

**Space Weather Highlights
20-26 April 1998**

Solar activity increased to high levels. The week began with activity at moderate levels due to a long-duration M1 X-ray flare detected at 20/1021UT. The source was likely old Region 8194, about two days behind the southwest limb at the time of the flare. An eruptive prominence and a Type II radio sweep accompanied the flare. Activity rose to high levels on 23 April due to an X1 X-ray flare at 23/0555UT. A type IV radio sweep and 430 SFU Tenflare were associated the flare. The source appeared to be old Region 8190, about a day behind the southeast limb at the time of the flare. Old Region 8190 began to rotate into view on 24 April and was numbered as Region 8210 (S17, L = 139, class/area Dso/230 on 25 April). Region 8210 produced isolated C-class flares during the remainder of the period. Despite the X-class activity, Region 8210 was unimpressive in size, but was becoming magnetically complex by the end of the period.

Solar wind data were available from the ACE and WIND spacecraft during most of the period. Velocities ranged from 300 - 400 km/sec during 20 - 23 April, but increased to 480 km/sec late on 23 April. Velocities gradually increased during the remainder of the period and ranged from 400 - 520 km/sec. Solar wind particle densities were in the 02 - 10 p/cc range through most of the period, but briefly increased to 40 p/cc late on 23 April. Bz hovered about zero in the plus to minus 07 nT range, but became more variable late 23 April and ranged from minus 14 to plus 18 nT. Solar sector orientation was toward (phi angle near 315 degrees) during 20 April, then shifted to away conditions (phi angle near 135 degrees) during 21 - 22 April. Orientation shifted back to toward conditions late 23 April and remained so for the rest of the period.

A Solar Proton Event (SPE) followed the long-duration M1 of 20 April. The greater than 10 MeV proton flux reached event threshold at 20/1400UT, reached a peak of 1700 PFU at 21/1205UT, and ended at 24/1550UT. The greater than 100 MeV proton flux reached event threshold at 20/1710UT, reached a maximum of 7.4 PFU at 21/1255UT, and ended at 22/0430UT (see GOES proton plot, p. 12). A polar cap absorption event (maximum 13dB) occurred in response to the SPE.

The greater than 2 MeV electron flux at geosynchronous altitude reached moderate to high levels during 25 - 26 April. Otherwise fluxes were at normal levels.

The geomagnetic field was quiet to unsettled during 20 - 23 April. Space-based sensors detected an interplanetary shock passage around 23/1800UT. A field disturbance followed the shock and continued through the rest of the period. Middle latitude stations detected active to minor storm levels during the disturbance, while higher latitudes detected active to major storm levels. It appears the disturbance was due, in part to a favorably positioned extension of the southern crown coronal hole, although the long-duration M1 may have played a part in the early stages.

**Space Weather Forecast
29 April 1998 - 25 May 1998**

Solar activity is expected to range from low to moderate. Region 8210 is expected to produce isolated M-class flares until its departure on 07 May. There is also a slight chance for another isolated X-class flare from this region. Chances for M-class flares will also increase after 01 May with the return of old Region 8194.

Another solar proton event may occur during the period, given the presence of Region 8210 and the expected return of old Region 8194.

The greater than 2 MeV electron flux at geosynchronous altitude is expected to be at normal levels during most of the period. However, moderate to high levels are expected during 28 April - 03 May and again during 22-28 May.

The geomagnetic field is expected to be at active levels during 29-30 April in response to a halo-CME detected 27 April. The CME was associated with another X1 flare from Region 8210 (details will be provided in next weeks issue). Active levels are also expected during 21 - 23 May due to a recurrent coronal hole high speed windstream. Quiet to unsettled conditions are forecast for the rest of the period. The disturbance was due, in most part, to a favorably positioned extension of the southern crown coronal hole, although the long-duration M1 may have played a part in the early stages.



