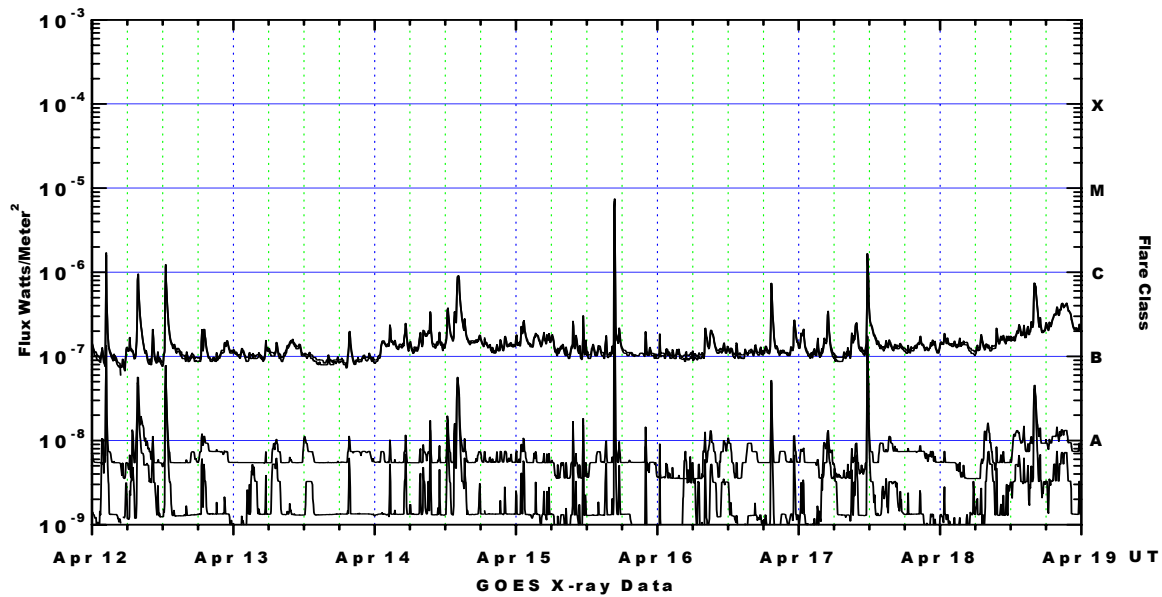
*Electrons* plot contains the five-minute averaged integral electron flux (electrons/cm<sup>2</sup>-sec -sr) with energies greater than 2 MeV at GOES-12 (W75).

*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.