Daily Solar Data

Date	Radio	Sun	Sunspot	X-ray	X-ray Flux			Flares				
	Flux 10.7 cm	spot No. (10 ⁶ hemi.)	Area	Background	C	M	X	S	Optical			
									1	2	3	4
20 April	98	35	100	B2.0	0	1	0	0	0	0	0	0
21 April	92	47	70	B3.3	0	0	0	1	0	0	0	0
22 April	88	41	130	B1.5	0	0	0	7	0	0	0	0
23 April	90	38	90	B1.8	0	0	1	0	0	0	0	0
24 April	91	22	0	B2.8	1	0	0	0	0	0	0	0
25 April	92	50	230	B2.0	3	0	0	2	1	0	0	0
26 April	91	30	200	B1.4	0	0	0	1	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
20 April	1.2E+7	6.8E+6	5.5E+4		1.0E+6	
21 April	1.2E+8	7.2E+7	2.7E+5		1.4E+4	
22 April	8.0E+7	3.7E+7	5.6E+4		6.3E+5	
23 April	2.1E+7	6.2E+6	6.0E+3		5.3E+5	
24 April	7.6E+6	1.1E+6	4.7E+3		2.3E+6	
25 April	4.2E+6	3.3E+5	5.1E+3		7.8E+7	
26 April	5.3E+6	8.0E+4	5.0E+3		1.3E+8	

Daily Geomagnetic Data

Date	Middle Latitude		High Latitude		Estimated	
	Fredericksburg		College		Planetary	
	A	K-indices	A	K-indices	A	K-indices
20 April	9	0-2-3-3-3-2-2-2	*	0-2-4-4-4-2-1-*	10	0-2-3-3-4-2-2-2
21 April	6	2-3-2-2-1-1-1-2	*	2-3-*-3-4-1-2-1	7	2-3-1-2-2-2-2-2
22 April	5	0-2-1-1-2-1-3-1	6	1-1-2-2-3-1-1-1	6	1-3-2-1-2-2-2-2
23 April	10	1-2-3-0-0-1-4-4	10	1-4-2-2-1-0-3-3	14	2-3-3-2-2-2-4-4
24 April	23	4-4-5-4-3-2-2-3	39	2-4-6-6-6-3-3-2	35	5-5-6-5-4-3-2-3
25 April	21	5-4-3-2-3-2-4-3	35	3-4-4-5-6-5-3-3	22	5-4-4-3-3-3-4-3
26 April	21	4-5-2-2-4-3-3-3	57	4-5-5-6-7-6-3-3	31	4-5-4-4-5-4-3-4

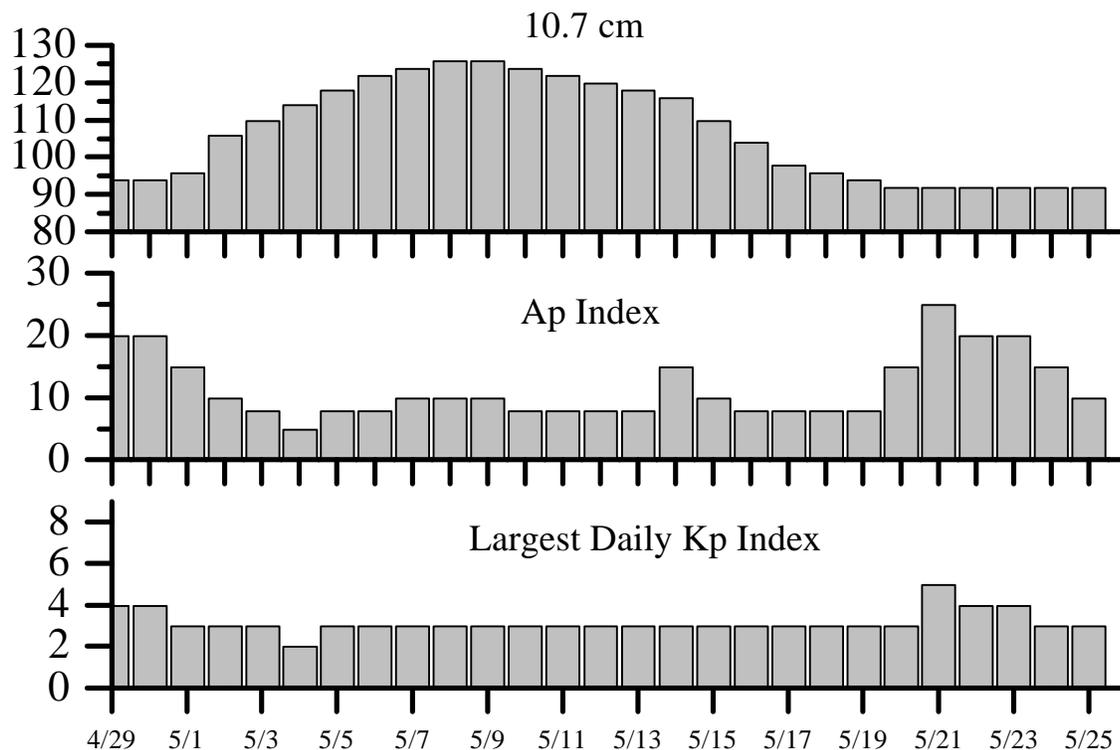


Alerts and Warnings Issued

Date and Time of Issue (UT)	Type of Alert or Warning	Date and Time of Event (UT)
20 Apr 0912	K= 4 Observed	20 Apr 06-09
20 Apr 1214	Type II Radio Emission	20 Apr 0956
20 Apr 1424	Proton Event ≥ 10 pfu @ ≥ 10 MeV	20 Apr 1400
20 Apr 1728	Proton Event > 1 pfu @ ≥ 100 MeV	20 Apr 1710
21 Apr 1451	Proton Event ≥ 10 pfu @ ≥ 10 MeV continues	21 Apr
21 Apr 1741	Proton Event > 1 pfu @ ≥ 100 MeV continues	21 Apr
22 Apr 0025	1-245 MHz Radio Burst	21 Apr
22 Apr 1834	Proton Event ≥ 10 pfu @ ≥ 10 MeV continues	22 Apr
22 Apr 1915	Proton Event > 1 pfu @ ≥ 100 MeV continues	22 Apr
23 Apr 0552	Type IV Radio Emission	23 Apr 0538
23 Apr 0616	2695 MHz Radio Burst	23 Apr 0536
23 Apr 0628	X-ray event X1.0	23 Apr 0535
23 Apr 1840	Proton Event ≥ 10 pfu @ ≥ 10 MeV continues	23 Apr
24 Apr 0000	K = 4 Observed	23 Apr 21-24
24 Apr 0300	K= 5 Observed	24 Apr 00-03
24 Apr 0603	A ≥ 20 Observed	24 Apr 0600
24 Apr 1432	Proton Event ≥ 10 pfu @ ≥ 10 MeV continues	24 Apr
24 Apr 1625	Proton Event ≥ 10 pfu @ ≥ 10 MeV ended	24 Apr
25 Apr 0259	K= 5 Observed	25 Apr 00-03
25 Apr 0603	A ≥ 20 Observed continues	25 Apr
25 Apr 1650	> 2 MeV Electron Event ≥ 1000 pfu	25 Apr 1643
26 Apr 0312	K= 4 Observed	26 Apr 00-03
24 Apr 0603	A ≥ 20 Observed	24 Apr 0600
26 Apr 0603	K= 5 Observed	26 Apr 03-06



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
29 Apr	94	20	4	13 May	118	8	3
30	94	20	4	14	110	15	3
01 May	96	15	3	15	104	8	3
02	106	10	3	16	98	8	3
03	110	8	3	17	96	8	3
04	114	5	2	18	94	8	3
05	118	8	3	19	92	8	3
06	124	10	3	20	92	15	3
07	126	10	3	21	92	25	5
08	124	10	3	22	92	20	4
09	122	8	3	23	92	20	4
10	120	8	3	24	92	15	3
11	118	8	3	25	92	10	3
12	120	8	3				



Energetic Events

Date	Time (UT)		X-ray		Optical Information			Peak		Sweep Freq		
	Begin	Max	½	Class	Integ Flux	Imp Brtns	Location		Radio Flux		Intensity	
			Max				Rgn #	245	2695	II	IV	
20 Apr	0938	1021	1118	M1.4	.061	2						
23 Apr	0535	0555	0623	X1.2	.240				590	430	3	3

Flare List

Date	Time			X-ray Class.	Imp / Brtns	Optical Location		Rgn #
	Begin	Max	End			Lat	CMD	
20 April	0938	1021	1118	M1.4				
21 April	2136	2139	2141	B2.8				
	2153	2156	2158	B4.3				
	2324	2324	2329	B4.2	SF	N03W50	8205	
22 April	1341	1343	1346		SF	N22W65	8205	
	1348	1351	1359	B2.3	SF	N22W63	8205	
	1606	1609	1617		SF	N22W67	8205	
	1631	1635	1640	B2.7				
	1843	1843	1849		SF	N22W69	8205	
	1904	1907	1915		SF	N22W69	8205	
	2244	2245	2250		SF	N23W70	8205	
	2255	2256	2301		SF	N23W70	8205	
23 April	2356	0002	0008	B6.3				
	0131	0152	0204	B7.2				
	0212	0218	0225	B6.8				
24 April	0535	0555	0623	X1.2				
	0226	0229	0231	B4.7				
	0834	0852	0854	C8.9				
	1506	1509	1524	B2.5				
25 April	1605	1608	1610	B2.6				
	0017	0020	0023	B2.5				
	0104	0113	0118	B5.6				
	0943	0946	0949	B2.7				
	1003	1007	1013	B2.9				
	1056	1059	1103	B5.1				
	1118	1123	1127	C1.2				
	1148	1152	1159	B2.7				
	1318	1321	1324	B2.0				
	1422	1514	1557	C3.6	SF	S19E73	8210	
26 April	1541	1541	1549		SF	S21E72	8210	
	1801	1816	1835	C1.5	1F	S18E72	8210	
	0613	0613	0618		SF	S14E68	8210	
	2009	2012	2015	B1.3				
	2209	2212	2214	B2.7				



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	4						
<i>Region 8202</i>																					
09 Apr	S21E56	002	0020	08	BXO	005	B														
10 Apr	S21E43	002	0020	11	BXO	011	B						2								
11 Apr	S21E29	003	0020	06	BXO	007	B														
12 Apr	S23E17	002	0020	08	BXO	006	B						2								
13 Apr	S26E06	000	0010	04	BXO	003	B	1					1								
14 Apr	S26W07	360	0030	06	BXO	008	B														
15 Apr	S24W21	360	0040	07	CSO	009	B														
16 Apr	S23W33	359	0010	08	BXO	005	B	1					1								
17 Apr	S24W47	360	0010	07	BXO	004	B														
18 Apr	S24W60	360																			
19 Apr	S24W73	360																			
20 Apr	S24W86	360																			
													2	0	0	6	0	0	0	0	0
Crossed West Limb.																					
Absolute heliographic longitude: 000																					
<i>Region 8203</i>																					
14 Apr	N30W12	005	0010	02	AXX	002	A														
15 Apr	N31W24	003	0100	06	DAO	009	B	3					4								
16 Apr	N31W41	007	0050	08	DAO	009	B														
17 Apr	N31W51	004	0030	06	CRO	005	B														
18 Apr	N33W59	359	0000	00	AXX	001	A														
19 Apr	N33W72	359																			
20 Apr	N33W85	359																			
													3	0	0	4	0	0	0	0	0
Crossed West Limb.																					
Absolute heliographic longitude: 005																					
<i>Region 8204</i>																					
16 Apr	S15E12	314	0010	03	BXO	004	B														
17 Apr	S16W02	315	0010	03	BXO	002	B														
18 Apr	S16W15	315																			
19 Apr	S16W28	315																			
20 Apr	S16W41	315																			
21 Apr	S16W54	315																			
22 Apr	S16W67	315																			
23 Apr	S16W80	315																			
													0	0	0	0	0	0	0	0	0
Crossed West Limb.																					
Absolute heliographic longitude: 315																					



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	4			
<i>Region 8205</i>																		
17 Apr	N21E00	313	0020	04	BXO	008	B											
18 Apr	N21W12	312	0050	06	DSO	007	B											
19 Apr	N21W25	312	0070	09	DSO	012	B					3						
20 Apr	N21W40	313	0100	10	DSO	014	B											
21 Apr	N21W53	313	0070	10	DSO	014	B					1						
22 Apr	N21W66	313	0130	11	EAO	009	B					7						
23 Apr	N22W79	313	0090	12	CSO	006	B											
								0	0	0	0	11	0	0	0	0	0	0

Crossed West Limb.

Absolute heliographic longitude: 313

Region 8206

19 Apr	N23E42	245	0020	03	BXO	003	B											
20 Apr	N25E29	243	0000	00	AXX	001	A											
21 Apr	N24E14	246	0000	00	AXX	001	A											
22 Apr	N24E01	246	0000	00	AXX	001	A											
23 Apr	N24W12	246																
24 Apr	N24W25	246																
25 Apr	N24W38	246																
26 Apr	N24W51	246																
								0	0	0	0	0	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 246

Region 8207

21 Apr	N00W09	269	0000	00	AXX	002	B											
22 Apr	N00W22	269																
23 Apr	N00W35	269																
24 Apr	N00W48	269																
25 Apr	N00W61	269																
26 Apr	N00W74	269																
								0	0	0	0	0	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 269

Region 8208

22 Apr	N18E57	190	0000	00	AXX	001	A											
23 Apr	N17E42	192	0000	00	AXX	001	A											
24 Apr	N18E30	191	0000	00	AXX	001	A											
25 Apr	N18E16	191	0000	01	BXO	002	B											
26 Apr	N18E03	191																
								0	0	0	0	0	0	0	0	0	0	

Still on Disk.

Absolute heliographic longitude: 191



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

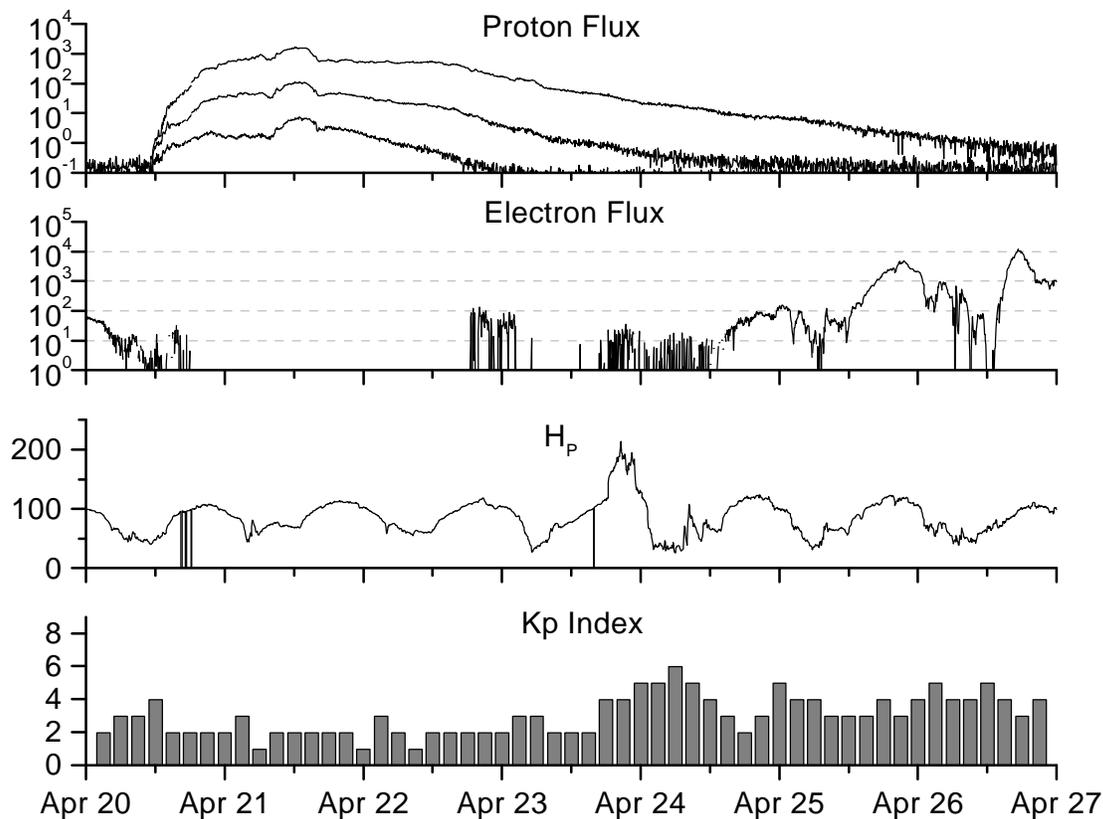
Month	Sunspot Numbers				Radio Flux		Geomagnetic		
	Observed SWO	values RI	Ratio RI/SWO	Smooth SWO	values RI	**Penticton 10.7 cm	Smooth Value	Planetary Ap	Smooth Value
1996									
April	08.5	04.8	0.56	13.6	08.5	69.3	71.6	11	09.7
May	11.8	05.5	0.47	12.9	08.0	72.1	71.4	07	09.5
June	18.8	11.8	0.63	13.5	08.5	69.6	71.8	05	09.4
July	13.2	08.2	0.62	13.4	08.4	71.2	72.0	07	09.3
August	20.5	14.4	0.70	13.1	08.3	72.4	72.1	09	09.4
September	02.9	01.6	0.55	13.3	08.4	69.4	72.3	15	09.3
October	02.3	00.9	0.39	14.0	08.8	69.2	72.6	13	09.1
November	26.7	17.9	0.67	15.4	09.8	78.7	73.0	08	09.1
December	21.1	13.3	0.63	16.2	10.4	77.8	73.3	07	09.3
1997									
January	09.0	05.7	0.63	16.5	10.5	74.0	73.4	09	09.3*
February	11.3	07.6	0.67	17.4	11.0	73.8	73.7	11	09.2*
March	14.4	08.7	0.60	20.4	13.5*	73.5	75.1*	08	08.9*
April	24.5	15.5	0.63	24.0	16.5*	74.5	76.8*	10	08.6*
May	28.6	18.5	0.65	26.4	18.4*	74.6	78.4*	08	08.6*
June	22.1	12.7	0.57	29.0	20.4*	71.7	80.1*	07	08.7*
July	17.0	10.5*	0.62*	32.4	22.7*	71.1	81.8*	06*	08.5*
August	36.7	24.7*	0.67*	35.9	25.2*	79.0	83.4*	08*	08.3*
September	58.2	51.3*	0.88*	40.5	28.5*	96.2	85.7*	10*	08.2*
October	33.6	23.3*	0.69*			84.9*		11*	
November	53.5	39.3*	0.73*			99.5*		11*	
December	57.9	41.5*	0.72*			98.8*		05*	
1998									
January	51.8	32.3*	0.62*			93.5*		07*	
February	54.4	40.7*	0.75*			93.6*		07*	
March	81.1	54.8*	0.67*			109.4*		11*	

*Preliminary estimates.

The lowest smoothed sunspot indices number for Cycle 22, RI = 8.0, occurred in May 1996. The highest smoothed sunspot number for Cycle 22, RI=158.5 occurred July 1989.

** From June 1991 onward, 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 20 April 1998

Protons plot contains the five-minute averaged integral proton flux (protons/ cm^2 -sec-sr) as measured by GOES-9 (W135) for each of three energy thresholds: greater than 10, 50, and 100 MeV.

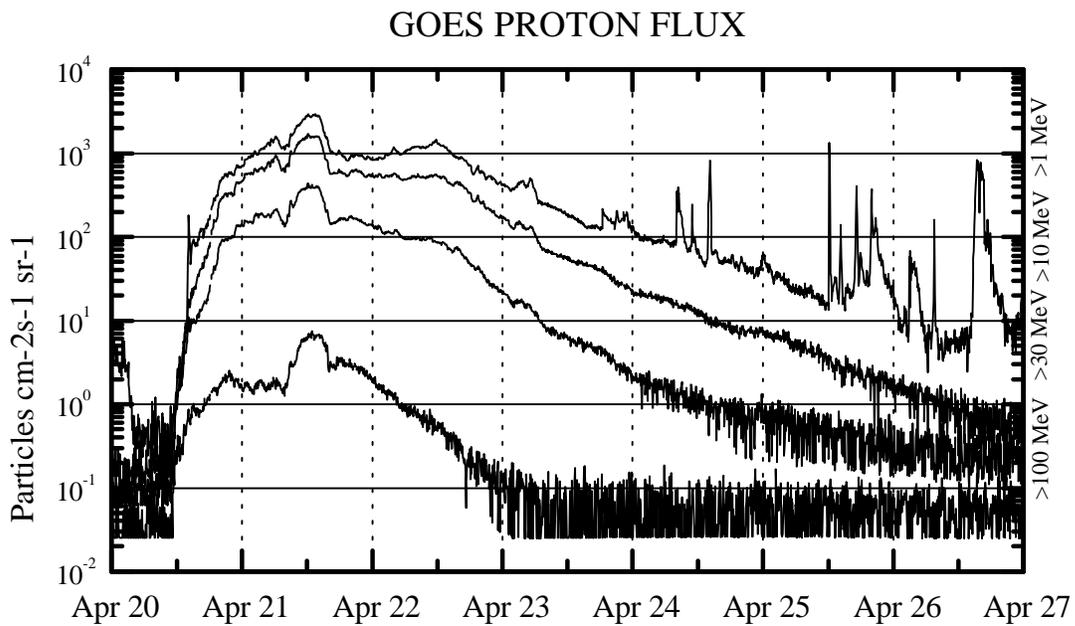
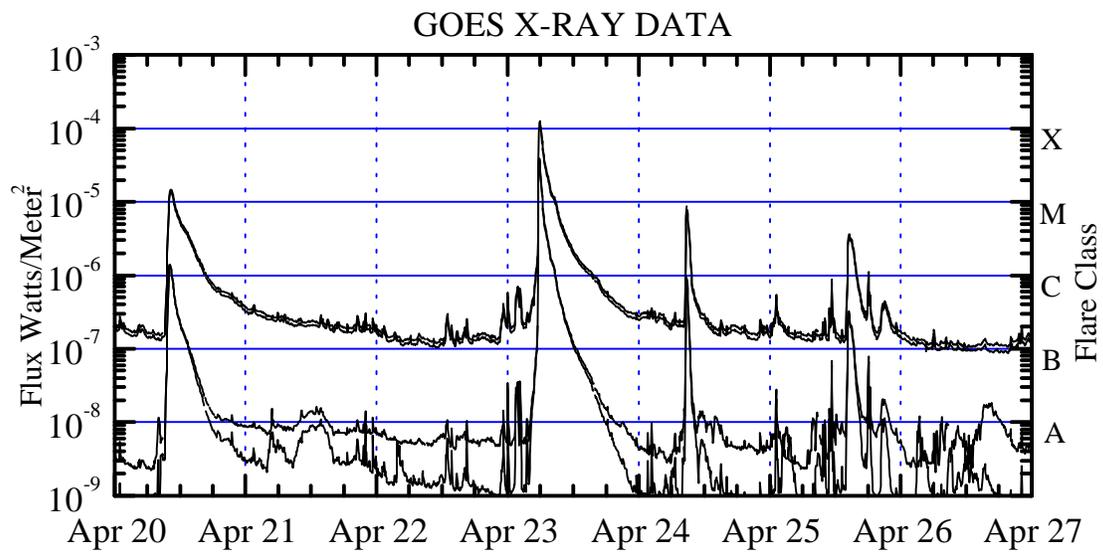
Electrons plot contains the five-minute averaged integral electron flux (electrons/ cm^2 -sec-sr) with energies greater than 2 MeV at GOES-9.

H_p plot contains the five minute averaged magnetic field H component in nanoteslas (nT) as measured by GOES-9. 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 USAF 55th Space Weather Squadron) 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_pparallel is subject to a 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

Proton plot contains the five minute averaged integral proton flux (protons/cm²-sec-sr) as measured by GOES-9 (W135) 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.

X-ray plot contains five minute averaged x-ray flux (watts/m²) as measured by GOES 8 and 9 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.

